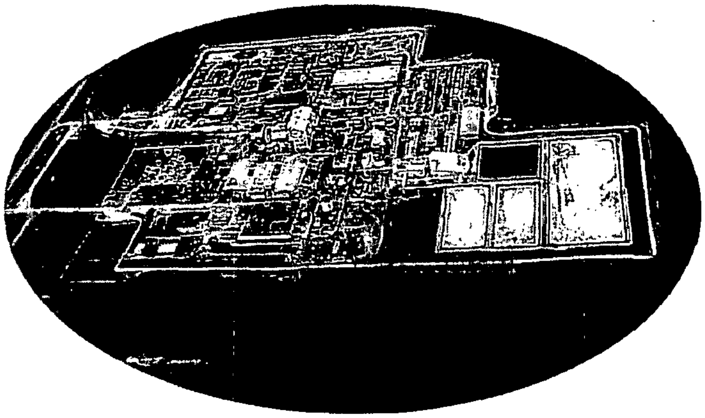
HONEYWELL INTERNATIONAL, INC.
METROPOLIS WORKS
METROPOLIS, IL

LICENSE AMENDMENT REQUEST REPORT
US NRC LICENSE NUMBER SUB-526
CLOSURE OF RETENTION PONDS B, C, D, and E



Prepared for:

Honeywell Metropolis Works
2768 North US 45 Road
Metropolis, IL 62960

Honeywell

Prepared by:

ENERCON Services, Inc.
4490 Old William Penn Highway
Murrysville, PA 15668

November 22, 2010

Prepared by:	Todd Brautigam, Technical Specialist	Date:	11/22/2010
Reviewed by:	Sean J. Horgan, Project Manager	Date:	11/22/2010
Approved by:	Gerald E. Williams, P.E., Manager, Technical Services	Date:	11/22/2010

Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

ANL	Argonne National Laboratory
ALARA	As Low As Reasonably Achievable
CaF_2	Calcium Fluoride
CFR	Code of Federal Regulations
DCGL	Derived Concentration Guideline Levels
DOE	United States Department of Energy
EA	Environmental Assessment
EPA	United States Environmental Protection Agency
HF	Hydrogen Fluoride
IEPA	Illinois Environmental Protection Agency
KOH	Potassium Hydroxide
LTR	License Termination Rule
MTW	Honeywell Metropolis Works
NAAQS	National Ambient Air Quality Standards
NRC	United States Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act
RESRAD	RESidual RADioactivity Family of Codes developed by Argonne National Laboratory
TEDE	Total Effective Dose Equivalent
UF_6	Uranium Hexafluoride

EXECUTIVE SUMMARY

Honeywell Metropolis Works (Honeywell or MTW) located in Metropolis, Illinois has four calcium fluoride surface impoundments, or ponds, known as Ponds B, C, D, and E. Honeywell operates the ponds in accordance with its Part B Permit No. B-65R (RCRA permit) issued pursuant to Part 703 of Title 35 of the Illinois Administrative Code. The Permit requires that Honeywell close the ponds by 2020. Honeywell is proposing to do so through in-situ stabilization and construction of an engineered cover system.

The ponds also are included on Source Materials License SUB-526 and contain small amounts of natural uranium and other isotopes. At the time that Honeywell closes the ponds in accordance with the Permit, Honeywell also is proposing to obtain a license amendment to release the closed ponds from Honeywell's NRC license.

In support of its license amendment request, Honeywell has performed a comprehensive characterization study of the ponds and their contents. This characterization study provides radiological and other data of sufficient quality and quantity to meet MARSSIM requirements for a final status survey.

The concentrations of detected isotopes from the characterization study were averaged and used as input values for a detailed, site-specific dose model using RESRAD Version 6.5. This detailed dose model was performed using parameters representative of an industrial worker scenario. Of the four ponds, Pond C yielded the highest annual does at 1.46E-07 mrem for an industrial worker. The cumulative annual dose for all four ponds was 1.83E-07 mrem for an industrial worker, a dose that is indistinguishable from background.

To demonstrate the protectiveness of the in-situ stabilization and engineered cover system, a dose model also was performed using parameters representative of a resident farmer scenario. This model yielded a cumulative annual dose of 6.66E-07 mrem which, like the does modeled in the industrial worker scenario, is indistinguishable from background. An analysis which considered the total failure of the cover system was completed by performing the dose model with the cover removed. This dose model resulted in a cumulative dose of 23.8 mrem.

1.0 General Information

1.1 Background

Honeywell International, Inc. (Honeywell or the Licensee) is the holder of Source Materials License No. SUB-526 (NRC License), a 10 Code of Federal Regulations (CFR) Part 40 license last renewed by the U.S. Nuclear Regulatory Commission (NRC) in 2007. Under this license, the licensee operates its Honeywell Metropolis Works, Inc. (MTW) formerly "Allied Signal" (Allied) plant at Metropolis, Illinois, where it converts uranium ore concentrates to uranium hexafluoride (UF_6) by the "fluoride volatility process." The UF_6 product is sold as the feed material for uranium enrichment plants. MTW has the capacity to convert approximately 14,000 metric tons of uranium per year from ore concentrates into UF_6.

This license amendment request relates to an area of the MTW site known as the CaF_2 Pond Area, where MTW formerly precipitated calcium fluoride (CaF_2). The CaF_2 Pond Area includes four surface impoundments known as Ponds B, C, D, and E. Pond A was closed in 2001 and the CaF_2 materials removed from the site.

Ponds B, C, D, and E were constructed from 1974 through 1979 and currently store CaF_2 materials which contain trace amounts of natural radioactive isotopes including, but not limited to uranium and thorium. This material was generated prior to 1982 when MTW used a fluoride removal process that involved use of calcium hydroxide to precipitate calcium fluoride in the ponds. The installation of a CaF_2 recovery system in 1982 curtailed the use of the ponds for calcium fluoride precipitation. Currently, no material is discharged to Ponds B, C and E, and Pond D only receives flow from MTW's National Pollutant Discharge Elimination System (NPDES) permitted wastewater treatment system prior to discharge at permitted Outfall 002.

MTW is required by its RCRA permit to close Ponds B, C, D and E by 2020. As part of the closure process, MTW has submitted to the Illinois Environmental Protection Agency (IEPA) an application to modify MTW's RCRA permit to close the ponds in place using in situ sludge stabilization with a pozzolanic cement material, construction of an engineered cap and long-term maintenance. As set forth more fully in the modification application, Honeywell believes that closing the ponds in place will be protective of human health and the environment.

1.2 Objective and Scope

This report has been prepared to support a license amendment request that would release the CaF_2 Pond Area from Honeywell's NRC license. This report models the radiological dose associated with Ponds B, C, D, and E after closure in-place, and describes how the modeled radiological dose compares with requirements of 10 CFR 20.1402 for unrestricted release.

1.3 Release Criteria

The dose criterion for unrestricted release is provided in 10 CFR 20.1402. This regulation indicates the following:

> *A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.*

1.4 Computational Model Used for Dose Calculations

RESRAD Version 6.5 has been used to perform site-specific dose modeling for the pond closure dose assessment. Argonne National Laboratory (ANL) developed the RESRAD computer code under the sponsorship of the U.S. Department of Energy (DOE). The code has been widely used by the DOE and its contractors, the U.S. Nuclear Regulatory Commission (NRC), U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers, industrial firms, universities, and foreign government agencies and institutions. This code is a pathway analysis model designed to evaluate potential radiological doses to an average member of a specific critical group. RESRAD is equipped with probabilistic sampling and analytical capabilities to allow implementation of a risk based modeling approach if determined to be appropriate.

1.5 Site Description

The MTW site is located on a 1,000-acre tract of land in Massac County at the southern tip of Illinois along the Ohio River. The primary site perimeter is formed by U.S. Highway 45 to the north, the Ohio River to the south, an industrial coal blending plant to the west and privately-owned developed land to the east. Honeywell also owns approximately 100 acres of land directly across U.S. Highway 45, north/northeast of the plant. Figure 1-1 shows the MTW site location.

Plant operations are conducted in a fenced restricted area covering approximately 59 acres in the north-central portion of the site. The primary facilities located in the operations area are the Feed Materials Building, Sampling and Storage Facility, Pretreatment Facility, Ore Calcining Facility, Storage Pads, Cylinder Wash Facility, and Waste Dryer. Additional facilities which are involved in the UF_6 manufacturing process, but do not involve the handling of any significant (licensable) quantities of source material, include a fluorine manufacturing building, a calcium fluoride recovery plant to recycle synthetic CaF_2, a power plant, an incinerator, two small settling ponds, and a former fluoride waste treatment facility with four large settling ponds (Ponds B, C, D, and E). The locations of Ponds B, C, D, and E within the operations area are shown in **Figure 1-2**.

1.6 Geology and Groundwater

Site geology has been determined based on previous subsurface investigations including the installation of the RCRA permit groundwater monitoring wells, and wells associated with the RCRA Groundwater Investigation interim groundwater monitoring program.

The MTW facility is located in the northern section of the Coastal Plains physiographic province and is underlain by deposits of Mesozoic age and younger. Although the area was not glaciated it was subject to glacially-related processes such as aeolian and meltwater deposition and erosion. The facility is situated on a 370- to 380-feet above mean sea level bluff top overlooking the Ohio River. The bluff is dissected by multiple ravines, which have an average depth of 30 to 40 feet that grade into a terrace that sits 30 to 50 feet above the river elevation. The river terrace is underlain by Cahokia Alluvium composed primarily of poorly sorted sand, silt or clay with sandy gravel locally. The upper 10 to 20 feet of the bluff may contain Peoria Loess and Roxanna Silt under which the Carmi Member of the Equality Formation is found. The Carmi is composed of quiet-water lake sediments dominated by well-bedded silts and clays. Below the Carmi is the Mackinaw Member of the Henry Formation, which is a glacial outwash deposit made up of well sorted sand and gravel with lenses of clay. The first bedrock unit encountered is the McNairy Sand. It is a poorly to moderately indurated, white to light gray sandstone approximately 150 to 200 feet in thickness with a 70-foot gray to black lignitic shale or siltstone sequence known as the Levings Member. This formation is unconformably underlain by a limestone of Mississippian age, believed to be the St. Louis Limestone.

Figure 1-1: Site Location Map

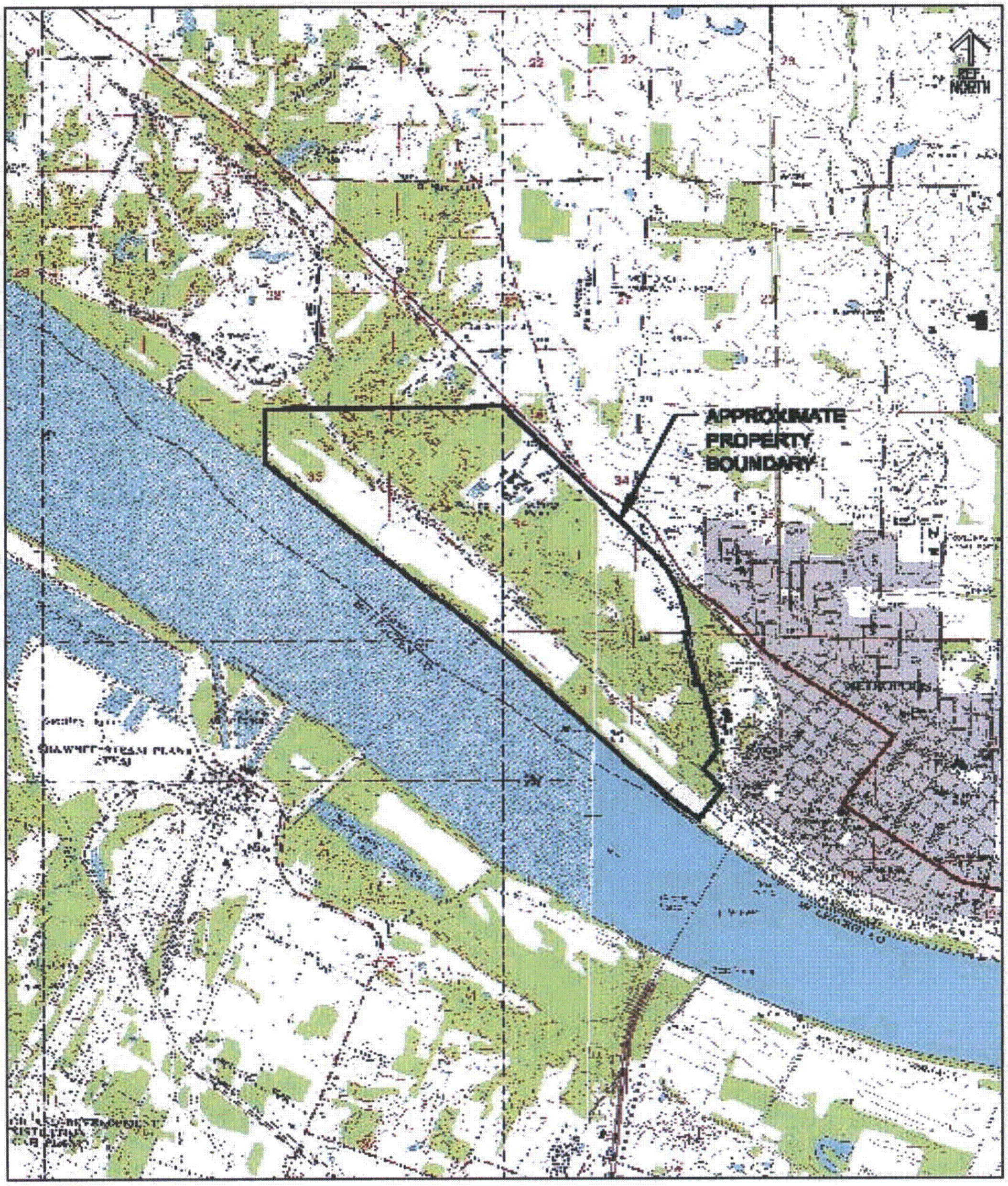
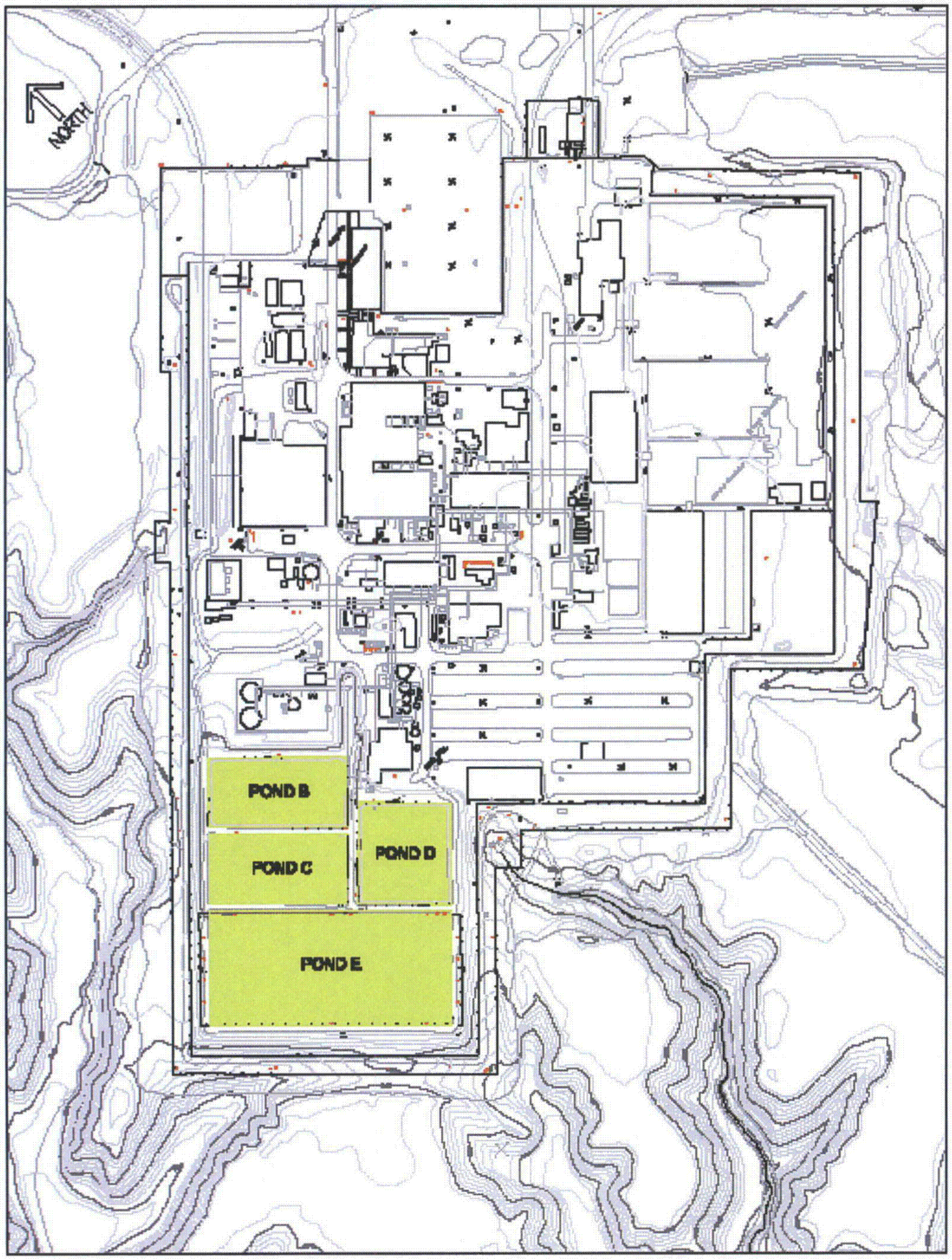


Figure 1-2: Pond Location Map



1.6.1 Site Geology

The uppermost geologic unit on the bluff overlooking the Ohio River Valley, on which the facility is located, is a deposit of clayey silt to silty clay that ranges from 25 to 55 feet in thickness. This material, for the most part, is believed to be the Carmi Member of the Equality Formation but may include Peoria Loess and Roxanna Silt. It also grades into fluvial/floodplain deposits near the river. Distinguishing between the aeolian and lacustrine deposits was not possible with the available data. These sediments were found to be thicker towards the center of the bluff than towards its edges.

The surficial deposit is underlain by a sand and gravel deposit that is approximately 35- to 65-feet thick with multiple lenses of silty clay. This deposit is believed to be outwash from a distal valley train of the Mackinaw Member of the Henry Formation. These sediments are generally thinner and finer grained inland than towards the edge of the river.

Beneath the unconsolidated sand is a sandstone deposit correlating with the McNairy Formation. The formation is encountered at a depth of approximately 90 to 95 feet and contains interbedded shale. The McNairy formation extends to a depth of 240- to 260-feet below the ground surface. No groundwater investigation boring/well encountered the bedrock formation. The bedrock contact was based on boring information from the installation of onsite production wells which are screened in bedrock deposits.

1.6.2 Site Hydrogeology

Groundwater elevations are obtained quarterly from wells within the RCRA permit groundwater monitoring program to determine groundwater flow characteristics within the unconsolidated sand and gravel deposits as described above. Each well is screened in the saturated sand and gravel deposit associated with the Mackinaw Member of the Henry Formation. Perched or shallow groundwater has not been encountered during the various groundwater well installations. A letter from the IEPA to MTW dated January 4, 1985 supports this by stating it is their conclusion that there is no perched water at the site suitable for monitoring and/or sampling.

Most recent groundwater elevations in the RCRA permit wells ranged from a high of 324.24 to a low of 310.63 feet MSL. The aquifer nearest to the ground surface is the Mackinaw Member of the Henry Formation. It is an unconfined aquifer with an upper boundary that is co-incident with the water table and maintains a direct hydraulic connection with the upper sandstone unit of the McNairy Formation. The lower sandstone unit of the McNairy Formation is bound by the Levings Member and the fractured zones of the St. Louis Limestone, which are bound by dense, cherty zones near the top of the formation. The cherty zones create confined conditions.

1.6.3 Site Groundwater

Groundwater flow varies slightly with season, but the prevailing flow is from plant north to plant south, from the bluff (plant location) to the Ohio River. Potentiometric surface maps indicating groundwater elevations and hydraulic gradients are submitted to the IEPA quarterly as part of the routine groundwater monitoring reports. The contours indicate a very consistent flow direction from plant north to plant south.

Precipitation that infiltrates the silty soils of the Carmi Member of the Equality Formation will eventually recharge the aquifer nearest to the ground surface, but due to the proximity of the Ohio River that water likely remains near the water table in the local flow system. Water found deeper within the Mackinaw Member is likely recharged farther upgradient and may be flowing slightly downward towards the McNairy sandstone in an intermediate flow regime. Water that is found in the confined aquifers should be generally flowing upward towards the upper McNairy sandstone in a regional flow system. The discharge point for all three systems would be the Ohio River due to its size, location and elevation. Based on data obtained from previous investigations and RCRA permit groundwater monitoring network, the groundwater flow characteristics beneath the facility have been adequately identified.

2.0 Calcium Fluoride Pond Characterization

An extensive pond characterization program was completed in 2009 by Andrews Engineering. The purpose of the characterization sampling was to determine unknown or undocumented data regarding the physical characteristics and composition of the contents of the CaF_2 ponds. The results of the sampling program are contained in Appendix T *Calcium Fluoride Sludge Pond Sampling Report,* September 2009 (Characterization Report).

Sampling was performed in a random grid pattern specific to each pond in accordance with EPA SW-846, Chapter 9, *Sampling Plan*. The random grid patterns resulted in 36 grid nodes for Ponds B, C, and D, and 105 grid nodes for Pond E. Samples were collected at grid nodes. Grid dimensions were approximately 34 feet by 37 feet but varied slightly from pond to pond.

Samples were collected using a 2 ¼" sludge sampler advanced within a 3" PVC pipe which was driven into the CaF_2 to minimize collapse of the sample hole. Multiple samples were collected from each grid location at varying depths. Samples were documented on a Chain of Custody form for shipment to the chosen laboratory for analysis.

Among the information collected were several parameters of value to the dose model including isotopic radionuclide content, material density, and moisture content. Other physical parameters were also obtained such as the dimensions and depths of each pond. Use of the radiological and physical data obtained from the pond characterization effort is described in the dose modeling section of this report (Section 5.0).

A composite sample was collected in each grid. At a minimum, each composite sample was analyzed for the following:

Table 2-1 Characterization Analyses and Methods

Analysis Type	Method
Total Uranium	EPA SW-846, Method 6010C (ICP)
U-234, U-235, U-238	Alpha Spectroscopy (A-01-R)
Th-232, Th230-Pa231, Th232, Th-234, Pa-234m, Ra-226, Pb-212, Pb-214, Bi-214	Gamma Spectroscopy (Ga-01-R)

Analysis Type	Method
RCRA TCLP Metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	EPA SW-846, Method 1311/6010C
Paint Filter Test	EPA SW-846, Method 9095B
Moisture Content	ASTM D2216

2.1 Total Uranium Characterization Results

A total of 283 samples were analyzed for total uranium. These 283 samples consisted of:

- 244 grid composite samples
- 35 discrete samples of material of different color
- 4 pond-wide composite samples (i.e., pond-wide composite samples from Ponds B, C, D, and E)

Several approaches were used or considered in the data reduction process. These approaches were:

1. Weighted combinations to result in one concentration per core sample
2. Removal of data associated with severe defects in quality control samples as reported by the laboratory
3. Data transformations to normalize the data

Table 2-2 summarizes the total uranium statistical procedures and analyses. A full discussion of the statistical procedures and analyses are included in the Andrews Engineering *Calcium Fluoride Sludge Pond Sampling Report* (Appendix T).

Table 2-2 Total Uranium Results Ponds B-E

Individual Samples ($Ln(x_i)$)		Pond E	Pond D	Pond C	Pond B
	Mean Uranium (mg/kg) (as-is basis)	203	245	287	240
	N (all data)	105	34	36	26
	Distribution	Ln Normal	Ln Normal	Ln Normal	Ln Normal
	95% Upper Confidence Limit Uranium (mg/kg) (one-tailed test) (as-is basis)	223	347	365	320
	Result	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg

2.2 Isotopic Analysis Characterization Results

The RESRAD dose models use the results of the isotopic analyses as input values for the concentrations of radionuclides. This approach is more appropriate than utilizing calculated values of radionuclides derived from the total uranium values. Isotopic analysis were performed on the composite grid sample locations and for discrete samples collected during the characterization phase. The number of samples used for the dose modeling of each pond is summarized in Table 4-2. These results are averaged by pond using actual reported values. Quality assurance duplicates; blanks; and spike samples were excluded from the results prior to averaging. A summary of the concentrations of the radionuclides of concern used in the RESRAD models are presented in Table 5-3. A discussion of the radionuclides of concern that are used in the RESRAD dose models are presented in Section 5.5 of this report.

U-235 results were obtained from gamma spectroscopy. Alpha spectroscopy analysis reported combined results for U-235/U-236. The more conservative gamma spectroscopy U-235 results were used in the RESRAD dose model for this radionuclide. Although U-236 is not expected to be present in the pond materials, it was entered into the RESRAD model to ensure a conservative evaluation. This was accomplished by using one-half of the reported U-235/U-236 alpha spectroscopy results as U-236 input values in the RESRAD model.

3.0 Proposed Pond Closure Action

MTW has managed its CaF_2 wastewater in surface impoundments under the facility's RCRA Part B Permit. Under the current requirements of the Permit, the impoundments must be closed by 2020. The current closure schedule, provided to IEPA in a letter dated April 10, 2003, indicated pond closure targets for all ponds by 2020.

As part of the engineering evaluations for pond closure, recycling was evaluated and found to be technically not feasible, while off-site disposal was evaluated and found to be financially infeasible. One option, stabilization of the ponds and closure in place, was evaluated and determined to be both technically and financially feasible.

Bench studies were completed to assess the viability of stabilizing the pond material. These tests concluded that the addition of Portland cement or similar pozzolanic material would provide a technical approach that achieves several key design objectives such as:

- Eliminating free liquids through removal or solidification
- Stabilizing the pond material to achieve a bearing capacity sufficient to support final cover
- Allowing construction of an engineered cover system that achieves the following:
    - Long-term minimization of the migration of liquids through the closed impoundment
    - Minimal or no maintenance
    - Proper surface water drainage and erosion protection of the final cover

Constructability reviews of this concept were solicited from several remediation contractors, who confirmed Honeywell's preliminary engineering evaluation and bench studies showing the technical viability of pozzolanic materials to stabilize the ponds.

Following stabilization of the pond contents, an engineered cover will be constructed on each pond. The cover system design is described in detail in *Honeywell–Metropolis Works Surface Impoundment Closure*, prepared by CH2M HILL (Appendix V). In summary, cover construction will begin by placing soil fill material directly on top of the stabilized material to bring the pond content area up to grade with the existing berm. It is expected that the fill material will be obtained from both onsite and offsite borrow sources and will consist primarily of Clayey Silt/Silty Clay which is prevalent in near surface layers throughout the site. The thickness of the fill will vary from pond to pond. A multi-layer engineered cover system will then be placed directly on the fill material. It is expected that the cover system above the borrow soil will include the following layers from top to bottom:

- Vegetated topsoil and support soil 2 feet thick
- Granular filter/drainage layer (sand and gravel): 1 foot thick
- Composite drainage net: <0.5 inch thick
- HDPE textured geomembrane: 0.06 inch thick
- Geosynthetic clay liner: <0.5 inch thick
- Common fill soil on top the stabilized pond material to provide a provide a subgrade for the cover system at or above the existing pond berm crest

The minimum thickness of the engineered cover system is approximately 3 feet. The average total thickness of the borrow soil plus the engineered cover system in each of the four ponds will range from 4.95 feet (1.51 meters) in Pond C to 9.05 feet (2.76 meters) in Pond D. The engineered cover system is designed to protect and contain the contents of the pond. The cover system design will minimize erosion by directing water flow off the relatively flat (4 percent slope) top cover to the designed riprap protected berm sideslopes and perimeter drainage ditches, and will prevent vegetative intrusion into the contaminated zone. The cover system soils consist of topsoil, vegetation support layer (clay and silt), and filter layer (sand with gravel). Due to the coarse-grained composition of the filter layer, it does not provide habitat for ecological receptors of concern (small burrowing mammals). Further, the coarse-grained material will provide a measure of resistance to deeper root penetration. The geosynthetics (CDN, geomembrane liner, and GCL) all provide additional barriers to prevent mammals from burrowing into the impounded materials and from root penetration into the stabilized material. Stabilization of the pond contents will minimize the risk of damage due to seismic events. Although the cover system design does not specifically include a radon barrier or a frost/freeze barrier, the proposed cover system design will act as an effective frost freeze barrier given the frost depth and erosion rate in the geographic region and the amount of material that will remain after 1,000 years. Similarly, the materials used for the cover system are comparable to those used for cover systems designed specifically as radon barriers at Uranium Mill Tailings Remedial Action (UMTRA) sites. Consequently, the cover system will act as an effective radon barrier.

As part of the closure, IEPA will impose land use restrictions (*e.g.*, deed restrictions) and will require monitoring and maintenance of the cover system. However, consistent with NRC guidance in NUREG-1757, only the passive performance of the cover system to mitigate radiological impacts may be credited (*i.e.*, performance of the barrier without monitoring, inspection, and maintenance) in the dose assessment to demonstrate compliance with the LTR dose criteria. In addition, the assessment of performance of the cover system considers the reasonableness of a breach and the potential degradation of the barriers over time because monitoring and maintenance are assumed to not be active. Other reasonably foreseeable disruptive conditions from humans or natural events and processes were evaluated, and uncertainty in projecting the passive performance of the barriers was considered. Thus, the existence of the IEPA requirements is intended only to provide additional assurance (and a measure of conservatism) in the dose analysis.

This pond closure approach, after verification of its technical viability and IEPA regulatory compliance, has been assessed for compliance with 10 CFR 20.1402 closure criteria. Engineering design details associated with pond closure were considered in the selection of appropriate input parameters for a dose modeling evaluation using RESRAD. The results of this assessment are detailed in this report.

4.0 Final Status Survey Plan

MARSSIM provides detailed guidance on planning, execution, evaluation and documentation of Final Status Surveys to demonstrate compliance with a dose or risk based approach to decommissioning a radiological facility. The process described within MARSSIM addresses development of DCGLs; design and performance of surveys in support of decommissioning, and; evaluation and analysis of survey results to determine compliance with criteria.

The overall process for a MARSSIM-based decommissioning approach is as follows:

- Scoping surveys
- Characterization surveys
- DCGL development
- Post-remediation surveys
- Final status surveys
- Survey data evaluation

This approach is typical for a facility where the dose impact to an average member of a defined critical group may be significant due to residual radioactivity and/or where the residual radioactivity is sporadic and not well defined. In such cases, DCGL development is important to the process. For the MTW pond closure project, neither situation exists. The low radioactivity of the pond contents coupled with a well-established knowledge of the contents allows for a direct dose assessment to demonstrate compliance with dose criterion for unrestricted release as provided in 10 CFR 20.1402. Use of a direct dose assessment to demonstrate compliance bypasses the need to develop and use DCGLs in the decommissioning process. This dose assessment has been performed using available characterization information.

To confirm that the available characterization data is sufficient for use in an unrestricted release criteria compliance demonstration, the data has been evaluated with respect to the MARSSIM Final Status Survey (FSS) design process. The approach within MARSSIM involves non-parametric hypothesis testing in order to decide whether a survey unit meets release criteria to a defined degree of certainty. The design process begins by identifying radionuclides of concern and defining areas according to their contamination potential as impacted or not impacted. Impacted areas are further classified as Class 1, Class 2, or Class 3 based on the potential level of contamination. The smallest area for evaluation is a survey unit. Survey units are contiguous areas of similar radiological history or potential and of similar physical characteristics of which the size is typically defined during the FSS design process. Class 1 areas are most likely to be contaminated in excess of DCGLs in some areas, Class 2 areas are expected to have residual radioactivity in excess of background, and Class 3 areas are expected to be similar to background areas. Then an appropriate non-parametric statistical test is selected for evaluation of each survey. The Wilcoxon Rank Sum (WRS) test is used for contaminants that are present in background, and the Sign Test is used for contaminants that are not present in background. Part of the FSS design process is to determine the quantity of minimum data points within a survey unit. The number of data points required to satisfy these non-parametric tests is based on the DCGL, the expected standard deviation of the contaminant in background and in the survey unit and the acceptable probability of making Type I and Type II decision errors.

Under the most restrictive impacted classification, Class 1, there is known radioactivity with potential to exceed the DCGL. Given the known levels of radioactivity within the ponds, and the DCGL assumed, a Class 1 definition is conservatively selected for the pond areas. Under a Class 1 definition, the recommended survey unit size is a surface area of 2,000 m^2. The size of the survey unit may be enlarged provided the number of data points is increased proportionally. Evaluation of the characterization data for use in the dose assessment includes an evaluation of the quantity of survey points required by MARSSIM. This has been calculated and compared with the number of radiological samples tested from the pond characterization program.

Evaluation of survey results by survey unit is done on both average and maximum values. If the maximum value is less than the defined DCGL then the survey unit is assured of passing the statistical test. Pond D has the highest radioactive concentrations, therefore utilizing data associated with this pond provides a bounding case applicable to the remaining ponds. Since DCGL development has not been performed, evaluation of the statistical acceptance of the characterization data will use the DCGL values determined by and reported in the RESRAD industrial worker scenario dose model for Pond D. These assumed DCGL values are calculated by RESRAD as a single nuclide DCGL which must also undergo an evaluation for unity to complete the analysis. A unity value is a measure of the ratio of a radionuclide to its DCGL when compared to the acceptance criteria and assures that the specific combination of radionuclides at their specific concentrations do not exceed the dose criteria. The basic formula for unity is:

Unity calculation: $$UNITY = \frac{C_1}{DCGL_1} + \frac{C_2}{DCGL_2} + \ldots + \frac{C_n}{DCGL_n}$$

Where:

C_x = radionuclide concentration

DCGL = guideline level for that nuclide

To pass unity evaluation, the result of the unity formula must be less than 1. Applying this formula to the known values for the pond D concentrations results in the unity values presented in Table 4-1:

Table 4-1: Unity Calculations

Radionuclide	Average Wet (as-is) Concentration (pCi/g)	Maximum Wet (as-is) Concentration (pCi/g)	DCGL (pCi/g)	Unity Value using Average Concentration	Unity Value using Maximum Concentration
Protactinium 231	0.25	0.58	4.72E+10	5.29E-12	1.23E-11
Radium 226	0.46	0.92	9.89E+11	4.65E-13	9.31E-13
Thorium 228	0.28	1.38	2.29E+13	1.22E-14	6.04E-14
Thorium 230	1.14	4.74	2.02E+10	5.65E-11	2.35E-10
Thorium 232	0.07	1.24	1.10E+05	6.38E-07	1.13E-05
Uranium 234	480.78	6242.70	6.25E+09	7.70E-08	9.99E-07
Uranium 235	8.68	27.44	2.16E+06	4.02E-06	1.27E-05
Uranium 236	12.87	171.80	6.47E+07	1.99E-07	2.66E-06
Uranium 238	503.83	6629.84	3.36E+05	1.50E-03	1.97E-02
		Unity Value:		1.50E-03	1.98E-02
		Standard Deviation:		4.99E-04	6.57E-03

An evaluation of the concentration data shows that both the average and maximum concentrations for each radionuclide are significantly below the assumed DCGL values. The unity values as calculated are also both less than 1 and are therefore acceptable.

Demonstrating a 95% certainty of meeting the acceptance criteria is evaluated by applying the formula for relative shift and using that result with the MARSSIM Table I.2a to determine the minimum number of required samples. This number of samples is then compared to the actual number of samples collected to verify compliance.

Within the MARSSIM methodology, relative shift (Δ/σ) is a calculated value where delta (Δ) is equal to the DCGL minus the Lower Boundary of the Gray Region (LBGR) and sigma (σ) is standard deviation. For this evaluation, DCGL is defined as unity (1) and the LBGR is defined as the calculated unity value from the maximum concentration (1.98E-02) for each radionuclide. The sigma (σ) used for the relative shift calculation is the standard deviation of the maximum concentration unity values in the table above (6.57E-03). Using these values, a relative shift of 149.1 is calculated.

Higher relative shift values result in a lower number of required samples. MARSSIM's recommended range for relative shift is between 1 and 3. It is common to administratively limit the maximum relative shift to a value of 3 in order to establish an absolute minimum quantity of data points per survey unit. Taking this approach and using Table I.2a from MARSSIM for a relative shift of 3, a minimum of 11 samples per survey unit is identified as the required number of samples to demonstrate a 95% certainty of compliance. Adjusting for the additional surface area of the ponds results in 22 samples required for Ponds B, C, and D, and 66 samples for Pond E. The dose model utilizes a compiled set of isotopic results for each pond. This compiled set and comparison with the statistically determined quantity of samples is summarized in Table 4-2.

Table 4-2: Sample Requirements

Pond	Minimum # Required Samples per Survey Unit	Pond Surface Area (m^2)	Proportional Factor	Minimum Number Samples with Proportional Increase	Number of Isotopic Analysis Samples Evaluated
B	11	4000	2	22	43
C	11	4000	2	22	39
D	11	3900	1.95	22	36
E	11	12000	6	66	78

Based on this evaluation using the MARSSIM statistical process, it is concluded that the sample quantities collected from each pond during the characterization activities exceed the minimum sample quantity requirements to demonstrate the pond radionuclide values are less than the assumed DCGL values. Overall, it is concluded that the sample sets from each pond obtained during characterization are acceptable for use as a final status data set for pond closure.

5.0 Dose Modeling Analysis

5.1 Source Terms

The objective of this dose modeling effort is to calculate the radiological dose consequence associated with four retention ponds at the MTW Site. These ponds, identified as Ponds B, C, D, and E contain CaF_2 material with trace amounts of natural radioactive isotopes. The proposed RCRA closure plan for Ponds B, C, D, and E involves in-place stabilization of the CaF_2 material with pozzolanic cement followed by construction of an engineered cover for each pond. The primary objective of the pozzolanic additive is to provide increased strength and stability to the materials in the ponds, not to immobilize radionuclides. It is expected that the stabilization will also somewhat reduce the permeability of the CaF_2 material, and therefore reduce the flux of liquids through the stabilized mass, which should already be negligible because of the cover system. Pozzolanic additives are commonly used to increase the bearing capacity of materials for other types of projects. Additional information regarding the stabilization and cover system is included in Appendix V, *Honeywell–Metropolis Works Surface Impoundment Closure.* Nevertheless, to be conservative, the model does not take credit for any reduced permeability. The stabilized CaF_2 material is the source term for this dose assessment.

The source term configuration was established for each pond using information provided in Andrews Engineering, Inc. calculation *"Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E"*, which is provided in Appendix A. This calculation was prepared specifically to estimate the average cover thickness for each pond but also provides the source term configuration data necessary to establish the contaminated zone (CZ) Area and CZ Thickness for each pond as presented in Table 5-1. The CZ Area, CZ Thickness, and Cover Thickness values presented in Table 5-1 were used in the RESRAD dose assessments for Ponds B, C, D, and E. It is assumed that radionuclides are uniformly distributed within the Pond B, C, D, and E contaminated zones. This is a reasonable assumption because the mixing of the pozzolanic materials into the pond results in a more uniform distribution of radionuclides. Radionuclide distributions have been derived for each Pond as described in Section 5.5.

Table 5-1: Source Term Configurations for Ponds B, C, D, and E

Pond	Material Volume[(1)] (ft^3)	5% Material Bulking Volume[(1)] (ft^3)	Stabilized Material Volume[(2)] (ft^3)	Material Surface Area[(1)] (ft^2)	Material Surface Area (m^2)	Estimated CZ Area[(3)] (m^2)	Material Surface Length[(4)] (m)	Material Surface Width[(4)] (m)	CZ Thickness[(5)] (m)	Average Cover Thickness[(1)] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

(1) Andrews Engineering Calculation *"Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E"* provided in Appendix A
(2) Stabilized Material Volume = Material Volume + 5% Material Bulking Volume
(3) CZ Area was estimated by rounding the Material Surface Area.
(4) Approximate material surface dimensions estimated with reference to material surface areas and the pond dimensions provided in Section 1.2 of the Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"
(5) CZ Thickness = (Stabilized Material Volume / Material Surface Area) x 0.3048 m/ft

5.2 Hydrogeologic Scenario

RESRAD requires that the hydrogeological conditions of the site be described from the surface down to the first saturated potable groundwater zone. The hydrogeologic setting for the model has been estimated as presented in Figure 5-1. This conceptual model is based upon the source terms described in Section 5.1 and a geologic cross section prepared by Andrews Environmental Engineering, Inc. provided in Appendix A. As indicated in Figure 5-1, the hydrogeologic setting consists of the following layers listed from the ground surface down to the groundwater table:

- A clayey silt/silty clay cover of varying thickness for each pond (See Table 5-1)
- A contaminated zone of varying thickness for each pond (See Table 5-1)
- A 6.86 m thick clayey silt/silty clay layer (Unsaturated Zone 1)
- A 1.71 m thick sandy silt/silty sand layer (Unsaturated Zone 2)
- A 1.71 m thick sand layer (Unsaturated Zone 3)
- A 4.00 m thick sandy silt/silty sand layer (Unsaturated Zone 4)
- A 1.14 m thick sand layer (Unsaturated Zone 5)
- A saturated sand layer (Saturated Zone)

The existing pond liner system is modeled as Unsaturated Zone 1. The existing pond liner system includes both an EPDM liner and a layer of natural clay materials. In the dose assessment, the existing EPDM liner was excluded from the unsaturated zone. Effectively, the model assumes that the EPDM liner does not exist. In fact, the long-term performance of the pond liner system can be assessed tough existing monitoring data. Early in their design lives the pond liners were substantially intact, though the sumps beneath the liner system indicate some minor leakage (probably along seams) that has remained relatively constant of over time. This indicates that there has been no significant deterioration of the liner system over time. In addition, once a pond was no longer in active use, the leakage was reduced to negligible levels. Based on the above, the conceptual model for the existing pond liner system is considered conservative.

Based on data obtained from previous investigations and currently permitted Part B groundwater monitoring network, the groundwater flow characteristics beneath the facility have been adequately identified. Site groundwater is well below the bottom of the ponds. The depth to the closest groundwater is approximately 45-60 feet. Water at this depth is not used for drinking water or process water. Locally and regionally an aquifer approximately 400 feet below the existing ground surface is used for drinking water. This aquifer was selected as the groundwater drinking water source.

5.3 Exposure Scenario

The critical group is based on the reasonably foreseeable land use scenario. The reasonably foreseeable future was defined as the next few decades (possibly as many as 100 years). The reasonably foreseeable land use at the MTW site was determined to be industrial use. The site is currently and will remain for the foreseeable future an industrial facility. Evaluation of an industrial worker scenario for the MTW pond closure project is appropriate based on both historical usage and future planned usage of the facility. The *Historical Site Assessment*, April 2009 (HSA) and the *Environmental Report Renewal of Source Material License SUB-526 Docket 40-3392 for HONEYWELL SPECIALTY MATERIALS*, May 25, 2005 (ER) provide discussions regarding the role MTW plays in the nuclear power industry, the land use and local trends of land use surrounding MTW. MTW's critical role in the nuclear power industry supports conclusion that the likely future use of the site is industrial.

As indicated in the HAS, initial construction of the facility was completed in 1958 and the first UF_6 was produced in 1959. In 1961, a UF_6 pilot plant was installed but the conversion contract with the Atomic Energy Commission (AEC) expired in 1964 and the conversion process was mothballed. Demand for conversion services increased and resulted in rehabilitation of the UF_6 facility in 1967 and the beginning of commercial conversion in 1968. In 1968-69 capacity for the facility was expanded to 9,000 metric tons. Further increases in capacity occurred in 1975 to 11,500 metric tons and in 1995 to 12,700 metric tons. The most recent re-engineering in 2001 increased capacity to approximately 14,000 metric tons. Thus, production has consistently increased from the start of operations in 1958 with the exception of the period from 1964 to 1967. Overall, the site has had continued operations with multiple expansions for nearly 45 years.

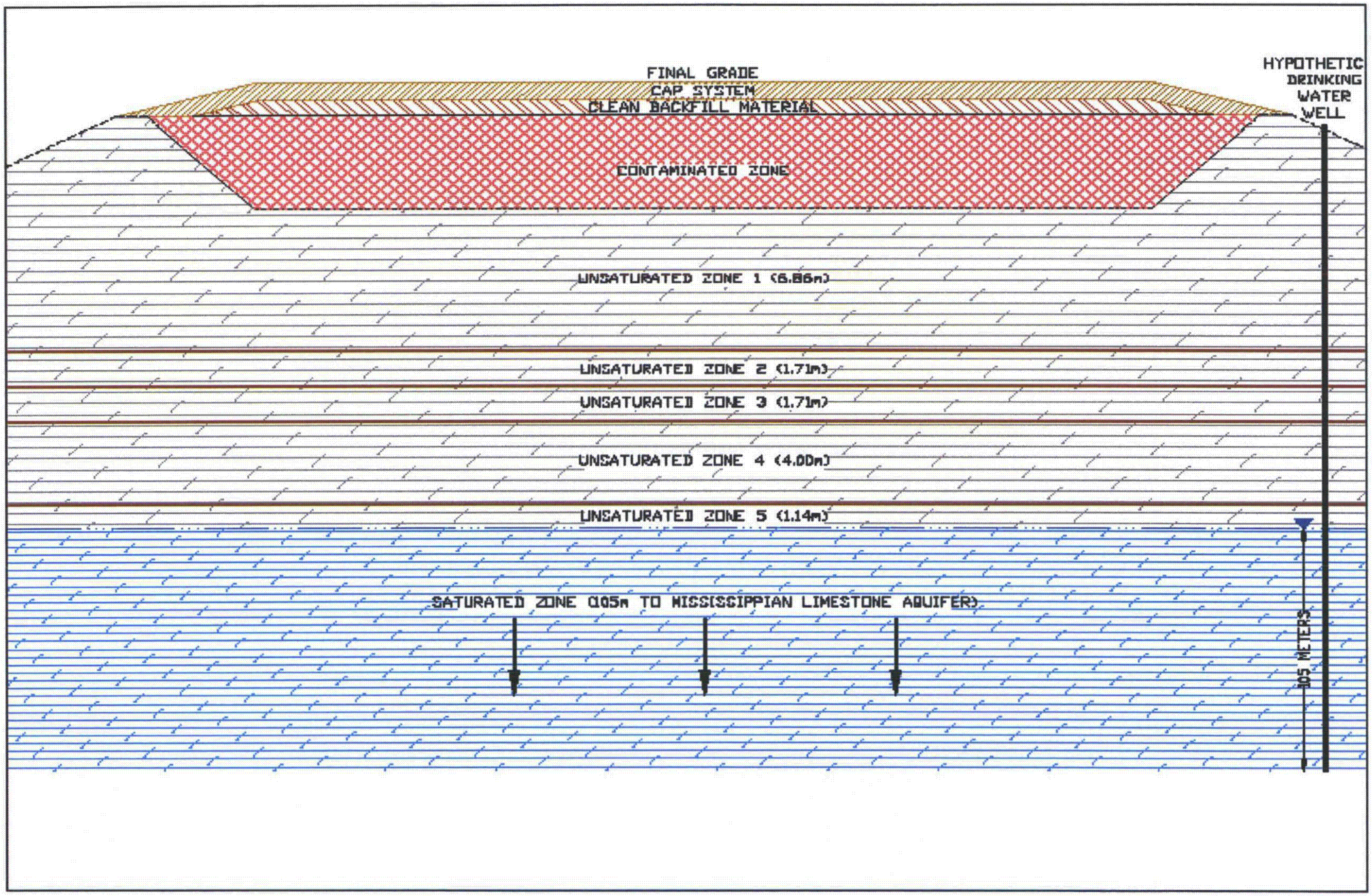
It is likely that MTW will continue operations into the foreseeable future considering the important service MTW provides for the commercial nuclear power industry and inclusion of nuclear power within the long range energy strategy of the United States. According to the United States Energy Information Administration, 50 of the existing 104 nuclear power plants currently operating in the United States possess renewed operating licenses. An additional 36 have either applied, or intend to apply for such a renewal. There have been no plans announced at this time to retire any of the currently operating domestic nuclear power plants. As of May 2010, there have been 16 new construction/operating license applications filed with the NRC. There are currently 13 of these under active NRC review which encompass up to 22 reactors. The existence of numerous new license applications; expectancy of new operating plants; and further anticipated trends for even more new plants strongly suggests a future moderate to significant increase in demand for the UF_6 product, thereby assuring continued industrial operation of MTW. This demonstrates a stable or increasing demand for the UF_6 product into the future and supports classification of the MTW as an industrial site and selection of the industrial worker scenario for the pond closure project.

Other characteristics of the site also make industrial use the reasonably and likely land use scenario. U.S. Highway 45 and a Burlington Northern railroad right-of-way border the site to the northeast. An American Electric Power Company coal blending plant is located immediately northwest of the site. An electrical transmission line crosses the property about half-way between the Ohio River and the southwestern border of the exclusion zone. A buried natural gas pipeline, crossing the property about 150 meters (500 feet) north of the administration building, provides gas to the MTW plant and continues east to serve the City of Metropolis. Conversion of the engineered cover system to agricultural use is also unlikely given the widespread availability of graded agricultural land in the surrounding area. Ground water in the vicinity of the site is not used as a source for drinking water and is unlikely to be used in this way in the future. And, no residences are adjacent to or immediately near the site.

The resident farmer was determined not be an appropriate scenario. Deed restrictions will be required by IEPA. Even if deed restrictions are not considered sufficient to ensure that institutional controls will remain in place for 1,000 years, the controls may reasonably be considered in determining the critical group based on foreseeable land use. In addition, the stabilized CaF_2 material will not support plant growth and, as a result, pathways such as plant growth and use, food pathways, and animal plant consumption are not reasonable. Nevertheless, as a means of demonstrating the overall conservatism in the proposed closure approach, the dose assessment modeled the residential farmer scenario. The calculated doses under the residential farmer scenario are still within NRC limits.

An industrial worker scenario will be considered for evaluation of the source terms in Ponds B through E. In the industrial scenario, industrial workers usually work 8 hours a day and do not ingest meat and milk from livestock raised on site. However, an industrial worker may have a higher inhalation rate than a resident farmer. The industrial worker scenario is the most plausible scenario for the ponds based historical and future site usage considerations. Since this portion of the site is owned and controlled by Honeywell, long term occupancy of the area is not a credible scenario. In addition, the recreationist scenario is implausible because there are no recreational opportunities afforded by this area.

Figure 5-1: Site Conceptual Model



5.4 Exposure Pathways

In the industrial worker scenario, an individual may receive radiation dose by direct external gamma radiation, inhalation of dust, inhalation of radon and its decay products, and ingestion of contaminated soil. In addition, the drinking water pathway has been activated in order to assess the hypothetical use of groundwater as a drinking water source in an industrial scenario. Based on these considerations, the pathways presented in Table 5-2 were used for the RESRAD dose assessment.

Table 5-2: Pathways Considered for the Industrial Worker Scenario

Pathway	Industrial Worker Scenario
External Gamma	Active
Inhalation	Active
Plant Ingestion	Suppressed
Meat Ingestion	Suppressed
Milk Ingestion	Suppressed
Aquatic Foods	Suppressed
Drinking Water	Active
Soil Ingestion	Active
Radon[(1)]	Suppressed

[(1)]Radon will be suppressed because it is not considered in the dose criteria.

The external gamma exposure is the pathway whereby the receptor receives gamma radiation directly from the source of contamination. This pathway is selected whenever the receptor may be situated in a location where the gamma rays would directly impact the body. For the pond closure project, considering the receptor to be located on the cap of the closure cell is conservative yet realistic, therefore the pathway should be enabled.

Inhalation of dust occurs when the receptor is in a location where dust from the source of contamination may become suspended in the air and then inhaled. RESRAD takes into account clean cover material and erosion rates when determining the quantity of suspended dust particles. Enabling this pathway for the pond closure project dose model is realistically conservative.

The radon inhalation pathway is generally not enabled in any scenario because of the difficulty determining natural background concentrations for the radon. It is typically only used when radon would be a primary dose contributor either as a principal radionuclide or as a progeny. Radon is not expected to be a significant contributor to the pond closure project because of the relatively low levels of uranium present and the attenuating effect of the cover system (even over the 1000 year compliance period); therefore the pathway should not be enabled.

The pathways for ingestion of plants, meat, milk, and fish are typically enabled when a contaminated zone would affect, directly or indirectly, the location from which that particular foodstuff would be collected for human consumption. In an industrial scenario, plants, meat, and milk will not be raised for human consumption. Therefore, these pathways should be excluded from consideration.

Soil ingestion occurs when the receptor is in a location where soil from the source of contamination may be ingested, much the same as inhalation of dust. Enabling this pathway for the pond closure project dose model is realistically conservative.

Ingestion of water occurs when the receptor drinks water taken from an aquifer impacted by the contaminated zone. RESRAD uses drinking water intake and the fraction of water that is contaminated to determine the exposure from drinking water intake. Currently, the MTW process water supply is pumped from wells bored into the Mississippian limestone aquifer. Process Wells 1, 2 and 3 are 455 feet, 520 feet and 500 feet deep, respectively. The plant sanitary well is 412 feet deep. MTW drinking water is obtained from the City of Metropolis public water system.

There are no other private water wells within the boundaries of the site. Public water use is obtained from the Massac County Water District (county residents) and the City of Metropolis. Both of these sources withdraw their water from wells in the Mississippian limestone aquifer.

The current groundwater use demonstrates that MTW has not in the past used groundwater for drinking water purposes; MTW does not have any future plans for groundwater use as a drinking water source since a public water source is available. Surrounding land residents do not use and do not have a need to use groundwater as a drinking water source. This information on past and projected future groundwater use further supports excluding drinking water as an exposure pathway. However, the drinking water pathway has been included because the Mississippian limestone aquifer is used by both the Massac County Water District and the City of Metropolis. This is a highly conservative assumption considering that the wells used by both public water supplies are located a significant distance from the site.

In summary, pathways enabled for the RESRAD dose model given the land and water use at and around MTW are direct gamma exposure, dust inhalation, soil ingestion, and drinking water. These are conservative, yet realistic pathways which may affect the receptor. The remaining pathways are disabled for the dose model of the MTW pond closure project.

5.5 Radionuclides of Concern

The Metropolis plant was designed to convert natural uranium ore concentrate (U_3O_8) into uranium hexafluoride (UF_6), which is then shipped to U.S. and foreign plants for enrichment. The facility uses the fluoride volatility process for this conversion. In addition to the natural Uranium, daughter radionuclides of Uranium are present. No fission radionuclides are contributed by MTW.

Industry standard dose modeling protocol only considers radionuclides with half-lives greater than 6 months because shorter-lived isotopes will not contribute significantly to future dose exposures. Using data collected in the pond characterization process, uranium isotopes and uranium decay daughter radionuclides were selected as the radionuclides of concern for RESRAD dose modeling.

Radionuclides of concern and associated radionuclide concentrations for each pond are listed in Table 5-3. These distributions were derived from analytical data presented in Calcium Fluoride Sludge Sampling Report prepared by Andrews Engineering after adjustment for moisture content and source term bulking that will occur due to the pond material stabilization process. Moisture content of the samples collected during the pond characterization activities was determined by ASTM method D2216. This method determines moisture content by mass. This analysis shows that the contents of the ponds have significant water content. Isotopic analyses of these samples were performed on a dry-weight basis; therefore an accurate dose model needs to account for the moisture content during the dose analysis. To accomplish this, the averaged dry-weight isotopic results from each pond were multiplied by the percent solids (i.e. that portion of the pond contents that is not water) to obtain an adjusted concentration result. Such a result maintains the total radionuclide inventory while providing the appropriate concentration result for use in the RESRAD dose model.

Table 5-3: Radionuclides of Concern

Wet (as-is) Concentration pCi/g				
Radionuclide	**Pond B**	**Pond C**	**Pond D**	**Pond E**
Pa-231	0.04	0.13	0.25	0.07
Ra-226	0.42	0.31	0.46	0.34
Th-228	0.08	0.05	0.28	0.03
Th-230	2.30	1.56	1.14	0.83
Th-232	0.07	0.05	0.07	0.03
U-234	69.50	136.83	480.78	118.57
U-235	4.48	7.31	8.68	5.11
U-236	1.86	3.27	12.87	2.91
U-238	71.59	141.58	503.83	122.69

5.6 Failure Modes

Two potential failure modes have been identified that may affect the dose consequence to an average member of the critical group. The first is failure of a portion of the existing pond liner system. . In the RESRAD model, the existing EPDM liner was excluded from the unsaturated zones and therefore its failure is of no consequence to the model results. The second is failure of the engineered cover system.

Because the pond materials will be stabilized prior to closure, intentional removal of the pond materials cannot occur without significant effort. As a result, inadvertent intruders are unlikely. While unlikely, the possibility exists where the cover system may be removed unintentionally due to an uncontrolled natural event. The cover system is designed to handle the design basis seismic and flooding events with tolerable displacements – such that complete removal would not occur for the design basis events, i.e. credible natural events, in accordance with IEPA and EPA requirements. The ponds are located approximately 1/3 of a mile from the Ohio River. The site is located on a bluff that sits 30 to 50 feet above the Ohio River elevation. The probable elevation of a 100-year flood in the area is approximately 337 feet. The plant site elevation is 375 feet and is considerably above the most extreme flood level projected for the Ohio River. In addition, the berms will be protected with riprap, so even if there is localized flooding, adverse impacts to the cover system would not be expected. Nevertheless, the dose assessment conservatively assumes that uncontrollable natural events, such as a severe seismic event, cover system erosion, or localized flood, could remove all or a portion of the cover system for a short period of time. Because of IEPA closure maintenance and monitoring requirements, it is reasonable to assume that should such an event occur, the cover system would be repaired or replaced in a timely fashion. Nevertheless, the dose assessment conservatively modeled the compliance scenario with the cover removed. The dose model indicates that, should such an event occur, the maximum dose consequence to an industrial worker would potentially increase to 13.7 mrem annual dose, which remains below the release criteria.

6.0 RESRAD Calculations

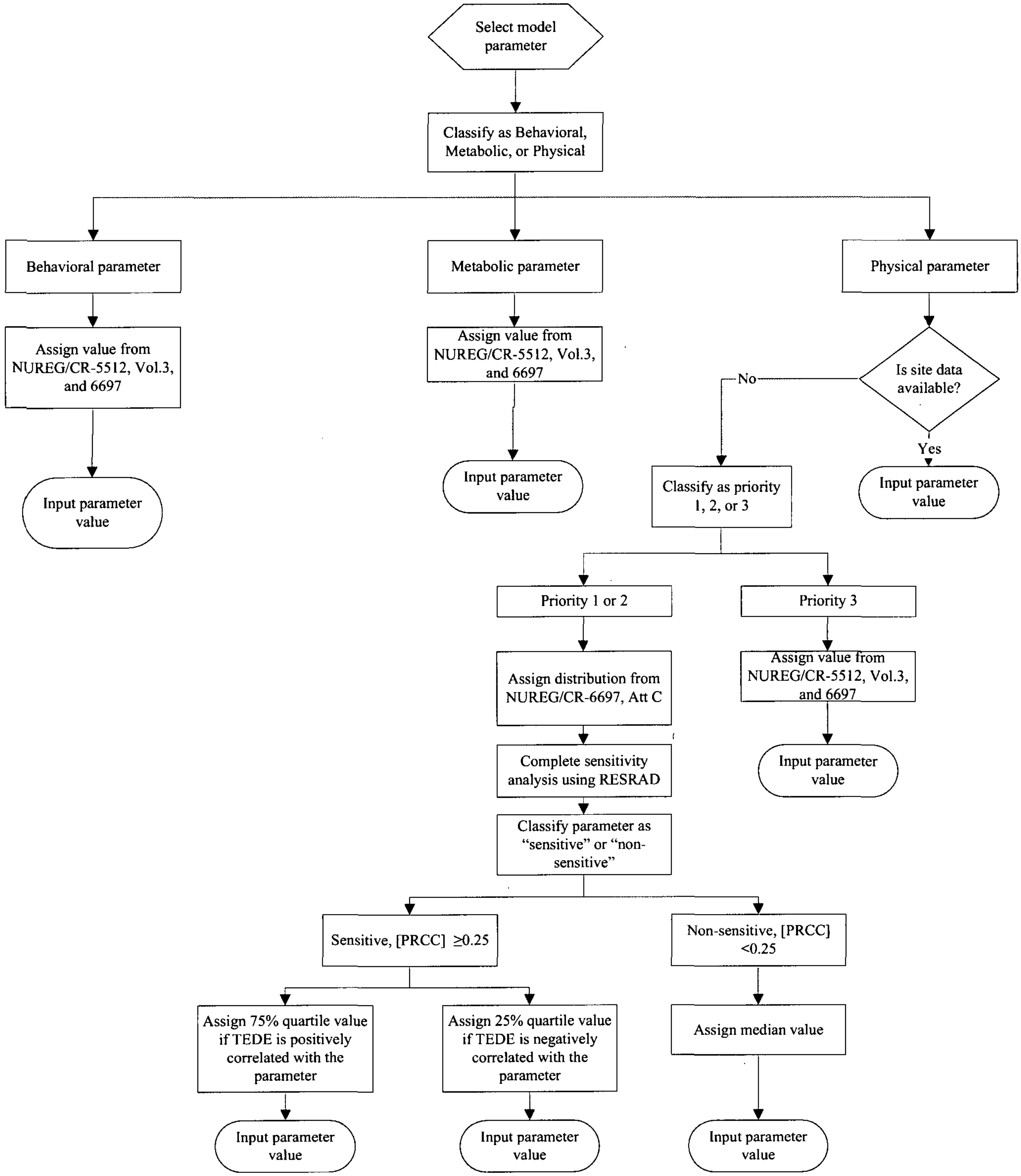
6.1 Approach

Dose assessments have been performed for Ponds B through E. RESRAD Version 6.5 was used to perform required analyses for each pond. The following steps were used in the analysis of each pond:

1. An input parameter treatment assessment was performed as part of a sensitivity analysis to determine which parameters should be treated deterministically (assigned single input values) and which should be treated stochastically (assigned probability distributions).
2. A statistical sensitivity analysis was performed for each radionuclide distribution using the uncertainty analysis features of RESRAD 6.5 to assess which parameters are the major contributors to the variation or uncertainty in the calculated dose.
3. Sensitive parameters were assigned conservative input values for dose calculations. These values replaced the probabilistic input distributions used in the sensitivity analysis.
4. Nonsensitive parameters were assigned median values from the relevant probabilistic distributions. These values replaced the probabilistic input distributions used in the sensitivity analysis.
5. The RESRAD model was run in the deterministic mode to determine dose for each pond.

The RESRAD Input Parameter Treatment Process is shown schematically in Figure 6-1 and described in more detail in the following sections.

Figure 6-1: Input Parameter Treatment Process



6.2 Input Parameter Treatment Assessment

RESRAD 6.5 input parameters were evaluated to determine whether they should be treated deterministically or stochastically for the pond dose assessment. Deterministic modules of the code use single values for input parameters and generate a single value for dose. Probabilistic modules of the code use probability distributions for input parameters and generate a range of doses. Stochastic parameters are parameters that are defined by a probability distribution. Parameter treatment for dose assessment for Ponds B through E was based on an assessment of parameter classification and ranking and the availability of site-specific data for the parameters.

6.2.1 Input Parameter Classification and Ranking

RESRAD input parameter classifications and rankings established by ANL were used in the dose assessment process for Ponds B through E. ANL classified and ranked RESRAD input parameters as part of the process of enhancing the deterministic RESRAD and RESRAD-BUILD codes for probabilistic dose analysis.

The ANL classification process identified each parameter as physical, behavioral, metabolic, or a combination of these types. The parameter classifications developed by ANL are documented in Attachment A of NUREG/CR-6697, "Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes." ANL classified parameters as follows:

Physical parameters include any parameter whose value would not change if a different group of receptors was considered. Physical parameters would be determined by the source, its location, and geological characteristics of the site (i.e., these parameters are source-specific and site-specific).

Behavioral parameters include any parameter whose value would depend on the receptor's behavior and the scenario definition. For the same group of receptors, a parameter value could change if the scenario changed (e.g., parameters for recreational use could be different from those for residential use).

Metabolic parameters include any parameter that represents the metabolic characteristics of the potential receptor and is independent of scenario. These parameter values may be different in different population age groups. Parameters representing metabolic characteristics are defined by average values for the general population. These values are not expected to be modified for a site-specific analysis because the parameter values would not depend on site conditions.

The ANL ranking process prioritized parameters for data collection and distribution analysis. Parameter rankings were based on the following four attributes of each parameter:

1. Relevance in dose calculations
2. Influence on dose variability
3. Parameter classification
4. Data availability

Based on these factors, ANL assigned priority rankings to each input parameter. Priority 1 was high priority, Priority 2 was medium priority, and Priority 3 was low priority. ANL ultimately developed probabilistic distributions for Priority 1 and 2 parameters. In general, the Priority 1 and 2 parameters were selected by ANL for data collection and distribution analysis because they had the following attributes:

1. High relevance to dose calculations
2. Medium to high influence on dose variability
3. Classified as physical parameters rather than behavioral or metabolic
4. Medium to high data availability for development of probabilistic distributions

ANL's input parameter rankings are documented in Attachment B to NUREG/CR-6697.

6.2.2 <u>Input Parameter Treatment</u>

Considering ANL classifications and rankings, each input parameter was evaluated to determine whether it should be treated deterministically or stochastically. As indicated in Figure 6-1, behavioral and metabolic parameters were typically treated deterministically, and physical parameters may have been treated in either manner depending on site-specific data availability and ANL priority rankings. Input parameter treatment may vary from the process indicated in Figure 6-1 depending on site-specific considerations.

The behavioral and metabolic parameters are typically treated deterministically because the range of possible values for these parameters is expected to be limited. The behavioral parameter values are limited to those that are appropriate for the chosen exposure scenario, while the metabolic parameters are not expected to vary for site-specific analysis. The behavioral and metabolic parameters were typically assigned values from NUREG/CR-5512, Volume 3, NUREG/CR-6697, or an appropriate RESRAD default library.

The physical parameters were treated deterministically or stochastically depending on a number of factors. If site-specific values were available for a parameter, then that parameter was treated deterministically and the appropriate value was used. The remaining physical parameters, for which no site-specific data are available, were further evaluated to identify appropriate treatment.

To determine appropriate treatment for the remaining physical parameters, the ANL priority rankings were reviewed. The remaining Priority 1 and Priority 2 physical parameters were treated stochastically based on their high potential to affect dose. Conversely, the remaining Priority 3 physical parameters were treated deterministically based on their low potential to affect dose. ANL statistical parameter distributions documented in NUREG/CR-6697, Attachment C was used for the Priority 1 and 2 parameters. Priority 3 physical parameters were assigned values from NUREG/CR-5512, Volume 3, NUREG/CR-6697, or an appropriate RESRAD default library.

The parameter values, distributions, and other settings used in the sensitivity analyses for Ponds B, C, D, and E are summarized in Appendix B, Appendix C, Appendix D, and Appendix E, respectively.

6.3 Statistical Sensitivity Analysis

After appropriate values or distributions were assigned for each RESRAD input parameter, a statistical sensitivity analysis was performed for each pond using the uncertainty analysis capabilities of RESRAD. The objective of the sensitivity analysis was to identify those parameters that are major contributors to the variation or uncertainty in the calculated dose for each contaminated area. Once the sensitivity analyses were complete, conservative input values were assigned to the sensitive parameters and median input values were assigned to the non-sensitive parameters for the final $DCGL_W$ calculations.

To perform the sensitivity analysis for each pond, the site-specific dose model was loaded with the selected values and statistical distributions summarized in Appendix B, Appendix C, Appendix D, and Appendix E. The radionuclide distributions presented in Section 5.5 were used. The model was then run in the probabilistic mode.

RESRAD reports generated for the Pond B, C, D, and E sensitivity analyses are presented electronically on CD in Appendix F, Appendix G, Appendix H, and Appendix I, respectively. These reports were evaluated to identify sensitive parameters. Sensitive parameters were identified for each pond based on partial ranked correlation coefficient (PRCC) analysis following the guidance of NUREG/CR-6676, "Probabilistic Dose Analysis Using Parameter Distributions Developed for RESRAD and RESRAD-BUILD Computer." The absolute value of the calculated PRCC obtained from the appropriate RESRAD report was used to classify the parameters with statistical distributions as sensitive or non-sensitive. PRCC was used because NUREG/CR-6692, "Probabilistic Modules for the RESRAD and RESRAD-BUILD Computer Codes," recommends that it be used when nonlinear relationships, widely disparate scales, or long tails are present in the input and output. If the absolute value of the PRCC is greater than or equal to 0.25, then the parameter was classified as sensitive. If the absolute value of the PRCC is less than 0.25, then the parameter was classified as non-sensitive. These thresholds were selected based on guidance included in NUREG/CR-6676 and 6692.

Based on the sensitivity analysis, conservative input values were identified for each sensitive parameter. These conservative values replaced probabilistic distributions in the subsequent dose calculations for each pond. Specific replacement values were selected for each sensitive parameter based on the parameter to dose correlation. If the PRCC value calculated during the sensitivity analysis was negative, the parameter value to dose correlation was negative, and the parameter value at the 25% quartile of the cumulative density function was selected. If the PRCC value was positive, the parameter value to dose correlation was positive, and the parameter value at the 75% quartile of the cumulative density function was selected. The median value (50% quartile) of the cumulative density function was selected for replacement of probabilistic distributions for non-sensitive parameters.

The sensitive and non-sensitive parameter replacement values were obtained from the RESRAD sensitivity calculation results using the interactive output feature of the uncertainty results. A double click on the left mouse button opens the interactive output dropdown window. From the interactive output dropdown window, the "Results" folder is selected. From the "Results" folder, the "Graphics" subfolder is selected. The "Cumulative Density" is then selected as the Plot Type and the "Input Vector" is selected as the Primary Object. The parameter value is determined by a right mouse button click on the plot and selecting "Edit Chart Data" from the dropdown window. This opens the Data Grid Editor dropdown window. From this window, 0.25, 0.50, or 0.75 is selected, as appropriate from the C2 column, which represents the appropriate quartile value. The corresponding parameter value is contained in the C1 column.

Appendix J presents sensitivity analysis results for each pond. The sensitivity analysis results summary tables list PRCC values for each parameter and identify conservative replacement values for each sensitive parameter. In addition, the summaries identify median (50%) values for each non-sensitive parameter. These replacement values were used in subsequent dose calculations.

6.4 Dose Assessment Calculations

6.4.1 Compliance Scenario – Industrial Worker

Dose assessments were performed for each pond using RESRAD to estimate the peak annual total effective dose equivalent to the average member of the critical group expected within the first 1,000 years after decommissioning, in accordance with 10 CFR 20.1401(d). The site-specific RESRAD dose model used in the sensitivity analysis for each pond was modified to replace all probabilistic distributions with conservative or median values as determined during the sensitivity analysis. The parameter values used for the dose calculations are summarized in Appendix K, Appendix L, Appendix M, and Appendix N for Pond B, C, D, and E, respectively.

RESRAD was then run in the deterministic mode to calculate dose for each pond. The RESRAD Summary Reports for each pond are provided in Appendix O, Appendix P, Appendix Q, and Appendix R for Pond B, C, D, and E respectively. The maximum total dose values obtained from the RESRAD Summary Reports are presented in Table 6-1. These results demonstrate that the 25 mrem/year dose criterion is not exceeded in any of the subject ponds in the foreseeable future.

Table 6-1: Maximum Total Dose – Industrial Worker Scenario

Pond	Time of Maximum Total Dose (years)	Maximum Total Dose (mrem/year)
B	1,000	9.93E-09
C	1,000	1.46E-07
D	1,000	3.11E-13
E	1,000	2.69E-08

6.4.2 Alternate Scenario – Residential Farmer

Dose assessments were performed for each pond using RESRAD to estimate the peak annual total effective dose equivalent using a resident farmer scenario expected within the first 1,000 years after decommissioning, in accordance with 10 CFR 20.1401(d). This scenario used the relevant deterministic values as determined from the probabilistic runs for the industrial worker; added the appropriate pathways, i.e. meat, milk, fish, and plant ingestion, and; modified specific parameter values to those more appropriate for a resident farmer such as inhalation rate and indoor and outdoor time fractions.

The maximum total dose values obtained from the RESRAD Summary Reports for the resident farmer scenario are presented Table 6-2. These results demonstrate that the 25 mrem/year dose criterion is not exceeded in any of the subject ponds in the foreseeable future when considering a resident farmer.

Table 6-2: Maximum Total Dose – Resident Farmer Scenario

Pond	Time of Maximum Total Dose (years)	Maximum Total Dose (mrem/year)
B	1,000	3.61E-08
C	1,000	5.32E-07
D	1,000	1.09E-12
E	1,000	9.79E-08

6.4.3 Alternate Scenario – Failure Modes

There are two failure modes were identified for consideration in the dose models: failure of the EPDM liner, and failure of the engineered cover system. The RESRAD models did not utilize the EPDM liner as one of the unsaturated zones, therefore this failure mode is eliminated from consideration. Failure of the engineered cover system was modeled using the industrial worker scenario modified to exclude the cover layer.

The maximum total dose values obtained from the RESRAD Summary Reports for the failure of the engineered cover system are presented Table 6-3. These results demonstrate that the 25 mrem/year dose criterion is not exceeded in any of the subject ponds in the foreseeable future when considering a resident farmer.

Table 6-3: Maximum Total Dose – Industrial Worker Cover System Failure Mode

Pond	Time of Maximum Total Dose (years)	Maximum Total Dose (mrem/year)
B	1,000	2.6
C	1,000	4.1
D	0	13.7
E	18.71	3.4

6.5 Pond Closure ALARA Evaluation

In order to terminate a license, a licensee should demonstrate that the dose criteria in Subpart E have been met, and should demonstrate whether it is feasible to further reduce the levels of residual radioactivity to levels below those necessary to meet the dose criteria (i.e., to levels that are ALARA). Per NUREG 1757 Volume 2, Appendix N, the following definition applies:

> "'Reasonably achievable' is judged by considering the state of technology and the economics of improvements in relation to all the benefits from these improvements. (However, a comprehensive consideration of risks and benefits will include risks from nonradiological hazards. An action taken to reduce radiation risks should not result in a significantly larger risk from other hazards.) NRC Regulatory Guide 8.8, Revision 3 (1978)." [Quotes in original.]

Subpart E contains specific requirements for a demonstration that residual radioactivity has been reduced to a level that is ALARA (10 CFR 20.1402, 20.1403(a), 20.1403(e), and 20.1404(a)(3)). NUREG-1757 Volume 2 Appendix N provides specific examples showing an ALARA demonstration. The ALARA demonstration for proposed pond closure at MTW is demonstrated using equation shown below.

$$\frac{Conc}{DCGL_W} = \frac{Cost_r}{\$2000 \ x \ P_D \ x \ 0.025 \ x \ F \ x \ A} \ x \ \frac{r+\lambda}{1-e^{-(r \lambda)N}}$$

The residual radioactivity level that is ALARA is the concentration, *Conc,* at which the benefit from removal equals the cost of removal. The ratio of the concentration, *Conc,* to the $DCGL_w$ can be determined to show that the proposed action meets ALARA. Ratios values less than 1 demonstrate that further action should be considered or taken. Ratio values above 1 demonstrate that the proposed action meets ALARA. Factors in this equation are defined below.

P_D = population density for the critical group scenario in people/m^2. For the MTW facility, the plant area is approximately 59 acres. MTW's work

		force is approximately 350. Thus, the value a P_D of 0.0015 people/m^2 is calculated.
A	=	area being evaluated in square meters (m^2). The evaluated total pond area is approximately 10 acres, or 40,470 m^2.
0.025	=	annual dose to an average member of the critical group from residual radioactivity at the Derived Concentration Guideline Level *($DCGL_W$)* concentration in rem/y. To obtain a conservative analysis, the annual dose from remaining uranium in the closed ponds was allowed to remain at 0.025 rem/year instead of the much lower industrial worker dose value.
F	=	effectiveness, or fraction of the residual radioactivity removed by the remediation action. The effectiveness was assumed to be 1 (complete removal).
Conc	=•	average concentration of residual radioactivity in the area being evaluated in units of activity per unit area for buildings or activity per unit volume for soils;
$DCGL_W$	=	derived concentration guideline equivalent to the average concentration of residual radioactivity that would give a dose of 0.25 mSv/y (25 mrem/y) to the average member of the critical group, in the same units as "Conc";
r	=	monetary discount rate in units per year. For durations exceeding 100 years, the NRC approved value is 0.03.
λ	=	radiological decay constant for the radionuclide in units per year. The radiological decay constant for uranium is 4.47 x 10^9
N	=	number of years over which the collective dose will be calculated, or 1,000 years.

For the ALARA analysis, $Cost_T$ can include all of the costs shown in the equation below.

$$Cost_T = Cost_R + Cost_{WD} + Cost_{ACC} + Cost_{TF}. + Cost_{WDose} + Cost_{PDose} + Cost_{other}$$

where

CostR	=	monetary cost of the remediation action (may include "mobilization" costs);
CostWD	=	monetary cost for transport and disposal of the waste generated by the action;
CostAcc		= monetary cost of worker accidents during the remediation action;
CostTF	=	monetary cost of traffic fatalities during transporting of the waste;
CostWDose		= monetary cost of dose received by workers performing the remediation action and transporting waste to the disposal facility;

CostPDose	=	monetary cost of the dose to the public from excavation, transport, and disposal of the waste; and
Costother	=	other costs as appropriate for the particular situation.

Honeywell has developed preliminary engineering estimates to complete pond closure as described in the preliminary engineering closure design report. As part of the evaluation and selection of this approach, preliminary engineering estimates to excavate, transport, and disposal of the pond materials off-site were also developed. These estimated costs are \$32,000,000 (closure in place using the RCRA required engineered cover) and \$61,300,000 (off-site disposal). Thus, a conservative estimate of the value of $Cost_T$ for the ALARA analysis is the difference between these values, or \$29,300,000. This value is conservatively limited since it only includes remediation, transportation, and disposal cost without adding the additional projected cost of worker accidents, traffic fatalities during transportation, worker exposure during transportation, regulatory interface costs, and other appropriate costs if identified.

Using these values gives:

$$\frac{Conc}{DCGL_W} = \frac{\$29{,}300{,}000}{\$2000 \ x \ 0.0015 \ x \ 0.025 \ x 1 \ x \ 40470} \ x \ \frac{0.03 + 1.55 \ x10^{-10}}{1 - e^{-(0.03 + 1.55 \, x10^{-10})/1{,}000}}$$

or

$$\frac{Conc}{DCGL_W} = 9{,}653{,}241$$

The ratio is significantly greater than 1, and shows that the proposed pond closure action meets the ALARA criteria by a wide margin. There is significant additional conservatism in the analysis because of the following:

- Dose limit for the selected industrial worker scenario is significantly lower than 25 mrem/year and in fact is shown to be indistinguishable from background.
- Other potential Honeywell costs as part of excavation, transportation and off-site disposal were not included in the total cost.

Overall, the ALARA analysis shows that the selected pond closure meets the regulatory ALARA criteria.

7.0 Environmental Report Supplement

This section describes the environmental effects specifically related to the partial site release of the Ponds B though E at MTW. This section was prepared in accordance with the guidance provided in Chapter 6.0 of the Office of Nuclear Material and Safety and Safeguards (NMSS) NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NRC 2003b). This section provides justification to the NRC that will support an environmental assessment in accordance with the National Environmental Policy Act (NEPA) of 1969 as outlined in 10 CFR Part 51. This section incorporates by reference relevant information in the May 2005 Environmental Report (Docket 40-3392) filed to support license renewal for MTW.

7.1 Purpose and Need for the Pond Closures

The four ponds at MTW are regulated by IEPA under a RCRA permit. MTW and IEPA have reached a preliminary agreement regarding status of the retention ponds. This agreement requires MTW to close the retention ponds by 2020. Under the Atomic Energy Act, the NRC has the statutory authority to protect public health and safety and the environment related to the use of source, byproduct, and special nuclear material. One aspect of the responsibility is to ensure safe and timely decommissioning of the nuclear facilities that it licenses. Once licensed activities have ceased, licensees are required by NRC regulations to decommission their facilities and have their licenses terminated. The criteria for allowing the release of sites for unrestricted use are listed in the NRC's License Termination Rule (LTR), codified in Subpart E of 10 CFR 20. 10 CFR 20.1402 states, in part, that a site will be considered acceptable for unrestricted use following decommissioning if the residual radioactivity that is distinguishable from background radiation results in a total effective dose equivalent (TEDE) to an average member of the critical group that is less than 25 mrem (0.25 mSv) per year and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). These criteria require that, through the decommissioning process, the residual radioactivity in buildings, equipment, soil, ground water, and surface water at the facility and its environs be reduced to such low levels that the TEDE limits are satisfied.

7.2 Description of the Proposed Action

MTW plans to close the retention ponds by stabilizing the contents of the ponds, and constructing an engineered cover system that meets RCRA Title C design criteria and NRC dose criteria for unrestricted release. The use of a cover system is appropriate in light of the low radionuclide concentrations in the pond and the fact that the radionuclides are currently in a controlled location (*i.e.*, the materials are in existing surface impoundments underlain by natural clay, the uranium materials have a very low solubility, and the materials will be stabilized in place). This action makes the ponds area unsuitable for operations involving the nuclear materials license thus justifying release of this area from source material license SUB-526.

7.3 Applicable Regulatory Requirements, Permits, and Required Consultations

Partial site release of the retention ponds area requires adherence to numerous federal and state regulations. Guidance for identifying the applicable federal and state requirements is stated below. This information is a broad overview of applicable regulations and is not intended to be all-inclusive. The licensee, Honeywell International, is responsible for compliance with applicable federal and state regulations.

7.3.1 Federal Requirements

Decommissioning activities that are subject to federal regulations, permits, licenses, notification, approvals, or acknowledgments may include:

- Handling, packaging, and shipment of radioactive waste
- Worker radiation protection
- License termination and final site release
- Worker, contractor, and the general public's health and safety
- Liquid effluent releases
- Hazardous waste generation and disposition

7.3.1.1 Nuclear Regulatory Commission

Radiological activities fall under Title 10 of the CFR and are administered by the NRC. Applicable portions of Title 10 regulations are included within the following Parts:

- Part 20 – "Standards For Protection Against Radiation"
- Part 40 – "Domestic Licensing Of Source Material"
- Part 51 – "Environmental Protection Regulations For Domestic Licensing And Related Functions"
- Part 61 – "Licensing Requirements For Land Disposal Of Radioactive Waste"
- Part 71 – "Packaging and Transportation of Radioactive Material"

Decommissioning requirements that involve activities for site control, characterization, and final status surveys are found within the following Parts of Title 10 of the CFR and are administered by the NRC. The Parts include:

- Part 20.1401 – "General provisions and scope"
- Part 20.1402 - "Radiological criteria for unrestricted use"
- Part 20.1403 – "Criteria for license termination under restricted conditions"
- Part 20.1404 – "Alternate criteria for license termination"
- Part 20.1405 – "Public notification and public participation"
- Part 20.1406 – "Minimization of contamination"
- Subpart F—"Surveys and Monitoring" Part 20.1501 – "General"
- Part 30.36 – "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas"
- Part 40.42 – "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas"
- Part 70.38 – "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas"
- Part 72.54 – "Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas"

7.3.1.2 Department Of Transportation

Radioactive material transportation activities falls under Title 49 of the CFR and are administered by the Department Of Transportation. Applicable portions of Title 49 regulations are included within Subtitle B – "Other Regulations Relating to Transportation" Parts 100 To 185, as applicable,

7.3.1.3 Environmental Protection Agency

The EPA regulations outlined in Title 40 of the CFR apply as follows:

- Part 61 – "National Emissions Standards For Hazardous Air Pollutants"

- Part 122 –"EPA Administered Permit Programs: The National Pollutant Discharge Elimination System" (NPDES) and Parts 123 to 125 in support of the NPDES

- Parts 129 to 132 –Clean Water Act

- Part 190 – "Environmental Radiation Protection Standards For Nuclear Power Operations"

- Parts 260 to 272 –hazardous waste disposal and solid waste disposal as included in the RCRA

7.3.2 State of Illinois Regulations

The IEPA regulations generally follow those of Federal EPA regulations contained in 40 CFR Part 264. The pertinent State of Illinois regulations are as follows:

- Conditions II.F.2 and II.H of MTW's RCRA Part B permit (Permit No. B-65R) – minimum technology closure requirements and the overall closure requirement for the surface impoundments

- 415 ILCS 5/ Illinois Environmental Protection Act, Section 21(d) – Requirement to Conduct Operations in Accordance with a Permit Issued by Illinois EPA

- 35 Illinois Administrative Code 724.211 – Closure Performance Standard

- 35 Illinois Administrative Code 724.328 – Closure and Post-closure Care

- 35 Illinois Administrative Code 722.111 – Hazardous Waste Determination

7.4 Pond Closure Alternatives

The proposed action is the partial site release of Ponds B through E from source materials license SUB-526. Five alternatives are associated with this action. MTW has evaluated these options regarding ultimate disposition of the pond area and their contents. The options identified are:

- No action
- Removal and disposal of the pond contents followed by closure of Ponds B through E
- Removal and recycling of the pond contents followed by closure of Ponds B through E
- In-situ closure of Ponds B through E leaving the contents in the current condition
- In-situ stabilization followed by closure of Ponds B through E

Each alternative is discussed below.

7.4.1 No Action

Under the no action alternative, MTW would not initiate decommissioning activities at the ponds. MTW would be required to maintain current radiological controls, site security, all applicable licenses and permits, and utilities. The no-action alternative requires MTW apply for and obtain an extension to the current IEPA permits and reach an agreement with IEPA as to the status of the retention ponds. The no-action alternative would also be non-compliant with the 10 CFR 40.42 (timeliness rule). The purpose of the timeliness rule is to reduce potential risk to the public and the environment. Moreover, the ponds will require decommissioning eventually. Thus, the no action alternative merely delays, rather than avoids, the impacts associated with the action alternatives.

7.4.2 Removal and Disposal of the Pond Contents

The off-site disposal alternative was considered but is not the preferred alternative on the basis of the cost/benefit analysis. Under this alternative, radiologically-contaminated materials would be removed from the facility and disposed of at a facility licensed to accept the materials. On-site radioactive contamination would be reduced to levels considered acceptable for release for unrestricted use. The radiologically-contaminated materials would be transported from the facility via railcar. Construction/rehabilitation of roadways to support truck traffic between the ponds and the railroad staging area would also be required. This alternative would result in increased noise and air emissions levels during the construction period. Because use of the pond area would be unrestricted following removal of the radiologically-impacted materials, the area could be redeveloped for additional industrial use. The long-term ecological value and aesthetic value of the area after release for unrestricted use are difficult to define as the site will continue in operation as an industrial facility after release of the ponds from the license. The potential for accidents during transport and high disposal cost significantly outweigh the minimal benefit to the plant from possible re-use of the pond areas. The potential impacts associated with this alternative are discussed below. This alternative is not environmentally preferable to the proposed action.

7.4.3 Removal and Recycling of the Pond Contents

This action requires removal and transportation of the pond contents to a recycling facility or construction of a recycling facility at MTW. Recycling would then be followed by closure of Ponds B through E. Engineering evaluations for pond closure found that recycling was not technically feasible. As a result, this option is not a reasonable alternative to the proposed action.

7.4.4 In-place Closure of Ponds B through E

This action requires construction of an engineered RCRA cover system while leaving the pond contents in their current condition. Physical property tests show that the pond contents without stabilization may not be able to remain cohesive in certain extreme seismic events. As a result, this option is less desirable than the proposed action.

7.4.5 Stabilization and In-place Closure of Ponds B through E

This action requires stabilization of the pond contents with Portland cement or similar pozzolanic material. Following stabilization of the pond contents, an engineered RCRA cover system will be constructed on each pond. This approach meets regulatory requirements by:

- Eliminating free liquids through adding pozzolanic materials
- Stabilizing the pond material to achieve a bearing capacity sufficient to support an engineered RCRA cover that provides:
  - Long-term minimization of the infiltration of water
  - No maintenance to meet NRC closure requirements for unrestricted release
  - Proper surface water drainage and erosion protection of the engineered RCRA cover

7.5 Cumulative Effects

The cumulative effects of the implementation of the proposed action will result in no short term cumulative impacts. It is likely that long-term site use restrictions under RCRA will be assigned to the pond areas. These restrictions are likely to prohibit future residential development of the property, regardless of its radiological status.

7.6 Description of the Affected Environment

7.6.1 Land Use

A description of land use in the vicinity of MTW was included in the Environmental Report associated with renewal of source material license SUB-526 (Renewal ER). That description is incorporated by reference.

7.6.2 Transportation

A description of transportation in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.3 Geology and Soils

A description of geology in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.4 Hydrology

A description of hydrology in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.5 Ecological Resources

A description of ecological resources in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.6 Air Quality, Meteorology and Climatology

A description of air quality and meteorology and in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.7 Noise

A description of noise in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.8 Historic and Cultural Resources

A description of historical and cultural resources in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.9 Visual/Scenic Resources

A description of visual/scenic resources in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.10 Socioeconomic

A description of socioeconomics in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.11 Public and Occupational Health

A description of public and occupational health in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.6.12 Waste Management

A description of waste management in the vicinity of MTW can be found in the Renewal ER and is incorporated by reference.

7.7 Description of Impacts to the Environment for Proposed Action

The following sections describe specific areas of the environment that may be affected as a result of the proposed activities.

7.7.1 Land Use

Ponds B through E are located at the southwest corner of the plant footprint within the existing controlled area. The existing plant footprint is in the central portion of the land owned and controlled by MTW. Construction activities associated with the pond closure will be limited to on-site actions. Therefore, no adverse impacts on neighboring land use, including residential or agricultural land uses, would result. Dust and noise impacts associated with this alternative are not expected to significantly impact off-site land use. On-site land use impacts during decommissioning would be minimal, as current industrial activities in construction area would not be affected. Off-site activities associated with decommissioning would include the identification of suitable sources of engineered barrier materials and the transport of those materials to the MTW facility. It is expected that commercial local sources of soil borrow materials would be identified. Similarly, the source of the rock cover materials is a commercial quarry. Therefore, off-site land use impacts associated with the, acquisition, removal and transport of engineered barrier materials from their respective source areas to the MTW facility would likely be minimal.

The only land use impacted by the decommissioning activities under the proposed action would be the future use of the closed ponds within the MTW facility. IEPA requires institutional controls related to future use of the area in which the engineered cover system is constructed regardless of its radiological status. Long-term land use impacts are difficult to predict, as future land use needs are dependent upon many factors. Isolation of the radioactive materials in place provides a greater degree of environmental protection than the existing conditions at the MTW facility and therefore is in keeping with the protection of the environment. The institutional controls that would limit future use of the restricted area would be in keeping with current industrial use. Therefore, the implementation of future use restrictions in the engineered barrier area would not significantly impact future development of currently undeveloped areas of the facility. Similarly, no adverse indirect off-site land use impacts would be expected following completion of decommissioning activities.

7.7.2 Transportation

The MTW facility is located approximately one mile west of Metropolis. US Highway 45 and Burlington North Railroad border the facility to the north, and Ohio River bounds the MTW facility to the south. Interstate 24 is located approximately 4.5 miles east of the facility and provides access from Paducah, KY across the Ohio River into Metropolis, IL. The proposed action would involve minimal on-site transportation impacts. An on-site roadway system to the ponds currently exists that could support the on-site truck traffic. A minor short-term increase in traffic to and from the facility would occur due to the transport of engineered cover system materials to the site but would require no modification of the local transportation system. To bring the estimated 80,000 cubic yards of engineered cover system materials and pozzolanic additives on-site, approximately 4,000 dump truck loads of soil, rock, and pozzolanic material (based on standard-sized 15-cubic meter [20-cubic yard] trucks) will be transported to the ponds from a combination of on-site borrow and offsite borrow sources. Assuming that these materials are transported to the facility over period of 18 months, the average round trip traffic to/from the facility would be approximately 10 trucks per day.

7.7.3 Geology and Soils

The MTW Site is located near the northern end of the Mississippian Embayment, an extension of the Gulf Coastal Plain and a depositional basin filled in with weakly lithified Cretaceous, Tertiary, and Quaternary clastic sediments, which overlap Paleozoic bedrock. Under this alternative, materials would be stabilized within the area in which they are currently located. Impacts to the geology and soils due to the proposed action would be limited to the immediate area within the footprint of Ponds B through E. Therefore, the impacts of the preferred alternative on existing geologic and soil features of the facility would be minimal. The greatest potential impact would be construction of an engineered barrier designed to provide protection against erosion, even under intense meteorological conditions. Other baseline geologic and soil features (underlying soil compaction, disruption of natural drainage patterns, etc.) are not expected to be significantly impacted, due to the presence of the existing ponds. Also, the existing ponds have demonstrated long-term stability. The engineering cover will exhibit even greater stability. The stability of the engineered barrier design under both static and seismic loadings is demonstrated by the stability analysis conducted as part of the engineering design of the engineered barrier (Appendix V). The maximum slopes of the cover system are also consistent with the design standard in the waste disposal industry and have been demonstrated to be protective against slope failures for highly variable waste materials. Therefore, the potential for slope failures of the engineering barriers are not a major concern.

7.7.4 Hydrology

The MTW Site is bound on the south by the Ohio River in the vicinity of River Mile 946 (USGS, 1982). The Ohio River at the plant site is about 910 meters (3,000 feet) wide with a normal pool elevation of 88 meters (290 feet) above mean sea level. The Ohio River drains 203,940 square miles (ORSANCO, 2004). The site is located along the Ohio River at a point approximately 35 miles upstream from its confluence with the Mississippi River.

Effluent from settling Pond D is mixed with other plant effluents before discharge at Outfall 002. Outfall 002, which is used to discharge the plant's treated sanitary, process waste waters, non-contact cooling water, and storm water, is located on one of the on-site drainages about 610 meters (2,000 feet) from the Ohio River. According to NPDES permit data, Outfall 002 is located at latitude 3710090, longitude – 08845290 within USGS hydrologic basin code 05140206 (USEPA, 2005). With the pond closure, discharges from Pond D to Outfall 002 will end.

Implementation of the preferred alternative will not require the use of water (other than potentially for dust control or equipment decontamination purposes), so there will be no significant project-related withdrawals of surface water or ground water. Similarly, no direct discharges to surface water will be associated with the implementation of this alternative. The only potential indirect discharges would be discharges to surface water via stormwater flow and infiltration of precipitation, with subsequent discharge to the ground water. All construction activities will comply with stormwater discharge requirements applicable to construction projects. Run-on and run-off controls will be used in construction areas to minimize the impact of construction activities on stormwater quality. Existing impacts to ground water associated with the presence of the ponds are not significant. Localized drainage controls would be placed to direct surface water flow from the engineered barriers to the desired points for control prior to off-site discharge. In addition, the berms will be protected with riprap, so even if there is localized flooding, adverse impacts to the cover system would not be expected. Once the engineered cover system is in place, direct contact between the consolidated radioactive materials and stormwater will no longer occur, preventing any associated stormwater impacts. The features of the engineered cover system will inhibit the potential infiltration of precipitation through the engineered cover system. These features, combined with the low leachability of the stockpiled materials, will inhibit any potential future impacts to ground water quality. Therefore, none of the alternatives are expected to have significant impacts on surface or ground water quality.

7.7.5 Ecological Resources

Developing the existing plant required clearing all natural vegetation from the site to allow construction of buildings, ponds, and other plant-related facilities. The plant site occupies only about 5% of applicant's property that has otherwise remained mostly undeveloped through the years. Review of topographic maps suggests that the plant site was historically devoid of aquatic features of interest, including ephemeral streams. Accordingly, like terrestrial habitats and biota, the plant has had little or no affect on the area's aquatic biotic resources. Potential ecological resource impacts from pond closure include impacts that could result from on-site construction activities. However, construction activities within the ponds area will for the most part occur in an area that is already relatively clear of existing vegetation and that has no significant ecological value. Over the long-term, ecological resources could be impacted by a change in the long-term habitat value of the areas affected by the cover system. There are no anticipated impacts to the ecological resources due to the proposed pond closure action.

7.7.6 Air Quality, Meteorology and Climatology

The Meteorology and Climate of the MTW UF_6 conversion plant near Metropolis, Illinois, was summarized in a 1995 Environmental Assessment (EA) (USNRC, 1995). This report referenced meteorological data from the National Weather Service at Paducah, Kentucky, which is on the far bank of the Ohio River just 6.8 miles south of the MTW UF_6 site. It is reasonable to assume that the climate at Paducah adequately describes the weather at the plant. There are no anticipated impacts to the meteorology and climatology due to the proposed pond closure action.

Construction activities associated with the preferred alternative could impact air quality through dust and emissions from construction equipment. Although dust from the pond contents would not occur due to the moisture content, dust from the surrounding soils and from installation of the cover system could be generated. Should this occur, dust suppression measures will be implemented, as necessary, during construction. Emissions from plant equipment during closure are expected to be minor and of limited duration. Overall, pond closure is not expected to alter the existing air quality and would comply with the National Ambient Air Quality Standards (NAAQS).

7.7.7 Noise

There are no ambient noise survey data available for the area around the MTW site nor has Honeywell performed any noise surveys at the boundary of the exclusion area. There are no known noise-sensitive receptors in close proximity to the site with the exception of Category B rural residences typically assigned a NAC of 72dBA. Common outdoor noise levels in the range of 60-70dBA are heavy highway traffic at 300 feet (60dBA) to a gas-powered lawn mower at 100 feet (75dBA). The potential noise impacts associated with the proposed action would be short-term impacts associated with construction activities. However, these impacts are not expected to be significant in light of the current noise levels at the site, which are typical of an industrial facility. Thus, there are no anticipated impacts to the noise conditions due to the proposed pond closure action beyond short-term general constructions noises typical of any operational industrial area. Following completion of the proposed action, no additional noise-generating activities would occur, with the possible exception of infrequent maintenance activities.

7.7.8 Historic and Cultural Resources

There are no known records of archeological or cultural surveys available for the previous development at the site. No registered Federal or State archaeological sites were identified within the boundaries of the site. There are no anticipated impacts to historical and cultural resources due to the proposed pond closure action, which will take place in a previously-disturbed area.

7.7.9 Visual/Scenic Resources

The MTW site lies in a rural region of extreme southern Illinois adjacent to the Ohio River. Generally, southern Illinois is an area of swampy, forested bottomlands and low clay and gravel hills. Away from well-traveled roadways, the area affords pastoral viewsheds where rural residences and undeveloped agricultural land and deciduous forests are the dominant visual features.

U.S. Highway 45 and a Burlington Northern railroad right-of-way border MTW to the northeast. Viewed from the air, MTW has the typical appearance of an industrial complex with interconnected industrial-looking buildings, storage of material, exhaust stacks with pollution control equipment, parking lots, railroad spurs, and other operational support areas. Cleared ground on the property is minimal. The plant buildings and operational areas are surrounded by two nine-foot high chain-link and barbed wire security fences approximately 50 feet apart. The majority of the site buildings are visible from U.S. Highway 45 northeast of the plant structures. While Massac County is mainly rural, the area in the immediate vicinity of the MTW site contains other substantial industrial and urban development on both sides of the Ohio River.

Impacts due to the proposed closure action will be limited to the appearance of the engineered RCRA cover system within the confines of the MTW owned and controlled land. The impact will not significantly alter the current visual/scenic resource.

7.7.10 Socioeconomic

The plant site is located in a predominantly agricultural area of low average population density with widely scattered villages and small cities in Massac County, Illinois, and across the Ohio River in McCracken County, Kentucky. The workforce required to implement the preferred alternative would be limited in size. Some of the work will require special qualifications and may therefore require the temporary importation of qualified workers from other areas. Workers that do not require special qualifications should be available locally. Overall, the potential individual and cumulative impacts on local population, housing, and health, social, and educational services are expected to be minimal. The presence of the construction workers will result in slight increases in the amount of income taxes collected. Purchase of materials of construction (e.g., soil) could potentially provide a positive local economic benefit during the construction period provided suitable materials are available locally.

The presence of the engineered barrier and associated institutional controls would prevent future development of the pond areas for commercial or industrial purposes. However, it is likely that land use across the facility will be limited to non-residential uses given the existing industrial facilities present. Therefore, restrictions on future development of the pond areas will have a limited impact on the potential development of the rest of the facility. Therefore, it is not expected that the implementation of the preferred alternative will have adverse socioeconomic impacts on the area.

7.7.11 Public and Occupational Health

External background radiation levels in the vicinity of Metropolis, Illinois, are primarily from natural sources of cosmic and terrestrial origin. The total effective dose equivalent from cosmic rays is about

.43 mSv (43 mrem) per year, while terrestrial sources contribute about .46 mSv (46 mrem) per year (Oakley). Radon progeny doses are highly variable, with an average effective dose equivalent of 2.0 mSv (200 mrem) per year (US National Council on Radiation Protection and Measurements). The impacts to the public and occupational radiological dose are discussed in detail in the dose modeling discussion in this report.

No liquid discharges are expected to be associated with this alternative. Stormwater management features associated with the design of the engineered barrier would contain the 100-year storm and would withstand temporary inundation during larger storm events without damage. Releases to the air associated with the construction of the engineered barrier would consist of the generation of air and particulate emissions. Exposures to on-site workers during the limited construction would mainly consist of exposures to fugitive dust and direct radiation associated with material stabilization activities. Cumulatively, onsite workers would be subject to the combined impacts of air emissions, direct radiation and noise. These impacts could be mitigated through the use of appropriate personal protection equipment and dust suppression materials.

Off-site cumulative impacts would mainly consist of air emissions and noise. These impacts would be short-term impacts incurred during the construction period. Risks associated with transportation activities are limited to the risks involved in the shipment of cover materials to the MTW facility. Dose to members of the public would be non-existent because the pond area will remain within the proprietor owned area and under the control of MTW. Due to the absence of projected impacts of the alternative on ground water quality, potable water use and use of ground water for irrigation purposes would not be impacted by this alternative. Even though no impacts on ground water quality are expected, this alternative would provide a greater degree of protection than the existing conditions because the engineered barrier will isolate the underlying materials from the infiltration of precipitation in the future.

7.7.12 <u>Waste Management</u>

The preferred alternative is not expected to result in the generation of significant amounts of waste requiring off-site management. The proposed closure action will eliminate use of the Pond D as a receptor for water. By stabilizing the radioactive materials beneath an engineered barrier on-site, there will be minimal, if any, impact on off-site waste management systems. Additional waste materials potentially generated under this alternative include personal protection equipment wastes (e.g., disposable protective clothing), which would be minimal. Waste generated during the closure process will be monitored as necessary for radiological contamination and dispositioned accordingly. No other impacts are anticipated.

7.8 Description of Impacts to the Environment for Alternate Off-Site Disposal Action

The following sections describe specific areas of the environment that may be affected as a result of the alternate off-site disposal activities.

7.8.1 Land Use

Ponds B through E are located at the southwest corner of the plant footprint within the existing controlled area. The existing plant footprint is in the central portion of the land owned and controlled by MTW. The off-site disposal alternative would result in the area remaining available for industrial uses. Dust and noise impacts associated with this alternative are not expected to significantly impact off-site land use. On-site land use impacts during decommissioning would be moderate, as current industrial activities in the construction area would be limited by increased activities specifically associated with the removal and disposal of the pond contents. Off-site activities associated with this alternative would include transport of construction equipment to and from the facility; construction/rehabilitation of roadways to support truck traffic from the ponds to the railroad staging area; and actual transport of the waste materials to the railroad staging area. It is expected that off-site land use impacts associated with the removal and transport of waste materials from the ponds to the disposal facility would be moderate.

The local land use impacted by the activities under the alternate off-site disposal action would be the future use of the pond area within the MTW facility and the road system to the railroad staging area. In addition, potential land impacts at the site receiving the excavated pond materials would be minimal, as the disposal site will be licensed to receive these types of material. This alternative would also have minimal indirect land use impacts.

7.8.2 Transportation

The alternate off-site disposal action would involve on-site and off-site transportation impacts. An on-site roadway system to the ponds currently exists that could support the on-site truck traffic. An increase in traffic to and from the facility would occur due to the transport of waste materials from the site to the railroad staging area and may also require modification/rehabilitation of the local transportation system. Transport of the waste materials off-site would require an estimated 4,410 dump truck loads waste material (based on standard-sized 15-cubic meter [20-cubic yard] trucks) to be transported to the railroad staging facility. Assuming that these materials are transported over period of 24 months, the average round trip traffic to/from the facility would be approximately 9 trucks per day. In addition, following the removal of the radioactive materials for off-site disposal, the excavation areas would be covered with clean topsoil. This would result in additional truck traffic.

7.8.3 Geology and Soils

Under this alternative, materials would be removed from the area in which they are currently located. Impacts to the geology and soils due to the alternate off-site disposal action could extend to the road system between MTW and the railroad staging area. Therefore, there may be minor impacts of the alternate off-site disposal on existing geologic and soil features of the facility roads. Other baseline geologic and soil features (underlying soil compaction, disruption of natural drainage patterns, etc.) are not expected to be significantly impacted, due to the presence of the existing ponds. The disposal site that would receive the decommissioning wastes was required to go through a rigorous geologic evaluation during the permitting process and, the disposal facility permit was issued based on demonstrated protectiveness of geology and soil conditions.

7.8.4 Hydrology

Implementation of the alternate off-site disposal action will not require the use of water (other than potentially for dust control or equipment decontamination purposes), so there will be no significant project-related withdrawals of surface water or ground water. Similarly, no direct discharges to surface water will be associated with the implementation of this alternative. The only potential indirect discharges would be discharges to surface water via stormwater flow and infiltration of precipitation, with subsequent discharge to the ground water. All construction activities will comply with stormwater discharge requirements applicable to construction projects. Run-on and run-off controls will be used in construction areas to minimize the impact of construction activities on stormwater quality. Existing impacts to ground water associated with the presence of the ponds are not significant. Localized drainage controls would be placed to direct surface water flow from the construction area to the desired points for control prior to off-site discharge. Therefore, none of the alternatives are expected to have significant impacts on local surface or ground water quality.

Transport of the materials via railcar to the disposal facility would occur in covered railcars, therefore potential impacts on surface and ground water quality during the transport process would be minimal, unless an unexpected accident were to occur. Even then, the nature of the materials would not present a significant risk to surface water or ground water quality. The containment features of the ultimate disposal facility were constructed in accordance with applicable regulations and would be expected to be protective of surface and ground water quality.

7.8.5 Ecological Resources

Potential ecological resource impacts from the alternate off-site disposal action would include impacts resulting from on-site construction activities and off-site transportation of waste materials. However, construction activities within the ponds area will for the most part occur in an area that is already relatively barren of existing vegetation and that has no ecological value. Over the long-term, ecological resources could be impacted by a change in the long-term habitat value of the areas affected by the demolition of the pond surface impoundments.

7.8.6 Air Quality, Meteorology and Climatology

There are no anticipated impacts to the meteorology and climatology due to the alternate off-site disposal action.

Construction activities associated with the alternate off-site disposal action could impact air quality through dust and emissions from excavation and construction equipment. Releases to the air associated with the demolition of the pond surface impoundments would consist of the generation of air and particulate emissions. Exposures to on-site workers during the limited construction would mainly consist of exposures to fugitive dust associated with material removal activities and possibly dust from the pond contents (though significant dust would not be expected due to the moisture content of the materials). Dust suppression measures will be implemented, as necessary, during waste excavation. Emissions from plant equipment during closure are expected to be minor and of limited duration. Overall, operations associated with the alternate off-site disposal action are not expected to alter the existing air quality and would comply with the NAAQS.

7.8.7 Noise

The potential noise impacts associated with the alternate off-site disposal action would be short-term impacts associated with construction activities. However, these impacts are not expected to be significant in light of the current noise levels at the site, which are typical of an industrial facility. Thus, there are no anticipated impacts to the noise conditions due to the alternate off-site disposal action beyond short-term general construction noises typical of any operational industrial area. Following completion of the alternate off-site disposal action, no additional noise-generating activities would occur.

7.8.8 Historic and Cultural Resources

There are no anticipated impacts to historical and cultural resources due to the alternate off-site disposal action, which will take place in a previously-disturbed area.

7.8.9 Visual/Scenic Resources

Impacts due to the alternate off-site disposal action will be limited to the change in scenery associated with the demolition and removal of the pond surface impoundments within the confines of the MTW owned and controlled land. The impact will not significantly alter the current off-site visual/scenic resource.

7.8.10 Socioeconomic

The socioeconomic impacts associated with this alternative would be comparable to the preferred alternative. The workforce required to implement the alternate off-site disposal action would be limited in size. Some of the work will require special qualifications and may therefore require the temporary importation of qualified workers from other areas. Workers that do not require special qualifications should be available locally. Overall, the potential individual and cumulative impacts on local population, housing, and health, social, and educational services are expected to be minimal. The presence of the construction workers will result in slight increases in the amount of income taxes collected. Purchase of materials for construction (e.g., soil) could potentially provide a positive local economic benefit during the construction period provided suitable materials are available locally.

The removal of the pond surface impoundments would potentially allow for future development of the pond areas for commercial or industrial purposes. However, it is likely that land use across the facility will be limited to non-residential uses given the existing industrial facilities present. Therefore, the availability of the pond area for future development will have a limited impact on the potential development of the rest of the facility. Therefore, it is not expected that the implementation of the alternate off-site disposal action will have adverse socioeconomic impacts on the area.

7.8.11 Public and Occupational Health

The impacts to the public and occupational radiological dose associated with the alternate off-site disposal action would be a result of the removal and transport of the waste materials. Given the low radioactivity of the material, exposure rates of the waste material would be minimal, and therefore of little significance when compared to background radiation exposure levels.

No liquid discharges are expected to be associated with this alternative. Releases to the air associated with the demolition of the pond surface impoundments would consist of the generation of air and particulate emissions. Exposures to on-site workers during the limited construction would mainly consist of exposures to fugitive dust and direct radiation associated with material removal activities. Cumulatively, onsite workers would be subject to the combined impacts of air emissions, direct radiation and noise. These impacts could be mitigated through the use of appropriate personal protection equipment and dust suppression materials.

Off-site cumulative impacts would mainly consist of air emissions, noise, direct radiation, and risks associated with the transport of the waste materials to the disposal facility and shipment of clean cover fill to MTW. These impacts would be short-term impacts incurred during the construction period. Even though no impacts on ground water quality are expected, this alternative would provide a greater degree of protection than the existing conditions because the removal of the pond contents will eliminate the underlying materials from the infiltration of precipitation in the future.

7.8.12 Waste Management

The alternate off-site disposal action is expected to result in the generation of significant amounts of waste requiring off-site management. Under this alternative, the radioactive materials will be transported to a licensed facility for final disposal. The waste disposal facility will have sufficient capacity to receive the described waste materials. This option consumes limited licensed waste disposal capacity. Additional waste materials potentially generated under this alternative include personal protection equipment wastes (e.g., disposable protective clothing), which would be minimal.

7.9 Mitigation Measures

Mitigation measures are those measures taken to minimize adverse impacts, such as the impacts of construction activities or potential post-closure actions. Mitigation measures associated with each of the alternatives are outlined below.

7.9.1 On Site Closure

Mitigation measures under the preferred alternative include:

- The development and implementation of effective health and safety measures to maintain a safe environment during construction.
- The implementation of a Quality Assurance/Quality Control Construction Plan to assure that decommissioning activities are performed in a manner consistent with the decommissioning plan, regulatory requirements and license conditions.
- The development and implementation of an environmental monitoring and control program to reduce exposures to radioactive materials and direct radiation. Such a program will include the following:
  - Sediment control measures, including run-off control measures as defined in the engineered cover system design.
  - Dust suppression measures, such as water spray, calcium chloride, or other dust suppression materials, to minimize the release of airborne materials from material excavation, transport and consolidation activities.
  - Air monitoring to monitor dust generation in the work area.
- The development and implementation of a long-term maintenance, monitoring and institutional control program, as required by IEPA, that will ensure the engineered cover system is adequately maintained following construction and to ensure that institutional controls limiting future site use are enforced. Such a program will include the following:
  - Inspection program to ensure the integrity of the engineered barrier, associated surface water management systems and site security;
  - Maintenance of the engineered barrier, surface water management systems, and site security measures;
  - Implementation of deed restrictions and maintenance of associated land use restrictions as required by IEPA.

7.9.2 Off Site Disposal

Mitigation measures under the off-site disposal alternative would include:

- The development and implementation of effective health and safety measures to maintain a safe environment during construction.
- The development and implementation of a Quality Assurance program to assure that decommissioning activities are performed in a manner consistent with regulatory requirements and license conditions.

- The development and implementation of an environmental monitoring and control program to reduce exposures to radioactive materials and direct radiation during decommissioning. Such a program would include the following:
  - Sediment control measures, including run-on and run-off control measures utilizing perimeter drainage swales, silt fences, hay bales and other stormwater and erosion control features, as necessary and stormwater collection and treatment in the staging area.
  - Dust suppression measures, such as water spray, calcium chloride, or other dust suppression materials, to minimize the release of airborne materials from material excavation, transport and material management (railcar loading) activities.
  - Air monitoring to monitor dust generation in the work area.
- The development and implementation of a transportation and contingency program, to ensure that the waste hauler (i.e., rail carrier) is knowledgeable of the materials being carried, and the associated health and safety/spill prevention and control issues and actions to be taken in the event of a transportation accident during shipment of the radioactive materials to the off-site disposal facility.

7.10 Environmental Impact Summary

Impacts to the environment and mitigation measures are summarized in the table below:

Affected Environment	No Action	Proposed Action	Offsite Disposal Alternative
Land Use	No Impacts	Possible Impact: The engineered cover system and institutional controls would limit future use of the pond area.	Possible Impact: Elimination of the pond surface impoundments would allow for future development of the pond area for additional industrial use. The land used by the off-site disposal facility would not be available for future use.
Transportation	No Impacts	Possible Impact: Significant increase in truck traffic to and from the facility to transport waste materials would occur; may result in a need for modification/rehabilitation of the local road system.	Possible Impact: Significant increase in truck traffic to and from the facility to transport waste materials would occur; may result in a need for modification/rehabilitation of the local road system.
Geology and Soils	No Impacts	Possible Impact: Construction/modification of local drainage system to properly direct runoff water from the pond area to outfall locations.	Possible Impact: Impacts associated with the modification/rehabilitation of the local road system.
Hydrology	No Impacts	Possible Impact: Discharge from the surface impoundments to outfall 002 will be eliminated.	Possible Impact: Discharge from the surface impoundments to outfall 002 will be eliminated.
Air Quality	No Impacts	Possible Impact: The placement of the soil materials associated with the engineered cover system will result in some increased air emissions. Dust suppression measure will be implemented, as necessary, during construction.	Possible Impact: The removal of the pond materials and loading of rail cars associated with this alternative will result in increased air emissions. Emissions would be greater than those expected to occur under the proposed action. Dust suppression measure will be implemented, as necessary, during construction.
Ecological Resources	No Impacts	No Impacts	No Impacts

Affected Environment	No Action	Proposed Action	Offsite Disposal Alternative
Noise	No Impacts	Possible Impact: Possible temporary noise increase due to construction activities at the surface impoundment location.	Possible Impact: Possible temporary noise increase due to construction activities at the surface impoundment location. Use of additional equipment (e.g., excavator, locomotives) results in slightly higher noise levels when compared to proposed action.
Cultural and Historic Resources	No Impacts	No Impacts	No Impacts
Visual/Scenic Resources	No Impacts	Possible impact: Change in appearance of the surface impoundments due to the placement of the engineered cover system.	Possible impact: Change in appearance of the surface impoundments due to the removal of the pond surface impoundments.
Socioeconomic	No Impacts	No Impacts	No Impacts
Public and Occupational Health	No Impacts	Possible Impact: Radiological dose consequence, which is very low, is detailed within this report	Possible Impact: Radiological dose consequence and transport accident risk would be increased as a result of the alternate off-site disposal action.
Waste Management	No Impacts	Possible Impact: Elimination of the pond area for liquid waste collection.	Possible Impact: Elimination of the pond area for liquid waste collection. Significant cost associated with transport and disposal of the waste materials. Consumes limited radioactive waste disposal capacity.

8.0 References

1. Andrews Engineering, Inc. "Calcium Fluoride Sludge Pond Sampling Report", February 2010
2. ANL/EAD-4, "User's Manual for RESRAD Version 6", July 2001
3. Argonne National Laboratory, NUREG/CR-6697, "Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes", December 2000
4. Benson, C.H. and Wang, X. "Hydraulic Conductivity of A Large Block Sample"
5. Enercon Services, Inc., "Historical Site Assessment, Honeywell Metropolis Works, Metropolis, IL", April 2009
6. Enercon Services, Inc., "Environmental Report Renewal of Source Material License SUB-526 Docket 40-3392 for Honeywell Specialty Materials", May 2005
7. International Commission on Radiological Protection, Radionuclide Transformations: Energy and Intensity of Emissions, ICRP Publication 38, 1983
8. International Commission on Radiological Protection, Principles of Monitoring for the Radiation Protection of the Population, A Report of Committee 4 of the ICRP (adopted 1984), ICRP 43, 1985
9. Title 10 to the Code of Federal Regulations, Part 20.1402, "Radiological Criteria for Unrestricted Use"
10. U.S. Environmental Protection Agency Federal Guidance Report No.11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion, 1988
11. U.S. Environmental Protection Agency Federal Guidance Report No.12, External Exposure To Radionuclides In Air, Water, and Soil, 1993
12. U.S. Nuclear Regulatory Commission, NUREG/CR-6692, "Probabilistic Modules for the RESRAD and RESRAD-BUILD Computer Codes", November 2000
13. U.S. Nuclear Regulatory Commission, NUREG-1757, Vol. 2, "Consolidated NMSS Decommissioning Guidance - Characterization, Survey, and Determination of Radiological Criteria", September 2003
14. U.S. Nuclear Regulatory Commission, NUREG/CR-6676, "Probabilistic Dose Analysis Using Parameter Distributions Developed for RESRAD and RESRAD-BUILD Computer", May 2000
15. U.S. Nuclear Regulatory Commission, NUREG/CR-1575, "Multi-Agency Radiation Survey and Site Investigation Manual", August 2000

9.0 List of Preparers

Gerald E. Williams, P.E.
Senior Project Manager
ENERCON Services, Inc.

Sean J. Horgan
Senior Engineer
ENERCON Services, Inc.

Todd S. Brautigam
Technical Specialist
ENERCON Services, Inc.

APPENDIX A

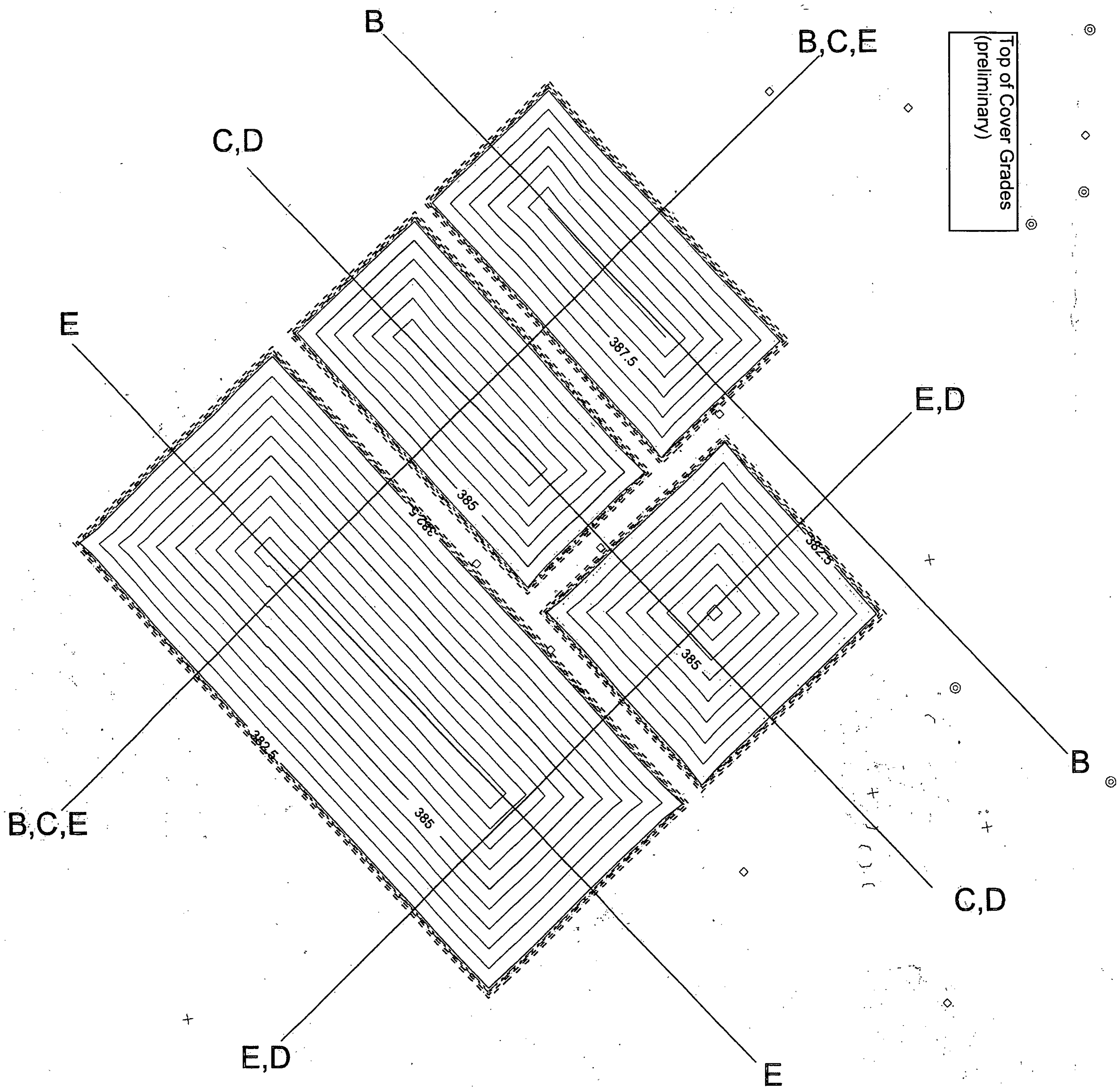
Supporting Documentation

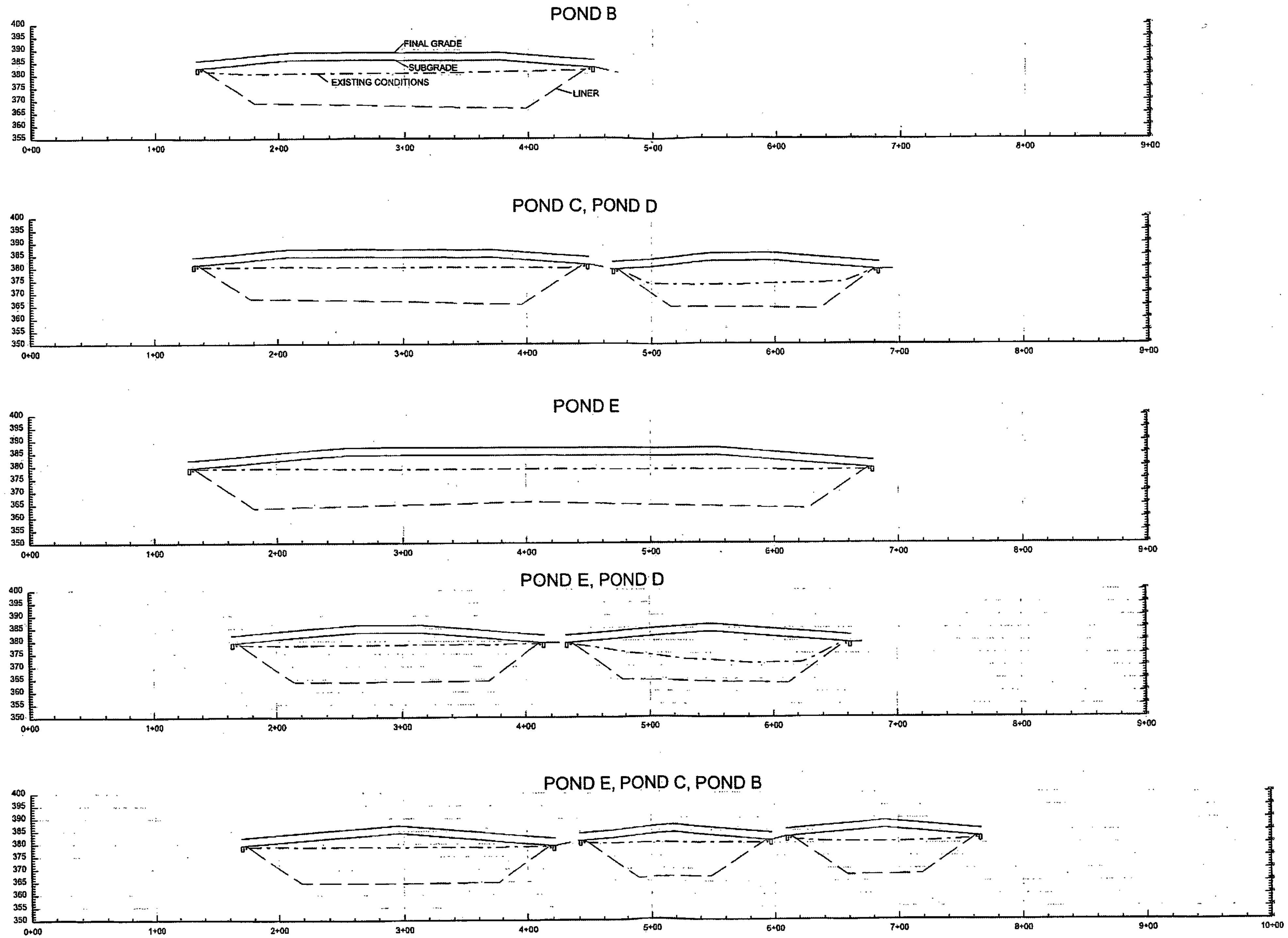
APPENDIX A-1

Calculation of Average Cover Soil Thickness over Sludge
Closure Option 2b - Ponds B, C, D, and E

Description	Pond B	Pond C	Pond D	Pond E
Volume Subgrade Fill Above Sludge (cu. ft.)	134450	102859	268162	360698
Volume of 3' Cover Above Subgrade (cu. ft.)	129463	129728	124716	390354
TOTAL Volume of Cover Soils (fill and cover) Above Sludge (cu. ft.)	263913	232587	392878	751052
Volume of Sludge (cu. yd.)	13027	13632	9518	52017
Volume of Sludge (cu. ft.)	351729	368064	256986	1404459
Bulking Increase of Sludge during In-Situ Mixing (assume 5%) (cu. ft.)	17586	18403	12849	70223
Surface Area of Sludge (sq. ft.)	43169	43244	41980	130156
Average Thickness of Cover Soil Over Current Sludge Surface (ft)	6.11	5.38	9.36	5.77
Reduction in Cover Soil Thickness due to 5% Sludge Bulking (ft)	0.41	0.43	0.31	0.54
BEST ESTIMATE: Average Cover Thickness (ft)	**5.71**	**4.95**	**9.05**	**5.23**

Top of Cover Grades (preliminary)





HONEYWELL METROPOLIS SITE CROSS SECTIONS

APPENDIX A-2

APPENDIX A-3

WATERSHED MAP

1000' 500' 0 500' 1000' 2000'

GRAPHIC SCALE
1"=2000'

APPENDIX B

Pond B Probabilistic Sensitivity Analysis Input Summary

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	4,000	NR	NR	NR	NR	See Table B-2.
Thickness of contaminated zone	m	2	P	2	D	2.608	NR	NR	NR	NR	See Table B-2.
Length parallel to the aquifer flow	m	100	P	2	D	94	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table B 2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table B-3
Soil: Pa-231	pCi/g	0	P	2	D	0.04	NR	NR	NR	NR	See Table B-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table B-3
Soil: Ra-226	pCi/g	0	P	2	D	0.42	NR	NR	NR	NR	See Table B-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table B-3
Soil: Th-228	pCi/g	0	P	2	D	0.08	NR	NR	NR	NR	See Table B-3
Soil: Th-230	pCi/g	0	P	2	D	2.30	NR	NR	NR	NR	See Table B-3
Soil: Th-232	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table B-3
Soil: U-234	pCi/g	0	P	2	D	69.50	NR	NR	NR	NR	See Table B-3
Soil: U-235	pCi/g	0	P	2	D	4.48	NR	NR	NR	NR	See Table B-3
Soil: U-236	pCi/g	0	P	2	D	1.86	NR	NR	NR	NR	See Table B-3
Soil: U-238	pCi/g	0	P	2	D	71.59	NR	NR	NR	NR	See Table B-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.74	NR	NR	NR	NR	See Table B-2
Density of cover material	g/cm^3	1.5	P	1	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Cover erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00003	0.00018	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with maximum 5% slope. Design maximum slope is 4%
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.575	NR	NR	NR	NR	See Table B-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00001	0.00006	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with assumed 2% slope after cover erosion.

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated zone total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	Uniform	0.5	0.75	-	-	NUREG/CR-6697 Att. C, Section 4.3
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois.
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	277817	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Saturated zone total porosity	-	0.4	P	1	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Saturated zone effective porosity	-	0.2	P	1	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Unsaturated zone 1 total porosity	-	0.4	P	2	S	Bounded Normal	0.36	0.07	0.144	0.576	NUREG/CR-6697 Att. C, Table 3.2-1, Silty Clay

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	Bounded Normal	0.289	0.0735	0.0623	0.517	NUREG/CR-6697 Att. C, Table 3.3-1, Silty Clay
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table B-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	2.29	0.259	4.43	22	NUREG/CR-6697 Att. C, Table 3.5-1, Silty Clay
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 2 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 3 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 4 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 5 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227	cm^3/g	20	P	1	S	Truncated lognormal-n	6.72	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pa-231	cm^3/g	50	P	1	S	Truncated lognormal-n	5.94	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pb-210	cm^3/g	100	P	1	S	Truncated lognormal-n	7.78	2.76	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-226	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-228	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-228	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-230	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-232	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-234	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-235	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-236	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-238	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	Continuous linear	-	-	-	-	NUREG/CR-6697 Att. C, Section 4.6
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	S	Uniform	0.15	0.95	-	-	NUREG/CR-6697 Att. C, Section 7.1
Shielding factor, external gamma	-	0.7	P	2	S	Bounded lognormal-n	-1.3	0.59	0.044	1	NUREG/CR-6697 Att. C, Section 7.10
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	S	Triangular	0	0.15	0.6	-	NUREG/CR-6697 Att. C, Section 3.12
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C□14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Donversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/ (pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/ (pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/ (pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/ (pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table B-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic
[4]Distribution Statistical Parameters:

Lognormal-n: 1 = mean, 2 = standard deviation
Bounded lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Truncated lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower quantile, 4 = upper quantile
Bounded normal: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Beta: 1 = minimum, 2 = maximum, 3 = P-value, 4 = Q-value
Triangular: 1 = minimum, 2 = mode (most likely), 3 = maximum
Uniform: 1 = minimum, 2 = maximum
Continuous logarithmic: RESRAD default statistical parameters
Continuous linear: RESRAD default statistical parameters
NR = not required

Additional Sensitivity Analysis Data:

Sampling Technique = Latin Hypercube
Random Seed = 1000
Number of observations = 300
Number of repetitions = 1
Grouping of Correlations = correlated or uncorrelated

Table B-2
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[1] (ft^3)	5% Sludge Bulking Volume[1] (ft^3)	Stabilized Sludge Volume[2] (ft^3)	Sludge Surface Area[1] (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area[3] (m^2)	Sludge Surface Length[4] (m)	Sludge Surface Width[4] (m)	CZ Thickness[5] (m)	Average Cover Thickness[1] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes:
(1) Andrews Engineering Calculation “Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E” provided in Appendix A
(2) Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume
(3) CZ Area was estimated by rounding the Sludge Surface Area.
(4) Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond dimensions provided in Section 1.2 of the Andrews Engineering "Calcium Fluoride Sludge Pond. Sampling Report"

Table B-3
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Radionuclide Concentration (pCi/g)		
	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.08	0.07	0.04
Radium 226	0.77	0.73	0.42
Thorium 228	0.15	0.15	0.08
Thorium 230	4.23	4.02	2.30
Thorium 232	0.13	0.12	0.07
Uranium 234	127.98	121.58	69.50
Uranium 235	8.24	7.83	4.48
Uranium 236	3.43	3.25	1.86
Uranium 238	131.84	125.25	71.59

Pond Solids: 57.16%

Table B-4
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table B-5
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX C

Pond C Probabilistic Sensitivity Analysis Input Summary

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	4,000	NR	NR	NR	NR	See Table C-2.
Thickness of contaminated zone	m	2	P	2	D	2.724	NR	NR	NR	NR	See Table C-2.
Length parallel to the aquifer flow	m	100	P	2	D	94	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table C-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table C-3
Soil: Pa-231	pCi/g	0	P	2	D	0.13	NR	NR	NR	NR	See Table C-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table C-3
Soil: Ra-226	pCi/g	0	P	2	D	0.31	NR	NR	NR	NR	See Table C-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table C-3
Soil: Th-228	pCi/g	0	P	2	D	0.05	NR	NR	NR	NR	See Table C-3
Soil: Th-230	pCi/g	0	P	2	D	1.56	NR	NR	NR	NR	See Table C-3
Soil: Th-232	pCi/g	0	P	2	D	0.05	NR	NR	NR	NR	See Table C-3
Soil: U-234	pCi/g	0	P	2	D	136.83	NR	NR	NR	NR	See Table C-3
Soil: U-235	pCi/g	0	P	2	D	7.31	NR	NR	NR	NR	See Table C-3
Soil: U-236	pCi/g	0	P	2	D	3.27	NR	NR	NR	NR	See Table C-3
Soil: U-238	pCi/g	0	P	2	D	141.58	NR	NR	NR	NR	See Table C-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.51	NR	NR	NR	NR	See Table C-2
Density of cover material	g/cm^3	1.5	P	1	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Cover erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00003	0.00018	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with maximum 5% slope. Design maximum slope is 4%
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.6	NR	NR	NR	NR	See Table C-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00001	0.00006	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with assumed 2% slope after cover erosion.

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated zone total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	Uniform	0.5	0.75	-	-	NUREG/CR-6697 Att. C, Section 4.3
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	277817	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Saturated zone total porosity	-	0.4	P	1	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Saturated zone effective porosity	-	0.2	P	1	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Unsaturated zone 1 total porosity	-	0.4	P	2	S	Bounded Normal	0.36	0.07	0.144	0.576	NUREG/CR-6697 Att. C, Table 3.2-1, Silty Clay

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	Bounded Normal	0.289	0.0735	0.0623	0.517	NUREG/CR-6697 Att. C, Table 3.3-1, Silty Clay
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table C-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	2.29	0.259	4.43	22	NUREG/CR-6697 Att. C, Table 3.5-1, Silty Clay
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 2 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 3 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 4 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 5 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227	cm^3/g	20	P	1	S	Truncated lognormal-n	6.72	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pa-231	cm^3/g	50	P	1	S	Truncated lognormal-n	5.94	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pb-210	cm^3/g	100	P	1	S	Truncated lognormal-n	7.78	2.76	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-226	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-228	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-228	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-230	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-232	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-234	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-2
U-235	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-3
U-236	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-4
U-238	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-5
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	Continuous linear	-	-	-	-	NUREG/CR-6697 Att. C, Section 4.6
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (*shielding factor, inhalation*)	-	0.4	P, B	2	S	Uniform	0.15	0.95	-	-	NUREG/CR-6697 Att. C, Section 7.1
Shielding factor, external gamma	-	0.7	P	2	S	Bounded lognormal-n	-1.3	0.59	0.044	1	NUREG/CR-6697 Att. C, Section 7.10
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	S	Triangular	0	0.15	0.6	-	NUREG/CR-6697 Att. C, Section 3.12
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Donversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors (pCi/g plant (wet))/(pCi/g soil (dry))											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/(pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table C-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic
[4]Distribution Statistical Parameters:

Lognormal-n: 1 = mean, 2 = standard deviation
Bounded lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Truncated lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower quantile, 4 = upper quantile
Bounded normal: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Beta: 1 = minimum, 2 = maximum, 3 = P-value, 4 = Q-value
Triangular: 1 = minimum, 2 = mode (most likely), 3 = maximum
Uniform: 1 = minimum, 2 = maximum
Continuous logarithmic: RESRAD default statistical parameters
Continuous linear: RESRAD default statistical parameters
NR = not required

Additional Sensitivity Analysis Data:

Sampling Technique = Latin Hypercube
Random Seed = 1000
Number of observations = 300
Number of repetitions = 1
Grouping of Correlations = correlated or uncorrelated

Table C-2
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[1] (ft^3)	5% Sludge Bulking Volume[1] (ft^3)	Stabilized Sludge Volume[2] (ft^3)	Sludge Surface Area[1] (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area[3] (m^2)	Sludge Surface Length[4] (m)	Sludge Surface Width[4] (m)	CZ Thickness[5] (m)	Average Cover Thickness[1] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes: [1] Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A
[2] Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume
[3] CZ Area was estimated by rounding the Sludge Surface Area.
[4] Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table C-3
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

	Radionuclide Concentration (pCi/g)		
Radionuclide	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.26	0.24	0.13
Radium 226	0.59	0.56	0.31
Thorium 228	0.10	0.09	0.05
Thorium 230	3.00	2.85	1.56
Thorium 232	0.09	0.09	0.05
Uranium 234	263.85	250.66	136.83
Uranium 235	14.10	13.40	7.31
Uranium 236	6.31	5.99	3.27
Uranium 238	273.00	259.35	141.58

% Solids: 54.59%

Table C-4
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table C-5
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX D

Pond D Probabilistic Sensitivity Analysis Input Summary

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	3,900	NR	NR	NR	NR	See Table D-2.
Thickness of contaminated zone	m	2	P	2	D	1.959	NR	NR	NR	NR	See Table D-2.
Length parallel to the aquifer flow	m	100	P	2	D	65	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table D-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table D-3
Soil: Pa-231	pCi/g	0	P	2	D	0.25	NR	NR	NR	NR	See Table D-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table D-3
Soil: Ra-226	pCi/g	0	P	2	D	0.46	NR	NR	NR	NR	See Table D-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table D-3
Soil: Th-228	pCi/g	0	P	2	D	0.28	NR	NR	NR	NR	See Table D-3
Soil: Th-230	pCi/g	0	P	2	D	1.14	NR	NR	NR	NR	See Table D-3
Soil: Th-232	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table D-3
Soil: U-234	pCi/g	0	P	2	D	480.78	NR	NR	NR	NR	See Table D-3
Soil: U-235	pCi/g	0	P	2	D	8.68	NR	NR	NR	NR	See Table D-3
Soil: U-236	pCi/g	0	P	2	D	12.87	NR	NR	NR	NR	See Table D-3
Soil: U-238	pCi/g	0	P	2	D	503.83	NR	NR	NR	NR	See Table D-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	2.76	NR	NR	NR	NR	See Table D-2
Density of cover material	g/cm^3	1.5	P	1	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Cover erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00003	0.00018	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with maximum 5% slope. Design maximum slope is 4%
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.6	NR	NR	NR	NR	See Table D-5

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00001	0.00006	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with assumed 2% slope after cover erosion.
Contaminated zone total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests *performed on in-situ Pond E* sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	Uniform	0.5	0.75	-	-	NUREG/CR-6697 Att. C, Section 4.3
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	277817	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Saturated zone total porosity	-	0.4	P	1	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Saturated zone effective porosity	-	0.2	P	1	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	*RESRAD default*
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Unsaturated zone 1 total porosity	-	0.4	P	2	S	Bounded Normal	0.36	0.07	0.144	0.576	NUREG/CR-6697 Att. C, Table 3.2-1, Silty Clay
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	Bounded Normal	0.289	0.0735	0.0623	0.517	NUREG/CR-6697 Att. C, Table 3.3-1, Silty Clay
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table D-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	2.29	0.259	4.43	22	NUREG/CR-6697 Att. C, Table 3.5-1, Silty Clay
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 2 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 3 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 4 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 5 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227	cm^3/g	20	P	1	S	Truncated lognormal-n	6.72	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pa-231	cm^3/g	50	P	1	S	Truncated lognormal-n	5.94	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pb-210	cm^3/g	100	P	1	S	Truncated lognormal-n	7.78	2.76	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-226	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-228	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-228	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-230	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-232	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-234	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-235	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-236	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-238	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	Continuous linear	-	-	-	-	NUREG/CR-6697 Att. C, Section 4.6
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	S	Uniform	0.15	0.95	-	-	NUREG/CR-6697 Att. C, Section 7.1
Shielding factor, external gamma	-	0.7	P	2	S	Bounded lognormal-n	-1.3	0.59	0.044	1	NUREG/CR-6697 Att. C, Section 7.10
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion: Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion: Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	*Pathway suppressed for* industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	S	Triangular	0	0.15	0.6	-	NUREG/CR-6697 Att. C, Section 3.12
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction *from groundwater*	-	1	B, P	3	NA	*Not used*	NR	NR	NR	NR	*Parameter applies to Radon only.*
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Donversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
U-236	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/(pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic
[4]Distribution Statistical Parameters:
Lognormal-n: 1 = mean, 2 = standard deviation
Bounded lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Truncated lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower quantile, 4 = upper quantile

Table D-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis

Bounded normal: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Beta: 1 = minimum, 2 = maximum, 3 = P-value, 4 = Q-value
Triangular: 1 = minimum, 2 = mode (most likely), 3 = maximum
Uniform: 1 = minimum, 2 = maximum
Continuous logarithmic: RESRAD default statistical parameters
Continuous linear: RESRAD default statistical parameters
NR = not required

Additional Sensitivity Analysis Data:
Sampling Technique = Latin Hypercube
Random Seed = 1000
Number of observations = 300
Number of repetitions = 1
Grouping of Correlations = correlated or uncorrelated

Table D-2
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[1] (ft³)	5% Sludge Bulking Volume[1] (ft³)	Stabilized Sludge Volume[2] (ft³)	Sludge Surface Area[1] (ft²)	Sludge Surface Area (m²)	Estimated CZ Area[3] (m²)	Sludge Surface Length[4] (m)	Sludge Surface Width[4] (m)	CZ Thickness[5] (m)	Average Cover Thickness[1] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes: [1] Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A

[2] Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume

[3] CZ Area was estimated by rounding the Sludge Surface Area.

[4] Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table D-3
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Radionuclide Concentration (pCi/g)		
	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.52	0.49	0.25
Radium 226	0.95	0.90	0.46
Thorium 228	0.58	0.55	0.28
Thorium 230	2.35	2.23	1.14
Thorium 232	0.15	0.14	0.07
Uranium 234	993.50	943.82	480.78
Uranium 235	17.94	17.04	8.68
Uranium 236	26.60	25.27	12.87
Uranium 238	1041.12	989.06	503.83

% Solids: 50.94%

Table D-4
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table D-5
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX E

Pond E Probabilistic Sensitivity Analysis Input Summary

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	12,000	NR	NR	NR	NR	See Table E-2.
Thickness of contaminated zone	m	2	P	2	D	3.453	NR	NR	NR	NR	See Table E-2.
Length parallel to the aquifer flow	m	100	P	2	D	165	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table E 2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table E-3
Soil: Pa-231	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table E-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table E-3
Soil: Ra-226	pCi/g	0	P	2	D	0.34	NR	NR	NR	NR	See Table E-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table E-3
Soil: Th-228	pCi/g	0	P	2	D	0.03	NR	NR	NR	NR	See Table E-3
Soil: Th-230	pCi/g	0	P	2	D	0.83	NR	NR	NR	NR	See Table E-3
Soil: Th-232	pCi/g	0	P	2	D	0.03	NR	NR	NR	NR	See Table E-3
Soil: U-234	pCi/g	0	P	2	D	118.57	NR	NR	NR	NR	See Table E-3
Soil: U-235	pCi/g	0	P	2	D	5.11	NR	NR	NR	NR	See Table E-3
Soil: U-236	pCi/g	0	P	2	D	2.91	NR	NR	NR	NR	See Table E-3
Soil: U-238	pCi/g	0	P	2	D	122.69	NR	NR	NR	NR	See Table E-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.59	NR	NR	NR	NR	See Table E-2
Density of cover material	g/cm^3	1.5	P	1	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Cover erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00003	0.00018	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with maximum 5% slope. Design maximum slope is 4%
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.438	NR	NR	NR	NR	See Table E-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	Uniform	0.00001	0.00006	-	-	Uniform distribution derived from NUREG/CR-6697 Att.C, Section 3.8 for permanent pasture with assumed 2% slope after cover erosion.

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated zone total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	Uniform	0.5	0.75	-	-	NUREG/CR-6697 Att. C, Section 4.3
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume c_1 = 0.3, c_2 = 0.2, and c_3 = 0.1
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	277817	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Saturated zone total porosity	-	0.4	P	1	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Saturated zone effective porosity	-	0.2	P	1	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.696	0.1855	1.123	2.269	NUREG/CR-6697 Att. C, Table 3.1-1, Silty Clay
Unsaturated zone 1 total porosity	-	0.4	P	2	S	Bounded Normal	0.36	0.07	0.144	0.576	NUREG/CR-6697 Att. C, Table 3.2-1, Silty Clay

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	Bounded Normal	0.289	0.0735	0.0623	0.517	NUREG/CR-6697 Att. C, Table 3.3-1, Silty Clay
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table E-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	2.29	0.259	4.43	22	NUREG/CR-6697 Att. C, Table 3.5-1, Silty Clay
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 2 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 3 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5635	0.2385	0.827	2.3	NUREG/CR-6697 Att. C, Table 3.1-1, Loamy Sand
Unsaturated zone 4 total porosity	-	0.4	P	2	S	Bounded Normal	0.41	0.09	0.1319	0.6881	NUREG/CR-6697 Att. C, Table 3.2-1, Loamy Sand
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	Bounded Normal	0.353	0.0913	0.0711	0.635	NUREG/CR-6697 Att. C, Table 3.3-1, Loamy Sand
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	Beta	12.3	4230	0.7992	1.91	NUREG/CR-6697 Att. C, Table 3.4-1, Loamy Sand
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	0.305	0.258	0.61	3.01	NUREG/CR-6697 Att. C, Table 3.5-1, Loamy Sand
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	Bounded Normal	1.5105	0.159	1.019	2.002	NUREG/CR-6697 Att. C, Table 3.1-1, Sand
Unsaturated zone 5 total porosity	-	0.4	P	2	S	Bounded Normal	0.43	0.06	0.2446	0.6154	NUREG/CR-6697 Att. C, Table 3.2-1, Sand
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	Bounded Normal	0.383	0.061	0.195	0.572	NUREG/CR-6697 Att. C, Table 3.3-1, Sand
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	Beta	110	5870	1.398	1.842	NUREG/CR-6697 Att. C, Table 3.4-1, Sand

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	Bounded lognormal-n	-0.0253	0.216	0.501	1.9	NUREG/CR-6697 Att. C, Table 3.5-1, Sand
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227	cm^3/g	20	P	1	S	Truncated lognormal-n	6.72	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pa-231	cm^3/g	50	P	1	S	Truncated lognormal-n	5.94	3.22	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Pb-210	cm^3/g	100	P	1	S	Truncated lognormal-n	7.78	2.76	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-226	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Ra-228	cm^3/g	70	P	1	S	Truncated lognormal-n	8.17	1.7	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-228	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-230	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Th-232	cm^3/g	60000	P	1	S	Truncated lognormal-n	8.68	3.62	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-234	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-235	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-236	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
U-238	cm^3/g	50	P	1	S	Truncated lognormal-n	4.84	3.13	0.001	0.999	NUREG/CR-6697 Att. C, Section 3.9, Table 3.9-1
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	Continuous linear	-	-	-	-	NUREG/CR-6697 Att. C, Section 4.6
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	S	Uniform	0.15	0.95	-	-	NUREG/CR-6697 Att. C, Section 7.1
Shielding factor, external gamma	-	0.7	P	2	S	Bounded lognormal-n	-1.3	0.59	0.044	1	NUREG/CR-6697 Att. C, Section 7.10
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	S	Triangular	0	0.15	0.6	-	NUREG/CR-6697 Att. C, Section 3.12
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C□14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Donversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/(pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table E-1
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Probabilistic Sensitivity Analysis Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value or Distribution[4]	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-226	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic
[4]Distribution Statistical Parameters:
Lognormal-n: 1 = mean, 2 = standard deviation
Bounded lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Truncated lognormal-n: 1 = mean, 2 = standard deviation, 3 = lower quantile, 4 = upper quantile
Bounded normal: 1 = mean, 2 = standard deviation, 3 = lower limit, 4 = upper limit
Beta: 1 = minimum, 2 = maximum, 3 = P-value, 4 = Q-value
Triangular: 1 = minimum, 2 = mode (most likely), 3 = maximum
Uniform: 1 = minimum, 2 = maximum
Continuous logarithmic: RESRAD default statistical parameters
Continuous linear: RESRAD default statistical parameters
NR = not required

Additional Sensitivity Analysis Data:
Sampling Technique = Latin Hypercube
Random Seed = 1000
Number of observations = 300
Number of repetitions = 1
Grouping of Correlations = correlated or uncorrelated

Table E-2
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[(1)] (ft^3)	5% Sludge Bulking Volume[(1)] (ft^3)	Stabilized Sludge Volume[(2)] (ft^3)	Sludge Surface Area[(1)] (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area[(3)] (m^2)	Sludge Surface Length[(4)] (m)	Sludge Surface Width[(4)] (m)	CZ Thickness[(5)] (m)	Average Cover Thickness[(1)] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes:

(1) Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A

(2) Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume

(3) CZ Area was estimated by rounding the Sludge Surface Area.

(4) Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table E-3
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Radionuclide Concentration (pCi/g)		
	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.15	0.14	0.07
Radium 226	0.69	0.66	0.34
Thorium 228	0.07	0.06	0.03
Thorium 230	1.66	1.58	0.83
Thorium 232	0.05	0.05	0.03
Uranium 234	237.77	225.89	118.57
Uranium 235	10.24	9.73	5.11
Uranium 236	5.84	5.55	2.91
Uranium 238	246.05	233.75	122.69

% Solids: 52.49%

Table E-4
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table E-5
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX F

Pond B RESRAD Probabilistic Sensitivity Analysis Uncertainty Output

Table F-1
Honeywell Metropolis Works
Pond B Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Density of cover material	1	**-0.9**	25%	1.571
Cover erosion rate	26	0.1	50%	1.05E-04
Contaminated zone erosion rate	85	0.04	50%	3.49E-05
Contaminated zone total porosity	66	0.05	50%	0.41
Contaminated Zone B parameter	106	-0.01	50%	1.35
Evapotranspiration coefficient	6	-0.18	50%	0.62
Density of saturated zone	75	-0.05	50%	1.510
Saturated zone total porosity	118	0.01	50%	0.43
Saturated zone effective porosity	5	-0.18	50%	0.38
Saturated zone hydraulic conductivity	50	-0.07	50%	2500.0
Saturated Zone B parameter	10	-0.15	50%	0.97
Density of Unsaturated Zone 1	8	-0.16	50%	1.695
Total Porosity of Unsaturated Zone 1	12	0.15	50%	0.360
Effective Porosity of Unsaturated Zone 1	20	-0.12	50%	0.289
b Parameter of Unsaturated Zone 1	74	-0.05	50%	9.870
Density of Unsaturated Zone 2	123	0	50%	1.563
Total Porosity of Unsaturated Zone 2	27	0.1	50%	0.409
Effective Porosity of Unsaturated Zone 2	103	-0.02	50%	0.35
Hydraulic Conductivity of Unsaturated Zone 2	51	-0.07	50%	1024.76
b Parameter of Unsaturated Zone 2	45	0.08	50%	1.35
Density of Unsaturated Zone 3	108	0.01	50%	1.510
Total Porosity of Unsaturated Zone 3	64	0.06	50%	0.430
Effective Porosity of Unsaturated Zone 3	114	-0.01	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 3	44	-0.08	50%	2495.4
b Parameter of Unsaturated Zone 3	58	0.06	50%	0.97
Density of Unsaturated Zone 4	67	0.05	50%	1.562
Total Porosity of Unsaturated Zone 4	37	0.09	50%	0.389
Effective Porosity of Unsaturated Zone 4	14	-0.14	50%	0.318
Hydraulic Conductivity of Unsaturated Zone 4	91	-0.03	50%	1021.1
b Parameter of Unsaturated Zone 4	94	-0.02	50%	1.35
Density of Unsaturated Zone 5	49	0.07	50%	1.510
Total Porosity of Unsaturated Zone 5	42	0.08	50%	0.430
Effective Porosity of Unsaturated Zone 5	48	0.08	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 5	89	-0.03	50%	2493.6
b Parameter of Unsaturated Zone 5	11	0.15	50%	0.97
Mass loading for inhalation	109	-0.01	50%	2.35E-05
Indoor dust filtration factor	53	0.07	50%	0.547
External gamma shielding factor	13	0.14	50%	0.269
Depth of soil mixing layer	78	0.04	50%	0.231
Kd of Ac-227 in Contaminated Zone	112	-0.01	50%	824.5
Kd of Ac-227 in Unsaturated Zone 1	86	0.03	50%	818.4
Kd of Ac-227 in Unsaturated Zone 2	56	-0.07	50%	828.4
Kd of Ac-227 in Unsaturated Zone 3	25	-0.11	50%	825.1
Kd of Ac-227 in Unsaturated Zone 4	40	-0.09	50%	809.7
Kd of Ac-227 in Unsaturated Zone 5	21	-0.11	50%	814.7
Kd of Ac-227 in Saturated Zone	24	-0.11	50%	810.4
Kd of Pa-231 in Contaminated Zone	17	0.12	50%	374.3
Kd of Pa-231 in Unsaturated Zone 1	92	-0.03	50%	370.7
Kd of Pa-231 in Unsaturated Zone 2	34	-0.09	50%	375.1
Kd of Pa-231 in Unsaturated Zone 3	35	0.09	50%	375.3
Kd of Pa-231 in Unsaturated Zone 4	32	-0.1	50%	378.2
Kd of Pa-231 in Unsaturated Zone 5	88	-0.03	50%	375.6
Kd of Pa-231 in Saturated Zone	93	-0.02	50%	378.4
Kd of Pb-210 in Contaminated Zone	77	0.04	50%	2373.8
Kd of Pb-210 in Unsaturated Zone 1	80	0.04	50%	2347.3
Kd of Pb-210 in Unsaturated Zone 2	62	-0.06	50%	2361.6
Kd of Pb-210 in Unsaturated Zone 3	73	0.05	50%	2356.9
Kd of Pb-210 in Unsaturated Zone 4	95	0.02	50%	2352.1
Kd of Pb-210 in Unsaturated Zone 5	83	-0.04	50%	2379.9
Kd of Pb-210 in Saturated Zone	104	-0.02	50%	2360.3
Kd of Ra-226 in Contaminated Zone	47	-0.08	50%	3501.2
Kd of Ra-226 in Unsaturated Zone 1	87	-0.03	50%	3506.5
Kd of Ra-226 in Unsaturated Zone 2	61	0.06	50%	3505.6

Table F-1
Honeywell Metropolis Works
Pond B Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Kd of Ra-226 in Unsaturated Zone 3	101	0.02	50%	3522.8
Kd of Ra-226 in Unsaturated Zone 4	99	0.02	50%	3484.6
Kd of Ra-226 in Unsaturated Zone 5	68	0.05	50%	3495.8
Kd of Ra-226 in Saturated Zone	116	-0.01	50%	3529.3
Kd of Ra-228 in Contaminated Zone	96	-0.02	50%	3489.5
Kd of Ra-228 in Unsaturated Zone 1	110	0.01	50%	3507.0
Kd of Ra-228 in Unsaturated Zone 2	54	0.07	50%	3521.8
Kd of Ra-228 in Unsaturated Zone 3	63	0.06	50%	3513.0
Kd of Ra-228 in Unsaturated Zone 4	23	-0.11	50%	3504.5
Kd of Ra-228 in Unsaturated Zone 5	52	0.07	50%	3483.8
Kd of Ra-228 in Saturated Zone	18	0.12	50%	3521.4
Kd of Th-228 in Contaminated Zone	102	0.02	50%	5883.2
Kd of Th-228 in Unsaturated Zone 1	111	-0.01	50%	5736.1
Kd of Th-228 in Unsaturated Zone 2	71	-0.05	50%	5825.4
Kd of Th-228 in Unsaturated Zone 3	97	0.02	50%	5786.3
Kd of Th-228 in Unsaturated Zone 4	30	-0.1	50%	5774.7
Kd of Th-228 in Unsaturated Zone 5	79	-0.04	50%	5784.1
Kd of Th-228 in Saturated Zone	122	0	50%	5828.0
Kd of Th-230 in Contaminated Zone	36	-0.09	50%	5770.7
Kd of Th-230 in Unsaturated Zone 1	33	0.09	50%	5842.5
Kd of Th-230 in Unsaturated Zone 2	72	-0.05	50%	5842.8
Kd of Th-230 in Unsaturated Zone 3	76	-0.04	50%	5882.2
Kd of Th-230 in Unsaturated Zone 4	29	0.1	50%	5778.8
Kd of Th-230 in Unsaturated Zone 5	41	-0.09	50%	5859.6
Kd of Th-230 in Saturated Zone	100	0.02	50%	5849.2
Kd of Th-232 in Contaminated Zone	3	0.21	50%	5770.9
Kd of Th-232 in Unsaturated Zone 1	16	-0.13	50%	5808.9
Kd of Th-232 in Unsaturated Zone 2	4	0.18	50%	5744.2
Kd of Th-232 in Unsaturated Zone 3	31	-0.1	50%	5769.1
Kd of Th-232 in Unsaturated Zone 4	117	-0.01	50%	5778.8
Kd of Th-232 in Unsaturated Zone 5	43	-0.08	50%	5822.9
Kd of Th-232 in Saturated Zone	107	0.01	50%	5864.1
Kd of U-234 in Contaminated Zone	82	0.04	50%	123.5
Kd of U-234 in Unsaturated Zone 1	22	0.11	50%	126.1
Kd of U-234 in Unsaturated Zone 2	60	0.06	50%	124.2
Kd of U-234 in Unsaturated Zone 3	55	-0.07	50%	124.2
Kd of U-234 in Unsaturated Zone 4	59	-0.06	50%	124.7
Kd of U-234 in Unsaturated Zone 5	119	-0.01	50%	125.7
Kd of U-234 in Saturated Zone	28	-0.1	50%	126.4
Kd of U-235 in Contaminated Zone	2	**-0.5**	25%	15.2
Kd of U-235 in Unsaturated Zone 1	84	-0.04	50%	125.8
Kd of U-235 in Unsaturated Zone 2	39	-0.09	50%	123.3
Kd of U-235 in Unsaturated Zone 3	19	0.12	50%	125.9
Kd of U-235 in Unsaturated Zone 4	70	0.05	50%	124.9
Kd of U-235 in Unsaturated Zone 5	113	-0.01	50%	124.7
Kd of U-235 in Saturated Zone	98	-0.02	50%	124.4
Kd of U-236 in Contaminated Zone	46	-0.08	50%	123.9
Kd of U-236 in Unsaturated Zone 1	57	0.06	50%	124.0
Kd of U-236 in Unsaturated Zone 2	69	0.05	50%	123.8
Kd of U-236 in Unsaturated Zone 3	121	0	50%	123.9
Kd of U-236 in Unsaturated Zone 4	105	-0.01	50%	124.0
Kd of U-236 in Unsaturated Zone 5	9	-0.16	50%	125.9
Kd of U-236 in Saturated Zone	81	-0.04	50%	125.8
Kd of U-238 in Contaminated Zone	38	-0.09	50%	124.0
Kd of U-238 in Unsaturated Zone 1	115	0.01	50%	123.8
Kd of U-238 in Unsaturated Zone 2	90	0.03	50%	124.5
Kd of U-238 in Unsaturated Zone 3	15	-0.13	50%	123.4
Kd of U-238 in Unsaturated Zone 4	120	0	50%	124.0
Kd of U-238 in Unsaturated Zone 5	65	0.06	50%	126.2
Kd of U-238 in Saturated Zone	7	0.17	50%	124.3

APPENDIX G

Pond C RESRAD Probabilistic Sensitivity Analysis Uncertainty Output

Table G-1
Honeywell Metropolis Works
Pond C Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Density of cover material	1	**-0.85**	25%	1.571
Cover erosion rate	3	**0.28**	75%	1.42E-04
Contaminated zone erosion rate	72	0.04	50%	3.49E-05
Contaminated zone total porosity	114	-0.01	50%	0.41
Contaminated Zone b parameter	58	-0.06	50%	1.35
Evapotranspiration coefficient	31	-0.1	50%	0.62
Density of saturated zone	54	-0.06	50%	1.510
Saturated zone total porosity	34	-0.09	50%	0.43
Saturated zone effective porosity	15	-0.13	50%	0.38
Saturated zone hydraulic conductivity	28	-0.11	50%	2500.0
Saturated Zone b parameter	45	-0.07	50%	0.97
Density of Unsaturated Zone 1	5	-0.2	50%	1.695
Total Porosity of Unsaturated Zone 1	4	0.2	50%	0.360
Effective Porosity of Unsaturated Zone 1	22	-0.12	50%	0.289
b Parameter of Unsaturated Zone 1	63	0.05	50%	9.870
Density of Unsaturated Zone 2	97	0.02	50%	1.563
Total Porosity of Unsaturated Zone 2	9	0.14	50%	0.409
Effective Porosity of Unsaturated Zone 2	46	0.07	50%	0.35
Hydraulic Conductivity of Unsaturated Zone 2	37	-0.08	50%	1024.76
b Parameter of Unsaturated Zone 2	110	-0.01	50%	1.35
Density of Unsaturated Zone 3	27	0.11	50%	1.510
Total Porosity of Unsaturated Zone 3	74	0.04	50%	0.430
Effective Porosity of Unsaturated Zone 3	106	-0.01	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 3	6	-0.16	50%	2495.4
b Parameter of Unsaturated Zone 3	71	0.04	50%	0.97
Density of Unsaturated Zone 4	116	0	50%	1.562
Total Porosity of Unsaturated Zone 4	77	0.03	50%	0.389
Effective Porosity of Unsaturated Zone 4	10	-0.14	50%	0.318
Hydraulic Conductivity of Unsaturated Zone 4	82	0.03	50%	1021.1
b Parameter of Unsaturated Zone 4	99	0.01	50%	1.35
Density of Unsaturated Zone 5	121	0	50%	1.510
Total Porosity of Unsaturated Zone 5	84	0.03	50%	0.430
Effective Porosity of Unsaturated Zone 5	101	0.01	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 5	91	-0.02	50%	2493.6
b Parameter of Unsaturated Zone 5	32	0.09	50%	0.97
Mass loading for inhalation	119	0	50%	2.35E-05
Indoor dust filtration factor	109	-0.01	50%	0.547
External gamma shielding factor	16	0.13	50%	0.269
Depth of soil mixing layer	55	-0.06	50%	0.231
Kd of Ac-227 in Contaminated Zone	68	0.04	50%	824.5
Kd of Ac-227 in Unsaturated Zone 1	111	-0.01	50%	818.4
Kd of Ac-227 in Unsaturated Zone 2	14	-0.13	50%	828.4
Kd of Ac-227 in Unsaturated Zone 3	56	-0.06	50%	825.1
Kd of Ac-227 in Unsaturated Zone 4	8	-0.15	50%	809.7
Kd of Ac-227 in Unsaturated Zone 5	13	-0.13	50%	814.7
Kd of Ac-227 in Saturated Zone	92	-0.02	50%	810.4
Kd of Pa-231 in Contaminated Zone	65	0.05	50%	374.3
Kd of Pa-231 in Unsaturated Zone 1	64	0.05	50%	370.7
Kd of Pa-231 in Unsaturated Zone 2	61	-0.05	50%	375.1
Kd of Pa-231 in Unsaturated Zone 3	67	0.04	50%	375.3
Kd of Pa-231 in Unsaturated Zone 4	11	-0.14	50%	378.2
Kd of Pa-231 in Unsaturated Zone 5	42	-0.08	50%	375.6
Kd of Pa-231 in Saturated Zone	30	0.1	50%	378.4
Kd of Pb-210 in Contaminated Zone	66	0.04	50%	2373.8
Kd of Pb-210 in Unsaturated Zone 1	78	0.03	50%	2347.3
Kd of Pb-210 in Unsaturated Zone 2	69	-0.04	50%	2361.6
Kd of Pb-210 in Unsaturated Zone 3	81	0.03	50%	2356.9
Kd of Pb-210 in Unsaturated Zone 4	36	-0.08	50%	2352.1
Kd of Pb-210 in Unsaturated Zone 5	76	-0.04	50%	2379.9
Kd of Pb-210 in Saturated Zone	35	-0.09	50%	2360.3
Kd of Ra-226 in Contaminated Zone	123	0	50%	3501.2
Kd of Ra-226 in Unsaturated Zone 1	94	0.02	50%	3506.5
Kd of Ra-226 in Unsaturated Zone 2	48	0.07	50%	3505.6

Table G-1
Honeywell Metropolis Works
Pond C Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Kd of Ra-226 in Unsaturated Zone 3	57	0.06	50%	3522.8
Kd of Ra-226 in Unsaturated Zone 4	38	-0.08	50%	3484.6
Kd of Ra-226 in Unsaturated Zone 5	117	0	50%	3495.8
Kd of Ra-226 in Saturated Zone	44	0.08	50%	3529.3
Kd of Ra-228 in Contaminated Zone	62	0.05	50%	3489.5
Kd of Ra-228 in Unsaturated Zone 1	96	0.02	50%	3507.0
Kd of Ra-228 in Unsaturated Zone 2	26	0.11	50%	3521.8
Kd of Ra-228 in Unsaturated Zone 3	87	0.02	50%	3513.0
Kd of Ra-228 in Unsaturated Zone 4	51	-0.07	50%	3504.5
Kd of Ra-228 in Unsaturated Zone 5	83	-0.03	50%	3483.8
Kd of Ra-228 in Saturated Zone	53	0.06	50%	3521.4
Kd of Th-228 in Contaminated Zone	100	0.01	50%	5883.2
Kd of Th-228 in Unsaturated Zone 1	108	0.01	50%	5736.1
Kd of Th-228 in Unsaturated Zone 2	103	-0.01	50%	5825.4
Kd of Th-228 in Unsaturated Zone 3	70	0.04	50%	5786.3
Kd of Th-228 in Unsaturated Zone 4	40	-0.08	50%	5774.7
Kd of Th-228 in Unsaturated Zone 5	89	-0.02	50%	5784.1
Kd of Th-228 in Saturated Zone	86	-0.03	50%	5828.0
Kd of Th-230 in Contaminated Zone	95	-0.02	50%	5770.7
Kd of Th-230 in Unsaturated Zone 1	90	-0.02	50%	5842.5
Kd of Th-230 in Unsaturated Zone 2	75	0.04	50%	5842.8
Kd of Th-230 in Unsaturated Zone 3	43	-0.08	50%	5882.2
Kd of Th-230 in Unsaturated Zone 4	41	0.08	50%	5778.8
Kd of Th-230 in Unsaturated Zone 5	79	0.03	50%	5859.6
Kd of Th-230 in Saturated Zone	39	0.08	50%	5849.2
Kd of Th-232 in Contaminated Zone	19	0.12	50%	5770.9
Kd of Th-232 in Unsaturated Zone 1	52	-0.07	50%	5808.9
Kd of Th-232 in Unsaturated Zone 2	29	0.1	50%	5744.2
Kd of Th-232 in Unsaturated Zone 3	115	-0.01	50%	5769.1
Kd of Th-232 in Unsaturated Zone 4	105	-0.01	50%	5778.8
Kd of Th-232 in Unsaturated Zone 5	23	-0.12	50%	5822.9
Kd of Th-232 in Saturated Zone	47	-0.07	50%	5864.1
Kd of U-234 in Contaminated Zone	85	-0.03	50%	123.5
Kd of U-234 in Unsaturated Zone 1	20	0.12	50%	126.1
Kd of U-234 in Unsaturated Zone 2	24	0.11	50%	124.2
Kd of U-234 in Unsaturated Zone 3	120	0	50%	124.2
Kd of U-234 in Unsaturated Zone 4	59	-0.06	50%	124.7
Kd of U-234 in Unsaturated Zone 5	25	-0.11	50%	125.7
Kd of U-234 in Saturated Zone	112	-0.01	50%	126.4
Kd of U-235 in Contaminated Zone	2	-0.6	50%	123.9
Kd of U-235 in Unsaturated Zone 1	88	0.02	50%	125.8
Kd of U-235 in Unsaturated Zone 2	93	0.02	50%	123.3
Kd of U-235 in Unsaturated Zone 3	60	0.06	50%	125.9
Kd of U-235 in Unsaturated Zone 4	73	0.04	50%	124.9
Kd of U-235 in Unsaturated Zone 5	80	0.03	50%	124.7
Kd of U-235 in Saturated Zone	98	0.02	50%	124.4
Kd of U-236 in Contaminated Zone	49	-0.07	50%	123.9
Kd of U-236 in Unsaturated Zone 1	33	0.09	50%	124.0
Kd of U-236 in Unsaturated Zone 2	118	0	50%	123.8
Kd of U-236 in Unsaturated Zone 3	122	0	50%	123.9
Kd of U-236 in Unsaturated Zone 4	50	-0.07	50%	124.0
Kd of U-236 in Unsaturated Zone 5	7	-0.16	50%	125.9
Kd of U-236 in Saturated Zone	113	-0.01	50%	125.8
Kd of U-238 in Contaminated Zone	12	-0.14	50%	124.0
Kd of U-238 in Unsaturated Zone 1	17	0.12	50%	123.8
Kd of U-238 in Unsaturated Zone 2	107	0.01	50%	124.5
Kd of U-238 in Unsaturated Zone 3	21	-0.12	50%	123.4
Kd of U-238 in Unsaturated Zone 4	102	0.01	50%	124.0
Kd of U-238 in Unsaturated Zone 5	104	0.01	50%	126.2
Kd of U-238 in Saturated Zone	18	0.12	50%	124.3

APPENDIX H

Pond D RESRAD Probabilistic Sensitivity Analysis Uncertainty Output

Table H-1
Honeywell Metropolis Works
Pond D Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Density of cover material	1	**-0.98**	25%	1.571
Cover erosion rate	43	-0.07	50%	1.05E-04
Contaminated zone erosion rate	71	-0.04	50%	3.49E-05
Contaminated zone total porosity	15	0.11	50%	0.41
Contaminated Zone B parameter	55	0.06	50%	1.35
Evapotranspiration coefficient	68	0.05	50%	0.62
Density of saturated zone	120	0	50%	1.510
Saturated zone total porosity	100	-0.01	50%	0.43
Saturated zone effective porosity	5	-0.16	50%	0.38
Saturated zone hydraulic conductivity	37	-0.08	50%	2500.0
Saturated Zone b parameter	74	-0.04	50%	0.97
Density of Unsaturated Zone 1	16	-0.11	50%	1.695
Total Porosity of Unsaturated Zone 1	58	0.05	50%	0.360
Effective Porosity of Unsaturated Zone 1	19	0.1	50%	0.289
b Parameter of Unsaturated Zone 1	24	-0.1	50%	9.870
Density of Unsaturated Zone 2	95	-0.02	50%	1.563
Total Porosity of Unsaturated Zone 2	47	-0.06	50%	0.409
Effective Porosity of Unsaturated Zone 2	108	0.01	50%	0.35
Hydraulic Conductivity of Unsaturated Zone 2	111	-0.01	50%	1024.76
b Parameter of Unsaturated Zone 2	44	-0.07	50%	1.35
Density of Unsaturated Zone 3	112	-0.01	50%	1.510
Total Porosity of Unsaturated Zone 3	121	0	50%	0.430
Effective Porosity of Unsaturated Zone 3	50	-0.06	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 3	65	0.05	50%	2495.4
b Parameter of Unsaturated Zone 3	28	0.08	50%	0.97
Density of Unsaturated Zone 4	110	0.01	50%	1.562
Total Porosity of Unsaturated Zone 4	41	0.07	50%	0.389
Effective Porosity of Unsaturated Zone 4	114	0	50%	0.318
Hydraulic Conductivity of Unsaturated Zone 4	21	-0.1	50%	1021.1
b Parameter of Unsaturated Zone 4	105	-0.01	50%	1.35
Density of Unsaturated Zone 5	77	0.04	50%	1.510
Total Porosity of Unsaturated Zone 5	9	0.14	50%	0.430
Effective Porosity of Unsaturated Zone 5	4	0.17	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 5	66	0.05	50%	2493.6
b Parameter of Unsaturated Zone 5	98	-0.01	50%	0.97
Mass loading for inhalation	75	0.04	50%	2.35E-05
Indoor dust filtration factor	25	-0.09	50%	0.547
External gamma shielding factor	2	**0.45**	75%	0.397
Depth of soil mixing layer	61	0.05	50%	0.231
Kd of Ac-227 in Contaminated Zone	83	-0.03	50%	824.5
Kd of Ac-227 in Unsaturated Zone 1	67	0.05	50%	818.4
Kd of Ac-227 in Unsaturated Zone 2	80	0.03	50%	828.4
Kd of Ac-227 in Unsaturated Zone 3	69	-0.05	50%	825.1
Kd of Ac-227 in Unsaturated Zone 4	116	0	50%	809.7
Kd of Ac-227 in Unsaturated Zone 5	76	0.04	50%	814.7
Kd of Ac-227 in Saturated Zone	102	0.01	50%	810.4
Kd of Pa-231 in Contaminated Zone	89	0.02	50%	374.3
Kd of Pa-231 in Unsaturated Zone 1	96	0.02	50%	370.7
Kd of Pa-231 in Unsaturated Zone 2	99	0.01	50%	375.1
Kd of Pa-231 in Unsaturated Zone 3	86	0.03	50%	375.3
Kd of Pa-231 in Unsaturated Zone 4	84	-0.03	50%	378.2
Kd of Pa-231 in Unsaturated Zone 5	35	0.08	50%	375.6
Kd of Pa-231 in Saturated Zone	62	-0.05	50%	378.4
Kd of Pb-210 in Contaminated Zone	8	-0.15	50%	2373.8
Kd of Pb-210 in Unsaturated Zone 1	122	0	50%	2347.3
Kd of Pb-210 in Unsaturated Zone 2	26	-0.09	50%	2361.6
Kd of Pb-210 in Unsaturated Zone 3	33	-0.08	50%	2356.9
Kd of Pb-210 in Unsaturated Zone 4	56	-0.06	50%	2352.1
Kd of Pb-210 in Unsaturated Zone 5	88	0.02	50%	2379.9
Kd of Pb-210 in Saturated Zone	12	-0.11	50%	2360.3
Kd of Ra-226 in Contaminated Zone	18	0.11	50%	3501.2
Kd of Ra-226 in Unsaturated Zone 1	97	-0.02	50%	3506.5
Kd of Ra-226 in Unsaturated Zone 2	14	0.11	50%	3505.6

Table H-1
Honeywell Metropolis Works
Pond D Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Kd of Ra-226 in Unsaturated Zone 3	53	-0.06	50%	3522.8
Kd of Ra-226 in Unsaturated Zone 4	94	-0.02	50%	3484.6
Kd of Ra-226 in Unsaturated Zone 5	93	-0.02	50%	3495.8
Kd of Ra-226 in Saturated Zone	72	-0.04	50%	3529.3
Kd of Ra-228 in Contaminated Zone	73	-0.04	50%	3489.5
Kd of Ra-228 in Unsaturated Zone 1	115	0	50%	3507.0
Kd of Ra-228 in Unsaturated Zone 2	23	-0.1	50%	3521.8
Kd of Ra-228 in Unsaturated Zone 3	78	-0.03	50%	3513.0
Kd of Ra-228 in Unsaturated Zone 4	119	0	50%	3504.5
Kd of Ra-228 in Unsaturated Zone 5	11	0.13	50%	3483.8
Kd of Ra-228 in Saturated Zone	45	-0.07	50%	3521.4
Kd of Th-228 in Contaminated Zone	82	0.03	50%	5883.2
Kd of Th-228 in Unsaturated Zone 1	46	-0.06	50%	5736.1
Kd of Th-228 in Unsaturated Zone 2	79	-0.03	50%	5825.4
Kd of Th-228 in Unsaturated Zone 3	109	-0.01	50%	5786.3
Kd of Th-228 in Unsaturated Zone 4	91	-0.02	50%	5774.7
Kd of Th-228 in Unsaturated Zone 5	7	-0.16	50%	5784.1
Kd of Th-228 in Saturated Zone	107	-0.01	50%	5828.0
Kd of Th-230 in Contaminated Zone	101	-0.01	50%	5770.7
Kd of Th-230 in Unsaturated Zone 1	48	0.06	50%	5842.5
Kd of Th-230 in Unsaturated Zone 2	17	-0.11	50%	5842.8
Kd of Th-230 in Unsaturated Zone 3	87	-0.03	50%	5882.2
Kd of Th-230 in Unsaturated Zone 4	54	0.06	50%	5778.8
Kd of Th-230 in Unsaturated Zone 5	70	-0.04	50%	5859.6
Kd of Th-230 in Saturated Zone	52	-0.06	50%	5849.2
Kd of Th-232 in Contaminated Zone	32	0.08	50%	5770.9
Kd of Th-232 in Unsaturated Zone 1	117	0	50%	5808.9
Kd of Th-232 in Unsaturated Zone 2	113	0.01	50%	5744.2
Kd of Th-232 in Unsaturated Zone 3	90	-0.02	50%	5769.1
Kd of Th-232 in Unsaturated Zone 4	60	0.05	50%	5778.8
Kd of Th-232 in Unsaturated Zone 5	81	-0.03	50%	5822.9
Kd of Th-232 in Saturated Zone	30	0.08	50%	5864.1
Kd of U-234 in Contaminated Zone	29	-0.08	50%	123.5
Kd of U-234 in Unsaturated Zone 1	104	0.01	50%	126.1
Kd of U-234 in Unsaturated Zone 2	27	0.09	50%	124.2
Kd of U-234 in Unsaturated Zone 3	103	-0.01	50%	124.2
Kd of U-234 in Unsaturated Zone 4	40	-0.07	50%	124.7
Kd of U-234 in Unsaturated Zone 5	34	-0.08	50%	125.7
Kd of U-234 in Saturated Zone	31	0.08	50%	126.4
Kd of U-235 in Contaminated Zone	6	-0.16	50%	123.9
Kd of U-235 in Unsaturated Zone 1	85	-0.03	50%	125.8
Kd of U-235 in Unsaturated Zone 2	20	-0.1	50%	123.3
Kd of U-235 in Unsaturated Zone 3	123	0	50%	125.9
Kd of U-235 in Unsaturated Zone 4	106	0.01	50%	124.9
Kd of U-235 in Unsaturated Zone 5	36	0.08	50%	124.7
Kd of U-235 in Saturated Zone	92	-0.02	50%	124.4
Kd of U-236 in Contaminated Zone	3	-0.23	50%	123.9
Kd of U-236 in Unsaturated Zone 1	51	-0.06	50%	124.0
Kd of U-236 in Unsaturated Zone 2	22	0.1	50%	123.8
Kd of U-236 in Unsaturated Zone 3	118	0	50%	123.9
Kd of U-236 in Unsaturated Zone 4	57	-0.05	50%	124.0
Kd of U-236 in Unsaturated Zone 5	63	0.05	50%	125.9
Kd of U-236 in Saturated Zone	64	-0.05	50%	125.8
Kd of U-238 in Contaminated Zone	38	0.08	50%	124.0
Kd of U-238 in Unsaturated Zone 1	59	0.05	50%	123.8
Kd of U-238 in Unsaturated Zone 2	42	0.07	50%	124.5
Kd of U-238 in Unsaturated Zone 3	13	0.11	50%	123.4
Kd of U-238 in Unsaturated Zone 4	49	-0.06	50%	124.0
Kd of U-238 in Unsaturated Zone 5	10	0.13	50%	126.2
Kd of U-238 in Saturated Zone	39	0.07	50%	124.3

APPENDIX I

Pond E RESRAD Probabilistic Sensitivity Analysis Uncertainty Output

Table I-1
Honeywell Metropolis Works
Pond E Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Density of cover material	1	-0.88	25%	1.571
Cover erosion rate	5	0.16	50%	1.05E-04
Contaminated zone erosion rate	122	0	50%	3.49E-05
Contaminated zone total porosity	82	0.03	50%	0.41
Contaminated Zone B parameter	61	-0.05	50%	1.35
Evapotranspiration coefficient	29	-0.11	50%	0.62
Density of saturated zone	102	-0.02	50%	1.510
Saturated zone total porosity	40	-0.08	50%	0.43
Saturated zone effective porosity	12	-0.14	50%	0.38
Saturated zone hydraulic conductivity	34	-0.1	50%	2500.0
Saturated Zone B parameter	15	-0.14	50%	0.97
Density of Unsaturated Zone 1	22	-0.12	50%	1.695
Total Porosity of Unsaturated Zone 1	21	0.13	50%	0.360
Effective Porosity of Unsaturated Zone 1	16	-0.13	50%	0.289
b Parameter of Unsaturated Zone 1	96	-0.02	50%	9.870
Density of Unsaturated Zone 2	103	0.02	50%	1.563
Total Porosity of Unsaturated Zone 2	24	0.12	50%	0.409
Effective Porosity of Unsaturated Zone 2	114	-0.01	50%	0.35
Hydraulic Conductivity of Unsaturated Zone 2	51	-0.07	50%	1024.76
b Parameter of Unsaturated Zone 2	121	0	50%	1.35
Density of Unsaturated Zone 3	60	0.05	50%	1.510
Total Porosity of Unsaturated Zone 3	104	0.02	50%	0.430
Effective Porosity of Unsaturated Zone 3	120	0	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 3	20	-0.13	50%	2495.4
b Parameter of Unsaturated Zone 3	80	0.03	50%	0.97
Density of Unsaturated Zone 4	110	0.01	50%	1.562
Total Porosity of Unsaturated Zone 4	32	0.1	50%	0.389
Effective Porosity of Unsaturated Zone 4	18	-0.13	50%	0.318
Hydraulic Conductivity of Unsaturated Zone 4	123	0	50%	1021.1
b Parameter of Unsaturated Zone 4	58	0.06	50%	1.35
Density of Unsaturated Zone 5	75	0.03	50%	1.510
Total Porosity of Unsaturated Zone 5	83	0.03	50%	0.430
Effective Porosity of Unsaturated Zone 5	63	0.05	50%	0.383
Hydraulic Conductivity of Unsaturated Zone 5	66	-0.04	50%	2493.6
b Parameter of Unsaturated Zone 5	27	0.12	50%	0.97
Mass loading for inhalation	109	0.01	50%	2.35E-05
Indoor dust filtration factor	39	0.08	50%	0.547
External gamma shielding factor	4	0.17	50%	0.269
Depth of soil mixing layer	92	-0.02	50%	0.231
Kd of Ac-227 in Contaminated Zone	89	0.03	50%	824.5
Kd of Ac-227 in Unsaturated Zone 1	91	0.02	50%	818.4
Kd of Ac-227 in Unsaturated Zone 2	25	-0.12	50%	828.4
Kd of Ac-227 in Unsaturated Zone 3	33	-0.1	50%	825.1
Kd of Ac-227 in Unsaturated Zone 4	31	-0.1	50%	809.7
Kd of Ac-227 in Unsaturated Zone 5	3	-0.18	50%	814.7
Kd of Ac-227 in Saturated Zone	55	-0.06	50%	810.4
Kd of Pa-231 in Contaminated Zone	28	0.11	50%	374.3
Kd of Pa-231 in Unsaturated Zone 1	117	0.01	50%	370.7
Kd of Pa-231 in Unsaturated Zone 2	59	-0.05	50%	375.1
Kd of Pa-231 in Unsaturated Zone 3	52	0.06	50%	375.3
Kd of Pa-231 in Unsaturated Zone 4	14	-0.14	50%	378.2
Kd of Pa-231 in Unsaturated Zone 5	85	0.03	50%	375.6
Kd of Pa-231 in Saturated Zone	73	0.04	50%	378.4
Kd of Pb-210 in Contaminated Zone	119	0	50%	2373.8
Kd of Pb-210 in Unsaturated Zone 1	49	0.07	50%	2347.3
Kd of Pb-210 in Unsaturated Zone 2	76	-0.03	50%	2361.6
Kd of Pb-210 in Unsaturated Zone 3	112	0.01	50%	2356.9
Kd of Pb-210 in Unsaturated Zone 4	100	-0.02	50%	2352.1
Kd of Pb-210 in Unsaturated Zone 5	47	-0.07	50%	2379.9
Kd of Pb-210 in Saturated Zone	68	-0.04	50%	2360.3
Kd of Ra-226 in Contaminated Zone	53	-0.06	50%	3501.2
Kd of Ra-226 in Unsaturated Zone 1	111	0.01	50%	3506.5
Kd of Ra-226 in Unsaturated Zone 2	44	0.07	50%	3505.6

Table I-1
Honeywell Metropolis Works
Pond E Dose Assessment
Probabilistic Sensitivity Analysis Results

Description of Probabilistic Variable	Significance	Coefficient	Cumulative Density Function Value	Deterministic Value
Kd of Ra-226 in Unsaturated Zone 3	79	-0.03	50%	3522.8
Kd of Ra-226 in Unsaturated Zone 4	67	-0.04	50%	3484.6
Kd of Ra-226 in Unsaturated Zone 5	54	0.06	50%	3495.8
Kd of Ra-226 in Saturated Zone	94	-0.02	50%	3529.3
Kd of Ra-228 in Contaminated Zone	69	0.04	50%	3489.5
Kd of Ra-228 in Unsaturated Zone 1	105	-0.02	50%	3507.0
Kd of Ra-228 in Unsaturated Zone 2	26	0.12	50%	3521.8
Kd of Ra-228 in Unsaturated Zone 3	106	0.02	50%	3513.0
Kd of Ra-228 in Unsaturated Zone 4	35	-0.09	50%	3504.5
Kd of Ra-228 in Unsaturated Zone 5	107	0.02	50%	3483.8
Kd of Ra-228 in Saturated Zone	17	0.13	50%	3521.4
Kd of Th-228 in Contaminated Zone	70	0.04	50%	5883.2
Kd of Th-228 in Unsaturated Zone 1	87	0.03	50%	5736.1
Kd of Th-228 in Unsaturated Zone 2	90	-0.03	50%	5825.4
Kd of Th-228 in Unsaturated Zone 3	88	0.03	50%	5786.3
Kd of Th-228 in Unsaturated Zone 4	50	-0.07	50%	5774.7
Kd of Th-228 in Unsaturated Zone 5	74	-0.03	50%	5784.1
Kd of Th-228 in Saturated Zone	116	-0.01	50%	5828.0
Kd of Th-230 in Contaminated Zone	42	-0.08	50%	5770.7
Kd of Th-230 in Unsaturated Zone 1	57	0.06	50%	5842.5
Kd of Th-230 in Unsaturated Zone 2	101	0.02	50%	5842.8
Kd of Th-230 in Unsaturated Zone 3	98	-0.02	50%	5882.2
Kd of Th-230 in Unsaturated Zone 4	36	0.09	50%	5778.8
Kd of Th-230 in Unsaturated Zone 5	118	0.01	50%	5859.6
Kd of Th-230 in Saturated Zone	48	0.07	50%	5849.2
Kd of Th-232 in Contaminated Zone	9	0.15	50%	5770.9
Kd of Th-232 in Unsaturated Zone 1	8	-0.15	50%	5808.9
Kd of Th-232 in Unsaturated Zone 2	11	0.15	50%	5744.2
Kd of Th-232 in Unsaturated Zone 3	41	-0.08	50%	5769.1
Kd of Th-232 in Unsaturated Zone 4	86	0.03	50%	5778.8
Kd of Th-232 in Unsaturated Zone 5	10	-0.15	50%	5822.9
Kd of Th-232 in Saturated Zone	99	-0.02	50%	5864.1
Kd of U-234 in Contaminated Zone	84	0.03	50%	123.5
Kd of U-234 in Unsaturated Zone 1	43	0.08	50%	126.1
Kd of U-234 in Unsaturated Zone 2	13	0.14	50%	124.2
Kd of U-234 in Unsaturated Zone 3	72	-0.04	50%	124.2
Kd of U-234 in Unsaturated Zone 4	46	-0.07	50%	124.7
Kd of U-234 in Unsaturated Zone 5	95	-0.02	50%	125.7
Kd of U-234 in Saturated Zone	45	-0.07	50%	126.4
Kd of U-235 in Contaminated Zone	2	**-0.58**	25%	15.2
Kd of U-235 in Unsaturated Zone 1	93	-0.02	50%	125.8
Kd of U-235 in Unsaturated Zone 2	77	-0.03	50%	123.3
Kd of U-235 in Unsaturated Zone 3	30	0.11	50%	125.9
Kd of U-235 in Unsaturated Zone 4	97	0.02	50%	124.9
Kd of U-235 in Unsaturated Zone 5	56	0.06	50%	124.7
Kd of U-235 in Saturated Zone	108	0.02	50%	124.4
Kd of U-236 in Contaminated Zone	38	-0.08	50%	123.9
Kd of U-236 in Unsaturated Zone 1	65	0.05	50%	124.0
Kd of U-236 in Unsaturated Zone 2	64	0.05	50%	123.8
Kd of U-236 in Unsaturated Zone 3	115	0.01	50%	123.9
Kd of U-236 in Unsaturated Zone 4	78	-0.03	50%	124.0
Kd of U-236 in Unsaturated Zone 5	6	-0.16	50%	125.9
Kd of U-236 in Saturated Zone	71	-0.04	50%	125.8
Kd of U-238 in Contaminated Zone	23	-0.12	50%	124.0
Kd of U-238 in Unsaturated Zone 1	37	0.09	50%	123.8
Kd of U-238 in Unsaturated Zone 2	81	0.03	50%	124.5
Kd of U-238 in Unsaturated Zone 3	19	-0.13	50%	123.4
Kd of U-238 in Unsaturated Zone 4	113	-0.01	50%	124.0
Kd of U-238 in Unsaturated Zone 5	62	0.05	50%	126.2
Kd of U-238 in Saturated Zone	7	0.16	50%	124.3

APPENDIX J

Ponds B through E Probabilistic Sensitivity Analysis Results
(On enclosed CD)

APPENDIX K

Pond B Deterministic Dose Assessment Input Summary

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	4,000	NR	NR	NR	NR	See Table K-2.
Thickness of contaminated zone	m	2	P	2	D	2.608	NR	NR	NR	NR	See Table K-2.
Length parallel to the aquifer flow	m	100	P	2	D	94	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table K-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table K-3
Soil: Pa-231	pCi/g	0	P	2	D	0.04	NR	NR	NR	NR	See Table K-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table K-3
Soil: Ra-226	pCi/g	0	P	2	D	0.42	NR	NR	NR	NR	See Table K-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table K-3
Soil: Th-228	pCi/g	0	P	2	D	0.08	NR	NR	NR	NR	See Table K-3
Soil: Th-230	pCi/g	0	P	2	D	2.30	NR	NR	NR	NR	See Table K-3
Soil: Th-232	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table K-3
Soil: U-234	pCi/g	0	P	2	D	69.50	NR	NR	NR	NR	See Table K-3
Soil: U-235	pCi/g	0	P	2	D	4.48	NR	NR	NR	NR	See Table K-3
Soil: U-236	pCi/g	0	P	2	D	1.86	NR	NR	NR	NR	See Table K-3
Soil: U-238	pCi/g	0	P	2	D	71.59	NR	NR	NR	NR	See Table K-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.74	NR	NR	NR	NR	See Table K-2
Density of cover material	g/cm^3	1.5	P	1	S	1.571	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
Cover erosion rate	m/yr	0.001	P,B	2	S	1.05E-04	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.575	NR	NR	NR	NR	See Table K-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	3.49E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone total porosity	-	0.4	P	2	S	0.41	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	0.62	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	277817	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	1.51	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone total porosity	-	0.4	P	1	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone effective porosity	-	0.2	P	1	S	0.38	NR	NR	NR	NR	*50% cumulative density function* value. See Appendix J
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	2500.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-*specific b parameter*	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function *value. See Appendix J*
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	1.695	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 total porosity	-	0.4	P	2	S	0.360	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	0.289	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table K-4
Unsaturated zone 1 soil- specific b parameter	-	5.3	P	2	S	9.87	NR	NR	NR	NR	*50% cumulative density function* value. See Appendix J
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	1.563	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 total porosity	-	0.4	P	2	S	0.409	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	0.35	NR	NR	NR	NR	*50% cumulative density function* value. See Appendix J
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	1024.76	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 total porosity	-	0.4	P	2	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	2495.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	1.562	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 total porosity	-	0.4	P	2	S	0.389	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	0.318	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	1021.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 total porosity	-	0.4	P	2	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	2493.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227 (CZ)	cm^3/g	20	P	1	S	824.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ1)	cm^3/g	20	P	1	S	818.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ2)	cm^3/g	20	P	1	S	828.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ3)	cm^3/g	20	P	1	S	825.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ4)	cm^3/g	20	P	1	S	809.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ5)	cm^3/g	20	P	1	S	814.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (SZ)	cm^3/g	20	P	1	S	810.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (CZ)	cm^3/g	50	P	1	S	374.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ1)	cm^3/g	50	P	1	S	370.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Pa-231 (UZ2)	cm^3/g	50	P	1	S	375.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ3)	cm^3/g	50	P	1	S	375.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ4)	cm^3/g	50	P	1	S	378.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ5)	cm^3/g	50	P	1	S	375.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (SZ)	cm^3/g	50	P	1	S	378.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (CZ)	cm^3/g	100	P	1	S	2373.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ1)	cm^3/g	100	P	1	S	2347.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ2)	cm^3/g	100	P	1	S	2361.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ3)	cm^3/g	100	P	1	S	2356.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ4)	cm^3/g	100	P	1	S	2352.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ5)	cm^3/g	100	P	1	S	2379.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (SZ)	cm^3/g	100	P	1	S	2360.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (CZ)	cm^3/g	70	P	1	S	3501.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ1)	cm^3/g	70	P	1	S	3506.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ2)	cm^3/g	70	P	1	S	3505.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ3)	cm^3/g	70	P	1	S	3522.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ4)	cm^3/g	70	P	1	S	3484.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ5)	cm^3/g	70	P	1	S	3495.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (SZ)	cm^3/g	70	P	1	S	3529.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (CZ)	cm^3/g	70	P	1	S	3489.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ1)	cm^3/g	70	P	1	S	3507.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ2)	cm^3/g	70	P	1	S	3521.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ3)	cm^3/g	70	P	1	S	3513.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ4)	cm^3/g	70	P	1	S	3504.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ5)	cm^3/g	70	P	1	S	3483.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (SZ)	cm^3/g	70	P	1	S	3521.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (CZ)	cm^3/g	60000	P	1	S	5883.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ1)	cm^3/g	60000	P	1	S	5736.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ2)	cm^3/g	60000	P	1	S	5825.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ3)	cm^3/g	60000	P	1	S	5786.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-228 (UZ4)	cm^3/g	60000	P	1	S	5774.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ5)	cm^3/g	60000	P	1	S	5784.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (SZ)	cm^3/g	60000	P	1	S	5828.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (CZ)	cm^3/g	60000	P	1	S	5770.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ1)	cm^3/g	60000	P	1	S	5842.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ2)	cm^3/g	60000	P	1	S	5842.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ3)	cm^3/g	60000	P	1	S	5882.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ5)	cm^3/g	60000	P	1	S	5859.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (SZ)	cm^3/g	60000	P	1	S	5849.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (CZ)	cm^3/g	60000	P	1	S	5770.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ1)	cm^3/g	60000	P	1	S	5808.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ2)	cm^3/g	60000	P	1	S	5744.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ3)	cm^3/g	60000	P	1	S	5769.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ5)	cm^3/g	60000	P	1	S	5822.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (SZ)	cm^3/g	60000	P	1	S	5864.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (CZ)	cm^3/g	50	P	1	NA	123.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ1)	cm^3/g	50	P	1	NA	126.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ2)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ3)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ4)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ5)	cm^3/g	50	P	1	NA	125.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (SZ)	cm^3/g	50	P	1	NA	126.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (CZ)	cm^3/g	50	P	1	NA	15.2	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
U-235 (UZ1)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ2)	cm^3/g	50	P	1	NA	123.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ3)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ4)	cm^3/g	50	P	1	NA	124.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ5)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
U-235 (SZ)	cm^3/g	50	P	1	NA	124.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ1)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ2)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ3)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ5)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (SZ)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (CZ)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ1)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ2)	cm^3/g	50	P	1	NA	124.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ3)	cm^3/g	50	P	1	NA	123.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ5)	cm^3/g	50	P	1	NA	126.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (SZ)	cm^3/g	50	P	1	NA	124.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	2.35E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	S	0.547	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Shielding factor, external gamma	-	0.7	P	2	S	0.269424	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD Default
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion; Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	S	0.231	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Conversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/(pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table K-1
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-228	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic

Table K-2
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume(1) (ft^3)	5% Sludge Bulking Volume(1) (ft^3)	Stabilized Sludge Volume(2) (ft^3)	Sludge Surface Area(1) (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area(3) (m^2)	Sludge Surface Length(4) (m)	Sludge Surface Width(4) (m)	CZ Thickness(5) (m)	Average Cover Thickness(1) (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes:

(1) Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A

(2) Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume

(3) CZ Area was estimated by rounding the Sludge Surface Area.

(4) Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table K-3
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Radionuclide Concentration (pCi/g)		
	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.08	0.07	0.04
Radium 226	0.77	0.73	0.42
Thorium 228	0.15	0.15	0.08
Thorium 230	4.23	4.02	2.30
Thorium 232	0.13	0.12	0.07
Uranium 234	127.98	121.58	69.50
Uranium 235	8.24	7.83	4.48
Uranium 236	3.43	3.25	1.86
Uranium 238	131.84	125.25	71.59

Pond Solids: 57.16%

Table K-4
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table K-5
Honeywell Metropolis Works
Pond B Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX L

Pond C Deterministic Dose Assessment Input Summary

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	4,000	NR	NR	NR	NR	See Table L-2.
Thickness of contaminated zone	m	2	P	2	D	2.724	NR	NR	NR	NR	See Table L-2.
Length parallel to the aquifer flow	m	100	P	2	D	94	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table L-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table L-3
Soil: Pa-231	pCi/g	0	P	2	D	0.31	NR	NR	NR	NR	See Table L-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table L-3
Soil: Ra-226	pCi/g	0	P	2	D	0.05	NR	NR	NR	NR	See Table L-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table L-3
Soil: Th-228	pCi/g	0	P	2	D	1.56	NR	NR	NR	NR	See Table L-3
Soil: Th-230	pCi/g	0	P	2	D	0.05	NR	NR	NR	NR	See Table L-3
Soil: Th-232	pCi/g	0	P	2	D	136.83	NR	NR	NR	NR	See Table L-3
Soil: U-234	pCi/g	0	P	2	D	7.31	NR	NR	NR	NR	See Table L-3
Soil: U-235	pCi/g	0	P	2	D	3.27	NR	NR	NR	NR	See Table L-3
Soil: U-236	pCi/g	0	P	2	D	141.58	NR	NR	NR	NR	See Table L-3
Soil: U-238	pCi/g	0	P	2	D	0.00	NR	NR	NR	NR	See Table L-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.51	NR	NR	NR	NR	See Table L-2
Density of cover material	g/cm^3	1.5	P	1	D	1.571	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
Cover erosion rate	m/yr	0.001	P,B	2	D	1.42E-04	NR	NR	NR	NR	75% cumulative density function value. See Appendix J
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.6	NR	NR	NR	NR	See Table L-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	D	3.49E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone total porosity	-	0.4	P	2	D	0.41	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	D	0.62	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume c_1 = 0.3, c_2 = 0.2, and c_3 = 0.1
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	2.78E+05	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	D	1.51	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone total porosity	-	0.4	P	1	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone effective porosity	-	0.2	P	1	D	0.38	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	D	2500.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	D	1.695	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 total porosity	-	0.4	P	2	D	0.360	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 effective porosity	-	0.2	P	2	D	0.289	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table L-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	D	9.87	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	D	1.563	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 total porosity	-	0.4	P	2	D	0.409	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 effective porosity	-	0.2	P	2	D	0.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	D	1024.76	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A'. January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm³	1.5	P	2	D	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 total porosity	-	0.4	P	2	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 effective porosity	-	0.2	P	2	D	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	D	2495.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A'. January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm³	1.5	P	2	D	1.562	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 total porosity	-	0.4	P	2	D	0.389	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 effective porosity	-	0.2	P	2	D	0.318	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	D	1021.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A'. January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm³	1.5	P	2	D	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 total porosity	-	0.4	P	2	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 effective porosity	-	0.2	P	2	D	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	D	2493.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227 (CZ)	cm³/g	20	P	1	S	824.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ1)	cm³/g	20	P	1	S	818.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ2)	cm³/g	20	P	1	S	828.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ3)	cm³/g	20	P	1	S	825.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ4)	cm³/g	20	P	1	S	809.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ5)	cm³/g	20	P	1	S	814.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (SZ)	cm³/g	20	P	1	S	810.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (CZ)	cm³/g	50	P	1	S	374.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ1)	cm³/g	50	P	1	S	370.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Pa-231 (UZ2)	cm^3/g	50	P	1	S	375.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ3)	cm^3/g	50	P	1	S	375.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ4)	cm^3/g	50	P	1	S	378.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ5)	cm^3/g	50	P	1	S	375.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (SZ)	cm^3/g	50	P	1	S	378.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (CZ)	cm^3/g	100	P	1	S	2373.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ1)	cm^3/g	100	P	1	S	2347.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ2)	cm^3/g	100	P	1	S	2361.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ3)	cm^3/g	100	P	1	S	2356.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ4)	cm^3/g	100	P	1	S	2352.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ5)	cm^3/g	100	P	1	S	2379.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (SZ)	cm^3/g	100	P	1	S	2360.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (CZ)	cm^3/g	70	P	1	S	3501.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ1)	cm^3/g	70	P	1	S	3506.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ2)	cm^3/g	70	P	1	S	3505.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ3)	cm^3/g	70	P	1	S	3522.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ4)	cm^3/g	70	P	1	S	3484.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ5)	cm^3/g	70	P	1	S	3495.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (SZ)	cm^3/g	70	P	1	S	3529.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (CZ)	cm^3/g	70	P	1	S	3489.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ1)	cm^3/g	70	P	1	S	3507.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ2)	cm^3/g	70	P	1	S	3521.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ3)	cm^3/g	70	P	1	S	3513.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ4)	cm^3/g	70	P	1	S	3504.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ5)	cm^3/g	70	P	1	S	3483.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (SZ)	cm^3/g	70	P	1	S	3521.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (CZ)	cm^3/g	60000	P	1	S	5883.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ1)	cm^3/g	60000	P	1	S	5736.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ2)	cm^3/g	60000	P	1	S	5825.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ3)	cm^3/g	60000	P	1	S	5786.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-228 (UZ4)	cm^3/g	60000	P	1	S	5774.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ5)	cm^3/g	60000	P	1	S	5784.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (SZ)	cm^3/g	60000	P	1	S	5828.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (CZ)	cm^3/g	60000	P	1	S	5770.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ1)	cm^3/g	60000	P	1	S	5842.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ2)	cm^3/g	60000	P	1	S	5842.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ3)	cm^3/g	60000	P	1	S	5882.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ5)	cm^3/g	60000	P	1	S	5859.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (SZ)	cm^3/g	60000	P	1	S	5849.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (CZ)	cm^3/g	60000	P	1	S	5770.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ1)	cm^3/g	60000	P	1	S	5808.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ2)	cm^3/g	60000	P	1	S	5744.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ3)	cm^3/g	60000	P	1	S	5769.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ5)	cm^3/g	60000	P	1	S	5822.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (SZ)	cm^3/g	60000	P	1	S	5864.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (CZ)	cm^3/g	50	P	1	NA	123.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ1)	cm^3/g	50	P	1	NA	126.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ2)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ3)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ4)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ5)	cm^3/g	50	P	1	NA	125.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (SZ)	cm^3/g	50	P	1	NA	126.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ1)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ2)	cm^3/g	50	P	1	NA	123.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ3)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ4)	cm^3/g	50	P	1	NA	124.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ5)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
U-235 (SZ)	cm^3/g	50	P	1	NA	124.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ1)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ2)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ3)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ5)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (SZ)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (CZ)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ1)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ2)	cm^3/g	50	P	1	NA	124.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ3)	cm^3/g	50	P	1	NA	123.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ5)	cm^3/g	50	P	1	NA	126.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (SZ)	cm^3/g	50	P	1	NA	124.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	D	2.35E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	D	0.547	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Shielding factor, external gamma	-	0.7	P	2	D	0.269	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD Default
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m³	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	D	0.231	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m²	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m²	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m²	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm³	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Donversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/(pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table L-1
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic

Table L-2
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume(1) (ft^3)	5% Sludge Bulking Volume(1) (ft^3)	Stabilized Sludge Volume(2) (ft^3)	Sludge Surface Area(1) (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area(3) (m^2)	Sludge Surface Length(4) (m)	Sludge Surface Width(4) (m)	CZ Thickness(5) (m)	Average Cover Thickness(1) (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes: (1) Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A

(2) Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume

(3) CZ Area was estimated by rounding the Sludge Surface Area.

(4) Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table L-3
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.26	0.24	0.13
Radium 226	0.59	0.56	0.31
Thorium 228	0.10	0.09	0.05
Thorium 230	3.00	2.85	1.56
Thorium 232	0.09	0.09	0.05
Uranium 234	263.85	250.66	136.83
Uranium 235	14.10	13.40	7.31
Uranium 236	6.31	5.99	3.27
Uranium 238	273.00	259.35	141.58

% Solids: 54.59%
Pond Solids: 57.16%

Table L-4
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table L-5
Honeywell Metropolis Works
Pond C Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX M

Pond D Deterministic Dose Assessment Input Summary

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	3,900	NR	NR	NR	NR	See Table M-2.
Thickness of contaminated zone	m	2	P	2	D	1.959	NR	NR	NR	NR	See Table M-2.
Length parallel to the aquifer flow	m	100	P	2	D	65	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table M-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table M-3
Soil: Pa-231	pCi/g	0	P	2	D	0.25	NR	NR	NR	NR	See Table M-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table M-3
Soil: Ra-226	pCi/g	0	P	2	D	0.46	NR	NR	NR	NR	See Table M-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table M-3
Soil: Th-228	pCi/g	0	P	2	D	0.28	NR	NR	NR	NR	See Table M-3
Soil: Th-230	pCi/g	0	P	2	D	1.14	NR	NR	NR	NR	See Table M-3
Soil: Th-232	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table M-3
Soil: U-234	pCi/g	0	P	2	D	480.78	NR	NR	NR	NR	See Table M-3
Soil: U-235	pCi/g	0	P	2	D	8.68	NR	NR	NR	NR	See Table M-3
Soil: U-236	pCi/g	0	P	2	D	12.87	NR	NR	NR	NR	See Table M-3
Soil: U-238	pCi/g	0	P	2	D	503.83	NR	NR	NR	NR	See Table M-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	2.76	NR	NR	NR	NR	See Table M-2
Density of cover material	g/cm^3	1.5	P	1	D	1.571	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
Cover erosion rate	m/yr	0.001	P,B	2	D	1.05E-04	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.6	NR	NR	NR	NR	See Table M-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	D	3.49E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone total porosity	-	0.4	P	2	D	0.41	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Evapotranspiration coefficient	-	0.5	P	2	D	0.62	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	Overhead	B	3	D	Overhead	NR	NR	NR	NR	RESRAD default. Method is used in Illinois
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	2.78E+05	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	D	1.51	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone total porosity	-	0.4	P	1	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone effective porosity	-	0.2	P	1	D	0.38	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	D	2500.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND Model is used for larger contaminated areas (e.g. more than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	D	1.695	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 total porosity	-	0.4	P	2	D	0.360	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 effective porosity	-	0.2	P	2	D	0.289	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table M-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	D	9.87	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	D	1.563	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 total porosity	-	0.4	P	2	D	0.409	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 2 effective porosity	-	0.2	P	2	D	0.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	D	1024.76	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	D	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 total porosity	-	0.4	P	2	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 effective porosity	-	0.2	P	2	D	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	D	2495.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	D	1.562	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 total porosity	-	0.4	P	2	D	0.389	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 effective porosity	-	0.2	P	2	D	0.318	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	D	1021.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	D	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	D	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 total porosity	-	0.4	P	2	D	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 effective porosity	-	0.2	P	2	D	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	D	2493.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	D	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227 (CZ)	cm^3/g	20	P	1	S	824.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ1)	cm^3/g	20	P	1	S	818.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ2)	cm^3/g	20	P	1	S	828.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ3)	cm^3/g	20	P	1	S	825.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ4)	cm^3/g	20	P	1	S	809.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ5)	cm^3/g	20	P	1	S	814.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (SZ)	cm^3/g	20	P	1	S	810.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (CZ)	cm^3/g	50	P	1	S	374.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ1)	cm^3/g	50	P	1	S	370.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Pa-231 (UZ2)	cm^3/g	50	P	1	S	375.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ3)	cm^3/g	50	P	1	S	375.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ4)	cm^3/g	50	P	1	S	378.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ5)	cm^3/g	50	P	1	S	375.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (SZ)	cm^3/g	50	P	1	S	378.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (CZ)	cm^3/g	100	P	1	S	2373.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ1)	cm^3/g	100	P	1	S	2347.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ2)	cm^3/g	100	P	1	S	2361.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ3)	cm^3/g	100	P	1	S	2356.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ4)	cm^3/g	100	P	1	S	2352.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ5)	cm^3/g	100	P	1	S	2379.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (SZ)	cm^3/g	100	P	1	S	2360.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (CZ)	cm^3/g	70	P	1	S	3501.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ1)	cm^3/g	70	P	1	S	3506.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ2)	cm^3/g	70	P	1	S	3505.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ3)	cm^3/g	70	P	1	S	3522.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ4)	cm^3/g	70	P	1	S	3484.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ5)	cm^3/g	70	P	1	S	3495.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (SZ)	cm^3/g	70	P	1	S	3529.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (CZ)	cm^3/g	70	P	1	S	3489.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ1)	cm^3/g	70	P	1	S	3507.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ2)	cm^3/g	70	P	1	S	3521.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ3)	cm^3/g	70	P	1	S	3513.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ4)	cm^3/g	70	P	1	S	3504.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ5)	cm^3/g	70	P	1	S	3483.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (SZ)	cm^3/g	70	P	1	S	3521.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (CZ)	cm^3/g	60000	P	1	S	5883.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ1)	cm^3/g	60000	P	1	S	5736.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ2)	cm^3/g	60000	P	1	S	5825.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ3)	cm^3/g	60000	P	1	S	5786.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ4)	cm^3/g	60000	P	1	S	5774.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ5)	cm^3/g	60000	P	1	S	5784.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (SZ)	cm^3/g	60000	P	1	S	5828.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (CZ)	cm^3/g	60000	P	1	S	5770.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ1)	cm^3/g	60000	P	1	S	5842.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ2)	cm^3/g	60000	P	1	S	5842.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ3)	cm^3/g	60000	P	1	S	5882.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ5)	cm^3/g	60000	P	1	S	5859.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-230 (SZ)	cm^3/g	60000	P	1	S	5849.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (CZ)	cm^3/g	60000	P	1	S	5770.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ1)	cm^3/g	60000	P	1	S	5808.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ2)	cm^3/g	60000	P	1	S	5744.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ3)	cm^3/g	60000	P	1	S	5769.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ5)	cm^3/g	60000	P	1	S	5822.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (SZ)	cm^3/g	60000	P	1	S	5864.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (CZ)	cm^3/g	50	P	1	NA	123.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ1)	cm^3/g	50	P	1	NA	126.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ2)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ3)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ4)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ5)	cm^3/g	50	P	1	NA	125.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (SZ)	cm^3/g	50	P	1	NA	126.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ1)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ2)	cm^3/g	50	P	1	NA	123.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ3)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ4)	cm^3/g	50	P	1	NA	124.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ5)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (SZ)	cm^3/g	50	P	1	NA	124.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ1)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ2)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ3)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ5)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (SZ)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (CZ)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ1)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ2)	cm^3/g	50	P	1	NA	124.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ3)	cm^3/g	50	P	1	NA	123.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ5)	cm^3/g	50	P	1	NA	126.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (SZ)	cm^3/g	50	P	1	NA	124.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Solubility limit	mol/L	0	P	3	D	2.94E-06	NR	NR	NR	NR	Value used for Uranium nuclides only
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	D	2.35E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	D	0.547	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Shielding factor, external gamma	-	0.7	P	2	D	0.397	NR	NR	NR	NR	75% cumulative density function value. See Appendix J
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Soil ingestion rate	g/yr	36.5	M, B	2	D	36.5	NR	NR	NR	NR	RESRAD Manual, Table 2.3 based on EPA suggested value of 100 mg/day
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD Default
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Depth of soil mixing layer	m	0.15	P	2	D	0.231	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Conversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/ (pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/ (pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/ (pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/ (pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/ (pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/ (pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table M-1
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-230	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/(pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic

Table M-2
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[1] (ft^3)	5% Sludge Bulking Volume[1] (ft^3)	Stabilized Sludge Volume[2] (ft^3)	Sludge Surface Area[1] (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area[3] (m^2)	Sludge Surface Length[4] (m)	Sludge Surface Width[4] (m)	CZ Thickness[5] (m)	Average Cover Thickness[1] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes: [1] Andrews Engineering Calculation “Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E” provided in Appendix A
[2] Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume
[3] CZ Area was estimated by rounding the Sludge Surface Area.
[4] Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table M-3
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

	Radionuclide Concentration (pCi/g)		
Radionuclide	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.52	0.49	0.25
Radium 226	0.95	0.90	0.46
Thorium 228	0.58	0.55	0.28
Thorium 230	2.35	2.23	1.14
Thorium 232	0.15	0.14	0.07
Uranium 234	993.50	943.82	480.78
Uranium 235	17.94	17.04	8.68
Uranium 236	26.60	25.27	12.87
Uranium 238	1041.12	989.06	503.83

% Solids: 50.94%

Table M-4
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table M-5
Honeywell Metropolis Works
Pond D Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX N

Pond E Deterministic Dose Assessment Input Summary

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Contaminated Zone											
Area of contaminated zone	m^2	10000	P	2	D	12,000	NR	NR	NR	NR	See Table N-2.
Thickness of contaminated zone	m	2	P	2	D	3.453	NR	NR	NR	NR	See Table N-2.
Length parallel to the aquifer flow	m	100	P	2	D	165	NR	NR	NR	NR	Length of longest side of contaminated zone. See Table N-2.
Basic Radiation Dose Limit	mrem/year	30	P	3	D	25	NR	NR	NR	NR	Unrestricted release criteria in 10 CFR 20.1402
Time since placement	yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1	P	3	D	1	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	3	P	3	D	3	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	10	P	3	D	10	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	30	P	3	D	30	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	100	P	3	D	100	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	300	P	3	D	300	NR	NR	NR	NR	RESRAD default
Times for calculations	yr	1000	P	3	D	1000	NR	NR	NR	NR	RESRAD default
Initial Principle Radionuclide Concentrations											
Soil: Ac-227	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table N-3
Soil: Pa-231	pCi/g	0	P	2	D	0.07	NR	NR	NR	NR	See Table N-3
Soil: Pb-210	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table N-3
Soil: Ra-226	pCi/g	0	P	2	D	0.34	NR	NR	NR	NR	See Table N-3
Soil: Ra-228	pCi/g	0	P	2	D	0	NR	NR	NR	NR	See Table N-3
Soil: Th-228	pCi/g	0	P	2	D	0.03	NR	NR	NR	NR	See Table N-3
Soil: Th-230	pCi/g	0	P	2	D	0.83	NR	NR	NR	NR	See Table N-3
Soil: Th-232	pCi/g	0	P	2	D	0.03	NR	NR	NR	NR	See Table N-3
Soil: U-234	pCi/g	0	P	2	D	118.57	NR	NR	NR	NR	See Table N-3
Soil: U-235	pCi/g	0	P	2	D	5.11	NR	NR	NR	NR	See Table N-3
Soil: U-236	pCi/g	0	P	2	D	2.91	NR	NR	NR	NR	See Table N-3
Soil: U-238	pCi/g	0	P	2	D	122.69	NR	NR	NR	NR	See Table N-3
Groundwater: Ac-227	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pa-231	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Pb-210	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-226	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Ra-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-228	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-230	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: Th-232	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-234	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-235	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-236	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Groundwater: U-238	pCi/L	0	P	3	NA	Not used	NR	NR	NR	NR	Not used for calculation of distribution coefficients
Cover and Contaminated Zone Hydrological Data											
Cover depth	m	0	P	2	D	1.594	NR	NR	NR	NR	See Table N-2
Density of cover material	g/cm^3	1.5	P	1	S	1.571	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
Cover erosion rate	m/yr	0.001	P,B	2	S	1.05E-04	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Density of contaminated zone	g/cm^3	1.5	P	1	D	1.4375	NR	NR	NR	NR	See Table N-5
Contaminated zone erosion rate	m/yr	0.001	P,B	2	S	3.49E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone total porosity	-	0.4	P	2	S	0.41	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Contaminated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Contaminated zone hydraulic conductivity	m/yr	10	P	2	D	1.6	NR	NR	NR	NR	Average Kh from dilatometer (DMT) pressure dissipation tests performed on in-situ Pond E sludge by In-Situ Testing LC, August 5-7, 2009
Contaminated zone b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Humidity in air	g/m^3	8	P	3	NA	Not used	NR	NR	NR	NR	This parameter only used if Tritium is present in soil
Evapotranspiration coefficient	-	0.5	P	2	S	0.62	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Average annual wind speed	m/s	2	P	2	D	3.3	NR	NR	NR	NR	Average annual wind speed for Paducah, KY (NOAA),7.4 mph http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html
Precipitation rate	m/yr	1	P	2	D	1.25	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.1-1, Paducah, KY
Irrigation rate	m/yr	0.2	B	3	D	0	NR	NR	NR	NR	Not applicable for industrial scenario
Irrigation mode	-	*Overhead*	*B*	*3*	*D*	*Overhead*	*NR*	*NR*	*NR*	*NR*	RESRAD default. Method is used *in Illinois*
Runoff coefficient	-	0.2	P	2	D	0.4	NR	NR	NR	NR	NUREG/CR-6697 Att. C, Table 4.2-1 method. Assume $c_1 = 0.3$, $c_2 = 0.2$, and $c_3 = 0.1$
Watershed area for nearby stream or pond	m^2	1.00E+06	P	3	D	2.78E+05	NR	NR	NR	NR	Pond area watershed. See Appendix A.
Accuracy for water soil computation	-	1.00E-03	NA	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Saturated Zone Hydrological Data											
Density of saturated zone	g/cm^3	1.5	P	1	S	1.51	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone total porosity	-	0.4	P	1	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone effective porosity	-	0.2	P	1	S	0.38	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Saturated zone hydraulic conductivity	m/yr	100	P	1	S	2500.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Saturated zone hydraulic gradient	-	0.02	P	2	D	0.0048	NR	NR	NR	NR	Andrews Engr. Geologic Cross Section Sheet A-A' (El. 319.24 – El. 298.54)/ 4320 ft. See Appendix A.
Saturated zone soil-specific b parameter	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Water table drop rate	m/yr	1.00E-03	P	3	D	1.00E-03	NR	NR	NR	NR	RESRAD default
Well-pump intake depth (below water table)	m	10	P	2	D	105	NR	NR	NR	NR	Honeywell Sanitary Well Depth from HSA - depth to saturated zone.
Model: non-dispersion or mass balance	-	ND	P	3	D	ND	NR	NR	NR	NR	ND *Model is used for larger contaminated areas (e.g. more* than 1,000 m^2) per RESRAD Users Manual Section E.3.1.
Well pumping rate	m^3/yr	250	B, P	2	D	Not used	NR	NR	NR	NR	This parameter is not used in the non-dispersion model
Unsaturated Zone Hydrological Data											
Number of unsaturated zones	-	1	P	3	D	5	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 thickness (Clayey Silt/Silty Clay)	m	4	P	1	D	6.86	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 1 soil density	g/cm^3	1.5	P	2	S	1.695	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 total porosity	-	0.4	P	2	S	0.360	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 effective porosity	-	0.2	P	2	S	0.289	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 1 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 1 hydraulic conductivity	m/yr	10	P	2	D	126	NR	NR	NR	NR	See Table N-4
Unsaturated zone 1 soil-specific b parameter	-	5.3	P	2	S	9.87	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Unsaturated zone 2 soil density	g/cm^3	1.5	P	2	S	1.563	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 total porosity	-	0.4	P	2	S	0.409	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 effective porosity	-	0.2	P	2	S	0.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 2 hydraulic conductivity	m/yr	10	P	2	S	1024.76	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 2 soil-specific b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 thickness (Sand)	m	4	P	1	D	1.71	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 3 soil density	g/cm^3	1.5	P	2	S	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 total porosity	-	0.4	P	2	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 effective porosity	-	0.2	P	2	S	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 3 hydraulic conductivity	m/yr	10	P	2	S	2495.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 3 soil-specific b parameter	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 thickness (Sandy Silt/Silty Sand)	m	4	P	1	D	4	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 4 soil density	g/cm^3	1.5	P	2	S	1.562	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 total porosity	-	0.4	P	2	S	0.389	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 effective porosity	-	0.2	P	2	S	0.318	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 4 hydraulic conductivity	m/yr	10	P	2	S	1021.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 4 soil-specific b parameter	-	5.3	P	2	S	1.35	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 thickness (Sand)	m	4	P	1	D	1.14	NR	NR	NR	NR	Andrews Engineering Project ID 91-135 cross section Sheet Number A-A', January 2007. See Appendix A.
Unsaturated zone 5 soil density	g/cm^3	1.5	P	2	S	1.510	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 total porosity	-	0.4	P	2	S	0.43	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 effective porosity	-	0.2	P	2	S	0.383	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 field capacity	-	0.2	P	3	D	0.2	NR	NR	NR	NR	RESRAD default
Unsaturated zone 5 hydraulic conductivity	m/yr	10	P	2	S	2493.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Unsaturated zone 5 soil-specific b parameter	-	5.3	P	2	S	0.97	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Distribution Coefficients (contaminated, unsaturated, and saturated zones)											
Ac-227 (CZ)	cm^3/g	20	P	1	S	824.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ1)	cm^3/g	20	P	1	S	818.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ2)	cm^3/g	20	P	1	S	828.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ3)	cm^3/g	20	P	1	S	825.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ4)	cm^3/g	20	P	1	S	809.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ac-227 (UZ5)	cm^3/g	20	P	1	S	814.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Ac-227 (SZ)	cm^3/g	20	P	1	S	810.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (CZ)	cm^3/g	50	P	1	S	374.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ1)	cm^3/g	50	P	1	S	370.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ2)	cm^3/g	50	P	1	S	375.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ3)	cm^3/g	50	P	1	S	375.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ4)	cm^3/g	50	P	1	S	378.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (UZ5)	cm^3/g	50	P	1	S	375.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pa-231 (SZ)	cm^3/g	50	P	1	S	378.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (CZ)	cm^3/g	100	P	1	S	2373.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ1)	cm^3/g	100	P	1	S	2347.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ2)	cm^3/g	100	P	1	S	2361.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ3)	cm^3/g	100	P	1	S	2356.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ4)	cm^3/g	100	P	1	S	2352.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (UZ5)	cm^3/g	100	P	1	S	2379.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Pb-210 (SZ)	cm^3/g	100	P	1	S	2360.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (CZ)	cm^3/g	70	P	1	S	3501.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ1)	cm^3/g	70	P	1	S	3506.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ2)	cm^3/g	70	P	1	S	3505.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ3)	cm^3/g	70	P	1	S	3522.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ4)	cm^3/g	70	P	1	S	3484.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (UZ5)	cm^3/g	70	P	1	S	3495.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-226 (SZ)	cm^3/g	70	P	1	S	3529.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (CZ)	cm^3/g	70	P	1	S	3489.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ1)	cm^3/g	70	P	1	S	3507.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ2)	cm^3/g	70	P	1	S	3521.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ3)	cm^3/g	70	P	1	S	3513.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ4)	cm^3/g	70	P	1	S	3504.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (UZ5)	cm^3/g	70	P	1	S	3483.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Ra-228 (SZ)	cm^3/g	70	P	1	S	3521.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (CZ)	cm^3/g	60000	P	1	S	5883.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ1)	cm^3/g	60000	P	1	S	5736.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ2)	cm^3/g	60000	P	1	S	5825.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ3)	cm^3/g	60000	P	1	S	5786.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ4)	cm^3/g	60000	P	1	S	5774.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (UZ5)	cm^3/g	60000	P	1	S	5784.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-228 (SZ)	cm^3/g	60000	P	1	S	5828.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (CZ)	cm^3/g	60000	P	1	S	5770.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ1)	cm^3/g	60000	P	1	S	5842.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-230 (UZ2)	cm^3/g	60000	P	1	S	5842.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ3)	cm^3/g	60000	P	1	S	5882.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (UZ5)	cm^3/g	60000	P	1	S	5859.6	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-230 (SZ)	cm^3/g	60000	P	1	S	5849.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (CZ)	cm^3/g	60000	P	1	S	5770.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ1)	cm^3/g	60000	P	1	S	5808.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ2)	cm^3/g	60000	P	1	S	5744.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ3)	cm^3/g	60000	P	1	S	5769.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ4)	cm^3/g	60000	P	1	S	5778.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (UZ5)	cm^3/g	60000	P	1	S	5822.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Th-232 (SZ)	cm^3/g	60000	P	1	S	5864.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (CZ)	cm^3/g	50	P	1	NA	123.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ1)	cm^3/g	50	P	1	NA	126.1	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ2)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ3)	cm^3/g	50	P	1	NA	124.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ4)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (UZ5)	cm^3/g	50	P	1	NA	125.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-234 (SZ)	cm^3/g	50	P	1	NA	126.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (CZ)	cm^3/g	50	P	1	NA	15.2	NR	NR	NR	NR	25% cumulative density function value. See Appendix J
U-235 (UZ1)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ2)	cm^3/g	50	P	1	NA	123.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ3)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ4)	cm^3/g	50	P	1	NA	124.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (UZ5)	cm^3/g	50	P	1	NA	124.7	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-235 (SZ)	cm^3/g	50	P	1	NA	124.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (CZ)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ1)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ2)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ3)	cm^3/g	50	P	1	NA	123.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (UZ5)	cm^3/g	50	P	1	NA	125.9	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-236 (SZ)	cm^3/g	50	P	1	NA	125.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (CZ)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ1)	cm^3/g	50	P	1	NA	123.8	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ2)	cm^3/g	50	P	1	NA	124.5	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ3)	cm^3/g	50	P	1	NA	123.4	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (UZ4)	cm^3/g	50	P	1	NA	124.0	NR	NR	NR	NR	50% cumulative density function value. See Appendix J

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
U-238 (UZ5)	cm^3/g	50	P	1	NA	126.2	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
U-238 (SZ)	cm^3/g	50	P	1	NA	124.3	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Transport Factor Options											
Leach rate	1/yr	0	P	3	D	0	NR	NR	NR	NR	RESRAD default, parameter is not used for calculation of distribution coefficients. Value of 0 not used for calculation of distribution coefficients.
Solubility limit	*mol/L*	*0*	*P*	*3*	*D*	*2.94E-06*	*NR*	*NR*	*NR*	*NR*	Value used for Uranium nuclides *only*
Use plant/soil ratio	Check box	Yes/No	NA	3	NA	No	NR	NR	NR	NR	RESRAD default, parameter not used for calculation of distribution coefficients.
Occupancy											
Inhalation rate	m^3/yr	8400	M, B	3	D	11400	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Mass loading for inhalation	g/m^3	0.0001	P, B	2	S	2.35E-05	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Exposure duration	yr	30	B	3	D	25	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Indoor dust filtration factor (shielding factor, inhalation)	-	0.4	P, B	2	S	0.547	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Shielding factor, external gamma	-	0.7	P	2	S	0.269424	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Indoor time fraction	-	0.5	B	3	D	0.17	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Outdoor (on site) time fraction	-	0.25	B	3	D	0.06	NR	NR	NR	NR	RESRAD Manual, Table 2.3
Shape of the contaminated zone	-	1	P	3	D	Non-circular	NR	NR	NR	NR	Shape representative of pond (rectangular)
Ingestion, Dietary											
Fruit, vegetable, and grain consumption rate	kg/yr	160	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Leafy vegetable consumption	kg/yr	14	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk consumption	L/yr	92	M, B	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat and poultry consumption	kg/yr	63	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Fish consumption rate	kg/yr	5.4	M, B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Other seafood consumption rate	kg/yr	0.9	M, B	3	NA	Not used	NR	NR	NR	NR	*Pathway suppressed for industrial* worker scenario
Soil ingestion rate	g/yr	*36.5*	M, B	2	*D*	*36.5*	NR	NR	*NR*	NR	RESRAD Manual, Table 2.3 based on EPA suggested value *of 100 mg/day*
Drinking water intake	L/yr	510	M, B	2	D	478.5	NR	NR	NR	NR	NUREG/CR-5512, V3 Table 6.87
Contamination fraction of drinking water	-	1	B, P	3	NA	1	NR	NR	NR	NR	RESRAD Default
Contamination fraction of household water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of livestock water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of irrigation water	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of aquatic food	-	0.5	B, P	2	NA	Not used	NR	NR	NR	NR	Pathway *suppressed for industrial* worker scenario
Contamination fraction of plant food	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of meat	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Contamination fraction of milk	-	-1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ingestion, Non-Dietary											
Livestock fodder intake rate for meat	kg/d	68	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock fodder intake rate for milk	kg/d	55	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock water intake rate for meat	L/d	50	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Livestock *water intake* rate for milk	L/d	160	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for *industrial* worker scenario
Livestock soil intake	kg/d	0.5	M	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Mass loading for foliar deposition	g/m^3	1.00E-04	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Depth of soil mixing layer	m	0.15	P	2	S	0.231	NR	NR	NR	NR	50% cumulative density function value. See Appendix J
Depth of roots	m	0.9	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Drinking water fraction from groundwater	-	1	B, P	3	D	1	NR	NR	NR	NR	RESRAD default, all drinking water assumed from groundwater
Household water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Parameter applies to Radon only.
Livestock water fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Irrigation fraction from groundwater	-	1	B, P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for non-leafy plants	kg/m^2	0.7	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for leafy plants	kg/m^2	1.5	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet weight crop yield for fodder	kg/m^2	1.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for non-leafy vegetables	yr	0.17	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for leafy vegetables	yr	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Growing season for fodder	yr	0.08	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for non-leafy vegetables	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for leafy vegetables	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Translocation factor for fodder	-	1	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Dry foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for non-leafy vegetables	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for leafy vegetables	-	0.25	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Wet foliar interception fraction for fodder	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Weathering removal constant for vegetation	1/yr	20	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Special Radionuclides (C-14)											
C-12 concentration in water	g/cm^3	2.00E-05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 concentration in contaminated soil	g/g	3.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from soil	-	2.00E-02	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of vegetation carbon from air	-	0.98	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion layer thickness in soil	m	0.3	P	2	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-14 evasion flux rate from soil	1/s	7.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
C-12 evasion flux rate from soil	1/s	1.00E-10	P	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in beef cattle feed	-	0.8	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Fraction of grain in milk cow feed	-	0.2	B	3	NA	Not used	NR	NR	NR	NR	Applicable for C-14 exposure only
Storage Times of Contaminated Foodstuffs											
Storage time for fruits, non-leafy vegetables, and grain	d	14	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for leafy vegetables	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for milk	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Storage time for meat	d	20	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for fish	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for crustacea and mollusks	d	7	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for well water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for surface water	d	1	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Storage time for livestock fodder	d	45	B	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Radon											
Thickness of building foundation	m	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Bulk density building foundation	g/m^3	2.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of cover material	-	0.4	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Total porosity of building foundation	-	0.1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of cover material	-	0.05	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Volumetric water content of building foundation	-	0.03	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in cover material	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in foundation material	m/s	3.00E-07	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon diffusion coefficient in contaminated zone soil	m/s	2.00E-06	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon vertical dimension of mixing	m	2	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Average building air exchange rate	1/hr	0.5	P, B	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building (room) height	m	2.5	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building interior area factor	-	0	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Building depth below ground surface	m	-1	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-222 emanation coefficient	-	0.25	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Radon-220 emanation coefficient	-	0.15	P	3	NA	Not used	NR	NR	NR	NR	Applicable for Radon exposure only
Risk Conversion Factors											
Slope factor – external	(risk/yr)/(pCi/g)	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – inhalation	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Slope factor – ingestion	risk/pCi	Nuclide specific	M	3	NA	Not used	NR	NR	NR	NR	RESRAD Default
Inhalation dose conversion factors											
Ac-227	mrem/pCi	6.7	M	3	D	6.7	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	1.28	M	3	D	1.28	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.0136	M	3	D	0.0136	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00858	M	3	D	0.00858	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00477	M	3	D	0.00477	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-228	mrem/pCi	0.342	M	3	D	0.342	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.326	M	3	D	0.326	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	1.64	M	3	D	1.64	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.132	M	3	D	0.132	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.123	M	3	D	0.123	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.125	M	3	D	0.125	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.118	M	3	D	0.118	NR	NR	NR	NR	FGR-11, RESRAD Library
Ingestion Dose Conversion Factors											
Ac-227	mrem/pCi	0.0141	M	3	D	0.0141	NR	NR	NR	NR	FGR-11, RESRAD Library
Pa-231	mrem/pCi	0.0106	M	3	D	0.0106	NR	NR	NR	NR	FGR-11, RESRAD Library
Pb-210	mrem/pCi	0.00537	M	3	D	0.00537	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-226	mrem/pCi	0.00132	M	3	D	0.00132	NR	NR	NR	NR	FGR-11, RESRAD Library
Ra-228	mrem/pCi	0.00144	M	3	D	0.00144	NR	NR	NR	NR	FGR-11, RESRAD Library

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
Th-228	mrem/pCi	0.000396	M	3	D	0.000396	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-230	mrem/pCi	0.000548	M	3	D	0.000548	NR	NR	NR	NR	FGR-11, RESRAD Library
Th-232	mrem/pCi	0.00273	M	3	D	0.00273	NR	NR	NR	NR	FGR-11, RESRAD Library
U-234	mrem/pCi	0.000283	M	3	D	0.000283	NR	NR	NR	NR	FGR-11, RESRAD Library
U-235	mrem/pCi	0.000266	M	3	D	0.000266	NR	NR	NR	NR	FGR-11, RESRAD Library
U-236	mrem/pCi	0.000269	M	3	D	0.000269	NR	NR	NR	NR	FGR-11, RESRAD Library
U-238	mrem/pCi	0.000255	M	3	D	0.000255	NR	NR	NR	NR	FGR-11, RESRAD Library
Plant Transfer Factors [pCi/g plant (wet)]/[pCi/g soil (dry)]											
Ac-227	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	-	0.01	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	-	0.04	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	-	0.001	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	-	0.0025	P	1	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Meat Transfer Factor											
Ac-227	(pCi/kg)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/(pCi/d)	0.005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/(pCi/d)	0.0008	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/(pCi/d)	0.0001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/(pCi/d)	0.00034	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Milk Transfer Factor											
Ac-227	(pCi/L)/(pCi/d)	0.00002	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/L)/(pCi/d)	0.0003	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/L)/(pCi/d)	0.001	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/L)/(pCi/d)	0.000005	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/L)/(pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario

Table N-1
Honeywell Metropolis Works
Pond E Dose Assessment
Worker Scenario
Deterministic Dose Assessment Input Summary

Parameter	Units	RESRAD Default	Type[1]	Priority[2]	Treatment[3]	Value	Distribution Parameter 1	Distribution Parameter 2	Distribution Parameter 3	Distribution Parameter 4	Basis
U-235	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/L)/ (pCi/d)	0.0006	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for fish											
Ac-227	(pCi/kg)/ (pCi/L)	15	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/L)	300	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	50	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	100	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	10	P	2	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Bioaccumulation factor for crustacea and mollusks											
Ac-227	(pCi/kg)/ (pCi/L)	1000	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pa-231	(pCi/kg)/ (pCi/L)	110	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Pb-210	(pCi/kg)/ (pCi/L)	100	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-226	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Ra-228	(pCi/kg)/ (pCi/L)	250	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-228	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-230	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Th-232	(pCi/kg)/ (pCi/L)	500	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-234	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-235	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-236	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
U-238	(pCi/kg)/ (pCi/L)	60	P	3	NA	Not used	NR	NR	NR	NR	Pathway suppressed for industrial worker scenario
Graphics Parameters											
Number of points	-	32	NA	NA	NA	1024	NR	NR	NR	NR	Value greater than default provides more evaluation points
Spacing	-	Log	NA	NA	NA	Log	NR	NR	NR	NR	RESRAD Default
Time Integration Parameters											
Maximum number of points for dose	-	17	NA	NA	NA	17	NR	NR	NR	NR	RESRAD Default

Notes:
[1]P = physical, B = behavioral, M = metabolic, when more than one type is listed the first is primary and the next is secondary (NUREG/CR-6697, Att. A, Table 2.1)
[2]1 = high priority, 2 = medium priority, 3 = low priority (NUREG/CR-6697, Att. B, Table 4.2)
[3]D = deterministic, S = stochastic

Table N-2
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Source Configuration Summary

Pond	Sludge Volume[1] (ft^3)	5% Sludge Bulking Volume[1] (ft^3)	Stabilized Sludge Volume[2] (ft^3)	Sludge Surface Area[1] (ft^2)	Sludge Surface Area (m^2)	Estimated CZ Area[3] (m^2)	Sludge Surface Length[4] (m)	Sludge Surface Width[4] (m)	CZ Thickness[5] (m)	Average Cover Thickness[1] (m)
B	351,729	17,586	369,315	43,169	4,011	4,000	94	43	2.608	1.74
C	368,064	18,403	386,467	43,244	4,017	4,000	94	43	2.724	1.51
D	256,986	12,849	269,835	41,980	3,900	3,900	65	60	1.959	2.76
E	1,404,459	70,223	1,474,682	130,156	12,092	12,000	165	74	3.453	1.59

Notes:
[1] Andrews Engineering Calculation "Calculation of Average Cover Soil Thickness over Sludge, Closure Option 2b – Ponds B, C, D, and E" provided in Appendix A
[2] Stabilized Sludge Volume = Sludge Volume + 5% Sludge Bulking Volume
[3] CZ Area was estimated by rounding the Sludge Surface Area.
[4] Approximate sludge surface dimensions estimated with reference to sludge surface areas and the pond

Table N-3
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Radionuclide Concentrations

Radionuclide	Radionuclide Concentration (pCi/g)		
	Average Dry	Corrected for 5% Bulking Factor	Corrected for % Solids
Protactinium 231	0.15	0.14	0.07
Radium 226	0.69	0.66	0.34
Thorium 228	0.07	0.06	0.03
Thorium 230	1.66	1.58	0.83
Thorium 232	0.05	0.05	0.03
Uranium 234	237.77	225.89	118.57
Uranium 235	10.24	9.73	5.11
Uranium 236	5.84	5.55	2.91
Uranium 238	246.05	233.75	122.69

% Solids: 52.49%

Table N-4
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Hydraulic Conductivity of Silty Clay

Pressure (psf)	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (m/yr)
1040	4.00E-04	126
1930	1.90E-04	60
2385	1.80E-04	57
	2.57E-04	81

Reference: Geotechnics Laboratory report "Hydraulic Conductivity of a Large Block Sample", June 17, 2010
Large Block Sample collected 8 to 10 ft below ground which is in Clayey Silt/Silty Clay Zone

Table N-5
Honeywell Metropolis Works
Pond E Dose Assessment
Industrial Worker Scenario
Contaminated Zone Bulk Density

Pond	Sample ID	Bulk Density (g/ml)	Average Bulk Density (g/ml)
B	B-18 Lower	1.6	-
B	B-18 Upper	1.7	-
B	B-19 Upper	1.4	-
B	B-26 Lower	1.6	-
B	-	-	1.575
C	C-2	1.6	-
C	C-5	1.7	-
C	C-19 Lower	1.6	-
C	C-19 Upper	1.5	-
C	-	-	1.6
D	D-8 Lower	1.5	-
D	D-8 Upper	1.6	-
D	D-10 Lower	1.4	-
D	D-10 Upper	1.5	-
D	D-17 Lower	1.5	-
D	D-17 Upper	1.6	-
D	D-26 Lower	1.8	-
D	D-26 Upper	1.9	-
D	-	-	1.6
E	E-65 Lower	1.3	-
E	E-65 Upper	1.5	-
E	E-80 Lower	1.5	-
E	E-80 Upper	1.5	-
E	E-97 Lower	1.2	-
E	E-97 Upper	1.1	-
E	E-103 Lower	1.7	-
E	E-103 Upper	1.7	-
E	-	-	1.4375

Reference: Andrews Engineering "Calcium Fluoride Sludge Pond Sampling Report"

APPENDIX O

Pond B Deterministic Dose Assessment Report

Summary : MTW Pond B Industrial Worker - Deterministic Run
File   : C:\RESRAD_FAMILY\RESRAD\6.5\USERFILES\MTW\MTW_POND_B_IW-DET.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(41)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(42)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(4)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(5)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-236	1.250E-01	1.250E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(4)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(10)
D-1	U-236	2.690E-04	2.690E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.608E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	9.400E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Pa-231	4.000E-02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.200E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Th-228	8.000E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	2.300E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	7.000E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	6.950E+01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	4.480E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-236	1.860E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	7.159E+01	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	1.740E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.571E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.050E-04	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.575E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	3.490E-05	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.100E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.600E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.350E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.200E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.250E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.778E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.510E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.800E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	2.500E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	9.700E-01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.050E+02	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	5	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.860E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.695E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	3.600E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.890E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	9.870E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.262E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.710E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.563E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.090E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	3.500E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	2.000E-01	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.350E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	1.025E+03	1.000E+01	---	HCUZ(2)
R015	Unsat. zone 3, thickness (m)	1.710E+00	0.000E+00	---	H(3)
R015	Unsat. zone 3, soil density (g/cm**3)	1.510E+00	1.500E+00	---	DENSUZ(3)
R015	Unsat. zone 3, total porosity	4.300E-01	4.000E-01	---	TPUZ(3)
R015	Unsat. zone 3, effective porosity	3.830E-01	2.000E-01	---	EPUZ(3)
R015	Unsat. zone 3, field capacity	2.000E-01	2.000E-01	---	FCUZ(3)
R015	Unsat. zone 3, soil-specific b parameter	9.700E-01	5.300E+00	---	BUZ(3)
R015	Unsat. zone 3, hydraulic conductivity (m/yr)	2.495E+03	1.000E+01	---	HCUZ(3)
R015	Unsat. zone 4, thickness (m)	4.000E+00	0.000E+00	---	H(4)
R015	Unsat. zone 4, soil density (g/cm**3)	1.562E+00	1.500E+00	---	DENSUZ(4)
R015	Unsat. zone 4, total porosity	3.890E-01	4.000E-01	---	TPUZ(4)
R015	Unsat. zone 4, effective porosity	3.180E-01	2.000E-01	---	EPUZ(4)
R015	Unsat. zone 4, field capacity	2.000E-01	2.000E-01	---	FCUZ(4)
R015	Unsat. zone 4, soil-specific b parameter	1.350E+00	5.300E+00	---	BUZ(4)
R015	Unsat. zone 4, hydraulic conductivity (m/yr)	1.021E+03	1.000E+01	---	HCUZ(4)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 5, thickness (m)	1.140E+00	0.000E+00	---	H(5)
R015	Unsat. zone 5, soil density (g/cm**3)	1.510E+00	1.500E+00	---	DENSUZ(5)
R015	Unsat. zone 5, total porosity	4.300E-01	4.000E-01	---	TPUZ(5)
R015	Unsat. zone 5, effective porosity	3.830E-01	2.000E-01	---	EPUZ(5)
R015	Unsat. zone 5, field capacity	2.000E-01	2.000E-01	---	FCUZ(5)
R015	Unsat. zone 5, soil-specific b parameter	9.700E-01	5.300E+00	---	BUZ(5)
R015	Unsat. zone 5, hydraulic conductivity (m/yr)	2.494E+03	1.000E+01	---	HCUZ(5)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	3.743E+02	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	3.707E+02	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	3.751E+02	5.000E+01	---	DCNUCU(2,2)
R016	Unsaturated zone 3 (cm**3/g)	3.753E+02	5.000E+01	---	DCNUCU(2,3)
R016	Unsaturated zone 4 (cm**3/g)	3.782E+02	5.000E+01	---	DCNUCU(2,4)
R016	Unsaturated zone 5 (cm**3/g)	3.756E+02	5.000E+01	---	DCNUCU(2,5)
R016	Saturated zone (cm**3/g)	3.784E+02	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.853E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	3.501E+03	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	3.507E+03	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	3.506E+03	7.000E+01	---	DCNUCU(4,2)
R016	Unsaturated zone 3 (cm**3/g)	3.523E+03	7.000E+01	---	DCNUCU(4,3)
R016	Unsaturated zone 4 (cm**3/g)	3.485E+03	7.000E+01	---	DCNUCU(4,4)
R016	Unsaturated zone 5 (cm**3/g)	3.496E+03	7.000E+01	---	DCNUCU(4,5)
R016	Saturated zone (cm**3/g)	3.529E+03	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.982E-05	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	5.883E+03	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.736E+03	6.000E+04	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	5.825E+03	6.000E+04	---	DCNUCU(6,2)
R016	Unsaturated zone 3 (cm**3/g)	5.786E+03	6.000E+04	---	DCNUCU(6,3)
R016	Unsaturated zone 4 (cm**3/g)	5.775E+03	6.000E+04	---	DCNUCU(6,4)
R016	Unsaturated zone 5 (cm**3/g)	5.784E+03	6.000E+04	---	DCNUCU(6,5)
R016	Saturated zone (cm**3/g)	5.828E+03	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.179E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	5.771E+03	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.843E+03	6.000E+04	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	5.843E+03	6.000E+04	---	DCNUCU(7,2)
R016	Unsaturated zone 3 (cm**3/g)	5.882E+03	6.000E+04	---	DCNUCU(7,3)
R016	Unsaturated zone 4 (cm**3/g)	5.779E+03	6.000E+04	---	DCNUCU(7,4)
R016	Unsaturated zone 5 (cm**3/g)	5.860E+03	6.000E+04	---	DCNUCU(7,5)
R016	Saturated zone (cm**3/g)	5.849E+03	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.202E-05	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	5.771E+03	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.809E+03	6.000E+04	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	5.744E+03	6.000E+04	---	DCNUCU(8,2)
R016	Unsaturated zone 3 (cm**3/g)	5.769E+03	6.000E+04	---	DCNUCU(8,3)
R016	Unsaturated zone 4 (cm**3/g)	5.779E+03	6.000E+04	---	DCNUCU(8,4)
R016	Unsaturated zone 5 (cm**3/g)	5.823E+03	6.000E+04	---	DCNUCU(8,5)
R016	Saturated zone (cm**3/g)	5.864E+03	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.202E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.235E+02	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	1.261E+02	5.000E+01	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	1.242E+02	5.000E+01	---	DCNUCU(9,2)
R016	Unsaturated zone 3 (cm**3/g)	1.242E+02	5.000E+01	---	DCNUCU(9,3)
R016	Unsaturated zone 4 (cm**3/g)	1.247E+02	5.000E+01	---	DCNUCU(9,4)
R016	Unsaturated zone 5 (cm**3/g)	1.257E+02	5.000E+01	---	DCNUCU(9,5)
R016	Saturated zone (cm**3/g)	1.264E+02	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.609E-04	ALEACH(9)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.762E-01 not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.520E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	1.258E+02	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	1.233E+02	5.000E+01	---	DCNUCU(10,2)
R016	Unsaturated zone 3 (cm**3/g)	1.259E+02	5.000E+01	---	DCNUCU(10,3)
R016	Unsaturated zone 4 (cm**3/g)	1.249E+02	5.000E+01	---	DCNUCU(10,4)
R016	Unsaturated zone 5 (cm**3/g)	1.247E+02	5.000E+01	---	DCNUCU(10,5)
R016	Saturated zone (cm**3/g)	1.244E+02	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.508E-03	ALEACH(10)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 2.808E+00 not used	SOLUBK(10)
R016	Distribution coefficients for U-236				
R016	Contaminated zone (cm**3/g)	1.239E+02	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	1.240E+02	5.000E+01	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	1.238E+02	5.000E+01	---	DCNUCU(11,2)
R016	Unsaturated zone 3 (cm**3/g)	1.239E+02	5.000E+01	---	DCNUCU(11,3)
R016	Unsaturated zone 4 (cm**3/g)	1.240E+02	5.000E+01	---	DCNUCU(11,4)
R016	Unsaturated zone 5 (cm**3/g)	1.259E+02	5.000E+01	---	DCNUCU(11,5)
R016	Saturated zone (cm**3/g)	1.258E+02	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.591E-04	ALEACH(11)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.509E-01 not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.240E+02	5.000E+01	3.041E+02	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	1.238E+02	5.000E+01	3.041E+02	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	1.245E+02	5.000E+01	3.041E+02	DCNUCU(12,2)
R016	Unsaturated zone 3 (cm**3/g)	1.234E+02	5.000E+01	3.041E+02	DCNUCU(12,3)
R016	Unsaturated zone 4 (cm**3/g)	1.240E+02	5.000E+01	3.041E+02	DCNUCU(12,4)
R016	Unsaturated zone 5 (cm**3/g)	1.262E+02	5.000E+01	3.041E+02	DCNUCU(12,5)
R016	Saturated zone (cm**3/g)	1.243E+02	5.000E+01	3.041E+02	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.280E-04	ALEACH(12)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 3.041E+02 used	SOLUBK(12)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	8.245E+02	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	8.184E+02	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	8.284E+02	2.000E+01	---	DCNUCU(1,2)
R016	Unsaturated zone 3 (cm**3/g)	8.251E+02	2.000E+01	---	DCNUCU(1,3)
R016	Unsaturated zone 4 (cm**3/g)	8.097E+02	2.000E+01	---	DCNUCU(1,4)
R016	Unsaturated zone 5 (cm**3/g)	8.147E+02	2.000E+01	---	DCNUCU(1,5)
R016	Saturated zone (cm**3/g)	8.104E+02	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.413E-05	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	2.374E+03	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.347E+03	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	2.362E+03	1.000E+02	---	DCNUCU(3,2)
R016	Unsaturated zone 3 (cm**3/g)	2.357E+03	1.000E+02	---	DCNUCU(3,3)
R016	Unsaturated zone 4 (cm**3/g)	2.352E+03	1.000E+02	---	DCNUCU(3,4)
R016	Unsaturated zone 5 (cm**3/g)	2.380E+03	1.000E+02	---	DCNUCU(3,5)
R016	Saturated zone (cm**3/g)	2.360E+03	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.923E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	3.490E+03	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	3.507E+03	7.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	3.522E+03	7.000E+01	---	DCNUCU(5,2)
R016	Unsaturated zone 3 (cm**3/g)	3.513E+03	7.000E+01	---	DCNUCU(5,3)
R016	Unsaturated zone 4 (cm**3/g)	3.505E+03	7.000E+01	---	DCNUCU(5,4)
R016	Unsaturated zone 5 (cm**3/g)	3.484E+03	7.000E+01	---	DCNUCU(5,5)
R016	Saturated zone (cm**3/g)	3.521E+03	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.988E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.350E-05	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.470E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	2.690E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	4.417E+00	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	8.833E+00	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	1.325E+01	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	1.767E+01	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	2.208E+01	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	2.650E+01	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	3.092E+01	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	3.533E+01	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	3.975E+01	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	4.417E+01	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	4.858E+01	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	5.300E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	1.000E+00	0.000E+00	---	FRACA(4)
R017	Ring 5	9.800E-01	0.000E+00	---	FRACA(5)
R017	Ring 6	6.900E-01	0.000E+00	---	FRACA(6)
R017	Ring 7	5.400E-01	0.000E+00	---	FRACA(7)
R017	Ring 8	4.400E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	3.900E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	3.400E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	2.700E-01	0.000E+00	---	FRACA(11)
R017	Ring 12	4.600E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	2.310E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	1024	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	4000.00 square meters	Pa-231	4.000E-02
Thickness:	2.61 meters	Ra-226	4.200E-01
Cover Depth:	1.74 meters	Th-228	8.000E-02
		Th-230	2.300E+00
		Th-232	7.000E-02
		U-234	6.950E+01
		U-235	4.480E+00
		U-236	1.860E+00
		U-238	7.159E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.287E-09	1.817E-09	1.408E-09	1.674E-09	2.391E-09	2.731E-09	3.658E-09	9.925E-09
M(t):	9.149E-11	7.268E-11	5.633E-11	6.697E-11	9.565E-11	1.092E-10	1.463E-10	3.970E-10

Maximum TDOSE(t): 9.925E-09 mrem/yr at t = 1.000E+03 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	9.451E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.965E-10	0.2171	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.759E-09	0.7689	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	5.892E-13	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.219E-11	0.0053	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.342E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.326E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	4.125E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.920E-11	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.287E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.451E-17	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.965E-10	0.2171
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.759E-09	0.7689
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.892E-13	0.0003
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.219E-11	0.0053
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.342E-17	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.326E-17	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.125E-21	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-11	0.0084
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.287E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.550E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.969E-10	0.2735	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.225E-09	0.6744	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.769E-12	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.378E-11	0.0406	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.742E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.365E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	5.514E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.922E-11	0.0106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.817E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.550E-16	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.969E-10	0.2735
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.225E-09	0.6744
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-12	0.0010
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.378E-11	0.0406
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.742E-16	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.365E-17	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.514E-20	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.922E-11	0.0106
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.817E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	5.624E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.977E-10	0.3535	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	5.949E-10	0.4225	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.136E-12	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.921E-10	0.2075	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.981E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.553E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	5.175E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.927E-11	0.0137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.408E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.624E-16	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.977E-10	0.3535
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.949E-10	0.4225
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.136E-12	0.0029
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.921E-10	0.2075
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.981E-15	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.553E-17	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.175E-19	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.927E-11	0.0137
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.408E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.510E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.005E-10	0.2989	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	4.744E-11	0.0283	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.249E-11	0.0075	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.094E-09	0.6537	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.784E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.257E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	7.120E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.944E-11	0.0116	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.674E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.510E-15	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.005E-10	0.2989
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.744E-11	0.0283
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.249E-11	0.0075
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.094E-09	0.6537
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.784E-14	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.257E-17	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.120E-18	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.944E-11	0.0116
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.674E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	3.381E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.084E-10	0.2126	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	3.451E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.703E-11	0.0155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.826E-09	0.7635	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.531E-13	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.479E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	4.887E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.993E-11	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.391E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.381E-15	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.084E-10	0.2126
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.451E-14	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.703E-11	0.0155
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.826E-09	0.7635
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.531E-13	0.0001
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.479E-16	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.887E-17	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.993E-11	0.0083
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.391E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	5.754E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.371E-10	0.1967	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	3.586E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.309E-10	0.0479	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.039E-09	0.7468	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.769E-12	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.564E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.333E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.175E-11	0.0080	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.731E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.754E-15	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.371E-10	0.1967
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.586E-25	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.309E-10	0.0479
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.039E-09	0.7468
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.769E-12	0.0006
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.564E-16	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.333E-16	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.175E-11	0.0080
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.731E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	7.917E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	6.282E-10	0.1717	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.782E-10	0.1307	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.505E-09	0.6847	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.892E-11	0.0052	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.984E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	8.790E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.793E-11	0.0076	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.658E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.917E-15	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.282E-10	0.1717
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.782E-10	0.1307
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.505E-09	0.6847
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.892E-11	0.0052
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.984E-15	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.790E-16	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.793E-11	0.0076
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.658E-09	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.090E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.088E-09	0.1096	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.230E-09	0.3254	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	5.146E-09	0.5185	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.938E-10	0.0397	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.134E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	5.154E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	6.734E-11	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.925E-09	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.090E-14	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.088E-09	0.1096
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.230E-09	0.3254
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.146E-09	0.5185
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.938E-10	0.0397
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.134E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.154E-15	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.734E-11	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.925E-09	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	3.178E-16	3.183E-16	3.194E-16	3.232E-16	3.345E-16	3.769E-16	5.303E-16	1.752E-15
Pa-231	Ac-227+D	1.000E+00	2.045E-15	6.057E-15	1.374E-14	3.742E-14	8.419E-14	1.435E-13	1.974E-13	5.208E-13
Pa-231	∑DSR(j)		2.363E-15	6.375E-15	1.406E-14	3.774E-14	8.453E-14	1.438E-13	1.979E-13	5.225E-13
Ra-226+D	Ra-226+D	1.000E+00	1.182E-09	1.183E-09	1.185E-09	1.192E-09	1.210E-09	1.279E-09	1.496E-09	2.590E-09
Ra-226+D	Pb-210+D	1.000E+00	1.633E-18	4.838E-18	1.098E-17	2.992E-17	6.742E-17	1.138E-16	1.466E-16	3.020E-16
Ra-226+D	∑DSR(j)		1.182E-09	1.183E-09	1.185E-09	1.192E-09	1.210E-09	1.279E-09	1.496E-09	2.590E-09
Th-228+D	Th-228+D	1.000E+00	2.198E-08	1.532E-08	7.436E-09	5.930E-10	4.314E-13	4.482E-24	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	6.972E-27	6.994E-27	7.037E-27	7.189E-27	7.644E-27	9.472E-27	1.748E-26	1.492E-25
Th-230	Ra-226+D	1.000E+00	2.562E-13	7.692E-13	1.798E-12	5.433E-12	1.610E-11	5.690E-11	2.079E-10	1.404E-09
Th-230	Pb-210+D	1.000E+00	2.365E-22	1.643E-21	8.533E-21	7.186E-20	5.163E-19	3.649E-18	1.806E-17	1.573E-16
Th-230	∑DSR(j)		2.562E-13	7.692E-13	1.798E-12	5.433E-12	1.610E-11	5.690E-11	2.079E-10	1.404E-09
Th-232	Th-232	1.000E+00	9.123E-30	9.154E-30	9.217E-30	9.441E-30	1.011E-29	1.284E-29	2.545E-29	2.786E-28
Th-232	Ra-228+D	1.000E+00	4.673E-12	1.332E-11	2.785E-11	5.869E-11	8.188E-11	9.238E-11	1.212E-10	3.133E-10
Th-232	Th-228+D	1.000E+00	1.695E-10	1.041E-09	4.145E-09	1.557E-08	2.600E-08	2.904E-08	3.566E-08	7.320E-08
Th-232	∑DSR(j)		1.742E-10	1.054E-09	4.173E-09	1.563E-08	2.608E-08	2.913E-08	3.578E-08	7.352E-08
U-234	U-234	1.000E+00	2.863E-28	2.871E-28	2.886E-28	2.940E-28	3.099E-28	3.727E-28	6.315E-28	3.998E-27
U-234	Th-230	1.000E+00	3.139E-32	9.441E-32	2.215E-31	6.776E-31	2.081E-30	8.340E-30	4.363E-29	1.037E-27
U-234	Ra-226+D	1.000E+00	7.686E-19	5.385E-18	2.851E-17	2.566E-16	2.203E-15	2.546E-14	2.722E-13	5.666E-12
U-234	Pb-210+D	1.000E+00	5.330E-28	7.950E-27	9.161E-26	2.325E-24	5.059E-23	1.309E-21	2.146E-20	6.168E-19
U-234	∑DSR(j)		7.686E-19	5.385E-18	2.851E-17	2.566E-16	2.203E-15	2.546E-14	2.722E-13	5.666E-12
U-235+D	U-235+D	1.000E+00	2.943E-18	2.936E-18	2.923E-18	2.878E-18	2.752E-18	2.354E-18	1.507E-18	3.160E-19
U-235+D	Pa-231	1.000E+00	3.358E-21	1.007E-20	2.348E-20	7.021E-20	2.023E-19	6.507E-19	1.892E-18	8.500E-18
U-235+D	Ac-227+D	1.000E+00	1.445E-20	1.002E-19	5.190E-19	4.322E-18	3.005E-17	1.882E-16	6.626E-16	2.522E-15
U-235+D	∑DSR(j)		2.961E-18	3.047E-18	3.466E-18	7.270E-18	3.301E-17	1.912E-16	6.660E-16	2.530E-15
U-236	U-236	1.000E+00	4.208E-29	4.219E-29	4.242E-29	4.324E-29	4.564E-29	5.516E-29	9.479E-29	6.305E-28
U-236	Th-232	1.000E+00	2.251E-40	6.773E-40	1.590E-39	4.876E-39	1.508E-38	6.195E-38	3.478E-37	1.059E-35
U-236	Ra-228+D	1.000E+00	7.761E-23	5.259E-22	2.587E-21	1.830E-20	9.227E-20	4.097E-19	1.614E-18	1.184E-17
U-236	Th-228+D	1.000E+00	2.140E-21	2.912E-20	2.757E-19	3.810E-18	2.618E-17	1.250E-16	4.709E-16	2.759E-15
U-236	∑DSR(j)		2.218E-21	2.965E-20	2.782E-19	3.828E-18	2.627E-17	1.254E-16	4.726E-16	2.771E-15
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238+D	U-238+D	9.999E-01	2.681E-13	2.685E-13	2.692E-13	2.715E-13	2.784E-13	3.038E-13	3.900E-13	9.351E-13
U-238+D	U-234	9.999E-01	4.061E-34	1.221E-33	2.865E-33	8.766E-33	2.693E-32	1.080E-31	5.660E-31	1.348E-29
U-238+D	Th-230	9.999E-01	2.967E-38	2.082E-37	1.107E-36	1.009E-35	9.005E-35	1.190E-33	1.869E-32	1.494E-30
U-238+D	Ra-226+D	9.999E-01	5.448E-25	8.178E-24	9.558E-23	2.551E-21	6.356E-20	2.425E-18	7.795E-17	5.503E-15
U-238+D	Pb-210+D	9.999E-01	3.026E-34	9.338E-33	2.331E-31	1.762E-29	1.142E-27	1.045E-25	5.617E-24	5.805E-22
U-238+D	∑DSR(j)		2.681E-13	2.685E-13	2.692E-13	2.715E-13	2.784E-13	3.038E-13	3.901E-13	9.406E-13

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10
Ra-226	2.115E+10	2.113E+10	2.110E+10	2.098E+10	2.065E+10	1.955E+10	1.671E+10	9.653E+09
Th-228	1.137E+09	1.632E+09	3.362E+09	4.216E+10	5.795E+13	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	1.780E+10
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-236	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pa-231	4.000E-02	1.000E+03	5.225E-13	*4.723E+10	5.225E-13	*4.723E+10
Ra-226	4.200E-01	1.000E+03	2.590E-09	9.653E+09	2.590E-09	9.653E+09
Th-228	8.000E-02	0.000E+00	2.198E-08	1.137E+09	0.000E+00	*8.195E+14
Th-230	2.300E+00	1.000E+03	1.404E-09	1.780E+10	1.404E-09	1.780E+10
Th-232	7.000E-02	1.000E+03	7.352E-08	*1.097E+05	7.352E-08	*1.097E+05
U-234	6.950E+01	1.000E+03	5.666E-12	*6.247E+09	5.666E-12	*6.247E+09
U-235	4.480E+00	1.000E+03	2.530E-15	*2.161E+06	2.530E-15	*2.161E+06
U-236	1.860E+00	1.000E+03	2.771E-15	*6.468E+07	2.771E-15	*6.468E+07
U-238	7.159E+01	1.000E+03	9.406E-13	*3.361E+05	9.406E-13	*3.361E+05

*At specific activity limit

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	1.271E-17	1.273E-17	1.278E-17	1.293E-17	1.338E-17	1.508E-17	2.121E-17	7.007E-17
Pa-231	U-235	1.000E+00	1.504E-20	4.511E-20	1.052E-19	3.146E-19	9.062E-19	2.915E-18	8.478E-18	3.808E-17
Pa-231	∑DOSE(j)		1.273E-17	1.278E-17	1.288E-17	1.324E-17	1.428E-17	1.799E-17	2.969E-17	1.082E-16
Ac-227	Pa-231	1.000E+00	8.180E-17	2.423E-16	5.497E-16	1.497E-15	3.368E-15	5.739E-15	7.896E-15	2.083E-14
Ac-227	U-235	1.000E+00	6.472E-20	4.490E-19	2.325E-18	1.936E-17	1.346E-16	8.430E-16	2.968E-15	1.130E-14
Ac-227	∑DOSE(j)		8.186E-17	2.427E-16	5.520E-16	1.516E-15	3.502E-15	6.582E-15	1.086E-14	3.213E-14
Ra-226	Ra-226	1.000E+00	4.965E-10	4.969E-10	4.977E-10	5.005E-10	5.084E-10	5.371E-10	6.282E-10	1.088E-09
Ra-226	Th-230	1.000E+00	5.892E-13	1.769E-12	4.136E-12	1.249E-11	3.703E-11	1.309E-10	4.782E-10	3.230E-09
Ra-226	U-234	1.000E+00	5.342E-17	3.742E-16	1.981E-15	1.784E-14	1.531E-13	1.769E-12	1.892E-11	3.938E-10
Ra-226	U-238	9.999E-01	3.900E-23	5.855E-22	6.842E-21	1.826E-19	4.550E-18	1.736E-16	5.580E-15	3.939E-13
Ra-226	∑DOSE(j)		4.971E-10	4.987E-10	5.019E-10	5.130E-10	5.456E-10	6.697E-10	1.125E-09	4.711E-09
Pb-210	Ra-226	1.000E+00	6.859E-19	2.032E-18	4.611E-18	1.257E-17	2.831E-17	4.781E-17	6.159E-17	1.269E-16
Pb-210	Th-230	1.000E+00	5.439E-22	3.778E-21	1.963E-20	1.653E-19	1.187E-18	8.392E-18	4.154E-17	3.617E-16
Pb-210	U-234	1.000E+00	3.704E-26	5.526E-25	6.367E-24	1.616E-22	3.516E-21	9.094E-20	1.491E-18	4.287E-17
Pb-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	1.261E-27	8.175E-26	7.479E-24	4.021E-22	4.155E-20
Pb-210	∑DOSE(j)		6.864E-19	2.036E-18	4.631E-18	1.273E-17	2.951E-17	5.629E-17	1.046E-16	5.315E-16
Th-228	Th-228	1.000E+00	1.759E-09	1.225E-09	5.949E-10	4.744E-11	3.451E-14	3.586E-25	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	1.186E-11	7.285E-11	2.902E-10	1.090E-09	1.820E-09	2.033E-09	2.496E-09	5.124E-09
Th-228	U-236	1.000E+00	3.980E-21	5.416E-20	5.127E-19	7.086E-18	4.870E-17	2.326E-16	8.760E-16	5.132E-15
Th-228	∑DOSE(j)		1.770E-09	1.298E-09	8.851E-10	1.138E-09	1.820E-09	2.033E-09	2.496E-09	5.124E-09
Th-230	Th-230	1.000E+00	1.604E-26	1.609E-26	1.618E-26	1.654E-26	1.758E-26	2.179E-26	4.020E-26	3.433E-25
Th-230	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.447E-28	5.796E-28	3.032E-27	7.209E-26
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.069E-28
Th-230	∑DOSE(j)		1.604E-26	1.609E-26	1.618E-26	1.654E-26	1.772E-26	2.236E-26	4.324E-26	4.155E-25
Th-232	Th-232	1.000E+00	6.386E-31	6.408E-31	6.452E-31	6.608E-31	7.076E-31	8.989E-31	1.781E-30	1.950E-29
Th-232	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	∑DOSE(j)		6.386E-31	6.408E-31	6.452E-31	6.608E-31	7.076E-31	8.989E-31	1.781E-30	1.950E-29
Ra-228	Th-232	1.000E+00	3.271E-13	9.324E-13	1.949E-12	4.108E-12	5.731E-12	6.466E-12	8.483E-12	2.193E-11
Ra-228	U-236	1.000E+00	1.444E-22	9.781E-22	4.812E-21	3.403E-20	1.716E-19	7.621E-19	3.003E-18	2.201E-17
Ra-228	∑DOSE(j)		3.271E-13	9.324E-13	1.949E-12	4.108E-12	5.731E-12	6.466E-12	8.483E-12	2.193E-11
U-234	U-234	1.000E+00	1.990E-26	1.995E-26	2.006E-26	2.043E-26	2.154E-26	2.590E-26	4.389E-26	2.779E-25
U-234	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.648E-28
U-234	∑DOSE(j)		1.990E-26	1.995E-26	2.006E-26	2.043E-26	2.154E-26	2.590E-26	4.389E-26	2.788E-25
U-235	U-235	1.000E+00	1.318E-17	1.315E-17	1.310E-17	1.289E-17	1.233E-17	1.055E-17	6.750E-18	1.416E-18
U-236	U-236	1.000E+00	7.827E-29	7.848E-29	7.891E-29	8.042E-29	8.489E-29	1.026E-28	1.763E-28	1.173E-27
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	1.920E-11	1.922E-11	1.927E-11	1.944E-11	1.993E-11	2.175E-11	2.792E-11	6.694E-11
U-238	∑DOSE(j)		1.920E-11	1.922E-11	1.927E-11	1.944E-11	1.993E-11	2.175E-11	2.792E-11	6.694E-11

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	4.000E-02	3.999E-02	3.998E-02	3.992E-02	3.975E-02	3.918E-02	3.760E-02	3.254E-02
Pa-231	U-235	1.000E+00	0.000E+00	9.457E-05	2.824E-04	9.259E-04	2.651E-03	7.546E-03	1.501E-02	1.768E-02
Pa-231	∑S(j):		4.000E-02	4.009E-02	4.026E-02	4.084E-02	4.240E-02	4.673E-02	5.261E-02	5.022E-02
Ac-227	Pa-231	1.000E+00	0.000E+00	1.253E-03	3.642E-03	1.089E-02	2.449E-02	3.768E-02	3.774E-02	3.266E-02
Ac-227	U-235	1.000E+00	0.000E+00	1.491E-06	1.309E-05	1.339E-04	9.617E-04	5.506E-03	1.417E-02	1.771E-02
Ac-227	∑S(j):		0.000E+00	1.255E-03	3.655E-03	1.102E-02	2.546E-02	4.319E-02	5.191E-02	5.038E-02
Ra-226	Ra-226	1.000E+00	4.200E-01	4.198E-01	4.194E-01	4.181E-01	4.143E-01	4.014E-01	3.666E-01	2.670E-01
Ra-226	Th-230	1.000E+00	0.000E+00	9.962E-04	2.987E-03	9.940E-03	2.968E-02	9.731E-02	2.786E-01	7.923E-01
Ra-226	U-234	1.000E+00	0.000E+00	1.355E-07	1.218E-06	1.350E-05	1.207E-04	1.309E-03	1.100E-02	9.656E-02
Ra-226	U-238	9.999E-01	0.000E+00	1.319E-13	3.558E-12	1.315E-10	3.528E-09	1.278E-07	3.240E-06	9.655E-05
Ra-226	∑S(j):		4.200E-01	4.208E-01	4.224E-01	4.281E-01	4.441E-01	5.000E-01	6.562E-01	1.156E+00
Pb-210	Ra-226	1.000E+00	0.000E+00	1.285E-02	3.737E-02	1.119E-01	2.526E-01	3.880E-01	3.717E-01	2.707E-01
Pb-210	Th-230	1.000E+00	0.000E+00	1.532E-05	1.351E-04	1.397E-03	1.040E-02	6.768E-02	2.502E-01	7.714E-01
Pb-210	U-234	1.000E+00	0.000E+00	1.393E-09	3.701E-08	1.298E-06	3.024E-05	7.294E-04	8.966E-03	9.138E-02
Pb-210	U-238	9.999E-01	0.000E+00	1.018E-15	8.144E-14	9.619E-12	6.911E-10	5.966E-08	2.413E-06	8.853E-05
Pb-210	∑S(j):		0.000E+00	1.287E-02	3.750E-02	1.133E-01	2.630E-01	4.564E-01	6.308E-01	1.134E+00
Th-228	Th-228	1.000E+00	8.000E-02	5.568E-02	2.698E-02	2.136E-03	1.522E-06	1.470E-17	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.305E-03	8.702E-03	3.950E-02	6.715E-02	6.991E-02	6.974E-02	6.916E-02
Th-228	U-236	1.000E+00	0.000E+00	5.932E-13	1.279E-11	2.411E-10	1.758E-09	7.954E-09	2.443E-08	6.924E-08
Th-228	∑S(j):		8.000E-02	5.699E-02	3.568E-02	4.164E-02	6.715E-02	6.991E-02	6.974E-02	6.916E-02
Th-230	Th-230	1.000E+00	2.300E+00	2.300E+00	2.300E+00	2.300E+00	2.299E+00	2.295E+00	2.286E+00	2.252E+00
Th-230	U-234	1.000E+00	0.000E+00	6.254E-04	1.875E-03	6.238E-03	1.861E-02	6.077E-02	1.721E-01	4.728E-01
Th-230	U-238	9.999E-01	0.000E+00	9.132E-10	8.214E-09	9.110E-08	8.154E-07	8.891E-06	7.583E-05	7.010E-04
Th-230	∑S(j):		2.300E+00	2.301E+00	2.302E+00	2.306E+00	2.317E+00	2.356E+00	2.458E+00	2.726E+00
Th-232	Th-232	1.000E+00	7.000E-02	7.000E-02	7.000E-02	6.999E-02	6.997E-02	6.992E-02	6.975E-02	6.916E-02
Th-232	U-236	1.000E+00	0.000E+00	9.174E-11	2.750E-10	9.150E-10	2.729E-09	8.919E-09	2.530E-08	6.983E-08
Th-232	∑S(j):		7.000E-02	7.000E-02	7.000E-02	6.999E-02	6.997E-02	6.992E-02	6.975E-02	6.916E-02
Ra-228	Th-232	1.000E+00	0.000E+00	7.949E-03	2.124E-02	4.902E-02	6.809E-02	6.991E-02	6.974E-02	6.916E-02
Ra-228	U-236	1.000E+00	0.000E+00	5.314E-12	4.426E-11	3.836E-10	1.998E-09	8.195E-09	2.465E-08	6.939E-08
Ra-228	∑S(j):		0.000E+00	7.949E-03	2.124E-02	4.902E-02	6.809E-02	6.991E-02	6.974E-02	6.916E-02
U-234	U-234	1.000E+00	6.950E+01	6.946E+01	6.938E+01	6.911E+01	6.833E+01	6.569E+01	5.869E+01	3.955E+01
U-234	U-238	9.999E-01	0.000E+00	2.029E-04	6.081E-04	2.021E-03	6.016E-03	1.951E-02	5.409E-02	1.372E-01
U-234	∑S(j):		6.950E+01	6.946E+01	6.938E+01	6.911E+01	6.834E+01	6.571E+01	5.874E+01	3.969E+01
U-235	U-235	1.000E+00	4.480E+00	4.460E+00	4.420E+00	4.283E+00	3.913E+00	2.854E+00	1.159E+00	4.939E-02
U-236	U-236	1.000E+00	1.860E+00	1.859E+00	1.857E+00	1.850E+00	1.829E+00	1.759E+00	1.573E+00	1.063E+00
U-238	U-238	5.400E-05	3.866E-03	3.865E-03	3.863E-03	3.857E-03	3.840E-03	3.779E-03	3.610E-03	3.078E-03
U-238	U-238	9.999E-01	7.159E+01	7.157E+01	7.154E+01	7.142E+01	7.110E+01	6.997E+01	6.685E+01	5.699E+01
U-238	∑S(j):		7.159E+01	7.157E+01	7.154E+01	7.143E+01	7.110E+01	6.998E+01	6.686E+01	5.700E+01

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 73.54 seconds

APPENDIX P

Pond C Deterministic Dose Assessment Report

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(41)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(42)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(4)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(5)

Dose Conversion Factor (and Related) Parameter Summary (continued)

Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-236	1.250E-01	1.250E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(4)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(10)
D-1	U-236	2.690E-04	2.690E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.724E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	9.400E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.300E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	3.100E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Th-228	5.000E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.560E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.368E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	7.310E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-236	3.270E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	1.416E+02	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	1.510E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.600E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.250E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.778E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.050E+02	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	5	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.860E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.262E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.710E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.000E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	2.000E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	2.000E-01	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(2)
R015	Unsat. zone 3, thickness (m)	1.710E+00	0.000E+00	---	H(3)
R015	Unsat. zone 3, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(3)
R015	Unsat. zone 3, total porosity	4.000E-01	4.000E-01	---	TPUZ(3)
R015	Unsat. zone 3, effective porosity	2.000E-01	2.000E-01	---	EPUZ(3)
R015	Unsat. zone 3, field capacity	2.000E-01	2.000E-01	---	FCUZ(3)
R015	Unsat. zone 3, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(3)
R015	Unsat. zone 3, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(3)
R015	Unsat. zone 4, thickness (m)	4.000E+00	0.000E+00	---	H(4)
R015	Unsat. zone 4, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(4)
R015	Unsat. zone 4, total porosity	4.000E-01	4.000E-01	---	TPUZ(4)
R015	Unsat. zone 4, effective porosity	2.000E-01	2.000E-01	---	EPUZ(4)
R015	Unsat. zone 4, field capacity	2.000E-01	2.000E-01	---	FCUZ(4)
R015	Unsat. zone 4, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(4)
R015	Unsat. zone 4, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(4)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 5, thickness (m)	1.140E+00	0.000E+00	---	H(5)
R015	Unsat. zone 5, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(5)
R015	Unsat. zone 5, total porosity	4.000E-01	4.000E-01	---	TPUZ(5)
R015	Unsat. zone 5, effective porosity	2.000E-01	2.000E-01	---	EPUZ(5)
R015	Unsat. zone 5, field capacity	2.000E-01	2.000E-01	---	FCUZ(5)
R015	Unsat. zone 5, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(5)
R015	Unsat. zone 5, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(5)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.713E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.225E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.434E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.434E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.434E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.713E-03	ALEACH(9)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.929E-01 not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.713E-03	ALEACH(10)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 4.670E+00 not used	SOLUBK(10)
R016	Distribution coefficients for U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.713E-03	ALEACH(11)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.519E-01 not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCU(12,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCU(12,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCU(12,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCU(12,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	6.017E+02	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.430E-04	ALEACH(12)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 6.017E+02 used	SOLUBK(12)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,2)
R016	Unsaturated zone 3 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,3)
R016	Unsaturated zone 4 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,4)
R016	Unsaturated zone 5 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,5)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.254E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,2)
R016	Unsaturated zone 3 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,3)
R016	Unsaturated zone 4 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,4)
R016	Unsaturated zone 5 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,5)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.585E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.225E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	4.417E+00	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	8.833E+00	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	1.325E+01	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	1.767E+01	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	2.208E+01	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	2.650E+01	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	3.092E+01	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	3.533E+01	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	3.975E+01	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	4.417E+01	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	4.858E+01	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	5.300E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	1.000E+00	0.000E+00	---	FRACA(4)
R017	Ring 5	9.800E-01	0.000E+00	---	FRACA(5)
R017	Ring 6	6.900E-01	0.000E+00	---	FRACA(6)
R017	Ring 7	5.400E-01	0.000E+00	---	FRACA(7)
R017	Ring 8	4.400E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	3.900E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	3.400E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	2.700E-01	0.000E+00	---	FRACA(11)
R017	Ring 12	4.600E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	1024	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	
Area:	4000.00 square meters
Thickness:	2.72 meters
Cover Depth:	1.51 meters

Initial Soil Concentrations, pCi/g	
Pa-231	1.300E-01
Ra-226	3.100E-01
Th-228	5.000E-02
Th-230	1.560E+00
Th-232	5.000E-02
U-234	1.368E+02
U-235	7.310E+00
U-236	3.270E+00
U-238	1.416E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	6.133E-08	5.246E-08	4.563E-08	5.727E-08	9.074E-08	1.942E-07	1.689E-06	5.798E-03
M(t):	2.453E-09	2.099E-09	1.825E-09	2.291E-09	3.629E-09	7.770E-09	6.754E-08	2.319E-04

Maximum TDOSE(t): 5.798E-03 mrem/yr at t = 1.000E+03 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	5.812E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.093E-08	0.3413	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	3.578E-08	0.5834	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.286E-11	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.958E-10	0.0048	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.022E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.369E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.495E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.300E-09	0.0701	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.133E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.812E-14	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.093E-08	0.3413
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.578E-08	0.5834
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.286E-11	0.0004
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.958E-10	0.0048
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.022E-15	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.369E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.495E-19	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.300E-09	0.0701
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.133E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.418E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.113E-08	0.4028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	2.514E-08	0.4792	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	6.923E-11	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.765E-09	0.0336	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	4.252E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.426E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	3.272E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.357E-09	0.0831	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.246E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.418E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.113E-08	0.4028
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.514E-08	0.4792
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.923E-11	0.0013
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.765E-09	0.0336
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.252E-14	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.272E-18	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.357E-09	0.0831
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.246E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	3.072E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.154E-08	0.4721	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.241E-08	0.2720	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.649E-10	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.032E-09	0.1541	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.292E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.574E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	3.077E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.475E-09	0.0981	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.563E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.072E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.154E-08	0.4721
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.241E-08	0.2720
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.649E-10	0.0036
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.032E-09	0.1541
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.292E-13	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.574E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.077E-17	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.475E-09	0.0981
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.563E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	8.676E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.304E-08	0.4022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.050E-09	0.0183	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	5.320E-10	0.0093	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.774E-08	0.4843	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.200E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.447E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	4.439E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.912E-09	0.0858	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.727E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.676E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.304E-08	0.4022
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.050E-09	0.0183
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.320E-10	0.0093
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.774E-08	0.4843
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.200E-12	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.447E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.439E-16	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.912E-09	0.0858
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.727E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.377E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.791E-08	0.3076	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	9.040E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.903E-09	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	5.449E-08	0.6005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.271E-11	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	9.276E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	3.553E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	6.409E-09	0.0706	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.074E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.377E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.791E-08	0.3076
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.040E-13	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.903E-09	0.0210
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.449E-08	0.6005
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.271E-11	0.0003
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.276E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.553E-15	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.409E-09	0.0706
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.074E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	8.685E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.462E-08	0.2812	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.694E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.302E-08	0.0670	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.098E-07	0.5654	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.012E-10	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	9.327E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.940E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.626E-08	0.0837	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.942E-07	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.685E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.462E-08	0.2812
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.694E-23	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.302E-08	0.0670
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.098E-07	0.5654
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.012E-10	0.0026
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.327E-13	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.940E-14	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.626E-08	0.0837
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.942E-07	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.189E-10	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.720E-07	0.2203	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.154E-07	0.1868	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.339E-07	0.4346	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.415E-08	0.0202	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	4.562E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	5.406E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.331E-07	0.1380	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.689E-06	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.189E-10	0.0001
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.720E-07	0.2203
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.154E-07	0.1868
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.339E-07	0.4346
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.415E-08	0.0202
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.562E-11	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.406E-13	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.331E-07	0.1380
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.689E-06	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.507E-06	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.092E-04	0.0533	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.718E-03	0.2963	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	6.339E-04	0.1093	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	4.920E-04	0.0849	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.934E-06	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	9.789E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.637E-03	0.4548	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.798E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.505E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.658E-06	0.0003
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.092E-04	0.0533
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.718E-03	0.2963
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.339E-04	0.1093
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.920E-04	0.0849
U-235	9.083E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.025E-06	0.0010
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.789E-10	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.637E-03	0.4548
Total	2.413E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.798E-03	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	1.242E-13	1.262E-13	1.302E-13	1.453E-13	1.988E-13	5.951E-13	1.365E-11	7.902E-07
Pa-231	Ac-227+D	1.000E+00	3.228E-13	9.648E-13	2.233E-12	6.529E-12	1.809E-11	6.621E-11	9.013E-10	1.196E-05
Pa-231	∑DSR(j)		4.470E-13	1.091E-12	2.363E-12	6.674E-12	1.829E-11	6.681E-11	9.149E-10	1.275E-05
Ra-226+D	Ra-226+D	1.000E+00	6.752E-08	6.817E-08	6.949E-08	7.432E-08	9.003E-08	1.762E-07	1.200E-06	9.973E-04
Ra-226+D	Pb-210+D	1.000E+00	1.895E-16	5.669E-16	1.315E-15	3.870E-15	1.086E-14	3.940E-14	4.502E-13	5.960E-09
Ra-226+D	∑DSR(j)		6.752E-08	6.817E-08	6.949E-08	7.432E-08	9.003E-08	1.762E-07	1.200E-06	9.973E-04
Th-228+D	Th-228+D	1.000E+00	7.155E-07	5.028E-07	2.483E-07	2.100E-08	1.808E-11	3.388E-22	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	7.632E-23	7.849E-23	8.302E-23	1.010E-22	1.770E-22	1.260E-21	3.434E-19	1.148E-10
Th-230	Ra-226+D	1.000E+00	1.466E-11	4.438E-11	1.057E-10	3.410E-10	1.220E-09	8.343E-09	2.022E-07	1.101E-03
Th-230	Pb-210+D	1.000E+00	2.747E-20	1.927E-19	1.023E-18	9.329E-18	8.416E-17	1.323E-15	6.583E-14	6.161E-09
Th-230	∑DSR(j)		1.466E-11	4.438E-11	1.057E-10	3.410E-10	1.220E-09	8.343E-09	2.022E-07	1.101E-03
Th-232	Th-232	1.000E+00	2.675E-25	2.760E-25	2.937E-25	3.654E-25	6.820E-25	6.057E-24	3.106E-21	9.477E-12
Th-232	Ra-228+D	1.000E+00	3.892E-10	1.120E-09	2.390E-09	5.426E-09	9.413E-09	2.306E-08	2.781E-07	1.693E-03
Th-232	Th-228+D	1.000E+00	5.528E-09	3.418E-08	1.383E-07	5.494E-07	1.080E-06	2.174E-06	1.440E-05	1.098E-02
Th-232	∑DSR(j)		5.917E-09	3.530E-08	1.406E-07	5.548E-07	1.090E-06	2.197E-06	1.468E-05	1.268E-02
U-234	U-234	1.000E+00	4.350E-24	4.471E-24	4.723E-24	5.721E-24	9.892E-24	6.727E-23	1.608E-20	3.398E-12
U-234	Th-230	1.000E+00	3.449E-28	1.060E-27	2.609E-27	9.465E-27	4.736E-26	1.048E-24	7.269E-22	4.961E-13
U-234	Ra-226+D	1.000E+00	4.401E-17	3.107E-16	1.675E-15	1.608E-14	1.660E-13	3.663E-12	2.496E-10	3.596E-06
U-234	Pb-210+D	1.000E+00	6.195E-26	9.331E-25	1.099E-23	3.015E-22	8.214E-21	4.676E-19	7.422E-17	1.970E-11
U-234	∑DSR(j)		4.401E-17	3.107E-16	1.675E-15	1.608E-14	1.660E-13	3.663E-12	2.496E-10	3.596E-06
U-235+D	U-235+D	1.000E+00	3.237E-15	3.299E-15	3.427E-15	3.914E-15	5.721E-15	2.161E-14	9.636E-13	5.705E-07
U-235+D	Pa-231	1.000E+00	1.318E-18	4.008E-18	9.646E-18	3.229E-17	1.283E-16	1.267E-15	8.709E-14	1.691E-08
U-235+D	Ac-227+D	1.000E+00	2.286E-18	1.602E-17	8.493E-17	7.694E-16	6.840E-15	1.047E-13	5.191E-12	2.368E-07
U-235+D	∑DSR(j)		3.240E-15	3.319E-15	3.521E-15	4.715E-15	1.269E-14	1.276E-13	6.241E-12	8.242E-07
U-236	U-236	1.000E+00	7.713E-25	7.932E-25	8.389E-25	1.020E-24	1.786E-24	1.267E-23	3.417E-21	1.101E-12
U-236	Th-232	1.000E+00	6.629E-36	2.043E-35	5.061E-35	1.877E-34	1.000E-33	2.759E-32	3.599E-29	2.239E-19
U-236	Ra-228+D	1.000E+00	6.469E-21	4.422E-20	2.220E-19	1.687E-18	1.048E-17	9.707E-17	3.154E-15	3.986E-11
U-236	Th-228+D	1.000E+00	6.982E-20	9.563E-19	9.189E-18	1.341E-16	1.076E-15	8.895E-15	1.622E-13	2.584E-10
U-236	∑DSR(j)		7.629E-20	1.001E-18	9.411E-18	1.357E-16	1.087E-15	8.992E-15	1.653E-13	2.994E-10
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.045E-44	1.833E-24
U-238+D	U-238+D	9.999E-01	3.037E-11	3.078E-11	3.161E-11	3.469E-11	4.526E-11	1.149E-10	1.646E-09	1.862E-05
U-238+D	U-234	9.999E-01	6.198E-30	1.906E-29	4.702E-29	1.717E-28	8.762E-28	2.076E-26	1.751E-23	2.342E-14
U-238+D	Th-230	9.999E-01	3.267E-34	2.341E-33	1.305E-32	1.414E-31	2.063E-30	1.528E-28	3.314E-25	8.516E-16
U-238+D	Ra-226+D	9.999E-01	3.121E-23	4.723E-22	5.621E-21	1.602E-19	4.821E-18	3.565E-16	7.621E-14	4.269E-09
U-238+D	Pb-210+D	9.999E-01	3.519E-32	1.097E-30	2.797E-29	2.289E-27	1.865E-25	3.805E-23	2.062E-20	2.254E-14
U-238+D	∑DSR(j)		3.037E-11	3.078E-11	3.161E-11	3.469E-11	4.526E-11	1.149E-10	1.646E-09	1.863E-05

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	2.732E+10	1.961E+06
Ra-226	3.703E+08	3.667E+08	3.598E+08	3.364E+08	2.777E+08	1.419E+08	2.083E+07	2.507E+04
Th-228	3.494E+07	4.972E+07	1.007E+08	1.191E+09	1.383E+12	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	2.996E+09	1.237E+08	2.270E+04
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	1.972E+03
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	6.953E+06
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-236	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pa-231	1.300E-01	1.000E+03	1.275E-05	1.961E+06	1.275E-05	1.961E+06
Ra-226	3.100E-01	1.000E+03	9.973E-04	2.507E+04	9.973E-04	2.507E+04
Th-228	5.000E-02	0.000E+00	7.155E-07	3.494E+07	0.000E+00	*8.195E+14
Th-230	1.560E+00	1.000E+03	1.101E-03	2.270E+04	1.101E-03	2.270E+04
Th-232	5.000E-02	1.000E+03	1.268E-02	1.972E+03	1.268E-02	1.972E+03
U-234	1.368E+02	1.000E+03	3.596E-06	6.953E+06	3.596E-06	6.953E+06
U-235	7.310E+00	1.000E+03	8.242E-07	*2.161E+06	8.242E-07	*2.161E+06
U-236	3.270E+00	1.000E+03	2.994E-10	*6.468E+07	2.994E-10	*6.468E+07
U-238	1.416E+02	1.000E+03	1.863E-05	*3.361E+05	1.863E-05	*3.361E+05

*At specific activity limit

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	1.615E-14	1.640E-14	1.693E-14	1.889E-14	2.584E-14	7.736E-14	1.775E-12	1.027E-07
Pa-231	U-235	1.000E+00	9.632E-18	2.930E-17	7.051E-17	2.360E-16	9.379E-16	9.260E-15	6.366E-13	1.236E-07
Pa-231	∑DOSE(j)		1.616E-14	1.643E-14	1.700E-14	1.912E-14	2.678E-14	8.662E-14	2.412E-12	2.263E-07
Ac-227	Pa-231	1.000E+00	4.197E-14	1.254E-13	2.903E-13	8.488E-13	2.351E-12	8.608E-12	1.172E-10	1.555E-06
Ac-227	U-235	1.000E+00	1.671E-17	1.171E-16	6.208E-16	5.625E-15	5.000E-14	7.655E-13	3.794E-11	1.731E-06
Ac-227	∑DOSE(j)		4.198E-14	1.255E-13	2.909E-13	8.544E-13	2.401E-12	9.373E-12	1.551E-10	3.286E-06
Ra-226	Ra-226	1.000E+00	2.093E-08	2.113E-08	2.154E-08	2.304E-08	2.791E-08	5.462E-08	3.720E-07	3.092E-04
Ra-226	Th-230	1.000E+00	2.286E-11	6.923E-11	1.649E-10	5.320E-10	1.903E-09	1.302E-08	3.154E-07	1.718E-03
Ra-226	U-234	1.000E+00	6.022E-15	4.252E-14	2.292E-13	2.200E-12	2.271E-11	5.012E-10	3.415E-08	4.920E-04
Ra-226	U-238	9.999E-01	4.419E-21	6.687E-20	7.958E-19	2.268E-17	6.826E-16	5.048E-14	1.079E-11	6.044E-07
Ra-226	∑DOSE(j)		2.095E-08	2.120E-08	2.171E-08	2.357E-08	2.984E-08	6.814E-08	7.215E-07	2.520E-03
Pb-210	Ra-226	1.000E+00	5.875E-17	1.757E-16	4.076E-16	1.200E-15	3.367E-15	1.221E-14	1.396E-13	1.848E-09
Pb-210	Th-230	1.000E+00	4.286E-20	3.006E-19	1.597E-18	1.455E-17	1.313E-16	2.065E-15	1.027E-13	9.612E-09
Pb-210	U-234	1.000E+00	8.477E-24	1.277E-22	1.503E-21	4.126E-20	1.124E-18	6.399E-17	1.016E-14	2.695E-09
Pb-210	U-238	9.999E-01	0.000E+00	1.553E-28	3.960E-27	3.241E-25	2.640E-23	5.386E-21	2.919E-18	3.192E-12
Pb-210	∑DOSE(j)		5.879E-17	1.760E-16	4.092E-16	1.214E-15	3.499E-15	1.434E-14	2.524E-13	1.416E-08
Th-228	Th-228	1.000E+00	3.578E-08	2.514E-08	1.241E-08	1.050E-09	9.040E-13	1.694E-23	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	2.764E-10	1.709E-09	6.913E-09	2.747E-08	5.402E-08	1.087E-07	7.200E-07	5.492E-04
Th-228	U-236	1.000E+00	2.283E-19	3.127E-18	3.005E-17	4.384E-16	3.519E-15	2.909E-14	5.302E-13	8.449E-10
Th-228	∑DOSE(j)		3.605E-08	2.685E-08	1.933E-08	2.852E-08	5.402E-08	1.087E-07	7.200E-07	5.492E-04
Th-230	Th-230	1.000E+00	1.191E-22	1.224E-22	1.295E-22	1.576E-22	2.761E-22	1.966E-21	5.358E-19	1.791E-10
Th-230	U-234	1.000E+00	4.720E-26	1.450E-25	3.571E-25	1.295E-24	6.480E-24	1.433E-22	9.947E-20	6.788E-11
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.920E-28	2.163E-26	4.691E-23	1.206E-13
Th-230	∑DOSE(j)		1.191E-22	1.226E-22	1.299E-22	1.589E-22	2.826E-22	2.109E-21	6.353E-19	2.471E-10
Th-232	Th-232	1.000E+00	1.338E-26	1.380E-26	1.469E-26	1.827E-26	3.410E-26	3.029E-25	1.553E-22	4.739E-13
Th-232	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.177E-28	7.321E-19
Th-232	∑DOSE(j)		1.338E-26	1.380E-26	1.469E-26	1.827E-26	3.410E-26	3.029E-25	1.553E-22	4.739E-13
Ra-228	Th-232	1.000E+00	1.946E-11	5.599E-11	1.195E-10	2.713E-10	4.706E-10	1.153E-09	1.390E-08	8.464E-05
Ra-228	U-236	1.000E+00	2.115E-20	1.446E-19	7.258E-19	5.517E-18	3.427E-17	3.174E-16	1.032E-14	1.303E-10
Ra-228	∑DOSE(j)		1.946E-11	5.599E-11	1.195E-10	2.713E-10	4.706E-10	1.153E-09	1.390E-08	8.464E-05
U-234	U-234	1.000E+00	5.953E-22	6.118E-22	6.462E-22	7.828E-22	1.354E-21	9.204E-21	2.201E-18	4.650E-10
U-234	U-238	9.999E-01	8.774E-28	2.699E-27	6.657E-27	2.431E-26	1.241E-25	2.940E-24	2.480E-21	3.316E-12
U-234	∑DOSE(j)		5.953E-22	6.118E-22	6.462E-22	7.828E-22	1.354E-21	9.207E-21	2.203E-18	4.683E-10
U-235	U-235	1.000E+00	2.366E-14	2.411E-14	2.505E-14	2.861E-14	4.182E-14	1.580E-13	7.044E-12	4.171E-06
U-236	U-236	1.000E+00	2.522E-24	2.594E-24	2.743E-24	3.337E-24	5.840E-24	4.142E-23	1.117E-20	3.600E-12
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.595E-22
U-238	U-238	9.999E-01	4.300E-09	4.357E-09	4.475E-09	4.912E-09	6.409E-09	1.626E-08	2.331E-07	2.637E-03
U-238	∑DOSE(j)		4.300E-09	4.357E-09	4.475E-09	4.912E-09	6.409E-09	1.626E-08	2.331E-07	2.637E-03

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	1.300E-01	1.298E-01	1.293E-01	1.278E-01	1.234E-01	1.093E-01	7.727E-02	2.295E-02
Pa-231	U-235	1.000E+00	0.000E+00	1.544E-04	4.616E-04	1.520E-03	4.406E-03	1.302E-02	2.767E-02	2.759E-02
Pa-231	∑S(j):		1.300E-01	1.299E-01	1.298E-01	1.293E-01	1.278E-01	1.223E-01	1.049E-01	5.054E-02
Ac-227	Pa-231	1.000E+00	0.000E+00	4.061E-03	1.174E-02	3.442E-02	7.356E-02	9.802E-02	7.160E-02	2.127E-02
Ac-227	U-235	1.000E+00	0.000E+00	2.430E-06	2.130E-05	2.165E-04	1.535E-03	8.663E-03	2.314E-02	2.482E-02
Ac-227	∑S(j):		0.000E+00	4.064E-03	1.176E-02	3.464E-02	7.509E-02	1.067E-01	9.474E-02	4.608E-02
Ra-226	Ra-226	1.000E+00	3.100E-01	3.095E-01	3.085E-01	3.049E-01	2.950E-01	2.626E-01	1.885E-01	5.904E-02
Ra-226	Th-230	1.000E+00	0.000E+00	6.753E-04	2.022E-03	6.702E-03	1.978E-02	6.224E-02	1.595E-01	3.277E-01
Ra-226	U-234	1.000E+00	0.000E+00	2.665E-07	2.393E-06	2.638E-05	2.321E-04	2.385E-03	1.724E-02	9.382E-02
Ra-226	U-238	9.999E-01	0.000E+00	2.606E-13	7.025E-12	2.586E-10	6.860E-09	2.390E-07	5.438E-06	1.152E-04
Ra-226	∑S(j):		3.100E-01	3.102E-01	3.105E-01	3.116E-01	3.150E-01	3.273E-01	3.652E-01	4.807E-01
Pb-210	Ra-226	1.000E+00	0.000E+00	9.476E-03	2.750E-02	8.177E-02	1.807E-01	2.565E-01	1.934E-01	6.059E-02
Pb-210	Th-230	1.000E+00	0.000E+00	1.039E-05	9.143E-05	9.415E-04	6.913E-03	4.308E-02	1.420E-01	3.149E-01
Pb-210	U-234	1.000E+00	0.000E+00	2.740E-09	7.270E-08	2.535E-06	5.815E-05	1.328E-03	1.402E-02	8.826E-02
Pb-210	U-238	9.999E-01	0.000E+00	2.013E-15	1.608E-13	1.891E-11	1.342E-09	1.112E-07	4.022E-06	1.045E-04
Pb-210	∑S(j):		0.000E+00	9.486E-03	2.759E-02	8.271E-02	1.877E-01	3.009E-01	3.495E-01	4.638E-01
Th-228	Th-228	1.000E+00	5.000E-02	3.480E-02	1.686E-02	1.335E-03	9.515E-07	9.198E-18	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	9.318E-04	6.208E-03	2.810E-02	4.756E-02	4.949E-02	4.948E-02	4.943E-02
Th-228	U-236	1.000E+00	0.000E+00	1.042E-12	2.244E-11	4.211E-10	3.032E-09	1.318E-08	3.639E-08	7.602E-08
Th-228	∑S(j):		5.000E-02	3.573E-02	2.307E-02	2.944E-02	4.757E-02	4.949E-02	4.948E-02	4.943E-02
Th-230	Th-230	1.000E+00	1.560E+00	1.560E+00	1.560E+00	1.560E+00	1.560E+00	1.558E+00	1.555E+00	1.544E+00
Th-230	U-234	1.000E+00	0.000E+00	1.231E-03	3.686E-03	1.221E-02	3.601E-02	1.131E-01	2.883E-01	5.849E-01
Th-230	U-238	9.999E-01	0.000E+00	1.805E-09	1.623E-08	1.795E-07	1.596E-06	1.699E-05	1.358E-04	1.038E-03
Th-230	∑S(j):		1.560E+00	1.561E+00	1.564E+00	1.572E+00	1.596E+00	1.672E+00	1.844E+00	2.130E+00
Th-232	Th-232	1.000E+00	5.000E-02	5.000E-02	5.000E-02	5.000E-02	5.000E-02	4.999E-02	4.998E-02	4.993E-02
Th-232	U-236	1.000E+00	0.000E+00	1.612E-10	4.827E-10	1.599E-09	4.717E-09	1.483E-08	3.783E-08	7.712E-08
Th-232	∑S(j):		5.000E-02	5.000E-02	5.000E-02	5.000E-02	5.000E-02	4.999E-02	4.998E-02	4.993E-02
Ra-228	Th-232	1.000E+00	0.000E+00	5.675E-03	1.515E-02	3.485E-02	4.821E-02	4.949E-02	4.948E-02	4.943E-02
Ra-228	U-236	1.000E+00	0.000E+00	9.335E-12	7.762E-11	6.694E-10	3.441E-09	1.356E-08	3.666E-08	7.610E-08
Ra-228	∑S(j):		0.000E+00	5.675E-03	1.515E-02	3.485E-02	4.821E-02	4.949E-02	4.948E-02	4.943E-02
U-234	U-234	1.000E+00	1.368E+02	1.366E+02	1.361E+02	1.345E+02	1.300E+02	1.153E+02	8.177E+01	2.460E+01
U-234	U-238	9.999E-01	0.000E+00	4.010E-04	1.201E-03	3.976E-03	1.171E-02	3.661E-02	9.195E-02	1.753E-01
U-234	∑S(j):		1.368E+02	1.366E+02	1.361E+02	1.345E+02	1.300E+02	1.153E+02	8.187E+01	2.478E+01
U-235	U-235	1.000E+00	7.310E+00	7.297E+00	7.273E+00	7.186E+00	6.944E+00	6.159E+00	4.372E+00	1.318E+00
U-236	U-236	1.000E+00	3.270E+00	3.264E+00	3.253E+00	3.214E+00	3.106E+00	2.755E+00	1.956E+00	5.896E-01
U-238	U-238	5.400E-05	7.645E-03	7.644E-03	7.642E-03	7.634E-03	7.613E-03	7.537E-03	7.324E-03	6.627E-03
U-238	U-238	9.999E-01	1.416E+02	1.416E+02	1.415E+02	1.414E+02	1.410E+02	1.396E+02	1.356E+02	1.227E+02
U-238	∑S(j):		1.416E+02	1.416E+02	1.415E+02	1.414E+02	1.410E+02	1.396E+02	1.356E+02	1.227E+02

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 8451.51 seconds

APPENDIX Q

Pond D Deterministic Dose Assessment Report

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(41)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(42)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(4)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(5)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-236	1.250E-01	1.250E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(4)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(10)
D-1	U-236	2.690E-04	2.690E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	3.900E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.959E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	6.500E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Pa-231	2.500E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.600E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Th-228	2.800E-01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.140E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	7.000E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	4.808E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	8.680E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-236	1.287E+01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	5.038E+02	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	2.760E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.600E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.250E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.778E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.050E+02	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	5	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.860E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.262E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.710E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.000E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	2.000E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	2.000E-01	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(2)
R015	Unsat. zone 3, thickness (m)	1.710E+00	0.000E+00	---	H(3)
R015	Unsat. zone 3, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(3)
R015	Unsat. zone 3, total porosity	4.000E-01	4.000E-01	---	TPUZ(3)
R015	Unsat. zone 3, effective porosity	2.000E-01	2.000E-01	---	EPUZ(3)
R015	Unsat. zone 3, field capacity	2.000E-01	2.000E-01	---	FCUZ(3)
R015	Unsat. zone 3, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(3)
R015	Unsat. zone 3, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(3)
R015	Unsat. zone 4, thickness (m)	4.000E+00	0.000E+00	---	H(4)
R015	Unsat. zone 4, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(4)
R015	Unsat. zone 4, total porosity	4.000E-01	4.000E-01	---	TPUZ(4)
R015	Unsat. zone 4, effective porosity	2.000E-01	2.000E-01	---	EPUZ(4)
R015	Unsat. zone 4, field capacity	2.000E-01	2.000E-01	---	FCUZ(4)
R015	Unsat. zone 4, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(4)
R015	Unsat. zone 4, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(4)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 5, thickness (m)	1.140E+00	0.000E+00	---	H(5)
R015	Unsat. zone 5, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(5)
R015	Unsat. zone 5, total porosity	4.000E-01	4.000E-01	---	TPUZ(5)
R015	Unsat. zone 5, effective porosity	2.000E-01	2.000E-01	---	EPUZ(5)
R015	Unsat. zone 5, field capacity	2.000E-01	2.000E-01	---	FCUZ(5)
R015	Unsat. zone 5, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(5)
R015	Unsat. zone 5, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(5)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.382E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.704E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.994E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.994E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.994E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.382E-03	ALEACH(9)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.129E-01 not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.382E-03	ALEACH(10)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 5.588E+00 not used	SOLUBK(10)
R016	Distribution coefficients for U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.382E-03	ALEACH(11)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 6.202E-02 not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCU(12,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCU(12,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCU(12,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCU(12,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	2.142E+03	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.586E-05	ALEACH(12)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 2.142E+03 used	SOLUBK(12)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,2)
R016	Unsaturated zone 3 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,3)
R016	Unsaturated zone 4 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,4)
R016	Unsaturated zone 5 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,5)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.916E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,2)
R016	Unsaturated zone 3 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,3)
R016	Unsaturated zone 4 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,4)
R016	Unsaturated zone 5 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,5)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.194E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.704E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	3.917E+00	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	7.833E+00	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	1.175E+01	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	1.567E+01	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	1.958E+01	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	2.350E+01	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	2.742E+01	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	3.133E+01	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	3.525E+01	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	3.917E+01	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	4.308E+01	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	4.700E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	9.800E-01	0.000E+00	---	FRACA(4)
R017	Ring 5	1.000E+00	0.000E+00	---	FRACA(5)
R017	Ring 6	9.700E-01	0.000E+00	---	FRACA(6)
R017	Ring 7	1.000E+00	0.000E+00	---	FRACA(7)
R017	Ring 8	9.500E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	6.300E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	2.900E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	1.200E-01	0.000E+00	---	FRACA(11)
R017	Ring 12	1.100E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	1024	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	
Area:	3900.00 square meters
Thickness:	1.96 meters
Cover Depth:	2.76 meters

Initial Soil Concentrations, pCi/g	
Pa-231	2.500E-01
Ra-226	4.600E-01
Th-228	2.800E-01
Th-230	1.140E+00
Th-232	7.000E-02
U-234	4.808E+02
U-235	8.680E+00
U-236	1.287E+01
U-238	5.038E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.512E-12	1.086E-12	6.123E-13	3.557E-13	5.924E-13	1.194E-12	8.096E-12	4.577E-07
M(t):	6.047E-14	4.342E-14	2.449E-14	1.423E-14	2.370E-14	4.776E-14	3.239E-13	1.831E-08

Maximum TDOSE(t): 4.577E-07 mrem/yr at t = 1.000E+03 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.172E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.425E-14	0.0160	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.484E-12	0.9815	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.305E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.870E-15	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.652E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	4.520E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	6.667E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	8.000E-16	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.512E-12	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.172E-21	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.425E-14	0.0160
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.484E-12	0.9815
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.305E-17	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.870E-15	0.0019
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.652E-20	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.520E-25	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.667E-24	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.000E-16	0.0005
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.512E-12	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	3.476E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.448E-14	0.0225	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.043E-12	0.9603	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.950E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.773E-14	0.0163	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.166E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.176E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	9.120E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	8.108E-16	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.086E-12	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.476E-21	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.448E-14	0.0225
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.043E-12	0.9603
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.950E-17	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.773E-14	0.0163
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.166E-19	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.176E-24	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.120E-23	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.108E-16	0.0007
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.086E-12	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	8.010E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.493E-14	0.0407	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	5.148E-13	0.8407	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	9.404E-17	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.166E-14	0.1170	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.282E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.077E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	8.754E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	8.327E-16	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.123E-13	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.010E-21	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.493E-14	0.0407
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.148E-13	0.8407
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.404E-17	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.166E-14	0.1170
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.282E-19	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.077E-23	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.754E-22	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.327E-16	0.0014
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.123E-13	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.320E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.657E-14	0.0747	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	4.354E-14	0.1224	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.029E-16	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.844E-13	0.7995	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.015E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	9.531E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.274E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	9.141E-16	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.557E-13	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.320E-20	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.657E-14	0.0747
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.354E-14	0.1224
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.029E-16	0.0009
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.844E-13	0.7995
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.015E-18	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.531E-23	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.274E-20	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.141E-16	0.0026
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.557E-13	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Pa-231	6.274E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.188E-14	0.0538	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	3.749E-17	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.079E-15	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	5.582E-13	0.9422	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	6.162E-17	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.275E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.015E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.193E-15	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.924E-13	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.274E-20	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.188E-14	0.0538
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.749E-17	0.0001
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.079E-15	0.0018
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.582E-13	0.9422
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.162E-17	0.0001
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.275E-22	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.015E-19	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.193E-15	0.0020
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.924E-13	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.140E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	6.034E-14	0.0505	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	7.022E-28	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	7.258E-15	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.122E-12	0.9397	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.325E-15	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.183E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	8.203E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.034E-15	0.0025	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.194E-12	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.140E-19	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.034E-14	0.0505
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.022E-28	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.258E-15	0.0061
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.122E-12	0.9397
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.325E-15	0.0011
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.183E-20	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.203E-19	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.034E-15	0.0025
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.194E-12	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.434E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	3.734E-13	0.0461	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.686E-13	0.0208	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.427E-12	0.9173	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	8.403E-14	0.0104	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	4.882E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.409E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.371E-14	0.0054	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.096E-12	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.434E-18	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.734E-13	0.0461
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.686E-13	0.0208
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.427E-12	0.9173
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.403E-14	0.0104
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.882E-19	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.409E-17	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.371E-14	0.0054
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.096E-12	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.113E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.201E-10	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	8.213E-10	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	5.554E-09	0.0121	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	9.786E-10	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.044E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.916E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	5.042E-10	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.078E-09	0.0176	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	3.274E-07	0.7154	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.274E-07	0.7154
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.201E-10	0.0005
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.213E-10	0.0018
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.554E-09	0.0121
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.786E-10	0.0021
U-235	1.222E-07	0.2670	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-07	0.2670
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.916E-14	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.042E-10	0.0011
Total	4.497E-07	0.9824	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.577E-07	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	4.448E-23	4.515E-23	4.653E-23	5.168E-23	6.975E-23	1.993E-22	4.000E-21	1.449E-16
Pa-231	Ac-227+D	1.000E+00	4.643E-21	1.386E-20	3.200E-20	9.273E-20	2.509E-19	8.560E-19	9.733E-18	1.310E-06
Pa-231	∑DSR(j)		4.687E-21	1.390E-20	3.204E-20	9.278E-20	2.509E-19	8.562E-19	9.737E-18	1.310E-06
Ra-226+D	Ra-226+D	1.000E+00	5.273E-14	5.321E-14	5.419E-14	5.776E-14	6.931E-14	1.312E-13	8.117E-13	4.784E-10
Ra-226+D	Pb-210+D	1.000E+00	8.854E-24	2.648E-23	6.135E-23	1.800E-22	5.007E-22	1.756E-21	1.791E-20	5.103E-17
Ra-226+D	∑DSR(j)		5.273E-14	5.321E-14	5.419E-14	5.776E-14	6.931E-14	1.312E-13	8.117E-13	4.784E-10
Th-228+D	Th-228+D	1.000E+00	5.299E-12	3.723E-12	1.838E-12	1.555E-13	1.339E-16	2.508E-27	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	4.520E-38	4.649E-38	4.917E-38	5.983E-38	1.048E-37	7.463E-37	2.034E-34	6.798E-26
Th-230	Ra-226+D	1.000E+00	1.145E-17	3.465E-17	8.249E-17	2.657E-16	9.461E-16	6.367E-15	1.479E-13	7.204E-10
Th-230	Pb-210+D	1.000E+00	1.284E-27	9.002E-27	4.778E-26	4.347E-25	3.898E-24	6.009E-23	2.808E-21	7.109E-17
Th-230	∑DSR(j)		1.145E-17	3.465E-17	8.249E-17	2.657E-16	9.461E-16	6.367E-15	1.479E-13	7.204E-10
Th-232	Th-232	1.000E+00	3.088E-42	3.187E-42	3.393E-42	4.221E-42	7.877E-42	6.994E-41	3.586E-38	1.094E-28
Th-232	Ra-228+D	1.000E+00	6.783E-17	1.951E-16	4.163E-16	9.439E-16	1.635E-15	4.004E-15	4.827E-14	2.937E-10
Th-232	Th-228+D	1.000E+00	4.093E-14	2.530E-13	1.023E-12	4.061E-12	7.972E-12	1.603E-11	1.060E-10	7.905E-08
Th-232	∑DSR(j)		4.100E-14	2.532E-13	1.024E-12	4.062E-12	7.974E-12	1.603E-11	1.061E-10	7.934E-08
U-234	U-234	1.000E+00	6.933E-40	7.121E-40	7.511E-40	9.056E-40	1.545E-39	1.003E-38	2.097E-36	2.774E-28
U-234	Th-230	1.000E+00	2.046E-43	6.278E-43	1.544E-42	5.587E-42	2.777E-41	6.007E-40	3.934E-37	2.338E-28
U-234	Ra-226+D	1.000E+00	3.437E-23	2.426E-22	1.307E-21	1.251E-20	1.282E-19	2.755E-18	1.748E-16	2.035E-12
U-234	Pb-210+D	1.000E+00	2.894E-33	4.358E-32	5.127E-31	1.403E-29	3.792E-28	2.098E-26	3.042E-24	1.975E-19
U-234	∑DSR(j)		3.437E-23	2.426E-22	1.307E-21	1.251E-20	1.282E-19	2.755E-18	1.748E-16	2.035E-12
U-235+D	U-235+D	1.000E+00	1.873E-26	1.908E-26	1.979E-26	2.250E-26	3.245E-26	1.170E-25	4.563E-24	1.690E-18
U-235+D	Pa-231	1.000E+00	4.717E-28	1.434E-27	3.447E-27	1.148E-26	4.503E-26	4.242E-25	2.551E-23	3.101E-18
U-235+D	Ac-227+D	1.000E+00	3.287E-26	2.302E-25	1.218E-24	1.095E-23	9.525E-23	1.363E-21	5.622E-20	1.408E-08
U-235+D	∑DSR(j)		5.208E-26	2.507E-25	1.241E-24	1.098E-23	9.533E-23	1.363E-21	5.625E-20	1.408E-08
U-236	U-236	1.000E+00	5.806E-41	5.967E-41	6.302E-41	7.630E-41	1.318E-40	8.919E-40	2.104E-37	4.245E-29
U-236	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.058E-36
U-236	Ra-228+D	1.000E+00	1.127E-27	7.703E-27	3.863E-26	2.929E-25	1.807E-24	1.636E-23	5.015E-22	5.514E-18
U-236	Th-228+D	1.000E+00	5.169E-25	7.079E-24	6.798E-23	9.894E-22	7.888E-21	6.372E-20	1.094E-18	1.483E-15
U-236	∑DSR(j)		5.181E-25	7.086E-24	6.802E-23	9.897E-22	7.890E-21	6.373E-20	1.095E-18	1.489E-15
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238+D	U-238+D	9.999E-01	1.588E-18	1.609E-18	1.653E-18	1.814E-18	2.368E-18	6.021E-18	8.670E-17	9.980E-13
U-238+D	U-234	9.999E-01	0.000E+00	2.803E-45	8.408E-45	2.803E-44	1.387E-43	3.219E-42	2.587E-39	3.133E-30
U-238+D	Th-230	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.401E-45	8.968E-44	1.864E-40	4.441E-31
U-238+D	Ra-226+D	9.999E-01	2.437E-29	3.688E-28	4.386E-27	1.248E-25	3.736E-24	2.713E-22	5.526E-20	2.686E-15
U-238+D	Pb-210+D	9.999E-01	1.644E-39	5.123E-38	1.306E-36	1.066E-34	8.633E-33	1.724E-30	8.727E-28	2.506E-22
U-238+D	∑DSR(j)		1.588E-18	1.609E-18	1.653E-18	1.814E-18	2.368E-18	6.022E-18	8.676E-17	1.001E-12

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	1.909E+07
Ra-226	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	*9.885E+11	5.225E+10
Th-228	4.718E+12	6.714E+12	1.360E+13	1.608E+14	*8.195E+14	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-236	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pa-231	2.500E-01	1.000E+03	1.310E-06	1.909E+07	1.310E-06	1.909E+07
Ra-226	4.600E-01	1.000E+03	4.784E-10	5.225E+10	4.784E-10	5.225E+10
Th-228	2.800E-01	0.000E+00	5.299E-12	4.718E+12	0.000E+00	*8.195E+14
Th-230	1.140E+00	1.000E+03	7.204E-10	*2.018E+10	7.204E-10	*2.018E+10
Th-232	7.000E-02	1.000E+03	7.934E-08	*1.097E+05	7.934E-08	*1.097E+05
U-234	4.808E+02	1.000E+03	2.035E-12	*6.247E+09	2.035E-12	*6.247E+09
U-235	8.680E+00	1.000E+03	1.408E-08	*2.161E+06	1.408E-08	*2.161E+06
U-236	1.287E+01	1.000E+03	1.489E-15	*6.468E+07	1.489E-15	*6.468E+07
U-238	5.038E+02	1.000E+03	1.001E-12	*3.361E+05	1.001E-12	*3.361E+05

*At specific activity limit

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	1.112E-23	1.129E-23	1.163E-23	1.292E-23	1.744E-23	4.982E-23	1.000E-21	3.623E-17
Pa-231	U-235	1.000E+00	4.095E-27	1.245E-26	2.992E-26	9.967E-26	3.909E-25	3.682E-24	2.215E-22	2.691E-17
Pa-231	∑DOSE(j)		1.112E-23	1.130E-23	1.166E-23	1.302E-23	1.783E-23	5.350E-23	1.221E-21	6.315E-17
Ac-227	Pa-231	1.000E+00	1.161E-21	3.465E-21	7.999E-21	2.318E-20	6.272E-20	2.140E-19	2.433E-18	3.274E-07
Ac-227	U-235	1.000E+00	2.853E-25	1.998E-24	1.057E-23	9.501E-23	8.268E-22	1.183E-20	4.880E-19	1.222E-07
Ac-227	∑DOSE(j)		1.161E-21	3.467E-21	8.009E-21	2.328E-20	6.355E-20	2.258E-19	2.921E-18	4.497E-07
Ra-226	Ra-226	1.000E+00	2.425E-14	2.448E-14	2.493E-14	2.657E-14	3.188E-14	6.034E-14	3.734E-13	2.201E-10
Ra-226	Th-230	1.000E+00	1.305E-17	3.950E-17	9.404E-17	3.029E-16	1.079E-15	7.258E-15	1.686E-13	8.213E-10
Ra-226	U-234	1.000E+00	1.652E-20	1.166E-19	6.282E-19	6.015E-18	6.162E-17	1.325E-15	8.403E-14	9.786E-10
Ra-226	U-238	9.999E-01	1.228E-26	1.858E-25	2.210E-24	6.288E-23	1.882E-21	1.367E-19	2.784E-17	1.353E-12
Ra-226	∑DOSE(j)		2.427E-14	2.452E-14	2.502E-14	2.688E-14	3.302E-14	6.892E-14	6.260E-13	2.021E-09
Pb-210	Ra-226	1.000E+00	4.073E-24	1.218E-23	2.822E-23	8.281E-23	2.303E-22	8.078E-22	8.237E-21	2.347E-17
Pb-210	Th-230	1.000E+00	1.463E-27	1.026E-26	5.447E-26	4.955E-25	4.444E-24	6.850E-23	3.201E-21	8.105E-17
Pb-210	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	6.747E-27	1.823E-25	1.009E-23	1.463E-21	9.495E-17
Pb-210	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.688E-28	4.397E-25	1.263E-19
Pb-210	∑DOSE(j)		4.074E-24	1.219E-23	2.828E-23	8.331E-23	2.350E-22	8.863E-22	1.290E-20	1.996E-16
Th-228	Th-228	1.000E+00	1.484E-12	1.043E-12	5.148E-13	4.354E-14	3.749E-17	7.022E-28	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	2.865E-15	1.771E-14	7.163E-14	2.843E-13	5.581E-13	1.122E-12	7.423E-12	5.533E-09
Th-228	U-236	1.000E+00	6.653E-24	9.110E-23	8.749E-22	1.273E-20	1.015E-19	8.201E-19	1.409E-17	1.909E-14
Th-228	∑DOSE(j)		1.487E-12	1.060E-12	5.864E-13	3.278E-13	5.581E-13	1.122E-12	7.423E-12	5.533E-09
Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.749E-26
Th-230	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.124E-25
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	∑DOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.899E-25
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.657E-30
Th-232	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	∑DOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.657E-30
Ra-228	Th-232	1.000E+00	4.748E-18	1.366E-17	2.914E-17	6.607E-17	1.144E-16	2.803E-16	3.379E-15	2.056E-11
Ra-228	U-236	1.000E+00	1.451E-26	9.913E-26	4.972E-25	3.770E-24	2.325E-23	2.105E-22	6.454E-21	7.097E-17
Ra-228	∑DOSE(j)		4.748E-18	1.366E-17	2.914E-17	6.607E-17	1.144E-16	2.803E-16	3.379E-15	2.056E-11
U-234	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.334E-25
U-234	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.579E-27
U-234	∑DOSE(j)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.350E-25
U-235	U-235	1.000E+00	1.626E-25	1.656E-25	1.718E-25	1.953E-25	2.817E-25	1.015E-24	3.960E-23	1.467E-17
U-236	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.464E-28
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	U-238	9.999E-01	8.000E-16	8.108E-16	8.327E-16	9.141E-16	1.193E-15	3.034E-15	4.368E-14	5.028E-10
U-238	∑DOSE(j)		8.000E-16	8.108E-16	8.327E-16	9.141E-16	1.193E-15	3.034E-15	4.368E-14	5.028E-10

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	2.500E-01	2.494E-01	2.482E-01	2.441E-01	2.326E-01	1.966E-01	1.216E-01	2.261E-02
Pa-231	U-235	1.000E+00	0.000E+00	1.832E-04	5.470E-04	1.793E-03	5.128E-03	1.446E-02	2.688E-02	1.678E-02
Pa-231	∑S(j):		2.500E-01	2.496E-01	2.488E-01	2.459E-01	2.377E-01	2.111E-01	1.484E-01	3.939E-02
Ac-227	Pa-231	1.000E+00	0.000E+00	7.801E-03	2.249E-02	6.545E-02	1.369E-01	1.719E-01	1.095E-01	2.036E-02
Ac-227	U-235	1.000E+00	0.000E+00	2.882E-06	2.522E-05	2.546E-04	1.771E-03	9.443E-03	2.192E-02	1.468E-02
Ac-227	∑S(j):		0.000E+00	7.804E-03	2.252E-02	6.570E-02	1.387E-01	1.813E-01	1.314E-01	3.504E-02
Ra-226	Ra-226	1.000E+00	4.600E-01	4.590E-01	4.571E-01	4.503E-01	4.314E-01	3.715E-01	2.423E-01	5.429E-02
Ra-226	Th-230	1.000E+00	0.000E+00	4.933E-04	1.477E-03	4.886E-03	1.435E-02	4.444E-02	1.092E-01	2.024E-01
Ra-226	U-234	1.000E+00	0.000E+00	9.361E-07	8.399E-06	9.234E-05	8.064E-04	8.072E-03	5.433E-02	2.411E-01
Ra-226	U-238	9.999E-01	0.000E+00	9.273E-13	2.498E-11	9.177E-10	2.422E-08	8.287E-07	1.797E-05	3.332E-04
Ra-226	∑S(j):		4.600E-01	4.595E-01	4.585E-01	4.553E-01	4.466E-01	4.240E-01	4.058E-01	4.980E-01
Pb-210	Ra-226	1.000E+00	0.000E+00	1.405E-02	4.075E-02	1.208E-01	2.648E-01	3.643E-01	2.498E-01	5.599E-02
Pb-210	Th-230	1.000E+00	0.000E+00	7.588E-06	6.676E-05	6.862E-04	5.012E-03	3.069E-02	9.686E-02	1.931E-01
Pb-210	U-234	1.000E+00	0.000E+00	9.624E-09	2.552E-07	8.875E-06	2.020E-04	4.495E-03	4.419E-02	2.261E-01
Pb-210	U-238	9.999E-01	0.000E+00	7.161E-15	5.716E-13	6.710E-11	4.736E-09	3.850E-07	1.326E-05	3.006E-04
Pb-210	∑S(j):		0.000E+00	1.406E-02	4.082E-02	1.215E-01	2.700E-01	3.995E-01	3.909E-01	4.755E-01
Th-228	Th-228	1.000E+00	2.800E-01	1.949E-01	9.443E-02	7.475E-03	5.328E-06	5.151E-17	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.304E-03	8.688E-03	3.928E-02	6.636E-02	6.901E-02	6.898E-02	6.889E-02
Th-228	U-236	1.000E+00	0.000E+00	4.101E-12	8.825E-11	1.652E-09	1.181E-08	5.019E-08	1.307E-07	2.376E-07
Th-228	∑S(j):		2.800E-01	1.962E-01	1.031E-01	4.676E-02	6.637E-02	6.901E-02	6.898E-02	6.889E-02
Th-230	Th-230	1.000E+00	1.140E+00	1.140E+00	1.140E+00	1.140E+00	1.140E+00	1.139E+00	1.136E+00	1.128E+00
Th-230	U-234	1.000E+00	0.000E+00	4.323E-03	1.294E-02	4.277E-02	1.253E-01	3.848E-01	9.257E-01	1.635E+00
Th-230	U-238	9.999E-01	0.000E+00	6.423E-09	5.772E-08	6.376E-07	5.646E-06	5.933E-05	4.589E-04	3.253E-03
Th-230	∑S(j):		1.140E+00	1.144E+00	1.153E+00	1.183E+00	1.265E+00	1.524E+00	2.062E+00	2.766E+00
Th-232	Th-232	1.000E+00	7.000E-02	7.000E-02	7.000E-02	7.000E-02	7.000E-02	6.999E-02	6.996E-02	6.986E-02
Th-232	U-236	1.000E+00	0.000E+00	6.342E-10	1.898E-09	6.274E-09	1.838E-08	5.649E-08	1.361E-07	2.416E-07
Th-232	∑S(j):		7.000E-02	7.000E-02	7.000E-02	7.000E-02	7.000E-02	6.999E-02	6.996E-02	6.986E-02
Ra-228	Th-232	1.000E+00	0.000E+00	7.943E-03	2.119E-02	4.870E-02	6.726E-02	6.901E-02	6.898E-02	6.889E-02
Ra-228	U-236	1.000E+00	0.000E+00	3.673E-11	3.052E-10	2.625E-09	1.340E-08	5.159E-08	1.316E-07	2.378E-07
Ra-228	∑S(j):		0.000E+00	7.943E-03	2.119E-02	4.870E-02	6.726E-02	6.901E-02	6.898E-02	6.889E-02
U-234	U-234	1.000E+00	4.808E+02	4.796E+02	4.774E+02	4.694E+02	4.476E+02	3.788E+02	2.351E+02	4.428E+01
U-234	U-238	9.999E-01	0.000E+00	1.427E-03	4.269E-03	1.411E-02	4.132E-02	1.267E-01	3.032E-01	5.234E-01
U-234	∑S(j):		4.808E+02	4.796E+02	4.774E+02	4.695E+02	4.476E+02	3.789E+02	2.354E+02	4.480E+01
U-235	U-235	1.000E+00	8.680E+00	8.659E+00	8.618E+00	8.476E+00	8.081E+00	6.840E+00	4.248E+00	8.017E-01
U-236	U-236	1.000E+00	1.287E+01	1.284E+01	1.278E+01	1.257E+01	1.198E+01	1.014E+01	6.298E+00	1.189E+00
U-238	U-238	5.400E-05	2.721E-02	2.721E-02	2.720E-02	2.719E-02	2.716E-02	2.706E-02	2.675E-02	2.573E-02
U-238	U-238	9.999E-01	5.038E+02	5.038E+02	5.037E+02	5.035E+02	5.030E+02	5.010E+02	4.954E+02	4.764E+02
U-238	∑S(j):		5.038E+02	5.038E+02	5.037E+02	5.035E+02	5.030E+02	5.010E+02	4.955E+02	4.765E+02

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 5875.80 seconds

APPENDIX R

Pond E Deterministic Dose Assessment Report

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(1)
A-1	Ac-228 (Source: FGR 12)	5.978E+00	5.978E+00	DCF1(2)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(3)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(4)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(5)
A-1	Bi-212 (Source: FGR 12)	1.171E+00	1.171E+00	DCF1(6)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(7)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(8)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(9)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(10)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(11)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(12)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(13)
A-1	Pb-212 (Source: FGR 12)	7.043E-01	7.043E-01	DCF1(14)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(15)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(16)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(17)
A-1	Po-212 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(18)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(19)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(20)
A-1	Po-216 (Source: FGR 12)	1.042E-04	1.042E-04	DCF1(21)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(22)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(23)
A-1	Ra-224 (Source: FGR 12)	5.119E-02	5.119E-02	DCF1(24)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(25)
A-1	Ra-228 (Source: FGR 12)	0.000E+00	0.000E+00	DCF1(26)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(27)
A-1	Rn-220 (Source: FGR 12)	2.298E-03	2.298E-03	DCF1(28)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(29)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(30)
A-1	Th-228 (Source: FGR 12)	7.940E-03	7.940E-03	DCF1(31)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(32)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(33)
A-1	Th-232 (Source: FGR 12)	5.212E-04	5.212E-04	DCF1(34)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(35)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(36)
A-1	Tl-208 (Source: FGR 12)	2.298E+01	2.298E+01	DCF1(37)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(38)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(39)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(40)
A-1	U-236 (Source: FGR 12)	2.148E-04	2.148E-04	DCF1(41)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(42)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(4)
B-1	Ra-228+D	5.078E-03	4.770E-03	DCF2(5)

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
B-1	Th-228+D	3.454E-01	3.420E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-236	1.250E-01	1.250E-01	DCF2(11)
B-1	U-238	1.180E-01	1.180E-01	DCF2(12)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(13)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(4)
D-1	Ra-228+D	1.442E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.086E-04	3.960E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.673E-04	2.660E-04	DCF3(10)
D-1	U-236	2.690E-04	2.690E-04	DCF3(11)
D-1	U-238	2.550E-04	2.550E-04	DCF3(12)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3(13)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(12,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(12,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(12,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(13,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(13,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(13,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC(12,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(12,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(13,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.
*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.200E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	3.453E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	1.650E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Pa-231	7.000E-02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	3.400E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Th-228	3.000E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	8.300E-01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	3.000E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.186E+02	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	5.110E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-236	2.910E+00	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): U-238	1.227E+02	0.000E+00	---	S1(12)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-236	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(12)
R013	Cover depth (m)	1.590E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.575E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.600E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.300E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.250E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	2.778E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	4.800E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.050E+02	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	5	1	---	NS
R015	Unsat. zone 1, thickness (m)	6.860E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.262E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	1.710E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.000E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	2.000E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	2.000E-01	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(2)
R015	Unsat. zone 3, thickness (m)	1.710E+00	0.000E+00	---	H(3)
R015	Unsat. zone 3, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(3)
R015	Unsat. zone 3, total porosity	4.000E-01	4.000E-01	---	TPUZ(3)
R015	Unsat. zone 3, effective porosity	2.000E-01	2.000E-01	---	EPUZ(3)
R015	Unsat. zone 3, field capacity	2.000E-01	2.000E-01	---	FCUZ(3)
R015	Unsat. zone 3, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(3)
R015	Unsat. zone 3, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(3)
R015	Unsat. zone 4, thickness (m)	4.000E+00	0.000E+00	---	H(4)
R015	Unsat. zone 4, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(4)
R015	Unsat. zone 4, total porosity	4.000E-01	4.000E-01	---	TPUZ(4)
R015	Unsat. zone 4, effective porosity	2.000E-01	2.000E-01	---	EPUZ(4)
R015	Unsat. zone 4, field capacity	2.000E-01	2.000E-01	---	FCUZ(4)
R015	Unsat. zone 4, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(4)
R015	Unsat. zone 4, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(4)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 5, thickness (m)	1.140E+00	0.000E+00	---	H(5)
R015	Unsat. zone 5, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(5)
R015	Unsat. zone 5, total porosity	4.000E-01	4.000E-01	---	TPUZ(5)
R015	Unsat. zone 5, effective porosity	2.000E-01	2.000E-01	---	EPUZ(5)
R015	Unsat. zone 5, field capacity	2.000E-01	2.000E-01	---	FCUZ(5)
R015	Unsat. zone 5, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(5)
R015	Unsat. zone 5, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(5)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.373E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.818E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.149E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.149E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,2)
R016	Unsaturated zone 3 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,3)
R016	Unsaturated zone 4 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,4)
R016	Unsaturated zone 5 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,5)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.149E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.373E-03	ALEACH(9)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-2.007E-01 not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.373E-03	ALEACH(10)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 3.194E+00 not used	SOLUBK(10)
R016	Distribution coefficients for U-236				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.373E-03	ALEACH(11)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd =-1.634E-01 not used	SOLUBK(11)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCU(12,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCU(12,2)
R016	Unsaturated zone 3 (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCU(12,3)
R016	Unsaturated zone 4 (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCU(12,4)
R016	Unsaturated zone 5 (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCU(12,5)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	5.213E+02	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.322E-04	ALEACH(12)
R016	Solubility constant	2.940E-06	0.000E+00	Sol. Kd = 5.213E+02 used	SOLUBK(12)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,2)
R016	Unsaturated zone 3 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,3)
R016	Unsaturated zone 4 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,4)
R016	Unsaturated zone 5 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,5)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.409E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,2)
R016	Unsaturated zone 3 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,3)
R016	Unsaturated zone 4 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,4)
R016	Unsaturated zone 5 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,5)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.880E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,2)
R016	Unsaturated zone 3 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,3)
R016	Unsaturated zone 4 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,4)
R016	Unsaturated zone 5 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,5)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.818E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.140E+04	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	2.500E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fraction of time spent outdoors (on site)	6.000E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	-1.000E+00	1.000E+00	-1 shows non-circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	7.667E+00	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	1.533E+01	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	2.300E+01	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	3.067E+01	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	3.833E+01	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	4.600E+01	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	5.367E+01	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	6.133E+01	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	6.900E+01	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	7.667E+01	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	8.433E+01	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	9.200E+01	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	1.000E+00	1.000E+00	---	FRACA(1)
R017	Ring 2	1.000E+00	2.732E-01	---	FRACA(2)
R017	Ring 3	1.000E+00	0.000E+00	---	FRACA(3)
R017	Ring 4	9.800E-01	0.000E+00	---	FRACA(4)
R017	Ring 5	9.800E-01	0.000E+00	---	FRACA(5)
R017	Ring 6	6.800E-01	0.000E+00	---	FRACA(6)
R017	Ring 7	5.300E-01	0.000E+00	---	FRACA(7)
R017	Ring 8	4.400E-01	0.000E+00	---	FRACA(8)
R017	Ring 9	3.900E-01	0.000E+00	---	FRACA(9)
R017	Ring 10	3.300E-01	0.000E+00	---	FRACA(10)
R017	Ring 11	2.800E-01	0.000E+00	---	FRACA(11)
R017	Ring 12	5.700E-02	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	1024	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	12000.00 square meters	Pa-231	7.000E-02
Thickness:	3.45 meters	Ra-226	3.400E-01
Cover Depth:	1.59 meters	Th-228	3.000E-02
		Th-230	8.300E-01
		Th-232	3.000E-02
		U-234	1.186E+02
		U-235	5.110E+00
		U-236	2.910E+00
		U-238	1.227E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.077E-08	1.830E-08	1.644E-08	1.997E-08	3.020E-08	6.373E-08	5.371E-07	1.746E-03
M(t):	8.308E-10	7.322E-10	6.577E-10	7.987E-10	1.208E-09	2.549E-09	2.148E-08	6.983E-05

Maximum TDOSE(t): 1.746E-03 mrem/yr at t = 1.000E+03 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	9.234E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.334E-09	0.4494	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	1.008E-08	0.4852	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.946E-12	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	8.217E-11	0.0040	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.122E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.163E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.023E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.271E-09	0.0612	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.077E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.234E-15	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.334E-09	0.4494
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.008E-08	0.4852
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.946E-12	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.217E-11	0.0040
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.122E-15	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.163E-15	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.023E-19	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.271E-09	0.0612
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.077E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.334E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.427E-09	0.5150	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	7.081E-09	0.3868	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.498E-11	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	4.938E-10	0.0270	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.498E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.250E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.354E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.288E-09	0.0704	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.830E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.334E-14	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.427E-09	0.5150
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.081E-09	0.3868
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.498E-11	0.0008
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.938E-10	0.0270
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.498E-14	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.250E-15	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.354E-18	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.288E-09	0.0704
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.830E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	5.126E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.614E-09	0.5847	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	3.496E-09	0.2126	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.568E-11	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.974E-09	0.1201	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	8.080E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.495E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.280E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.323E-09	0.0805	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.644E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.126E-14	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.614E-09	0.5847
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.496E-09	0.2126
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.568E-11	0.0022
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.974E-09	0.1201
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.080E-14	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.495E-15	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.280E-17	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.323E-09	0.0805
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.644E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.463E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.030E-08	0.5158	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	2.957E-10	0.0148	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.152E-10	0.0058	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.804E-09	0.3908	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	7.768E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	5.109E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.853E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.452E-09	0.0727	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.997E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.463E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.030E-08	0.5158
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.957E-10	0.0148
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.152E-10	0.0058
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.804E-09	0.3908
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.768E-13	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.109E-15	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.853E-16	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.452E-09	0.0727
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.997E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	4.060E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.254E-08	0.4152	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	2.546E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.132E-10	0.0137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.535E-08	0.5081	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	8.050E-12	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.689E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.489E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.895E-09	0.0627	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.020E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.060E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.254E-08	0.4152
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.546E-13	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.132E-10	0.0137
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.535E-08	0.5081
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.050E-12	0.0003
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.689E-14	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.489E-15	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.895E-09	0.0627
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.020E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.527E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.496E-08	0.3916	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	4.771E-24	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.849E-09	0.0447	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.093E-08	0.4853	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.800E-10	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.979E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	1.246E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	4.812E-09	0.0755	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.373E-08	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.527E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.496E-08	0.3916
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.771E-24	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.849E-09	0.0447
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.093E-08	0.4853
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.800E-10	0.0028
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.979E-13	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.246E-14	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.812E-09	0.0755
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.373E-08	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.221E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.784E-07	0.3323	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	7.056E-08	0.1314	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.062E-07	0.3840	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.273E-08	0.0237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.038E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	2.358E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	6.905E-08	0.1286	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.371E-07	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.221E-11	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.784E-07	0.3323
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.056E-08	0.1314
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.062E-07	0.3840
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.273E-08	0.0237
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.038E-11	0.0000
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.358E-13	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.905E-08	0.1286
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.371E-07	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	3.249E-07	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.753E-04	0.1004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.062E-04	0.2327	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.729E-04	0.0991	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.044E-04	0.1171	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.275E-06	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-236	4.485E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	7.851E-04	0.4497	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.746E-03	0.9999	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	9.597E-08	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.209E-07	0.0002
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.753E-04	0.1004
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-04	0.2327
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.729E-04	0.0991
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.044E-04	0.1171
U-235	7.514E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.350E-06	0.0008
U-236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.485E-10	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.851E-04	0.4497
Total	1.711E-07	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.746E-03	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	3.089E-14	3.138E-14	3.240E-14	3.625E-14	4.992E-14	1.531E-13	3.760E-12	2.761E-07
Pa-231	Ac-227+D	1.000E+00	1.010E-13	3.021E-13	6.999E-13	2.054E-12	5.750E-12	2.166E-11	3.135E-10	5.736E-06
Pa-231	∑DSR(j)		1.319E-13	3.335E-13	7.324E-13	2.091E-12	5.800E-12	2.181E-11	3.173E-10	6.012E-06
Ra-226+D	Ra-226+D	1.000E+00	2.745E-08	2.773E-08	2.828E-08	3.029E-08	3.688E-08	7.341E-08	5.249E-07	5.157E-04
Ra-226+D	Pb-210+D	1.000E+00	6.427E-17	1.923E-16	4.461E-16	1.315E-15	3.705E-15	1.364E-14	1.624E-13	1.842E-09
Ra-226+D	∑DSR(j)		2.745E-08	2.773E-08	2.828E-08	3.029E-08	3.688E-08	7.341E-08	5.249E-07	5.157E-04
Th-228+D	Th-228+D	1.000E+00	3.359E-07	2.360E-07	1.165E-07	9.857E-09	8.488E-12	1.590E-22	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	8.092E-24	8.322E-24	8.803E-24	1.071E-23	1.877E-23	1.336E-22	3.642E-20	1.218E-11
Th-230	Ra-226+D	1.000E+00	5.959E-12	1.805E-11	4.299E-11	1.388E-10	4.979E-10	3.433E-09	8.501E-08	4.894E-04
Th-230	Pb-210+D	1.000E+00	9.316E-21	6.536E-20	3.472E-19	3.168E-18	2.864E-17	4.540E-16	2.293E-14	1.646E-09
Th-230	∑DSR(j)		5.959E-12	1.805E-11	4.299E-11	1.388E-10	4.979E-10	3.433E-09	8.501E-08	4.894E-04
Th-232	Th-232	1.000E+00	2.205E-26	2.274E-26	2.421E-26	3.012E-26	5.621E-26	4.992E-25	2.560E-22	7.813E-13
Th-232	Ra-228+D	1.000E+00	1.438E-10	4.137E-10	8.831E-10	2.006E-09	3.483E-09	8.535E-09	1.029E-07	6.267E-04
Th-232	Th-228+D	1.000E+00	2.595E-09	1.605E-08	6.493E-08	2.581E-07	5.081E-07	1.022E-06	6.771E-06	5.137E-03
Th-232	∑DSR(j)		2.739E-09	1.646E-08	6.581E-08	2.601E-07	5.115E-07	1.031E-06	6.874E-06	5.764E-03
U-234	U-234	1.000E+00	4.242E-25	4.361E-25	4.610E-25	5.597E-25	9.745E-25	6.786E-24	1.737E-21	4.657E-13
U-234	Th-230	1.000E+00	3.658E-29	1.124E-28	2.769E-28	1.005E-27	5.047E-27	1.129E-25	8.081E-23	5.981E-14
U-234	Ra-226+D	1.000E+00	1.789E-17	1.264E-16	6.815E-16	6.551E-15	6.789E-14	1.518E-12	1.073E-10	1.724E-06
U-234	Pb-210+D	1.000E+00	2.101E-26	3.165E-25	3.727E-24	1.024E-22	2.800E-21	1.614E-19	2.638E-17	5.661E-12
U-234	∑DSR(j)		1.789E-17	1.264E-16	6.815E-16	6.551E-15	6.789E-14	1.518E-12	1.073E-10	1.724E-06
U-235+D	U-235+D	1.000E+00	6.180E-16	6.301E-16	6.549E-16	7.498E-16	1.104E-15	4.269E-15	2.038E-13	1.530E-07
U-235+D	Pa-231	1.000E+00	3.276E-19	9.969E-19	2.401E-18	8.054E-18	3.223E-17	3.258E-16	2.398E-14	5.907E-09
U-235+D	Ac-227+D	1.000E+00	7.153E-19	5.015E-18	2.661E-17	2.419E-16	2.170E-15	3.413E-14	1.803E-12	1.053E-07
U-235+D	∑DSR(j)		6.191E-16	6.361E-16	6.839E-16	9.997E-16	3.305E-15	3.873E-14	2.031E-12	2.643E-07
U-236	U-236	1.000E+00	7.168E-26	7.374E-26	7.804E-26	9.516E-26	1.677E-25	1.218E-24	3.517E-22	1.438E-13
U-236	Th-232	1.000E+00	5.464E-37	1.684E-36	4.173E-36	1.549E-35	8.284E-35	2.312E-33	3.110E-30	2.098E-20
U-236	Ra-228+D	1.000E+00	2.390E-21	1.634E-20	8.203E-20	6.244E-19	3.892E-18	3.648E-17	1.222E-15	1.676E-11
U-236	Th-228+D	1.000E+00	3.278E-20	4.491E-19	4.316E-18	6.304E-17	5.078E-16	4.246E-15	7.981E-14	1.372E-10
U-236	∑DSR(j)		3.517E-20	4.654E-19	4.398E-18	6.366E-17	5.117E-16	4.283E-15	8.103E-14	1.541E-10
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.064E-26
U-238+D	U-238+D	9.999E-01	1.036E-11	1.050E-11	1.078E-11	1.184E-11	1.545E-11	3.922E-11	5.628E-10	6.397E-06
U-238+D	U-234	9.999E-01	6.043E-31	1.859E-30	4.587E-30	1.677E-29	8.588E-29	2.059E-27	1.794E-24	2.622E-15
U-238+D	Th-230	9.999E-01	3.465E-35	2.483E-34	1.385E-33	1.501E-32	2.195E-31	1.639E-29	3.631E-26	9.906E-17
U-238+D	Ra-226+D	9.999E-01	1.269E-23	1.921E-22	2.287E-21	6.524E-20	1.969E-18	1.471E-16	3.234E-14	1.967E-09
U-238+D	Pb-210+D	9.999E-01	1.193E-32	3.720E-31	9.490E-30	7.774E-28	6.349E-26	1.308E-23	7.237E-21	6.232E-15
U-238+D	∑DSR(j)		1.036E-11	1.050E-11	1.078E-11	1.184E-11	1.545E-11	3.922E-11	5.628E-10	6.399E-06

The DSR includes contributions from associated (half-life ≤ 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	*4.723E+10	4.158E+06
Ra-226	9.106E+08	9.017E+08	8.841E+08	8.253E+08	6.779E+08	3.406E+08	4.763E+07	4.848E+04
Th-228	7.442E+07	1.059E+08	2.145E+08	2.536E+09	2.945E+12	*8.195E+14	*8.195E+14	*8.195E+14
Th-230	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	*2.018E+10	7.283E+09	2.941E+08	5.108E+04
Th-232	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	*1.097E+05	4.337E+03
U-234	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	*6.247E+09	1.450E+07
U-235	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06	*2.161E+06
U-236	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07	*6.468E+07
U-238	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05	*3.361E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pa-231	7.000E-02	1.000E+03	6.012E-06	4.158E+06	6.012E-06	4.158E+06
Ra-226	3.400E-01	1.000E+03	5.157E-04	4.848E+04	5.157E-04	4.848E+04
Th-228	3.000E-02	0.000E+00	3.359E-07	7.442E+07	0.000E+00	*8.195E+14
Th-230	8.300E-01	1.000E+03	4.894E-04	5.108E+04	4.894E-04	5.108E+04
Th-232	3.000E-02	1.000E+03	5.764E-03	4.337E+03	5.764E-03	4.337E+03
U-234	1.186E+02	1.000E+03	1.724E-06	1.450E+07	1.724E-06	1.450E+07
U-235	5.110E+00	1.000E+03	2.643E-07	*2.161E+06	2.643E-07	*2.161E+06
U-236	2.910E+00	1.000E+03	1.541E-10	*6.468E+07	1.541E-10	*6.468E+07
U-238	1.227E+02	1.000E+03	6.399E-06	*3.361E+05	6.399E-06	*3.361E+05

*At specific activity limit

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	2.162E-15	2.197E-15	2.268E-15	2.537E-15	3.495E-15	1.071E-14	2.632E-13	1.933E-08
Pa-231	U-235	1.000E+00	1.674E-18	5.094E-18	1.227E-17	4.116E-17	1.647E-16	1.665E-15	1.225E-13	3.019E-08
Pa-231	∑DOSE(j)		2.164E-15	2.202E-15	2.281E-15	2.578E-15	3.659E-15	1.238E-14	3.857E-13	4.951E-08
Ac-227	Pa-231	1.000E+00	7.072E-15	2.115E-14	4.900E-14	1.438E-13	4.025E-13	1.516E-12	2.195E-11	4.015E-07
Ac-227	U-235	1.000E+00	3.655E-18	2.563E-17	1.360E-16	1.236E-15	1.109E-14	1.744E-13	9.212E-12	5.381E-07
Ac-227	∑DOSE(j)		7.076E-15	2.117E-14	4.913E-14	1.450E-13	4.136E-13	1.690E-12	3.116E-11	9.397E-07
Ra-226	Ra-226	1.000E+00	9.334E-09	9.427E-09	9.614E-09	1.030E-08	1.254E-08	2.496E-08	1.784E-07	1.753E-04
Ra-226	Th-230	1.000E+00	4.946E-12	1.498E-11	3.568E-11	1.152E-10	4.132E-10	2.849E-09	7.056E-08	4.062E-04
Ra-226	U-234	1.000E+00	2.122E-15	1.498E-14	8.080E-14	7.768E-13	8.050E-12	1.800E-10	1.273E-08	2.044E-04
Ra-226	U-238	9.999E-01	1.557E-21	2.357E-20	2.805E-19	8.004E-18	2.416E-16	1.805E-14	3.967E-12	2.413E-07
Ra-226	∑DOSE(j)		9.339E-09	9.442E-09	9.650E-09	1.042E-08	1.296E-08	2.799E-08	2.617E-07	7.862E-04
Pb-210	Ra-226	1.000E+00	2.185E-17	6.538E-17	1.517E-16	4.470E-16	1.260E-15	4.639E-15	5.521E-14	6.262E-10
Pb-210	Th-230	1.000E+00	7.733E-21	5.425E-20	2.882E-19	2.629E-18	2.378E-17	3.768E-16	1.903E-14	1.366E-09
Pb-210	U-234	1.000E+00	2.491E-24	3.752E-23	4.420E-22	1.215E-20	3.320E-19	1.913E-17	3.128E-15	6.712E-10
Pb-210	U-238	9.999E-01	0.000E+00	0.000E+00	1.164E-27	9.538E-26	7.790E-24	1.605E-21	8.879E-19	7.646E-13
Pb-210	∑DOSE(j)		2.186E-17	6.543E-17	1.520E-16	4.497E-16	1.284E-15	5.035E-15	7.737E-14	2.664E-09
Th-228	Th-228	1.000E+00	1.008E-08	7.081E-09	3.496E-09	2.957E-10	2.546E-13	4.771E-24	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	7.785E-11	4.814E-10	1.948E-09	7.743E-09	1.524E-08	3.067E-08	2.031E-07	1.541E-04
Th-228	U-236	1.000E+00	9.539E-20	1.307E-18	1.256E-17	1.834E-16	1.478E-15	1.236E-14	2.322E-13	3.993E-10
Th-228	∑DOSE(j)		1.016E-08	7.562E-09	5.444E-09	8.039E-09	1.524E-08	3.067E-08	2.031E-07	1.541E-04
Th-230	Th-230	1.000E+00	6.717E-24	6.908E-24	7.306E-24	8.891E-24	1.558E-23	1.109E-22	3.023E-20	1.011E-11
Th-230	U-234	1.000E+00	4.337E-27	1.333E-26	3.283E-26	1.192E-25	5.985E-25	1.339E-23	9.582E-21	7.092E-12
Th-230	U-238	9.999E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.011E-27	4.454E-24	1.215E-14
Th-230	∑DOSE(j)		6.721E-24	6.921E-24	7.339E-24	9.010E-24	1.618E-23	1.243E-22	3.981E-20	1.721E-11
Th-232	Th-232	1.000E+00	6.614E-28	6.823E-28	7.263E-28	9.035E-28	1.686E-27	1.498E-26	7.679E-24	2.344E-14
Th-232	U-236	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.050E-30	6.104E-20
Th-232	∑DOSE(j)		6.614E-28	6.823E-28	7.263E-28	9.035E-28	1.686E-27	1.498E-26	7.679E-24	2.344E-14
Ra-228	Th-232	1.000E+00	4.313E-12	1.241E-11	2.649E-11	6.019E-11	1.045E-10	2.561E-10	3.088E-09	1.880E-05
Ra-228	U-236	1.000E+00	6.954E-21	4.754E-20	2.387E-19	1.817E-18	1.133E-17	1.062E-16	3.557E-15	4.877E-11
Ra-228	∑DOSE(j)		4.313E-12	1.241E-11	2.649E-11	6.019E-11	1.045E-10	2.561E-10	3.088E-09	1.880E-05
U-234	U-234	1.000E+00	5.030E-23	5.171E-23	5.466E-23	6.636E-23	1.155E-22	8.046E-22	2.059E-19	5.522E-11
U-234	U-238	9.999E-01	0.000E+00	2.281E-28	5.628E-28	2.058E-27	1.054E-26	2.527E-25	2.201E-22	3.217E-13
U-234	∑DOSE(j)		5.030E-23	5.171E-23	5.466E-23	6.637E-23	1.156E-22	8.049E-22	2.061E-19	5.554E-11
U-235	U-235	1.000E+00	3.158E-15	3.220E-15	3.347E-15	3.831E-15	5.639E-15	2.182E-14	1.041E-12	7.821E-07
U-236	U-236	1.000E+00	2.086E-25	2.146E-25	2.271E-25	2.769E-25	4.880E-25	3.544E-24	1.023E-21	4.185E-13
U-238	U-238	5.400E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.305E-24
U-238	U-238	9.999E-01	1.271E-09	1.288E-09	1.323E-09	1.452E-09	1.895E-09	4.812E-09	6.905E-08	7.848E-04
U-238	∑DOSE(j)		1.271E-09	1.288E-09	1.323E-09	1.452E-09	1.895E-09	4.812E-09	6.905E-08	7.848E-04

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	7.000E-02	6.990E-02	6.971E-02	6.903E-02	6.713E-02	6.089E-02	4.608E-02	1.737E-02
Pa-231	U-235	1.000E+00	0.000E+00	1.080E-04	3.230E-04	1.066E-03	3.112E-03	9.415E-03	2.142E-02	2.711E-02
Pa-231	∑S(j):		7.000E-02	7.001E-02	7.003E-02	7.010E-02	7.024E-02	7.031E-02	6.750E-02	4.448E-02
Ac-227	Pa-231	1.000E+00	0.000E+00	2.188E-03	6.331E-03	1.864E-02	4.027E-02	5.533E-02	4.333E-02	1.633E-02
Ac-227	U-235	1.000E+00	0.000E+00	1.699E-06	1.492E-05	1.521E-04	1.088E-03	6.326E-03	1.815E-02	2.474E-02
Ac-227	∑S(j):		0.000E+00	2.190E-03	6.346E-03	1.880E-02	4.136E-02	6.165E-02	6.149E-02	4.107E-02
Ra-226	Ra-226	1.000E+00	3.400E-01	3.395E-01	3.386E-01	3.352E-01	3.259E-01	2.951E-01	2.224E-01	8.259E-02
Ra-226	Th-230	1.000E+00	0.000E+00	3.593E-04	1.076E-03	3.570E-03	1.056E-02	3.351E-02	8.775E-02	1.912E-01
Ra-226	U-234	1.000E+00	0.000E+00	2.310E-07	2.075E-06	2.291E-05	2.023E-04	2.107E-03	1.580E-02	9.615E-02
Ra-226	U-238	9.999E-01	0.000E+00	2.259E-13	6.090E-12	2.244E-10	5.971E-09	2.102E-07	4.918E-06	1.134E-04
Ra-226	∑S(j):		3.400E-01	3.399E-01	3.396E-01	3.388E-01	3.366E-01	3.308E-01	3.260E-01	3.700E-01
Pb-210	Ra-226	1.000E+00	0.000E+00	1.039E-02	3.018E-02	8.987E-02	1.995E-01	2.877E-01	2.277E-01	8.457E-02
Pb-210	Th-230	1.000E+00	0.000E+00	5.527E-06	4.866E-05	5.016E-04	3.693E-03	2.322E-02	7.830E-02	1.843E-01
Pb-210	U-234	1.000E+00	0.000E+00	2.375E-09	6.303E-08	2.201E-06	5.067E-05	1.172E-03	1.285E-02	9.053E-02
Pb-210	U-238	9.999E-01	0.000E+00	1.745E-15	1.394E-13	1.641E-11	1.168E-09	9.778E-08	3.640E-06	1.031E-04
Pb-210	∑S(j):		0.000E+00	1.040E-02	3.022E-02	9.037E-02	2.032E-01	3.121E-01	3.188E-01	3.595E-01
Th-228	Th-228	1.000E+00	3.000E-02	2.088E-02	1.012E-02	8.009E-04	5.709E-07	5.519E-18	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	5.591E-04	3.726E-03	1.688E-02	2.859E-02	2.975E-02	2.975E-02	2.972E-02
Th-228	U-236	1.000E+00	0.000E+00	9.277E-13	1.998E-11	3.754E-10	2.712E-09	1.192E-08	3.396E-08	7.699E-08
Th-228	∑S(j):		3.000E-02	2.144E-02	1.384E-02	1.768E-02	2.859E-02	2.975E-02	2.975E-02	2.972E-02
Th-230	Th-230	1.000E+00	8.300E-01	8.300E-01	8.300E-01	8.299E-01	8.297E-01	8.292E-01	8.275E-01	8.216E-01
Th-230	U-234	1.000E+00	0.000E+00	1.067E-03	3.195E-03	1.060E-02	3.136E-02	9.967E-02	2.619E-01	5.763E-01
Th-230	U-238	9.999E-01	0.000E+00	1.565E-09	1.407E-08	1.558E-07	1.388E-06	1.489E-05	1.216E-04	9.870E-04
Th-230	∑S(j):		8.300E-01	8.311E-01	8.332E-01	8.405E-01	8.611E-01	9.288E-01	1.090E+00	1.399E+00
Th-232	Th-232	1.000E+00	3.000E-02	3.000E-02	3.000E-02	3.000E-02	3.000E-02	3.000E-02	2.999E-02	2.997E-02
Th-232	U-236	1.000E+00	0.000E+00	1.435E-10	4.298E-10	1.426E-09	4.219E-09	1.341E-08	3.530E-08	7.802E-08
Th-232	∑S(j):		3.000E-02	3.000E-02	3.000E-02	3.000E-02	3.000E-02	3.000E-02	2.999E-02	2.997E-02
Ra-228	Th-232	1.000E+00	0.000E+00	3.405E-03	9.091E-03	2.093E-02	2.898E-02	2.975E-02	2.975E-02	2.972E-02
Ra-228	U-236	1.000E+00	0.000E+00	8.309E-12	6.912E-11	5.969E-10	3.079E-09	1.227E-08	3.423E-08	7.709E-08
Ra-228	∑S(j):		0.000E+00	3.405E-03	9.091E-03	2.093E-02	2.898E-02	2.975E-02	2.975E-02	2.972E-02
U-234	U-234	1.000E+00	1.186E+02	1.184E+02	1.181E+02	1.170E+02	1.138E+02	1.033E+02	7.848E+01	2.996E+01
U-234	U-238	9.999E-01	0.000E+00	3.475E-04	1.041E-03	3.452E-03	1.020E-02	3.228E-02	8.370E-02	1.744E-01
U-234	∑S(j):		1.186E+02	1.184E+02	1.181E+02	1.170E+02	1.138E+02	1.034E+02	7.856E+01	3.013E+01
U-235	U-235	1.000E+00	5.110E+00	5.103E+00	5.089E+00	5.040E+00	4.904E+00	4.455E+00	3.385E+00	1.295E+00
U-236	U-236	1.000E+00	2.910E+00	2.906E+00	2.898E+00	2.870E+00	2.793E+00	2.537E+00	1.928E+00	7.374E-01
U-238	U-238	5.400E-05	6.625E-03	6.624E-03	6.623E-03	6.617E-03	6.599E-03	6.538E-03	6.368E-03	5.805E-03
U-238	U-238	9.999E-01	1.227E+02	1.227E+02	1.226E+02	1.225E+02	1.222E+02	1.211E+02	1.179E+02	1.075E+02
U-238	∑S(j):		1.227E+02	1.227E+02	1.226E+02	1.225E+02	1.222E+02	1.211E+02	1.179E+02	1.075E+02

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 8238.53 seconds

APPENDIX S

Alternate Assessment Reports (e.g., Resident Farmer, no cover)
(On enclosed CD)

APPENDIX T

Pond Characterization Report (Andrews Engineering, Inc.)

Honeywell International Inc., Metropolis Works
Massac County, Illinois

Pond Characterization Report

November 2010

Prepared for:
Honeywell International Inc.
2768 North US 45 Road
Metropolis, IL 62960

Prepared by:

ANDREWS
ENGINEERING, INC.
3300 Ginger Creek Drive
Springfield, Illinois 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

TABLE OF CONTENTS

TABLES

FIGURES

EXHIBITS

LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
CaF_2	Calcium Fluoride
CI	Confidence Interval
DOT	U.S. Department of Transportation
EPF	Environmental Protection Facility
FML	Flexible Membrane Liner
HASP	Health and Safety Plan
MCAWW	Methods for Chemical Analysis of Water and Wastes
MTW	Honeywell International Inc. Metropolis Works
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety & Health Administration
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
U.S. EPA	U.S. Environmental Protection Agency

EXECUTIVE SUMMARY

Sampling of the calcium fluoride (CaF_2) ponds at Honeywell International Inc.'s Metropolis Works (MTW) was performed from March through July 2009. The goal of the sampling was to obtain characterization information of the CaF_2 material for the following parameters:

- Uranium
- Uranium Daughter Product Isotopes
- RCRA Toxicity Characteristic Leaching Procedure (TCLP) metals
- Presence of Free Liquids
- pH
- Total Organic Carbon
- Bulk Density
- Cation Exchange Capacity
- Chloride and Sulfide
- Grain Size Distribution

Prior to sampling, the ponds were divided into a total of 213 grids. Figures B-1 through E-1 show the locations of the grids. Composite CaF_2 samples were obtained from the grids and analyzed for total uranium and results reported on an as-is basis. None of the samples contained free water as determined by the paint filter liquids test. At random grid locations, samples were analyzed for additional parameters, listed previously. In addition to the grid samples, pondwide physically composited samples were obtained from B, C, D, and E Ponds.

Two sample types, composite and discrete, were collected from each core. Composite samples are physical composites of the core as retrieved. In these instances, compositing was done after the removal (without replacement) of the discrete samples. Discrete samples are grab samples selected based on their position in the sampler or a particular color (tan, yellow, white, etc.). The discrete samples were a much smaller weighted fraction of the composite.

The sampling results were statistically evaluated to determine if the CaF_2 material is characteristically hazardous in accordance with 35 Illinois Administrative Code (Ill. Adm. Code) 721, Subpart C. Sampling indicates none of the CaF_2 material is characteristically hazardous.

1. INTRODUCTION

1.1 Purpose and Objectives

The purpose of the CaF_2 pond sampling is to gather information necessary to characterize the CaF_2 material and best represent the concentration of the previously listed constituents in each pond.

1.2 Pond Background Overview

MTW's B, C, D, and E Ponds were constructed between 1974 and 1979 and are regulated under its RCRA Part B Permit (Permit No. B-65R and subsequent modifications). The approximate dimensions of each pond are shown below.

Pond ID	Length (feet)	Width (feet)	Depth (feet)
B Pond	306	147	14.25 – 16.5
C Pond	306	147	14.25 – 16.5
D Pond	220	205	14.25 – 16.5
E Pond	539	242	14.25 – 16.5

Based upon a more specific CAD modeling survey, the precise volume of CaF_2 material in the ponds is shown below, corrected for actual pond geometry.

Pond ID	Volume (cubic feet)
B Pond	356,125
C Pond	365,732
D Pond	240,533
E Pond	1,404,863

Material is no longer discharged to B, C, and E Ponds. Water from MTW's EPF is discharged to D Pond for final clarification prior to discharge at MTW's NPDES permitted Outfall 002.

2. FIELD INVESTIGATION PROGRAM

As discussed previously, the goal of the sampling is to characterize the CaF_2 material in the MTW ponds for a number of parameters. Procedures for sample locations, sample collection, analytical parameters, worker safety, and sample shipment are discussed in this section.

2.1 Sample Locations

Prior to sampling, the ponds were divided into the following grids:

B and C Ponds	36 Grid Locations
Approximate Grid Dimensions:	34' x 36'9"
D Pond	36 Grid Locations
Approximate Grid Dimensions:	34'2" x 36'8"
E Pond	105 Grid Locations
Approximate Grid Dimensions:	35'11" x 34'7"

The grid locations are shown in Figures B-1 through E-1. Each grid location is referred by its pond designation (B through E) followed by its numeric designation (ranging from 1 to 105). Thus, the sample located at the southeast corner of C Pond is referred to as C-33; the sample located at the northwest corner of D Pond is referred to as D-6.

Samples were collected from the approximate center of the grids, unless the presence of equipment prohibited movement in the center of a grid.

2.2 Sample Collection Procedures

The following procedures were followed to obtain samples of the CaF_2 material:

1. The grid centers were marked on the pond's perimeter fenceline using surveying ribbon tape.

2. Prior to entering the ponds, samplers were tied off with a harness. The harness was secured to a Bobcat®-mounted winch in the slack position. A minimum of two members of the sampling team remained at the pond shoreline on an emergency, as-needed basis.

3. Two 14-foot, flat-bottomed jon boats were braced together to provide a stable platform from which to perform sampling. One boat was used to perform the material borings, and the other boat was used to record notes and obtain samples. The boat used to obtain borings had a hole cut in the bottom, in which a 2-foot high standpipe was placed to perform the borings.

4. At a minimum, samplers transported the following items onto the ponds in the boats:

   - Sampling jars
   - Small, temporary cooler
   - Small diameter material sampling device and disposable liners
   - Field book for recording notes
   - Latex sampling gloves
   - Two-way radios
   - Five-gallon buckets
   - Digital camera
   - Hand tools
   - Cookie sheets
   - Garbage bags

5. Using the fenceline ribbon tape as a guide, a Bobcat®-mounted winch pulled the flat-bottomed boats across the ponds. A winch line was attached to the boats at the front and back; however, pulling only occurred from the front unless absolutely necessary. Samplers located in the boats used two-way radios to inform the winch operators that the boats were in the appropriate location for sampling.

6. When the boats had reached their intended position, samplers hand augured into the CaF_2 material and obtained samples using the following procedure:

   a. A 2¼-inch diameter valved sampler was utilized. When the sampler is pushed downward, the valve opens allowing material to enter the sampler. When the sampler is pulled upward, the valve closes to maximize the amount of material recovered.

b. Prior to beginning at each grid location, a clean, 3-foot plastic liner was inserted into the sampler. To maximize the amount of material recovered, a soil core catcher was fitted on the end of the liner. The same liner and core catcher was used throughout the borehole at each grid location.

c. With the material sampler's t-handle attached, the sampler was slowly advanced into the CaF_2 material. Extensions to the material sampler were attached as necessary.

d. After advancing the sampler into the material approximately three feet, the sampler was slowly withdrawn. The sampler was withdrawn as close to vertical as possible.

e. The liner was removed from the sampler. A cookie sheet was covered with a clean, plastic garbage bag. The CaF_2 material was removed from the liner by gravity and placed on the lined cookie sheet. Each cookie sheet accommodated material from one sample liner (i.e., three feet). Depending upon the boring location, between one and five sample liner volumes were obtained. After the material had been placed upon the lined cookie sheet, the grid identification, and depth intervals were written on the garbage bag.

f. Notes regarding the approximate amount recovered, appearance and visual consistency of the CaF_2 material were recorded in field books. Photographs of the material were taken to document the appearance of the material. Select photographs are contained in Exhibit 1.

g. Using a putty knife, the CaF_2 material in each cookie sheet was mixed until the material had an approximately visually consistent color. On a new, lined cookie sheet, two to three putty knife scoops of material from each individual sheet was placed. The material in the new cookie sheet was mixed until the material had an approximately visually consistent color. Sample jars were filled from the CaF_2 material on the new cookie sheet.

h. A portion of the composited material was placed into a pond-specific five-gallon bucket.

7. Grid locations marked with "•" on Figures B-1 through E-1.

   a. Where the depth of the boring allowed, a composite sample was collected from the upper and lower halves of the CaF_2 material (i.e., two samples in each boring location). In some locations near the pond shoreline, only one composite sample was obtained. The CaF_2 material was composited using the procedures described in Step 6.

   b. At a minimum, the composite samples were analyzed for the parameters listed below.

Parameter	Method
Total Uranium	EPA SW-846, Method 6010C (ICP)
U-234, U-235, U-238	Alpha Spectroscopy (A-01-R)
Th-232, Th230-Pa231, Th232, Th-234, Pa-234m, Ra-226, Pb-212, Pb-214, Bi-214	Gamma Spectroscopy (Ga-01-R)
RCRA TCLP Metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)	EPA SW-846, Method 1311/6010C
Paint Filter Test	EPA SW-846, Method 9095B
Moisture Content	ASTM D2216

Some of the composite samples were also analyzed for the parameters listed below. The composite samples analyzed for these additional parameters were spaced throughout the ponds to provide an overall characterization.

Parameter	Method
Grain Size Distribution	ASTM D422
Bulk Density	ASTM D-5057-90
Cation Exchange Capacity	EPA SW-846, Method 9081
Chloride	MCAWW, Method 300.0A
Sulfide	MCAWW, Method 376.1
Total Organic Carbon	EPA SW-846, Method 9060

8. All other grid locations.

   a. A composite sample was collected from the entire length of the boring. The CaF_2 material was composited using the procedures described in Step 6.

   b. Discrete samples were obtained from locations where the appearance of the CaF_2 material had a significantly different color. A maximum of three samples were obtained from each of these grid locations (i.e., typically either one discrete and one composite sample or one discrete and two composite samples [(upper and lower]). The discrete samples were selected prior to homogenization for separate evaluation. These discrete samples occupied 2 ounces of the 317-ounce sampling core (0.63 percent).

   c. Samples from these grid locations were analyzed for the following parameters:

Parameter	Method
Total Uranium	EPA SW-846, Method 6010C (ICP)
Moisture Content	ASTM D2216

9. Samples were placed into laboratory-supplied wide-mouth amber glass sample jars.

10. After samples from a grid location had been obtained, the used sampling devices (i.e., liners, gloves, etc.) were placed in a garbage bag. At the end of each day, the garbage bags were placed in 55-gallon drums located within a rubber containment dike. MTW arranged for proper disposal of the used sampling devices. Excess CaF_2 material was returned to the pond.

11. When shipping samples to the laboratory, the procedures listed in Section 2.5 were followed.

2.3 Analytical Parameters

A minimum of one composite uranium sample was obtained from each grid location, except D-6 and D-33. At D-6 and D-33, after three attempts, no CaF_2 material was recovered in the borings (i.e., the borings were not completed), and no sample was obtained.

In addition to the composite uranium samples, discrete uranium samples were obtained if visually distinct (i.e., different colored) layers were observed in the material.

At locations marked with a dot, samples were also collected for:

- RCRA TCLP metals (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)
- Uranium Daughter Product Isotopes
- Chloride and Sulfide
- Cation Exchange Capacity
- Grain Size Distribution
- pH
- Paint Filter Test

2.4 Worker Safety

All sampling personnel were OSHA 40-hour HAZWOPER trained in accordance with 29 CFR 1920. In addition, all sampling personnel received MTW's site-specific general and radiation safety training.

Prior to initiating sampling, a project HASP was developed in accordance with 29 CFR 1910.120. Among other things, the HASP included:

- An identification of potential hazards
- Provisions for minimizing potential hazards
- Worker protection and personal protective equipment
- Communication

- Emergency contacts
- Monitoring
- Daily safety meetings

Prior to sampling, Mr. Joe Johnson, MTW's Safety Supervisor, reviewed the HASP and discussed potential hazards associated with the sampling and CaF_2 material.

2.4.1 *Personal Protective Equipment*

In accordance with 29 CFR 1910.120, each offshore member of the sampling team was equipped with the following modified Level D PPE:

- Hard hat with face shield
- Long-sleeve shirt
- Tyvek suit
- Life jackets (D Pond)
- Safety harness
- Steel-toed boots with boot covers
- Gloves

2.5 Sample Packaging and Shipment

Samples were collected in laboratory-supplied wide-mouth amber glass sample jars. Sample jars were either packed on ice or stored in MTW's laboratory refrigerator prior to shipment to the laboratory.

Sample packaging procedures were:

1. Samples jars were labeled with laboratory supplied labels.

2. In addition to the laboratory supplied labels, all sample jars were labeled as "RADIOACTIVE MATERIAL SAMPLE."

3. Sample jars were securely closed and electrical tape was wrapped around the jar lid.

4. Sample jars were packaged in bubble wrap.

5. Sample jars were packaged in DOT-approved containers for shipment to the analytical laboratory.

    a. A styrofoam cooler was utilized to hold the sample jars and ice. The coolers were sealed with tape and shrink wrap. A member of MTW's Health Physics group scanned the outside of the coolers prior to shipment, then they were placed inside DOT-approved containers for shipment.

    b. Layers of absorbent, which consisted of absorbent mats, were placed at the bottom of the DOT-approved containers.

    c. Shock absorbent packaging material (e.g., bubble wrap or packaging peanuts) was placed around the bottom, sides and top of the styrofoam cooler.

d. Layers of absorbent were placed at the top of the DOT-approved container.

e. Above the absorbent referenced in Item d., additional bubble wrap was placed.

f. Above the bubble wrap, an 8.5"x11" label reading "RADIOACTIVE MATERIAL SAMPLE" was placed.

g. The DOT-approved container was securely closed with packaging tape and shrink wrap.

h. The outside of the DOT-approved container (on one side) was labeled with:

    i. Orientation arrows (i.e., up arrows)
    ii. A label reading "FRAGILE—HANDLE WITH CARE" (this label was placed on two sides of the container, with labels on opposite sides of the container)
    iii. A label with Honeywell's address and the laboratory address
    iv. A UN label with a UN number of 2910
    v. In the event multiple containers were shipped at a time, each container was numbered and showed the total number of containers in the shipment (e.g., 1 of 3, 2 of 3, 3 of 3)

i. A laboratory chain of custody accompanied all sample shipments.

j. Prior to leaving MTW, the DOT containers were scanned by MTW's Health Physics department

k. Samples were transported to the laboratory using MTW's courier service.

3. DISCUSSION OF RESULTS

A summary of the analytical results is contained in the Tables section of this report. Laboratory analytical reports and completed Chain-of-Custody forms are contained in Exhibit 2.

The remainder of this section discusses analytical results for the various parameters that were analyzed.

3.1 Total Uranium

A total of 283 samples were analyzed for total uranium. These samples consisted of:

- 244 grid composite samples
- 35 discrete samples of material of different color
- 4 pondwide composite samples (i.e., pondwide composite samples from B, C, D, and E Ponds)

Tables B-1 through E-1 summarize the results of the composite and discrete samples. Tables B-2 through E-2 summarize the results of the pondwide composite samples. These can be found in the Tables section of this report.

3.2 Uranium Daughter Products Isotopes

A summary of uranium daughter product isotopes is contained in Tables B-3 through E-3.

3.3 RCRA TCLP Metals

A total of 74 samples were analyzed for RCRA TCLP metals. The number of samples per pond is:

- B Pond – 11 samples
- C Pond – 16 samples
- D Pond – 14 samples
- E Pond – 33 samples

None of the 74 samples contained concentrations of RCRA TCLP metals greater than the TCLP limits listed in 35 Ill. Adm. Code 721.124. Tables B-4 through E-4 summarize the RCRA TCLP metal analytical results.

With the exceptions noted in Section 4.2, in accordance with SW-846, Chapter 9, the TCLP metal results were statistically evaluated to determine the 80-percent upper confidence interval (CI) (two-tailed test). Statistical methods are discussed in Section 5. The 80-percent upper CI (two-tailed test) for arsenic, barium, and chromium is shown below.

Pond (sample size)	Arsenic (mg/l) (distribution)	Barium (mg/l) (distribution)	Chromium (mg/l) (distribution)
B Pond (11)	0.058 (log-normal)	0.103 (normal)	0.022 (normal)
C Pond (16)	0.019 (not discernable)	0.057 (normal)	0.0170 (normal)
D Pond (14)	0.089 (normal)	0.073 (normal)	0.154 (not discernable)
E Pond (33)	0.021 (normal)	0.059 (normal)	0.0166 (not discernable)

The data were tested for goodness of fit with various distributions (gamma, log-normal, and normal) and were, for the most part, normally distributed. In cases where the normal distribution did not apply, the 80-percent upper confidence limit of other distributions was sufficiently far below the TCLP threshold, that further data transformations could not result in the 80-percent upper confidence limit exceeding the TCLP regulatory limit. Since the 80-percent upper CI (two-tailed test) for all RCRA TCLP metals is less than the TCLP limit contained in 35 Ill. Adm. Code 721.124, the CaF_2 material is not hazardous for any RCRA metals.

3.4 Paint Filter Test

A total of 75 samples were tested by the Paint Filter test. None of the samples contained free liquids as tested by the Paint Filter test. A summary of the test results is contained in Tables B-5 through E-5.

3.5 pH

A total of 77 samples were tested for pH. A summary of the results is presented in Tables B-5 through E-5.

Sample pH ranged from 10.6 to 12.8 standard units. In accordance with 35 Ill. Adm. Code 721.122, the hazardous waste characteristic of corrosivity applies to aqueous and liquid wastes. There is no regulatory definition of "aqueous." In an April 23, 1993, memorandum, U.S. EPA indicated "...any waste for which this method is applicable must contain at least 20% free water by volume." A copy of the memorandum is contained in Exhibit 3. As discussed in Section 3.4, all of the samples passed the Paint Filter test (i.e., contained no free liquids). As none of the samples contained free liquids, the CaF_2 material contains less than 20 percent free water by volume. Thus, the CaF_2 material does not carry the characteristic of corrosivity.

3.6 Total Organic Carbon

A total of 24 samples were tested for TOC. Tables B-6 through E-6 summarize the results. The TOC content ranged from 0.77 to 11 g/kg (as-is basis).

3.7 Bulk Density

A total of 24 samples were tested for bulk density. Tables B-7 through E-7 summarize the results. The bulk density of the CaF_2 material ranged from 1.1 to 1.9 g/ml (as-is basis).

3.8 Cation Exchange Capacity

A total of 24 samples were tested for cation exchange capacity. Tables B-8 through E-8 summarize the results. The cation exchange capacity ranged from 1.9 to 24.8 meq/100g (as-is basis).

3.9 Chloride and Sulfide

A total of 26 samples were tested for chloride and sulfide. Tables B-9 through E-9 summarize the results. The total chloride concentration ranged from 3.6 to 36 mg/kg (as-is basis). The total sulfide concentration ranged from <10 to 140 mg/kg (as-is basis).

3.10 Grain Size Distribution

A total of 24 samples were tested for grain size distribution. Grain size distribution curves are provided in Exhibit 4. The testing indicated the material particle size ranged from medium sand to clay. The majority of the material particle size is silty with some samples having a particle size of silty clay.

4. STATISTICAL PROCEDURES

4.1 Total Uranium

Prior to sampling, the ponds were divided into a total of 213 grids. Composite CaF_2 samples were obtained from the grids and analyzed for total uranium. At random grid locations samples were analyzed for additional parameters, listed previously. In addition to the grid samples, pondwide physically composited samples were obtained from B, C, D, and E Ponds as were pondwide weighted composite samples. A statistical data reduction was performed on the total uranium concentrations on an as-is basis. The procedures are described below.

4.2 Total Uranium Statistical Procedures

A total of 283 samples were analyzed for total uranium. These samples consisted of:

- 244 grid composite samples
- 35 discrete samples of material of different color
- 4 pondwide composite samples (i.e., pondwide composite samples from B, C, D, and E Ponds)

Tables B-1 through E-1 summarize the results of the composite and discrete samples. Tables B-2 through E-2 summarize the results of the pond-wide composite samples. These can be found in the Tables section of this report.

The final results are presented below and were derived as explained in Sections 4.2.1 – 4.2.3.

Table 4.2-1. Uranium Results Ponds B - E

		Pond E	Pond D	Pond C	Pond B
Individual Samples ($Ln(x_i)$)	**Mean Uranium (mg/kg) (as-is basis)**	203	245	287	240
	N (all data)	105	34	36	26
	Distribution	Ln Normal	Ln Normal	Ln Normal	Ln Normal
	95% Upper Confidence Limit Uranium (mg/kg) (one-tailed test) (as-is basis)	223	347	365	320
	Result	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg	95% UCL < 500 mg/kg

A total of three approaches were used/considered in the data reduction process resulting in the results in Table 4.2-1.

4.2.1. Weighted combinations to result in one concentration per core sample

4.2.2. Removal of data associated with severe defects in quality control samples as reported by the laboratory

4.2.3. Data transformations to normalize the data

Table 4.2-2 summarizes the data reduction process. Each of these three approaches will be described in Sections 4.2.1 – 4.2.3 below.

Table 4.2-2. Results of Data Reduction Process

Pond	Original Number of Samples	Number of Samples Weighted to Result in One Concentration per Core Sample (Section 4.2.1)	Number of Samples Associated with Severe Defects in Quality Control (MS/MSD)** (Section 4.2.2)	Remaining Observations
B	46	10	10	26
C	45	9	0	36
D	54	20	0	34
E	134	29	0	105
Total	279 (244 grid composite; 35 discrete samples)	68	10	201

*** Lab batch ID 9082046 and associated data removed (Pond B). MSD and MS amounts were less than 4 times the sample concentration so MS and MSD could be evaluated as to their impact on data. MS and MSD recovery was 406 and 0.87 percent, respectively and were determined to introduce unacceptable and indeterminate bias to the uranium results.*

4.2.1 Weighted Combinations to Result in One Concentration Per Core Sample

Two sample types from each core were considered: composite and discrete. Composite samples were physical composites of the core as retrieved. In these instances, compositing was done after the removal (without replacement) of the discrete samples. Discrete samples are grab samples selected based on their position in the sampler or a particular color (tan, yellow, white, etc.). The discrete samples were a much smaller weighted fraction of the composite and were weighted as follows. The weighting was done by considering the overall volume recovered from a boring (317 ounces). Of this volume, 2 ounces was the volume of a discrete sample. Therefore, if a discrete and a continuous sample arose from the same location the concentration of the location was computed by weighting as follows: [0.9937*composite concentration + 0.0063*discrete concentration]. The 0.0063 value is 2/317 = 0.0063. In other cases, the sampler was sectioned into an upper and a lower portion of equal volumes. In these cases the concentration of the location was computed by assigning equal weights to the upper and lower halves of the sampler: 0.50*[concentration of upper half] + 0.50*[concentration of lower half]. The variations in sampling and associated calculations are summarized below and in Table 4.2-3.

(a) Samples in which there are upper and lower halves:
These samples are designated as "lower" and "upper" and x_i for the sample was computed be equal weighting: $0.5(x_{lower}) + 0.5(x_{upper})$.

(b) Samples in which there were discrete and composite samples from the same boring:
These samples were volume weighted as indicated above and x_i computed as follows: $0.0063(x_{discrete}) + 0.9937(x_{composite})$

(c) Samples in which there were discrete samples as well as upper and lower halves from the same boring:
These samples were weighted and x_i was computed as follows: $0.0063(x_{discrete}) + 0.4969(x_{upper}) + 0.4969(x_{lower})$.

Table 4.2-3. Summary of the Samples Combined to Represent One Result per Core Sample

Pond	Original Number of Samples	Number of Composite and Discrete Samples Mathematically Combined
B	46	10
C	45	9
D	54	20
E	134	29
Total	279 (244 grid composite; 35 discrete samples)	68

This process of weighting is consistent with SW-846 Chapter 9 (September 1986) and prevents undue weighting to any one core sample or set of core samples.

4.2.2 Removal of Data Associated with Severe Defects in Quality Control Samples as Reported by the Laboratory

TestAmerica performed matrix spike (MS) and matrix spike duplicate (MSD) analysis on various uranium samples at a rate of approximately one of each per batch. Each uranium batch consisted of approximately 10 total uranium samples (but in no event exceeded 20 samples). A total of 34 MS and MSD samples were analyzed, corresponding to the 34 batches of total uranium samples. Tables B-10 through E-10 summarize the laboratory MS and MSD recoveries.

In the MS and MSD samples where the sample concentration exceeded four times the spike amount, neither the MS nor the MSD percentage recovery results from that laboratory batch were considered for review. This is generally referred to as "the 4x rule." As a result of this review, the MS and MSD results (not the uranium results) for these laboratory batches were removed from statistical evaluation of the MS and MSD recoveries. However, as noted above, the uranium results from samples associated these MS and MSDs were valid and retained for calculations of the mean and standard deviations of the uranium concentrations.

In addition, the percent recoveries for the MS and MSD for samples (B Pond) B-21 LIQ, B-20 U, and B-18 U were reported as 0.87 and 406 percent. The amount of these spikes was less than 4x the sample concentration so the MS and MSD recovery information from these QC samples was usable. Unfortunately, the MS recovery was 406 percent and the MSD recovery was 0.87 percent. Not only was the recovery of both QC spikes unacceptable, but the difference in the MS and MSD recovery was too wide to be acceptable and outside of laboratory control limits. Due to their extreme difference from the ideal percent recovery of 70 to 130 percent, and the RPD of 20 percent between the MS and MSD, all of the uranium results from discrete and composite samples in this laboratory batch (9082046) were removed from statistical evaluation in accordance with professional judgment (MARSSIM Section 9.3.2.1; Appendix N [Tables N1 and N3]). In any event, these results would receive a "J" or estimated flag according to US EPA National Functional Guidelines for Inorganic Data Review. In some cases, estimated results can be considered as usable, but in this case were judged to be sufficiently defective to impart significant bias to these statistical evaluations.

4.2.3 Data transformations to normalize the data

U.S. EPA through SW-846 and its statistical software package Scout (Version 1.0, 2008) requires data normalization and testing of data distributions. Data transformations include log transforms as one of the more preferred. Transformation of the data is always preferred when considering parametric/non-parametric statistics. A log transformation using parametric alternatives is preferred to the use of non-parametric alternatives to compute the appropriate statistics. This method of data transformation is also discussed in EPA publication SW-846.

4.3 RCRA TCLP Metals

The RCRA TCLP metal results were statistically evaluated to determine if the CaF_2 material in any of the Ponds is characteristically hazardous. The statistical evaluation was performed in accordance with procedures identified in EPA SW-846, Chapter 9. Statistical tests were performed using U.S. EPA's Scout 2008 Version 1.00.01 software (Scout). Scout may be downloaded at: http://www.epa.gov/esd/databases/scout/abstract.htm. With the exceptions noted below, the TCLP metal results were statistically evaluated to determine the 80-percent upper CI using a two-tailed test. This is equivalent to a 90-percent upper confidence interval using a one- tailed test (SW-846, Chapter 9).

A statistical evaluation was not performed for the RCRA metals cadmium, lead, mercury, selenium, and silver. A statistical evaluation was not performed on these metals because the vast majority of analytical results were non-detects. Where results were reported, the results were estimated results, below the laboratory's reporting limit. The table below lists the number of reported, estimated results for cadmium, lead, selenium, and silver, and the laboratory's reporting limit.

TCLP Parameter	Number of Reported, Estimated Results	Laboratory TCLP Reporting Limit (mg/l)
Cadmium	10	0.01
Lead	4	0.04
Selenium	1	0.03
Silver	1	0.02

Mercury had two results (both 0.0014 mg/l) reported at above the laboratory's reporting limit (0.001 mg/l). As only two of the 74 analytical results for mercury were reported above the laboratory's reporting limit, and were much less than the RCRA TCLP limit of 0.2 mg/l, a statistical evaluation was not performed for mercury.

The 80-percent upper CI (two-tailed test) along with the normalizing distribution for arsenic, barium, and chromium is the following table.

Pond (sample size)	Arsenic (mg/l) (distribution)	Barium (mg/l) (distribution)	Chromium (mg/l) (distribution)
B Pond (11)	0.058 (log-normal)	0.103 (normal)	0.022 (normal)
C Pond (16)	0.019 (not discernable)	0.057 (normal)	0.0170 (normal)
D Pond (14)	0.089 (normal)	0.073 (normal)	0.154 (not discernable)
E Pond (33)	0.021 (normal)	0.059 (normal)	0.0166 (not discernable)

The data were tested for goodness of fit with various distributions (gamma, log-normal and normal) and were, for the most part, normally distributed. In cases where the normal distribution did not apply, the 80-percent upper confidence limit of other distributions evaluated by U.S. EPA sponsored ProUCL Version 4.0 was sufficiently far below the TCLP threshold that further data transformations could not result in the 80-percent upper confidence limit exceeding the TCLP regulatory limit. Since the 80-percent upper CI (two-tailed test) for all RCRA TCLP metals is less than the TCLP limit contained in 35 Ill. Adm. Code 721.124, the CaF_2 material is not hazardous for any RCRA metals. Exhibit 5 contains output from Scout.

5. CONCLUSIONS

Sampling of MTW's CaF_2 ponds was completed to obtain characterization information of the CaF_2 material.

The sampling of the CaF_2 material indicates the material is not a characteristically hazardous waste in accordance with 35 Ill. Adm. Code 721, Subpart C.

Corporate Headquarters
Springfield Branch Office
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334
Fax: (217) 787-9495
marketing@andrews-eng.com

Pontiac Branch Office
215 West Washington Street
Pontiac, IL 61764
Tel: (815) 842-2042
Fax: (815) 842-2159
pont@andrews-eng.com

Indianapolis Branch Office
7478 Shadeland Station Way
Indianapolis, IN 46256
Tel: (317) 595-6492
Fax: (317) 598-9929
indy@andrews-eng.com

Naperville Branch Office
1701 Quincy Avenue, Suite 25
Naperville, IL 60540
Tel: (630) 544-3332
Fax: (630) 544-3398
naperville@andrews-eng.com

St. Louis Branch Office
131 W. Booneslick Road
Warrenton, MO 63383
Tel: (636) 456-6387
Fax: (636) 456-6389
stl@andrews-eng.com

Table B-1
B Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Core Weighted Averages, U mg/kg (X_iA_i) Samples Meeting Quality Control Criteria	Ln(A_iX_i) All Samples	Ln(A_iX_i) Samples Meeting Quality Control Criteria
B-01	B-1	238	1	238	238	5.472271	5.472271
B-02	B-2	240	1	240	240	5.480639	5.480639
B-03	B-3	323	1	323	323	5.777652	5.777652
B-04	B-4	214	1	214	214	5.365976	5.365976
B-05	**B-5 Lower**	**321**	**0.5**	**331**	**331**	**5.800607**	**5.800607**
	B-5 Upper	**340**	**0.5**				
B-06	B-6	206	1	206	206	5.327876	5.327876
B-07	B-7	289	1	289	289	5.666427	5.666427
B-08	B-8	1,950	1	1950	1950	7.575585	7.575585
B-09	B-9	308	1	308	308	5.730100	5.730100
B-10	**B-10 Lower**	**297**	**0.5**	**246**	**246**	**5.505332**	**5.505332**
	B-10 Upper	**195**	**0.5**				
B-11	B-11	66.6	1	66.6	66.6	4.198705	4.198705
B-12	B-12	336	1	336	336	5.817111	5.817111
B-13	**B-13**	**105**	**0.994**	**108**	**108**	**4.673763**	**4.673763**
	B-13 LIQ	**455**	**0.006**				
B-14	B-14	183	1	183	183	5.209486	5.209486
B-15	B-15	177	1	177	177	5.176150	5.176150
B-16	B-16	514	1	514	514	6.242223	6.242223
B-17	B-17	1,640	1	1640	1640	7.402452	7.402452
B-18	**B-18 Lower**	126	0.497	178.703		5.185725	
	B-18 Upper	229	0.497				
	B-18U	**378**	0.006				
B-19	**B-19 Lower**	213	0.5	210.5		5.349486	
	B-19 Upper	208	0.5				
B-20	**B-20**	199	0.994	202.018		5.308357	
	B-20U	**702**	0.006				
B-21	**B-21**	110	0.994	110.618		4.706083	
	B-21 LIQ	**213**	0.006				
B-22	B-22	136	1	136		4.912655	
B-23	B-23	221	1	221		5.398163	
B-24	B-24	332	1	332		5.805135	
B-25	B-25	162	1	162		5.087596	
B-26	**B-26 Lower**	95	0.5	88.4		4.481872	
	B-26 Upper	81.8	0.5				
B-27	B-27	146	1	146		4.983607	

Table B-1
B Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Core Weighted Averages, U mg/kg (X_iA_i) Samples Meeting Quality Control Criteria	Ln(A_iX_i) All Samples	Ln(A_iX_i) Samples Meeting Quality Control Criteria
B-28	B-28	258	1	258	258	5.552960	5.552960
B-29	B-29	196	1	196	196	5.278115	5.278115
B-30	**B-30 Lower**	**98.8**	**0.5**	**198**	**198**	**5.290285**	**5.290285**
	B-30 Upper	**298**	**0.5**				
B-31	B-31	224	1	224	224	5.411646	5.411646
B-32	B-32	304	1	304	304	5.717028	5.717028
B-33	B-33	37.7	1	37.7	37.7	3.629660	3.629660
B-34	B-34	40.2	1	40.2	40.2	3.693867	3.693867
B-35	B-35	331	1	331	331	5.802118	5.802118
B-36	B-36	296	1	296	296	5.690359	5.690359
	Average					5.380752	5.480323
	95% UCL (1-tail)					5.5911	5.75698
	Average (transformed from Ln)					217	**240**
	95% UCL (1-tail) (transformed from Ln)					268	**320**

Cells with light gray background represent discrete subsamples that were analyzed separately because they differed in color or other characteristic from the surrounding core material. The results from these subsamples were weighted by their mass and included as a part of a weighted average for the core as a whole, as shown in columns 5 and 6 (Core Weighted Averages).

Cells with darker gray background (B-18 through B-27) represent *samples that were unusable because the asociated matrix spike data did not meet quality control criteria.*

*B-13 example: (0.994*105)+(0.006*455) = 108 mg/kg U (as-is)*

Table C-1
C Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Ln(A_iX_i)
C-01	C-1	159	1	159	5.068904
C-02	C-2	320	1	320	5.768321
C-03	C-3	361	1	361	5.888878
C-04	C-4	606	1	606	6.40688
C-05	C-5	303	1	303	5.713733
C-06	**C-6 (COMPOSITE)**	**193**	**0.988**	**206**	**5.327216**
	C-6 U 12.00'-12.50'	**1,370**	**0.006**		
	C-6 U 2.00'-2.50'	**1,160**	**0.006**		
C-07	C-7	1,770	1	1770	7.478735
C-08	C-8	309	1	309	5.733341
C-09	C-9	145	1	145	4.976734
C-10	**C-10 Lower**	**2,000**	**0.5**	**1052**	**6.957973**
	C-10 Upper	**103**	**0.5**		
C-11	C-11	184	1	184	5.214936
C-12	C-12	111	1	111	4.70953
C-13	C-13	133	1	133	4.890349
C-14	C-14	116	1	116	4.75359
C-15	C-15	170	1	170	5.135798
C-16	C-16	151	1	151	5.01728
C-17	C-17	284	1	284	5.648974
C-18	C-18	124	1	124	4.820282
C-19	**C-19 Lower**	**218**	**0.5**	**181**	**5.198497**
	C-19 Upper	**144**	**0.5**		
C-20	C-20	138	1	138	4.927254
C-21	**C-21**	**4,630**	**0.994**	**4647**	**8.444076**
	C-21U	**7,540**	**0.006**		
C-22	C-22	1,850	1	1850	7.522941
C-23	C-23	213	1	213	5.361292
C-24	C-24	117	1	117	4.762174
C-25	C-25	355	1	355	5.872118
C-26	**C-26 Lower**	**579**	**0.497**	**505**	**6.224061**
	C-26 Upper	**418**	**0.497**		
	C-26U	**1,540**	**0.006**		
C-27	C-27	216	1	216	5.375278
C-28	C-28	137	1	137	4.919981
C-29	C-29	236	1	236	5.463832
C-30	**C-30 Lower**	**412**	**0.497**	**492**	**6.198064**
	C-30 Upper	**476**	**0.497**		
	C-30U	**8,410**	**0.006**		
C-31	C-31	298	1	298	5.697093
C-32	C-32	158	1	158	5.062595
C-33	C-33	286	1	286	5.655992
C-34	C-34	555	1	555	6.318968
C-35	C-35	293	1	293	5.680173
C-36	C-36	259	1	259	5.556828
	Average				5.659796
	95% UCL (1-tail)				5.8999
	Average (transformed from Ln)				**287**
	95% UCL (1-tail) (transformed from Ln)				**365**

Cells with light gray background represent discrete subsamples that were analyzed separately because they differed in color or other characteristic from the surrounding core material. The results from these subsamples were weighted by their mass and included as a part of a weighted average for the core as a whole, as shown in columns 5 and 6 (Core Weighted Averages).

*C-06 example: (0.988*193)+(0.006*1370)*(0.006*1160) = 206 mg/kg U (as-is)*

Honeywell International Inc.
Metropolis Works

Table D-1
D Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	$Ln(A_iX_i)$
D-01	D-1	113	1	113	4.727388
D-02	D-2	103	1	103	4.634729
D-03	D-3	170	1	170	5.135798
D-04	D-4	105	1	105	4.65396
D-05	D-5	297	1	297	5.693732
D-07	**D-7**	**129**	**0.994**	**132**	**4.88212**
	D-7 Yellow	**614**	**0.006**		
D-08	**D-8**	**558**	**0.006**	**546**	**6.30184**
	D-8 Lower	**907**	**0.497**		
	D-8 Upper	**184**	**0.497**		
D-09	D-9	1,210	1	1210	7.098376
D-10	**D-10**	**447**	**0.006**	**686**	**6.530236**
	D-10 Lower	**756**	**0.497**		
	D-10 Upper	**618**	**0.497**		
D-11	**D-11**	**658**	**0.006**	**801**	**6.686031**
	D-11 Lower	**1,180**	**0.497**		
	D-11 Upper	**424**	**0.497**		
D-12	D-12	83.2	1	83.2	4.421247
D-13	D-13	101	1	101	4.615121
D-14	**D-14**	**389**	**0.994**	**400**	**5.992179**
	D-14 U @ 6.0'	**2,270**	**0.006**		
D-15	**D-15**	**901**	**0.994**	**900**	**6.802153**
	D-15 U	**698**	**0.006**		
D-16	**D-16**	**941**	**0.994**	**941**	**6.846624**
	D-16 U @ 5.75'	**891**	**0.006**		
D-17	**D-17**	**437**	**0.006**	**809**	**6.695497**
	D-17 Lower	**1,280**	**0.497**		
	D-17 Upper	**342**	**0.497**		
D-18	D-18	72.8	1	72.8	4.287716
D-19	**D-19**	**82**	**0.006**	**70.5**	**4.255886**
	D-19 Lower	**70.2**	**0.497**		
	D-19 Upper	**70.7**	**0.497**		
D-20	D-20	286	1	286	5.655992
D-21	D-21	401	1	401	5.993961
D-22	D-22	2,990	1	2990	8.003029
D-23	D-23	852	1	852	6.747587
D-24	D-24	59.2	1	59.2	4.080922
D-25	D-25	68.5	1	68.5	4.226834

Honeywell International Inc.
Metropolis Works

Table D-1
D Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Ln(A_iX_i)
D-26	**D-26**	**258**	**0.006**	**2210**	**7.70079**
	D-26 Lower	**2,150**	**0.494**		
	D-26 Upper	**2,320**	**0.494**		
	D-26 U @ 8.50'	**60.7**	**0.006**		
D-27	D-27	326	1	326	5.786897
D-28	**D-28**	**307**	**0.994**	**310**	**5.737153**
	D-28 U @ 7.00'	**837**	**0.006**		
D-29	**D-29**	**530**	**0.006**	**383**	**5.94904**
	D-29 Lower	**628**	**0.497**		
	D-29 Upper	**137**	**0.497**		
D-30	D-30	62.2	1	62.2	4.130355
D-31	D-31	76.3	1	76.3	4.334673
D-32	D-32	37.9	1	37.9	3.634951
D-34	D-34	103	1	103	4.634729
D-35	D-35	684	1	684	6.527958
D-36	D-36	39.3	1	39.3	3.671225
	Average				5.50226
	95% UCL (1-tail)				5.84935
	Average (transformed from Ln)				**245**
	95% UCL (1-tail) (transformed from Ln)				**347**

Cells with light gray background represent discrete subsamples that were analyzed separately because they differed in color or other characteristic from the surrounding core material. The results from these subsamples were weighted by their mass and included as a part of a weighted average for the core as a whole, as shown in columns 5 and 6 (Core Weighted Averages).

*D-08 example: (0.006*558)+(0.497*907)+(0.497*184) = 546 mgkg U (as-is)*

Honeywell International Inc.
Metropolis Works

Table E-1
E-Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Ln(A_iX_i)
E-001	E-1	449	1	449	6.107023
E-002	E-2	335	1	335	5.814131
E-003	E-3	301	1	301	5.707110
E-004	E-4	125	1	125	4.828314
E-005	E-5	207	1	207	5.332719
E-006	E-6	161	1	161	5.081404
E-007	E-7	139	1	139	4.934474
E-008	E-8	236	1	236	5.463832
E-009	E-9	235	1	235	5.459586
E-010	**E-10 Lower**	**215**	**0.497**	**210**	**5.344876**
	E-10 U	**2,120**	**0.006**		
	E-10 Upper	**181**	**0.497**		
E-011	E-11	320	1	320	5.768321
E-012	**E-12 Lower**	**312**	**0.5**	**348**	**5.850765**
	E-12 Upper	**383**	**0.5**		
E-013	E-13	147	1	147	4.990433
E-014	E-14	141	1	141	4.948760
E-015	E-15	260	1	260	5.560682
E-016	**E-16 Lower**	**188**	**0.5**	**253**	**5.531411**
	E-16 Upper	**317**	**0.5**		
E-017	E-17	288	1	288	5.662960
E-018	E-18	445	1	445	6.098074
E-019	E-19	314	1	314	5.749393
E-020	E-20	926	1	926	6.830874
E-021	E-21	254	1	254	5.537334
E-022	E-22	415	1	415	6.028279
E-023	**E-23 Lower**	**439**	**0.5**	**318**	**5.762051**
	E-23 Upper	**197**	**0.5**		
E-024	E-24	238	1	238	5.472271
E-025	E-25	106	1	106	4.663439
E-026	E-26	531	1	531	6.274762
E-027	**E-27 Lower**	**676**	**0.5**	**358**	**5.879695**
	E-27 Upper	**39.4**	**0.5**		
E-028	E-28	199	1	199	5.293305
E-029	E-29	429	1	429	6.061457
E-030	E-30	235	1	235	5.459586
E-031	E-31	206	1	206	5.327876
E-032	E-32	197	1	197	5.283204
E-033	E-33	989	1	989	6.896694
E-034	E-34	344	1	344	5.840642
E-035	E-35	66	1	66	4.189655
E-036	E-36	201	1	201	5.303305
E-037	E-37	486	1	486	6.186209
E-038	**E-38 Lower**	**302**	**0.5**	**218**	**5.384495**
	E-38 Upper	**134**	**0.5**		
E-039	E-39	202	1	202	5.308268
E-040	E-40	474	1	474	6.161207
E-041	**E-41 Lower**	**455**	**0.5**	**446**	**6.100319**
	E-41 Upper	**437**	**0.5**		
E-042	E-42	148	1	148	4.997212
E-043	E-43	239	1	239	5.476464
E-044	**E-44 Lower**	**309**	**0.5**	**234**	**5.453182**
	E-44 Upper	**158**	**0.5**		
E-045	E-45	580	1	580	6.363028
E-046	E-46	195	1	195	5.273000
E-047	E-47	275	1	275	5.616771
E-048	E-48	126	1	126	4.836282
E-049	E-49	218	1	218	5.384495
E-050	E-50	247	1	247	5.509388
E-051	**E-51 Lower**	**294**	**0.5**	**239**	**5.476464**
	E-51 Upper	**184**	**0.5**		
E-052	E-52	96.4	1	96.4	4.568506
E-053	E-53	215	1	215	5.370638

Honeywell International Inc.
Metropolis Works

Table E-1
E-Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Ln(A_iX_i)
E-054	E-54	125	1	125	4.828314
E-055	E-55	184	1	184	5.214936
E-056	E-56	120	1	120	4.787492
E-057	E-57	693	1	693	6.541030
E-058	E-58	122	1	122	4.804021
E-059	E-59	297	1	297	5.693732
E-060	E-60	410	1	410	6.016157
E-061	E-61	137	1	137	4.919981
E-062	E-62	261	1	261	5.564520
E-063	E-63	142	1	142	4.955827
E-064	E-64	111	1	111	4.709530
E-065	**E-65 Lower**	**397**	**0.5**	**259**	**5.556828**
	E-65 Upper	**121**	**0.5**		
E-066	E-66	331	1	331	5.802118
E-067	**E-67 Lower**	**1,280**	**0.5**	**689**	**6.535532**
	E-67 Upper	**98.4**	**0.5**		
E-068	E-68	98	1	98	4.584967
E-069	E-69	672	1	672	6.510258
E-070	E-70	121	1	121	4.795791
E-071	E-71	99.1	1	99.1	4.596129
E-072	E-72	262	1	262	5.568345
E-073	E-73	118	1	118	4.770685
E-074	**E-74 Lower**	**188**	**0.5**	**136**	**4.912287**
	E-74 Upper	**83.9**	**0.5**		
E-075	E-75	166	1	166	5.111988
E-076	E-76	97.1	1	97.1	4.575741
E-077	E-77	167	1	167	5.117994
E-078	E-78	93.8	1	93.8	4.541165
E-079	**E-79 Lower**	**193**	**0.5**	**134**	**4.897840**
	E-79 Upper	**75**	**0.5**		
E-080	**E-80 Lower**	**245**	**0.5**	**184**	**5.212215**
	E-80 Upper	**122**	**0.5**		
E-081	**E-81**	**162**	**0.994**	**165**	**5.107980**
	E-81 U	**718**	**0.006**		
E-082	E-82	155	1	155	5.043425
E-083	E-83	119	1	119	4.779123
E-084	E-84	83.9	1	83.9	4.429626
E-085	E-85	83.2	1	83.2	4.421247
E-086	E-86	190	1	190	5.247024
E-087	E-87	224	1	224	5.411646
E-088	**E-88**	**185**	**0.994**	**187**	**5.229557**
	E-88 U	**470**	**0.006**		
E-089	**E-89**	**146**	**0.988**	**146**	**4.984560**
	E-89 U1	**71.2**	**0.006**		
	E-89 U2	**244**	**0.006**		
E-090	**E-90**	**122**	**0.994**	**122**	**4.803923**
	E-90 U	**120**	**0.006**		
E-091	E-91	80.9	1	80.9	4.393214
E-092	E-92	147	1	147	4.990433
E-093	**E-93**	**271**	**0.994**	**270**	**5.598261**
	E-93 Grey	**97.1**	**0.006**		
E-094	**E-94**	**152**	**0.994**	**152**	**5.021711**
	E-94 Tan	**97.1**	**0.006**		
E-095	**E-95**	**223**	**0.994**	**226**	**5.421092**
	E-95 U	**744**	**0.006**		
E-096	**E-96**	**202**	**0.988**	**201**	**5.302519**
	E-96 Tan	**103**	**0.006**		
	E-96 White	**108**	**0.006**		
E-097	**E-97 Lower**	**216**	**0.497**	**149**	**5.003376**
	E-97 U	**110**	**0.006**		
	E-97 Upper	**82.3**	**0.497**		

Honeywell International Inc.
Metropolis Works

Table E-1
E-Pond - Total Uranium Analytical Summary - All Samples

Sort ID	Sample ID	Individual Samples, U mg/kg (X_i)	Sample Weights (A_i)	Core Weighted Averages, U mg/kg (X_iA_i)	Ln(A_iX_i)
E-098	E-98	65.1	1	65.1	4.175925
E-099	E-99	103	1	103	4.634729
E-100	E-100	156	1	156	5.049856
E-101	E-101	155	1	155	5.043425
E-102	E-102	159	1	159	5.068904
E-103	E-103	136	0.006	109	4.687812
	E103 Lower	145	0.497		
	E-103 Upper	71.9	0.497		
E-104	E-104	107	1	107	4.672829
E-105	E-105	89.7	1	89.7	4.496471
	Average				5.313797
	95% UCL (1-tail)				5.40652
	Average (transformed from Ln)				**203**
	95% UCL (1-tail) (transformed from Ln)				**223**

Cells with light gray background represent discrete subsamples that were analyzed separately because they differed in color or other characteristic from the surrounding core material. The results from these subsamples were weighted by their mass and included as a part of a weighted average for the core as a whole, as shown in columns 5 and 6 (Core Weighted Averages).

*E-10 example: (0.497*215)+(0.006*2120)+(0.497*181) = 210 mg/kg U (as-is)*

Honeywell International Inc.
Metropolis Works

Table B-2
B Pond - Pond Wide Composite Total Uranium Analytical Summary

Sample ID	Parameter	Units	Result
B-Pond Comp	Uranium	mg/kg	249

Honeywell International Inc.
Metropolis Works

Table C-2
C Pond - Pond Wide Composite Total Uranium Analytical Summary

Sample ID	Parameter	Units	Result
C-Pond Comp	Uranium	mg/kg	352

Table D-2
D Pond - Pond Wide Composite Total Uranium Analytical Summary

Sample ID	Parameter	Units	Result
D-Pond Comp	Uranium	mg/kg	574

Honeywell International Inc.
Metropolis Works

Table E-2
E-Pond - Pond Wide Composite Total Uranium Analytical Summary

Sample ID	Parameter	Units	Result
E-Pond Comp	Uranium	mg/kg	168

Honeywell International Inc.
Metropolis Works

Table B-3
B Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	B-2	B-5 Lower	B-5 Upper	B-10 Lower	B-10 Upper	B-18 Lower	B-18 Upper
Bismuth 214	pCi/g	0.29	1.37	0.749286	1.36	0.89	0.69	0.76	0.75	0.6	1.37
Bismuth 214 (counting error)	pCi/g	0.2	0.48	0.291429	0.48	0.3	0.29	0.29	0.28	0.31	0.41
Lead 212	pCi/g	-0.1	0.5	0.143571	0.5	< 0.26	0.33	< 0.09	< 0.06	< 0.03	0.38
Lead 212 (counting error)	pCi/g	0.15	4.8	0.610714	0.23	< 0.22	0.2	< 0.16	< 0.15	< 0.18	0.22
Lead 214	pCi/g	0.33	1.68	0.900714	1.36	1.14	0.65	0.72	1.28	0.67	1.68
Lead 214 (counting error)	pCi/g	0.18	0.37	0.259286	0.31	0.33	0.2	0.27	0.37	0.24	0.35
Potassium 40	pCi/g	2.5	10.1	5.95		4.6				6.7	
Potassium 40 (counting error)	pCi/g	1.4	2.7	1.933333		1.7				2	
Protactinium 231	pCi/g	-0.8	1.1	-0.05714	< -0.8	< 0	< 1.1	< 0.02	< -0.02	< -0.4	< -0.6
Protactinium 231 (counting error)	pCi/g	1.5	2.7	2.121429	< 2.7	< 2.4	< 1.5	< 2.1	< 2.3	< 2.6	< 2.7
Protactinium 234M	pCi/g	61	329	160.9286	186	200	159	153	191	170	329
Protactinium 234M (counting error)	pCi/g	20	43	29.07143	33	30	28	30	32	29	43
Radium (226)	pCi/g	0.29	1.37	0.749286	1.36	J 0.89	J 0.69	J 0.76	J 0.75	J 0.6	1.37
Radium (226) (counting error)	pCi/g	0.2	0.48	0.291429	0.48	J 0.3	J 0.29	J 0.29	J 0.28	J 0.31	0.41
Thorium 228	pCi/g	0.0003	0.53	0.146736	J 0.53	< 0.17	< 0.16	< 0.034	J 0.19	< 0.08	< 0.15
Thorium 228 (counting error)	pCi/g	0.051	0.25	0.133714	J 0.25	< 0.15	< 0.15	< 0.095	J 0.14	< 0.12	< 0.15
Thorium 230	pCi/g	1.11	9	3.932857	8.4	9	7.1	2.64	3.56	J 1.6	4.34
Thorium 230 (counting error)	pCi/g	0.35	1.2	0.675714	1.1	1.2	1	0.56	0.66	J 0.41	0.75
Thorium 232	pCi/g	-0.1	0.28	0.131429	< 0.28	< 0.2	< 0.23	< 0.04	< 0.12	< 0.17	< 0.22
Thorium 232 (counting error)	pCi/g	0.26	0.5	0.320714	< 0.32	< 0.26	< 0.28	< 0.3	< 0.35	< 0.32	< 0.3
Thorium 234	pCi/g	60.3	287	142.0071	171	204	156	122	180	146	287
Thorium 234 (counting error)	pCi/g	5.6	25	13.02143	16	18	14	12	16	14	25
Uranium 234	pCi/g	41.8	248	114.0643	154	174	130	88	142	120	248
Uranium 234 (counting error)	pCi/g	4	22	12.45	18	19	16	11	17	11	22
Uranium 235	pCi/g	3.43	14.4	7.310714	9.4	10.2	7.77	6.8	9.1	7.5	14.4
Uranium 235 (counting error)	pCi/g	0.71	1.6	1.060714	1.4	1.2	0.99	1.1	1.1	1.2	1.6
Uranium 235/236	pCi/g	2.25	11.7	6.654286	J 11.2	J 11.5	J 10.3	J 7.1	J 9.5	5.8	11.7
Uranium 235/236 (counting error)	pCi/g	0.55	3.8	2.157857	J 3.8	J 3.8	J 3.7	J 2.9	J 3.4	1.1	2.1
Uranium 238	pCi/g	41.1	257	119.1214	170	176	135	86	148	122	257
Uranium 238 (counting error)	pCi/g	4	23	12.81429	19	20	16	11	17	11	23

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. *The associated method blank contains the target analyte at a reportable level.*

Honeywell International Inc.
Metropolis Works

Table B-3
B Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	B-19 Lower	B-19 Upper	B-26 Lower	B-26 Upper	B-30 Lower	B-30 Upper	B-35
Bismuth 214	pCi/g	0.29	1.37	0.749286	0.75	0.77	0.51	0.39	0.5	0.86	< 0.29
Bismuth 214 (counting error)	pCi/g	0.2	0.48	0.291429	0.31	0.3	0.23	0.2	0.23	0.22	< 0.23
Lead 212	pCi/g	-0.1	0.5	0.143571	< -0.04	< 0.18	< 0.04	< -0.02	< -0.1	< 0.18	< 0.12
Lead 212 (counting error)	pCi/g	0.15	4.8	0.610714	< 1.5	< 0.16	< 0.17	< 0.21	< 4.8	< 0.19	< 0.16
Lead 214	pCi/g	0.33	1.68	0.900714	0.68	0.89	0.65	0.68	0.33	0.96	0.92
Lead 214 (counting error)	pCi/g	0.18	0.37	0.259286	0.19	0.23	0.27	0.18	0.2	0.22	0.27
Potassium 40	pCi/g	2.5	10.1	5.95	10.1		9.2	2.5		2.6	
Potassium 40 (counting error)	pCi/g	1.4	2.7	1.933333	2.3		2.7	1.5		1.4	
Protactinium 231	pCi/g	-0.8	1.1	-0.05714	< 0	< -0.4	< 0.9	< 0.7	< 0	< -0.5	< -0.8
Protactinium 231 (counting error)	pCi/g	1.5	2.7	2.121429	< 1.8	< 2.4	< 1.6	< 1.5	< 2.1	< 1.8	< 2.2
Protactinium 234M	pCi/g	61	329	160.9286	143	143	142	61	76	143	157
Protactinium 234M (counting error)	pCi/g	20	43	29.07143	26	30	30	20	22	24	30
Radium (226)	pCi/g	0.29	1.37	0.749286	J 0.75	J 0.77	J 0.51	J 0.39	J 0.5	J 0.86	< 0.29
Radium (226) (counting error)	pCi/g	0.2	0.48	0.291429	J 0.31	J 0.3	J 0.23	J 0.2	J 0.23	J 0.22	< 0.23
Thorium 228	pCi/g	0.0003	0.53	0.146736	< 0.015	J 0.2	< 0.11	< 0.015	< 0.08	J 0.32	< 0.0003
Thorium 228 (counting error)	pCi/g	0.051	0.25	0.133714	< 0.089	J 0.16	< 0.14	< 0.051	< 0.11	J 0.2	< 0.067
Thorium 230	pCi/g	1.11	9	3.932857	J 1.53	2.76	J 1.91	J 1.11	2.1	5.84	3.17
Thorium 230 (counting error)	pCi/g	0.35	1.2	0.675714	J 0.41	0.57	J 0.47	J 0.35	0.46	0.93	0.59
Thorium 232	pCi/g	-0.1	0.28	0.131429	< 0.15	< -0.1	< 0.15	< 0	< 0.04	< 0.22	< 0.12
Thorium 232 (counting error)	pCi/g	0.26	0.5	0.320714	< 0.27	< 0.5	< 0.38	< 0.27	< 0.37	< 0.28	< 0.29
Thorium 234	pCi/g	60.3	287	142.0071	115	129	111	60.3	67.8	105	134
Thorium 234 (counting error)	pCi/g	5.6	25	13.02143	9.7	13	11	6.8	5.6	8.2	13
Uranium 234	pCi/g	41.8	248	114.0643	89.4	105	66	41.8	71.6	69.1	98
Uranium 234 (counting error)	pCi/g	4	22	12.45	8.2	9.6	6.1	4	8.8	9.6	14
Uranium 235	pCi/g	3.43	14.4	7.310714	6.19	5.3	4.96	3.43	4.16	6.04	7.1
Uranium 235 (counting error)	pCi/g	0.71	1.6	1.060714	0.95	1.1	0.97	0.73	0.71	0.8	1
Uranium 235/236	pCi/g	2.25	11.7	6.654286	4.6	4.5	3.41	2.25	J 3	J 3.6	J 4.7
Uranium 235/236 (counting error)	pCi/g	0.55	3.8	2.157857	0.9	0.94	0.72	0.55	J 1.5	J 2	J 2.8
Uranium 238	pCi/g	41.1	257	119.1214	89	112	68.5	41.1	78.2	69.9	115
Uranium 238 (counting error)	pCi/g	4	23	12.81429	8.1	10	6.3	4	9.4	9.6	15

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte

Honeywell International Inc.
Metropolis Works

Table C-3
C Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	C-2	C-5	C-9	C-10 Lower	C-10 Upper	C-17	C-19 Lower	C-19 Upper
Bismuth 214	pCi/g	0.25	1.25	0.605625	0.56	1.25	0.52	0.77	0.69	0.82	< 0.25	< 0.3
Bismuth 214 (counting error)	pCi/g	0.19	0.38	0.280625	0.24	0.38	0.28	0.31	0.25	0.34	< 0.21	< 0.23
Lead 212	pCi/g	-0.29	0.17	0.039938	< 0.09	< 0.06	< 0.01	< 0.12	< 0.17	< 0.13	< -0.03	< 0.03
Lead 212 (counting error)	pCi/g	0.11	0.71	0.225625	< 0.17	< 0.2	< 0.14	< 0.17	< 0.14	< 0.19	< 0.19	< 0.15
Lead 214	pCi/g	0.36	1.16	0.6525	0.6	1.05	0.73	0.66	0.62	1.16	0.46	0.72
Lead 214 (counting error)	pCi/g	0.14	0.35	0.2625	0.22	0.35	0.23	0.24	0.25	0.32	0.2	0.35
Potassium 40	pCi/g	3.1	9	4.9		3.1	5.3	7.5	3.3	3.3		5.3
Potassium 40 (counting error)	pCi/g	1.2	2.1	1.56		1.3	1.5	2.1	1.5	1.6		1.9
Protactinium 231	pCi/g	-2	1.6	0.25875	< 1.6	< 0.6	< -0.2	< 1.4	< 0.3	< 0.1	< 0.7	< 1.4
Protactinium 231 (counting error)	pCi/g	1.5	4.1	2.30625	< 1.8	< 2.4	< 2	< 2.1	< 2.5	< 2.6	< 1.8	< 2.4
Protactinium 234	pCi/g	1.89	1.89	1.89								
Protactinium 234 (counting error)	pCi/g	0.56	0.56	0.56								
Protactinium 234M	pCi/g	131	812	305.0625	208	320	159	252	225	299	131	224
Protactinium 234M (counting error)	pCi/g	25	69	38.375	35	39	25	38	33	42	25	33
Radium (226)	pCi/g	0.25	1.25	0.605625	J 0.56	1.25	J 0.52	J 0.77	J 0.69	J 0.82	< 0.25	< 0.3
Radium (226) (counting error)	pCi/g	0.19	0.38	0.280625	J 0.24	0.38	J 0.28	J 0.31	J 0.25	J 0.34	< 0.21	< 0.23
Thallium 208	pCi/g	0.19	0.19	0.19		0.19						
Thallium 208 (counting error)	pCi/g	0.12	0.12	0.12		0.12						
Thorium 228	pCi/g	0.008	0.24	0.104938	< 0.08	< 0.14	< 0.096	J 0.24	< 0.11	J 0.107	J 0.122	< 0.008
Thorium 228 (counting error)	pCi/g	0.046	0.16	0.089438	< 0.13	< 0.13	< 0.08	J 0.16	< 0.11	J 0.079	J 0.081	< 0.046
Thorium 230	pCi/g	1.6	6.42	3.043125	5.03	4.03	1.68	6.42	2.23	1.9	4.91	1.83
Thorium 230 (counting error)	pCi/g	0.3	0.93	0.4925	0.84	0.69	0.32	0.93	0.5	0.33	0.65	0.34
Thorium 232	pCi/g	0.008	0.18	0.083563	< 0.01	< 0.16	< 0.043	< 0.18	< 0.1	< 0.036	J 0.096	< 0.025
Thorium 232 (counting error)	pCi/g	0.034	0.31	0.122	< 0.31	< 0.31	< 0.054	< 0.28	< 0.29	< 0.045	J 0.072	< 0.044
Thorium 234	pCi/g	101	671	254.5625	167	312	138	207	212	285	101	170
Thorium 234 (counting error)	pCi/g	7.9	53	20.60625	15	26	13	17	18	24	7.9	14
Uranium 234	pCi/g	113	726	264.5625	150	256	118	164	159	237	181	117
Uranium 234 (counting error)	pCi/g	12	77	29.3125	18	31	12	25	21	24	19	12
Uranium 235	pCi/g	5.9	35.4	13.81625	8.6	15.7	7.7	11.4	10.3	14.1	5.9	9.1
Uranium 235 (counting error)	pCi/g	0.81	3	1.4825	1.3	1.8	1.2	1.4	1.2	1.5	0.81	1.2
Uranium 235/236	pCi/g	4.9	33.5	12.4875	J 5.4	J 11.2	J 5.2	J 11.6	J 4.9	J 11.7	J 9	J 6.8
Uranium 235/236 (counting error)	pCi/g	1.8	10	4.7375	J 2.9	J 5.4	J 1.8	J 6.3	J 3.3	J 3.6	J 2.9	J 2.1
Uranium 238	pCi/g	120	745	272.125	165	259	128	166	145	253	170	125
Uranium 238 (counting error)	pCi/g	13	78	30.0625	20	32	13	25	19	26	18	13

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table C-3
C Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	C-21	C-24	C-26 Lower	C-26 Upper	C-30 Lower	C-30 Upper	C-34	C-35
Bismuth 214	pCi/g	0.25	1.25	0.605625	< 0.41	< 0.28	1.06	< 0.47	0.64	0.46	0.77	0.44
Bismuth 214 (counting error)	pCi/g	0.19	0.38	0.280625	< 0.3	< 0.24	0.32	< 0.32	0.28	0.19	0.31	0.29
Lead 212	pCi/g	-0.29	0.17	0.039938	< -0.29	< 0.16	< 0.08	< -0.15	< 0.08	< 0.09	< 0.09	< -0.001
Lead 212 (counting error)	pCi/g	0.11	0.71	0.225625	< 0.61	< 0.16	< 0.18	< 0.71	< 0.13	< 0.11	< 0.21	< 0.15
Lead 214	pCi/g	0.36	1.16	0.6525	0.65	0.63	0.84	0.46	0.44	0.46	0.6	0.36
Lead 214 (counting error)	pCi/g	0.14	0.35	0.2625	0.31	0.3	0.31	0.32	0.2	0.14	0.25	0.21
Potassium 40	pCi/g	3.1	9	4.9			9		4.3	4.6	3.3	
Potassium 40 (counting error)	pCi/g	1.2	2.1	1.56			2		1.2	1.2	1.3	
Protactinium 231	pCi/g	-2	1.6	0.25875	< -2	< 0.4	< -0.7	< 0.1	< -0.7	< 0.3	< 0.04	< 0.8
Protactinium 231 (counting error)	pCi/g	1.5	4.1	2.30625	< 4.1	< 1.9	< 2.3	< 2.7	< 1.8	< 1.5	< 2.7	< 2.3
Protactinium 234	pCi/g	1.89	1.89	1.89							1.89	
Protactinium 234 (counting error)	pCi/g	0.56	0.56	0.56							0.56	
Protactinium 234M	pCi/g	131	812	305.0625	748	150	206	399	276	195	812	277
Protactinium 234M (counting error)	pCi/g	25	69	38.375	69	30	33	55	30	26	68	33
Radium (226)	pCi/g	0.25	1.25	0.605625	< 0.41	< 0.28	1.06	< 0.47	J 0.64	J 0.46	J 0.77	J 0.44
Radium (226) (counting error)	pCi/g	0.19	0.38	0.280625	< 0.3	< 0.24	0.32	< 0.32	J 0.28	J 0.19	J 0.31	J 0.29
Thallium 208	pCi/g	0.19	0.19	0.19								
Thallium 208 (counting error)	pCi/g	0.12	0.12	0.12								
Thorium 228	pCi/g	0.008	0.24	0.104938	J 0.108	J 0.095	J 0.129	< 0.093	J 0.084	< 0.061	< 0.096	J 0.11
Thorium 228 (counting error)	pCi/g	0.046	0.16	0.089438	J 0.081	J 0.077	J 0.084	< 0.078	J 0.068	< 0.064	< 0.082	J 0.081
Thorium 230	pCi/g	1.6	6.42	3.043125	2.09	3.04	3.3	1.6	2.62	2.9	2.75	2.36
Thorium 230 (counting error)	pCi/g	0.3	0.93	0.4925	0.36	0.46	0.48	0.3	0.4	0.45	0.44	0.39
Thorium 232	pCi/g	0.008	0.18	0.083563	J 0.114	J 0.13	J 0.054	< 0.008	< 0.052	J 0.125	< 0.064	J 0.14
Thorium 232 (counting error)	pCi/g	0.034	0.31	0.122	J 0.084	J 0.087	J 0.051	< 0.034	< 0.057	J 0.087	< 0.063	J 0.084
Thorium 234	pCi/g	101	671	254.5625	671	126	193	350	226	130	589	196
Thorium 234 (counting error)	pCi/g	7.9	53	20.60625	53	13	17	29	15	9.8	43	15
Uranium 234	pCi/g	113	726	264.5625	726	113	138	326	298	206	663	381
Uranium 234 (counting error)	pCi/g	12	77	29.3125	77	12	16	37	34	24	66	41
Uranium 235	pCi/g	5.9	35.4	13.81625	35.4	6.7	10	18.7	12.1	8.46	34.4	12.5
Uranium 235 (counting error)	pCi/g	0.81	3	1.4825	3	1.1	1.2	2	1.2	0.91	2.6	1.3
Uranium 235/236	pCi/g	4.9	33.5	12.4875	J 25	J 5.8	J 9.7	J 14.2	J 17.8	J 5.5	J 33.5	J 22.5
Uranium 235/236 (counting error)	pCi/g	1.8	10	4.7375	J 10	J 2	J 3.4	J 6	J 6.4	J 3.1	J 9.5	J 7.1
Uranium 238	pCi/g	120	745	272.125	745	120	139	326	311	203	695	404
Uranium 238 (counting error)	pCi/g	13	78	30.0625	78	13	16	37	35	24	69	43

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table D-3
D Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	D-8 Lower	D-8 Upper	D-10 Lower	D-10 Upper	D-11 Lower	D-11 Upper	D-17 Lower	D-17 Upper
Bismuth 214	pCi/g	0.46	1.91	0.938571	0.71	0.5	0.74	0.86	0.89	1.32	1.91	0.99
Bismuth 214 (counting error)	pCi/g	0.25	0.79	0.405714	0.33	0.26	0.27	0.29	0.41	0.52	0.79	0.39
Lead 212	pCi/g	-0.21	0.22	0.059643	< 0.16	< -0.01	< 0.09	< 0.01	< 0.05	< 0.2	< -0.21	< 0.06
Lead 212 (counting error)	pCi/g	0.13	0.79	0.264286	< 0.13	< 0.22	< 0.18	< 0.13	< 0.3	< 0.24	< 0.79	< 0.22
Lead 214	pCi/g	0.26	1.51	0.98	0.78	0.62	0.82	< 0.26	0.91	1.26	0.85	1.49
Lead 214 (counting error)	pCi/g	0.22	0.62	0.366429	0.24	0.29	0.26	< 0.22	0.37	0.46	0.46	0.39
Potassium 40	pCi/g	3	10	6.516667	6		3	9.7	5.3	6.4	5.6	9.3
Potassium 40 (counting error)	pCi/g	1.1	2.8	2.05	1.3		1.1	2.8	2.1	2.5	2.2	2.2
Protactinium 231	pCi/g	-1.2	1.1	-0.28286	< -0.9	< 0.9	< -0.6	< -0.4	< -0.2	< -1.2	< -0.7	< -0.3
Protactinium 231 (counting error)	pCi/g	1.6	5.2	3.1	< 2.2	< 2	< 2.5	< 2.1	< 4.3	< 4	< 5	< 2.6
Protactinium 234	pCi/g	1.93	990	320.77	419	135	431	28	1.93			
Protactinium 234 (counting error)	pCi/g	0.95	100	38.10556	40	26	44	18	0.95			
Protactinium 234M	pCi/g	170	1200	569.5					755	337	1200	273
Protactinium 234M (counting error)	pCi/g	30	110	64.16667					76	52	110	41
Radium (226)	pCi/g	0.46	1.91	0.938571	J 0.71	J 0.5	J 0.74	J 0.86	J 0.89	1.32	1.91	J 0.99
Radium (226) (counting error)	pCi/g	0.25	0.79	0.405714	J 0.33	J 0.26	J 0.27	J 0.29	J 0.41	0.52	0.79	J 0.39
Thorium 228	pCi/g	-0.19	2.86	0.629714	J 2.86	2.31	< -0.19	< 0.21	J 0.44	< 0.008	< -0.09	< 0.09
Thorium 228 (counting error)	pCi/g	0.094	0.78	0.338857	J 0.78	0.53	< 0.25	< 0.41	J 0.32	< 0.2	< 0.45	< 0.16
Thorium 230	pCi/g	1.08	9.8	2.465	9.8	2.38	1.52	2.49	J 2.07	J 1.33	J 3.1	J 1.58
Thorium 230 (counting error)	pCi/g	0.34	3	0.862857	3	0.53	0.68	0.98	J 0.59	J 0.65	J 1.4	J 0.51
Thorium 232	pCi/g	-0.1	0.57	0.081429	< -0.05	< 0.15	< -0.09	< -0.01	< 0.15	< 0	< 0.15	< 0.08
Thorium 232 (counting error)	pCi/g	0.18	5.5	1.130714	< 0.51	< 0.36	< 5.2	< 0.34	< 0.49	< 0.63	< 0.51	< 0.38
Thorium 234	pCi/g	56.6	1110	422.7286	312	122	421	56.6	756	321	1110	294
Thorium 234 (counting error)	pCi/g	7.8	87	36.05	33	11	43	7.8	61	28	87	25
Uranium 234	pCi/g	1.15	12900	1229.061	2.3	2.4	481	423	1040	763	12900	513
Uranium 234 (counting error)	pCi/g	0.66	1200	116.8186	1.6	1.5	43	39	100	74	1200	50
Uranium 235	pCi/g	3.46	56.7	21.39	17.7	7.4	21.2	3.6	38.6	16.3	56.7	13.7
Uranium 235 (counting error)	pCi/g	0.8	4.4	2.137143	1.6	1.2	2	0.82	3.6	2	4.4	1.8
Uranium 235/236	pCi/g	-0.27	710	65.75386	< -0.23	< -0.046	23.2	22.7	63	32.7	710	J 20
Uranium 235/236 (counting error)	pCi/g	0.091	130	13.61079	< 0.2	< 0.091	4.4	4.6	15	9	130	J 5.9
Uranium 238	pCi/g	1.2	13700	1288.965	2.7	< 1.2	505	465	1030	771	13700	511
Uranium 238 (counting error)	pCi/g	0.96	1200	117.1829	1.5	< 1.1	46	42	99.9	75	1200	50

Notes:
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table D-3
D Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	D-19 Lower	D-19 Upper	D-26 Lower	D-26 Upper	D-29 Lower	D-29 Upper
Bismuth 214	pCi/g	0.46	1.91	0.938571	0.91	0.73	< 0.61	< 0.46	0.95	1.56
Bismuth 214 (counting error)	pCi/g	0.25	0.79	0.405714	0.27	0.25	< 0.57	< 0.37	0.5	0.46
Lead 212	pCi/g	-0.21	0.22	0.059643	< -0.04	< 0.005	< 0.1	< 0.22	< 0.15	< 0.05
Lead 212 (counting error)	pCi/g	0.13	0.79	0.264286	< 0.24	< 0.14	< 0.39	< 0.28	< 0.29	< 0.15
Lead 214	pCi/g	0.26	1.51	0.98	0.78	0.88	1.51	0.97	1.14	1.45
Lead 214 (counting error)	pCi/g	0.22	0.62	0.366429	0.26	0.28	0.62	0.49	0.4	0.39
Potassium 40	pCi/g	3	10	6.516667	7.6	7		5	3.3	10
Potassium 40 (counting error)	pCi/g	1.1	2.8	2.05	2.1	2.1		1.8	1.9	2.5
Protactinium 231	pCi/g	-1.2	1.1	-0.28286	< 0.04	< 0	< 1.1	< -1.1	< -0.9	< 0.3
Protactinium 231 (counting error)	pCi/g	1.6	5.2	3.1	< 1.6	< 2.1	< 5.2	< 4	< 3.7	< 2.1
Protactinium 234	pCi/g	1.93	990	320.77	191	82	990	609		
Protactinium 234 (counting error)	pCi/g	0.95	100	38.10556	32	20	100	62		
Protactinium 234M	pCi/g	170	1200	569.5					682	170
Protactinium 234M (counting error)	pCi/g	30	110	64.16667					76	30
Radium (226)	pCi/g	0.46	1.91	0.938571	J 0.91	J 0.73	< 0.61	< 0.46	J 0.95	1.56
Radium (226) (counting error)	pCi/g	0.25	0.79	0.405714	J 0.27	J 0.25	< 0.57	< 0.37	J 0.5	0.46
Thorium 228	pCi/g	-0.19	2.86	0.629714	J 1.53	J 1.41	< -0.12	< 0.048	< 0.1	< 0.21
Thorium 228 (counting error)	pCi/g	0.094	0.78	0.338857	J 0.38	J 0.43	< 0.38	< 0.094	< 0.13	< 0.23
Thorium 230	pCi/g	1.08	9.8	2.465	2.6	J 1.43	J 2	J 1.08	2.03	J 1.1
Thorium 230 (counting error)	pCi/g	0.34	3	0.862857	1	J 0.42	J 1.1	J 0.34	0.48	J 0.4
Thorium 232	pCi/g	-0.1	0.57	0.081429	< 0.17	< 0.07	< 0.57	< -0.1	< 0.05	< 0
Thorium 232 (counting error)	pCi/g	0.18	5.5	1:130714	< 0.28	< 0.24	< 0.72	< 5.5	< 0.49	< 0.18
Thorium 234	pCi/g	56.6	1110	422.7286	138	61.6	896	618	677	135
Thorium 234 (counting error)	pCi/g	7.8	87	36.05	12	7.9	72	49	54	14
Uranium 234	pCi/g	1.15	12900	1229.061	2.7	1.15	315	42.3	537	184
Uranium 234 (counting error)	pCi/g	0.66	1200	116.8186	1.6	0.66	30	4.1	70	20
Uranium 235	pCi/g	3.46	56.7	21.39	8.6	3.46	44	29.8	31.8	6.6
Uranium 235 (counting error)	pCi/g	0.8	4.4	2.137143	1.1	0.8	4	2.6	2.9	1.1
Uranium 235/236	pCi/g	-0.27	710	65.75386	< -0.27	< 0.29	15.2	2.21	J 22	J 9.8
Uranium 235/236 (counting error)	pCi/g	0.091	130	13.61079	< 0.22	< 0.36	3.7	0.58	J 13	J 3.5
Uranium 238	pCi/g	1.2	13700	1288.965	< 1.3	2.51	312	39.8	513	191
Uranium 238 (counting error)	pCi/g	0.96	1200	117.1829	< 1.2	0.96	30	3.9	68	21

Notes:
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-3
E Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	E-2	E-10 Lower	E-10 Upper	E-12 Lower	E-12 Upper	E-16 Lower	E-16 Upper
Bismuth 214	pCi/g	-0.1	1.06	0.681613	0.79	0.87	0.73	0.63	< 0.31	< 0.18	0.77
Bismuth 214 (counting error)	pCi/g	0.23	4.7	0.437742	0.34	0.32	0.32	0.27	< 0.24	< 0.25	0.31
Lead 212	pCi/g	-0.08	0.27	0.061742	< 0.03	< 0.02	< 0.06	< 0.12	< 0.04	< 0.16	< -0.01
Lead 212 (counting error)	pCi/g	0.13	5.3	0.365484	< 0.21	< 0.19	< 0.2	< 0.15	< 0.2	< 0.16	< 0.27
Lead 214	pCi/g	0.45	1.19	0.827097	0.72	0.63	0.99	0.83	0.71	0.69	0.93
Lead 214 (counting error)	pCi/g	0.21	0.37	0.275806	0.29	0.26	0.26	0.24	0.25	0.25	0.37
Potassium 40	pCi/g	4.6	9.8	6.957895		5.8					7.7
Potassium 40 (counting error)	pCi/g	1.7	2.6	2.110526		1.7					1.9
Protactinium 231	pCi/g	-1.4	1.9	0.065387	< 0.2	< -0.7	< -0.2	< -0.4	< -1.4	< 0.005	< 0.01
Protactinium 231 (counting error)	pCi/g	1.6	3.8	2.390323	< 2.2	< 2.5	< 2.2	< 1.9	< 2.9	< 2.6	< 2.9
Protactinium 234M	pCi/g	62	556	229.129	374	363	279	210	305	283	359
Protactinium 234M (counting error)	pCi/g	20	64	35.74194	51	44	44	35	38	44	44
Radium (226)	pCi/g	-0.1	1.06	0.681613	J 0.79	J 0.87	J 0.73	J 0.63	< 0.31	< 0.18	J 0.77
Radium (226) (counting error)	pCi/g	0.23	4.7	0.437742	J 0.34	J 0.32	J 0.32	J 0.27	< 0.24	< 0.25	J 0.31
Thorium 228	pCi/g	-0.015	0.21	0.071003	< 0.08	< 0.021	< 0.021	< 0.12	< 0.1	< 0.021	< 0.12
Thorium 228 (counting error)	pCi/g	0.07	0.27	0.119406	< 0.14	< 0.081	< 0.07	< 0.27	< 0.11	< 0.071	< 0.16
Thorium 230	pCi/g	0.8	3.04	1.712581	J 1.24	J 1.14	J 1.2	2.25	J 1.5	J 1.3	3.02
Thorium 230 (counting error)	pCi/g	0.26	0.73	0.433226	J 0.37	J 0.34	J 0.35	0.73	J 0.4	J 0.37	0.63
Thorium 232	pCi/g	-0.1	0.37	0.052548	< -0.03	< 0.18	< 0.08	< -0.07	< 0.14	< -0.1	< 0.1
Thorium 232 (counting error)	pCi/g	0.28	150	5.678065	< 0.48	< 0.29	< 0.35	< 0.34	< 0.32	< 11	< 0.35
Thorium 234	pCi/g	70.7	490	210.8452	375	319	234	204	252	269	322
Thorium 234 (counting error)	pCi/g	7.2	40	18.77097	32	27	21	18	22	24	28
Uranium 234	pCi/g	53.8	1820	266.171	290	220	170	160	209	1030	474
Uranium 234 (counting error)	pCi/g	5.1	160	24.87419	31	23	19	18	20	92	45
Uranium 235	pCi/g	3.58	26.7	11.01871	18.4	16.1	12	10.2	14.2	14.3	16.2
Uranium 235 (counting error)	pCi/g	0.82	2.9	1.458387	2.3	1.7	1.6	1.3	1.6	1.7	1.8
Uranium 235/236	pCi/g	2	88	12.91903	J 15.3	J 10.5	J 9.9	J 8.5	10	49.4	22.7
Uranium 235/236 (counting error)	pCi/g	0.58	15	2.78	J 5	J 3.4	J 3.3	J 3.1	2.5	8.3	5.4
Uranium 238	pCi/g	51.9	1930	275.3452	318	226	181	155	208	1080	478
Uranium 238 (counting error)	pCi/g	4.9	170	25.59032	33	23	19	17	20	96	45

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-3
E Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	E-23 Lower	E-23 Upper	E-27 Lower	E-27 Upper	E-38 Lower	E-38 Upper	E-41 Lower	E-41 Upper
Bismuth 214	pCi/g	-0.1	1.06	0.681613	0.81	1	0.57	0.77	< 0.32	0.65	< -0.1	0.61
Bismuth 214 (counting error)	pCi/g	0.23	4.7	0.437742	0.32	0.35	0.34	0.3	< 0.25	0.23	< 4.7	0.25
Lead 212	pCi/g	-0.08	0.27	0.061742	< 0.07	< 0.08	< 0.1	< -0.05	< 0.13	< 0.02	< 0.05	< -0.08
Lead 212 (counting error)	pCi/g	0.13	5.3	0.365484	< 0.22	< 0.16	< 0.23	< 5.3	< 0.17	< 0.13	< 0.18	< 0.73
Lead 214	pCi/g	0.45	1.19	0.827097	0.94	0.86	0.72	0.86	0.86	0.84	< 0.45	0.72
Lead 214 (counting error)	pCi/g	0.21	0.37	0.275806	0.33	0.32	0.3	0.25	0.29	0.22	< 0.29	0.21
Potassium 40	pCi/g	4.6	9.8	6.957895	6.1					5.8		9.6
Potassium 40 (counting error)	pCi/g	1.7	2.6	2.110526	1.8					2		2.1
Protactinium 231	pCi/g	-1.4	1.9	0.065387	< -1.3	< 0.2	< 0.7	< -0.008	< 0.2	< 0.7	< -0.2	< 0
Protactinium 231 (counting error)	pCi/g	1.6	3.8	2.390323	< 3.3	< 2.1	< 2.9	< 1.8	< 2.3	< 1.7	< 3	< 2.3
Protactinium 234M	pCi/g	62	556	229.129	415	196	556	74	275	139	294	115
Protactinium 234M (counting error)	pCi/g	20	64	35.74194	47	36	64	24	41	26	48	25
Radium (226)	pCi/g	-0.1	1.06	0.681613	J 0.81	J 1	J 0.57	J 0.77	< 0.32	J 0.65	< -0.1	J 0.61
Radium (226) (counting error)	pCi/g	0.23	4.7	0.437742	J 0.32	J 0.35	J 0.34	J 0.3	< 0.25	J 0.23	< 4.7	J 0.25
Thorium 228	pCi/g	-0.015	0.21	0.071003	< 0.17	< 0.05	J 0.21	< -0.002	J 0.14	< 0.05	< 0.12	< 0.044
Thorium 228 (counting error)	pCi/g	0.07	0.27	0.119406	< 0.2	< 0.11	J 0.16	< 0.087	J 0.12	< 0.12	< 0.14	< 0.092
Thorium 230	pCi/g	0.8	3.04	1.712581	J 0.97	J 1.7	2.14	2.37	J 1.26	2.18	J 1.32	J 1.25
Thorium 230 (counting error)	pCi/g	0.26	0.73	0.433226	J 0.43	J 0.46	0.51	0.56	J 0.34	0.5	J 0.37	J 0.35
Thorium 232	pCi/g	-0.1	0.37	0.052548	< -0.08	< 0.07	< -0.1	< -0.001	< 0.05	< 0.19	< -0.1	< 0.05
Thorium 232 (counting error)	pCi/g	0.28	150	5.678065	< 0.34	< 0.35	< 150	< 0.38	< 0.4	< 0.29	< 4.7	< 0.28
Thorium 234	pCi/g	70.7	490	210.8452	346	207	490	77.5	245	101	280	97.3
Thorium 234 (counting error)	pCi/g	7.2	40	18.77097	29	19	40	7.2	21	8.6	25	8.5
Uranium 234	pCi/g	53.8	1820	266.171	952	150	1820	63.3	218	89.1	232	79.7
Uranium 234 (counting error)	pCi/g	5.1	160	24.87419	86	17	160	8.9	19	8.2	21	7.3
Uranium 235	pCi/g	3.58	26.7	11.01871	19.7	10.5	26.7	4.28	12	5.85	14.4	5.51
Uranium 235 (counting error)	pCi/g	0.82	2.9	1.458387	2.2	1.3	2.9	0.84	1.6	0.87	1.8	0.93
Uranium 235/236	pCi/g	2	88	12.91903	45.6	J 6.5	88	J 2	11.2	4.04	10.9	4.43
Uranium 235/236 (counting error)	pCi/g	0.58	15	2.78	8.8	J 2.7	15	J 1.5	1.9	0.85	1.8	0.87
Uranium 238	pCi/g	51.9	1930	275.3452	961	160	1930	66.6	222	91.8	238	79.9
Uranium 238 (counting error)	pCi/g	4.9	170	25.59032	87	18	170	9.2	20	8.4	21	7.3

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-3
E Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	E-44 Lower	E-44 Upper	E-51 Lower	E-51 Upper	E-65 Lower	E-65 Upper	E-67 Lower	E-67 Upper
Bismuth 214	pCi/g	-0.1	1.06	0.681613	1.06	0.65	1.06	0.95	0.92	0.89	< 0.31	0.61
Bismuth 214 (counting error)	pCi/g	0.23	4.7	0.437742	0.3	0.24	0.34	0.25	0.35	0.29	< 0.3	0.23
Lead 212	pCi/g	-0.08	0.27	0.061742	< 0.11	< 0.15	< 0.09	< 0.006	< 0.27	< 0.11	< -0.002	< 0.09
Lead 212 (counting error)	pCi/g	0.13	5.3	0.365484	< 0.17	< 0.15	< 0.18	< 0.16	< 0.21	< 0.17	< 0.21	< 0.13
Lead 214	pCi/g	0.45	1.19	0.827097	0.65	0.67	0.93	1.04	1.17	1.12	0.73	0.73
Lead 214 (counting error)	pCi/g	0.21	0.37	0.275806	0.21	0.22	0.27	0.26	0.34	0.29	0.34	0.24
Potassium 40	pCi/g	4.6	9.8	6.957895			4.6	7.9	5.4	5.7	6.2	9.8
Potassium 40 (counting error)	pCi/g	1.7	2.6	2.110526			1.8	1.9	1.9	1.9	2.2	2.4
Protactinium 231	pCi/g	-1.4	1.9	0.065387	< -1.4	< -0.3	< 0.04	< 0.7	< -0.2	< -0.02	< 1.9	< 0.4
Protactinium 231 (counting error)	pCi/g	1.6	3.8	2.390323	< 2.6	< 1.7	< 2.7	< 2.1	< 3.8	< 2.4	< 2.8	< 1.6
Protactinium 234M	pCi/g	62	556	229.129	240	159	276	125	343	97	261	119
Protactinium 234M (counting error)	pCi/g	20	64	35.74194	36	31	39	24	42	21	41	25
Radium (226)	pCi/g	-0.1	1.06	0.681613	1.06	J 0.65	1.06	J 0.95	J 0.92	J 0.89	< 0.31	J 0.61
Radium (226) (counting error)	pCi/g	0.23	4.7	0.437742	0.3	J 0.24	0.34	J 0.25	J 0.35	J 0.29	< 0.3	J 0.23
Thorium 228	pCi/g	-0.015	0.21	0.071003	< 0.064	< 0.12	< 0.09	J 0.17	< 0.06	< 0.01	< -0.015	< 0.037
Thorium 228 (counting error)	pCi/g	0.07	0.27	0.119406	< 0.092	< 0.12	< 0.13	J 0.14	< 0.1	< 0.12	< 0.079	< 0.088
Thorium 230	pCi/g	0.8	3.04	1.712581	2.66	J 1.48	2.75	J 1.28	2.61	J 1.04	2.28	J 1.18
Thorium 230 (counting error)	pCi/g	0.26	0.73	0.433226	0.54	J 0.4	0.55	J 0.36	0.52	J 0.33	0.48	J 0.33
Thorium 232	pCi/g	-0.1	0.37	0.052548	< 0.18	< -0.05	< 0.16	< 0.06	< 0.23	< 0	< -0.1	< 0.01
Thorium 232 (counting error)	pCi/g	0.28	150	5.678065	< 0.32	< 0.69	< 0.35	< 0.33	< 0.41	< 0.45	< 0.4	< 0.39
Thorium 234	pCi/g	70.7	490	210.8452	224	133	268	128	332	81	252	102
Thorium 234 (counting error)	pCi/g	7.2	40	18.77097	20	13	21	12	28	9	22	8.7
Uranium 234	pCi/g	53.8	1820	266.171	170	107	239	100	228	58.1	188	88.7
Uranium 234 (counting error)	pCi/g	5.1	160	24.87419	15	9.7	25	12	20	5.4	17	8.2
Uranium 235	pCi/g	3.58	26.7	11.01871	12.5	6.6	16	6.6	16.6	4.3	12.4	6.01
Uranium 235 (counting error)	pCi/g	0.82	2.9	1.458387	1.7	1.1	1.7	1	2.1	1	1.7	0.94
Uranium 235/236	pCi/g	2	88	12.91903	8.8	5.3	J 6.9	J 6.1	11.4	3.6	8.4	4.87
Uranium 235/236 (counting error)	pCi/g	0.58	15	2.78	1.5	1	J 2.9	J 2.5	1.9	0.74	1.5	0.98
Uranium 238	pCi/g	51.9	1930	275.3452	175	106	243	101	239	60.5	194	95.6
Uranium 238 (counting error)	pCi/g	4.9	170	25.59032	16	9.6	25	12	21	5.7	17	8.8

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-3
E Pond - Isotope Analytical Summary

Parameter	Units	Minimum	Maximum	Mean	E-74 Lower	E-74 Upper	E-79 Lower	E-79 Upper	E-80 Lower	E-80 Upper	E-97 Lower	E-97 Upper	E-103 Lower	E-103 Upper
Bismuth 214	pCi/g	-0.1	1.06	0.681613	0.93	< 0.39	0.99	0.86	0.83	0.58	0.71	0.48	0.7	0.8
Bismuth 214 (counting error)	pCi/g	0.23	4.7	0.437742	0.39	< 0.24	0.33	0.28	0.34	0.26	0.41	0.23	0.31	0.29
Lead 212	pCi/g	-0.08	0.27	0.061742	< 0.1	< 0.05	< 0.11	< 0.06	< -0.01	< -0.03	< 0.05	< 0.02	< 0.06	< 0.02
Lead 212 (counting error)	pCi/g	0.13	5.3	0.365484	< 0.2	< 0.15	< 0.2	< 0.14	< 0.25	< 0.2	< 0.17	< 0.14	< 0.15	< 0.13
Lead 214	pCi/g	0.45	1.19	0.827097	0.75	0.62	1.1	1.19	0.74	0.59	1.01	0.85	0.94	0.59
Lead 214 (counting error)	pCi/g	0.21	0.37	0.275806	0.3	0.21	0.31	0.3	0.28	0.23	0.3	0.32	0.25	0.19
Potassium 40	pCi/g	4.6	9.8	6.957895	8.1	8.8	5.6	5.1	6.4	9.8	4.9	8.9	9.2	7.4
Potassium 40 (counting error)	pCi/g	1.7	2.6	2.110526	2.6	2.2	2.1	2.4	2.4	2.2	2	2.6	2.7	2.2
Protactinium 231	pCi/g	-1.4	1.9	0.065387	< -0.1	< -0.2	< 1.2	< 0	< 1.1	< -0.2	< 1.1	< 0.2	< 0.9	< -0.2
Protactinium 231 (counting error)	pCi/g	1.6	3.8	2.390323	< 2.6	< 1.7	< 2.8	< 1.6	< 2.4	< 1.9	< 2.4	< 2.4	< 1.8	< 1.6
Protactinium 234M	pCi/g	62	556	229.129	255	96	314	78	184	103	154	62	92	64
Protactinium 234M (counting error)	pCi/g	20	64	35.74194	44	20	43	23	36	20	29	23	23	19
Radium (226)	pCi/g	-0.1	1.06	0.681613	J 0.93	< 0.39	J 0.99	J 0.86	J 0.83	J 0.58	J 0.71	J 0.48	J 0.7	J 0.8
Radium (226) (counting error)	pCi/g	0.23	4.7	0.437742	J 0.39	< 0.24	J 0.33	J 0.28	J 0.34	J 0.26	J 0.41	J 0.23	J 0.31	J 0.29
Thorium 228	pCi/g	-0.015	0.21	0.071003	< 0.08	< 0.028	< 0.07	< 0.18	< 0.0261	< 0.02	< -0.009	< 0.005	< 0.07	< 0.005
Thorium 228 (counting error)	pCi/g	0.07	0.27	0.119406	< 0.14	< 0.078	< 0.1	< 0.15	< 0.0996	< 0.15	< 0.1	< 0.084	< 0.11	< 0.092
Thorium 230	pCi/g	0.8	3.04	1.712581	J 1.95	J 0.93	3.04	J 0.87	J 1.8	2.06	J 1.52	J 0.8	J 1.07	J 0.59
Thorium 230 (counting error)	pCi/g	0.26	0.73	0.433226	J 0.45	J 0.3	0.58	J 0.29	J 0.42	0.52	J 0.39	J 0.26	J 0.33	J 0.23
Thorium 232	pCi/g	-0.1	0.37	0.052548	< 0.1	< -0.01	< 0.17	< 0	< 0.01	< 0.37	< 0.17	< -0.05	< 0	< -0.08
Thorium 232 (counting error)	pCi/g	0.28	150	5.678065	< 0.28	< 0.3	< 0.41	< 0.37	< 0.39	< 0.3	< 0.38	< 0.38	< 0.53	< 0.34
Thorium 234	pCi/g	70.7	490	210.8452	239	77.5	296	70.7	177	82.2	162	93	91	63.1
Thorium 234 (counting error)	pCi/g	7.2	40	18.77097	22	8.6	26	8.6	17	8.7	16	11	10	6
Uranium 234	pCi/g	53.8	1820	266.171	173	57.9	229	53.8	139	63.8	123	75.9	73.6	62.9
Uranium 234 (counting error)	pCi/g	5.1	160	24.87419	16	5.4	20	5.1	13	5.9	11	7	7	6
Uranium 235	pCi/g	3.58	26.7	11.01871	12.4	4.26	14.6	3.79	8.9	3.58	7	5.7	5.28	3.49
Uranium 235 (counting error)	pCi/g	0.82	2.9	1.458387	1.8	0.82	1.7	0.84	1.4	0.87	1.1	1	0.97	0.8
Uranium 235/236	pCi/g	2	88	12.91903	8.9	3.2	11.9	2.38	6.9	3.26	6	3.61	3.9	2.94
Uranium 235/236 (counting error)	pCi/g	0.58	15	2.78	1.6	0.69	2	0.58	1.3	0.7	1.1	0.77	0.9	0.73
Uranium 238	pCi/g	51.9	1930	275.3452	177	58.2	225	51.9	146	63.9	129	75.3	74.1	63
Uranium 238 (counting error)	pCi/g	4.9	170	25.59032	16	5.5	20	4.9	13	5.9	12	7	7	6

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table B-4
B Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
B-2	Arsenic	mg/L		0.141
B-5 Lower	Arsenic	mg/L	<	0.02
B-5 Upper	Arsenic	mg/L	<	0.02
B-10 Lower	Arsenic	mg/L	B	0.0115
B-10 Upper	Arsenic	mg/L		0.0816
B-18 Lower	Arsenic	mg/L	B	0.0113
B-18 Upper	Arsenic	mg/L		0.0981
B-19 Upper	Arsenic	mg/L	B	0.0039
B-30 Lower	Arsenic	mg/L		0.0209
B-30 Upper	Arsenic	mg/L	B	0.0091
B-35	Arsenic	mg/L	B	0.0093
B-2	Barium	mg/L	J	0.164
B-5 Lower	Barium	mg/L	B J	0.0591
B-5 Upper	Barium	mg/L	B J	0.0408
B-10 Lower	Barium	mg/L	J	0.103
B-10 Upper	Barium	mg/L	J	0.161
B-18 Lower	Barium	mg/L	B J	0.0561
B-18 Upper	Barium	mg/L	J	0.117
B-19 Upper	Barium	mg/L	B J	0.0538
B-30 Lower	Barium	mg/L	B J	0.0766
B-30 Upper	Barium	mg/L	B J	0.0552
B-35	Barium	mg/L	B J	0.0332
B-2	Cadmium	mg/L	<	0.01
B-5 Lower	Cadmium	mg/L	<	0.01
B-5 Upper	Cadmium	mg/L	<	0.01
B-10 Lower	Cadmium	mg/L	<	0.01
B-10 Upper	Cadmium	mg/L	<	0.01
B-18 Lower	Cadmium	mg/L	<	0.01
B-18 Upper	Cadmium	mg/L	<	0.01
B-19 Upper	Cadmium	mg/L	<	0.01
B-30 Lower	Cadmium	mg/L	<	0.01
B-30 Upper	Cadmium	mg/L	<	0.01
B-35	Cadmium	mg/L	B	0.0015

Honeywell International Inc.
Metropolis Works

Table B-4
B Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
B-2	Chromium	mg/L		0.0229
B-5 Lower	Chromium	mg/L	B	0.0147
B-5 Upper	Chromium	mg/L	B	0.011
B-10 Lower	Chromium	mg/L	B	0.0169
B-10 Upper	Chromium	mg/L		0.0359
B-18 Lower	Chromium	mg/L	<	0.02
B-18 Upper	Chromium	mg/L		0.0275
B-19 Upper	Chromium	mg/L	B	0.0096
B-30 Lower	Chromium	mg/L	<	0.02
B-30 Upper	Chromium	mg/L	B	0.017
B-35	Chromium	mg/L	B	0.0153
B-2	Lead	mg/L	<	0.04
B-5 Lower	Lead	mg/L	<	0.04
B-5 Upper	Lead	mg/L	<	0.04
B-10 Lower	Lead	mg/L	<	0.04
B-10 Upper	Lead	mg/L	<	0.04
B-18 Lower	Lead	mg/L	<	0.04
B-18 Upper	Lead	mg/L	B J	0.0078
B-19 Upper	Lead	mg/L	<	0.04
B-30 Lower	Lead	mg/L	<	0.04
B-30 Upper	Lead	mg/L	<	0.04
B-35	Lead	mg/L	<	0.04
B-2	Mercury	mg/L	B	0.00024
B-5 Lower	Mercury	mg/L	<	0.001
B-5 Upper	Mercury	mg/L	<	0.001
B-10 Lower	Mercury	mg/L	<	0.001
B-10 Upper	Mercury	mg/L	B	0.00034
B-18 Lower	Mercury	mg/L	<	0.001
B-18 Upper	Mercury	mg/L	<	0.001
B-19 Upper	Mercury	mg/L	<	0.001
B-30 Lower	Mercury	mg/L	<	0.001
B-30 Upper	Mercury	mg/L	<	0.001
B-35	Mercury	mg/L	<	0.001

Honeywell International Inc.
Metropolis Works

Table B-4
B Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
B-2	Selenium	mg/L	< 0.03
B-5 Lower	Selenium	mg/L	< 0.03
B-5 Upper	Selenium	mg/L	< 0.03
B-10 Lower	Selenium	mg/L	< 0.03
B-10 Upper	Selenium	mg/L	< 0.03
B-18 Lower	Selenium	mg/L	< 0.03
B-18 Upper	Selenium	mg/L	< 0.03
B-19 Upper	Selenium	mg/L	< 0.03
B-30 Lower	Selenium	mg/L	< 0.03
B-30 Upper	Selenium	mg/L	< 0.03
B-35	Selenium	mg/L	< 0.03
B-2	Silver	mg/L	< 0.02
B-5 Lower	Silver	mg/L	< 0.02
B-5 Upper	Silver	mg/L	< 0.02
B-10 Lower	Silver	mg/L	< 0.02
B-10 Upper	Silver	mg/L	< 0.02
B-18 Lower	Silver	mg/L	< 0.02
B-18 Upper	Silver	mg/L	< 0.02
B-19 Upper	Silver	mg/L	< 0.02
B-30 Lower	Silver	mg/L	< 0.02
B-30 Upper	Silver	mg/L	< 0.02
B-35	Silver	mg/L	< 0.02

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table C-4
C Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Arsenic	mg/L	< 0.02
C-5	Arsenic	mg/L	< 0.02
C-9	Arsenic	mg/L	< 0.02
C-10 Lower	Arsenic	mg/L	B 0.0133
C-10 Upper	Arsenic	mg/L	B 0.0127
C-17	Arsenic	mg/L	< 0.02
C-19 Lower	Arsenic	mg/L	0.0231
C-19 Upper	Arsenic	mg/L	< 0.02
C-21	Arsenic	mg/L	< 0.02
C-24	Arsenic	mg/L	< 0.02
C-26 Lower	Arsenic	mg/L	B 0.005
C-26 Upper	Arsenic	mg/L	< 0.02
C-30 Lower	Arsenic	mg/L	B 0.012
C-30 Upper	Arsenic	mg/L	< 0.02
C-34	Arsenic	mg/L	< 0.02
C-35	Arsenic	mg/L	B 0.0082
C-2	Barium	mg/L	B J 0.0288
C-5	Barium	mg/L	B J 0.0711
C-9	Barium	mg/L	B J 0.0337
C-10 Lower	Barium	mg/L	B J 0.066
C-10 Upper	Barium	mg/L	B J 0.0537
C-17	Barium	mg/L	B J 0.0511
C-19 Lower	Barium	mg/L	B J 0.0452
C-19 Upper	Barium	mg/L	B J 0.0684
C-21	Barium	mg/L	B J 0.0405
C-24	Barium	mg/L	B J 0.0336
C-26 Lower	Barium	mg/L	B J 0.0677
C-26 Upper	Barium	mg/L	B J 0.0623
C-30 Lower	Barium	mg/L	B J 0.0635
C-30 Upper	Barium	mg/L	B J 0.0461
C-34	Barium	mg/L	B J 0.0344
C-35	Barium	mg/L	B J 0.0664
C-2	Cadmium	mg/L	< 0.01
C-5	Cadmium	mg/L	< 0.01
C-9	Cadmium	mg/L	< 0.01
C-10 Lower	Cadmium	mg/L	< 0.01
C-10 Upper	Cadmium	mg/L	< 0.01
C-17	Cadmium	mg/L	< 0.01
C-19 Lower	Cadmium	mg/L	< 0.01
C-19 Upper	Cadmium	mg/L	< 0.01
C-21	Cadmium	mg/L	< 0.01
C-24	Cadmium	mg/L	< 0.01
C-26 Lower	Cadmium	mg/L	< 0.01
C-26 Upper	Cadmium	mg/L	< 0.01
C-30 Lower	Cadmium	mg/L	< 0.01
C-30 Upper	Cadmium	mg/L	< 0.01
C-34	Cadmium	mg/L	< 0.01
C-35	Cadmium	mg/L	< 0.01

Table C-4
C Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Chromium	mg/L	0.0244
C-5	Chromium	mg/L	B 0.0138
C-9	Chromium	mg/L	B 0.0128
C-10 Lower	Chromium	mg/L	B 0.0066
C-10 Upper	Chromium	mg/L	B 0.0106
C-17	Chromium	mg/L	B 0.0117
C-19 Lower	Chromium	mg/L	B 0.0105
C-19 Upper	Chromium	mg/L	B 0.0172
C-21	Chromium	mg/L	0.0216
C-24	Chromium	mg/L	B 0.0177
C-26 Lower	Chromium	mg/L	B 0.0091
C-26 Upper	Chromium	mg/L	B 0.0088
C-30 Lower	Chromium	mg/L	B 0.0076
C-30 Upper	Chromium	mg/L	B 0.0127
C-34	Chromium	mg/L	0.0202
C-35	Chromium	mg/L	0.0311
C-2	Lead	mg/L	< 0.04
C-5	Lead	mg/L	< 0.04
C-9	Lead	mg/L	< 0.04
C-10 Lower	Lead	mg/L	< 0.04
C-10 Upper	Lead	mg/L	< 0.04
C-17	Lead	mg/L	B 0.0183
C-19 Lower	Lead	mg/L	< 0.04
C-19 Upper	Lead	mg/L	< 0.04
C-21	Lead	mg/L	< 0.04
C-24	Lead	mg/L	< 0.04
C-26 Lower	Lead	mg/L	< 0.04
C-26 Upper	Lead	mg/L	< 0.04
C-30 Lower	Lead	mg/L	< 0.04
C-30 Upper	Lead	mg/L	< 0.04
C-34	Lead	mg/L	< 0.04
C-35	Lead	mg/L	< 0.04
C-2	Mercury	mg/L	< 0.001
C-5	Mercury	mg/L	< 0.001
C-9	Mercury	mg/L	< 0.001
C-10 Lower	Mercury	mg/L	< 0.001
C-10 Upper	Mercury	mg/L	< 0.001
C-17	Mercury	mg/L	B 0.00028
C-19 Lower	Mercury	mg/L	< 0.001
C-19 Upper	Mercury	mg/L	B 0.00049
C-21	Mercury	mg/L	< 0.001
C-24	Mercury	mg/L	< 0.001
C-26 Lower	Mercury	mg/L	< 0.001
C-26 Upper	Mercury	mg/L	B 0.0005
C-30 Lower	Mercury	mg/L	B J 0.0003
C-30 Upper	Mercury	mg/L	< 0.001
C-34	Mercury	mg/L	B J 0.00066
C-35	Mercury	mg/L	< 0.001

Honeywell International Inc.
Metropolis Works

Table C-4
C Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
C-2	Selenium	mg/L	<	0.03
C-5	Selenium	mg/L	<	0.03
C-9	Selenium	mg/L	<	0.03
C-10 Lower	Selenium	mg/L	<	0.03
C-10 Upper	Selenium	mg/L	<	0.03
C-17	Selenium	mg/L	<	0.03
C-19 Lower	Selenium	mg/L	<	0.03
C-19 Upper	Selenium	mg/L	<	0.03
C-21	Selenium	mg/L	<	0.03
C-24	Selenium	mg/L	<	0.03
C-26 Lower	Selenium	mg/L	<	0.03
C-26 Upper	Selenium	mg/L	<	0.03
C-30 Lower	Selenium	mg/L	<	0.03
C-30 Upper	Selenium	mg/L	<	0.03
C-34	Selenium	mg/L	<	0.03
C-35	Selenium	mg/L	<	0.03
C-2	Silver	mg/L	<	0.02
C-5	Silver	mg/L	<	0.02
C-9	Silver	mg/L	<	0.02
C-10 Lower	Silver	mg/L	<	0.02
C-10 Upper	Silver	mg/L	<	0.02
C-17	Silver	mg/L	<	0.02
C-19 Lower	Silver	mg/L	<	0.02
C-19 Upper	Silver	mg/L	<	0.02
C-21	Silver	mg/L	<	0.02
C-24	Silver	mg/L	<	0.02
C-26 Lower	Silver	mg/L	<	0.02
C-26 Upper	Silver	mg/L	<	0.02
C-30 Lower	Silver	mg/L	<	0.02
C-30 Upper	Silver	mg/L	<	0.02
C-34	Silver	mg/L	<	0.02
C-35	Silver	mg/L	<	0.02

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Table D-4
D Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
D-8 Lower	Arsenic	mg/L	0.0211
D-8 Upper	Arsenic	mg/L	B 0.0161
D-10 Lower	Arsenic	mg/L	0.0338
D-10 Upper	Arsenic	mg/L	0.0246
D-11 Lower	Arsenic	mg/L	0.0464
D-11 Upper	Arsenic	mg/L	0.138
D-17 Lower	Arsenic	mg/L	0.0392
D-17 Upper	Arsenic	mg/L	B 0.019
D-19 Lower	Arsenic	mg/L	0.0789
D-19 Upper	Arsenic	mg/L	0.0716
D-26 Lower	Arsenic	mg/L	0.0402
D-26 Upper	Arsenic	mg/L	0.269
D-29 Lower	Arsenic	mg/L	0.0351
D-29 Upper	Arsenic	mg/L	0.0648
D-8 Lower	Barium	mg/L	B J 0.0521
D-8 Upper	Barium	mg/L	B J 0.0559
D-10 Lower	Barium	mg/L	B J 0.0476
D-10 Upper	Barium	mg/L	B J 0.0398
D-11 Lower	Barium	mg/L	B J 0.0356
D-11 Upper	Barium	mg/L	B J 0.0879
D-17 Lower	Barium	mg/L	B J 0.0495
D-17 Upper	Barium	mg/L	B J 0.0552
D-19 Lower	Barium	mg/L	B J 0.0485
D-19 Upper	Barium	mg/L	B J 0.0368
D-26 Lower	Barium	mg/L	B J 0.0617
D-26 Upper	Barium	mg/L	B J 0.0879
D-29 Lower	Barium	mg/L	B J 0.0597
D-29 Upper	Barium	mg/L	J 0.153
D-8 Lower	Cadmium	mg/L	< 0.01
D-8 Upper	Cadmium	mg/L	< 0.01
D-10 Lower	Cadmium	mg/L	< 0.01
D-10 Upper	Cadmium	mg/L	< 0.01
D-11 Lower	Cadmium	mg/L	< 0.01
D-11 Upper	Cadmium	mg/L	< 0.01
D-17 Lower	Cadmium	mg/L	< 0.01
D-17 Upper	Cadmium	mg/L	< 0.01
D-19 Lower	Cadmium	mg/L	B 0.001
D-19 Upper	Cadmium	mg/L	B 0.001
D-26 Lower	Cadmium	mg/L	< 0.01
D-26 Upper	Cadmium	mg/L	B 0.0012
D-29 Lower	Cadmium	mg/L	< 0.01
D-29 Upper	Cadmium	mg/L	B 0.00092

Honeywell International Inc.
Metropolis Works

Table D-4
D Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
D-8 Lower	Chromium	mg/L	B	0.0074
D-8 Upper	Chromium	mg/L	B	0.0092
D-10 Lower	Chromium	mg/L	<	0.02
D-10 Upper	Chromium	mg/L	<	0.02
D-11 Lower	Chromium	mg/L	<	0.02
D-11 Upper	Chromium	mg/L	B	0.0064
D-17 Lower	Chromium	mg/L	<	0.02
D-17 Upper	Chromium	mg/L	B	0.0094
D-19 Lower	Chromium	mg/L		0.279
D-19 Upper	Chromium	mg/L		0.724
D-26 Lower	Chromium	mg/L	B	0.0082
D-26 Upper	Chromium	mg/L	B	0.0107
D-29 Lower	Chromium	mg/L	<	0.02
D-29 Upper	Chromium	mg/L	B	0.0064
D-8 Lower	Lead	mg/L	<	0.04
D-8 Upper	Lead	mg/L	<	0.04
D-10 Lower	Lead	mg/L	<	0.04
D-10 Upper	Lead	mg/L	<	0.04
D-11 Lower	Lead	mg/L	<	0.04
D-11 Upper	Lead	mg/L	<	0.04
D-17 Lower	Lead	mg/L	<	0.04
D-17 Upper	Lead	mg/L	<	0.04
D-19 Lower	Lead	mg/L	<	0.04
D-19 Upper	Lead	mg/L	<	0.04
D-26 Lower	Lead	mg/L	<	0.04
D-26 Upper	Lead	mg/L	<	0.04
D-29 Lower	Lead	mg/L	<	0.04
D-29 Upper	Lead	mg/L	<	0.04
D-8 Lower	Mercury	mg/L	<	0.001
D-8 Upper	Mercury	mg/L	<	0.001
D-10 Lower	Mercury	mg/L	<	0.001
D-10 Upper	Mercury	mg/L	<	0.001
D-11 Lower	Mercury	mg/L	<	0.001
D-11 Upper	Mercury	mg/L	<	0.001
D-17 Lower	Mercury	mg/L	<	0.001
D-17 Upper	Mercury	mg/L	<	0.001
D-19 Lower	Mercury	mg/L	<	0.001
D-19 Upper	Mercury	mg/L	<	0.001
D-26 Lower	Mercury	mg/L	B	0.00025
D-26 Upper	Mercury	mg/L	<	0.001
D-29 Lower	Mercury	mg/L	<	0.001
D-29 Upper	Mercury	mg/L	<	0.001

Honeywell International Inc.
Metropolis Works

Table D-4
D Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
D-8 Lower	Selenium	mg/L	< 0.03
D-8 Upper	Selenium	mg/L	< 0.03
D-10 Lower	Selenium	mg/L	< 0.03
D-10 Upper	Selenium	mg/L	< 0.03
D-11 Lower	Selenium	mg/L	< 0.03
D-11 Upper	Selenium	mg/L	< 0.03
D-17 Lower	Selenium	mg/L	< 0.03
D-17 Upper	Selenium	mg/L	< 0.03
D-19 Lower	Selenium	mg/L	< 0.03
D-19 Upper	Selenium	mg/L	< 0.03
D-26 Lower	Selenium	mg/L	< 0.03
D-26 Upper	Selenium	mg/L	< 0.03
D-29 Lower	Selenium	mg/L	< 0.03
D-29 Upper	Selenium	mg/L	< 0.03
D-8 Lower	Silver	mg/L	< 0.02
D-8 Upper	Silver	mg/L	< 0.02
D-10 Lower	Silver	mg/L	< 0.02
D-10 Upper	Silver	mg/L	< 0.02
D-11 Lower	Silver	mg/L	< 0.02
D-11 Upper	Silver	mg/L	< 0.02
D-17 Lower	Silver	mg/L	< 0.02
D-17 Upper	Silver	mg/L	< 0.02
D-19 Lower	Silver	mg/L	< 0.02
D-19 Upper	Silver	mg/L	< 0.02
D-26 Lower	Silver	mg/L	< 0.02
D-26 Upper	Silver	mg/L	< 0.02
D-29 Lower	Silver	mg/L	< 0.02
D-29 Upper	Silver	mg/L	< 0.02

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
E-2	Arsenic	mg/L	B 0.0045
E-10 Lower	Arsenic	mg/L	0.0586
E-10 Upper	Arsenic	mg/L	0.153
E-12 Lower	Arsenic	mg/L	0.0556
E-12 Upper	Arsenic	mg/L	0.033
E-16 Lower	Arsenic	mg/L	0.0592
E-16 Upper	Arsenic	mg/L	0.0752
E-23 Lower	Arsenic	mg/L	0.0565
E-23 Upper	Arsenic	mg/L	0.132
E-27 Lower	Arsenic	mg/L	0.0349
E-27 Upper	Arsenic	mg/L	0.185
E-38 Lower	Arsenic	mg/L	0.0667
E-38 Upper	Arsenic	mg/L	0.481
E-41 Lower	Arsenic	mg/L	0.0392
E-41 Upper	Arsenic	mg/L	0.222
E-44 Lower	Arsenic	mg/L	0.0978
E-44 Upper	Arsenic	mg/L	0.389
E-51 Lower	Arsenic	mg/L	0.146
E-51 Upper	Arsenic	mg/L	0.413
E-65 Lower	Arsenic	mg/L	0.128
E-65 Upper	Arsenic	mg/L	0.427
E-67 Lower	Arsenic	mg/L	0.104
E-67 Upper	Arsenic	mg/L	0.3
E-74 Lower	Arsenic	mg/L	0.0881
E-74 Upper	Arsenic	mg/L	0.555
E-79 Lower	Arsenic	mg/L	0.138
E-79 Upper	Arsenic	mg/L	0.315
E-80 Lower	Arsenic	mg/L	0.126
E-80 Upper	Arsenic	mg/L	0.219
E-97 Lower	Arsenic	mg/L	0.0875
E-97 Upper	Arsenic	mg/L	0.118
E103 Lower	Arsenic	mg/L	0.209
E-103 Upper	Arsenic	mg/L	0.187

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result
E-2	Barium	mg/L	B J 0.0545
E-10 Lower	Barium	mg/L	B J 0.0656
E-10 Upper	Barium	mg/L	B J 0.0489
E-12 Lower	Barium	mg/L	B J 0.0647
E-12 Upper	Barium	mg/L	B J 0.0501
E-16 Lower	Barium	mg/L	B J 0.0791
E-16 Upper	Barium	mg/L	B J 0.0686
E-23 Lower	Barium	mg/L	B J 0.0489
E-23 Upper	Barium	mg/L	B J 0.0846
E-27 Lower	Barium	mg/L	B J 0.0522
E-27 Upper	Barium	mg/L	B J 0.0572
E-38 Lower	Barium	mg/L	B J 0.0518
E-38 Upper	Barium	mg/L	B J 0.0557
E-41 Lower	Barium	mg/L	B J 0.0454
E-41 Upper	Barium	mg/L	B J 0.0726
E-44 Lower	Barium	mg/L	B J 0.0477
E-44 Upper	Barium	mg/L	B J 0.0396
E-51 Lower	Barium	mg/L	B J 0.0577
E-51 Upper	Barium	mg/L	B J 0.0651
E-65 Lower	Barium	mg/L	B J 0.0543
E-65 Upper	Barium	mg/L	B J 0.06
E-67 Lower	Barium	mg/L	B J 0.0504
E-67 Upper	Barium	mg/L	B J 0.0628
E-74 Lower	Barium	mg/L	B J 0.0263
E-74 Upper	Barium	mg/L	B J 0.034
E-79 Lower	Barium	mg/L	B J 0.0673
E-79 Upper	Barium	mg/L	B J 0.0592
E-80 Lower	Barium	mg/L	B J 0.0518
E-80 Upper	Barium	mg/L	B J 0.0538
E-97 Lower	Barium	mg/L	B J 0.0541
E-97 Upper	Barium	mg/L	B J 0.0573
E103 Lower	Barium	mg/L	B J 0.0425
E-103 Upper	Barium	mg/L	B J 0.074

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Cadmium	mg/L	<	0.01
E-10 Lower	Cadmium	mg/L	<	0.01
E-10 Upper	Cadmium	mg/L	<	0.01
E-12 Lower	Cadmium	mg/L	<	0.01
E-12 Upper	Cadmium	mg/L	<	0.01
E-16 Lower	Cadmium	mg/L	<	0.01
E-16 Upper	Cadmium	mg/L	<	0.01
E-23 Lower	Cadmium	mg/L	<	0.01
E-23 Upper	Cadmium	mg/L	<	0.01
E-27 Lower	Cadmium	mg/L	<	0.01
E-27 Upper	Cadmium	mg/L	<	0.01
E-38 Lower	Cadmium	mg/L	<	0.01
E-38 Upper	Cadmium	mg/L	<	0.01
E-41 Lower	Cadmium	mg/L	<	0.01
E-41 Upper	Cadmium	mg/L	B	0.0024
E-44 Lower	Cadmium	mg/L	<	0.01
E-44 Upper	Cadmium	mg/L	<	0.01
E-51 Lower	Cadmium	mg/L	<	0.01
E-51 Upper	Cadmium	mg/L	<	0.01
E-65 Lower	Cadmium	mg/L	<	0.01
E-65 Upper	Cadmium	mg/L	<	0.01
E-67 Lower	Cadmium	mg/L	<	0.01
E-67 Upper	Cadmium	mg/L	B	0.0018
E-74 Lower	Cadmium	mg/L	<	0.01
E-74 Upper	Cadmium	mg/L	B	0.0013
E-79 Lower	Cadmium	mg/L	<	0.01
E-79 Upper	Cadmium	mg/L	<	0.01
E-80 Lower	Cadmium	mg/L	<	0.01
E-80 Upper	Cadmium	mg/L	<	0.01
E-97 Lower	Cadmium	mg/L	<	0.01
E-97 Upper	Cadmium	mg/L	B	0.0012
E103 Lower	Cadmium	mg/L	<	0.01
E-103 Upper	Cadmium	mg/L	B	0.0024

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Chromium	mg/L	B	0.0111
E-10 Lower	Chromium	mg/L	B	0.0064
E-10 Upper	Chromium	mg/L	B	0.0168
E-12 Lower	Chromium	mg/L	B	0.0071
E-12 Upper	Chromium	mg/L	B	0.0101
E-16 Lower	Chromium	mg/L	<	0.02
E-16 Upper	Chromium	mg/L	B	0.0105
E-23 Lower	Chromium	mg/L	B	0.0077
E-23 Upper	Chromium	mg/L	B	0.0085
E-27 Lower	Chromium	mg/L	<	0.02
E-27 Upper	Chromium	mg/L	<	0.02
E-38 Lower	Chromium	mg/L	B	0.0155
E-38 Upper	Chromium	mg/L	<	0.02
E-41 Lower	Chromium	mg/L	B	0.009
E-41 Upper	Chromium	mg/L	B	0.0186
E-44 Lower	Chromium	mg/L	<	0.02
E-44 Upper	Chromium	mg/L	<	0.02
E-51 Lower	Chromium	mg/L	<	0.02
E-51 Upper	Chromium	mg/L	<	0.02
E-65 Lower	Chromium	mg/L	<	0.02
E-65 Upper	Chromium	mg/L	<	0.02
E-67 Lower	Chromium	mg/L	<	0.02
E-67 Upper	Chromium	mg/L	<	0.02
E-74 Lower	Chromium	mg/L	<	0.02
E-74 Upper	Chromium	mg/L		0.0303
E-79 Lower	Chromium	mg/L	B	0.0104
E-79 Upper	Chromium	mg/L	B	0.009
E-80 Lower	Chromium	mg/L	B	0.0109
E-80 Upper	Chromium	mg/L	B	0.0104
E-97 Lower	Chromium	mg/L	B	0.0167
E-97 Upper	Chromium	mg/L	B	0.0081
E103 Lower	Chromium	mg/L	B	0.0092
E-103 Upper	Chromium	mg/L	B	0.0185

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Lead	mg/L	<	0.04
E-10 Lower	Lead	mg/L	<	0.04
E-10 Upper	Lead	mg/L	<	0.04
E-12 Lower	Lead	mg/L	<	0.04
E-12 Upper	Lead	mg/L	<	0.04
E-16 Lower	Lead	mg/L	<	0.04
E-16 Upper	Lead	mg/L	<	0.04
E-23 Lower	Lead	mg/L	<	0.04
E-23 Upper	Lead	mg/L	<	0.04
E-27 Lower	Lead	mg/L	<	0.04
E-27 Upper	Lead	mg/L	<	0.04
E-38 Lower	Lead	mg/L	<	0.04
E-38 Upper	Lead	mg/L	<	0.04
E-41 Lower	Lead	mg/L	<	0.04
E-41 Upper	Lead	mg/L	B	0.0065
E-44 Lower	Lead	mg/L	<	0.04
E-44 Upper	Lead	mg/L	<	0.04
E-51 Lower	Lead	mg/L	<	0.04
E-51 Upper	Lead	mg/L	<	0.04
E-65 Lower	Lead	mg/L	<	0.04
E-65 Upper	Lead	mg/L	<	0.04
E-67 Lower	Lead	mg/L	<	0.04
E-67 Upper	Lead	mg/L	<	0.04
E-74 Lower	Lead	mg/L	<	0.04
E-74 Upper	Lead	mg/L	<	0.04
E-79 Lower	Lead	mg/L	<	0.04
E-79 Upper	Lead	mg/L	<	0.04
E-80 Lower	Lead	mg/L	<	0.04
E-80 Upper	Lead	mg/L	<	0.04
E-97 Lower	Lead	mg/L	<	0.04
E-97 Upper	Lead	mg/L	<	0.04
E103 Lower	Lead	mg/L	<	0.04
E-103 Upper	Lead	mg/L	<	0.04

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Mercury	mg/L	<	0.001
E-10 Lower	Mercury	mg/L	B J	0.00022
E-10 Upper	Mercury	mg/L	<	0.001
E-12 Lower	Mercury	mg/L	<	0.001
E-12 Upper	Mercury	mg/L	B J	0.00025
E-16 Lower	Mercury	mg/L	<	0.001
E-16 Upper	Mercury	mg/L	B J	0.00027
E-23 Lower	Mercury	mg/L	B J	0.00029
E-23 Upper	Mercury	mg/L	B J	0.00025
E-27 Lower	Mercury	mg/L	<	0.001
E-27 Upper	Mercury	mg/L	<	0.001
E-38 Lower	Mercury	mg/L	<	0.001
E-38 Upper	Mercury	mg/L	B	0.00025
E-41 Lower	Mercury	mg/L	<	0.001
E-41 Upper	Mercury	mg/L		0.0014
E-44 Lower	Mercury	mg/L	<	0.001
E-44 Upper	Mercury	mg/L	B	0.00023
E-51 Lower	Mercury	mg/L	<	0.001
E-51 Upper	Mercury	mg/L		0.0014
E-65 Lower	Mercury	mg/L	B	0.00024
E-65 Upper	Mercury	mg/L	<	0.001
E-67 Lower	Mercury	mg/L	<	0.001
E-67 Upper	Mercury	mg/L	B	0.00044
E-74 Lower	Mercury	mg/L	<	0.001
E-74 Upper	Mercury	mg/L	B	0.00058
E-79 Lower	Mercury	mg/L	B J	0.0008
E-79 Upper	Mercury	mg/L	<	0.001
E-80 Lower	Mercury	mg/L	J	0.0011
E-80 Upper	Mercury	mg/L	<	0.001
E-97 Lower	Mercury	mg/L	B J	0.00081
E-97 Upper	Mercury	mg/L	B J	0.0008
E103 Lower	Mercury	mg/L	<	0.001
E-103 Upper	Mercury	mg/L	<	0.001

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Selenium	mg/L	<	0.03
E-10 Lower	Selenium	mg/L	<	0.03
E-10 Upper	Selenium	mg/L	<	0.03
E-12 Lower	Selenium	mg/L	<	0.03
E-12 Upper	Selenium	mg/L	<	0.03
E-16 Lower	Selenium	mg/L	<	0.03
E-16 Upper	Selenium	mg/L	<	0.03
E-23 Lower	Selenium	mg/L	<	0.03
E-23 Upper	Selenium	mg/L	<	0.03
E-27 Lower	Selenium	mg/L	<	0.03
E-27 Upper	Selenium	mg/L	<	0.03
E-38 Lower	Selenium	mg/L	<	0.03
E-38 Upper	Selenium	mg/L	<	0.03
E-41 Lower	Selenium	mg/L	<	0.03
E-41 Upper	Selenium	mg/L	<	0.03
E-44 Lower	Selenium	mg/L	<	0.03
E-44 Upper	Selenium	mg/L	<	0.03
E-51 Lower	Selenium	mg/L	<	0.03
E-51 Upper	Selenium	mg/L	B	0.0277
E-65 Lower	Selenium	mg/L	<	0.03
E-65 Upper	Selenium	mg/L	<	0.03
E-67 Lower	Selenium	mg/L	<	0.03
E-67 Upper	Selenium	mg/L	<	0.03
E-74 Lower	Selenium	mg/L	<	0.03
E-74 Upper	Selenium	mg/L	<	0.03
E-79 Lower	Selenium	mg/L	<	0.03
E-79 Upper	Selenium	mg/L	<	0.03
E-80 Lower	Selenium	mg/L	<	0.03
E-80 Upper	Selenium	mg/L	<	0.03
E-97 Lower	Selenium	mg/L	<	0.03
E-97 Upper	Selenium	mg/L	<	0.03
E103 Lower	Selenium	mg/L	<	0.03
E-103 Upper	Selenium	mg/L	<	0.03

Honeywell International Inc.
Metropolis Works

Table E-4
E Pond - RCRA TCLP Metals Analytical Summary

Sample ID	Parameter	Units	Result	
E-2	Silver	mg/L	<	0.02
E-10 Lower	Silver	mg/L	<	0.02
E-10 Upper	Silver	mg/L	<	0.02
E-12 Lower	Silver	mg/L	<	0.02
E-12 Upper	Silver	mg/L	<	0.02
E-16 Lower	Silver	mg/L	<	0.02
E-16 Upper	Silver	mg/L	<	0.02
E-23 Lower	Silver	mg/L	<	0.02
E-23 Upper	Silver	mg/L	<	0.02
E-27 Lower	Silver	mg/L	<	0.02
E-27 Upper	Silver	mg/L	<	0.02
E-38 Lower	Silver	mg/L	<	0.02
E-38 Upper	Silver	mg/L	<	0.02
E-41 Lower	Silver	mg/L	<	0.02
E-41 Upper	Silver	mg/L	B	0.0123
E-44 Lower	Silver	mg/L	<	0.02
E-44 Upper	Silver	mg/L	<	0.02
E-51 Lower	Silver	mg/L	<	0.02
E-51 Upper	Silver	mg/L	<	0.02
E-65 Lower	Silver	mg/L	<	0.02
E-65 Upper	Silver	mg/L	<	0.02
E-67 Lower	Silver	mg/L	<	0.02
E-67 Upper	Silver	mg/L	<	0.02
E-74 Lower	Silver	mg/L	<	0.02
E-74 Upper	Silver	mg/L	<	0.02
E-79 Lower	Silver	mg/L	<	0.02
E-79 Upper	Silver	mg/L	<	0.02
E-80 Lower	Silver	mg/L	<	0.02
E-80 Upper	Silver	mg/L	<	0.02
E-97 Lower	Silver	mg/L	<	0.02
E-97 Upper	Silver	mg/L	<	0.02
E103 Lower	Silver	mg/L	<	0.02
E-103 Upper	Silver	mg/L	<	0.02

Notes:
B = Estimated result. Result is less than RL.
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table B-5
B Pond - Paint Filter Test & pH Analytical Summary

Sample ID	Parameter	Units	Result	pH
B-2	Paint Filter Test	No Units	CNF	11.7
B-5 Lower	Paint Filter Test	No Units	CNF	12.4
B-5 Upper	Paint Filter Test	No Units	CNF	12.1
B-10 Lower	Paint Filter Test	No Units	CNF	12.5
B-10 Upper	Paint Filter Test	No Units	CNF	12.4
B-18 Lower	Paint Filter Test	No Units	CNF	12.2
B-18 Upper	Paint Filter Test	No Units	CNF	11.8
B-19 Lower	Paint Filter Test	No Units	CNF	12.9
B-19 Upper	Paint Filter Test	No Units	CNF	12.3
B-26 Lower	Paint Filter Test	No Units	CNF	12.8
B-26 Upper	Paint Filter Test	No Units	CNF	12.6
B-30 Lower	Paint Filter Test	No Units	CNF	12.7
B-30 Upper	Paint Filter Test	No Units	CNF	12.6
B-35	Paint Filter Test	No Units	CNF	12.2

Note:
CNF = Contains No Free Liquids

Honeywell International Inc.
Metropolis Works

Table C-5
C Pond - Paint Filter Test & pH Analytical Summary

Sample ID	Parameter	Units	Result	pH
C-2	Paint Filter Test	No Units	CNF	12.4
C-5	Paint Filter Test	No Units	CNF	12.5
C-9	Paint Filter Test	No Units	CNF	12.6
C-10 Lower	Paint Filter Test	No Units	CNF	12.8
C-10 Upper	Paint Filter Test	No Units	CNF	12.5
C-17	Paint Filter Test	No Units	CNF	12.6
C-19 Lower	Paint Filter Test	No Units	CNF	12.8
C-19 Upper	Paint Filter Test	No Units	CNF	12.7
C-21	Paint Filter Test	No Units	CNF	12.5
C-24	Paint Filter Test	No Units	CNF	12.6
C-26 Lower	Paint Filter Test	No Units	CNF	12.7
C-26 Upper	Paint Filter Test	No Units	CNF	12.6
C-30 Lower	Paint Filter Test	No Units	CNF	12.6
C-30 Upper	Paint Filter Test	No Units	CNF	12.6
C-34	Paint Filter Test	No Units	CNF	12.6
C-35	Paint Filter Test	No Units	CNF	12.5

Note:
CNF = Contains No Free Liquids

Honeywell International Inc.
Metropolis Works

Table D-5
D Pond - Paint Filter Test & pH Analytical Summary

Sample ID	Parameter	Units	Result	pH
D-8 Lower	Paint Filter Test	No Units	CNF	12.6
D-8 Upper	Paint Filter Test	No Units	CNF	12.2
D-10 Lower	Paint Filter Test	No Units	CNF	12.5
D-10 Upper	Paint Filter Test	No Units	CNF	12.4
D-11 Lower	Paint Filter Test	No Units	CNF	12.6
D-11 Upper	Paint Filter Test	No Units	CNF	12.5
D-17 Lower	Paint Filter Test	No Units	CNF	12.5
D-17 Upper	Paint Filter Test	No Units	CNF	12.5
D-19 Lower	Paint Filter Test	No Units	CNF	11.2
D-19 Upper	Paint Filter Test	No Units	CNF	10.6
D-26 Lower	Paint Filter Test	No Units	CNF	12.6
D-26 Upper	Paint Filter Test	No Units	CNF	12
D-29 Lower	Paint Filter Test	No Units	CNF	12.5
D-29 Upper	Paint Filter Test	No Units	CNF	12

Note:
CNF = Contains No Free Liquids

Honeywell International Inc.
Metropolis Works

Table E-5
E Pond - Paint Filter Test & pH Analytical Summary

Sample ID	Parameter	Units	Result	pH
E-2	Paint Filter Test	No Units	CNF	12
E-10 Lower	Paint Filter Test	No Units	CNF	12.4
E-10 Upper	Paint Filter Test	No Units	CNF	12.7
E-12 Lower	Paint Filter Test	No Units	CNF	12.2
E-12 Upper	Paint Filter Test	No Units	CNF	12.1
E-16 Lower	Paint Filter Test	No Units	CNF	12.8
E-16 Upper	Paint Filter Test	No Units	CNF	12.6
E-23 Lower	Paint Filter Test	No Units	CNF	12.7
E-23 Upper	Paint Filter Test	No Units	CNF	12.6
E-27 Lower	Paint Filter Test	No Units	CNF	12.5
E-27 Upper	Paint Filter Test	No Units	CNF	12.4
E-38 Lower	Paint Filter Test	No Units	CNF	12.6
E-38 Upper	Paint Filter Test	No Units	CNF	12.2
E-41 Lower	Paint Filter Test	No Units	CNF	12.2
E-41 Upper	Paint Filter Test	No Units	CNF	12.3
E-44 Lower	Paint Filter Test	No Units	CNF	12.2
E-44 Upper	Paint Filter Test	No Units	CNF	12.3
E-51 Lower	Paint Filter Test	No Units	CNF	12.2
E-51 Upper	Paint Filter Test	No Units	CNF	12.2
E-65 Lower	Paint Filter Test	No Units	CNF	12.5
E-65 Upper	Paint Filter Test	No Units	CNF	12.4
E-67 Lower	Paint Filter Test	No Units	CNF	12.6
E-67 Upper	Paint Filter Test	No Units	CNF	12.4
E-74 Lower	Paint Filter Test	No Units	CNF	12.6
E-74 Upper	Paint Filter Test	No Units	CNF	12.5
E-79 Lower	Paint Filter Test	No Units	CNF	12.4
E-79 Upper	Paint Filter Test	No Units	CNF	12.5
E-80 Lower	Paint Filter Test	No Units	CNF	12.4
E-80 Upper	Paint Filter Test	No Units	CNF	12.2
E-97 Lower	Paint Filter Test	No Units	NT	12.4
E-97 Upper	Paint Filter Test	No Units	NT	12.4
E-103 Lower	Paint Filter Test	No Units	CNF	12.4
E-103 Upper	Paint Filter Test	No Units	CNF	12.2

Note:
CNF = Contains No Free Liquids
NT = Not Tested

Honeywell International Inc.
Metropolis Works

Table B-6
B Pond - Total Organic Carbon Analytical Summary

Sample ID	Parameter	Units	Result
B-18 Lower	Total Organic Carbon	g/kg	B 1.7
B-18 Upper	Total Organic Carbon	g/kg	B 1.2
B-19 Upper	Total Organic Carbon	g/kg	B 1.2
B-26 Lower	Total Organic Carbon	g/kg	B 0.98

Note:
B = Estimated result. Result is less than RL.

Honeywell International Inc.
Metropolis Works

Table C-6
C Pond - Total Organic Carbon Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Total Organic Carbon	g/kg	3.1
C-5	Total Organic Carbon	g/kg	2.9
C-19 Lower	Total Organic Carbon	g/kg	B 1.8
C-19 Upper	Total Organic Carbon	g/kg	10.7

Note:
B = Estimated result. Result is less than RL.

Table D-6
D Pond - Total Organic Carbon Analytical Summary

Sample ID	Parameter	Units	Result
D-10 Lower	Total Organic Carbon	g/kg	3.3
D-10 Upper	Total Organic Carbon	g/kg	3.6
D-17 Lower	Total Organic Carbon	g/kg	5.6
D-17 Upper	Total Organic Carbon	g/kg	4.5
D-19 Lower	Total Organic Carbon	g/kg	3
D-19 Upper	Total Organic Carbon	g/kg	4
D-26 Lower	Total Organic Carbon	g/kg	11
D-26 Upper	Total Organic Carbon	g/kg	3.1

Honeywell International Inc.
Metropolis Works

Table E-6
E Pond - Total Organic Carbon Analytical Summary

Sample ID	Parameter	Units	Result
E-65 Lower	Total Organic Carbon	g/kg	2.7
E-65 Upper	Total Organic Carbon	g/kg	B 0.77
E-80 Lower	Total Organic Carbon	g/kg	2.9
E-80 Upper	Total Organic Carbon	g/kg	B 1.3
E-97 Lower	Total Organic Carbon	g/kg	B 1
E-97 Upper	Total Organic Carbon	g/kg	2
E-103 Lower	Total Organic Carbon	g/kg	3.9
E-103 Upper	Total Organic Carbon	g/kg	3.8

Note:
B = Estimated result. Result is less than RL.

Honeywell International Inc.
Metropolis Works

Table B-7
B Pond - Bulk Density Analytical Summary

Sample ID	Parameter	Units	Result
B-18 Lower	Bulk Density	g/mL	1.6
B-18 Upper	Bulk Density	g/mL	1.7
B-19 Upper	Bulk Density	g/mL	1.4
B-26 Lower	Bulk Density	g/mL	1.6

Honeywell International Inc.
Metropolis Works

Table C-7
C Pond - Bulk Density Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Bulk Density	g/mL	1.6
C-5	Bulk Density	g/mL	1.7
C-19 Lower	Bulk Density	g/mL	1.6
C-19 Upper	Bulk Density	g/mL	1.5

Honeywell International Inc.
Metropolis Works

Table D-7
D Pond - Bulk Density Analytical Summary

Sample ID	Parameter	Units	Result
D-8 Lower	Bulk Density	g/mL	1.5
D-8 Upper	Bulk Density	g/mL	1.6
D-10 Lower	Bulk Density	g/mL	1.4
D-10 Upper	Bulk Density	g/mL	1.5
D-17 Lower	Bulk Density	g/mL	1.5
D-17 Upper	Bulk Density	g/mL	1.6
D-26 Lower	Bulk Density	g/mL	1.8
D-26 Upper	Bulk Density	g/mL	1.9

Table E-7
E Pond - Bulk Density Analytical Summary

Sample ID	Parameter	Units	Result
E-65 Lower	Bulk Density	g/mL	1.3
E-65 Upper	Bulk Density	g/mL	1.5
E-80 Lower	Bulk Density	g/mL	1.5
E-80 Upper	Bulk Density	g/mL	1.5
E-97 Lower	Bulk Density	g/mL	1.2
E-97 Upper	Bulk Density	g/mL	1.1
E-103 Lower	Bulk Density	g/mL	1.7
E-103 Upper	Bulk Density	g/mL	1.7

Table B-8
B Pond - Cation Exchange Capacity Analytical Summary

Sample ID	Parameter	Units	Result
B-18 Lower	Cation Exchange Capacity	meq/100g	7.1
B-18 Upper	Cation Exchange Capacity	meq/100g	6.7
B-19 Upper	Cation Exchange Capacity	meq/100g	6.8
B-26 Lower	Cation Exchange Capacity	meq/100g	7.1

Honeywell International Inc.
Metropolis Works

Table C-8
C Pond - Cation Exchange Capacity Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Cation Exchange Capacity	meq/100g	24.8
C-5	Cation Exchange Capacity	meq/100g	6.7
C-19 Lower	Cation Exchange Capacity	meq/100g	21.5
C-19 Upper	Cation Exchange Capacity	meq/100g	14.6

Honeywell International Inc.
Metropolis Works

Table D-8
D Pond - Cation Exchange Capacity Analytical Summary

Sample ID	Parameter	Units	Result
D-8 Lower	Cation Exchange Capacity	meq/100g	11
D-8 Upper	Cation Exchange Capacity	meq/100g	10.5
D-10 Lower	Cation Exchange Capacity	meq/100g	7.5
D-10 Upper	Cation Exchange Capacity	meq/100g	11.6
D-17 Lower	Cation Exchange Capacity	meq/100g	7.4
D-17 Upper	Cation Exchange Capacity	meq/100g	6.7
D-26 Lower	Cation Exchange Capacity	meq/100g	7
D-26 Upper	Cation Exchange Capacity	meq/100g	12.6

Honeywell International Inc.
Metropolis Works

Table E-8
E Pond - Cation Exchange Capacity Analytical Summary

Sample ID	Parameter	Units	Result
E-65 Lower	Cation Exchange Capacity	meq/100g	9.1
E-65 Upper	Cation Exchange Capacity	meq/100g	10.2
E-80 Lower	Cation Exchange Capacity	meq/100g	9.6
E-80 Upper	Cation Exchange Capacity	meq/100g	8.2
E-97 Lower	Cation Exchange Capacity	meq/100g	9.4
E-97 Upper	Cation Exchange Capacity	meq/100g	10.1
E-103 Lower	Cation Exchange Capacity	meq/100g	11.5
E-103 Upper	Cation Exchange Capacity	meq/100g	B 1.9

Honeywell International Inc.
Metropolis Works

Table B-9
B Pond - Total Chloride & Sulfide Analytical Summary

Sample ID	Parameter	Units	Result
B-18 Lower	Total Chloride	mg/kg	15.6
B-18 Lower	Total Sulfide	mg/kg	< 10
B-18 Upper	Total Chloride	mg/kg	24.5
B-18 Upper	Total Sulfide	mg/kg	< 10
B-19 Upper	Total Chloride	mg/kg	8.8
B-19 Upper	Total Sulfide	mg/kg	< 10
B-26 Lower	Total Chloride	mg/kg	11.8
B-26 Lower	Total Sulfide	mg/kg	< 10

Honeywell International Inc.
Metropolis Works

Table C-9
C Pond - Total Chloride & Sulfide Analytical Summary

Sample ID	Parameter	Units	Result
C-2	Total Chloride	mg/kg	3.6
C-2	Total Sulfide	mg/kg	50
C-5	Total Chloride	mg/kg	6.9
C-5	Total Sulfide	mg/kg	140
C-19 Lower	Total Chloride	mg/kg	17.9
C-19 Lower	Total Sulfide	mg/kg	< 10
C-19 Upper	Total Chloride	mg/kg	17.1
C-19 Upper	Total Sulfide	mg/kg	60

Honeywell International Inc.
Metropolis Works

Table D-9
D Pond - Total Chloride & Sulfide Analytical Summary

Sample ID	Parameter	Units	Result	
D-8 Lower	Total Chloride	mg/kg	J	28.7
D-8 Lower	Total Sulfide	mg/kg	<	10
D-8 Upper	Total Chloride	mg/kg	J	19.7
D-8 Upper	Total Sulfide	mg/kg	<	10
D-10 Lower	Total Chloride	mg/kg	J	30
D-10 Lower	Total Sulfide	mg/kg	<	10
D-10 Upper	Total Chloride	mg/kg	J	26.6
D-10 Upper	Total Sulfide	mg/kg	<	10
D-17 Lower	Total Chloride	mg/kg	J	28.1
D-17 Lower	Total Sulfide	mg/kg	<	10
D-17 Upper	Total Chloride	mg/kg	J	17.8
D-17 Upper	Total Sulfide	mg/kg	<	10
D-19 Lower	Total Chloride	mg/kg	J	9.8
D-19 Lower	Total Sulfide	mg/kg	<	10
D-19 Upper	Total Chloride	mg/kg	J	7.7
D-19 Upper	Total Sulfide	mg/kg	<	10
D-26 Lower	Total Chloride	mg/kg	J	23.1
D-26 Lower	Total Sulfide	mg/kg	<	10
D-26 Upper	Total Chloride	mg/kg	J	6.3
D-26 Upper	Total Sulfide	mg/kg	<	10

Note:
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Honeywell International Inc.
Metropolis Works

Table E-9
E Pond - Total Chloride & Sulfide Analytical Summary

Sample ID	Parameter	Units	Result	
E-65 Lower	Total Chloride	mg/kg	J	24.3
E-65 Lower	Total Sulfide	mg/kg	<	10
E-65 Upper	Total Chloride	mg/kg	J	18.3
E-65 Upper	Total Sulfide	mg/kg	<	10
E-80 Lower	Total Chloride	mg/kg	J	36
E-80 Lower	Total Sulfide	mg/kg	<	10
E-80 Upper	Total Chloride	mg/kg	J	19.1
E-80 Upper	Total Sulfide	mg/kg	<	10
E-97 Lower	Total Chloride	mg/kg	J	24.2
E-97 Lower	Total Sulfide	mg/kg	<	10
E-97 Upper	Total Chloride	mg/kg	J	13.1
E-97 Upper	Total Sulfide	mg/kg	<	10
E-103 Lower	Total Chloride	mg/kg		20.1
E-103 Lower	Total Sulfide	mg/kg	<	10
E-103 Upper	Total Chloride	mg/kg		10.4
E-103 Upper	Total Sulfide	mg/kg	<	10

Note:
J = Method blank contamination. The associated method blank contains the target analyte at a reportable level.

Table B-10
B Pond - Total Uranium Matrix Spike and Matrix Spike Duplicate Summary

Laboratory Sample ID	Sample ID	Sample Type (MS or MSD)	Laboratory Batch ID	Parameter	Units	Measured Value of Unspiked Sample	RL	Spike Amount	Measured Value of Spiked Sample	Percent Recovery	RPD
F9C130321001S	B-1	MS	9082045	Uranium	mg/kg	238	50	100	316	78	9.9
F9C130321001D	B-1	MSD	9082045	Uranium	mg/kg	238	50	100	349	111	9.9
F9C190122009D	B-13 LIQ	MSD	9082046	Uranium	mg/kg	455	50	100	456	0.87	62
F9C190122009S	B-13 LIQ	MS	9082046	Uranium	mg/kg	455	50	100	861	406	62
F9C260105001S	B-30 Upper	MS	9090230	Uranium	mg/kg	298	50	100	345	47	21
F9C260105001D	B-30 Upper	MSD	9090230	Uranium	mg/kg	298	50	100	427	129	21

Notes:
1. Method 6010c specifies the percent recovery to be within ± 25% and the RPD to be within ±20%.
2. MS = Matrix Spike.
3. MSD = Matrix Spike Duplicate.
4. RL = Reporting Limit.
5. RPD = Relative Percent Difference.

Honeywell International Inc.
Metropolis Works

Table C-10
C Pond - Total Uranium Matrix Spike and Matrix Spike Duplicate Analytical Summary

Laboratory Sample ID	Sample ID	Sample Type (MS or MSD)	Laboratory Batch ID	Parameter	Units	Measured Value of Unspiked Sample	RL	Spike Amount	Measured Value of Spiked Sample	Percent Recovery	RPD
F9D030324001S	C-9	MS	9096062	Uranium	mg/kg	145	50	182	238	93	20
F9D030324001D	C-9	MSD	9096062	Uranium	mg/kg	145	50	100	291	146	20
F9C270267001S	C-10 Upper	MS	9090231	Uranium	mg/kg	103	50	100	188	85	8.2
F9C270267001D	C-10 Upper	MSD	9090231	Uranium	mg/kg	103	50	100	204	101	8.2
F9D030318001D	C-13	MSD	9096061	Uranium	mg/kg	133	50	100	290	157	5.4
F9D030318001S	C-13	MS	9096061	Uranium	mg/kg	133	50	100	306	173	5.4
F9D080316002D	C-34	MSD	9103207	Uranium	mg/kg	555	50	100	693	138	1.8
F9D080316002S	C-34	MS	9103207	Uranium	mg/kg	555	93	100	706	151	1.8

Notes:
1. Method 6010c specifies the percent recovery to be within ± 25% and the RPD to be within ±20%.
2. MS = Matrix Spike.
3. MSD = Matrix Spike Duplicate.
4. RL = Reporting Limit.
5. RPD = Relative Percent Difference.

Honeywell International Inc.
Metropolis Works

Table D-10
D Pond - Total Uranium Matrix Spike and Matrix Spike Duplicate Summary

Laboratory Sample ID	Sample ID	Sample Type (MS or MSD)	Laboratory Batch ID	Parameter	Units	Measured Value of Unspiked Sample	RL	Spike Amount	Measured Value of Spiked Sample	Percent Recovery	RPD
F9F190210001D	D-14	MSD	9174136	Uranium	mg/kg	389	50	100	407	18	21
F9F190210001S	D-14	MS	9174136	Uranium	mg/kg	389	50	100	504	115	21
F9F190210009S	D-15 U	MS	9175246	Uranium	mg/kg	698	50	100	953	255	15
F9F190210009D	D-15 U	MSD	9175246	Uranium	mg/kg	698	50	100	1,110	410	15
F9F120114001D	D-31	MSD	9167137	Uranium	mg/kg	76.3	50	100	154	78	12
F9F120114001S	D-31	MS	9167137	Uranium	mg/kg	76.3	50	100	174	98	12
F9F190219001S	D-26 Upper	MS	9180110	Uranium	mg/kg	60.7	50	100	158	97	19
F9F190219001D	D-26 Upper	MSD	9180110	Uranium	mg/kg	60.7	50	100	191	130	19
F9G020279001D	D-28	MSD	9187052	Uranium	mg/kg	307	50	100	494	187	10
F9G020279001S	D-28	MS	9187052	Uranium	mg/kg	307	50	100	547	239	10
F9G020284001D	D-29 Upper	MSD	9190064	Uranium	mg/kg	137	50	100	232	95	3.2
F9G020284001S	D-29 Upper	MS	9190064	Uranium	mg/kg	137	50	100	240	102	3.2

Notes:
1. Method 6010c specifies the percent recovery to be within ± 25% and the RPD to be within ±20%.
2. MS = Matrix Spike.
3. MSD = Matrix Spike Duplicate.
4. RL = Reporting Limit.
5. RPD = Relative Percent Difference.

Honeywell International Inc.
Metropolis Works

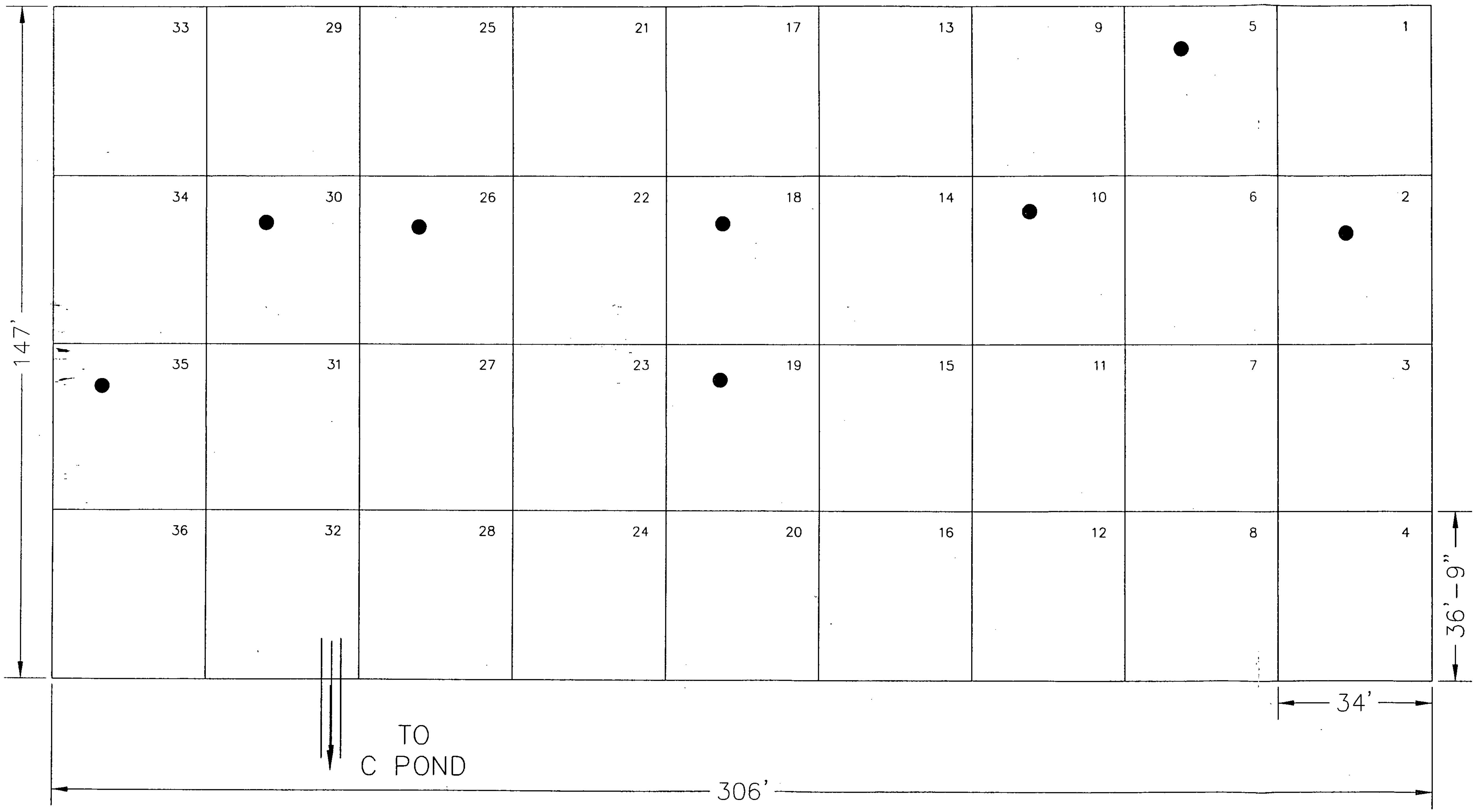
Table E-10
E Pond - Total Uranium Matrix Spike and Matrix Spike Duplicate Summary

Laboratory Sample ID	Sample ID	Sample Type (MS or MSD)	Laboratory Batch ID	Parameter	Units	Measured Value of Unspiked Sample	RL	Spike Amount	Measured Value of Spiked Sample	Percent Recovery	RPD
F9D170288001D	E-7	MSD	9110114	Uranium	mg/kg	139	50	100	298	159	10
F9D170288001S	E-7	MS	9110114	Uranium	mg/kg	139	50	100	330	191	10
F9D170288021S	E-25	MS	9110357	Uranium	mg/kg	106	50	100	246	140	27
F9D170288021D	E-25	MSD	9110357	Uranium	mg/kg	106	50	100	323	217	27
F9D230339001D	E-34	MSD	9114039	Uranium	mg/kg	344	50	100	403	59	11
F9D230339001S	E-34	MS	9114039	Uranium	mg/kg	344	50	100	448	104	11
F9D230339021D	E-48	MSD	9114040	Uranium	mg/kg	126	50	100	238	112	8.9
F9D230339021S	E-48	MS	9114040	Uranium	mg/kg	126	50	100	260	134	8.9

Notes:
1. Method 6010c specifies the percent recovery to be within ± 25% and the RPD to be within ±20%.
2. MS = Matrix Spike.
3. MSD = Matrix Spike Duplicate.
4. RL = Reporting Limit.
5. RPD = Relative Percent Difference.

REVISIONS			
NO.	DATE	DESCRIPTION	BY
1	3/09	GRID NUMBERING	SCC
2	8/09	LEGEND, DOT LOCATION	SCC

B POND



SHALLOW DEPTH (14'-3")

LEGEND

• LOCATION OF ADDITIONAL ANALYTICAL PARAMETERS

NOTES:

1. LOCATION OF OVERFLOW PIPING IS APPROXIMATE.
2. URANIUM SAMPLES WILL BE OBTAINED FROM ALL GRID LOCATIONS.

DEEP DEPTH (16'-6")

PLANT N

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: SCC DESIGNED BY: SCC DRAWN BY: MPN

B POND GRID LOCATIONS

PLANS PREPARED FOR
HONEYWELL INTERNATIONAL INC.
METROPOLIS, MASSAC COUNTY, ILLINOIS

DATE: MARCH 2009

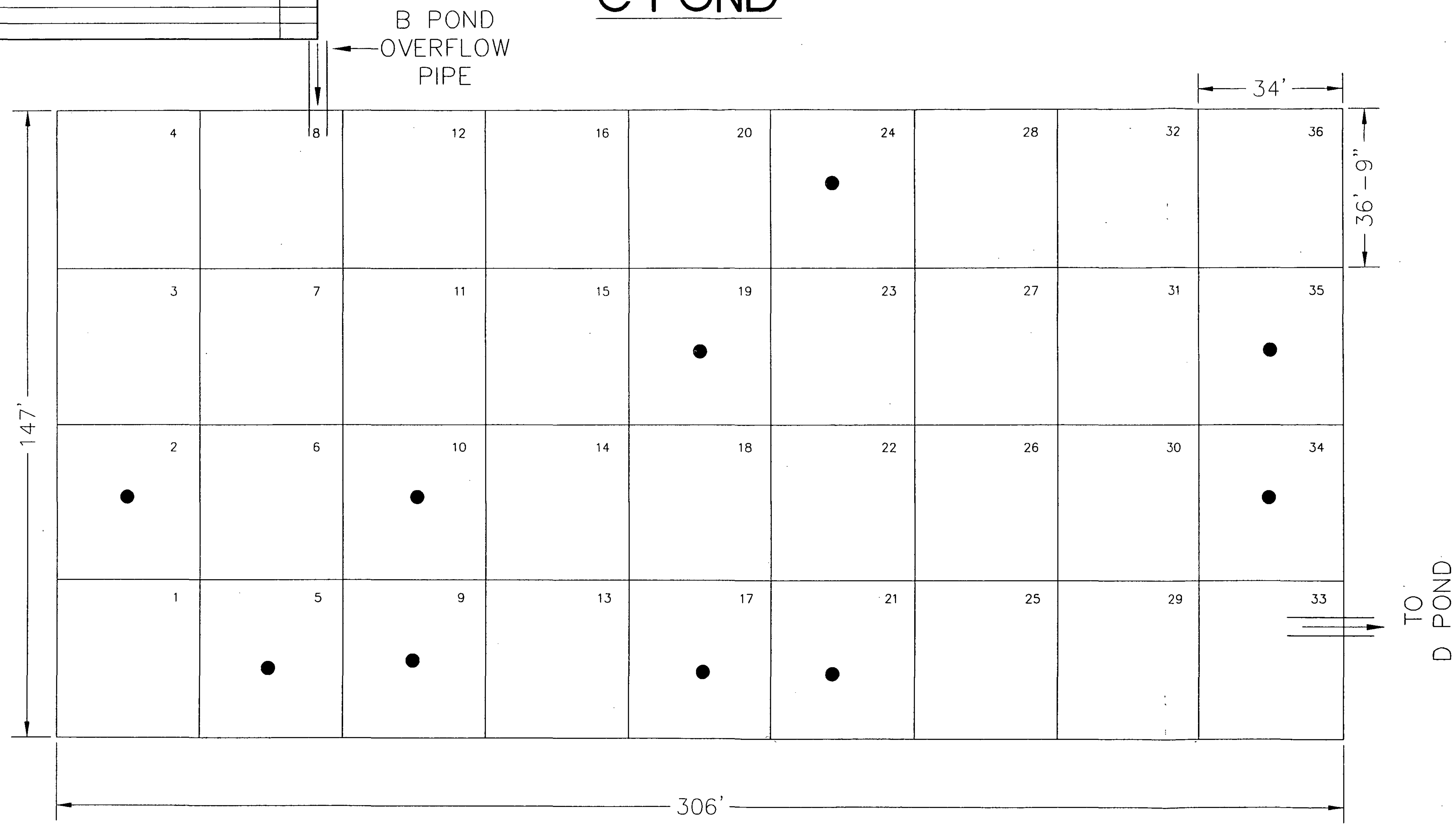
PROJECT ID: 91-135

SHEET NUMBER: B-1

File: J:\1991\91-...DWG\PondSampling\Pond-B-Sample-location rev3.dwg Tab: Layout1 User: m...yen Plotted: Nov 17, 2010 - 8:54 AM

REVISIONS			
NO.	DATE	DESCRIPTION	BY

C POND



SHALLOW DEPTH (14'-3")

NOTES:

1. LOCATION OF OVERFLOW PIPING IS APPROXIMATE.
2. URANIUM SAMPLE WILL BE OBTAINED FROM ALL GRID LOCATIONS.

LEGEND

● LOCATION OF ADDITIONAL ANALYTICAL PARAMETERS

DEEP DEPTH (16'-6")

PLANT N

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: SCC DESIGNED BY: SCC DRAWN BY: MPN

C POND GRID LOCATIONS

PLANS PREPARED FOR
HONEYWELL INTERNATIONAL INC.
METROPOLIS, MASSAC COUNTY, ILLINOIS

DATE: MARCH 2009

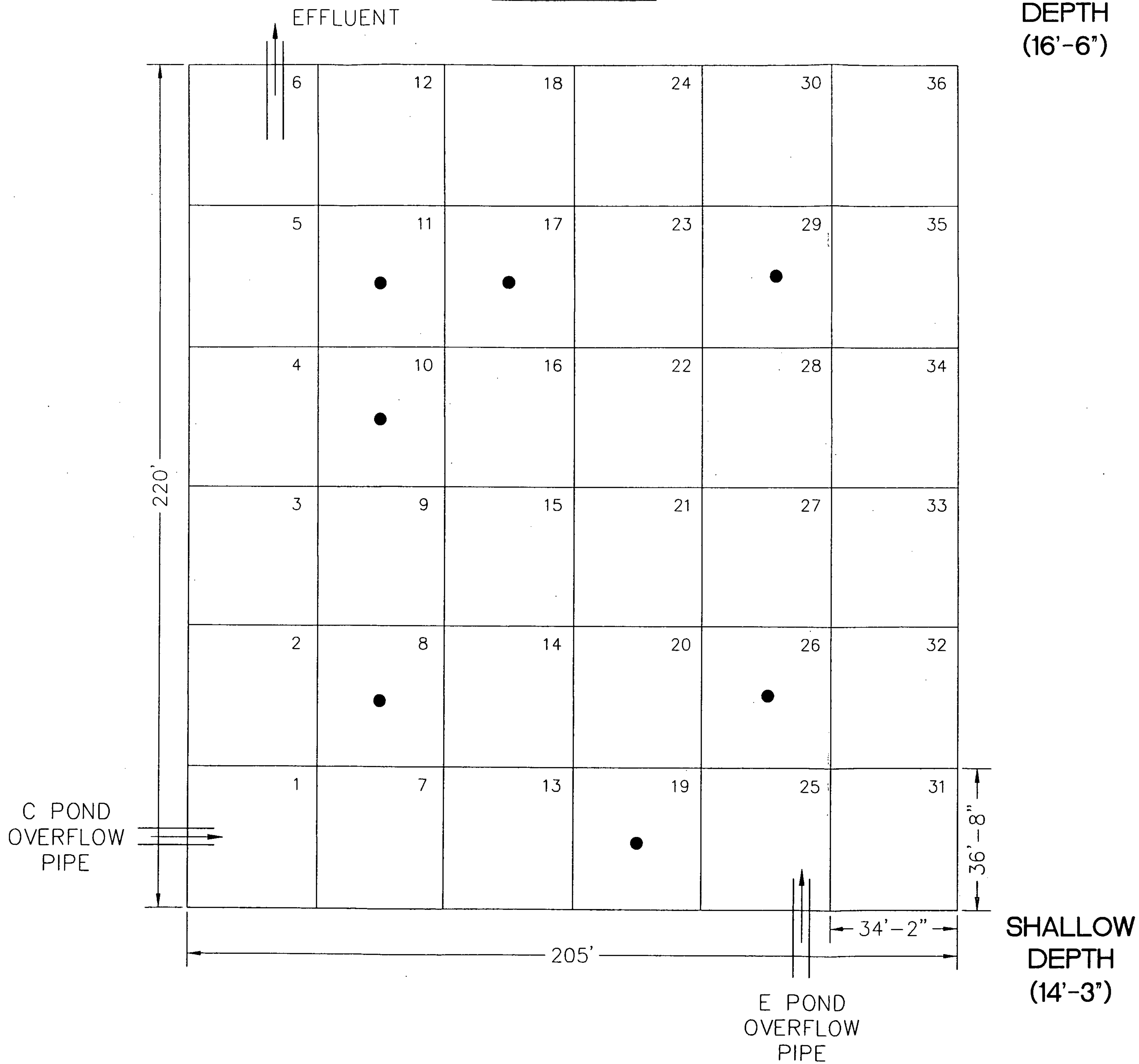
PROJECT ID: 91-135

SHEET NUMBER: C-1

File: J:\1991\91-135\DWG\PondSampling\Pond-C-Sample-location rev3.dwg Tab: Layout 2 User: mnguyen Plotted: Nov 17, 2010 - 8:53 AM

D POND

REVISIONS			
NO.	DATE		BY



PLANT
N

LEGEND
● LOCATION OF ADDITIONAL ANALYTICAL PARAMETERS

NOTES:
1. LOCATION OF OVERFLOW PIPING IS APPROXIMATE.
2. URANIUM SAMPLE WILL BE OBTAINED FROM ALL GRID LOCATIONS.

ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

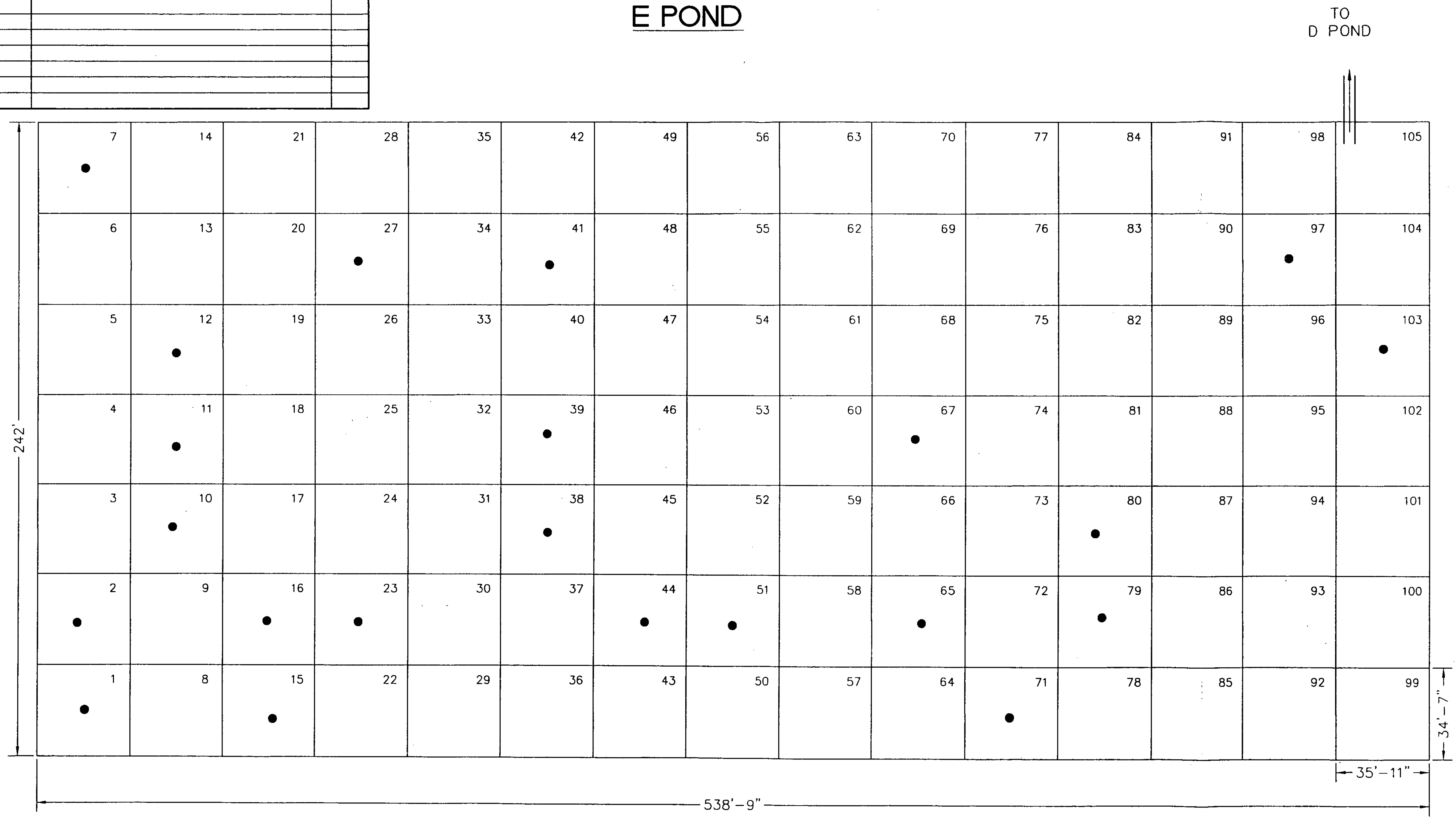
APPROVED BY: SCC DESIGNED BY: SCC DRAWN BY: MPN

D POND GRID LOCATIONS
PLANS PREPARED FOR
HONEYWELL INTERNATIONAL INC.
METROPOLIS, MASSAC COUNTY, ILLINOIS

DATE: JUNE 2009
PROJECT ID: 91-135
SHEET NUMBER: D-1

REVISIONS			
NO.	DATE	DESCRIPTION	BY

E POND



DEEP
DEPTH
(14'-3")

SHALLOW
DEPTH
(14'-2 1/2")

PLANT
N

DEEP
DEPTH
(16'-6")

LEGEND

• LOCATION OF ADDITIONAL ANALYTICAL PARAMETERS

NOTES:
1. LOCATION OF OVERFLOW PIPING IS APPROXIMATE.
2. URANIUM SAMPLE WILL BE OBTAINED FROM ALL GRID LOCATIONS.

ANDREWS
ENGINEERING, INC.
3300 Ginger Creek Drive, Springfield, IL 62711-7233
Tel (217) 787-2334 Fax (217) 787-9495
Pontiac, IL • Naperville, IL • Indianapolis, IN • Warrenton, MO

APPROVED BY: SCC | DESIGNED BY: SCC | DRAWN BY: MPN

E POND GRID LOCATIONS

PLANS PREPARED FOR
HONEYWELL INTERNATIONAL INC.
METROPOLIS, MASSAC COUNTY, ILLINOIS

DATE: APRIL 2009

PROJECT ID: 91-135

SHEET NUMBER:

E-1

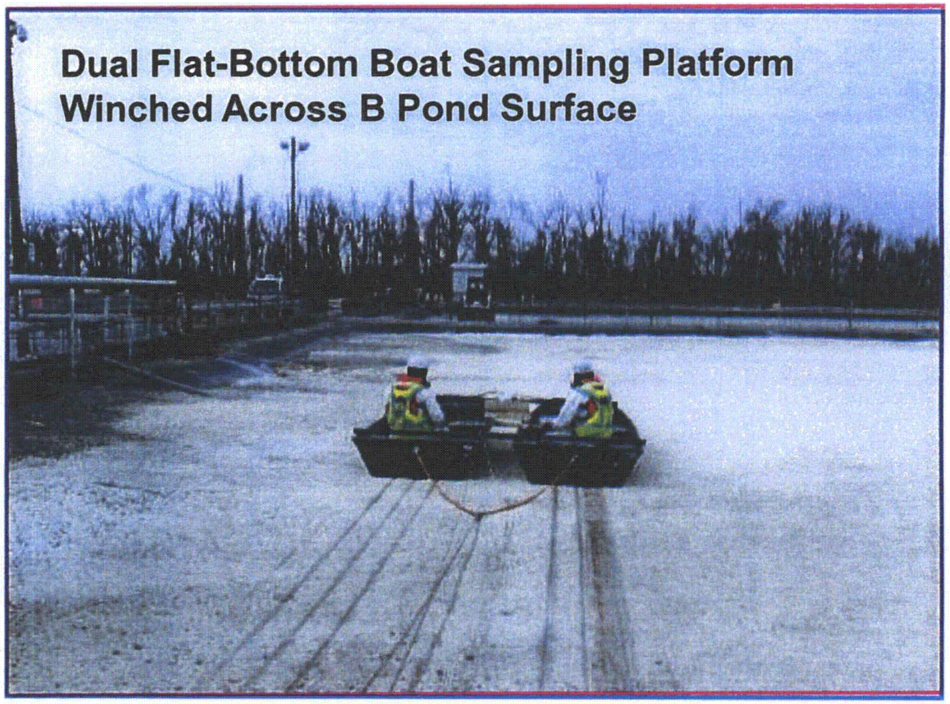
File: J:\1991\91-135\DWG\PondSampling\Pond-E-Sample-location rev3.dwg Tab: Layout2 User: mnguyen Plotted: Nov 17, 2010 - 8:53 AM

EXHIBIT 1

PHOTOGRAPHS

Honeywell MTW Pond CaF_2 Material Characterization Sampling

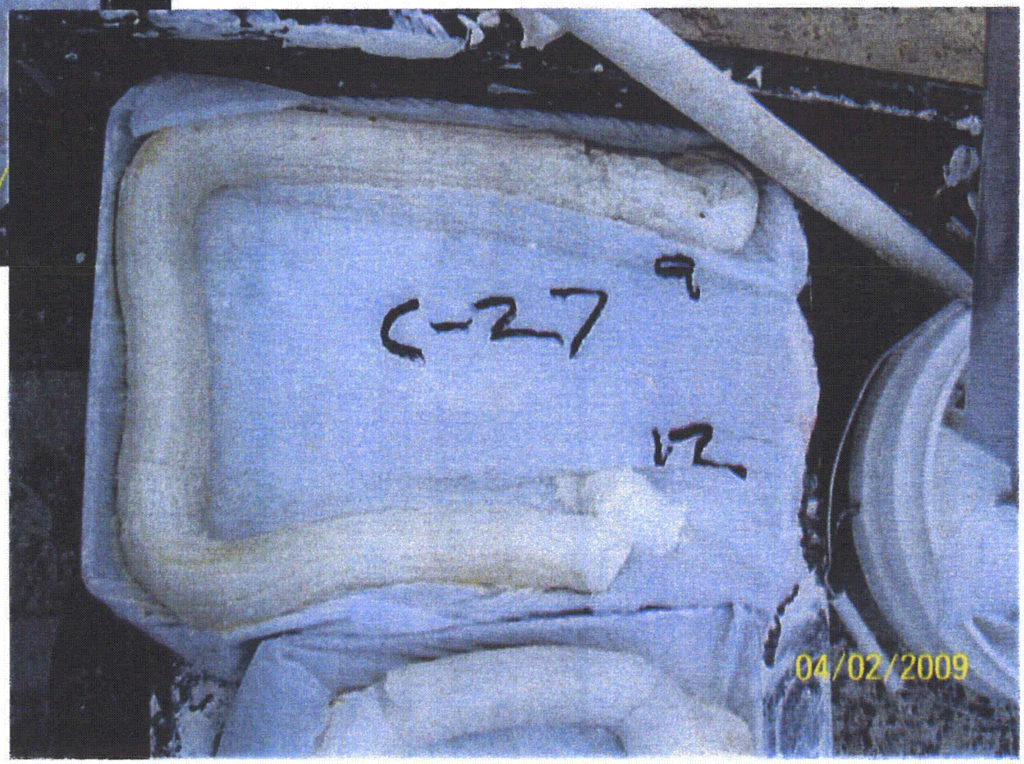
Honeywell International Inc.
Andrews Engineering, Inc.



Dual Flat-Bottom Boat Sampling Platform
Winched Across B Pond Surface

Field Sampling Event Photo Log
March – July 2009

C-27; 6 – 9'

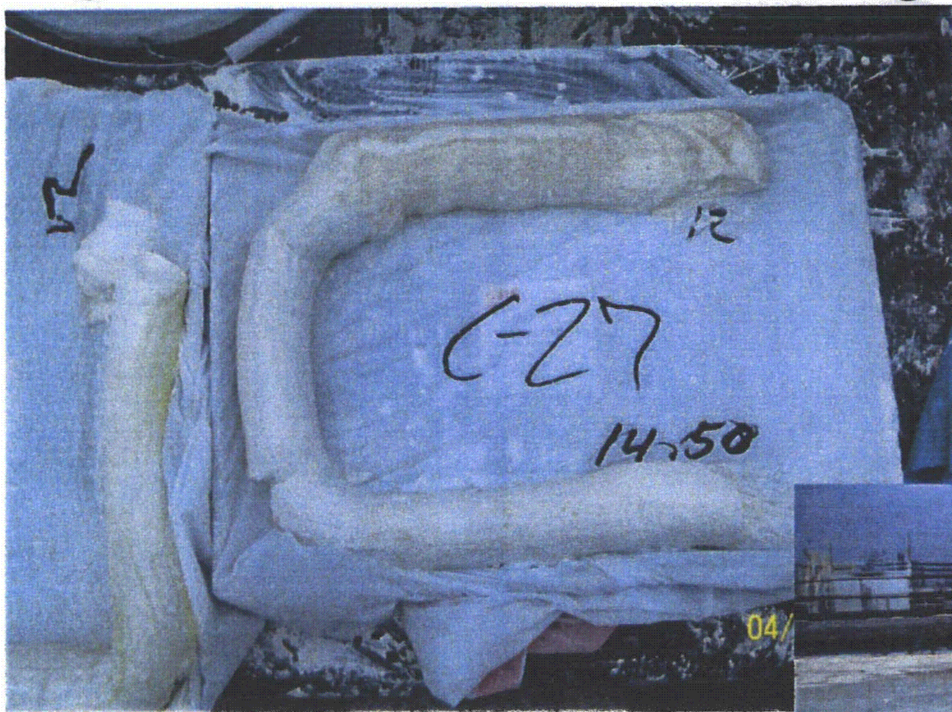


C-27: 9 – 12'

Honeywell

C Pond CaF_2 Material Sample Core Photos

ANDREWS ENGINEERING INC



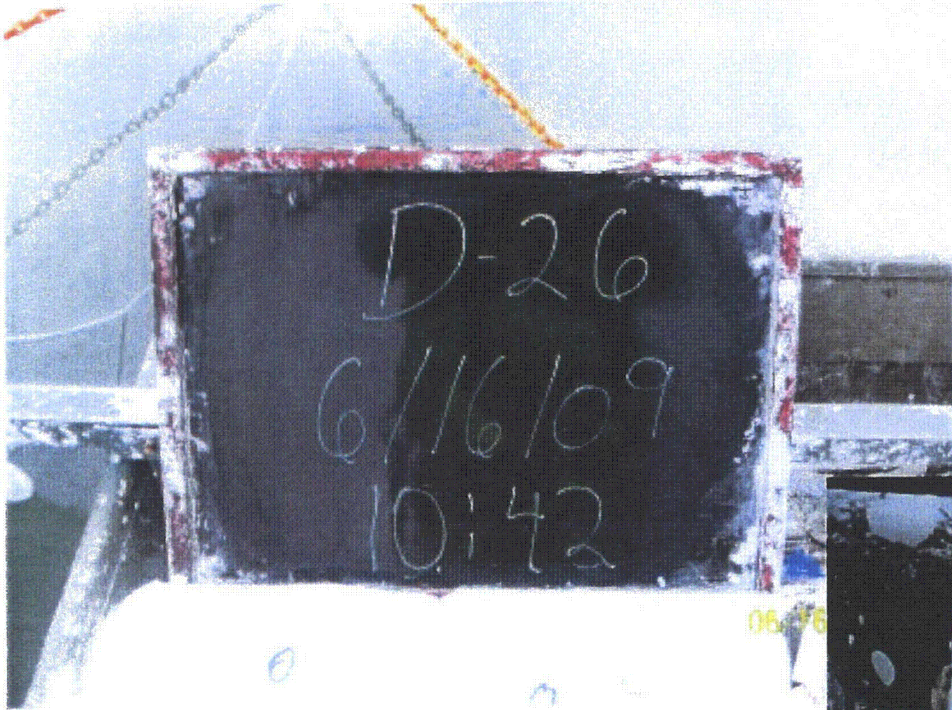
C-27; 12 – 14.5’

C Pond, Looking North

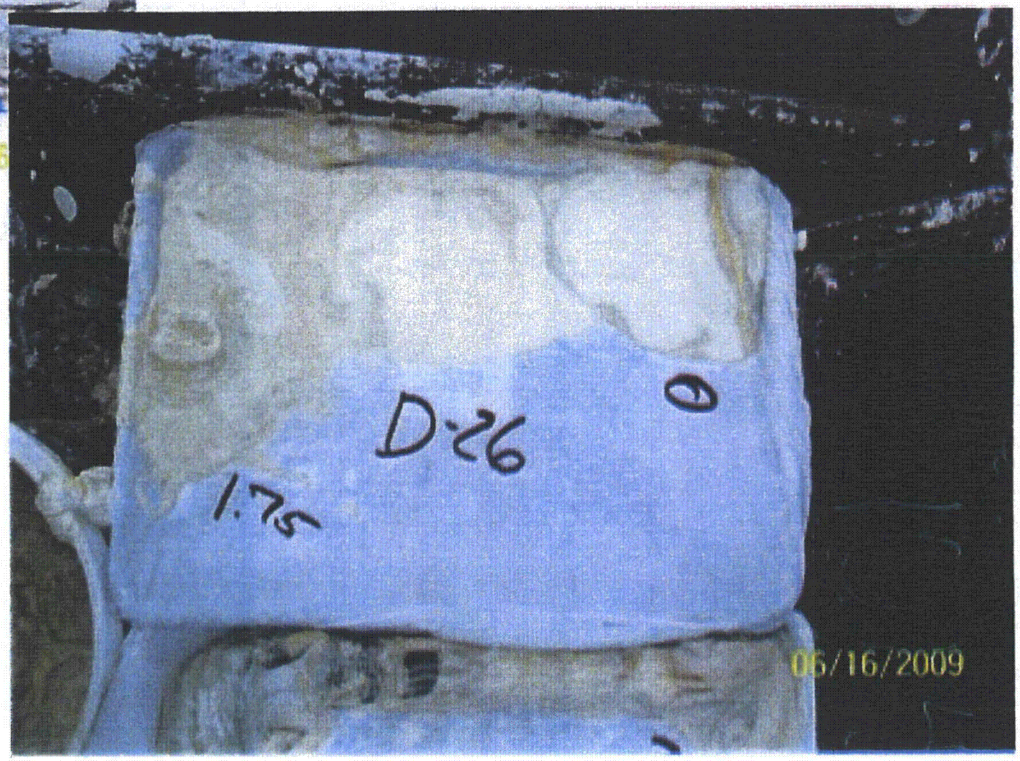
Honeywell

C Pond CaF_2 Material Sample Core Photos

ANDREWS ENGINEERING INC



D-26

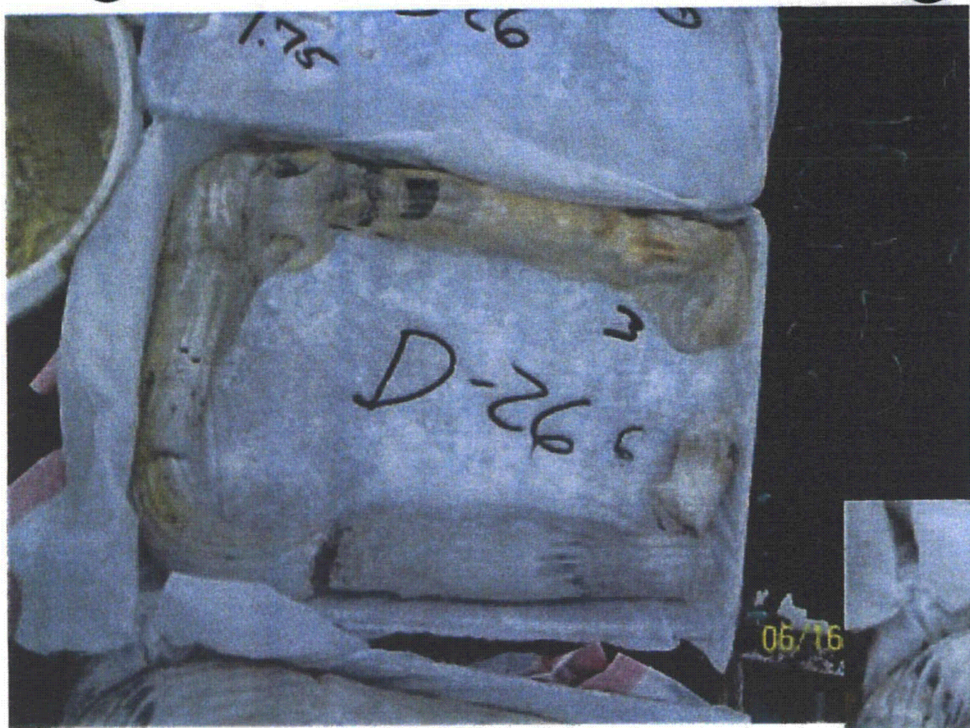


D-26: 0 – 1.75'

Honeywell

D Pond CaF_2 Material Sample Core Photos

ANDREWS ENGINEERING INC



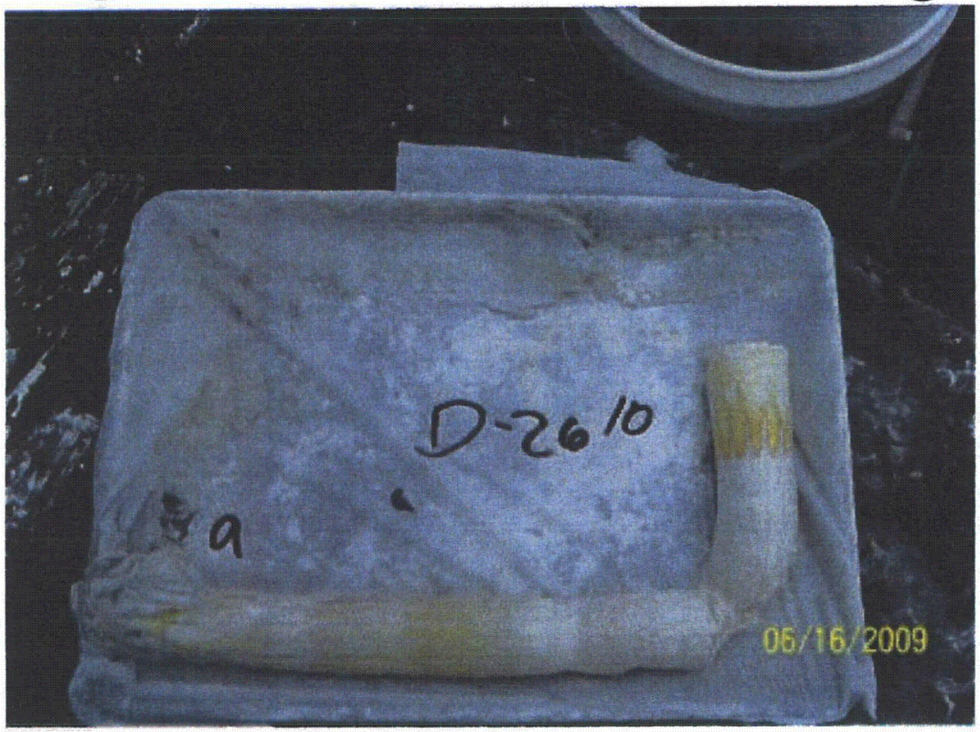
D-26: 3 – 6’

D-26: 6 – 9’

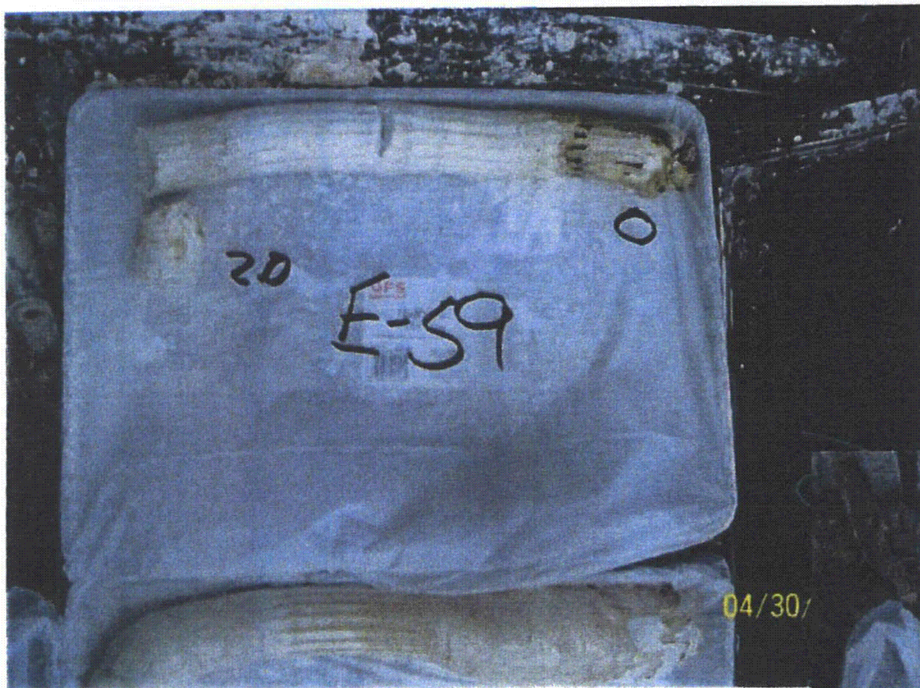
Honeywell

D Pond CaF_2 Material Sample Core Photos

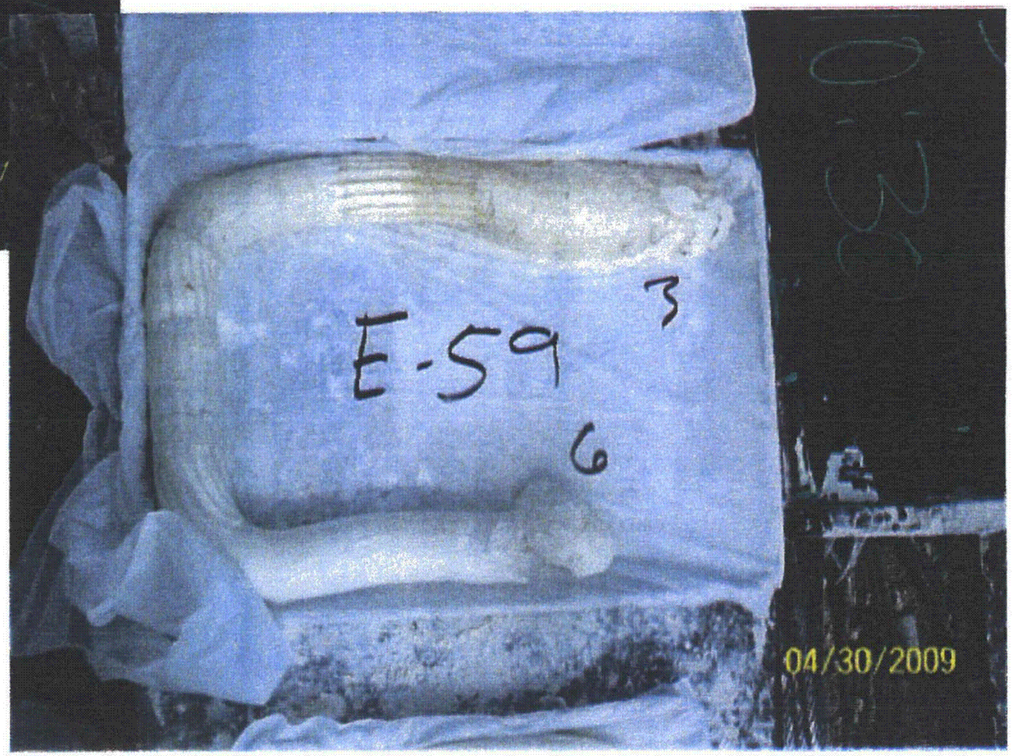
ANDREWS ENGINEERING INC



D-26: 9 – 10’



E-59; 0 – 2'



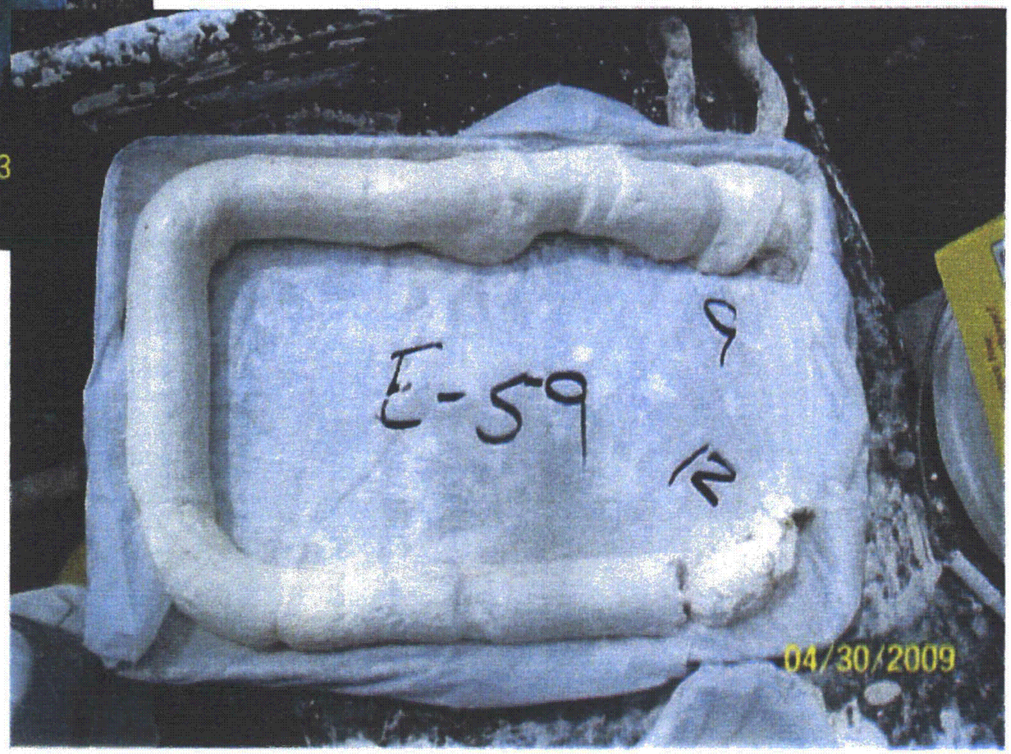
E-59: 3 – 6'

Honeywell

E Pond CaF_2 Material Sample Core Photos

ANDREWS ENGINEERING INC

E-59; 6 – 9’

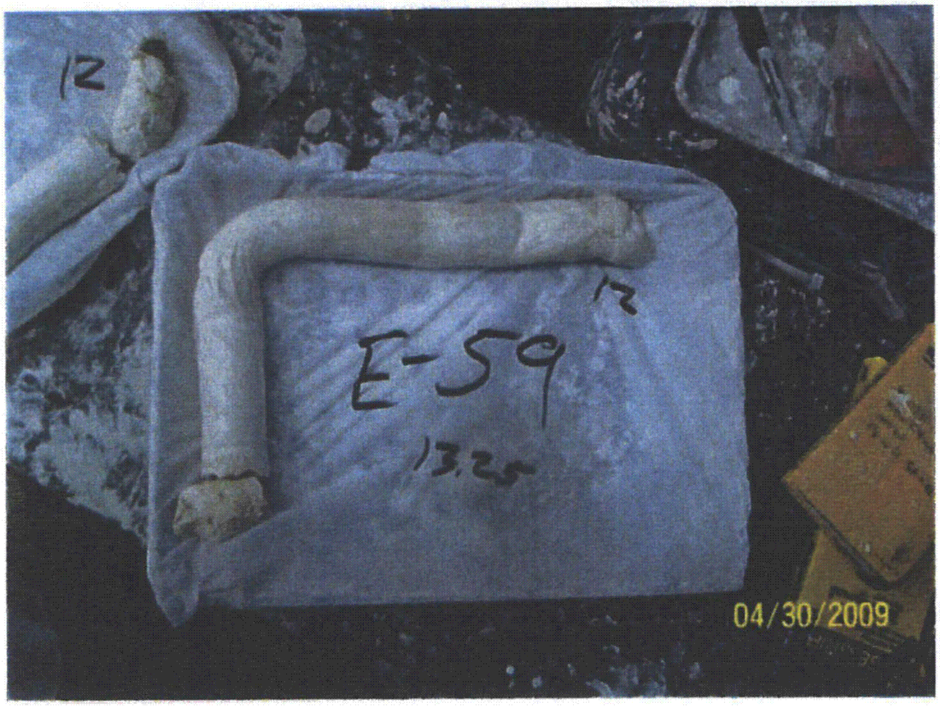


E-59: 9 – 12’

Honeywell

E Pond CaF_2 Material Sample Core Photos

ANDREWS ENGINEERING INC



E-59; 12 – 13.25'

EXHIBIT 2

LABORATORY ANALYTICAL REPORTS

EXHIBIT 3

U.S. EPA APRIL 23, 1993 MEMORANDUM

9443.1993(05)

United States Environmental Protection Agency
Washington, D.C. 20460
Office of Solid Waste and Emergency Response

April 23, 1993

MEMORANDUM

SUBJECT: Interpretation of "Aqueous" as Applied to the Corrosivity Characteristic (40 CFR 261.22)

TO: Joseph R. Franzmathes, Director
Waste Management Division

FROM: David Bussard, Director
Characterization and Assessment Division

This memorandum responds to your memorandum to Bruce Diamond dated March 11, 1993 requesting clarification of the term "aqueous" as it applies to the corrosivity characteristic. Your memorandum references a September 1992 "Hotline Questions and Answers" publication produced by the RCRA/Superfund Hotline contractors and concurred upon by my Division and by OSW.

The Hotline publication correctly defines "aqueous," for the purposes of the corrosivity characteristic, to mean in a form amenable to pH measurement. This interpretation is consistent with the supporting documentation found in the background document for the corrosivity characteristic final rulemaking (Background Document: Section 261.22 - Characteristic of Corrosivity, May 2, 1980). I have attached the applicable section for your information.

A more specific interpretation of "aqueous" for the purpose of the corrosivity characteristic may be found in the method referenced in the actual regulatory text for the corrosivity characteristic at 40 CFR 261.22(a)(1). The regulation states that "[the EPA test method for pH is specified as Method 5.2, in "Test Methods for the Evaluation "of Solid Waste, Physical/Chemical Methods" (see attachment). Method 5.2, pH Electrometric Measurement, which was renumbered to Method 9040 specifies under scope and application that the method "is used to measure the pH of aqueous wastes and those wastes where the aqueous phase constitutes at least 20% of the total volume of "waste." Therefore, any waste for which this method is applicable must contain at least 20% free water by volume. This method is also attached for your information.

If you or your staff should have any questions regarding this memorandum, please call me or have your staff call Al Collins, of my staff, at 202-260-4791.

Attachments

EXHIBIT 4

GRAIN SIZE DISTRIBUTION CURVES

TestAmerica
South Burlington, VT

Sample Data Summary Package

9C190122

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

April 10, 2009

Mr. Terry Romanko
TestAmerica, Inc.
13715 Rider Trail North
Earth City, MO 63045

Re: Laboratory Project No. 29014
Case: HONEYWEL; SDG: 9C190122

Dear Mr. Romanko:

Enclosed are the analytical results for the samples that were received by TestAmerica Burlington on March 26th, 2009. Laboratory identification numbers were assigned, and designated as follows:

Lab ID	Client Sample ID	Sample Date	Sample Matrix
	Received: 03/26/09 ETR No: 130882		
790231	B-18 LOWER	03/17/09	SOLID
790232	B-18 UPPER	03/17/09	SOLID

Documentation of the condition of the samples at the time of their receipt and any exception to the laboratory's Sample Acceptance Policy is documented in the Sample Handling section of this submittal.

Particle Size Analysis by ASTM D422:
There were no exceptions to the method quality control criteria during the analyses of these samples.

Any reference within this report to Severn Trent Laboratories, Inc. or STL, should be understood to refer to TestAmerica Laboratories, Inc. (formerly known as Severn Trent Laboratories, Inc.) The analytical results associated with the samples presented in this test report were generated under a quality system that adheres to requirements specified in the NELAC standard. Release of the data in this test report and any associated electronic deliverables is authorized by the Laboratory Director's designee as verified by the following signature.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

If there are any questions regarding this submittal, please contact me at 802 660-1990.

Sincerely,

Ron Pentkowski

Ron Pentkowski
Project Manager

Enclosure

F9C190122

INTER-COMPANY LOG

COMMENTS:
Project Manager:
Project: 1991-135-11/002 Honeywell Pond B
[illegible]rt Type: B Standard Report
[illegible]: 472876 - Andrews Engineering, Inc.

Date Received: 2009-03-18
Analytical Due Date: 2009-04-13
Report Due Date: 2009-04-15

WORK LOCATION: ***H2*** ***TestAmerica Burlington***

SMP#: 10 CLIENT ID: B-18 LOWER DATE SAMPLED: 20090317 MATRIX: A SOLID
SAMPLE COMMENTS:

METHOD: ZZ NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K8RN41A3 METAL: **XX**

SMP#: 11 CLIENT ID: B-18 UPPER DATE SAMPLED: 20090317 MATRIX: A SOLID
SAMPLE COMMENTS:

METHOD: ZZ NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K8RP71A1 METAL: **XX**

The sample(s) listed on this form are being sent to your location for the specified analysis. If you have any questions, please contact the Project Manager listed above. PLEASE RETURN THE ORIGINAL SIGNED FORM WITH THE REPORT AT THE COMPLETION OF ANALYSIS.

Thank You

TA- St. Louis
Sample Receiving

RELINQUISHED BY: Angela Boon DATE: 3-25-09 17:00
RECEIVED FOR LAB BY: Clara Kolb DATE: 03/26/09 1015

TestAmerica

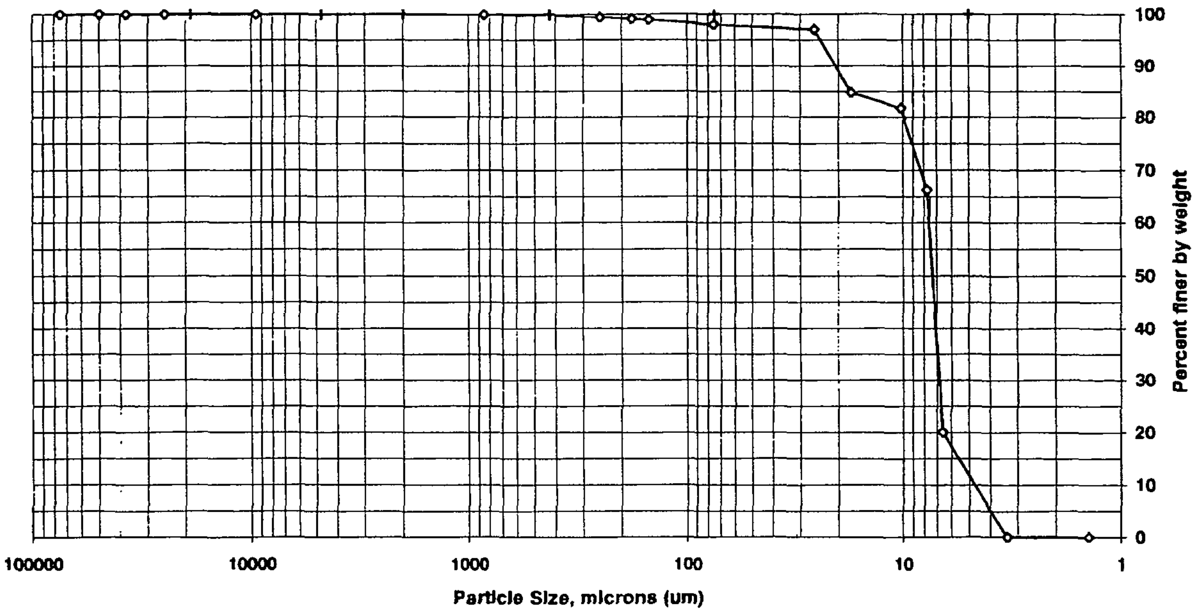
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

nt Code:	STLMOS	SDG:	9C190122	Date Received:	3/26/2009
mple ID:	B-18 LOWER	ETR(s):	130882	Start Date:	3/27/2009
Lab ID:	790231			End Date:	4/9/2009

Percent Solids:	58.1%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.9	0.1
#40	425	99.7	0.2
#60	250	99.4	0.3
#80	180	99.1	0.3
#100	150	98.9	0.2
#200	75	98.0	1.0
Hydrometer	25.6	97.1	0.9
|	17.4	84.8	12.3
|	10.2	81.7	3.1
|	7.8	66.3	15.4
|	6.6	20.0	46.2
|	3.3	0.0	20.0
V	1.4	0.0	0.0

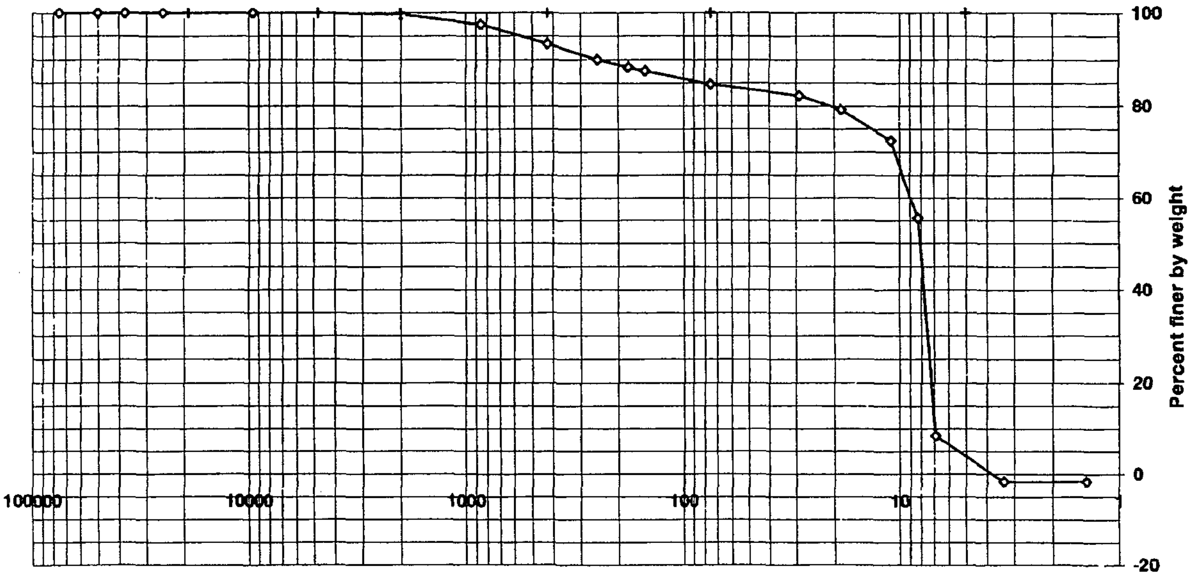
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	2.0
Coarse Sand	0.0
Medium Sand	0.3
Fine Sand	1.8
Silt	77.9
Clay	20.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

nt Code:	STLMOS	SDG:	9C190122	Date Received:	3/26/2009
mple ID:	B-18 UPPER	ETR(s):	130882	Start Date:	3/27/2009
Lab ID:	790232			End Date:	4/9/2009

Percent Solids:	58.1%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	angular
Maximum Particle Size:	Crs sand	Hardness (> #10):	hard



Particle Size, microns (um)

Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	99.7	0.3
#20	850	97.5	2.2
#40	425	93.4	4.1
#60	250	90.0	3.4
#80	180	88.4	1.6
#100	150	87.6	0.8
#200	75	84.8	2.9
Hydrometer	29.0	82.2	2.5
|	18.5	79.2	3.1
|	11.0	72.4	6.7
|	8.3	55.6	16.8
|	6.9	8.4	47.2
|	3.4	-1.7	10.1
V	1.4	-1.7	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	15.2
Coarse Sand	0.3
Medium Sand	6.3
Fine Sand	8.6
Silt	76.4
Clay	8.4

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
South Burlington, VT

Sample Data Summary Package

9C200257

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

April 10, 2009

Mr. Terry Romanko
TestAmerica, Inc.
13715 Rider Trail North
Earth City, MO 63045

Re: Laboratory Project No. 29014
Case: HONEYWEL; SDG: 9C200257

Dear Mr. Romanko:

Enclosed are the analytical results for the samples that were received by TestAmerica Burlington on March 26th, 2009. Laboratory identification numbers were assigned, and designated as follows:

Lab ID	Client Sample ID	Sample Date	Sample Matrix
	Received: 03/26/09 ETR No: 130884		
790233	B-19 UPPER	03/18/09	SOLID
790234	B-26 LOWER	03/19/09	SOLID

Documentation of the condition of the samples at the time of their receipt and any exception to the laboratory's Sample Acceptance Policy is documented in the Sample Handling section of this submittal.

Particle Size Analysis by ASTM D422:
There were no exceptions to the method quality control criteria during the analyses of these samples.

Any reference within this report to Severn Trent Laboratories, Inc. or STL, should be understood to refer to TestAmerica Laboratories, Inc. (formerly known as Severn Trent Laboratories, Inc.) The analytical results associated with the samples presented in this test report were generated under a quality system that adheres to requirements specified in the NELAC standard. Release of the data in this test report and any associated electronic deliverables is authorized by the Laboratory Director's designee as verified by the following signature.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

If there are any questions regarding this submittal, please contact me at 802 660-1990.

Sincerely,

Ron Pentkowski

Ron Pentkowski
Project Manager

Enclosure

F9C200257

INTER-COMPANY LOG

COMMENTS:
Project Manager:
Project: 1991-135-11/002 Honeywell Pond B
rt Type: B Standard Report
: 472876 - Andrews Engineering, Inc.

Date Received: 2009-03-20
Analytical Due Date: 2009-04-15
Report Due Date: 2009-04-17

WORK LOCATION: ***H2*** ***TestAmerica Burlington***

SMP#: 5 CLIENT ID: B-19 UPPER DATE SAMPLED: 20090318 MATRIX: A SOLID
SAMPLE COMMENTS:

METHOD: ZZ NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K8WTK1A2 METAL: XX

SMP#: 12 CLIENT ID: B-26 LOWER DATE SAMPLED: 20090319 MATRIX: A SOLID
SAMPLE COMMENTS:

METHOD: ZZ NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K8WXX1AP METAL: XX

The sample(s) listed on this form are being sent to your location for the specified analysis. If you have any questions, please contact the Project Manager listed above. PLEASE RETURN THE ORIGINAL SIGNED FORM WITH THE REPORT AT THE COMPLETION OF ANALYSIS.

Thank You

TA- St. Louis
Sample Receiving

RELINQUISHED BY: Angel Boom DATE: 3-25-09 17:00
RECEIVED FOR LAB BY: Chris Kolb DATE: 03/26/09 1015

TestAmerica

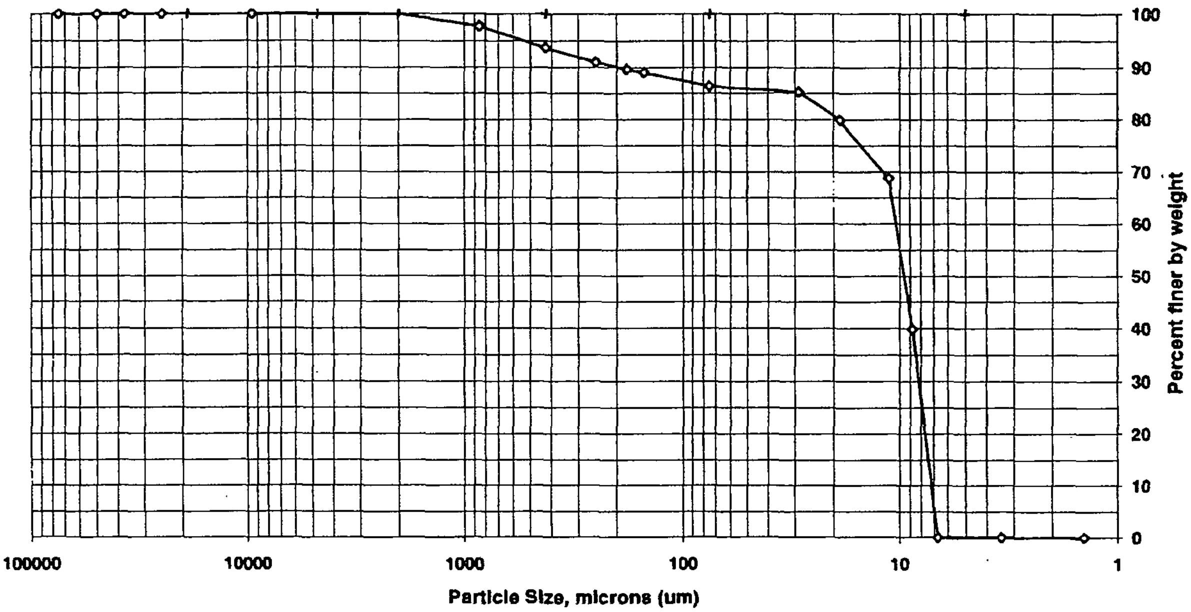
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

t Code:	STLMOS	SDG:	9C200257	Date Received:	3/26/2009
mple ID:	B-19 UPPER	ETR(s):	130884	Start Date:	4/1/2009
Lab ID:	790233			End Date:	4/9/2009

Percent Solids:	57.9%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.7	2.3
#40	425	93.7	4.0
#60	250	91.0	2.7
#80	180	89.6	1.3
#100	150	89.0	0.6
#200	75	86.3	2.7
Hydrometer	28.8	85.3	1.0
|	18.6	79.9	5.4
|	11.3	68.7	11.2
|	8.8	39.8	28.9
|	6.7	0.0	39.8
|	3.4	0.0	0.0
V	1.4	0.0	0.0

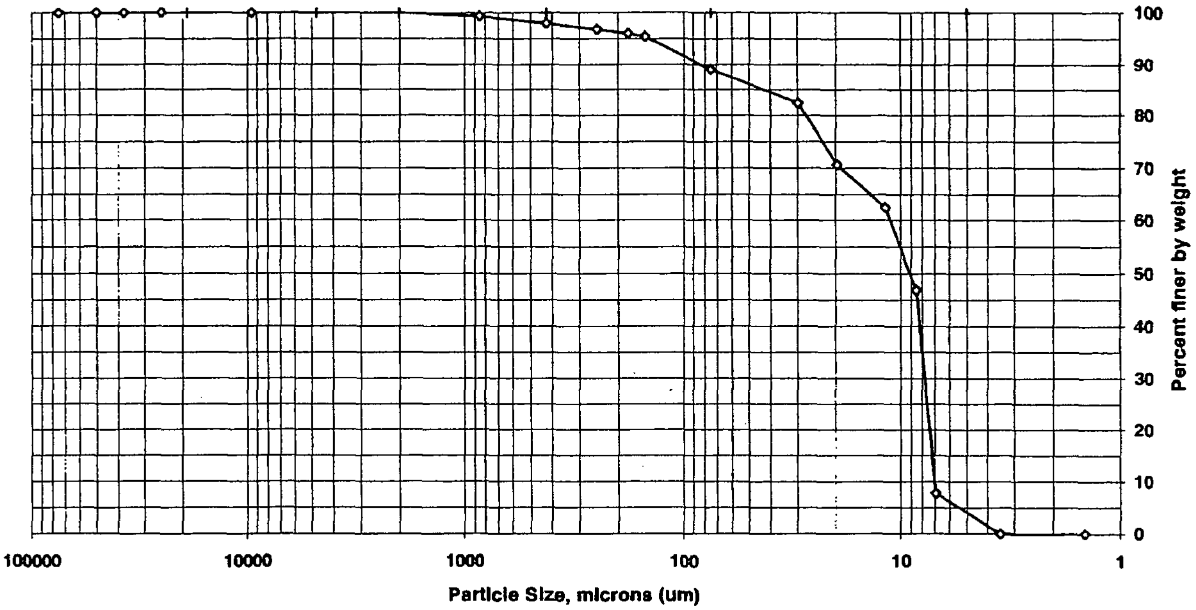
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	13.7
Coarse Sand	0.0
Medium Sand	6.3
Fine Sand	7.3
Silt	86.3
Clay	0.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

t Code:	STLMOS	**SDG:**	9C200257	**Date Received:**	3/26/2009
mple ID:	B-26 LOWER	**ETR(s):**	130884	**Start Date:**	4/1/2009
Lab ID:	790234			**End Date:**	4/9/2009

Percent Solids:	52.7%	**Non-soil material:**	na
Specific Gravity:	2.650	**Shape (> #10):**	na
Maximum Particle Size:	Med sand	**Hardness (> #10):**	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.3	0.7
#40	425	98.0	1.4
#60	250	96.8	1.2
#80	180	96.0	0.8
#100	150	95.4	0.6
#200	75	89.0	6.4
Hydrometer	29.9	82.3	6.7
|	19.6	70.6	11.7
|	11.7	62.5	8.1
|	8.5	46.9	15.6
|	6.9	7.8	39.1
|	3.5	0.0	7.8
V	1.4	0.0	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	11.0
Coarse Sand	0.0
Medium Sand	2.0
Fine Sand	9.0
Silt	81.2
Clay	7.8

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. HONEYWELL METROPOLIS

Honeywell Pond B

Lot #: F9C270267

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

Terry Romanko
Project Manager

April 22, 2009

13715 Rider Trail North Earth City, MO 63045 tel 314.298.8566 fax 314.298.8757 www.testamericainc.com

Case Narrative
LOT NUMBER: F9C270267

This report contains the analytical results for the 16 samples received under chain of custody by STL St. Louis on March 27, 2009. These samples are associated with your Honeywell Pond B project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Cation Exchange Capacity

Batch 9092126:
The samples were analyzed at a dilution due to high concentrations of salts. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9C270267 (8): C-5
F9C270267 (12): C-2

Trace ICP Metals

Batch9080231:
The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9C270267 (2): C-10 LOWER
F9C270267 (3): C-6 U 2.00'-2.50'
F9C270267 (4): C-6 U 12.00'-12.50'
F9C270267 (13): C-7

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9C270267

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9C270267

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
K89AQ	001	C-10 UPPER	03/26/09	13:50
K89CF	002	C-10 LOWER	03/26/09	13:50
K89CG	003	C-6 U 2.00'-2.50'	03/26/09	08:50
K89CH	004	C-6 U 12.00'-12.50'	03/26/09	08:50
K89CJ	005	C-12	03/26/09	10:50
K89CK	006	C-6 (COMPOSITE)	03/26/09	08:50
K89CL	007	C-8	03/25/09	10:20
K89CM	008	C-5	03/25/09	14:20
K89CN	009	C-3	03/25/09	12:50
K89CP	010	B-36	03/25/09	09:00
K89CR	011	B-35	03/25/09	08:35
K89CT	012	C-2	03/25/09	13:10
K89DH	013	C-7	03/26/09	09:55
K89DK	014	C-1	03/25/09	13:40
K89DM	015	C-11	03/26/09	13:00
K89DN	016	C-4	03/25/09	12:30

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

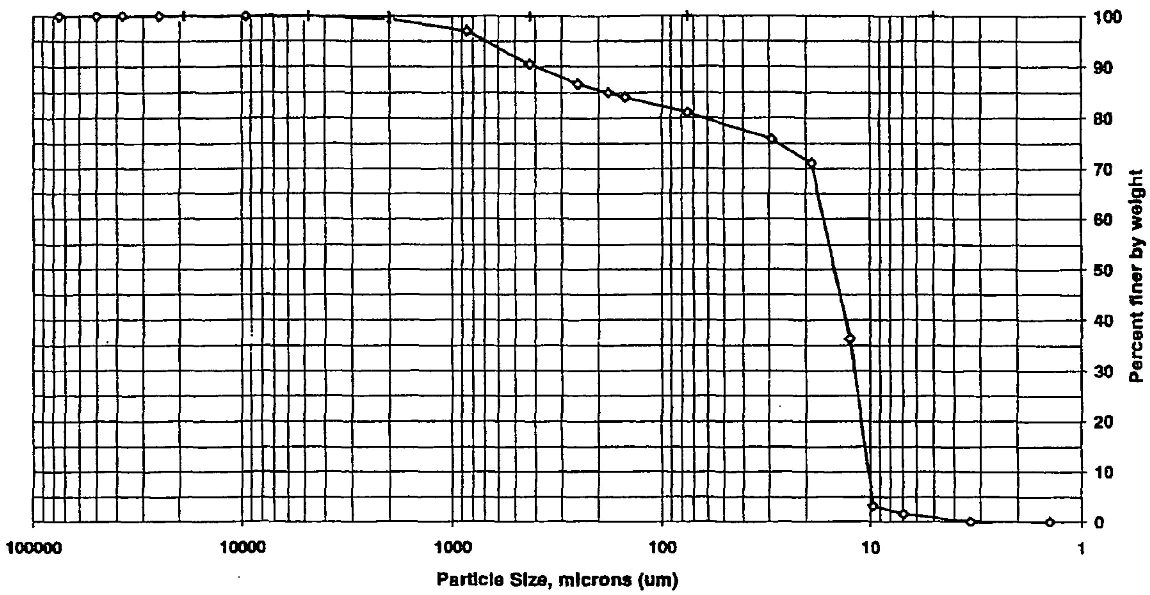
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

ent Code:	STLMOS	SDG:	9C270267	Date Received:	4/2/2009
Sample ID:	C-5	ETR(s):	131014	Start Date:	4/6/2009
Lab ID:	791170			End Date:	4/15/2009

Percent Solids:	58.8%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	angular
Maximum Particle Size:	Crs sand	Hardness (> #10):	hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	99.5	0.5
#20	850	97.0	2.5
#40	425	90.5	6.6
#60	250	86.7	3.8
#80	180	85.0	1.7
#100	150	84.1	0.9
#200	75	81.0	3.1
Hydrometer	29.0	75.8	5.2
|	18.7	71.0	4.7
|	12.4	36.3	34.7
|	9.7	3.2	33.2
|	6.9	1.6	1.6
|	3.3	0.0	1.6
V	1.4	0.0	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	19.0
Coarse Sand	0.5
Medium Sand	9.0
Fine Sand	9.5
Silt	79.4
Clay	1.6

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

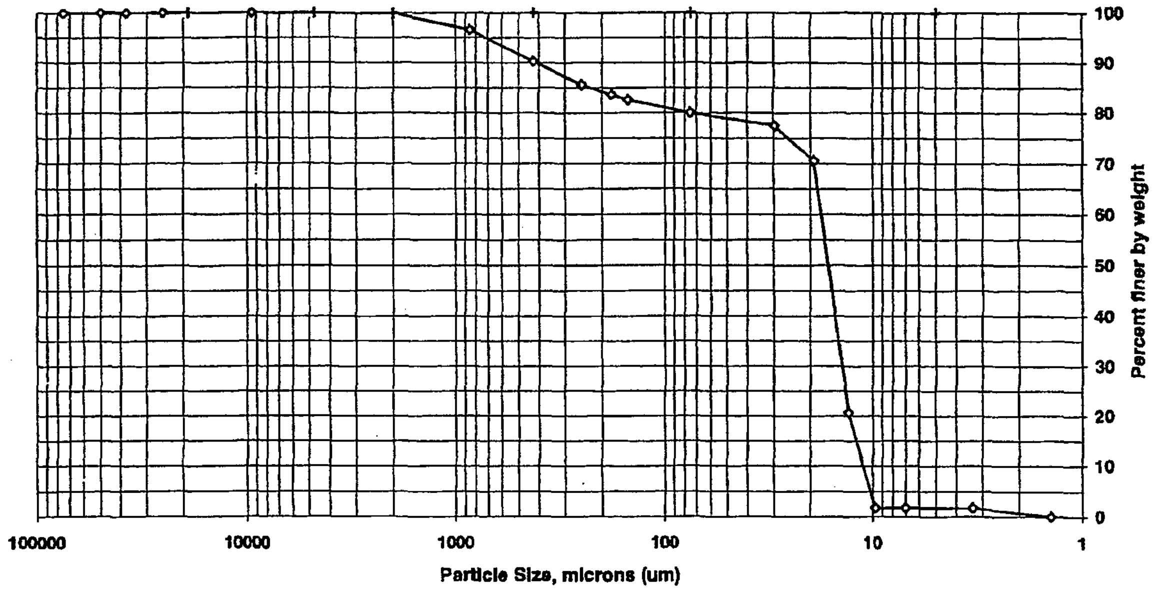
FSL024:07.29.05:0
TestAmerica Burlington

9C270267PS 4/15/2009

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9C270267	Date Received:	4/2/2009
Sample ID:	C-2	ETR(s):	131014	Start Date:	4/6/2009
Lab ID:	791171			End Date:	4/15/2009

Percent Solids:	58.5%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	angular
Maximum Particle Size:	Crs sand	Hardness (> #10):	hard



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	99.9	0.1
#20	850	96.6	3.3
#40	425	90.3	6.3
#60	250	85.5	4.8
#80	180	83.6	1.9
#100	150	82.5	1.0
#200	75	80.0	2.5
Hydrometer	29.6	77.4	2.6
|	19.3	70.5	6.9
|	13.1	20.6	49.9
|	9.7	1.7	18.9
|	7.0	1.7	0.0
|	3.3	1.7	0.0
V	1.4	0.0	1.7

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	20.0
Coarse Sand	0.1
Medium Sand	9.6
Fine Sand	10.3
Silt	78.3
Clay	1.7

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
South Burlington, VT

Sample Data Summary Package

9D030324

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

April 15, 2009

Mr. Terry Romanko
TestAmerica, Inc.
13715 Rider Trail North
Earth City, MO 63045

Re: Laboratory Project No. 29014
Case: HONEYWEL; SDG: 9D030324

Dear Mr. Romanko:

Enclosed are the analytical results for the samples that were received by TestAmerica Burlington on April 4th, 2009. Laboratory identification numbers were assigned, and designated as follows:

Lab ID	Client Sample ID	Sample Date	Sample Matrix
	Received: 04/04/09 ETR No: 131082		
791807	C-19 UPPER	04/01/09	SOLID
791808	C-19 LOWER	04/01/09	SOLID

Documentation of the condition of the samples at the time of their receipt and any exception to the laboratory's Sample Acceptance Policy is documented in the Sample Handling section of this submittal.

Particle Size Analysis by ASTM D422:
There were no exceptions to the method quality control criteria during the analyses of these samples.

Any reference within this report to Severn Trent Laboratories, Inc. or STL, should be understood to refer to TestAmerica Laboratories, Inc. (formerly known as Severn Trent Laboratories, Inc.) The analytical results associated with the samples presented in this test report were generated under a quality system that adheres to requirements specified in the NELAC standard. Release of the data in this test report and any associated electronic deliverables is authorized by the Laboratory Director's designee as verified by the following signature.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

If there are any questions regarding this submittal, please contact me at 802 660-1990.

Sincerely,

Ron Pentkowski

Ron Pentkowski
Project Manager

Enclosure

F9D030324

INTER-COMPANY LOG

COMMENTS:
Project Manager:
Project: 1991-135-11/002 Honeywell Ponds
Report Type: B Standard Report
: 472876 - Andrews Engineering, Inc.

Date Received: 2009-04-03
Analytical Due Date: 2009-04-29
Report Due Date: 2009-05-01

WORK LOCATION: ***H2*** ***TestAmerica Burlington***

SMP#: 2 CLIENT ID: C-19 UPPER DATE SAMPLED: 20090401 MATRIX: A **SOLID**
SAMPLE COMMENTS:

METHOD: **ZZ** NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K9K8A1A1 METAL: **XX**

SMP#: 3 CLIENT ID: C-19 LOWER DATE SAMPLED: 20090401 MATRIX: A **SOLID**
SAMPLE COMMENTS:

METHOD: **ZZ** NONE NONE **Archive**
EXTRACTION: 88 NO SAMPLE PREPARATION PERFORMED / QC TYPE: 01 STANDARD TEST SET
WORKORDER K9K8H1AC METAL: **XX**

The sample(s) listed on this form are being sent to your location for the specified analysis. If you have any questions, please contact the Project Manager listed above. PLEASE RETURN THE ORIGINAL SIGNED FORM WITH THE REPORT AT THE COMPLETION OF ANALYSIS.

Thank You

TA- St. Louis
Sample Receiving

RELINQUISHED BY: Angela Boon DATE: 4-3-09 17:00
RECEIVED FOR LAB BY: [signature] DATE: 4-04-09 1000

TestAmerica

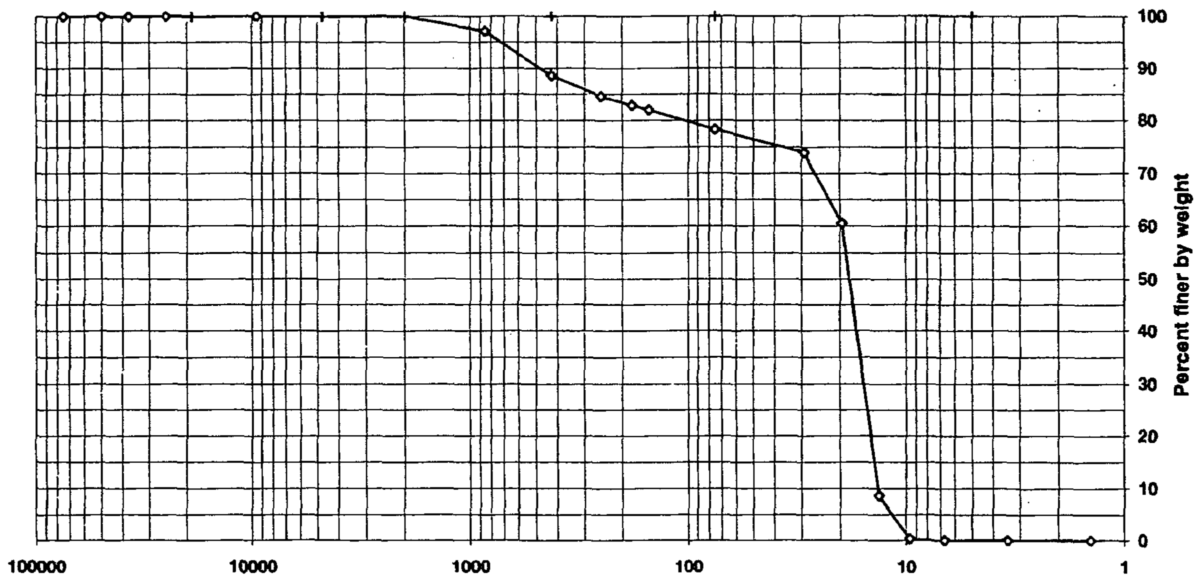
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

nt Code:	STLMOS	SDG:	9D030324	Date Received:	4/9/2009
mple ID:	C-19 UPPER	ETR(s):	131082	Start Date:	4/9/2009
Lab ID:	791807			End Date:	4/14/2009

Percent Solids:	53.8%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.1	2.9
#40	425	88.6	8.5
#60	250	84.6	4.0
#80	180	82.9	1.7
#100	150	82.0	0.9
#200	75	78.3	3.7
Hydrometer	29.2	73.9	4.4
|	19.5	60.5	13.4
|	13.3	8.6	51.9
|	9.6	0.3	8.4
|	6.7	0.0	0.3
|	3.4	0.0	0.0
V	1.4	0.0	0.0

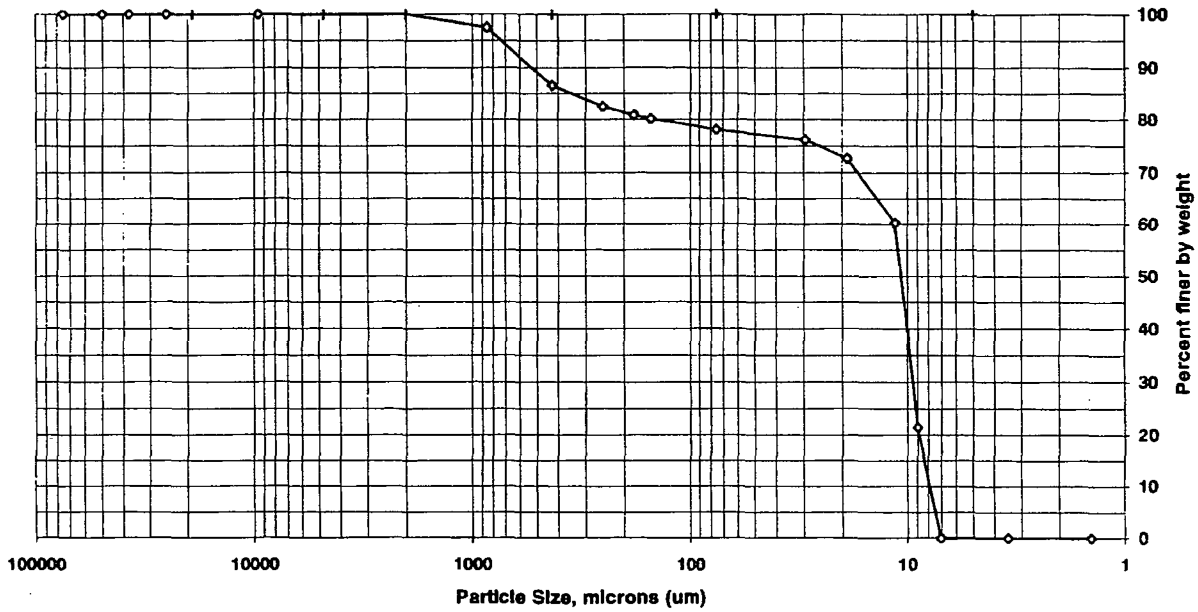
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	21.7
Coarse Sand	0.0
Medium Sand	11.4
Fine Sand	10.3
Silt	78.3
Clay	0.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

nt Code:	STLMOS	SDG:	9D030324	Date Received:	4/9/2009
mple ID:	C-19 LOWER	ETR(s):	131082	Start Date:	4/9/2009
Lab ID:	791808			End Date:	4/14/2009

Percent Solids:	53.5%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.5	2.5
#40	425	86.6	10.9
#60	250	82.5	4.1
#80	180	80.9	1.6
#100	150	80.2	0.8
#200	75	78.1	2.1
Hydrometer	29.4	76.2	1.9
	18.9	72.6	3.5
	11.4	60.3	12.4
	9.0	21.5	38.8
	7.0	0.0	21.5
	3.5	0.0	0.0
V	1.4	0.0	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	21.9
Coarse Sand	0.0
Medium Sand	13.4
Fine Sand	8.5
Silt	78.1
Clay	0.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds D

Lot #: F9F120116

Seän Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

TJRomanko

Terry Romanko
Project Manager

July 8, 2009

Case Narrative
LOT NUMBER: **F9F120116**

This report contains the analytical results for the four samples received under chain of custody by TestAmerica St. Louis on June 11, 2009. These samples are associated with your Honeywell Ponds D project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances
Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Bulk Density

There was insufficient sample to perform the analysis of a duplicate for density batch 9188234.
Affected Samples:
F9F120116 (3): D-8 UPPER
F9F120116 (4): D-8 LOWER

Cation Exchange Capacity

Batch 9169422:
- The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
- The RPD is not within method acceptance criteria. The sample is non-homogeneous. Method performance is demonstrated by acceptable LCS recovery.

Affected Samples:
F9F120116 (3): D-8 UPPER
F9F120116 (4): D-8 LOWER

Gamma Spectroscopy

- There was insufficient sample to fill a tuna can geometry for Radium-226 by gamma spec which could potentially bias the results low due to the loss of Radon into the headspace of the container.
- The Americium 241, Cesium 137 and Cobalt 60 LCS was used and recoveries are within QC limits.

Affected Samples:
F9F120116 (1): D-19 UPPER
F9F120116 (2): D-19 LOWER
F9F120116 (3): D-8 UPPER
F9F120116 (4): D-8 LOWER

TCLP Preparation

The standard volume for TCLP non-volatiles preparation is 100 grams of sample. There was insufficient sample to perform analysis at the standard amount. A reduced sample amount was used, maintaining the 20:1 leachate to sample ratio.

Affected Samples:

F9F120116 (1): D-19 UPPER

F9F120116 (2): D-19 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9F120116

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9F120116

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LERPH	001	D-19 UPPER	06/09/09	09:30
LERP6	002	D-19 LOWER	06/09/09	09:30
LERP7	003	D-8 UPPER	06/10/09	12:55
LERQL	004	D-8 LOWER	06/10/09	12:55

NOTE (S) :

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

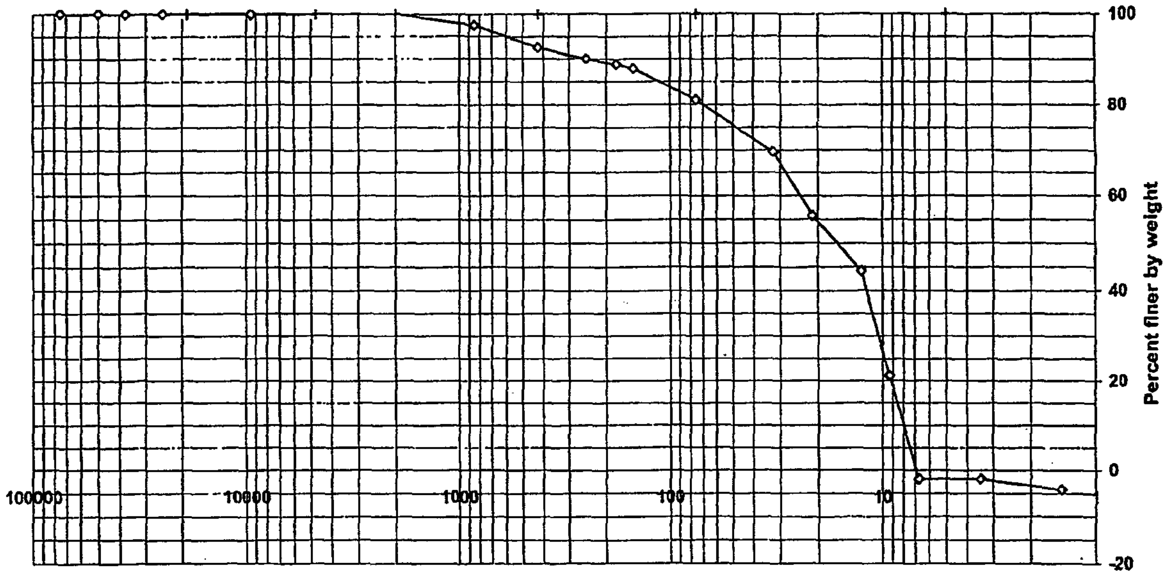
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code: STLMOS **SDG:** 9F120116 **Date Received:** 6/18/2009
Sample ID: D-8 UPPER **ETR(s):** 132255 **Start Date:** 6/19/2009
Lab ID: 798625 **End Date:** 6/30/2009

Percent Solids: 52.7% **Non-soil material:** N/A
Specific Gravity: 2.650 **Shape (> #10):** N/A
Maximum Particle Size: Med sand **Hardness (> #10):** N/A



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.6	2.4
#40	425	92.6	5.0
#60	250	90.0	2.6
#80	180	88.8	1.3
#100	150	87.9	0.9
#200	75	81.0	6.9
Hydrometer	32.4	69.6	11.4
|	21.2	55.7	13.8
|	12.6	44.2	11.5
|	9.3	21.1	23.1
|	6.7	-1.9	23.1
|	3.4	-1.9	0.0
V	1.4	-4.2	2.3

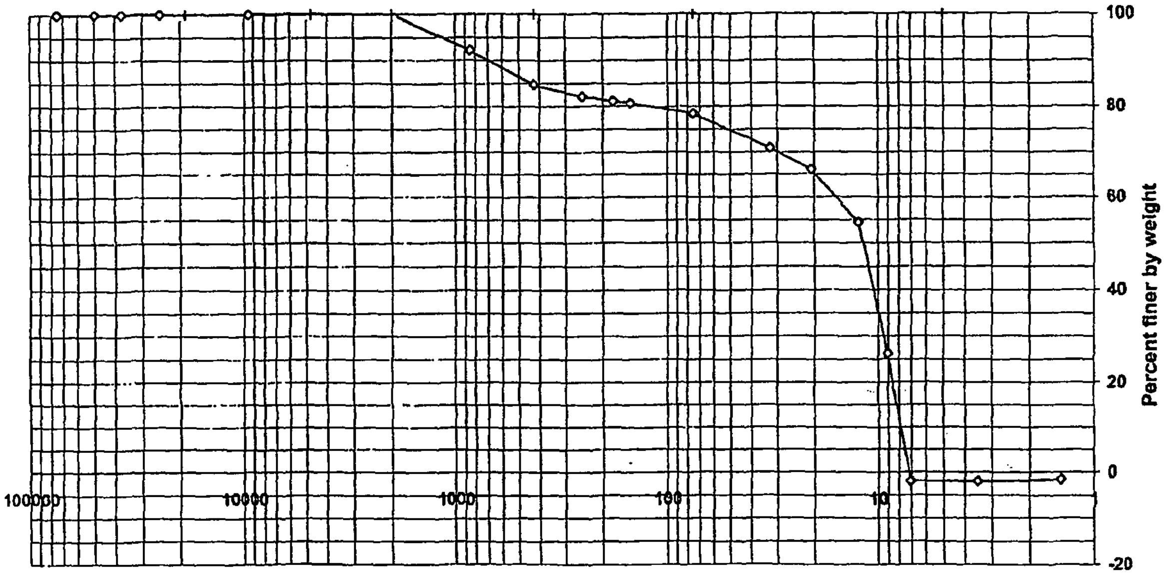
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	19.0
Coarse Sand	0.0
Medium Sand	7.4
Fine Sand	11.6
Silt	82.9
Clay	-1.9

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9F120116	Date Received:	6/18/2009
Sample ID:	D-8 LOWER	ETR(s):	132255	Start Date:	6/19/2009
Lab ID:	798626			End Date:	6/30/2009

Percent Solids:	49.7%	Non-soil material:	N/A
Specific Gravity:	2.650	Shape (> #10):	N/A
Maximum Particle Size:	Med sand	Hardness (> #10):	N/A



Particle Size, microns (um)

Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	92.3	7.7
#40	425	84.8	7.5
#60	250	82.2	2.6
#80	180	81.1	1.1
#100	150	80.7	0.4
#200	75	78.4	2.3
Hydrometer	32.4	70.8	7.6
I	20.7	66.1	4.7
I	12.3	54.4	11.7
I	9.1	26.2	28.2
I	7.1	-2.0	28.2
I	3.5	-2.0	0.0
V	1.4	-1.6	-0.4

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	21.6
Coarse Sand	0.0
Medium Sand	15.2
Fine Sand	6.3
Silt	80.4
Clay	-2.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds

Lot #: F9F190219

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

Terry Romanko
Project Manager

July 14, 2009

13715 Rider Trail North Earth City, MO 63045 tel 314.298.8566 fax 314.298.8757 www.testamericainc.com

Case Narrative
LOT NUMBER: **F9F190219**

This report contains the analytical results for the two samples received under chain of custody by TestAmerica St. Louis on June 18, 2009. These samples are associated with your Honeywell Ponds project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances
Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Trace ICP Metals

Batch 9180110:
The MS (MSD) recovery for uranium is outside the established QC limits. The RPD is within method acceptance criteria indicating a possible matrix interference. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9F190219 (1): D-26 UPPER F9F190219 (2): D-26 LOWER

The sample was analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted only for those targets reported from the dilution run.
Affected Samples:
F9F190219 (2): D-26 LOWER

Batch 9177271 (TCLP):
The CCV recovery was outside the upper QC limit (greater than 110%) for barium indicating a potential high bias for this analyte in the samples associated with this CCV. This analyte was not detected above the reporting limit in the associated samples.

Bulk Density

There was insufficient sample provided to perform the analysis of a duplicate for density batch 9188234.
Affected Samples:
F9F190219 (1): D-26 UPPER F9F190219 (2): D-26 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9F190219

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9F190219

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LE9P8	001	D-26 UPPER	06/16/09	10:42
LE9RP	002	D-26 LOWER	06/16/09	10:42

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

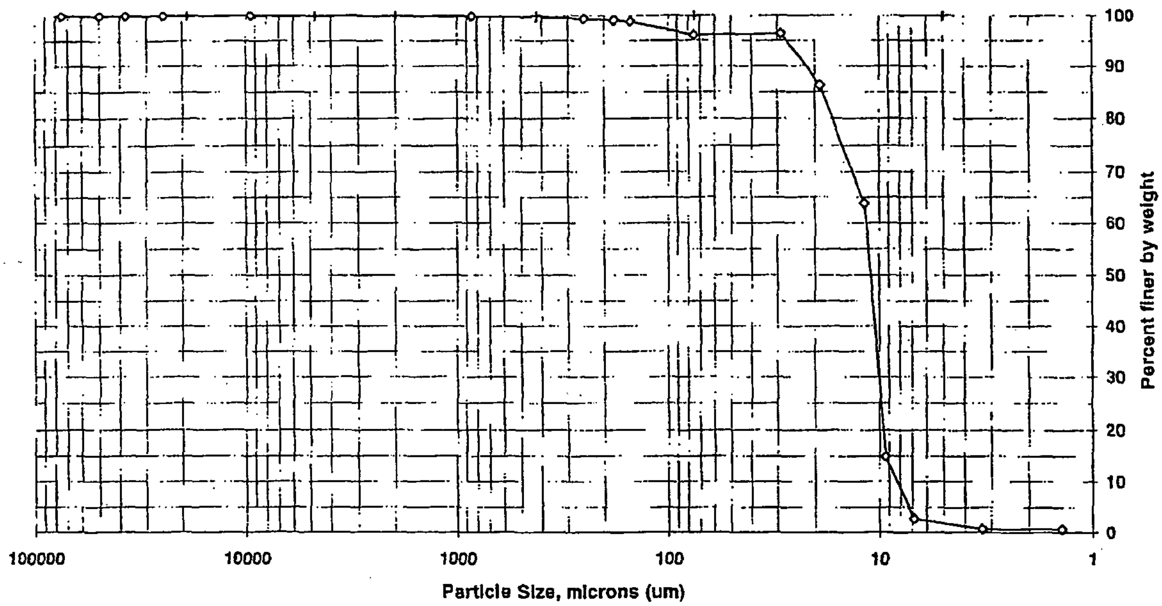
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9F190219	Date Received:	6/20/2009
Sample ID:	D-26 UPPER	ETR(s):	132299	Start Date:	6/22/2009
Lab ID:	798865			End Date:	7/6/2009

Percent Solids:	49.5%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.9	0.1
#40	425	99.7	0.2
#60	250	99.4	0.3
#80	180	99.1	0.3
#100	150	98.8	0.3
#200	75	96.1	2.7
Hydrometer	28.8	96.4	-0.3
|	18.9	86.2	10.2
|	11.7	63.8	22.4
|	9.4	14.9	48.9
|	6.9	2.7	12.2
|	3.3	0.7	2.0
V	1.4	0.7	0.0

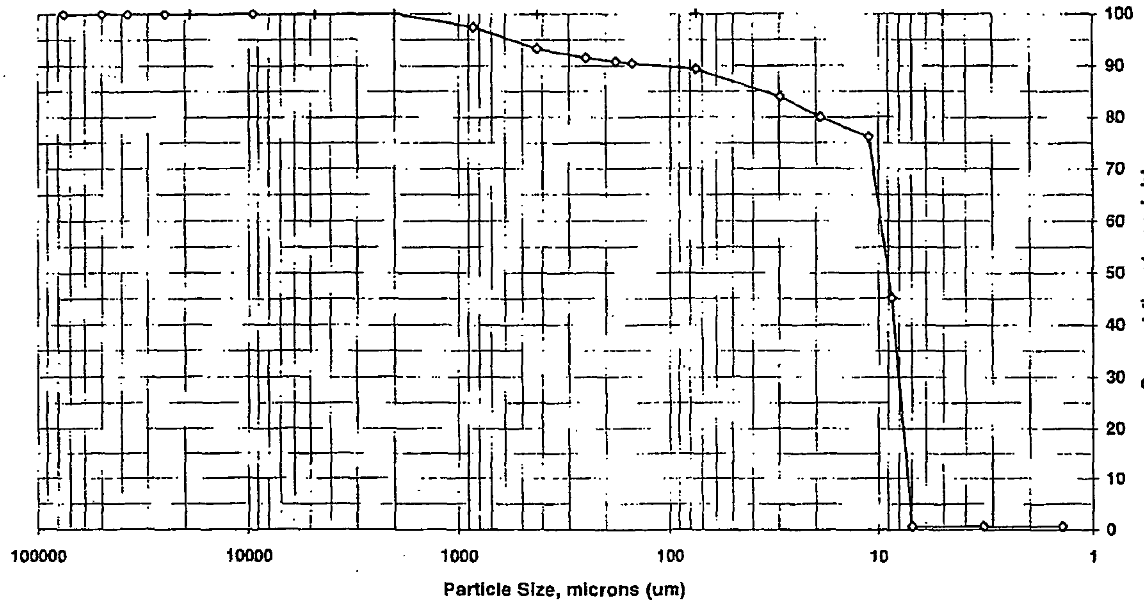
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	3.9
Coarse Sand	0.0
Medium Sand	0.3
Fine Sand	3.6
Silt	93.4
Clay	2.7

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9F190219	Date Received:	6/20/2009
Sample ID:	D-26 LOWER	ETR(s):	132299	Start Date:	6/22/2009
Lab ID:	798866			End Date:	7/6/2009

Percent Solids:	51.0%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.5	2.5
#40	425	93.3	4.1
#60	250	91.6	1.8
#80	180	90.8	0.7
#100	150	90.4	0.4
#200	75	89.3	1.1
Hydrometer	29.7	83.9	5.4
|	19.0	80.1	3.9
|	11.1	76.2	3.9
|	8.6	45.2	31.0
|	6.9	0.6	44.6
|	3.3	0.6	0.0
V	1.4	0.6	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	10.7
Coarse Sand	0.0
Medium Sand	6.7
Fine Sand	4.0
Silt	88.7
Clay	0.6

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds D

Lot #: F9F260219

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

TJRomanko
Terry Romanko
Project Manager

July 22, 2009

Case Narrative
LOT NUMBER: **F9F260219**

This report contains the analytical results for the two samples received under chain of custody by TestAmerica St. Louis on June 26, 2009. These samples are associated with your Honeywell Ponds D project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances
Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Chloride by IC
Batch 9196208:
The MS recovery is outside the established QC limits. A matrix interference is evident in the sample. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9F260219 (1): D-10 UPPER F9F260219 (2): D-10 LOWER

Gamma Spectroscopy
The presence of Thorium 234/Uranium 238 indicate the presence of Proactinium 234m. The Proactinium 234m results were calculated above the MDA in the samples, however, the results may be biased high due to the low abundance at keyline 1001.3 keV.
Affected Samples:
F9F260219 (1): D-10 UPPER F9F260219 (2): D-10 LOWER

Trace ICP Metals
Batch 9180110:
The MS (MSD) recovery for uranium is outside the established QC limits. The RPD is within method acceptance criteria indicating a possible matrix interference. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9F260219 (1): D-10 UPPER F9F260219 (2): D-10 LOWER

Batch 9183253 (TCLP):
The LLC recovery for cadmium is outside the upper QC limit, indicating a potential positive bias for that analyte. This analyte was non-detect, indicating that the samples were not affected by this excursion.
Affected Samples:
F9F260219 (1): D-10 UPPER F9F260219 (2): D-10 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9F260219

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9F260219

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LFPDH	001	D-10 UPPER	06/25/09	06:50
LFPD8	002	D-10 LOWER	06/25/09	06:50

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- *Results noted as "ND" were not detected at or above the stated limit.*
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

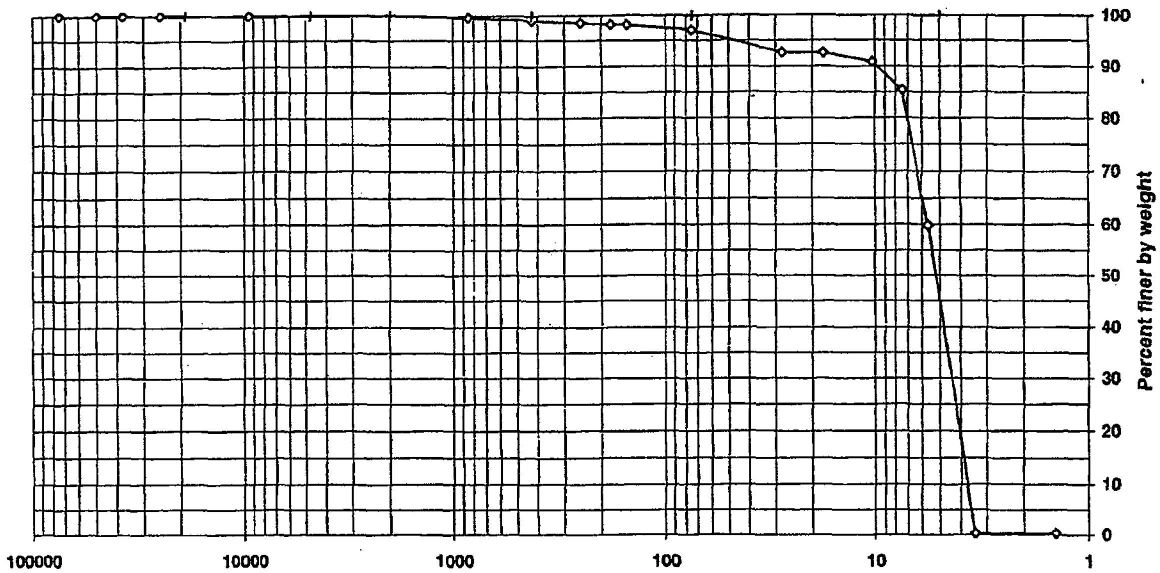
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9F260219	Date Received:	6/27/2009
Sample ID:	D-10 UPPER	ETR(s):	132397	Start Date:	6/29/2009
Lab ID:	799491			End Date:	7/7/2009

Percent Solids:	52.3%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.7	0.3
#40	425	99.0	0.7
#60	250	98.5	0.6
#80	180	98.2	0.3
#100	150	98.1	0.1
#200	75	97.1	1.1
Hydrometer	28.0	92.6	4.5
|	17.7	92.6	0.0
|	10.3	90.8	1.8
|	7.4	85.4	5.4
|	5.7	59.8	25.6
|	3.4	0.3	59.5
V	1.4	0.3	0.0

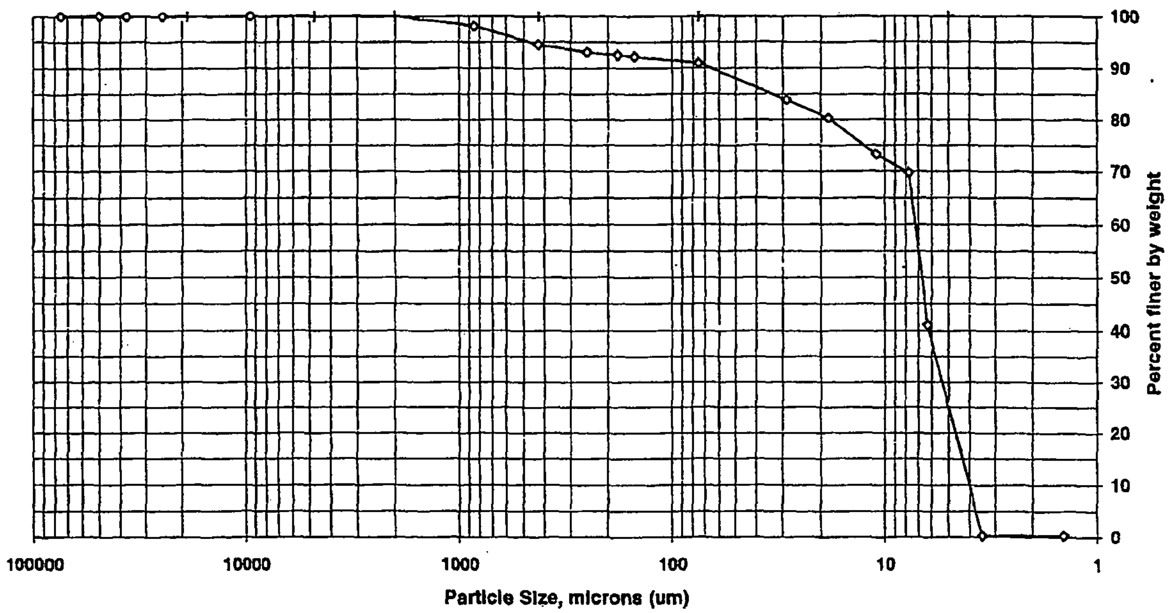
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	2.9
Coarse Sand	0.0
Medium Sand	1.0
Fine Sand	2.0
Silt	37.2
Clay	59.8

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9F260219	Date Received:	6/27/2009
Sample ID:	D-10 LOWER	ETR(s):	132397	Start Date:	6/29/2009
Lab ID:	799492			End Date:	7/7/2009

Percent Solids:	51.2%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	98.1	1.9
#40	425	94.5	3.5
#60	250	93.1	1.4
#80	180	92.5	0.6
#100	150	92.2	0.3
#200	75	90.9	1.3
Hydrometer	28.8	83.8	7.1
|	18.5	80.3	3.5
|	11.0	73.2	7.1
|	7.7	69.7	3.5
|	6.3	41.0	28.6
|	3.5	0.3	40.7
V	1.4	0.3	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	9.1
Coarse Sand	0.0
Medium Sand	5.5
Fine Sand	3.6
Silt	49.9
Clay	41.0

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds

Lot #: F9G020284

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

TRomanko

Terry Romanko
Project Manager

July 28, 2009

13715 Rider Trail North Earth City, MO 63045 tel 314.298.8566 fax 314.298.8757 www.testamericainc.com

Case Narrative
LOT NUMBER: **F9G020284**

This report contains the analytical results for the six samples received under chain of custody by TestAmerica St. Louis on July 2, 2009. These samples are associated with your Honeywell Ponds project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances
Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Chloride

The MS recovery for Chloride in batch 9196208 is outside the established QC limits. A matrix interference is evident in the sample. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9G020284 (3): D-17 UPPER
F9G020284 (4): D-17 LOWER

Density

There was insufficient sample remaining to perform the analysis of a duplicate for batch 9188234.
Affected Samples:
F9G020284 (3): D-17 UPPER
F9G020284 (4): D-17 LOWER

Gamma Spectroscopy

The presence of Thorium 234/Uranium 238 indicate the presence of Proactinium 234m. The Proactinium 234m results were calculated above the MDA in the samples, however, the results may be biased high due to the low abundance at keyline 1001.3 keV.
Affected Samples:
F9G020284 (1): D-29 UPPER
F9G020284 (2): D-29 LOWER
F9G020284 (3): D-17 UPPER
F9G020284 (4): D-17 LOWER
F9G020284 (5): D-11 UPPER
F9G020284 (6): D-11 LOWER

Trace ICP Metals

Batch 9190064:
The samples were analyzed at a dilution due to high concentrations of target and interfering analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9G020284 (4): D-17 LOWER F9G020284 (6): D-11 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9G020284

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9G020284

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LF187	001	D-29 UPPER	06/30/09	07:30
LF19Q	002	D-29 LOWER	06/30/09	07:30
LF19T	003	D-17 UPPER	06/30/09	09:45
LF198	004	D-17 LOWER	06/30/09	09:45
LF2AA	005	D-11 UPPER	06/30/09	10:15
LF2AD	006	D-11 LOWER	06/30/09	10:15

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

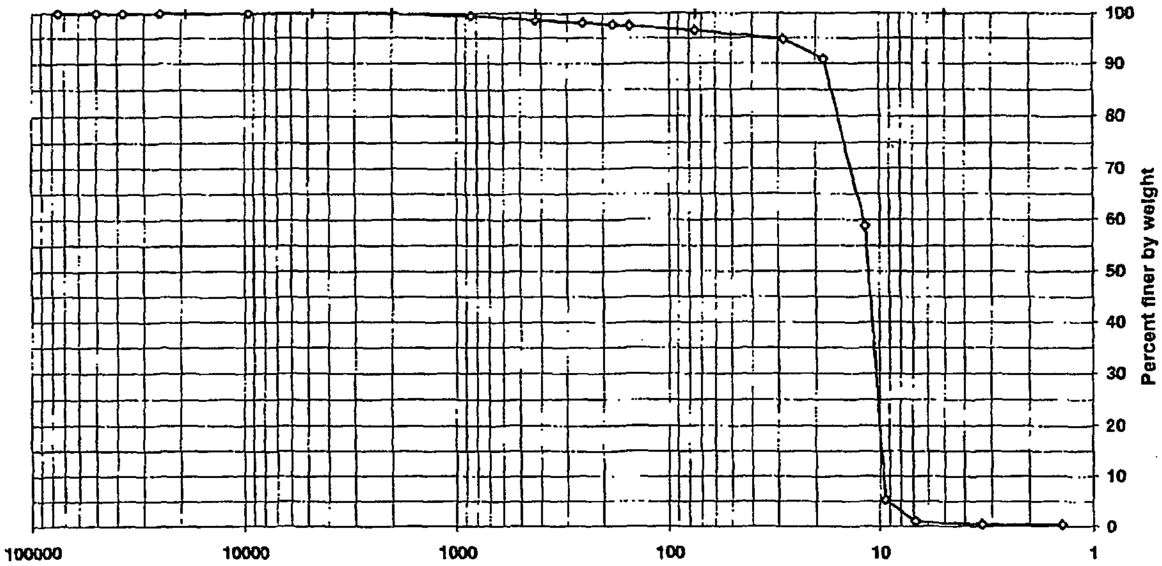
TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Sample Report Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9G020284	Date Received:	7/3/2009
Sample ID:	D-17 UPPER	ETR(s):	132479	Start Date:	7/7/2009
Lab ID:	799911			End Date:	7/13/2009

Percent Solids:	50.6%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.5	0.5
#40	425	98.7	0.9
#60	250	98.1	0.6
#80	180	97.7	0.3
#100	150	97.4	0.3
#200	75	96.6	0.9
Hydrometer	28.3	94.8	1.8
|	18.2	90.8	4.0
|	11.7	58.8	32.0
|	9.4	5.3	53.5
|	6.8	1.0	4.3
|	3.3	0.3	0.7
V	1.4	0.3	0.0

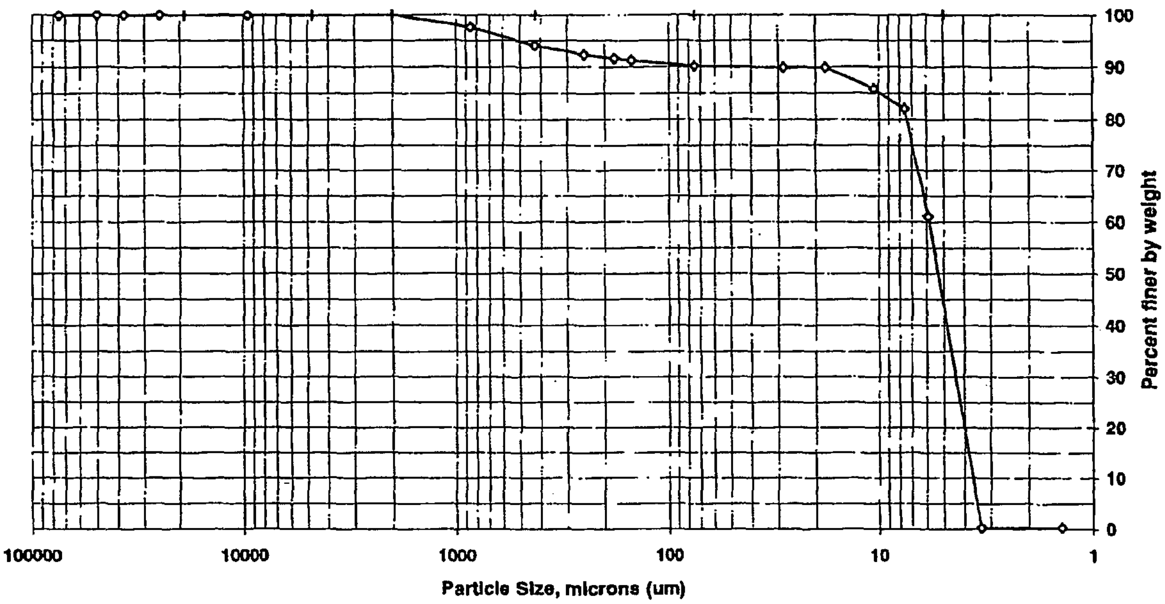
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	3.4
Coarse Sand	0.0
Medium Sand	1.3
Fine Sand	2.1
Silt	95.6
Clay	1.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code: STLMOS | SDG: 9G020284 | Date Received: 7/3/2009
Sample ID: D-17 LOWER | ETR(s): 132479 | Start Date: 7/7/2009
Lab ID: 799912 | | End Date: 7/13/2009

Percent Solids: 50.3% | Non-soil material: na
Specific Gravity: 2.650 | Shape (> #10): na
Maximum Particle Size: Med sand | Hardness (> #10): na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	97.7	2.3
#40	425	94.1	3.6
#60	250	92.3	1.8
#80	180	91.6	0.7
#100	150	91.2	0.4
#200	75	90.2	1.1
Hydrometer	28.3	89.9	0.3
|	17.9	89.9	0.0
|	10.5	85.8	4.1
|	7.6	82.0	3.8
|	5.9	61.1	21.0
|	3.3	0.3	60.8
V	1.4	0.3	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	9.8
Coarse Sand	0.0
Medium Sand	5.9
Fine Sand	3.9
Silt	29.1
Clay	61.1

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds

Lot #: F9E070213

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

Terry Romanko
Project Manager

June 3, 2009

13715 Rider Trail North Earth City, MO 63045 tel 314.298.8566 fax 314.298.8757 www.testamericainc.com

Case Narrative
LOT NUMBER: F9E070213

This report contains the analytical results for the six samples received under chain of custody by STL St. Louis on May 6, 2009. These samples are associated with your Honeywell Ponds project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Cation Exchange Capacity

Batch 9133197:
The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9E070213 (1): E-65 UPPER
F9E070213 (6): E-65 LOWER

Gamma Spectroscopy

The presence of Thorium 234/Uranium 238 indicate the presence of Proactinium 234m. The Proactinium 234m results were calculated above the MDA in the samples, however, the results may be biased high due to the low abundance at keyline 1001.3 keV.
Affected Samples:
F9E070213 (1): E-65 UPPER
F9E070213 (2): E-67 UPPER
F9E070213 (3): E-74 UPPER
F9E070213 (4): E-74 LOWER
F9E070213 (5): E-67 LOWER
F9E070213 (6): E-65 LOWER

Reactive Cyanide

LCS/MS recoveries for Reactive cyanide are outside the established QC limits. All results are non-detect for this batch. Since this test is semi-qualitative no further action is required.
Affected Samples:
F9E070213 (6): E-65 LOWER

TCLP Preparation

Due to limited sample volume, a reduced sample amount was used for the TCLP extraction. The 20:1 leachate:sample ratio was maintained.
Affected Samples:
F9E070213 (1): E-65 UPPER
F9E070213 (6): E-65 LOWER

Trace ICP Metals

Batch 9131193:
The sample was analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9E070213 (5): E-67 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9E070213

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Reactive Cyanide	SW846 7.3.3	SW846 7.3.3
Reactive Sulfide	SW846 7.3.4	SW846 7.3.4
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9E070213

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LCJNP	001	E-65 UPPER	05/04/09	14:00
LCJPG	002	E-67 UPPER	05/05/09	10:15
LCJPM	003	E-74 UPPER	05/06/09	10:30
LCJPV	004	E-74 LOWER	05/06/09	10:30
LCJP3	005	E-67 LOWER	05/05/09	10:15
LCJP6	006	E-65 LOWER	05/04/09	14:00

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

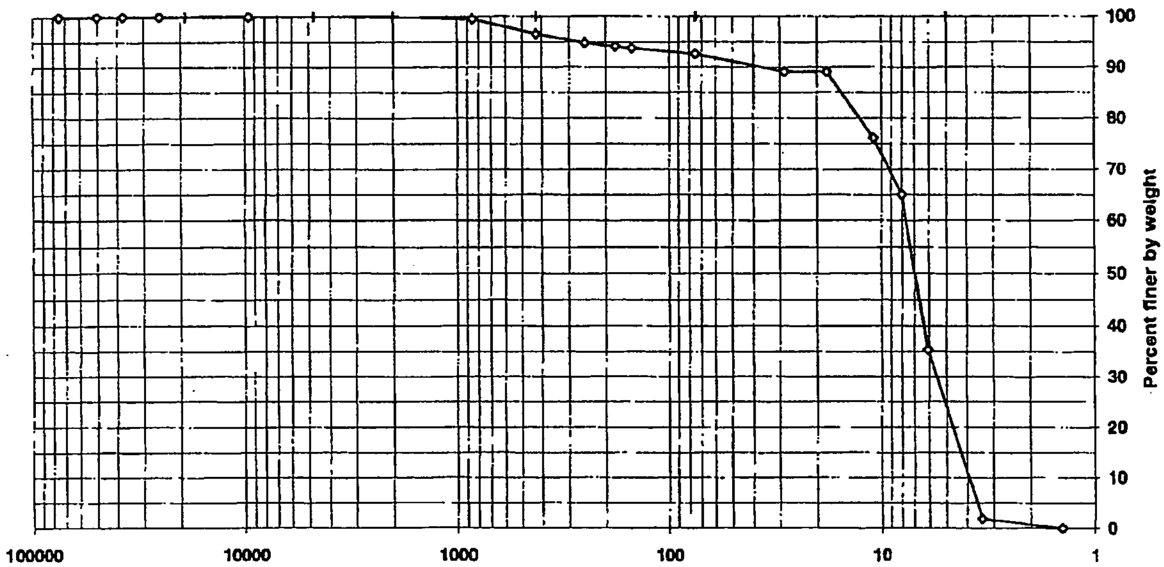
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9E070213	Date Received:	5/8/2009
Sample ID:	E-65 UPPER	ETR(s):	131603	Start Date:	5/8/2009
Lab ID:	794744			End Date:	5/18/2009

Percent Solids:	54.3%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.5	0.5
#40	425	96.6	2.9
#60	250	94.8	1.8
#80	180	94.1	0.7
#100	150	93.8	0.4
#200	75	92.6	1.2
Hydrometer	28.4	89.1	3.5
|	18.0	89.1	0.0
|	10.9	76.1	12.9
|	8.0	65.0	11.1
|	6.1	35.4	29.6
|	3.4	1.8	33.6
V	1.4	0.0	1.8

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	7.4
Coarse Sand	0.0
Medium Sand	3.4
Fine Sand	4.0
Silt	57.2
Clay	35.4

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

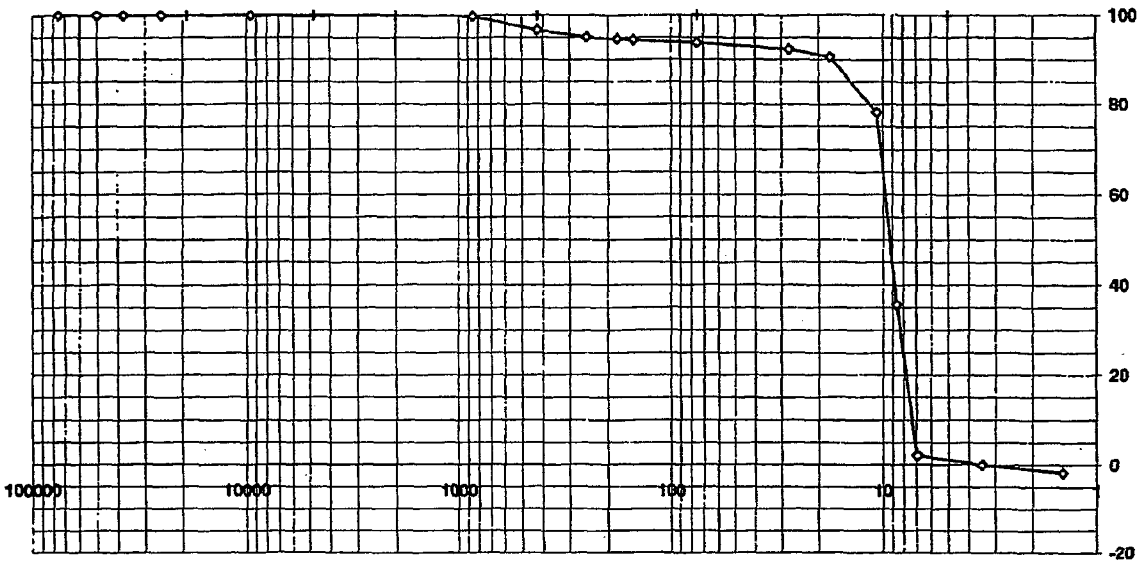
FSL024:07.29.05:0
TestAmerica Burlington

9E070213PS 5/20/2009

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9E070213	Date Received:	5/8/2009
Sample ID:	E-65-LOWER	ETR(s):	131603	Start Date:	5/8/2009
Lab ID:	794745			End Date:	5/18/2009

Percent Solids:	50.4%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Particle Size, microns (um)

Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.8	0.2
#40	425	96.7	3.1
#60	250	95.1	1.6
#80	180	94.7	0.4
#100	150	94.5	0.2
#200	75	93.8	0.6
Hydrometer	27.5	92.4	1.5
|	17.5	90.6	1.8
|	10.7	78.2	12.4
|	8.6	35.7	42.5
|	7.0	2.1	33.6
|	3.5	0.0	2.1
V	1.4	-1.8	1.8

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	6.2
Coarse Sand	0.0
Medium Sand	3.3
Fine Sand	2.8
Silt	91.8
Clay	2.1

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds

Lot #: F9E140145

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

T Romanko

Terry Romanko
Project Manager

June 19, 2009

13715 Rider Trail North Earth City, MO 63045 tel 314.298.8566 fax 314.298.8757 www.testamericainc.com

Case Narrative
LOT NUMBER: F9E140145

This report contains the analytical results for the four samples received under chain of custody by STL St. Louis on May 13, 2009. These samples are associated with your Honeywell Ponds project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Cation Exchange Capacity

Batch 9149113:
The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9E140145 (1): E-80 UPPER
F9E140145 (2): E-80 LOWER

Trace ICP Metals

Batch 9135064:
The MS (MSD) recovery for uranium is outside the established QC limits. The RPD is within method acceptance criteria indicating a possible matrix interference. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9E140145 (1): E-80 UPPER
F9E140145 (2): E-80 LOWER
F9E140145 (3): E-79 UPPER
F9E140145 (4): E-79 LOWER

Batch 9140214 (TCLP):
The CRI for arsenic spiked at 10ppb was outside the upper limit of the established QC criteria (130.5%). The concentrations of the samples were at such a level as to make the quantification of a spiked standard at this level unnecessary.
Affected Samples:
F9E140145 (1): E-80 UPPER
F9E140145 (2): E-80 LOWER
F9E140145 (3): E-79 UPPER
F9E140145 (4): E-79 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9E140145

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9E140145

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LC1M0	001	E-80 UPPER	05/12/09	10:15
LC1M6	002	E-80 LOWER	05/12/09	10:24
LC1M7	003	E-79 UPPER	05/12/09	13:10
LC1NA	004	E-79 LOWER	05/12/09	13:20

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

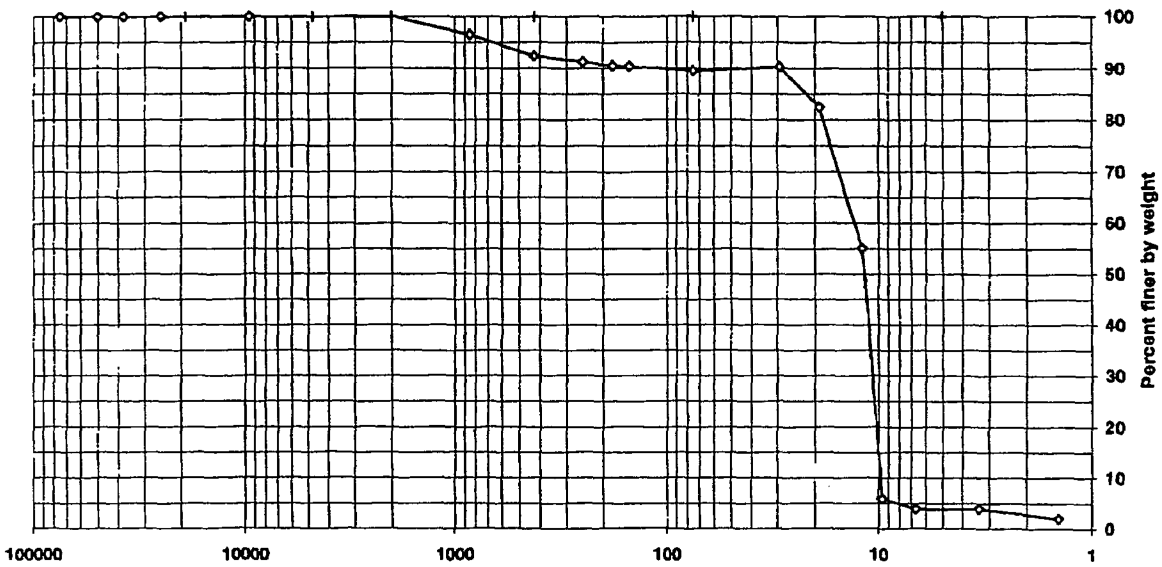
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

...nt Code:	STLMOS	SDG:	9E140145	Date Received:	5/15/2009
Sample ID:	E-80 UPPER	ETR(s):	131733	Start Date:	5/19/2009
Lab ID:	795433			End Date:	6/1/2009

Percent Solids:	55.6%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	96.5	3.5
#40	425	92.4	4.1
#60	250	91.2	1.2
#80	180	90.5	0.7
#100	150	90.4	0.1
#200	75	89.5	0.9
Hydrometer	29.2	90.3	-0.8
|	19.0	82.5	7.8
|	12.0	55.1	27.4
|	9.6	5.9	49.2
|	6.7	3.9	2.0
|	3.3	3.9	0.0
V	1.4	2.0	2.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	10.5
Coarse Sand	0.0
Medium Sand	7.6
Fine Sand	2.9
Silt	85.6
Clay	3.9

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

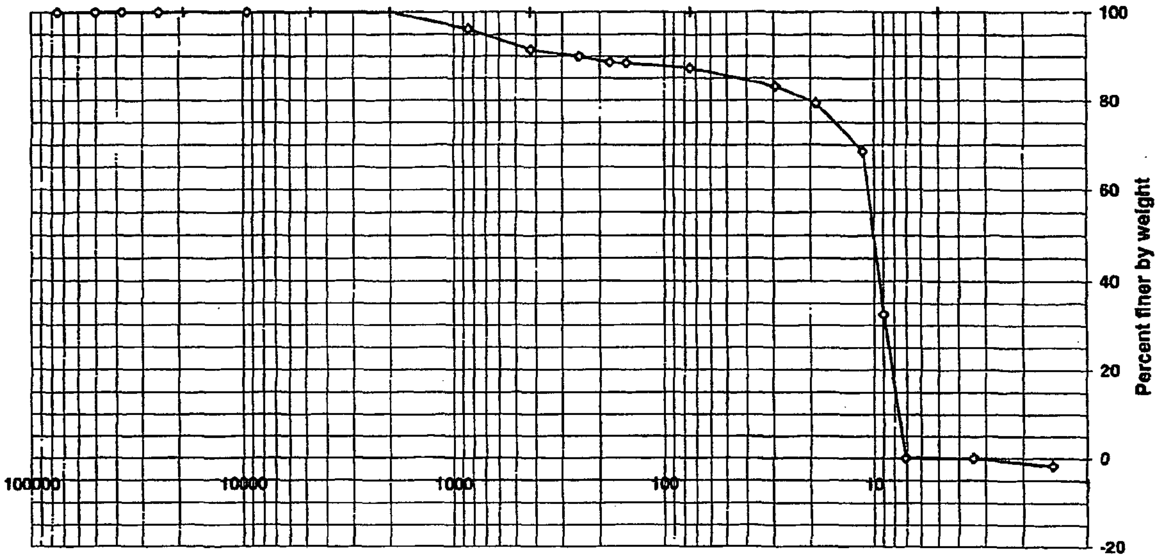
Client Code: STLMOS
Sample ID: E-80 LOWER
Lab ID: 795434

SDG: 9E140145
ETR(s): 131733

Date Received: 5/15/2009
Start Date: 5/19/2009
End Date: 6/1/2009

Percent Solids: 50.5%
Specific Gravity: 2.650
Maximum Particle Size: Med sand

Non-soil material: na
Shape (> #10): na
Hardness (> #10): na



Particle Size, microns (um)

Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	96.2	3.8
#40	425	91.5	4.7
#60	250	89.9	1.6
#80	180	88.6	1.3
#100	150	88.4	0.2
#200	75	87.3	1.1
Hydrometer	29.2	83.2	4.2
|	18.9	79.3	3.9
|	11.3	68.5	10.8
|	9.0	32.4	36.0
|	7.1	0.0	32.4
|	3.4	0.0	0.0
V	1.4	-1.8	1.8

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	12.7
Coarse Sand	0.0
Medium Sand	8.5
Fine Sand	4.2
Silt	87.3
Clay	0.0

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds E

Lot #: F9E150228

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

T. Romanko
Terry Romanko
Project Manager

June 19, 2009

Case Narrative
LOT NUMBER: F9E150228

This report contains the analytical results for the two samples received under chain of custody by STL St. Louis on May 15, 2009. These samples are associated with your Honeywell Ponds E project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by STL St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances

Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Trace ICP Metals

Batch 9140214 (TCLP):
The CRI for arsenic spiked at 10ppb was outside the upper limit of the established QC criteria (130.5%). The concentrations of the samples were at such a level as to make the quantification of a spiked standard at this level unnecessary.
Affected Samples:
F9E150228 (1): E-97 LOWER F9E150228 (2): E-97 UPPER

Cation Exchange Capacity

Batch 9149113:
The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
Affected Samples:
F9E150228 (1): E-97 LOWER F9E150228 (2): E-97 UPPER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9E150228

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9E150228

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LC5V8	001	E-97 LOWER	05/14/09	08:50
LC50M	002	E-97 UPPER	05/14/09	08:40

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

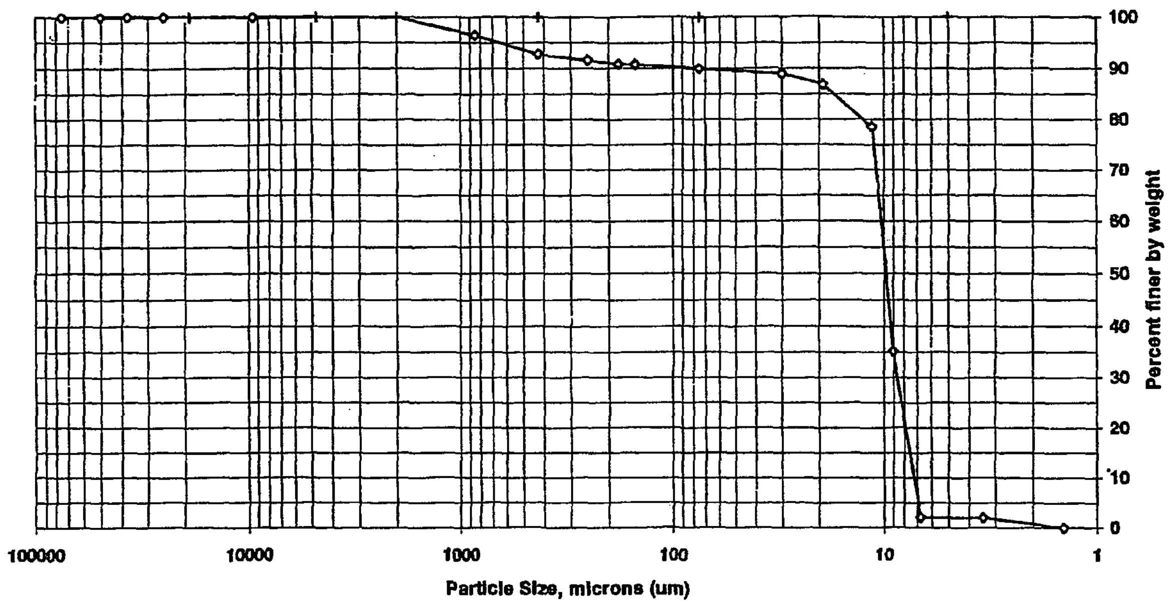
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9E150228	Date Received:	5/18/2009
Sample ID:	E-97 LOWER	ETR(s):	131779	Start Date:	5/19/2009
Lab ID:	795770			End Date:	6/1/2009

Percent Solids:	53.7%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	96.5	3.5
#40	425	92.7	3.8
#60	250	91.6	1.2
#80	180	90.8	0.7
#100	150	90.7	0.1
#200	75	89.9	0.8
Hydrometer	30.0	88.9	1.0
|	19.1	86.8	2.1
|	11.3	78.6	8.3
|	9.0	35.1	43.4
|	6.7	2.1	33.1
|	3.4	2.1	0.0
V	1.4	0.0	2.1

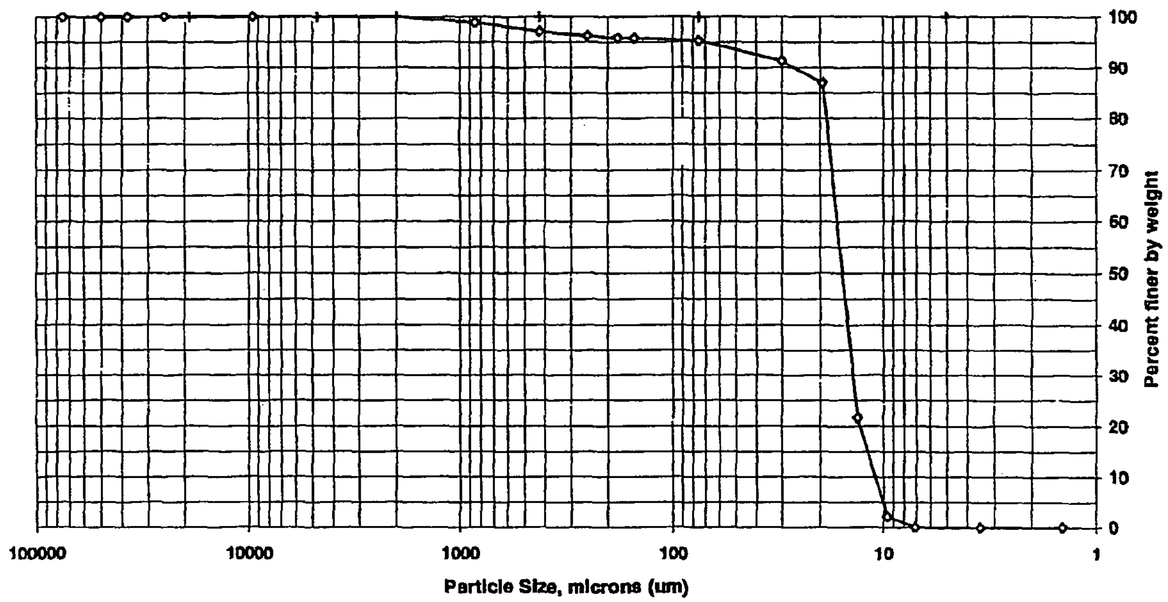
Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	10.1
Coarse Sand	0.0
Medium Sand	7.3
Fine Sand	2.8
Silt	87.9
Clay	2.1

Preparation Method: D2217
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	SDG:	9E150228	Date Received:	5/18/2009
Sample ID:	E-97 UPPER	ETR(s):	131779	Start Date:	5/19/2009
Lab ID:	795771			End Date:	6/1/2009

Percent Solids:	53.6%	Non-soil material:	na
Specific Gravity:	2.650	Shape (> #10):	na
Maximum Particle Size:	Med sand	Hardness (> #10):	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	98.9	1.1
#40	425	97.1	1.8
#60	250	96.3	0.9
#80	180	95.8	0.4
#100	150	95.8	0.0
#200	75	95.3	0.5
Hydrometer	30.1	91.3	4.1
|	19.3	86.9	4.3
|	13.2	21.6	65.3
|	9.6	2.2	19.5
|	7.1	0.0	2.2
|	3.5	0.0	0.0
V	1.4	0.0	0.0

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	4.7
Coarse Sand	0.0
Medium Sand	2.9
Fine Sand	1.8
Silt	95.3
Clay	0.0

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

ANALYTICAL REPORT

PROJECT NO. 1991-135-11/002

Honeywell Ponds

Lot #: F9F050289

Sean Chisek

Andrews Engineering, Inc.
3300 Ginger Creek Drive
Springfield, IL 62711

TESTAMERICA LABORATORIES, INC.

Terry Romanko
Project Manager

July 1, 2009

Case Narrative
LOT NUMBER: **F9F050289**

This report contains the analytical results for the two samples received under chain of custody by TestAmerica St. Louis on June 5, 2009. These samples are associated with your Honeywell Ponds project.

The analytical results included in this report meet all applicable quality control procedure requirements except as noted on the following page.

The test results in this report meet all NELAP requirements for parameters in which accreditations are held by TestAmerica St. Louis. Any exceptions to NELAP requirements are noted in the case narrative. The case narrative is an integral part of this report.

All chemical analysis results are based upon sample as received, wet weight, unless noted otherwise. All radiochemistry results are based upon sample as dried and ground with the exception of tritium, unless requested wet weight by the client.

Grain size analysis was performed at the Burlington, VT laboratory. TOC analysis was performed at the Denver, CO laboratory.

Observations/Nonconformances
Reference the chain of custody and condition upon receipt report for any variations on receipt conditions and temperature of samples on receipt.

Cation Exchange Capacity
- The samples were analyzed at a dilution due to high concentrations of target analytes. The reporting limit has been adjusted for the dilution since no analysis at a lesser dilution was performed.
- The RPD is not within method acceptance criteria. The sample is non-homogeneous. Method performance is demonstrated by acceptable LCS recovery.

Affected Samples:
F9F050289 (1): E-103 UPPER   F9F050289 (2): E-103 LOWER

Bulk Density
A duplicate was not performed due to insufficient volume.
Affected Samples:
F9F050289 (1): E-103 UPPER   F9F050289 (2): E-103 LOWER

TCLP Extraction
Due to limited sample volume, a reduced sample amount was used for the TCLP extraction for metals, maintaining the 20:1 sample to leachate ratio.
Affected Samples:
F9F050289 (1): E-103 UPPER   F9F050289 (2): E-103 LOWER

Trace ICP Metals
Batch 9159092:
The MS (MSD) recovery for uranium is outside the established QC limits. The RPD is within method acceptance criteria indicating a possible matrix interference. Method performance is demonstrated by acceptable LCS recovery.
Affected Samples:
F9F050289 (1): E-103 UPPER   F9F050289 (2): E-103 LOWER

There were no nonconformances or observations noted with any other analysis on this lot.

METHODS SUMMARY

F9F050289

PARAMETER	ANALYTICAL METHOD	PREPARATION METHOD
Bulk Density	ASTM D-5057-90	ASTM D-5057-90
Cation-Exchange Capacity	SW846 9081	SW846 9081
Chloride	MCAWW 300.0A	MCAWW 300.0A
Gamma Spectroscopy - Radium-226 & Hits	EML GA-01-R MOD	
Isotopic Thorium by Alpha Spectroscopy	EML A-01-R MOD	
Isotopic Uranium by Alpha Spectroscopy	EML A-01-R MOD	
Mercury in Liquid Waste (Manual Cold-Vapor)	SW846 7470A	SW846 1311/7470
Method D2216 Percent H2O Dry 105 Degrees C, Weigh	ASTM Moisture,	ASTM ASTM 2216
Paint Filter Test	SW846 9095	SW846 9095
Soil and Waste pH	SW846 9045C	SW846 DI-LEACHA
Sulfide	MCAWW 376.1	MCAWW 376.1
Total Organic Carbon	SW846 9060	SW846 9060
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	
Trace Inductively Coupled Plasma (ICP) Metals	SW846 6010B	SW846 1311/3010

References:

ASTM Annual Book Of ASTM Standards.

EML "ENVIRONMENTAL MEASUREMENTS LABORATORY PROCEDURES MANUAL" HASL-300 28TH EDITION, VOLUME I and II DEPARTMENT OF ENERGY

MCAWW "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1983 and subsequent revisions.

SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 and its updates.

SAMPLE SUMMARY

F9F050289

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
LEE33	001	E-103 UPPER	06/03/09	08:45
LEE4P	002	E-103 LOWER	06/03/09	08:45

NOTE(S):

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

TestAmerica

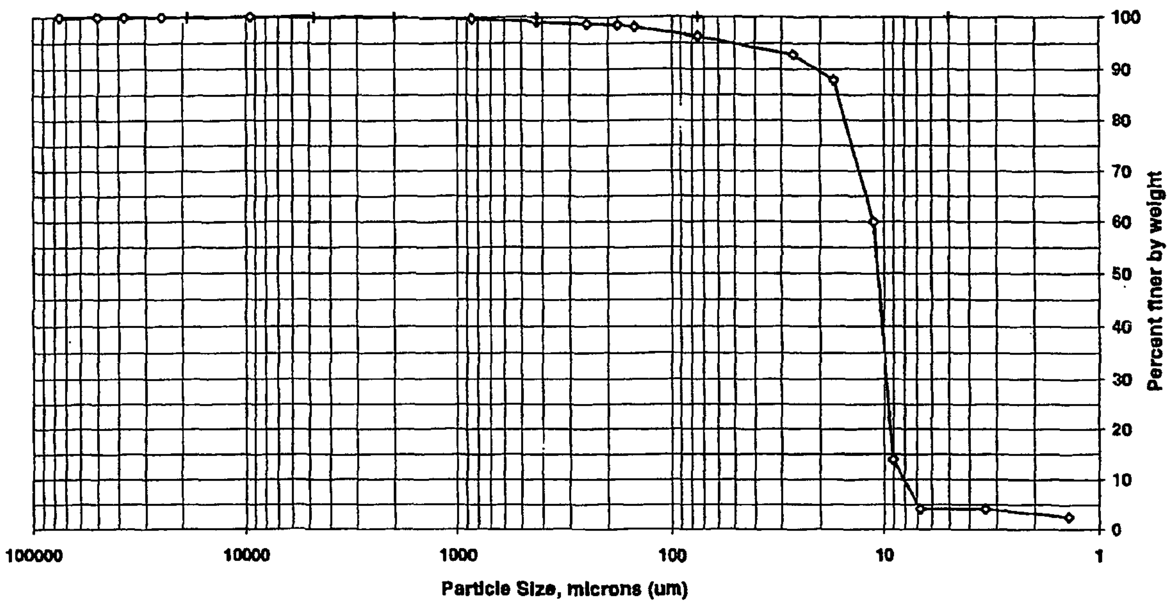
THE LEADER IN ENVIRONMENTAL TESTING

Sample Data Summary – Geotechnical

Particle Size of Soils by ASTM D422

Client Code:	STLMOS	**SDG:**	9F050289	**Date Received:**	6/11/2009
Sample ID:	E-103 UPPER	**ETR(s):**	132154	**Start Date:**	6/11/2009
Lab ID:	797954			**End Date:**	6/26/2009

Percent Solids:	52.0%	**Non-soil material:**	na
Specific Gravity:	2.650	**Shape (> #10):**	na
Maximum Particle Size:	Med sand	**Hardness (> #10):**	na



Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	99.6	0.4
#40	425	99.2	0.4
#60	250	98.7	0.5
#80	180	98.5	0.2
#100	150	98.2	0.4
#200	75	96.3	1.9
Hydrometer	26.5	92.7	3.5
|	17.2	87.8	4.9
|	11.2	59.9	27.9
|	9.1	14.0	46.0
|	6.8	4.1	9.8
|	3.4	4.1	0.0
V	1.4	2.5	1.6

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	3.7
Coarse Sand	0.0
Medium Sand	0.8
Fine Sand	2.9
Silt	92.2
Clay	4.1

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

Particle Size of Soils by ASTM D422

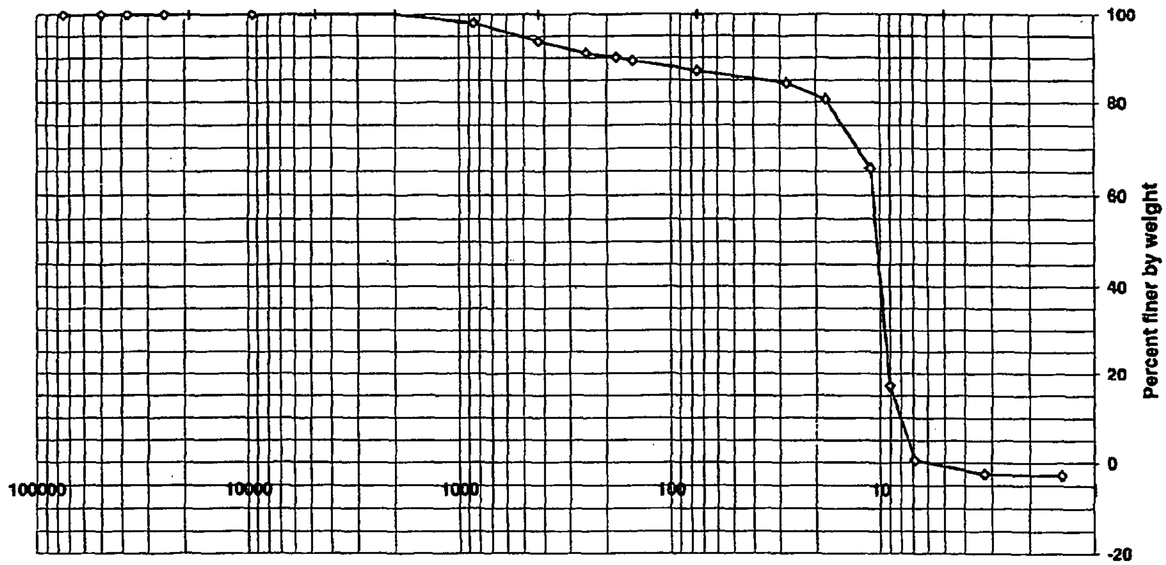
Client Code: STLMOS
Sample ID: E-103 LOWER
Lab ID: 797955

SDG: 9F050289
ETR(s): 132154

Date Received: 6/11/2009
Start Date: 6/11/2009
End Date: 6/26/2009

Percent Solids: 50.5%
Specific Gravity: 2.650
Maximum Particle Size: Med sand

Non-soil material: na
Shape (> #10): na
Hardness (> #10): na



Particle Size, microns (um)

Sieve size	Particle size, um	Percent finer	Incremental percent
3 inch	75000	100.0	0.0
2 inch	50000	100.0	0.0
1.5 inch	37500	100.0	0.0
1 inch	25000	100.0	0.0
3/4 inch	19000	100.0	0.0
3/8 inch	9500	100.0	0.0
#4	4750	100.0	0.0
#10	2000	100.0	0.0
#20	850	98.0	2.0
#40	425	93.7	4.3
#60	250	91.0	2.7
#80	180	90.0	1.0
#100	150	89.3	0.7
#200	75	87.1	2.2
Hydrometer	27.8	84.2	2.8
|	18.0	80.6	3.6
|	11.1	65.6	15.0
|	9.0	17.2	48.4
|	6.9	0.6	16.7
|	3.2	-2.5	3.1
V	1.4	-2.8	0.3

Soil Classification	Percent of Total Sample
Gravel	0.0
Sand	12.9
Coarse Sand	0.0
Medium Sand	6.3
Fine Sand	6.6
Silt	86.5
Clay	0.6

Preparation Method: **D2217**
Dispersion Device: Mechanical mixer with a metal paddle.
Dispersion Period: 1 minute

EXHIBIT 5

SCOUT STATISTICAL OUTPUT

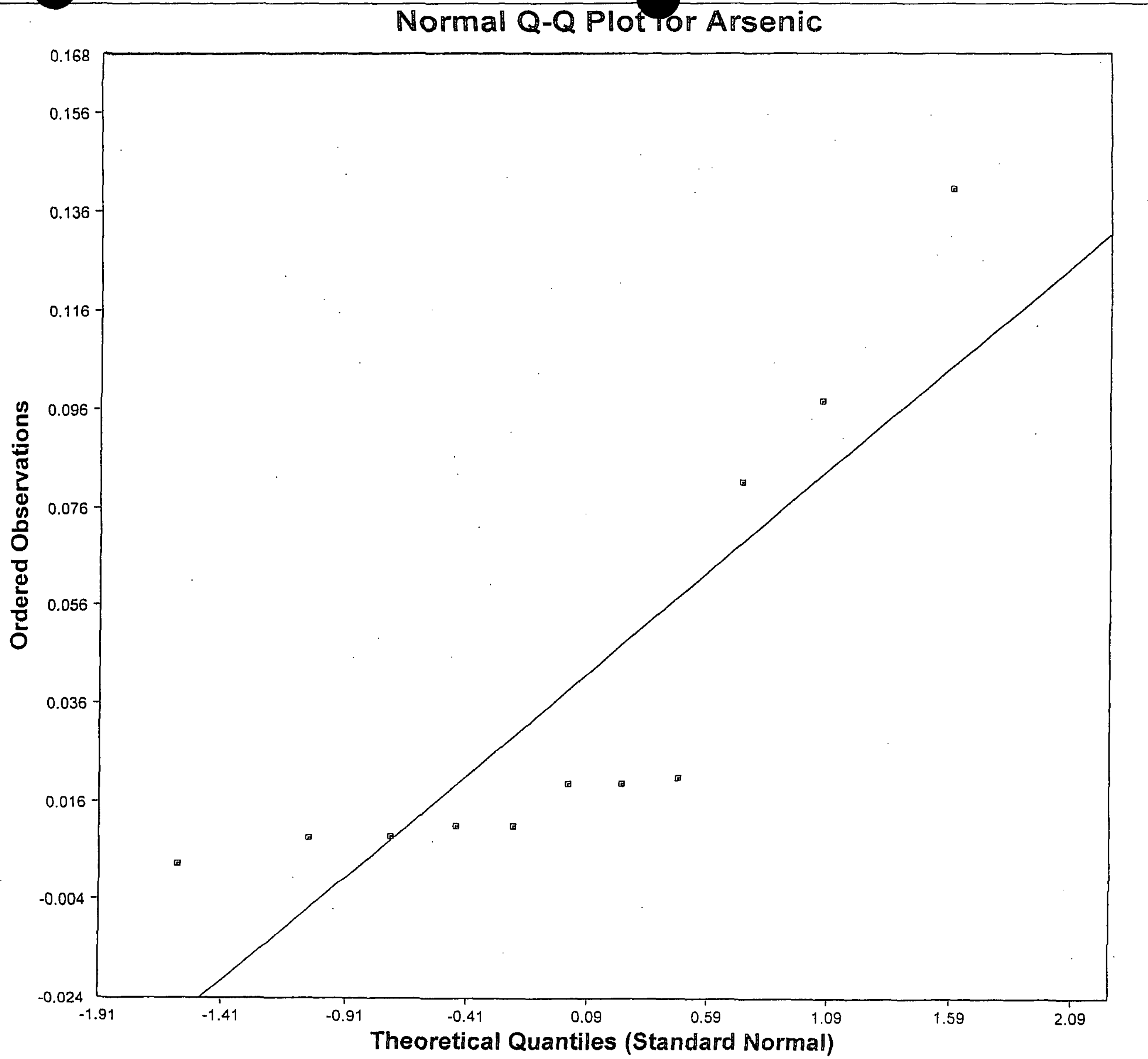
B POND

	Univariate Descriptive Statistics for Datasets with NDs
Date/Time of Computation	8/14/2009 8:48:17 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\B Pond\Metals.wst
Full Precision	OFF

	Arsenic	Chromium	Mercury					
Number of Observations	11	11	11					
Number of Missing Values	0	0	0					
Number of Detects	9	9	2					
Number of Non-Detects	2	2	9					
Percentage of Non-Detects	18.18%	18.18%	81.82%					
Minimum Observed Detected Value	0.0039	0.0096	2.4000E-4					
Maximum Observed Detected Value	0.141	0.0359	3.4000E-4					
Mean of Detected Values	0.043	0.019	2.9000E-4					
Median of Detected Values	0.0115	0.0169	2.9000E-4					
Standard Deviation of Detected Values	0.0505	0.00841	7.0711E-5					
MAD of Detected Values	0.0076	0.0059	5.0000E-5					
MAD / 0.6745 of Detected Values	0.0113	0.00875	7.4129E-5					
Skewness of Detected Values	1.192	1.093	N/A					
Kurtosis of Detected Values	-1.031	-0.51	16768					
CV of Detected Values	1.176	0.443	0.244					
(Q1) 25% Percentile (All Obs)	0.00925	0.0138	8.3500E-4					
(Q2) Median (All Obs)	0.0115	0.0169	2.9000E-4					
(Q3) 75% Percentile (All Obs)	0.0361	0.0207	0.001					
90% Percentile (All Obs)	0.0965	0.027	0.001					
95% Percentile (All Obs)	0.117	0.0313	0.001					
99% Percentile (All Obs)	0.136	0.035	0.001					

	Univariate Descriptive Statistics for Datasets with No NDs
Date/Time of Computation	8/14/2009 8:49:17 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\B Pond\Metals.wst
Full Precision	OFF

	Barium							
Number of Observations	11							
Number of Missing Values	0							
Minimum Observed Value	0.0332							
Maximum Observed Value	0.164							
Mean	0.0836							
10% Percentile	0.034							
15% Percentile	0.0381							
(Q1) 25% Percentile	0.0506							
(Q2) Median	0.0591							
(Q3) 75% Percentile	0.107							
90% Percentile	0.157							
95% Percentile	0.162							
99% Percentile	0.164							
Standard Deviation	0.0463							
Variance	0.00214							
Median of Absolute Deviation (MAD)	0.0183							
MAD / 0.6745	0.0271							
Mean of Abs. Deviation (AD) Median	0.0348							
Mean of AD Median/0.6745	0.0516							
IQR	0.0632							
IQR / 1.35	0.0468							
Skewness	0.906							
Kurtosis	-0.523							
CV	0.553							



Arsenic

n = 11

Mean = 0.0388

Sd = 0.0461

Slope = 0.0417

Intercept = 0.0388

Correlation, R = 0.853

Shapiro-Wilk Test

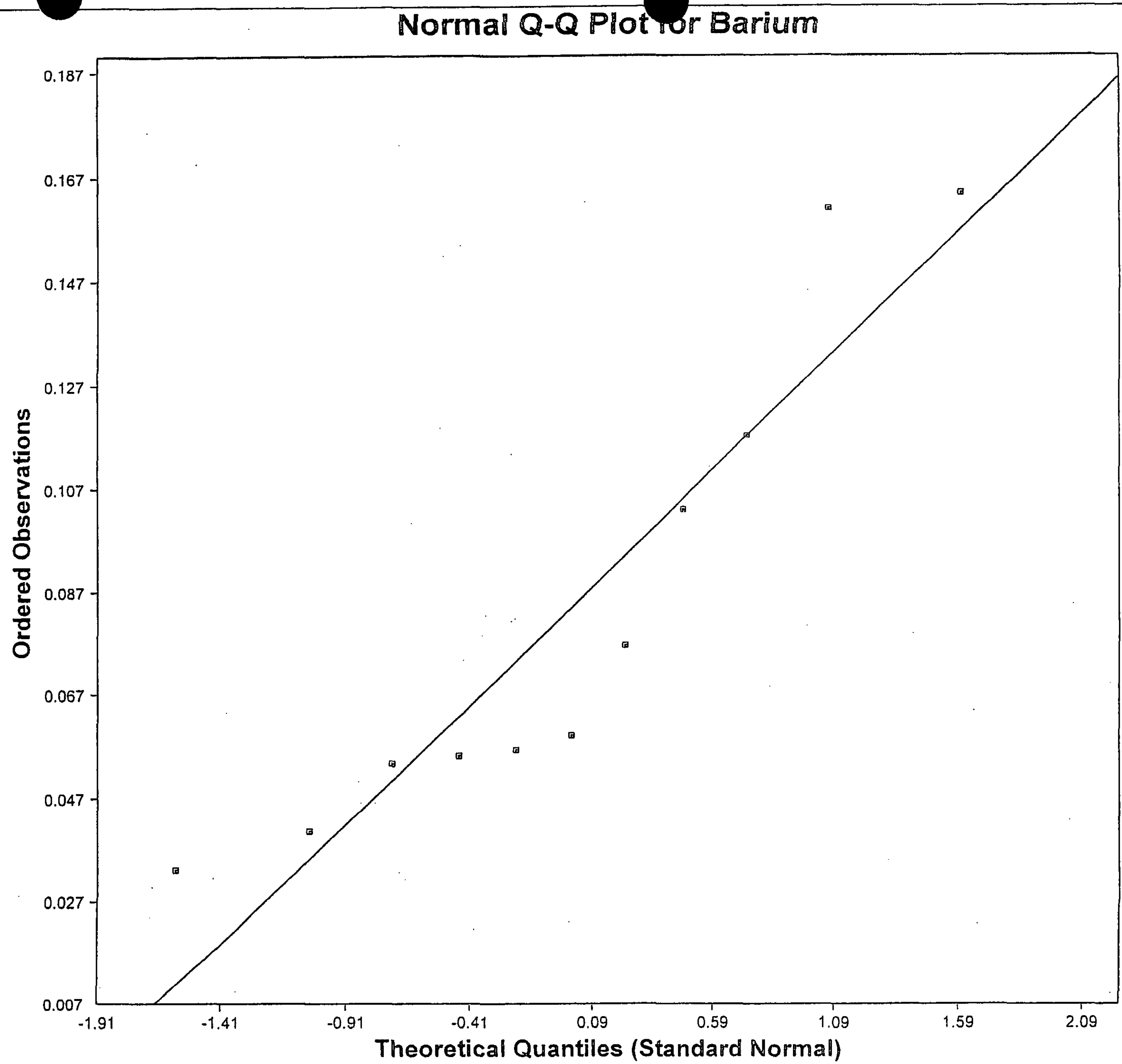
Exact Test Value = 0.729

Critical Val(0.05) = 0.850

Data Not Normal

Approx. Test Value = 0.729

p-Value = 0.00156



Barium

n = 11

Mean = 0.0836

Sd = 0.0463

Slope = 0.0458

Intercept = 0.0836

Correlation, R = 0.935

Shapiro-Wilk Test

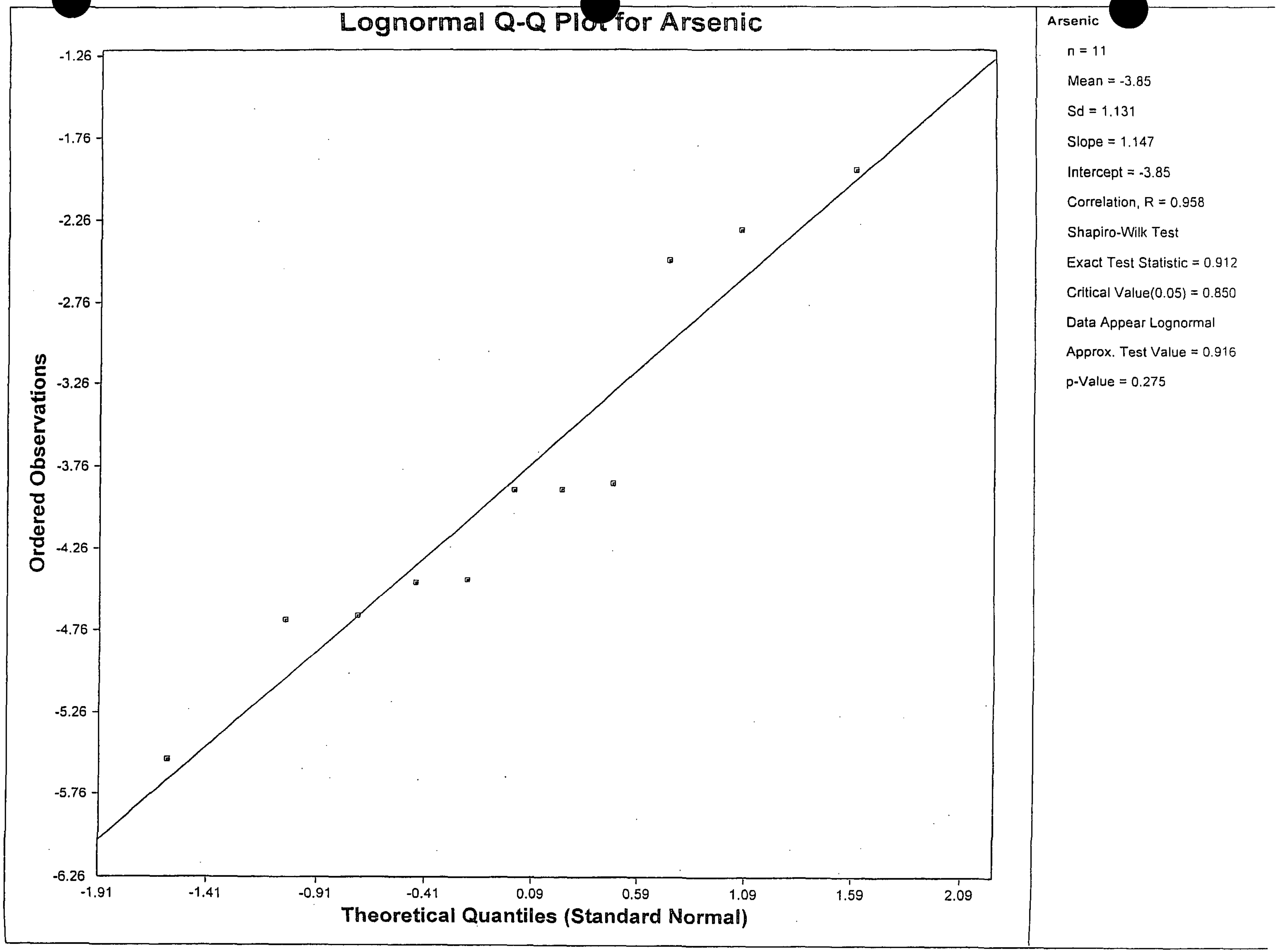
Exact Test Value = 0.859

Critical Val(0.05) = 0.850

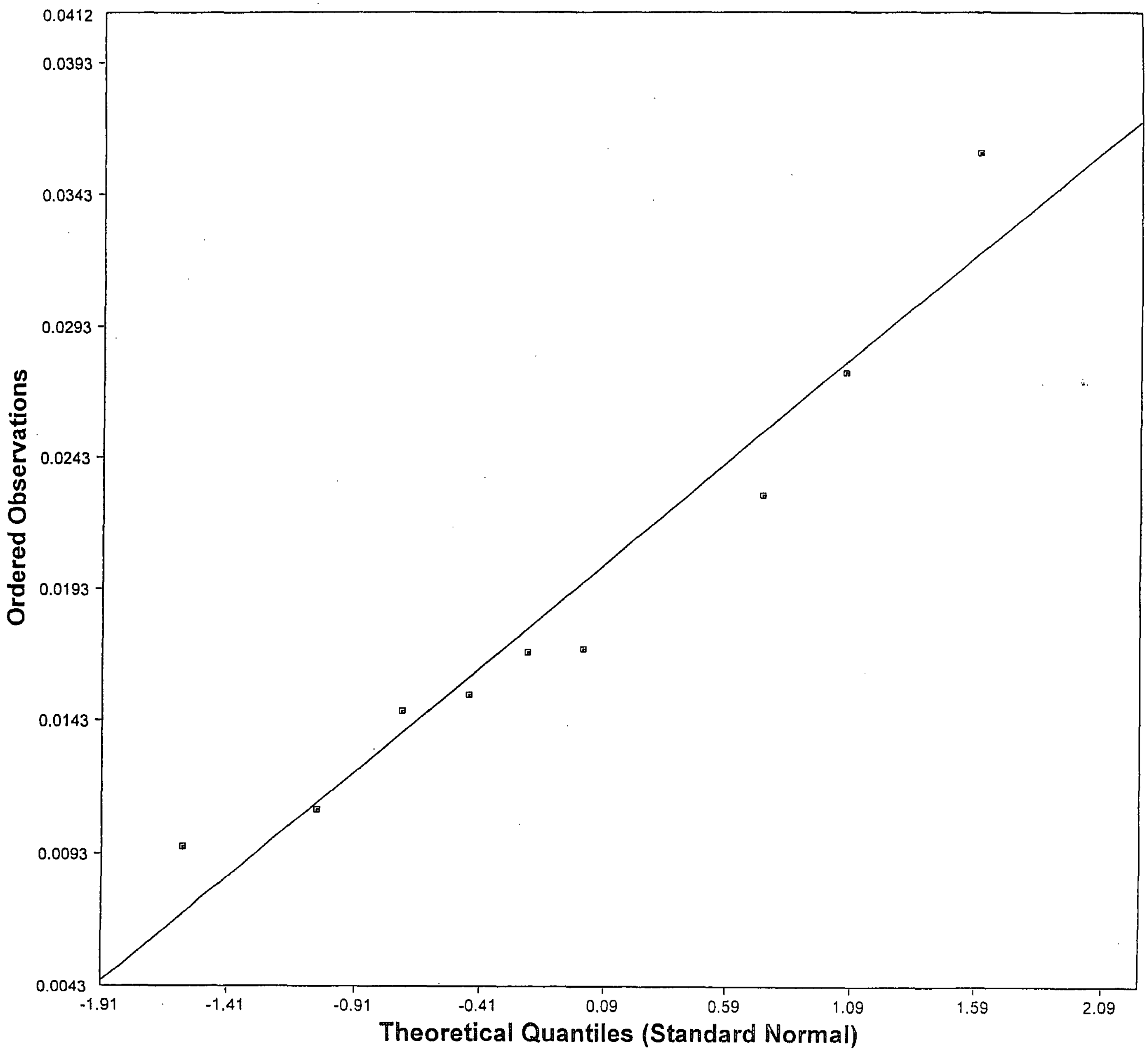
Data Appear Normal

Approx. Test Value = 0.870

p-Value = 0.0758


Lognormal Q-Q Plot for Arsenic
Ordered Observations
-1.26
-1.76
-2.26
-2.76
-3.26
-3.76
-4.26
-4.76
-5.26
-5.76
-6.26
-1.91
-1.41
-0.91
-0.41
0.09
0.59
1.09
1.59
2.09
Theoretical Quantiles (Standard Normal)
Arsenic
n = 11
Mean = -3.85
Sd = 1.131
Slope = 1.147
Intercept = -3.85
Correlation, R = 0.958
Shapiro-Wilk Test
Exact Test Statistic = 0.912
Critical Value(0.05) = 0.850
Data Appear Lognormal
Approx. Test Value = 0.916
p-Value = 0.275

Normal Excluding NDs Q-Q Plot for Chromium



Chromium

Total Number of Data = 11

Number treated as ND = 2

Max DL = 0.02

N = 9

Percent NDs = 18%

Mean = 0.019

Sd = 0.00841

Slope = -0.00101

Intercept = 0.019

Correlation, R = -0.113

Shapiro-Wilk Test

Exact Test Value = 0.927

Critical Val(0.05) = 0.850

Data Appear Normal

Approx. Test Value = 0.923

p-Value = 0.329

	Confidence Intervals Datasets with Non-Detects
Date/Time of Computation	8/14/2009 10:49:30 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\B Pond\Metals.wst
Full Precision	OFF
Number of Bootstrap Operations	2000
Confidence Coefficient	0.8

Arsenic

General Statistics

Number of Valid Data	11
Number of Detected Data	9
Number of Distinct Detected Data	9
Minimum Detected	0.0039
Maximum Detected	0.141
Number of Non-Detect Data	2
Percent Non-Detects	18.18%
Minimum Non-detect	0.02
Maximum Non-detect	0.02

Raw Statistics

Mean of Detected Data	0.043
SD of Detected Data	0.0505

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Maximum Likelihood Estimates (MLEs)

MLE Mean	-0.00921
MLE Stdv	0.0897

Normal (MLE) Confidence Interval

	Lower Limit	Upper Limit
MLE (t)	-0.0463	0.0279

Normal ROS Statistics

Mean of Normal ROS Data	0.0374
Stdv of Normal ROS Data	0.0473

Normal ROS Confidence Intervals

	Lower Limit	Upper Limit
ROS Student's t	0.0178	0.057

Gamma ROS Statistics

k Star of Gamma ROS Data	0.712
Theta Star of Gamma ROS Data	0.0552
Nu Star of Gamma ROS Data	15.66

Gamma Intervals

Gamma	Lower Limit	Upper Limit
ROS Approximate Gamma	0.0266	0.068
ROS Adjusted Gamma	0.0253	0.0731

Log-Transformed Statistics

Mean of Log-Transformed Detected Data	-3.836
Stdv of Log-Transformed Detected Data	1.264
Mean of Lognormal ROS Data	0.037
Stdv of Lognormal ROS Data	0.0472

Lognormal Confidence Intervals

Lognormal	Lower Limit	Upper Limit
ROS Land's H	0.0224	0.0926
ROS % Bootstrap	0.0196	0.0558
ROS BCA Bootstrap	0.0218	0.0595

Kaplan Meier Distribution Free Statistics

Kaplan Meier Mean	0.0368
Kaplan Meier Stdv	0.0451
Kaplan Meier SEM	0.0144

Nonparametric Confidence Intervals

Nonparametric	Lower Limit	Upper Limit
Kaplan Meier (t)	0.017	0.0566
Kaplan Meier (z)	0.0183	0.0553
Kaplan Meier % Bootstrap	0.02	0.054
Kaplan Meier BCA Bootstrap	0.0183	0.0542
Kaplan Meier Chebyshev	0.00456	0.069

Unable to Winsorize Data!

Chromium

General Statistics

Number of Valid Data	11
Number of Detected Data	9
Number of Distinct Detected Data	9
Minimum Detected	0.0096
Maximum Detected	0.0359
Number of Non-Detect Data	2
Percent Non-Detects	18.18%
Minimum Non-detect	0.02
Maximum Non-detect	0.02

Raw Statistics

Mean of Detected Data	0.019
SD of Detected Data	0.00841

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Maximum Likelihood Estimates (MLEs)

MLE Mean	0.0295
MLE Stdv	0.00538

Normal (MLE) Confidence Interval

	Lower Limit	Upper Limit
MLE (t)	0.0273	0.0317

Normal ROS Statistics

Mean of Normal ROS Data	0.0182
Stdv of Normal ROS Data	0.00782

Normal ROS Confidence Intervals

	Lower Limit	Upper Limit
ROS Student's t	0.015	0.0214

Gamma ROS Statistics

k Star of Gamma ROS Data	5.424
Theta Star of Gamma ROS Data	0.00348
Nu Star of Gamma ROS Data	119.3

Gamma Intervals

Gamma	Lower Limit	Upper Limit
ROS Approximate Gamma	0.0161	0.0225
ROS Adjusted Gamma	0.0158	0.023

Log-Transformed Statistics

Mean of Log-Transformed Detected Data	-4.045
Stdv of Log-Transformed Detected Data	0.421
Mean of Lognormal ROS Data	0.0181
Stdv of Lognormal ROS Data	0.00782

Lognormal Confidence Intervals

Lognormal	Lower Limit	Upper Limit
ROS Land's H	0.0156	0.0219
ROS % Bootstrap	0.0154	0.0209
ROS BCA Bootstrap	0.0157	0.0219

Kaplan Meier Distribution Free Statistics

Kaplan Meier Mean	0.0181
Kaplan Meier Stdv	0.00751
Kaplan Meier SEM	0.00244

Nonparametric Confidence Intervals

Nonparametric	Lower Limit	Upper Limit
Kaplan Meier (t)	0.0147	0.0214
Kaplan Meier (z)	0.015	0.0212

Kaplan Meier % Bootstrap	0.0151	0.0212							
Kaplan Meier BCA Bootstrap	0.0151	0.0209							
Kaplan Meier Chebyshev	0.0126	0.0236							
Jnable to Winsorize Data!									

	Confidence Intervals/Limits (CLs) for Datasets Without Non-Detects	
Date/Time of Computation	8/14/2009 10:50:44 AM	
User Selected Options		
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\B Pond\Metals.wst	
Full Precision	OFF	
Number of Bootstrap Operations	2000	
Confidence Coefficient	0.8	
Barium		
Number of Valid Observations	11	
Number of Distinct Observations	11	
Raw Statistics		
Mean	0.0836	
Minimum	0.0332	
5% Percentile	0.0332	
10% Percentile	0.034	
1st Quartile	0.0506	
Median	0.0591	
3rd Quartile	0.107	
90% Percentile	0.157	
95% Percentile	0.162	
Maximum	0.164	
Standard Deviation	0.0463	
MAD / 0.6745	0.0271	
IQR / 1.35	0.0468	
Normal Statistics		
1% Percentile (z)	-0.024	
5% Percentile (z)	0.00749	
10% Percentile (z)	0.0243	
1st Quartile (z)	0.0524	
Median (z)	0.0836	
3rd Quartile (z)	0.115	
90% Percentile (z)	0.143	
95% Percentile (z)	0.16	
99% Percentile (z)	0.191	
Normal Confidence Intervals		
Normal	Lower Limit	Upper Limit
Student's t	0.0645	0.103
Gamma Statistics		
k hat	3.931	
Theta hat	0.0213	
nu hat	86.47	
k star	2.919	
Theta star	0.0286	
MLE of Mean	0.0836	
MLE of Standard Deviation	0.0489	
nu star	64.22	

80% Percentile of Chisquare (2k)	8.355

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0679	0.107
Adjusted Gamma	0.0661	0.11

Log-Transformed Statistics

Mean of Log-Transformed Data	-2.614
Standard Deviation of Log-Transformed Data	0.536
MVU Estimate of Median	0.0723
MVU Estimate of Mean	0.0833
MVU Estimate of SD	0.0458
MVU Estimate of Standard Error of Mean	0.0138

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.0683	0.111
Chebyshev (MVUE)	0.0525	0.114

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0657	0.102
Jackknife	0.0645	0.103
Standard Bootstrap	0.067	0.1
Bootstrap-t	0.0673	0.107
Percentile Bootstrap	0.0665	0.101
BCA Bootstrap	0.0681	0.103
Chebyshev	0.0524	0.115
Modified (t)	0.0651	0.103
Adjusted CLT	0.063	0.104

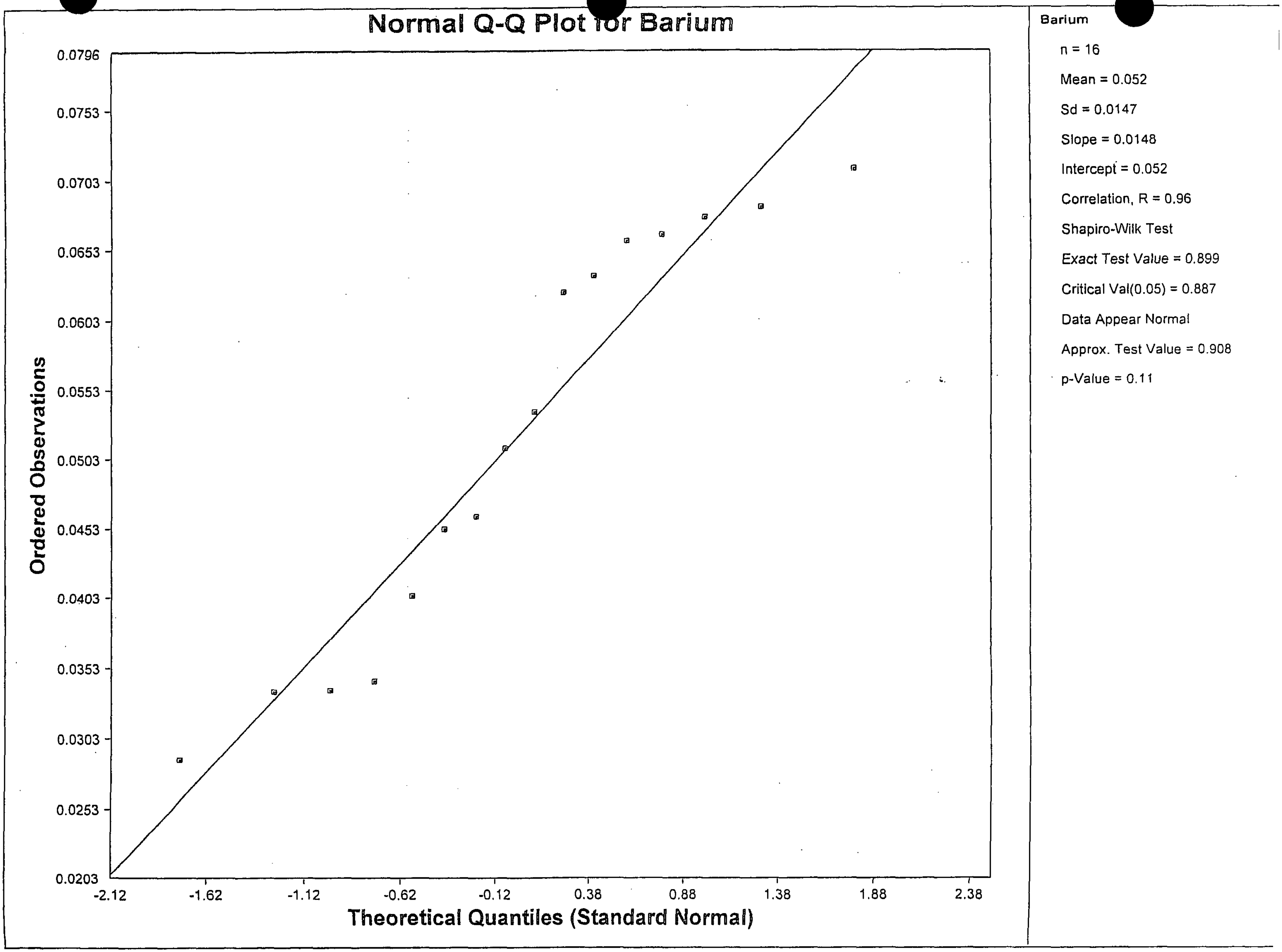
C POND

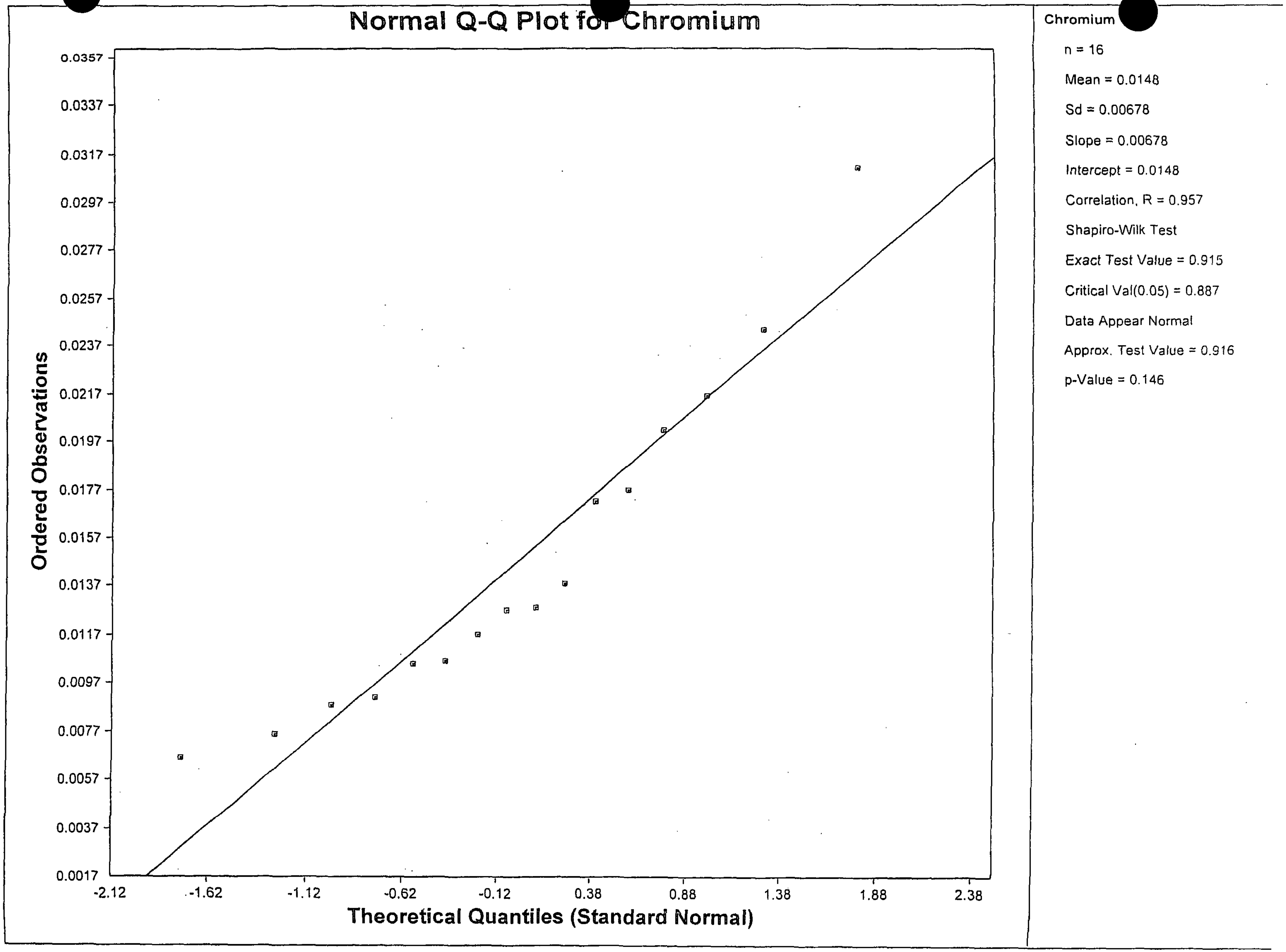
	Univariate Descriptive Statistics for Datasets with No NDs
Date/Time of Computation	8/14/2009 9:07:17 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\C Pond\Metals.wst
Full Precision	OFF

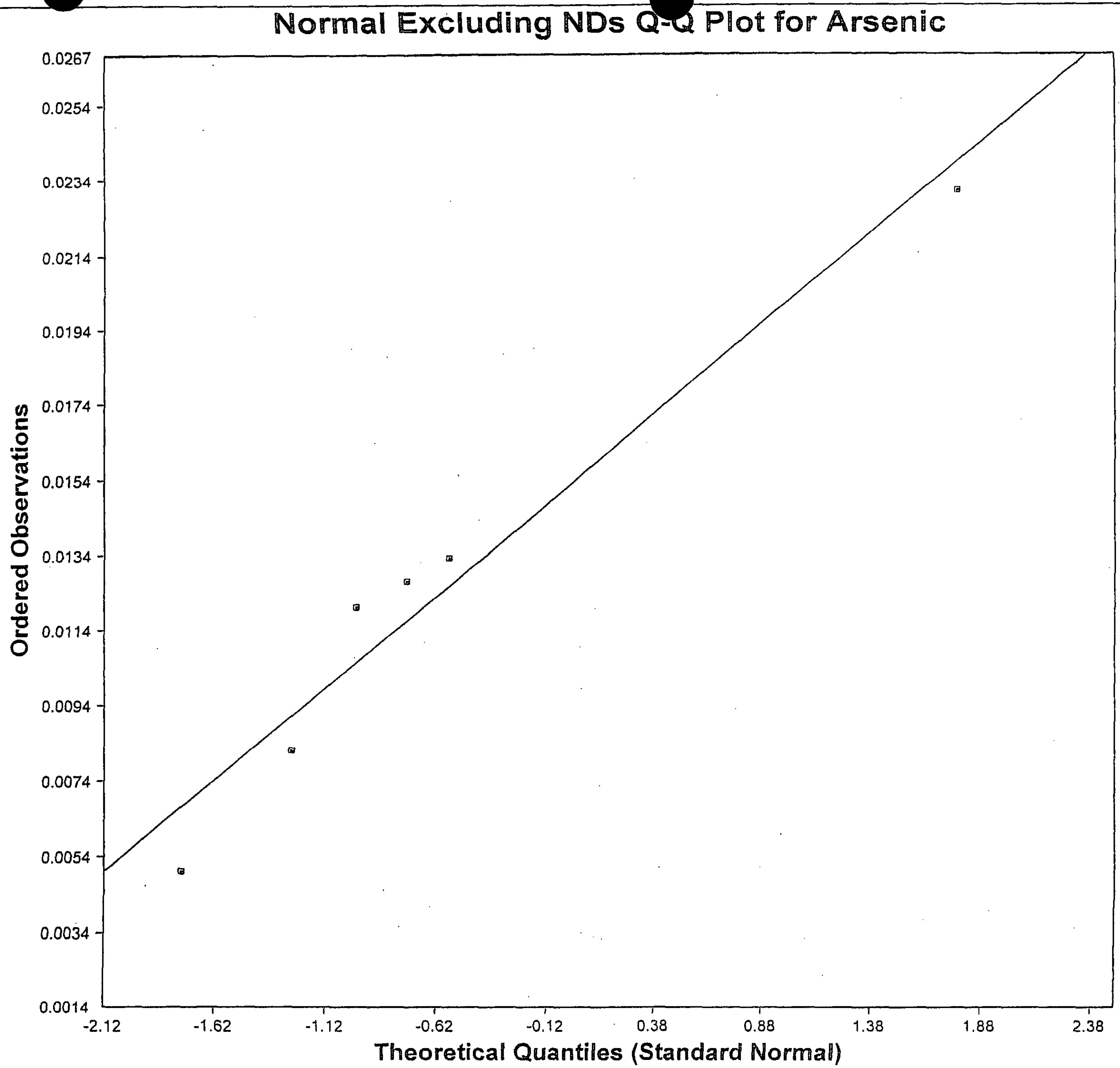
	Barium	Chromium						
Number of Observations	16	16						
Number of Missing Values	0	0						
Minimum Observed Value	0.0288	0.0066						
Maximum Observed Value	0.0711	0.0311						
Mean	0.052	0.0148						
10% Percentile	0.0317	0.0072						
15% Percentile	0.0336	0.00808						
(Q1) 25% Percentile	0.0344	0.0091						
(Q2) Median	0.0524	0.0128						
(Q3) 75% Percentile	0.066	0.0177						
90% Percentile	0.068	0.0227						
95% Percentile	0.0689	0.0257						
99% Percentile	0.0707	0.03						
Standard Deviation	0.0147	0.00678						
Variance	2.1736E-4	4.6009E-5						
Median of Absolute Deviation (MAD)	0.0138	0.0042						
MAD / 0.6745	0.0205	0.00623						
Mean of Abs. Deviation (AD) Median	0.0129	0.00508						
Mean of AD Median/0.6745	0.0191	0.00752						
IQR	0.0304	0.0101						
IQR / 1.35	0.0225	0.0075						
Skewness	-0.215	1.038						
Kurtosis	-1.577	0.666						
CV	0.283	0.459						

	Univariate Descriptive Statistics for Datasets with NDs
Date/Time of Computation	8/14/2009 9:07:56 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\C Pond\Metals.wst
Full Precision	OFF

	Arsenic								
Number of Observations	16								
Number of Missing Values	0								
Number of Detects	6								
Number of Non-Detects	10								
Percentage of Non-Detects	62.5%								
Minimum Observed Detected Value	0.005								
Maximum Observed Detected Value	0.0231								
Mean of Detected Values	0.0124								
Median of Detected Values	0.0124								
Standard Deviation of Detected Values	0.00613								
MAD of Detected Values	0.00255								
MAD / 0.6745 of Detected Values	0.00378								
Skewness of Detected Values	0.984								
Kurtosis of Detected Values	-0.174								
CV of Detected Values	0.495								
(Q1) 25% Percentile (All Obs)	0.0127								
(Q2) Median (All Obs)	0.0124								
(Q3) 75% Percentile (All Obs)	0.02								
90% Percentile (All Obs)	0.02								
95% Percentile (All Obs)	0.0206								
99% Percentile (All Obs)	0.0226								


Normal Q-Q Plot for Barium
Ordered Observations
0.0796
0.0753
0.0703
0.0653
0.0603
0.0553
0.0503
0.0453
0.0403
0.0353
0.0303
0.0253
0.0203
-2.12
-1.62
-1.12
-0.62
-0.12
0.38
0.88
1.38
1.88
2.38
Theoretical Quantiles (Standard Normal)
Barium
n = 16
Mean = 0.052
Sd = 0.0147
Slope = 0.0148
Intercept = 0.052
Correlation, R = 0.96
Shapiro-Wilk Test
Exact Test Value = 0.899
Critical Val(0.05) = 0.887
Data Appear Normal
Approx. Test Value = 0.908
p-Value = 0.11


Normal Q-Q Plot for Chromium
Ordered Observations
0.0357
0.0337
0.0317
0.0297
0.0277
0.0257
0.0237
0.0217
0.0197
0.0177
0.0157
0.0137
0.0117
0.0097
0.0077
0.0057
0.0037
0.0017
-2.12
-1.62
-1.12
-0.62
-0.12
0.38
0.88
1.38
1.88
2.38
Theoretical Quantiles (Standard Normal)
Chromium
n = 16
Mean = 0.0148
Sd = 0.00678
Slope = 0.00678
Intercept = 0.0148
Correlation, R = 0.957
Shapiro-Wilk Test
Exact Test Value = 0.915
Critical Val(0.05) = 0.887
Data Appear Normal
Approx. Test Value = 0.916
p-Value = 0.146



Arsenic

Total Number of Data = 16

Number treated as ND = 10

Max DL = 0.02

N = 6

Percent NDs = 63%

Mean = 0.0124

Sd = 0.00613

Slope = -0.00254

Intercept = 0.0124

Correlation, R = -0.379

Shapiro-Wilk Test

Exact Test Value = 0.750

Critical Val(0.05) = 0.887

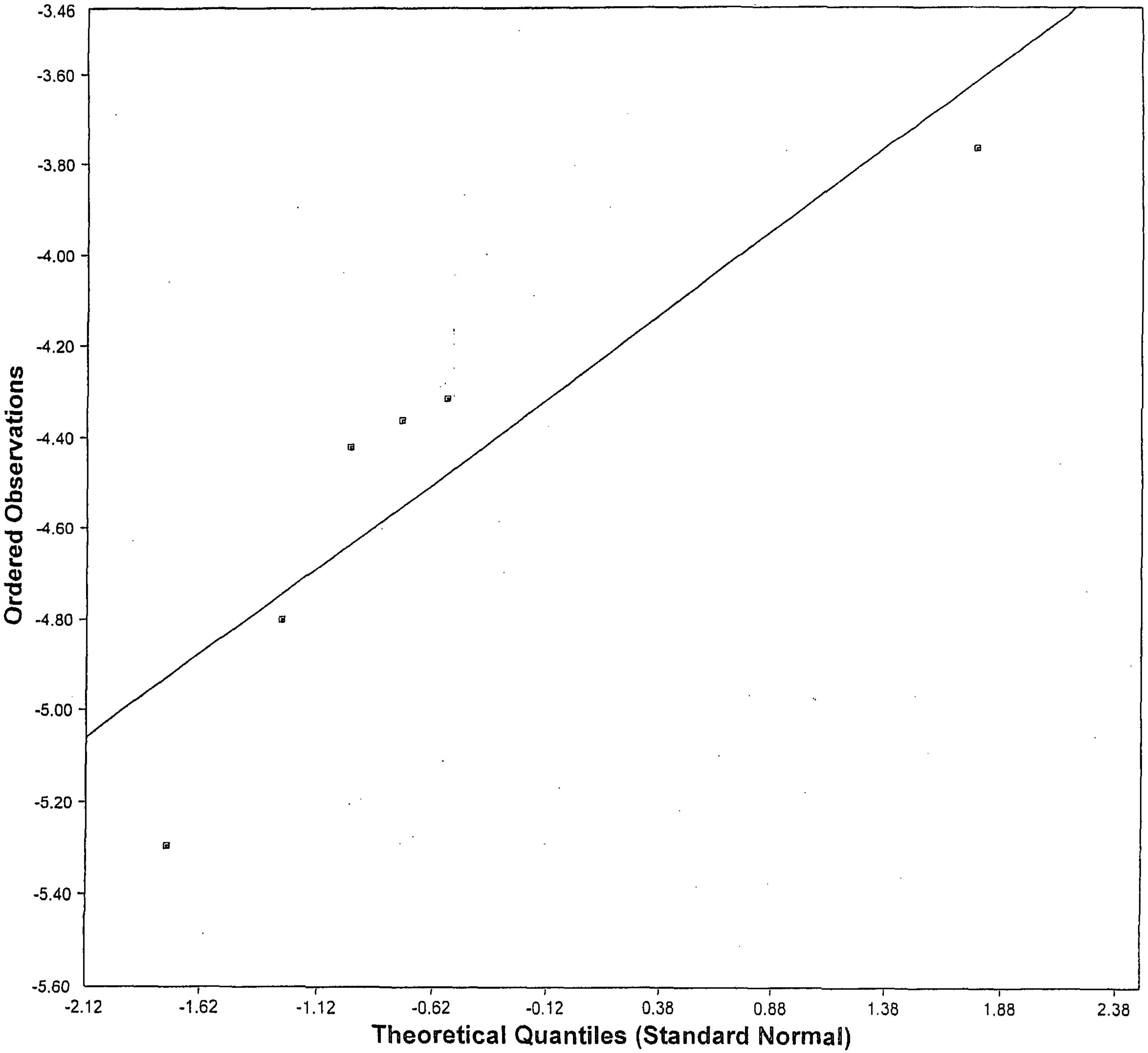
Data Not Normal

Approx. Test Value = 0.748

p-Value = 4.2729E-4

Distribution Test Suspect

Lognormal Excluding NDs Q-Q Plot for Arsenic



Arsenic

Total Number of Data = 16

Number treated as ND = 10

Max DL = 0.02

N = 6

Percent NDs = 63%

Mean = -4.496

Sd = 0.514

Slope = 0.545

Intercept = -4.496

Correlation, R = 0.97

Shapiro-Wilk Test

Exact Test Statistic = 0.693

Critical Value(0.05) = 0.887

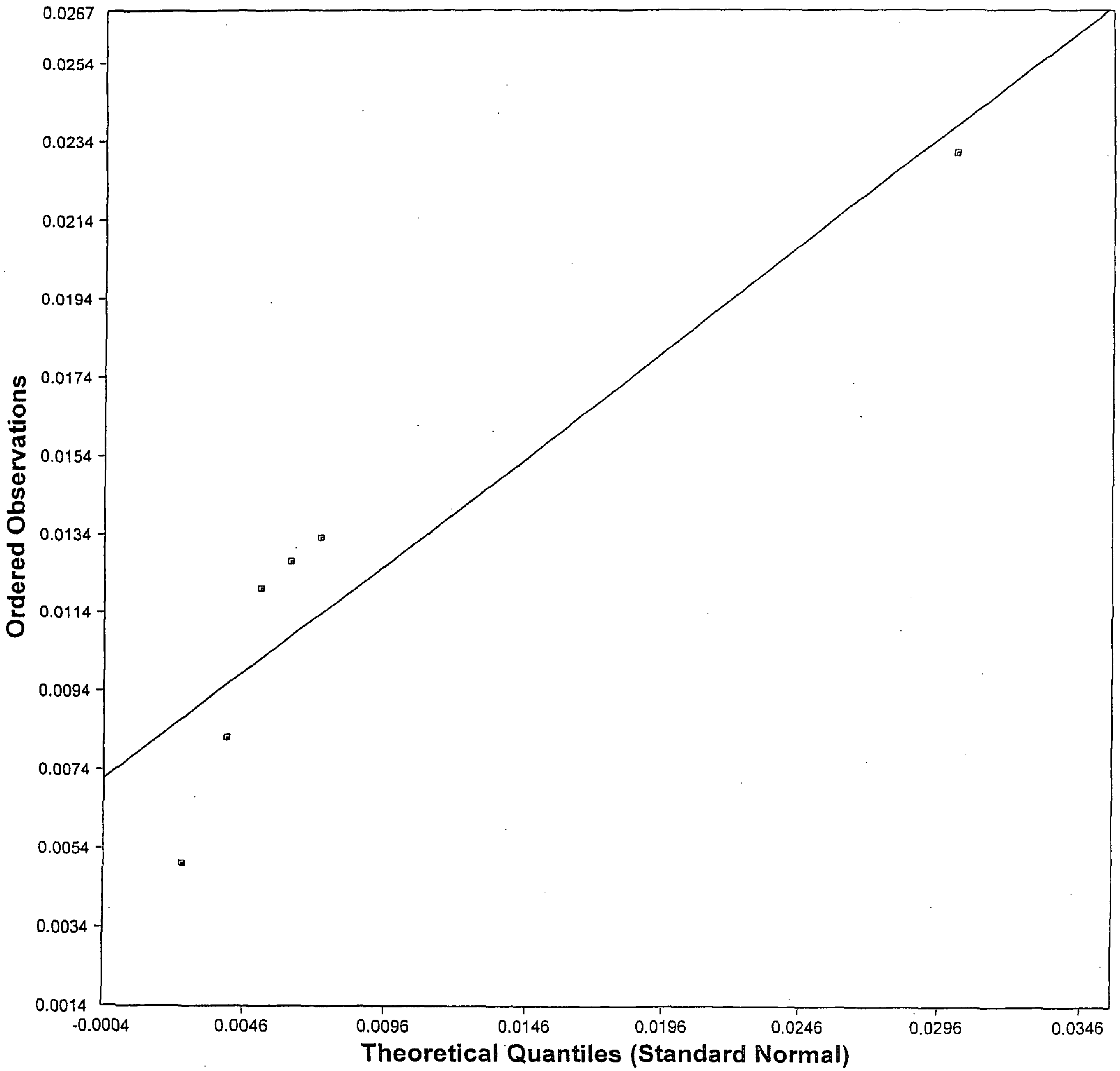
Data Not Lognormal

Approx. Test Value = 0.689

p-Value = 6.9955E-5

Distribution Test Suspect

Gamma Excluding NDs Q-Q Plot for Arsenic



Arsenic

Total Number of Data = 16

Number treated as ND = 10

Max DL = 0.0200000

n = 6

Percent NDs = 63%

Mean = 0.0124

SD = 0.00613

k star = 4.039

Slope = 0.816

Intercept = 0.00252

Correlation, R = 0.969

Anderson-Darling Test

Critical Value(0.05) = 0.698

Data Appear Gamma Distributed

Distribution Test Suspect

	Confidence Intervals/Limits (CLs) for Datasets Without Non-Detects
Date/Time of Computation	8/14/2009 9:11:12 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\C Pond\Metals.wst
Full Precision	OFF
Number of Bootstrap Operations	2000
Confidence Coefficient	0.8

Barium

Number of Valid Observations	16
Number of Distinct Observations	16

Raw Statistics

Mean	0.052
Minimum	0.0288
5% Percentile	0.0288
10% Percentile	0.0317
1st Quartile	0.0344
Median	0.0524
3rd Quartile	0.066
90% Percentile	0.068
95% Percentile	0.0689
Maximum	0.0711
Standard Deviation	0.0147
MAD / 0.6745	0.0205
IQR / 1.35	0.0225

Normal Statistics

1% Percentile (z)	0.0177
5% Percentile (z)	0.0278
10% Percentile (z)	0.0331
1st Quartile (z)	0.0421
Median (z)	0.052
3rd Quartile (z)	0.062
90% Percentile (z)	0.0709
95% Percentile (z)	0.0763
99% Percentile (z)	0.0863

Normal Confidence Intervals

Normal	Lower Limit	Upper Limit
Student's t	0.0471	0.057

Gamma Statistics

k hat	12.18
Theta hat	0.00427
nu hat	389.8
k star	9.939
Theta star	0.00524
MLE of Mean	0.052
MLE of Standard Deviation	0.0165
nu star	318

80% Percentile of Chisquare (2k)	24.9

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0472	0.0578
Adjusted Gamma	0.0468	0.0584

Log-Transformed Statistics

Mean of Log-Transformed Data	-2.998
Standard Deviation of Log-Transformed Data	0.306
MVU Estimate of Median	0.0498
MVU Estimate of Mean	0.0521
MVU Estimate of SD	0.0161
MVU Estimate of Standard Error of Mean	0.00403

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.0473	0.0584
Chebyshev (MVUE)	0.0431	0.0612

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0473	0.0568
Jackknife	0.0471	0.057
Standard Bootstrap	0.0475	0.0565
Bootstrap-t	0.047	0.0567
Percentile Bootstrap	0.0475	0.0567
BCA Bootstrap	0.0471	0.0565
Chebyshev	0.0438	0.0603
Modified (t)	0.0471	0.0569
Adjusted CLT	0.0474	0.0566

Chromium

Number of Valid Observations	16
Number of Distinct Observations	16

Raw Statistics

Mean	0.0148
Minimum	0.0066
5% Percentile	0.0066
10% Percentile	0.0072
1st Quartile	0.0091
Median	0.0128
3rd Quartile	0.0177
90% Percentile	0.0227
95% Percentile	0.0257
Maximum	0.0311
Standard Deviation	0.00678
MAD / 0.6745	0.00623
IQR / 1.35	0.0075

Normal Statistics

1% Percentile (z)	-0.001
5% Percentile (z)	0.00362
10% Percentile (z)	0.00608
1st Quartile (z)	0.0102
Median (z)	0.0148
3rd Quartile (z)	0.0194
90% Percentile (z)	0.0235
95% Percentile (z)	0.0259
99% Percentile (z)	0.0306

Normal Confidence Intervals

Normal	Lower Limit	Upper Limit
Student's t	0.0125	0.017

Gamma Statistics

k hat	5.594
Theta hat	0.00264
nu hat	179
k star	4.587
Theta star	0.00322
MLE of Mean	0.0148
MLE of Standard Deviation	0.0069
nu star	146.8
80% Percentile of Chisquare (2k)	12.45

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0128	0.0173
Adjusted Gamma	0.0127	0.0176

Log-Transformed Statistics

Mean of Log-Transformed Data	-4.307
Standard Deviation of Log-Transformed Data	0.439
MVU Estimate of Median	0.0134
MVU Estimate of Mean	0.0147
MVU Estimate of SD	0.00665
MVU Estimate of Standard Error of Mean	0.00166

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.0129	0.0176
Chebyshev (MVUE)	0.011	0.0185

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0126	0.0169
Jackknife	0.0125	0.017
Standard Bootstrap	0.0127	0.0169
Bootstrap-t	0.0127	0.0175
Percentile Bootstrap	0.0127	0.017
BCA Bootstrap	0.013	0.0174

Chebyshev	0.011	0.0186							
Modified (t)	0.0126	0.0171							
Adjusted CLT	0.0123	0.0173							

	Confidence Intervals Datasets with Non-Detects
Date/Time of Computation	8/14/2009 9:12:03 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\C Pond\Metals.wst
Full Precision	OFF
Number of Bootstrap Operations	2000
Confidence Coefficient	0.8

Arsenic

General Statistics	
Number of Valid Data	16
Number of Detected Data	6
Number of Distinct Detected Data	6
Minimum Detected	0.005
Maximum Detected	0.0231
Number of Non-Detect Data	10
Percent Non-Detects	62.50%
Minimum Non-detect	0.02
Maximum Non-detect	0.02
Raw Statistics	
Mean of Detected Data	0.0124
SD of Detected Data	0.00613

Warning: There are only 6 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Maximum Likelihood Estimates (MLEs)	
MLE Mean	N/A
MLE Stdv	N/A

Normal (MLE) Confidence Interval

	Lower Limit	Upper Limit
MLE (t)	N/A	N/A

Normal ROS Statistics	
Mean of Normal ROS Data	0.0111
Stdv of Normal ROS Data	0.00507

Normal ROS Confidence Intervals

	Lower Limit	Upper Limit
ROS Student's t	0.00944	0.0128

Gamma ROS Statistics	
k Star of Gamma ROS Data	9.933
Theta Star of Gamma ROS Data	0.00123
Nu Star of Gamma ROS Data	317.9

Gamma Intervals		
Gamma	Lower Limit	Upper Limit
ROS Approximate Gamma	0.0111	0.0136
ROS Adjusted Gamma	0.011	0.0137

Log-Transformed Statistics	
Mean of Log-Transformed Detected Data	-4.496
Stdv of Log-Transformed Detected Data	0.514
Mean of Lognormal ROS Data	0.0109
Stdv of Lognormal ROS Data	0.00467

Lognormal Confidence Intervals		
Lognormal	Lower Limit	Upper Limit
ROS Land's H	0.00959	0.0129
ROS % Bootstrap	0.00945	0.0124
ROS BCA Bootstrap	0.00963	0.0125

Kaplan Meier Distribution Free Statistics	
Kaplan Meier Mean	0.011
Kaplan Meier Stdv	0.00437
Kaplan Meier SEM	0.00169

Nonparametric Confidence Intervals		
Nonparametric	Lower Limit	Upper Limit
Kaplan Meier (t)	0.00878	0.0133
Kaplan Meier (z)	0.00888	0.0132
Kaplan Meier % Bootstrap	0.009	0.0132
Kaplan Meier BCA Bootstrap	0.00913	0.0133
Kaplan Meier Chebyshev	0.00727	0.0148

Unable to Winsorize Data!

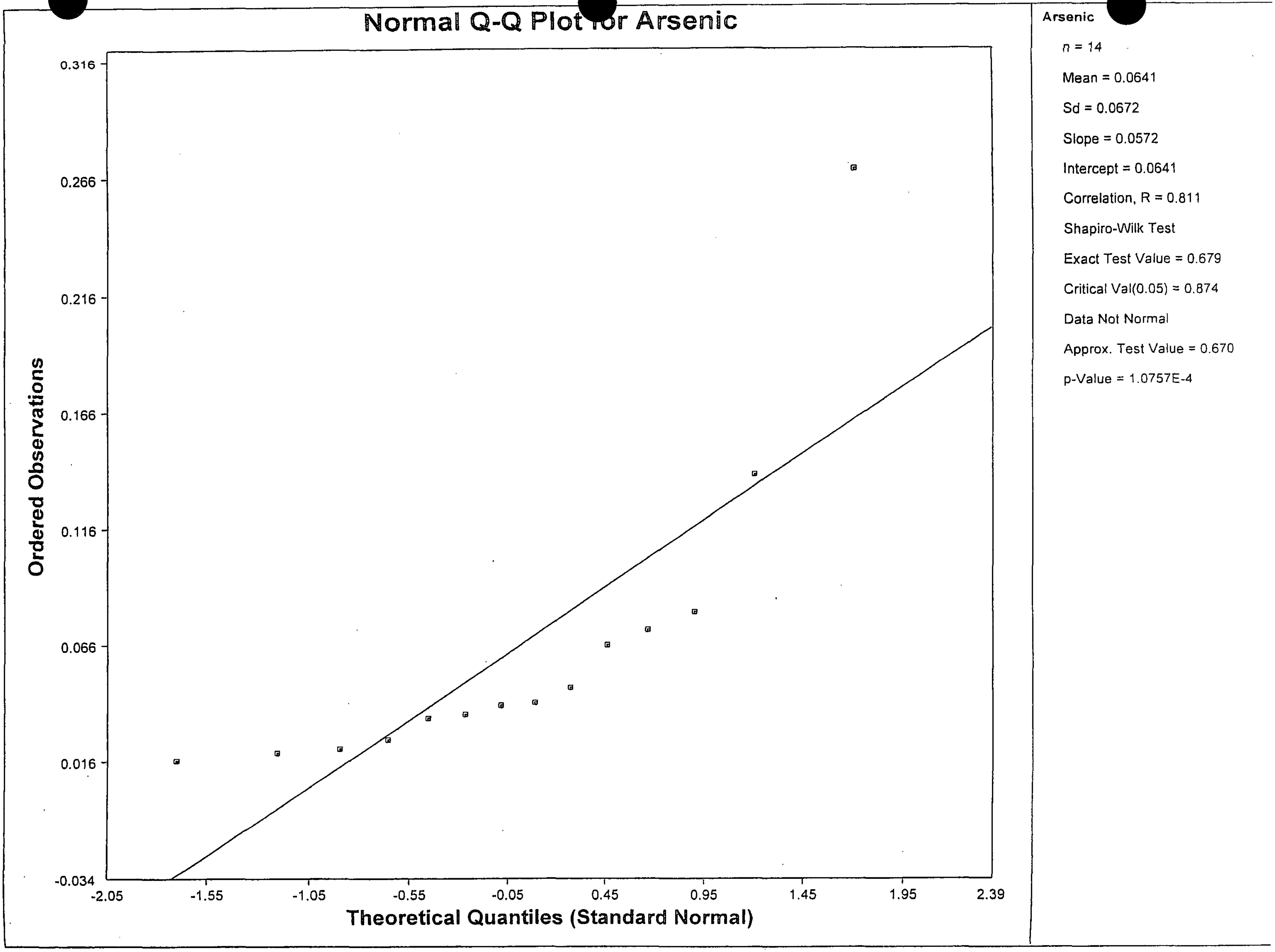
D POND

	Univariate Descriptive Statistics for Datasets with No NDs
Date/Time of Computation	8/14/2009 9:24:03 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\D Pond\Metals.wst
Full Precision	OFF

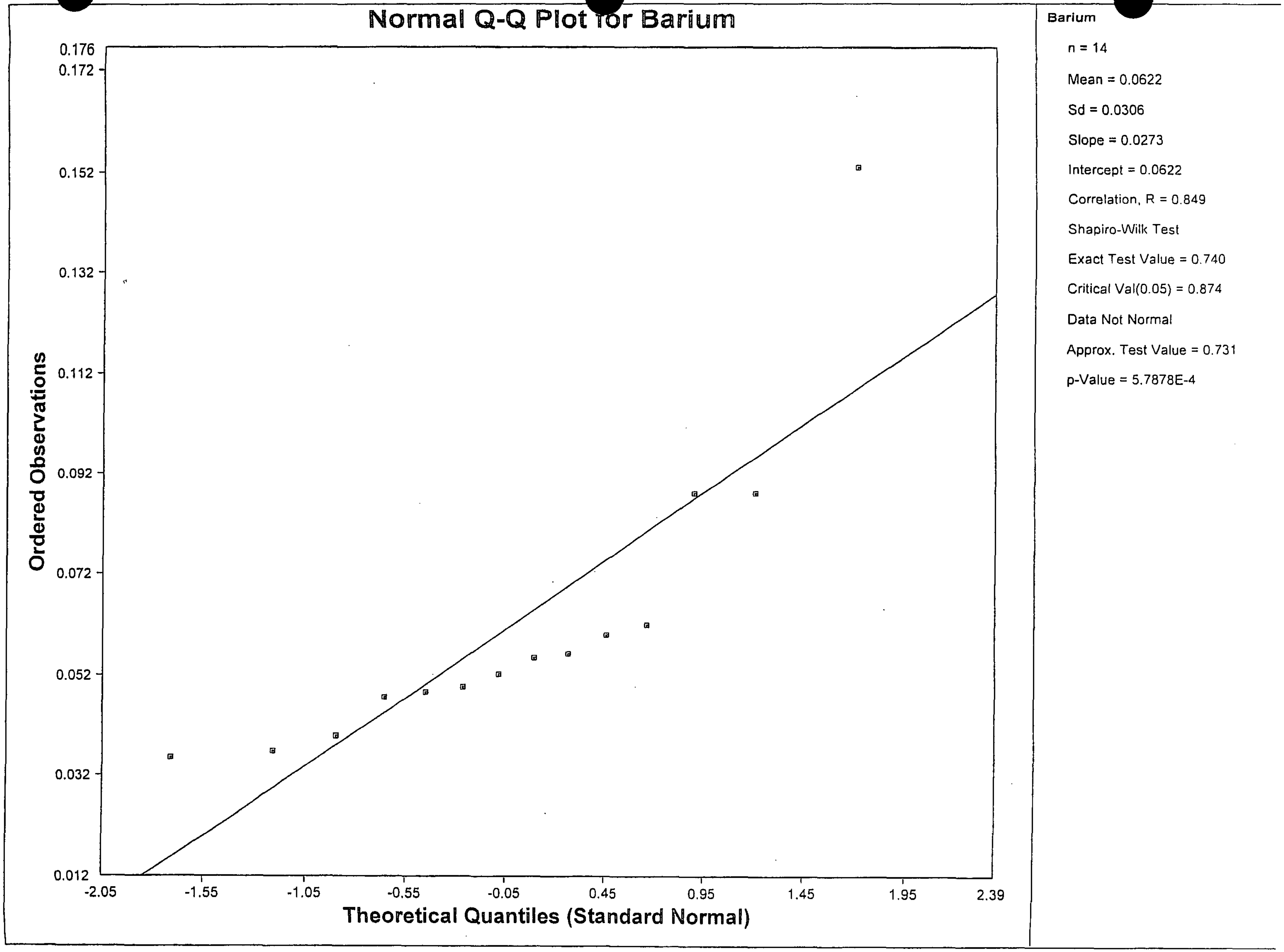
	Arsenic	Barium							
Number of Observations	14	14							
Number of Missing Values	0	0							
Minimum Observed Value	0.0161	0.0356							
Maximum Observed Value	0.269	0.153							
Mean	0.0641	0.0622							
10% Percentile	0.0173	0.0361							
15% Percentile	0.0192	0.0371							
(Q1) 25% Percentile	0.0229	0.0437							
(Q2) Median	0.0397	0.0537							
(Q3) 75% Percentile	0.0682	0.0607							
90% Percentile	0.114	0.0879							
95% Percentile	0.177	0.107							
99% Percentile	0.251	0.144							
Standard Deviation	0.0672	0.0306							
Variance	0.00452	9.3688E-4							
Median of Absolute Deviation (MAD)	0.0197	0.00705							
MAD / 0.6745	0.0291	0.0105							
Mean of Abs. Deviation (AD) Median	0.0371	0.018							
Mean of AD Median/0.6745	0.0551	0.0266							
IQR	0.0497	0.0226							
IQR / 1.35	0.0368	0.0167							
Skewness	2.534	2.271							
Kurtosis	7.007	5.926							
CV	1.048	0.492							

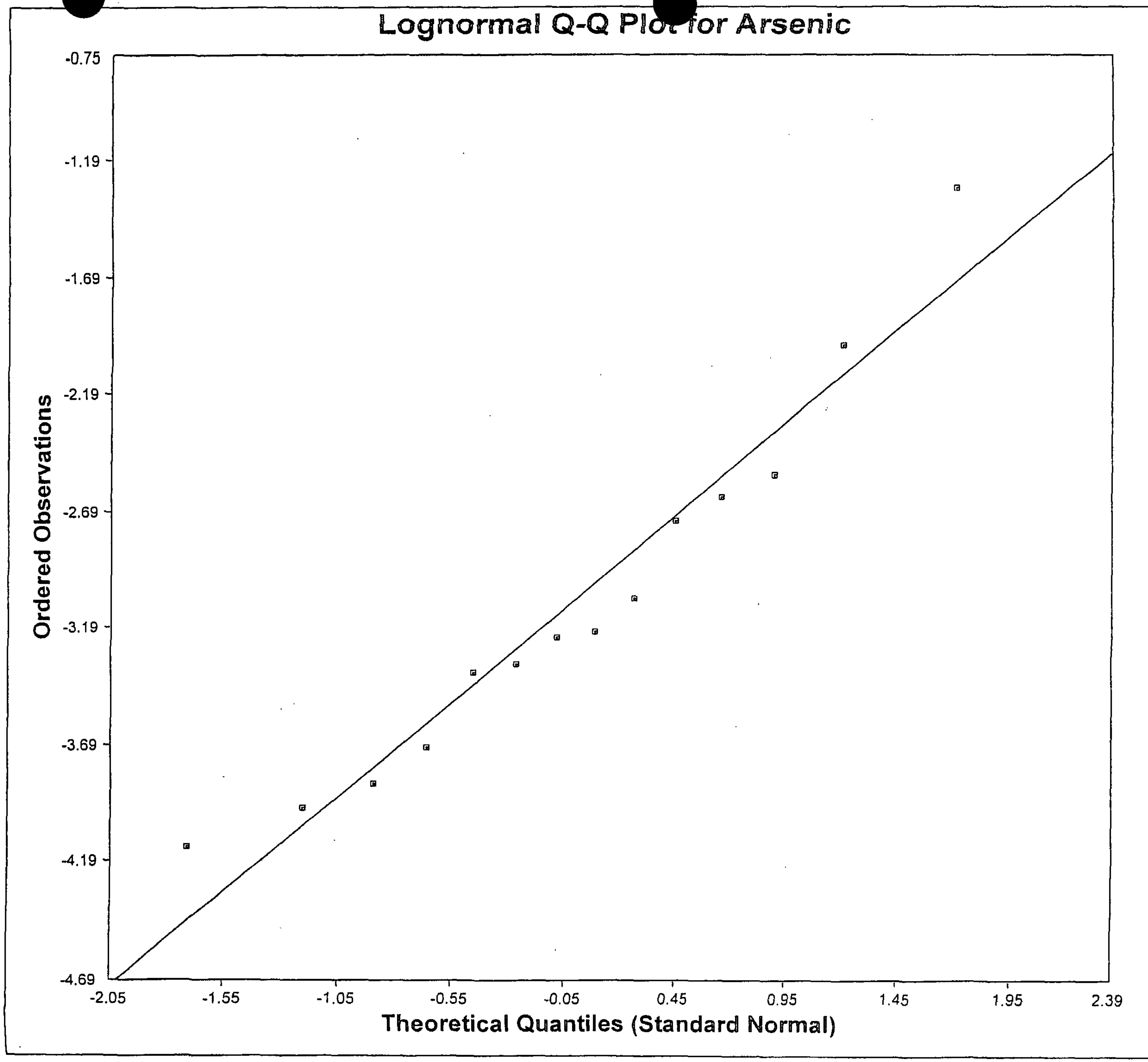
	Univariate Descriptive Statistics for Datasets with NDs
Date/Time of Computation	8/14/2009 9:24:38 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\D Pond\Metals.wst
Full Precision	OFF

	Chromium								
Number of Observations	14								
Number of Missing Values	0								
Number of Detects	9								
Number of Non-Detects	5								
Percentage of Non-Detects	35.71%								
Minimum Observed Detected Value	0.0064								
Maximum Observed Detected Value	0.724								
Mean of Detected Values	0.118								
Median of Detected Values	0.0092								
Standard Deviation of Detected Values	0.244								
MAD of Detected Values	0.0018								
MAD / 0.6745 of Detected Values	0.00267								
Skewness of Detected Values	2.399								
Kurtosis of Detected Values	0.87								
CV of Detected Values	2.073								
(Q1) 25% Percentile (All Obs)	0.0078								
(Q2) Median (All Obs)	0.0092								
(Q3) 75% Percentile (All Obs)	0.02								
90% Percentile (All Obs)	0.175								
95% Percentile (All Obs)	0.413								
99% Percentile (All Obs)	0.662								



Normal Q-Q Plot for Arsenic
Ordered Observations
0.316
0.266
0.216
0.166
0.116
0.066
0.016
-0.034
-2.05
-1.55
-1.05
-0.55
-0.05
0.45
0.95
1.45
1.95
2.39
Theoretical Quantiles (Standard Normal)
Arsenic
n = 14
Mean = 0.0641
Sd = 0.0672
Slope = 0.0572
Intercept = 0.0641
Correlation, R = 0.811
Shapiro-Wilk Test
Exact Test Value = 0.679
Critical Val(0.05) = 0.874
Data Not Normal
Approx. Test Value = 0.670
p-Value = 1.0757E-4


Normal Q-Q Plot for Barium
Ordered Observations
0.176
0.172
0.152
0.132
0.112
0.092
0.072
0.052
0.032
0.012
-2.05
-1.55
-1.05
-0.55
-0.05
0.45
0.95
1.45
1.95
2.39
Theoretical Quantiles (Standard Normal)
Barium
n = 14
Mean = 0.0622
Sd = 0.0306
Slope = 0.0273
Intercept = 0.0622
Correlation, R = 0.849
Shapiro-Wilk Test
Exact Test Value = 0.740
Critical Val(0.05) = 0.874
Data Not Normal
Approx. Test Value = 0.731
p-Value = 5.7878E-4



Arsenic

n = 14

Mean = -3.08

Sd = 0.786

Slope = 0.802

Intercept = -3.08

Correlation, R = 0.972

Shapiro-Wilk Test

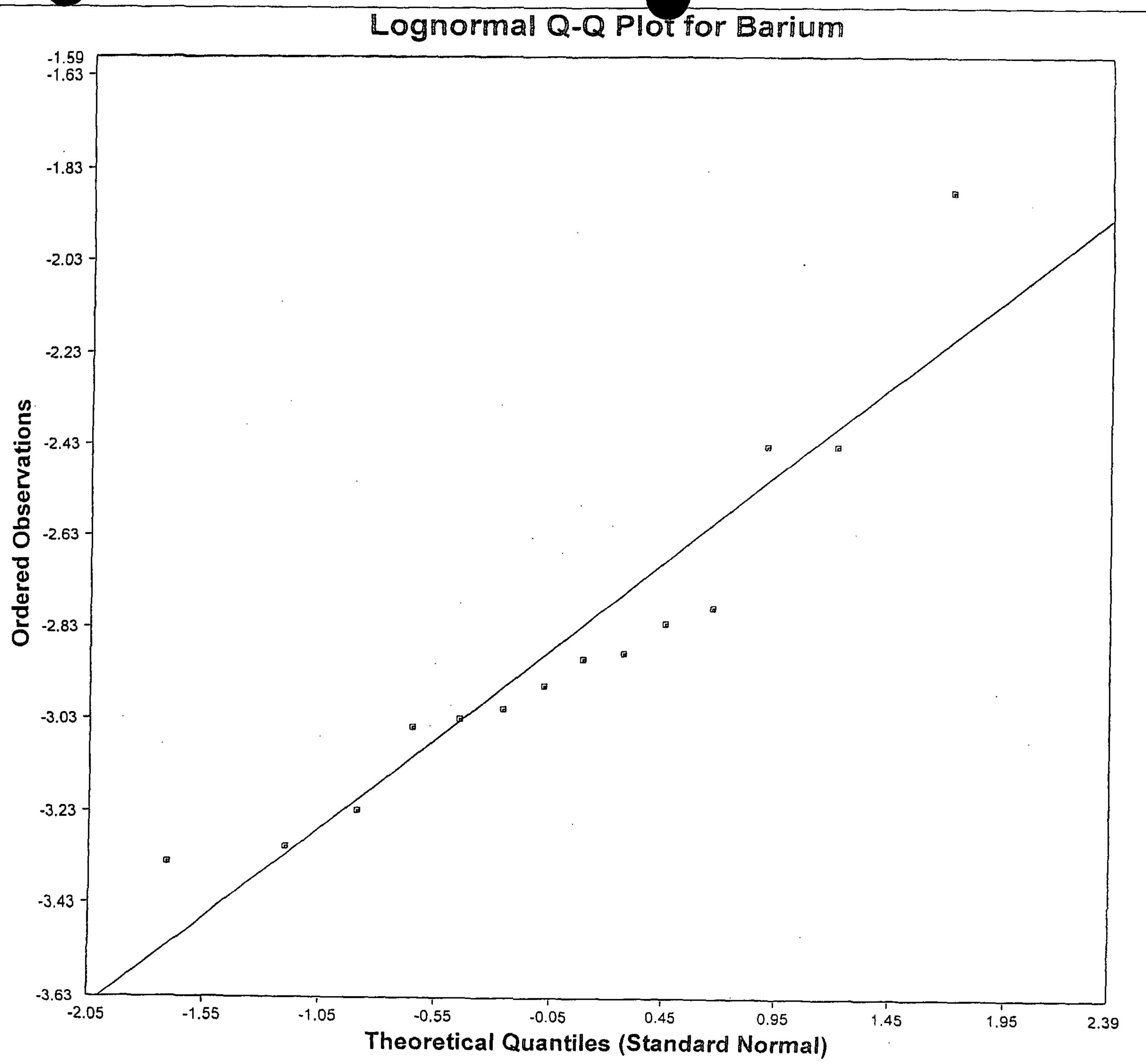
Exact Test Statistic = 0.946

Critical Value(0.05) = 0.874

Data Appear Lognormal

Approx. Test Value = 0.946

p-Value = 0.481



Barium

n = 14

Mean = -2.858

Sd = 0.391

Slope = 0.386

Intercept = -2.858

Correlation, R = 0.941

Shapiro-Wilk Test

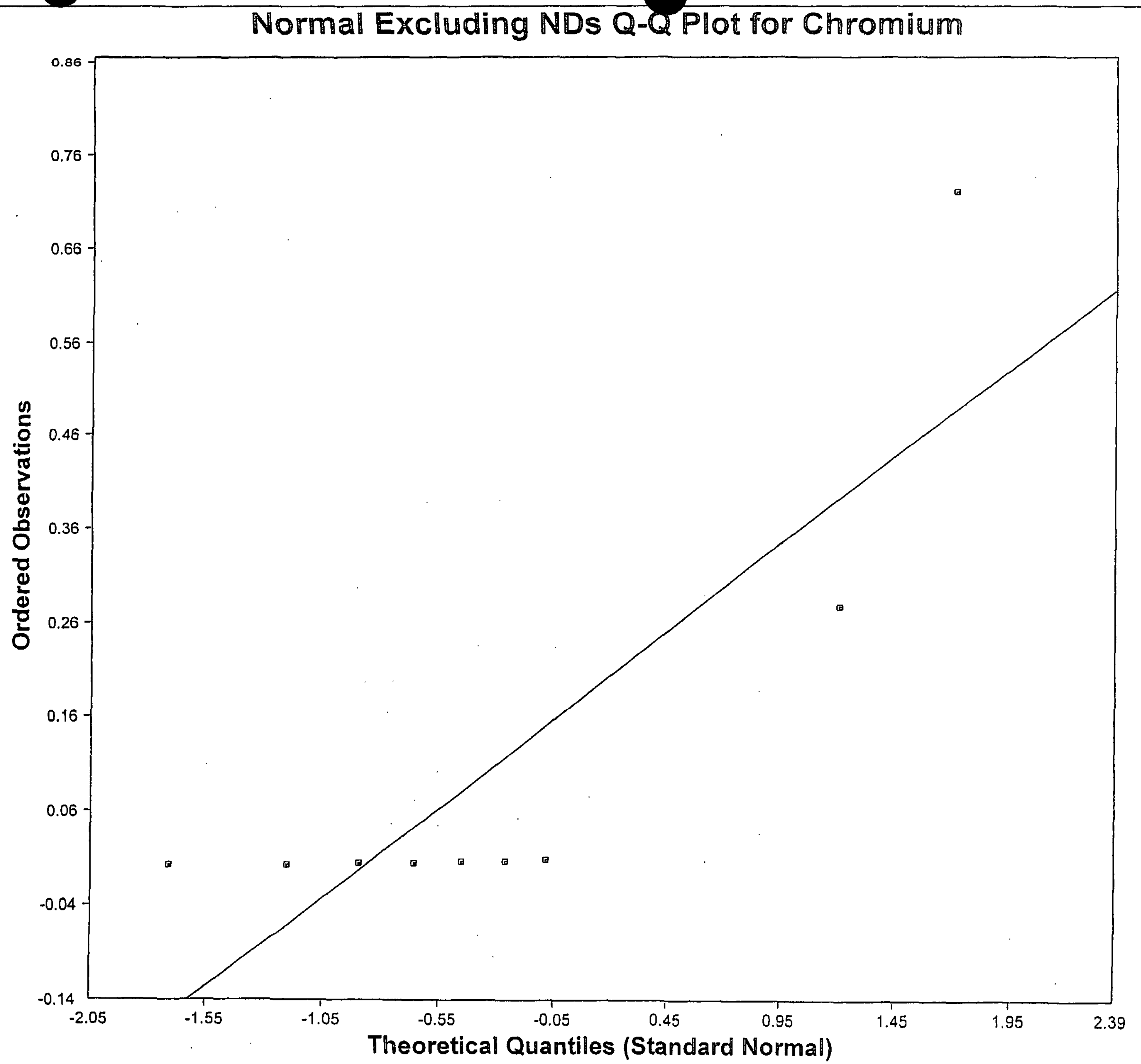
Exact Test Statistic = 0.893

Critical Value(0.05) = 0.874

Data Appear Lognormal

Approx. Test Value = 0.889

p-Value = 0.0792



Chromium

Total Number of Data = 14

Number treated as ND = 5

Max DL = 0.02

N = 9

Percent NDs = 36%

Mean = 0.118

Sd = 0.244

Slope = 0.0281

Intercept = 0.118

Correlation, R = 0.108

Shapiro-Wilk Test

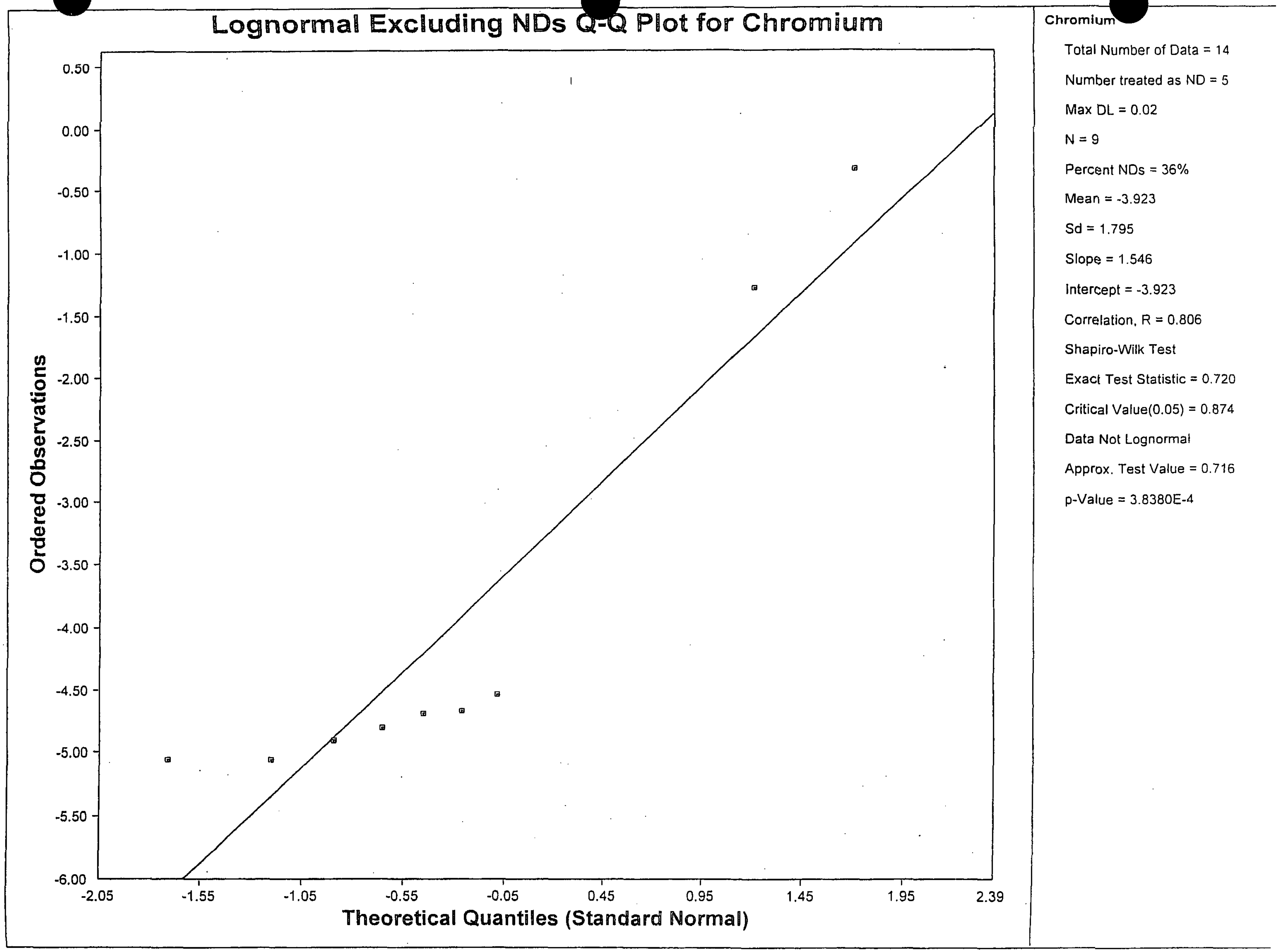
Exact Test Value = 0.444

Critical Val(0.05) = 0.874

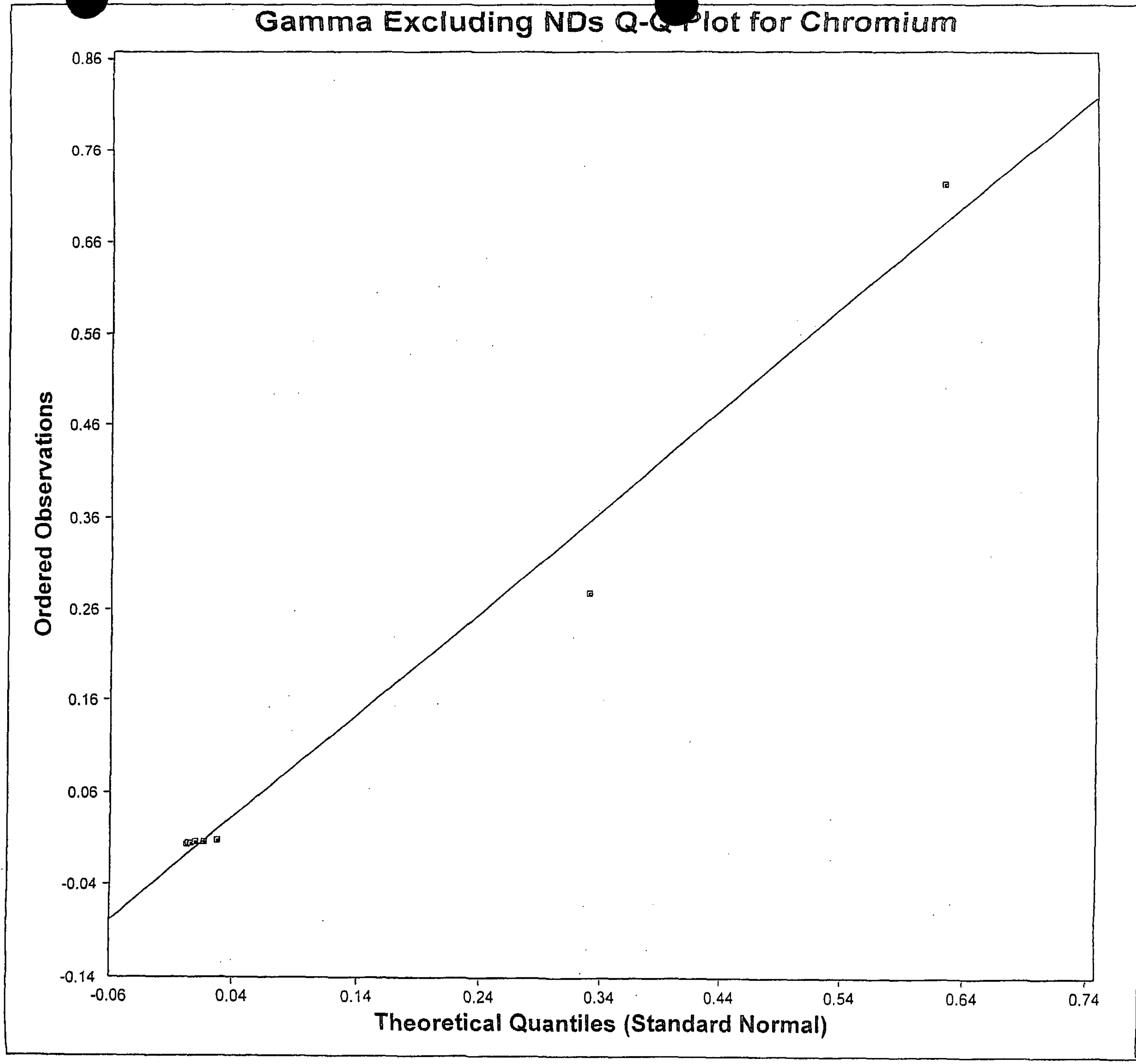
Data Not Normal

Approx. Test Value = 0.431

p-Value = 3.7667E-7



Lognormal Excluding NDs Q-Q Plot for Chromium
Ordered Observations
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-2.05
-1.55
-1.05
-0.55
-0.05
0.45
0.95
1.45
1.95
2.39
Theoretical Quantiles (Standard Normal)
Chromium
Total Number of Data = 14
Number treated as ND = 5
Max DL = 0.02
N = 9
Percent NDs = 36%
Mean = -3.923
Sd = 1.795
Slope = 1.546
Intercept = -3.923
Correlation, R = 0.806
Shapiro-Wilk Test
Exact Test Statistic = 0.720
Critical Value(0.05) = 0.874
Data Not Lognormal
Approx. Test Value = 0.716
p-Value = 3.8380E-4



Chromium

Total Number of Data = 14

Number treated as ND = 5

Max DL = 0.0200000

n = 9

Percent NDs = 36%

Mean = 0.118

SD = 0.244

k star = 0.341

Slope = 1.449

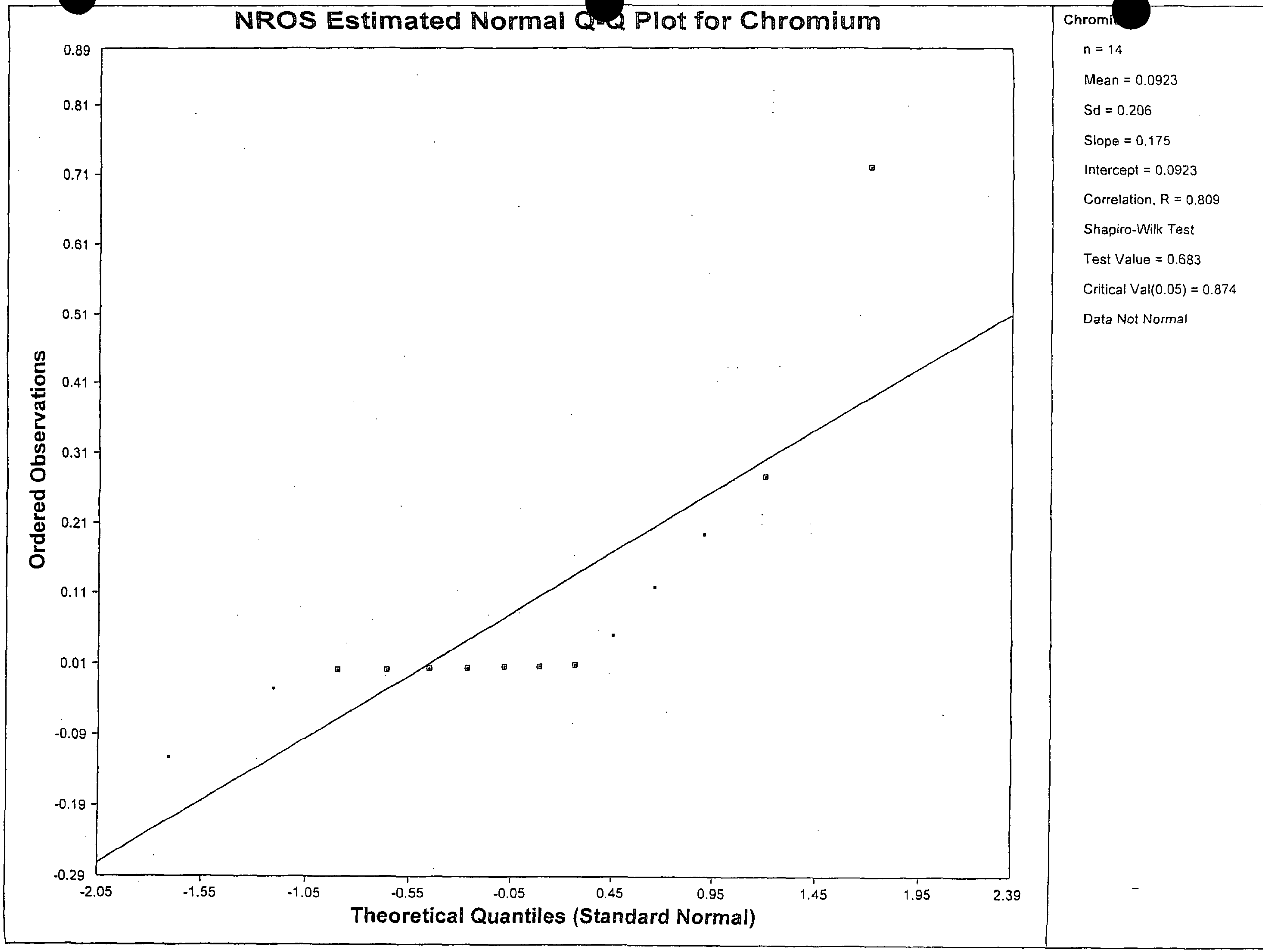
Intercept = -0.0361

Correlation, R = 0.974

Anderson-Darling Test

Critical Value(0.05) = 0.794

Data Not Gamma Distributed



NROS Estimated Normal Q-Q Plot for Chromium
Ordered Observations
Theoretical Quantiles (Standard Normal)
0.89
0.81
0.71
0.61
0.51
0.41
0.31
0.21
0.11
0.01
-0.09
-0.19
-0.29
-2.05
-1.55
-1.05
-0.55
-0.05
0.45
0.95
1.45
1.95
2.39
Chromi
n = 14
Mean = 0.0923
Sd = 0.206
Slope = 0.175
Intercept = 0.0923
Correlation, R = 0.809
Shapiro-Wilk Test
Test Value = 0.683
Critical Val(0.05) = 0.874
Data Not Normal

	Confidence Intervals/Limits (CLs) for Datasets Without Non-Detects
Date/Time of Computation	8/14/2009 9:29:02 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\D Pond\Metals.wst
Full Precision	OFF
ber of Bootstrap Operations	2000
Confidence Coefficient	0.8

Arsenic

Number of Valid Observations	14
Number of Distinct Observations	14

Raw Statistics

Mean	0.0641
Minimum	0.0161
5% Percentile	0.0161
10% Percentile	0.0173
1st Quartile	0.0229
Median	0.0397
3rd Quartile	0.0682
90% Percentile	0.114
95% Percentile	0.177
Maximum	0.269
Standard Deviation	0.0672
MAD / 0.6745	0.0291
IQR / 1.35	0.0368

Normal Statistics

1% Percentile (z)	-0.0922
5% Percentile (z)	-0.0464
10% Percentile (z)	-0.022
1st Quartile (z)	0.0188
Median (z)	0.0641
3rd Quartile (z)	0.109
90% Percentile (z)	0.15
95% Percentile (z)	0.175
99% Percentile (z)	0.22

Normal Confidence Intervals

Normal	Lower Limit	Upper Limit
Student's t	0.0399	0.0884

Gamma Statistics

k hat	1.647
Theta hat	0.0389
nu hat	46.12
k star	1.342
Theta star	0.0478
MLE of Mean	0.0641
MLE of Standard Deviation	0.0554
nu star	37.57

80% Percentile of Chisquare (2k)	4.202

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0492	0.0893
Adjusted Gamma	0.0478	0.0925

Log-Transformed Statistics

Mean of Log-Transformed Data	-3.08
Standard Deviation of Log-Transformed Data	0.786
MVU Estimate of Median	0.0449
MVU Estimate of Mean	0.0609
MVU Estimate of SD	0.0514
MVU Estimate of Standard Error of Mean	0.0136

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.0471	0.0923
Chebyshev (MVUE)	0.0306	0.0912

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0411	0.0872
Jackknife	0.0399	0.0884
Standard Bootstrap	0.0421	0.0862
Bootstrap-t	0.0454	0.122
Percentile Bootstrap	0.0424	0.0885
BCA Bootstrap	0.0472	0.0966
Chebyshev	0.024	0.104
Modified (t)	0.0419	0.0904
Adjusted CLT	0.0324	0.0958

Barium

Number of Valid Observations	14
Number of Distinct Observations	13

Raw Statistics

Mean	0.0622
Minimum	0.0356
5% Percentile	0.0356
10% Percentile	0.0361
1st Quartile	0.0437
Median	0.0537
3rd Quartile	0.0607
90% Percentile	0.0879
95% Percentile	0.107
Maximum	0.153
Standard Deviation	0.0306
MAD / 0.6745	0.0105
IQR / 1.35	0.0167

Normal Statistics	
1% Percentile (z)	-0.00898
5% Percentile (z)	0.0119
10% Percentile (z)	0.023
1st Quartile (z)	0.0416
Median (z)	0.0622
3rd Quartile (z)	0.0829
90% Percentile (z)	0.101
95% Percentile (z)	0.113
99% Percentile (z)	0.133

Normal Confidence Intervals

Normal	Lower Limit	Upper Limit
Student's t	0.0512	0.0733

Gamma Statistics	
k hat	6.296
Theta hat	0.00988
nu hat	176.3
k star	4.994
Theta star	0.0125
MLE of Mean	0.0622
MLE of Standard Deviation	0.0278
nu star	139.8
80% Percentile of Chisquare (2k)	13.43

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0538	0.0732
Adjusted Gamma	0.053	0.0745

Log-Transformed Statistics	
Mean of Log-Transformed Data	-2.858
Standard Deviation of Log-Transformed Data	0.391
MVU Estimate of Median	0.057
MVU Estimate of Mean	0.0616
MVU Estimate of SD	0.0245
MVU Estimate of Standard Error of Mean	0.00655

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.054	0.0726
Chebyshev (MVUE)	0.0469	0.0762

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0517	0.0727
Jackknife	0.0512	0.0733
Standard Bootstrap	0.0522	0.0722
Bootstrap-t	0.0535	0.0849
Percentile Bootstrap	0.0526	0.0724
BCA Bootstrap	0.0546	0.0764

Chebyshev	0.0439	0.0805							
Modified (t)	0.052	0.0741							
Adjusted CLT	0.0482	0.0763							

	Confidence Intervals Datasets with Non-Detects
Date/Time of Computation	8/14/2009 9:29:45 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\D Pond\Metals.wst
Full Precision	OFF
[illegible]ber of Bootstrap Operations	2000
Confidence Coefficient	0.8

Chromium

General Statistics

Number of Valid Data	14
Number of Detected Data	9
Number of Distinct Detected Data	8
Minimum Detected	0.0064
Maximum Detected	0.724
Number of Non-Detect Data	5
Percent Non-Detects	35.71%
Minimum Non-detect	0.02
Maximum Non-detect	0.02

Raw Statistics

Mean of Detected Data	0.118
SD of Detected Data	0.244

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Maximum Likelihood Estimates (MLEs)

MLE Mean	-0.86
MLE Stdv	0.84

Normal (MLE) Confidence Interval

	Lower Limit	Upper Limit
MLE (t)	-1.163	-0.557

Normal ROS Statistics

Mean of Normal ROS Data	0.0923
Stdv of Normal ROS Data	0.206

Normal ROS Confidence Intervals

	Lower Limit	Upper Limit
ROS Student's t	0.0179	0.167

Gamma ROS Statistics

k Star of Gamma ROS Data	0.273
Theta Star of Gamma ROS Data	0.421
Nu Star of Gamma ROS Data	7.65

Gamma Intervals		
Gamma	Lower Limit	Upper Limit
ROS Approximate Gamma	0.0683	0.27
ROS Adjusted Gamma	0.0644	0.296
Log-Transformed Statistics		
Mean of Log-Transformed Detected Data		-3.923
Stdv of Log-Transformed Detected Data		1.795
Mean of Lognormal ROS Data		0.0814
Stdv of Lognormal ROS Data		0.198
Lognormal Confidence Intervals		
Lognormal	Lower Limit	Upper Limit
ROS Land's H	0.0274	0.167
ROS % Bootstrap	0.0137	0.151
ROS BCA Bootstrap	0.0306	0.201
Kaplan Meier Distribution Free Statistics		
Kaplan Meier Mean		0.0787
Kaplan Meier Stdv		0.192
Kaplan Meier SEM		0.0544
Nonparametric Confidence Intervals		
Nonparametric	Lower Limit	Upper Limit
Kaplan Meier (t)	0.00522	0.152
Kaplan Meier (z)	0.00895	0.148
Kaplan Meier % Bootstrap	0.00878	0.149
Kaplan Meier BCA Bootstrap	0.00853	0.136
Kaplan Meier Chebyshev	-0.043	0.2
Unable to Winsorize Data!		

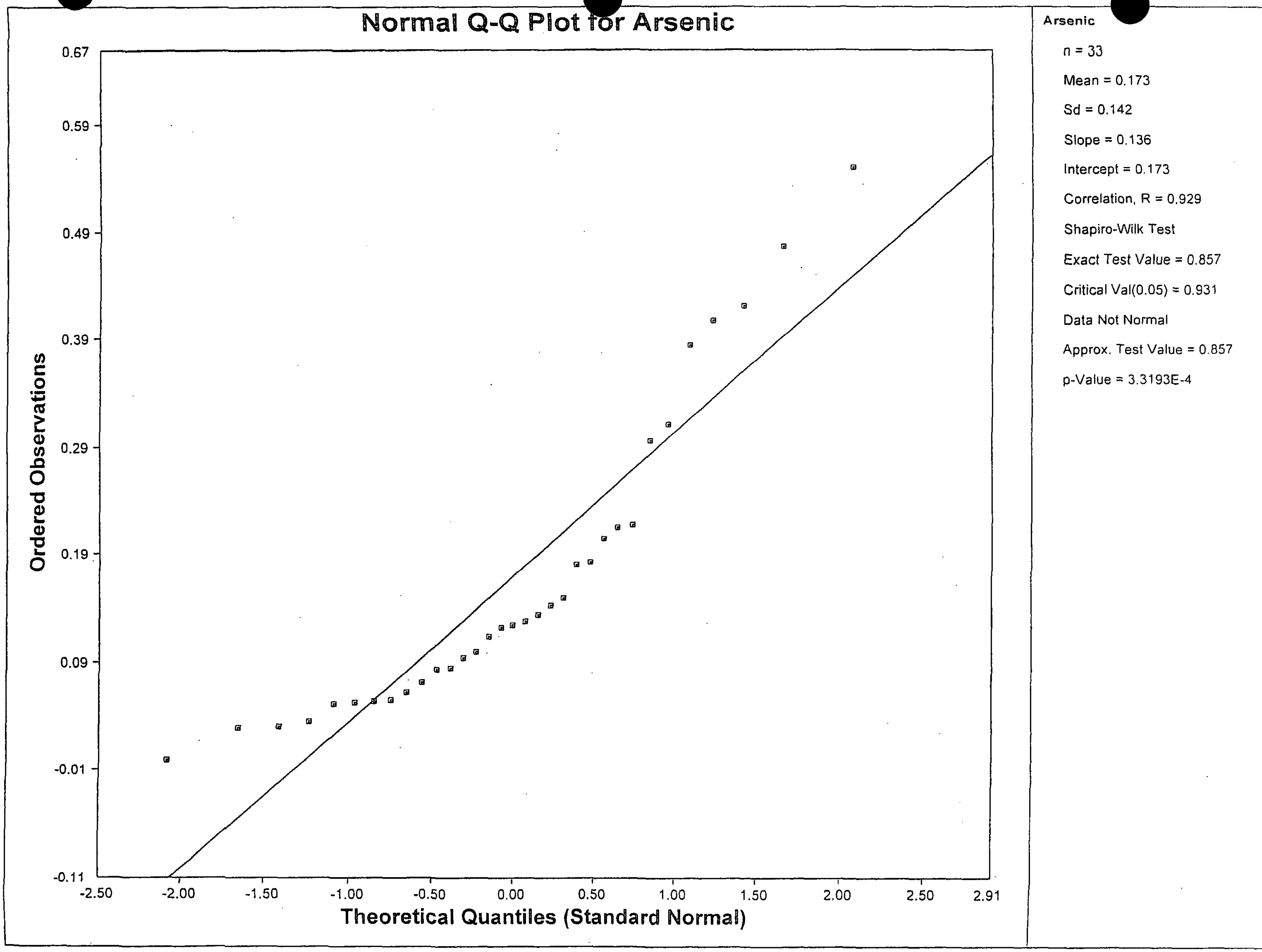
E POND

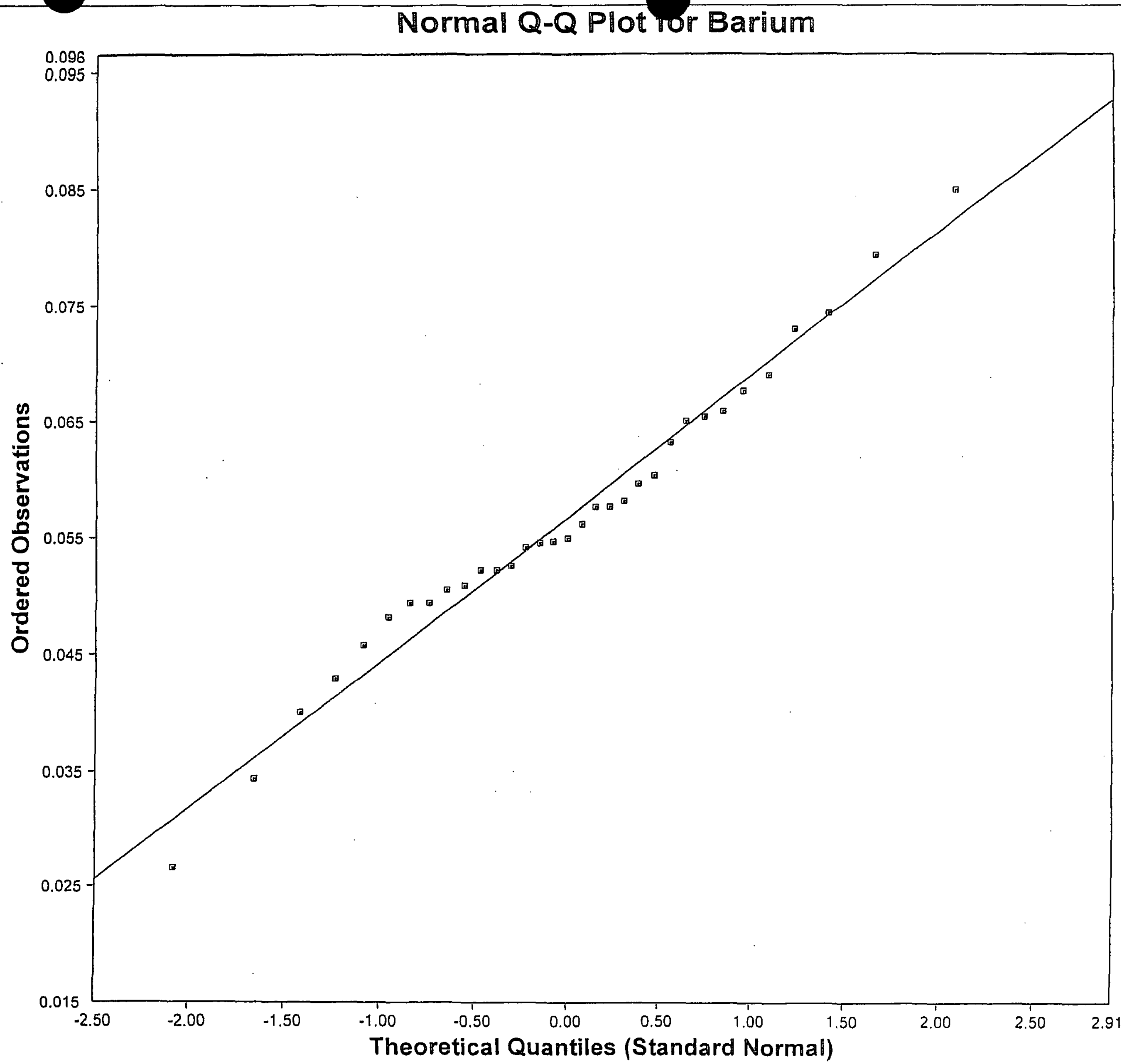
	Univariate Descriptive Statistics for Datasets with No NDs
Date/Time of Computation	8/14/2009 9:36:03 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\E Pond\Metals.wst
Full Precision	OFF

	Arsenic	Barium
Number of Observations	33	33
Number of Missing Values	0	0
Minimum Observed Value	0.0045	0.0263
Maximum Observed Value	0.555	0.0846
Mean	0.173	0.0563
10% Percentile	0.0362	0.0405
15% Percentile	0.0548	0.0453
(Q1) 25% Percentile	0.0611	0.0492
(Q2) Median	0.128	0.0545
(Q3) 75% Percentile	0.217	0.0642
90% Percentile	0.406	0.0714
95% Percentile	0.446	0.0758
99% Percentile	0.531	0.0828
Standard Deviation	0.142	0.0122
Variance	0.0202	1.4977E-4
Median of Absolute Deviation (MAD)	0.0694	0.0056
MAD / 0.6745	0.103	0.0083
Mean of Abs. Deviation (AD) Median	0.102	0.00908
Mean of AD Median/0.6745	0.151	0.0135
IQR	0.158	0.0154
IQR / 1.35	0.117	0.0114
Skewness	1.241	0.022
Kurtosis	0.72	0.628
CV	0.823	0.217

	Univariate Descriptive Statistics for Datasets with NDs
Date/Time of Computation	8/14/2009 9:36:36 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\E Pond\Metals.wst
Full Precision	OFF

	Chromium								
Number of Observations	33								
Number of Missing Values	0								
Number of Detects	20								
Number of Non-Detects	13								
Percentage of Non-Detects	39.39%								
Minimum Observed Detected Value	0.0064								
Maximum Observed Detected Value	0.0303								
Mean of Detected Values	0.0122								
Median of Detected Values	0.0104								
Standard Deviation of Detected Values	0.0057								
MAD of Detected Values	0.0021								
MAD / 0.6745 of Detected Values	0.00311								
Skewness of Detected Values	1.874								
Kurtosis of Detected Values	2.443								
CV of Detected Values	0.466								
(Q1) 25% Percentile (All Obs)	0.00943								
(Q2) Median (All Obs)	0.0104								
(Q3) 75% Percentile (All Obs)	0.02								
90% Percentile (All Obs)	0.02								
95% Percentile (All Obs)	0.02								
99% Percentile (All Obs)	0.0269								


Normal Q-Q Plot for Arsenic
0.67
0.59
0.49
0.39
0.29
0.19
0.09
-0.01
-0.11
Ordered Observations
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
2.91
Theoretical Quantiles (Standard Normal)
Arsenic
n = 33
Mean = 0.173
Sd = 0.142
Slope = 0.136
Intercept = 0.173
Correlation, R = 0.929
Shapiro-Wilk Test
Exact Test Value = 0.857
Critical Val(0.05) = 0.931
Data Not Normal
Approx. Test Value = 0.857
p-Value = 3.3193E-4



Barium

n = 33

Mean = 0.0563

Sd = 0.0122

Slope = 0.0124

Intercept = 0.0563

Correlation, R = 0.989

Shapiro-Wilk Test

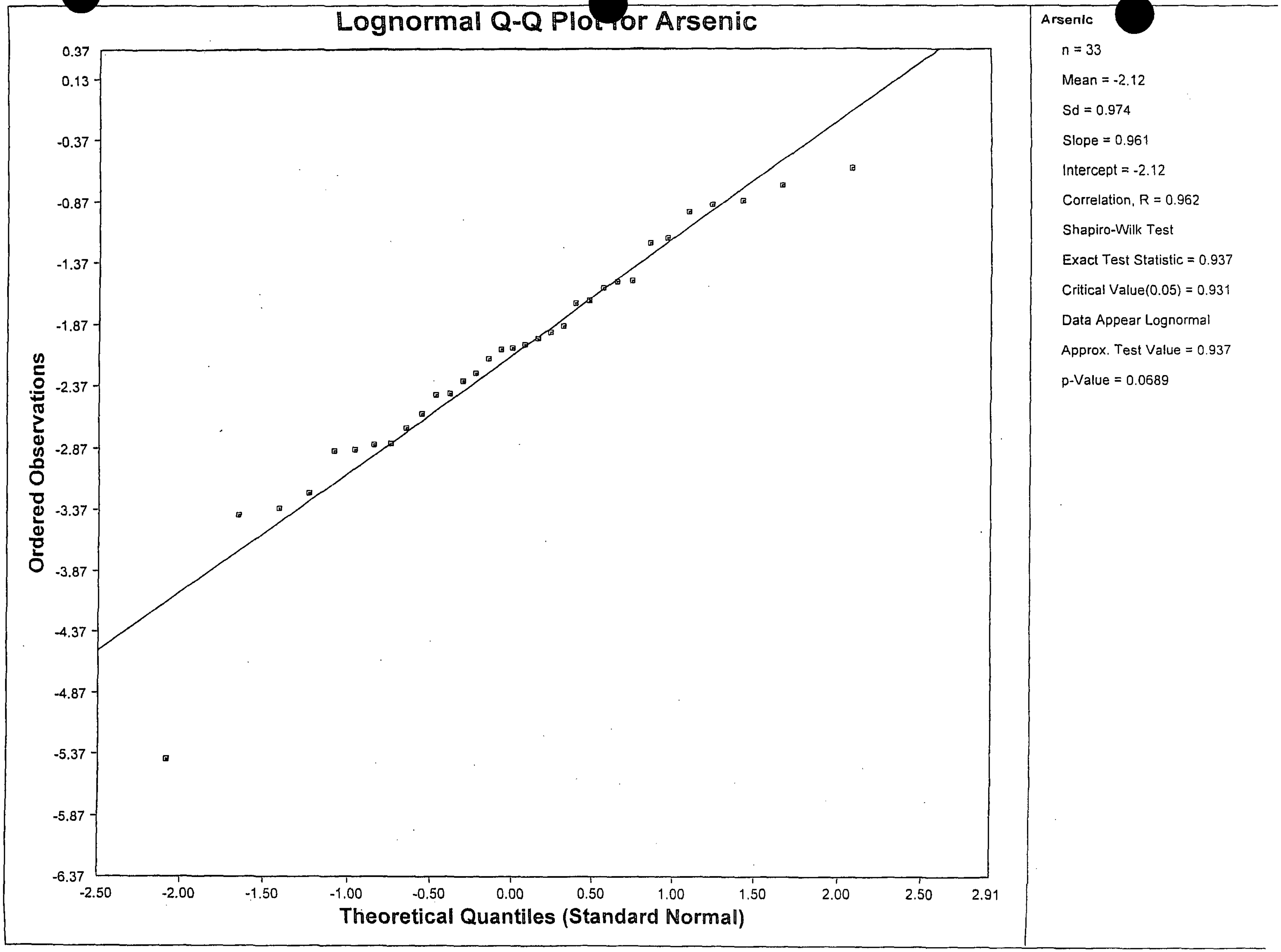
Exact Test Value = 0.985

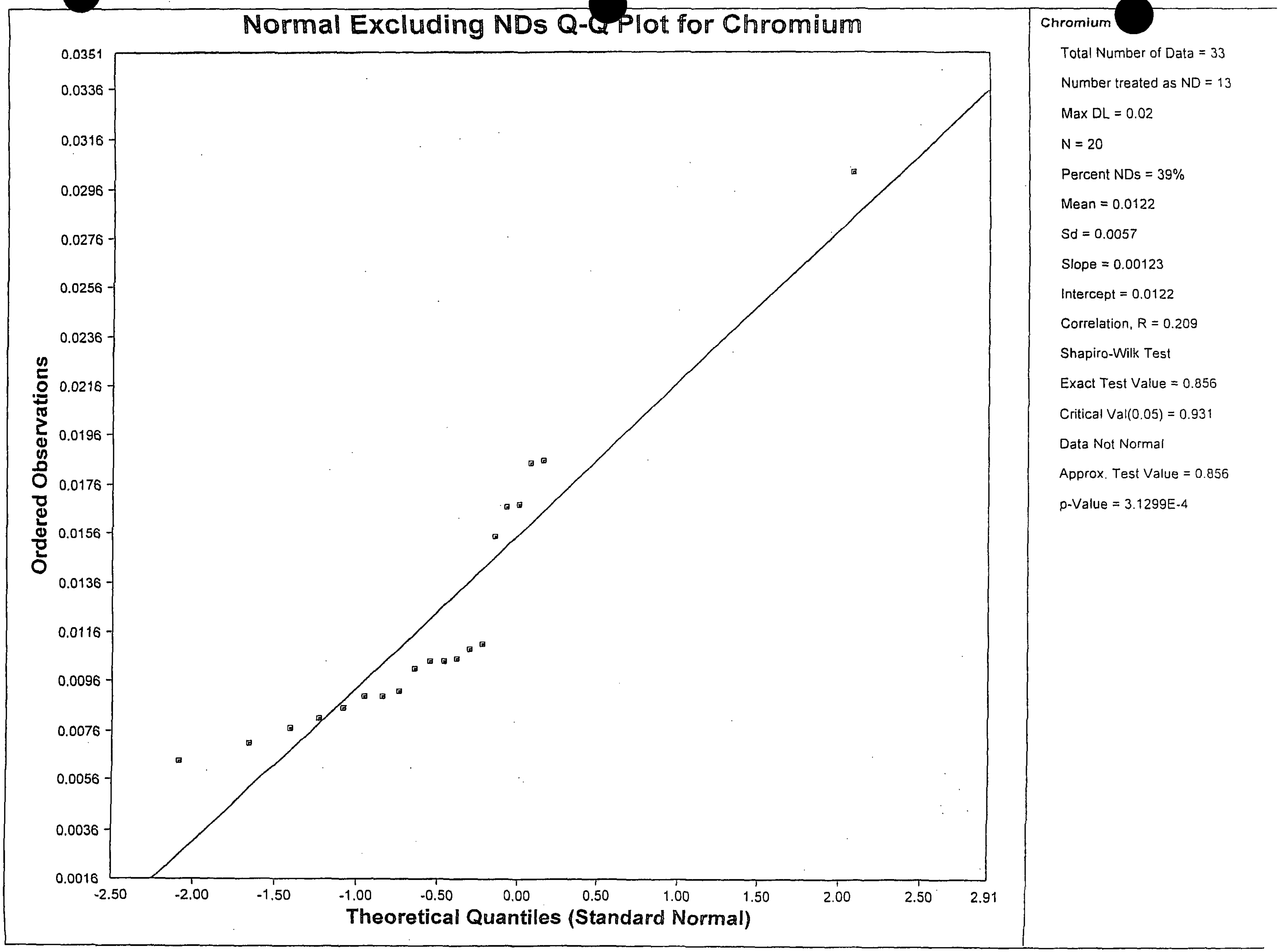
Critical Val(0.05) = 0.931

Data Appear Normal

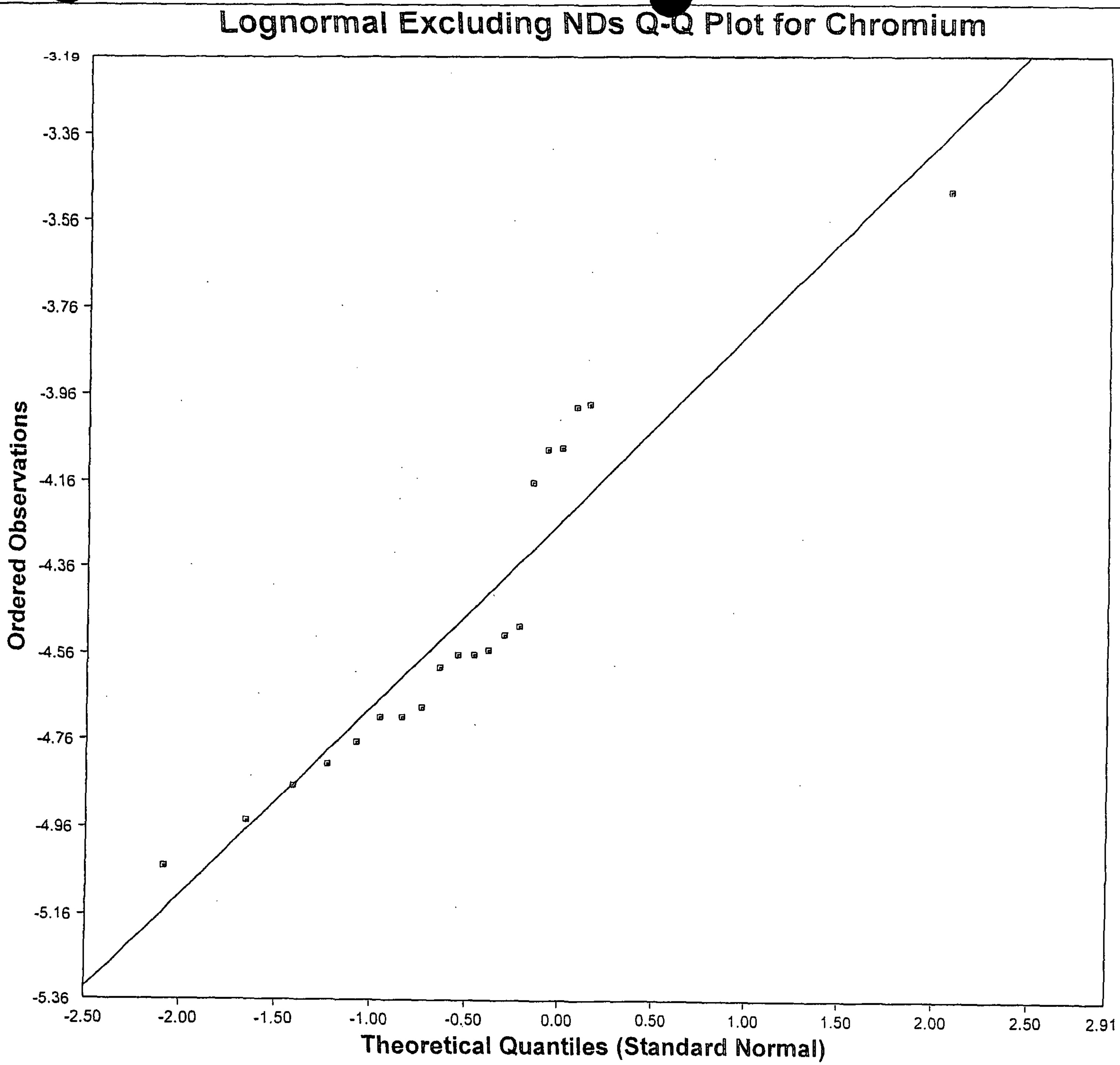
Approx. Test Value = 0.985

p-Value = 0.936


Lognormal Q-Q Plot for Arsenic
Ordered Observations
Theoretical Quantiles (Standard Normal)
0.37
0.13
-0.37
-0.87
-1.37
-1.87
-2.37
-2.87
-3.37
-3.87
-4.37
-4.87
-5.37
-5.87
-6.37
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
2.91
Arsenic
n = 33
Mean = -2.12
Sd = 0.974
Slope = 0.961
Intercept = -2.12
Correlation, R = 0.962
Shapiro-Wilk Test
Exact Test Statistic = 0.937
Critical Value(0.05) = 0.931
Data Appear Lognormal
Approx. Test Value = 0.937
p-Value = 0.0689



Normal Excluding NDs Q-Q Plot for Chromium
Ordered Observations
Theoretical Quantiles (Standard Normal)
0.0351
0.0336
0.0316
0.0296
0.0276
0.0256
0.0236
0.0216
0.0196
0.0176
0.0156
0.0136
0.0116
0.0096
0.0076
0.0056
0.0036
0.0016
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
2.91
Chromium
Total Number of Data = 33
Number treated as ND = 13
Max DL = 0.02
N = 20
Percent NDs = 39%
Mean = 0.0122
Sd = 0.0057
Slope = 0.00123
Intercept = 0.0122
Correlation, R = 0.209
Shapiro-Wilk Test
Exact Test Value = 0.856
Critical Val(0.05) = 0.931
Data Not Normal
Approx. Test Value = 0.856
p-Value = 3.1299E-4



Chromium

Total Number of Data = 33

Number treated as ND = 13

Max DL = 0.02

N = 20

Percent NDs = 39%

Mean = -4.484

Sd = 0.393

Slope = 0.391

Intercept = -4.484

Correlation, R = 0.959

Shapiro-Wilk Test

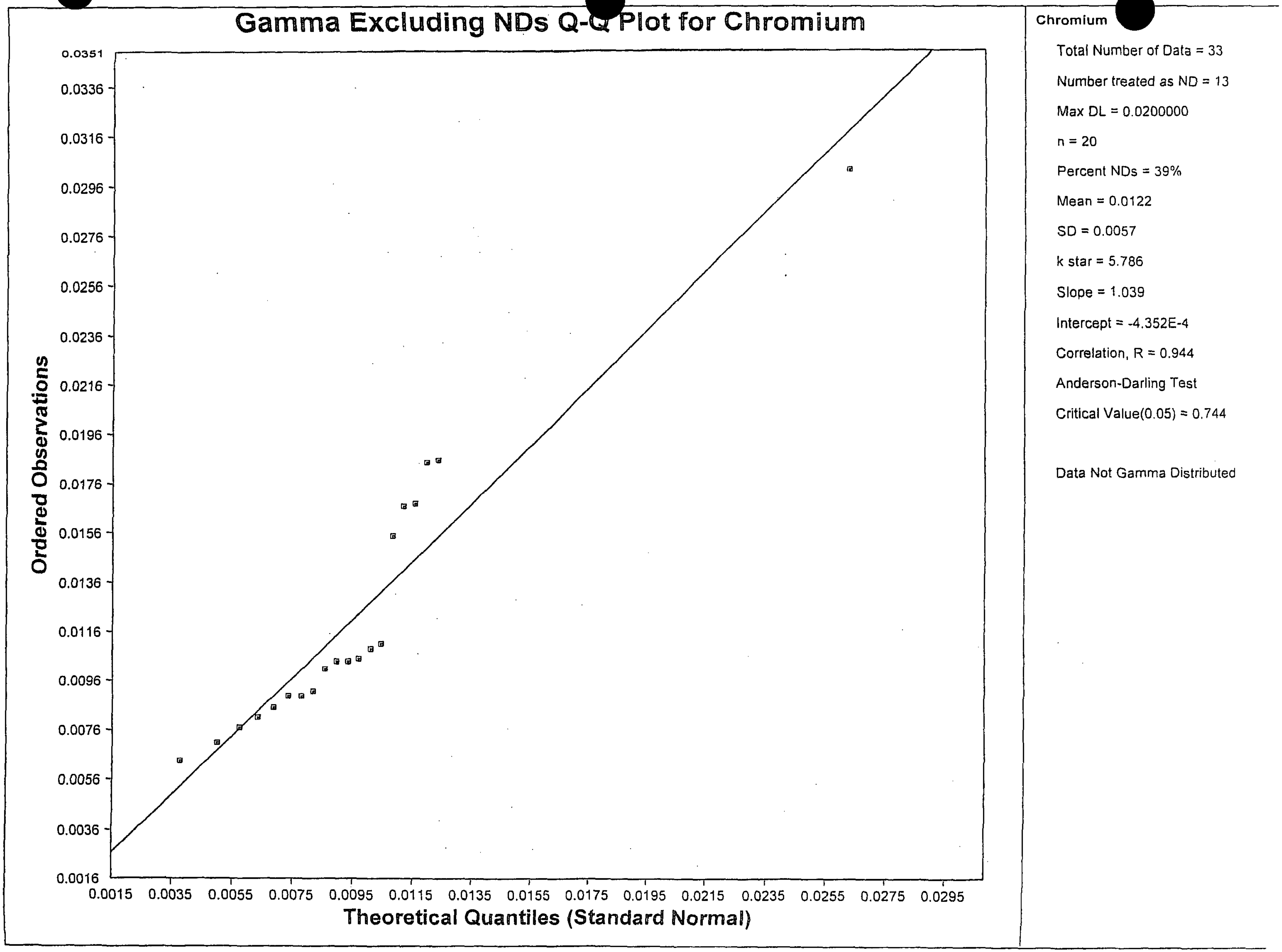
Exact Test Statistic = 0.861

Critical Value(0.05) = 0.931

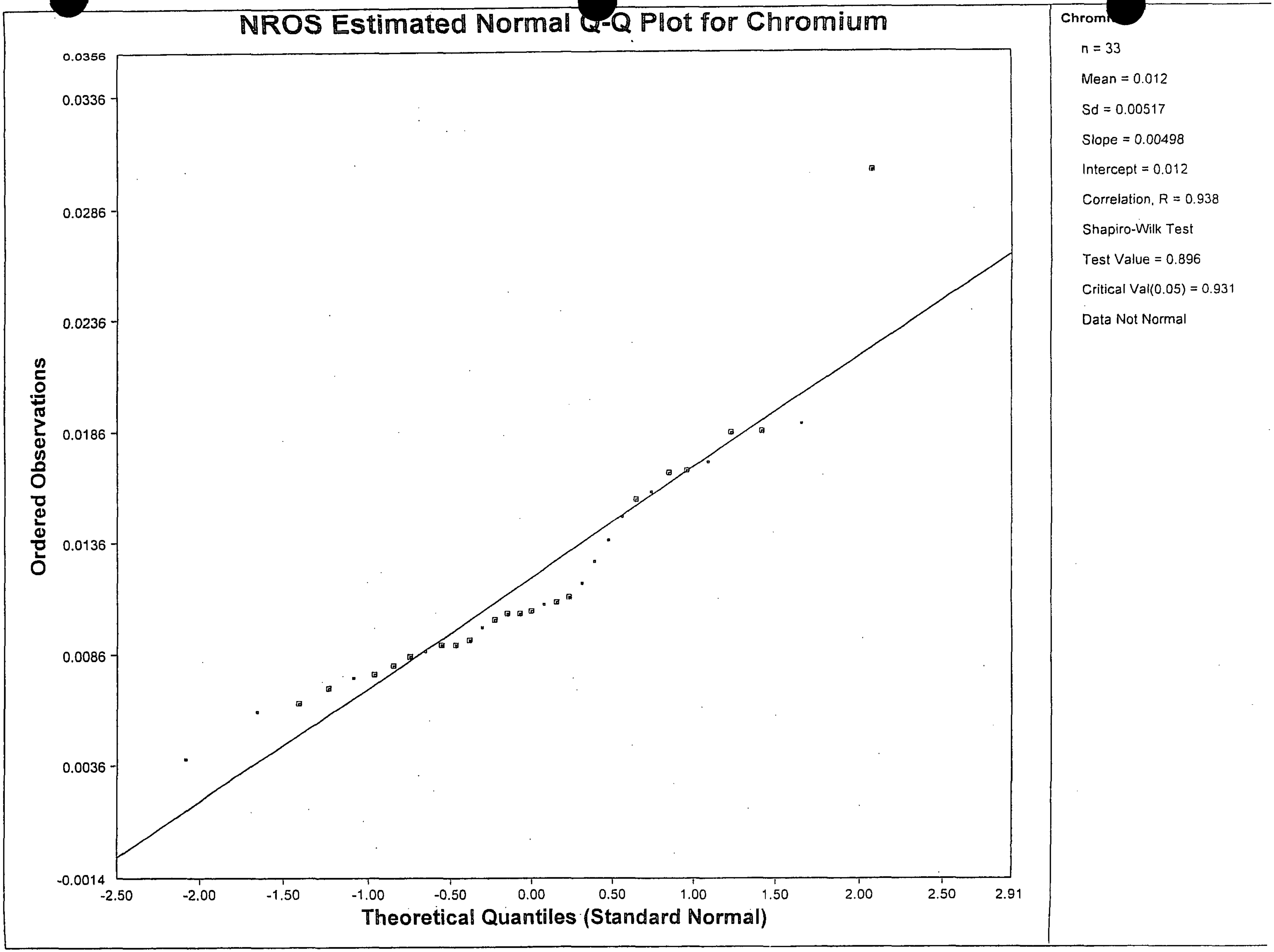
Data Not Lognormal

Approx. Test Value = 0.862

p-Value = 4.3193E-4

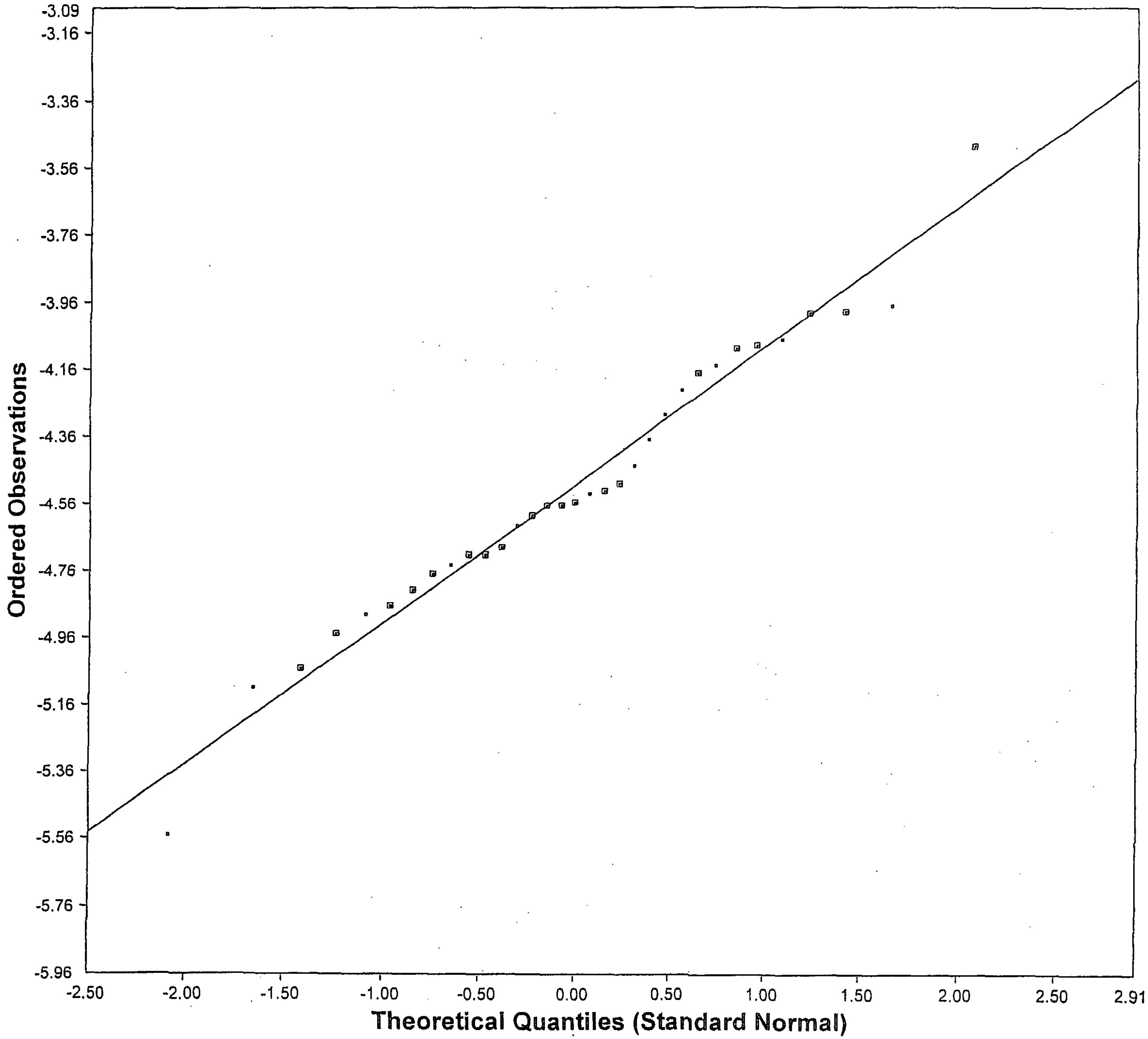


Gamma Excluding NDs Q-Q Plot for Chromium
Ordered Observations
Theoretical Quantiles (Standard Normal)
0.0351
0.0336
0.0316
0.0296
0.0276
0.0256
0.0236
0.0216
0.0196
0.0176
0.0156
0.0136
0.0116
0.0096
0.0076
0.0056
0.0036
0.0016
0.0015
0.0035
0.0055
0.0075
0.0095
0.0115
0.0135
0.0155
0.0175
0.0195
0.0215
0.0235
0.0255
0.0275
0.0295
Chromium
Total Number of Data = 33
Number treated as ND = 13
Max DL = 0.0200000
n = 20
Percent NDs = 39%
Mean = 0.0122
SD = 0.0057
k star = 5.786
Slope = 1.039
Intercept = -4.352E-4
Correlation, R = 0.944
Anderson-Darling Test
Critical Value(0.05) = 0.744
Data Not Gamma Distributed



NROS Estimated Normal Q-Q Plot for Chromium
Ordered Observations
0.0356
0.0336
0.0286
0.0236
0.0186
0.0136
0.0086
0.0036
-0.0014
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
2.91
Theoretical Quantiles (Standard Normal)
n = 33
Mean = 0.012
Sd = 0.00517
Slope = 0.00498
Intercept = 0.012
Correlation, R = 0.938
Shapiro-Wilk Test
Test Value = 0.896
Critical Val(0.05) = 0.931
Data Not Normal

NROS Estimated Lognormal Q-Q Plot for Chromium



Chromium

n = 33

Mean = -4.504

Sd = 0.41

Slope = 0.415

Intercept = -4.504

Correlation, R = 0.986

Shapiro-Wilk Test

Test Statistic = 0.984

Critical Value(0.05) = 0.931

Data Appear Lognormal

	Confidence Intervals/Limits (CLs) for Datasets Without Non-Detects
Date/Time of Computation	8/14/2009 9:42:48 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\E Pond\Metals.wst
Full Precision	OFF
Number of Bootstrap Operations	2000
Confidence Coefficient	0.8

Arsenic		
Number of Valid Observations	33	
Number of Distinct Observations	33	
Raw Statistics		
Mean	0.173	
Minimum	0.0045	
5% Percentile	0.023	
10% Percentile	0.0362	
1st Quartile	0.0611	
Median	0.128	
3rd Quartile	0.217	
90% Percentile	0.406	
95% Percentile	0.446	
Maximum	0.555	
Standard Deviation	0.142	
MAD / 0.6745	0.103	
IQR / 1.35	0.117	
Normal Statistics		
1% Percentile (z)	-0.158	
5% Percentile (z)	-0.0611	
10% Percentile (z)	-0.00945	
1st Quartile (z)	0.0769	
Median (z)	0.173	
3rd Quartile (z)	0.269	
90% Percentile (z)	0.355	
95% Percentile (z)	0.407	
99% Percentile (z)	0.504	
Normal Confidence Intervals		
Normal	Lower Limit	Upper Limit
Student's t	0.14	0.205
Gamma Statistics		
k hat	1.515	
Theta hat	0.114	
nu hat	100	
k star	1.398	
Theta star	0.124	
MLE of Mean	0.173	
MLE of Standard Deviation	0.146	
nu star	92.26	

80% Percentile of Chisquare (2k)	4.359	
Gamma Confidence Intervals		
Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.145	0.212
Adjusted Gamma	0.144	0.213
Log-Transformed Statistics		
Mean of Log-Transformed Data	-2.12	
Standard Deviation of Log-Transformed Data	0.974	
MVU Estimate of Median	0.118	
MVU Estimate of Mean	0.189	
MVU Estimate of SD	0.221	
MVU Estimate of Standard Error of Mean	0.0368	
Lognormal Confidence Intervals		
Confidence	Lower Limit	Upper Limit
Land's H	0.151	0.263
Chebyshev (MVUE)	0.107	0.271
Nonparametric Confidence Intervals		
Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.141	0.205
Jackknife	0.14	0.205
Standard Bootstrap	0.142	0.204
Bootstrap-t	0.144	0.212
Percentile Bootstrap	0.143	0.206
BCA Bootstrap	0.144	0.207
Chebyshev	0.117	0.228
Modified (t)	0.141	0.206
Adjusted CLT	0.137	0.208
Barium		
Number of Valid Observations	33	
Number of Distinct Observations	31	
Raw Statistics		
Mean	0.0563	
Minimum	0.0263	
5% Percentile	0.0313	
10% Percentile	0.0405	
1st Quartile	0.0492	
Median	0.0545	
3rd Quartile	0.0642	
90% Percentile	0.0714	
95% Percentile	0.0758	
Maximum	0.0846	
Standard Deviation	0.0122	
MAD / 0.6745	0.0083	
IQR / 1.35	0.0114	

Normal Statistics

1% Percentile (z)	0.0278
5% Percentile (z)	0.0362
10% Percentile (z)	0.0406
1st Quartile (z)	0.048
Median (z)	0.0563
3rd Quartile (z)	0.0646
90% Percentile (z)	0.072
95% Percentile (z)	0.0764
99% Percentile (z)	0.0848

Normal Confidence Intervals

Normal	Lower Limit	Upper Limit
Student's t	0.0535	0.0591

Gamma Statistics

k hat	20.18
Theta hat	0.00279
nu hat	1332
k star	18.36
Theta star	0.00307
MLE of Mean	0.0563
MLE of Standard Deviation	0.0131
nu star	1212
80% Percentile of Chisquare (2k)	43.68

Gamma Confidence Intervals

Confidence	Lower Limit	Upper Limit
Approximate Gamma	0.0535	0.0594
Adjusted Gamma	0.0534	0.0595

Log-Transformed Statistics

Mean of Log-Transformed Data	-2.902
Standard Deviation of Log-Transformed Data	0.234
MVU Estimate of Median	0.0549
MVU Estimate of Mean	0.0564
MVU Estimate of SD	0.0133
MVU Estimate of Standard Error of Mean	0.00232

Lognormal Confidence Intervals

Confidence	Lower Limit	Upper Limit
Land's H	0.0535	0.0597
Chebyshev (MVUE)	0.0512	0.0616

Nonparametric Confidence Intervals

Confidence	Lower Limit	Upper Limit
Central Limit Theorem	0.0536	0.059
Jackknife	0.0535	0.0591
Standard Bootstrap	0.0536	0.0589
Bootstrap-t	0.0536	0.059
Percentile Bootstrap	0.0536	0.059
BCA Bootstrap	0.0535	0.0588

Chebyshev	0.0515	0.0611							
Modified (t)	0.0535	0.0591							
Adjusted CLT	0.0536	0.059							

Confidence Intervals Datasets with Non-Detects

Date/Time of Computation	8/14/2009 9:43:23 AM
User Selected Options	
From File	J:\1991\91-135\MON\Lab Data\2009\Ponds\Sludge\Scout\E Pond\Metals.wst
Full Precision	OFF
Number of Bootstrap Operations	2000
Confidence Coefficient	0.8

Chromium

General Statistics

Number of Valid Data	33
Number of Detected Data	20
Number of Distinct Detected Data	18
Minimum Detected	0.0064
Maximum Detected	0.0303
Number of Non-Detect Data	13
Percent Non-Detects	39.39%
Minimum Non-detect	0.02
Maximum Non-detect	0.02

Raw Statistics

Mean of Detected Data	0.0122
SD of Detected Data	0.0057

Maximum Likelihood Estimates (MLEs)

MLE Mean	N/A
MLE Stdv	N/A

Normal (MLE) Confidence Interval

	Lower Limit	Upper Limit
MLE (t)	N/A	N/A

Normal ROS Statistics

Mean of Normal ROS Data	0.012
Stdv of Normal ROS Data	0.00517

Normal ROS Confidence Intervals

	Lower Limit	Upper Limit
ROS Student's t	0.0108	0.0132

Gamma ROS Statistics

k Star of Gamma ROS Data	9.155
Theta Star of Gamma ROS Data	0.00134
Nu Star of Gamma ROS Data	604.3

Gamma Intervals

Gamma	Lower Limit	Upper Limit
ROS Approximate Gamma	0.0114	0.0133
ROS Adjusted Gamma	0.0114	0.0133

Log-Transformed Statistics

Mean of Log-Transformed Detected Data	-4.484
Stdv of Log-Transformed Detected Data	0.393
Mean of Lognormal ROS Data	0.0119
Stdv of Lognormal ROS Data	0.00494

Lognormal Confidence Intervals

Lognormal	Lower Limit	Upper Limit
ROS Land's H	0.0109	0.013
ROS % Bootstrap	0.0108	0.013
ROS BCA Bootstrap	0.0109	0.0131

Kaplan Meier Distribution Free Statistics

Kaplan Meier Mean	0.0119
Kaplan Meier Stdv	0.00496
Kaplan Meier SEM	0.00104

Nonparametric Confidence Intervals

Nonparametric	Lower Limit	Upper Limit
Kaplan Meier (t)	0.0105	0.0132
Kaplan Meier (z)	0.0105	0.0132
Kaplan Meier % Bootstrap	0.0106	0.0132
Kaplan Meier BCA Bootstrap	0.0104	0.0131
Kaplan Meier Chebyshev	0.00953	0.0142

Unable to Winsorize Data!

APPENDIX U

Construction Quality Assurance Plan

Honeywell International Inc., Metropolis Works
Massac County, Illinois

RCRA Pond Closure Construction Quality Assurance Plan

November 2010

Prepared for:
Honeywell
Honeywell International Inc.
2768 North US 45 Road
Metropolis, IL 62960

Prepared by:
ANDREWS ENGINEERING, INC.
3300 Ginger Creek Drive
Springfield, Illinois 62711
Tel: (217) 787-2334; Fax: (217) 787-9495

TABLE OF CONTENTS

TABLES

LIST OF ACRONYMS

CQA	Construction Quality Assurance
EPA	Illinois Environmental Protection Agency
GCL	Geosynthetic Clay Liner
HDPE	High Density Polyethylene
RCRA	Resource Conservation and Recovery Act
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture

1. INTRODUCTION

This Construction Quality Assurance (CQA) Program has been developed to ensure the surface impoundment cover system over B, C, D, and E Ponds is installed in a manner that ensures the cover system will meet the applicable RCRA and NRC closure performance standards and is protective of human health and the environment. This CQA program provides an outline of inspection activities and responsibilities to ensure proper installation and performance of the cap components.

2. CQA OFFICER

A third-party contractor, independent of the owner, operator, and Project Manager, will be designated as the CQA Officer. The CQA Officer will be an Illinois Registered Professional Engineer and will supervise, approve, and be responsible for all inspections, testing, and other activities required in this program. The CQA Officer will be responsible for providing documentation and as-built record drawings of completed construction and maintaining records of the construction sequences throughout the capping project.

The CQA Officer may utilize one or more inspectors to assist with the various inspections and testing to be conducted in the field. Any such inspector will work under the direct supervision of the CQA Officer and will be properly trained and/or experienced as appropriate. If the CQA Officer is unable to be present, he/she will designate a person who will exercise professional judgment in carrying out the duties of a CQA Officer as the designated CQA Officer-in-absentia. At a minimum, the CQA Officer will be on site at the start and end of major construction activities and once per week during construction.

3. INSPECTION ACTIVITIES

The CQA Officer will be present to provide supervision and assume responsibility for performing inspections of the following activities:

1. Site preparation work, including but not necessarily limited to:
   a. Removal of fencing surrounding the ponds
   b. Borrow area preparation
   c. Installation of temporary roadways
2. Material stabilization and grading
3. Common fill installation
4. Installation of the geosynthetic clay liner (GCL)
5. Installation of the high density polyethylene (HDPE) cover
6. Installation of the composite drainage net (CDN)
7. Installation of the granular drainage/filter layer
8. Installation of the protective soil cover

4. SAMPLING PLAN

A sampling plan will be implemented as part of the CQA Program for all construction activities.

The CQA Officer will review all specifications and requirements for the manufactured items used and will approve all materials based on satisfaction of their individual specification. Furthermore, he/she will ensure that proper construction and installation methods are used.

Below is a listing of tables summarizing the minimum sampling frequencies for the various cap components.

Facility Component	Sample Program Location
Material Stabilization and Grading	Table 1
Common Fill	Table 2
Anchor Trenches	Table 3
Geosynthetic Clay Liner	Table 4
HDPE Geomembranes	Table 5
Geocomposite Drainage Layer	Table 6
Granular Drainage/Filter Layer	Table 7
Protective Soil Layer	Table 8
Surface Water Control Structures	Table 9

All tables are included at the end of this CQA Program.

Additional testing and sampling may be required at the discretion of the CQA Officer if in his/her judgment it is necessary to ensure proper materials usage and construction procedures set forth by Federal and State Regulations.

5. CONSTRUCTION MEETINGS

The CQA Officer may hold meetings prior to, and during, construction to ensure:

- Proper construction techniques are utilized
- Project staff understand the specifications and plans
- Proper handling of deviations from the plans necessitated by site-specific field conditions
- Review of the appropriate chain-of-command is used if unsuitable work is discovered

Meetings should be held with all Contractors and Honeywell representatives involved with the project to discuss their individual responsibilities.

6. DOCUMENTATION

6.1 Daily Summary Report

A daily summary report, prepared by or under the direct supervision of the CQA Officer during each day of activity, will contain, at a minimum:

1. The date
2. A summary of the weather conditions
3. A summary of locations where construction is occurring
4. Equipment and personnel on the project
5. A summary of any meetings held and attendees
6. A description of materials used and references or results of testing and documentation
7. The calibration and recalibration of test equipment
8. The daily inspection report from each inspector

6.2 Daily Inspection Reports

Each construction inspector will complete a daily inspection report containing:

1. The location of inspection
2. The type of inspection
3. The procedure used
4. Test data
5. Acceptable limits for construction testing analysis
6. In the event of unsuitable materials or construction techniques, documentation regarding corrective action taken and causes for the incongruity
7. Results of the activity
8. Personnel involved in the inspection and sampling activities
9. The signature of the inspector

References may be made to other documents in order to preclude redundant reporting of information. Multiple inspectors may collaborate and complete a single inspection report summarizing their activities. If deemed appropriate by the CQA Officer, the Daily Summary Report and Daily Inspection Report(s) may be combined into a single daily report.

6.3 Photographic Records

Photographs will be used as tools to document the progress and acceptability of the work and may be incorporated into a daily summary report, a daily inspection report, and/or the construction acceptance report. Each photograph will be identified with:

1. The date and time
2. The name of the photographer

3. Identification on a map showing the approximate photographer location and direction of the photograph

6.4 Acceptance Report

Upon completion of the construction of the RCRA cover, the CQA Officer will submit a construction acceptance report to the Illinois EPA and Honeywell. At a minimum, the construction acceptance report will contain:

1. A certification by the CQA Officer the cover has been constructed in accordance with the engineering design.
2. Documentation of any changes to the design made during construction.
3. All daily summary and inspection reports.
4. Documentation of materials used during construction.
5. Documentation of testing as required by this CQA plan.
6. Copies of waste manifests and/or bills of lading for materials sent off-site for disposal.
7. As-built record drawings.

7. WASTE DISPOSAL

Waste generated during construction activities will be managed at an authorized facility. Documentation of waste management, such as manifests, bills of lading, etc., will be included in the construction acceptance report.

8. MATERIAL STABILIZATION

During material stabilization activities, the CQA Officer will be present and will ensure:

1. The proper mix of binder is utilized
2. Proper techniques for tracking the extent of stabilized material are used
3. Stabilized material has the required strength
4. Final elevation and grades of stabilized material

Samples of the material/binder mix will be obtained at the frequency identified in Table 1.

If an uncured sample is obtained, in a location next to the pond from which it was obtained, the sample will be allowed to cure at approximately the same conditions as the material in the ponds.

If a cured sample is obtained, the location where the sample was obtained will be backfilled with concrete and/or cement and will be noted on the record drawings.

A topographic survey of the top of the stabilized material will be conducted. The stabilized material finished surface will be surveyed on a spacing, which should not exceed 25-feet in any ordinate direction.

9. COMMON FILL

The CQA Officer will be present during all phases of the common fill construction to ensure:

1. Uniformity of coverage by compaction equipment
2. A minimum of six inches of clean soil is placed as the top layer of common fill
3. The final top surface of common fill is smooth
4. Use of methods to bond successive lifts together is appropriate
5. Contemporaneous placement of protective covering to prevent drying and desiccation, where necessary
6. Prevention of the placement of frozen material or the placement of material on frozen ground
7. Prevention of damage to completed sections
8. Construction only proceeds during favorable climatic conditions

The material will be placed in thin lifts (8-inch loose max.), worked to ensure proper lift binding and homogeneous moisture and density and then thoroughly recompacted. Each lift is to receive a minimum of two complete passes of the soil compactor prior to placing additional material.

The common fill will be protected from freezing and desiccation during and after construction. If necessary, this may be achieved by applying a random soil layer of sufficient thickness to provide protection. Additional moisture may also be added. Plastic sheeting or other appropriate coverings may also be used in lieu of, or in addition to, the above methods, as necessary, to protect against desiccation.

If moisture is added to the soil to increase water content, then water will be uniformly applied to the soil. The soil will be allowed to absorb the water throughout the particles before being re-compacted. Double handling may be necessary or water added to the material source prior to excavation.

Minimum testing of the common fill will be according to the sampling schedule presented in Table 2. Test results will meet the limits shown or the deficiency will be corrected.

In addition to the laboratory testing, it will be equally important to continually perform visual inspections of the common fill material during construction. The inspections should ensure:

1. The thickness of each lift is no more than 8 inches loose
2. The adequacy of the binding between lifts
3. Compaction is occurring uniformly across the lift
4. The finished grade conforms to the design grades and lines

If the inspection reveals a deficiency, the Contractor will be promptly notified and corrective action taken. In addition, the deficiency location and corrective action taken will be noted on the daily inspection report. If additional testing is warranted in the area of the nonconformity then it will be completed and/or the suspect soil recompacted or removed and replaced as appropriate to acceptable limits.

All cover placement activities will be conducted to promote drainage to the extent possible. Protection of the common fill from erosion due to run-on and runoff will be maintained at all times, as practicable.

A topographic survey of the top of the common fill will be conducted to ensure design elevations have been met. The common fill finished surface will be surveyed on a spacing that should not exceed 25 feet in any ordinate direction. The surface grades will be considered acceptable if the grades when compared to the design grades yield a difference of no greater than ±0.1 foot.

10. ANCHOR TRENCH

The anchor trench dimensions are specified in the design plans. The location will be marked prior to excavation. The anchor trench will be surveyed and visually inspected for proper dimensions, location, and roundness or corners prior to geosynthetic deployment.

No loose soils will be present in the anchor trench. Corners of the anchor trench shall be rounded to minimize the potential for damage to the synthetic materials.

Prior to deployment of geosynthetics, the base of the anchor trench will be surveyed at 25-foot intervals.

After deployment of the geosynthetic materials, the anchor trench shall be filled in lifts and compacted as specified.

11. GEOSYNTHETIC CLAY LINER

11.1 Manufacturing

The GCL manufacturer will provide the CQA Officer with a written certification signed by a responsible party that the materials actually delivered have properties that meet or exceed all property values guaranteed for that type of GCL. The CQA Officer will examine all manufacturer certifications to ensure that the property values listed on the certifications meet or exceed those specified for the particular type of GCL.

11.2 Labeling

The GCL manufacturer will identify all rolls of GCL with the:

- GCL manufacturer's name
- Product identification
- Lot number
- Roll number
- Roll weight
- Roll dimensions (length and width)

In addition, if any special handling of the GCL is required, it will be so marked on the top surface (e.g., "This Side Up").

11.3 Shipment and Storage

During shipment and storage, the GCL will be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions.

A visual inspection of each roll will be made during unloading to identify any damaged packaging. Rolls with damaged packaging will be marked, the packaging repaired, and the roll set aside for further inspection.

Rolls of GCL will be stored in a level, dry, and well-drained area away from high traffic areas. All rolls and accessory bentonite will be covered with plastic sheeting until installation. The GCL will not be exposed to precipitation.

Any deviation from the above requirements will be reported to the CQA Officer and Project Manager.

11.4 Conformance Testing

11.4.1 *Tests*

Upon delivery of the rolls of GCL, the manufacturer shall provide results of quality control tests listed in Table 4. The CQA Officer will ensure that samples are removed and forwarded to the geosynthetic CQA laboratory for testing to ensure conformance to both the design specifications and the guaranteed properties provided by the manufacturer. The GCL material shall conform to the properties described in Table 4.

11.4.2 *Sampling Procedures*

Samples will be taken across the entire width of the roll. Unless otherwise specified, samples will be three feet long by the roll width. The CQA Officer will mark the machine direction on the samples with an arrow. Samples will be taken at the rate specified in Table 4.

11.4.3 *Test Results*

The CQA Officer will examine all results from laboratory conformance testing and will report any non-conformance to the Project Manager.

11.4.4 *Conformance Test Failure*

When a sample fails a conformance test conducted by the geosynthetics CQA laboratory, the following procedures will apply:

- The manufacturer will replace the roll of GCL that is in non-conformance with a roll that meets specifications.
- The installer will remove conformance samples for testing by the geosynthetics CQA laboratory from the closest numerical roll on both sides of the failed roll. These two samples must conform to the specifications. If either of these samples fail, the two numerically closest untested rolls on both sides of the failed sample will be tested by the geosynthetics CQA laboratory. These four samples must conform to the specifications. If any of these samples fail, every roll of GCL on site, and every

subsequently delivered roll that is from the same supplier, must be tested by the geosynthetics CQA laboratory for conformance to the specifications.

The CQA Officer will document actions taken in conjunction with conformance test failures.

11.5 Surface Preparation

The subgrade shall be fine-graded to fill in all voids or cracks and then smooth-rolled to provide the best practicable surface for the GCL, eliminating all protrusions extending more than one-half inch from the surface.

The installer will certify in writing that the surface on which the GCL will be installed is acceptable. The certificate of acceptance will be given by the installer to the CQA Officer prior to the CQA Officer inspecting the area.

The CQA Officer will thoroughly inspect the common fill surface on which the GCL is to be placed prior to installation. The inspector will concentrate on the following and completion of any corrective action required:

1. The surface of the common fill cover will be inspected and surveyed, ensuring the grades and lines are consistent with those on the design plans.
2. The surface will be examined to ensure all rocks, roots, animal burrows, litter, construction debris, and/or undesirable objects that could weaken the support of the GCL or puncture it are not present.
3. All depressions will be filled and raised areas corrected.
4. All desiccation cracks larger than one-quarter inch will be corrected as necessary to ensure proper performance of the common fill earthen cover.
5. No vegetative growth will be present.
6. The common fill earthen cover will be free from chemicals (e.g. solvents, antifreeze, and crankcase and hydraulic oil resulting from construction).
7. All common fill cover grade change intersections will be rounded to prevent undue stresses on the GCL cover.
8. All common fill cover surfaces are firm and have not been wetted excessively in local areas in the period preceding the GCL installation.
9. The common fill will be free of ice or standing water.
10. The common fill will be free of any other foreign material that could contact the GCL.

The CQA Officer will certify acceptance of the common fill subgrade prior to GCL placement.

After the supporting materials have been accepted by the CQA Officer, he/she will continue to inspect the base for any change in the supporting materials condition that may require repair work.

11.6 Handling and Placement

The installer will handle all GCL in such a manner as to ensure it is not damaged in any way, and the following will be complied with:

- On slopes, the GCL shall be placed so that seams are parallel to the direction of the slope. Shingle ends of panels in the direction of the grade.
- In the presence of wind, all GCL will be weighted with sandbags or the equivalent. Sandbags will be installed during placement and will remain until replaced with protective cover soils, geomembrane, or waterproof tarpaulin.
- The GCL will be kept continually under tension to minimize the presence of wrinkles.
- If in-place, special care must be taken to protect other materials from damage, which could be caused by the cutting of the GCL. The GCL should be cut using a utility blade in a manner recommended by the manufacturer.
- During placement of the GCL, care will be taken not to entrap stones or moisture in the GCL. Care will be taken not to walk on or drag equipment across the exposed GCL.
- A temporary geosynthetic slip sheet may be used to reduce friction damage during placement.
- A visual examination of the GCL will be carried out over the entire surface after installation, to ensure that no potentially harmful foreign objects are present.
- Only as much GCL shall be deployed as can be covered at the end of the day with a geomembrane or temporary waterproof tarpaulin. GCL shall not be left uncovered overnight. If GCL is hydrated when no confining stress is present, it may require replacement of the hydrated material based on observations of the CQA Officer, Project Manager, and consultation with the supplier.

The CQA Officer will note any noncompliance and report it to the Project Manager.

11.7 Anchorage

At the top of slope, the GCL will be placed in an anchor trench or an equivalent runout design will be utilized. If an anchor trench is utilized, the requirements of Section 10 will be followed. If an anchor trench is used, the GCL will cover the entire floor of the trench but will not extend up the rear of the trench wall.

11.8 Seams

Longitudinal seams will be overlapped at a minimum of six inches. If the GCL is manufactured with a grooved cut in the nonwoven geotextile, then no bentonite enhanced seam is required. If the GCL does not have a grooved cut in one of the nonwoven geotextiles in the longitudinal overlap, then bentonite enhanced seams are required.

End-of-roll seams ends will be overlapped a minimum of 24 inches. All end-of-roll seams require bentonite-enhanced seams.

<u>Bentonite-Enhanced Seams</u>

To construct a bentonite-enhanced seam, the following procedure will be used.

1. A continuous bead of granular bentonite will be applied along the underlying panel edge at a zone defined by the edge of the underlying panel and the 6-inch overlap line.
2. Granular bentonite will be applied at a minimum of one-fourth pound per lineal foot.

11.9 Repair

Any holes or tears in the GCL will be repaired as follows:

> A patch made from the same GCL will be placed over the damaged area no closer than 12 inches (300 mm) from any edge. Granular bentonite or mastic will be applied around the damaged area prior to placement of the patch. An adhesive may be used to affix the patch in place. The patch will be sandbagged into position until it is covered by the overlying geomembrane. Should any tear exceed 10 percent of the width of the roll, that roll will be removed and replaced.

Care will be taken to remove any soil, or other material, that may have penetrated the torn GCL. The CQA Officer will observe any repair.

11.10 Care After Placement

After placement, soft-soled shoes shall be used when walking upon the GCL. Lightweight, low ground pressure vehicles (i.e., 4-wheel all-terrain vehicles or similar) may be used to facilitate installation of the geomembrane above the GCL.

12. GEOMEMBRANE COVER

12.1 Surface Preparation

The CQA Officer will thoroughly inspect the GCL surface on which the geomembrane is to be laid. The inspector will concentrate on the following and completion of necessary corrective actions:

1. The GCL will have been installed in accordance with design parameters.
2. The GCL will not be hydrated. If the GCL is hydrated, the procedures in Section 11.6 will be followed.

In conjunction with the monitoring activities described above, the CQA Officer will implement the sampling program summarized in Table 5.

12.2 Panel Layout Plan

Prior to any geomembrane cover installation, the installer will provide the CQA Officer a panel layout plan for the specific area included in his construction bid. The geomembrane cover will be installed on top of the GCL in accordance with the drawings, specifications, and manufacturer's instructions by persons experienced in similar cover installation. Furthermore, the geomembrane cover will be installed in accordance with the installer's panel layout plan and as it may be revised with the approval of the CQA Officer and Project Manager to suit field conditions at the time of installation.

12.3 Field Seaming

All field seaming will be in accordance with the manufacturer's specifications. Any necessary revisions during installation will be reflected on the record "as-built" drawings.

Geomembrane bonding will use fusion welding when possible and extrusion welding as a secondary means. Fusion welding will typically consist of applying dynamic energy, heat and/or extrudate between two overlapped panels. This will allow a bonding of the extrudate with the panel material, or panel-to-panel, providing a homogenous mass along the area of the seam. Extrusion welding may be similar to fusion welding but typically lacks the dynamic energy.

Equipment used to bond the geomembrane will be equipped with monitors capable of providing instantaneous temperature readings regarding the zone of contact. This will allow the operator to manually or automatically alter the bonding process to ensure integrity based on changes in environment.

The quality control aspects of the actual geomembrane cover installation will include, but not necessarily be limited to:

1. Inspection of the procedures and adequacy used for cleaning and/or drying the surfaces of the geomembrane to be seamed
2. Monitoring of the temperature and speed of welding
3. Only smooth-soled shoes will be allowed on the geomembrane cover
4. No vehicles will be allowed directly on the geomembrane cover

The quality assurance aspects of the actual geomembrane cover installation will include, but not necessarily be limited to:

1. Test welds on scrap geomembrane cover materials will be produced by each seamer at least twice daily, in the early morning and afternoon, under the same conditions as production seaming to verify conditions are adequate.
2. All field seams will be pressure or vacuum tested over their full length.
3. Samples of actual field seams will be tested on an average basis of at least once every 500 feet of seam length by sample removal and laboratory testing for bonded seam strength and peel adhesion. The test results will be considered acceptable if they meet or exceed the minimum values indicated in Table 5. (Patches will be welded over holes created by sampling.)
4. Inadequate seams will be cut out and rewelded or an additional layer of cover will be welded over the suspect seam.
5. Documentation of the location of each panel, sample point, repaired areas and the test results.

Using the above-mentioned procedures and others that may be required or deemed appropriate by the CQA Officer, upon completion of the geomembrane installation, he will exercise professional judgment to certify that:

1. The bedding material contained no undesirable objects.
2. The placement plan has been followed.
3. The anchor trench and back-fill were constructed to prevent damage to the geomembrane.
4. All tears, rips, punctures, and other damage were repaired.
5. All geomembrane seams were properly constructed and tested in accordance with the manufacturer's specifications.

13. GEOCOMPOSITE DRAINAGE LAYER

A double-sided geotextile composite will be used as a drainage layer over the HDPE. The geocomposite drainage layer will have a minimum hydraulic transmissivity of $9x10^{-4}$ m^2/s.

The geocomposite will be made of polyethylene materials and a geotextile (filter fabric) adhered to its sides to facilitate improved slope stability and separation from overlying materials. Manufacturer testing will be in accordance with Table 6. Installation will be in accordance with recommendations of the manufacturer as approved by the CQA Officer and Project Manager.

The finished surface of the geocomposite drainage layer will be surveyed on a spacing, which should not exceed 25 feet in any ordinate direction. The purpose of this survey is to establish the elevation of the bottom of the granular drainage layer.

14. GRANULAR DRAINAGE/FILTER LAYER

A granular drainage/filter layer will be provided above the CDN. Before use, the source of the granular drainage/filter layer will be sampled under the supervision of the CQA Officer for the parameters listed in Table 7. Additional sampling will be performed as the material is received, ensuring continued satisfaction of the specifications. Care should be taken to avoid contamination of the granular drainage material with soil during stockpiling operations.

The granular drainage layer will be placed (not dropped) using a low-ground pressure crawler end loader or dozer. A uniform 12-inch (min.) thickness of granular material will be placed in one lift.

Operation of equipment on the granular drainage layer will be kept to a minimum. Movement of machinery will be done in straight lines with no sudden turns, starting, or stopping.

A comparison of elevations of the top of the CDN and top of granular drainage/filter layer surface will be used to verify the thickness of the drainage layer. Drainage layer thickness will be measured at least every 25 feet horizontally, and at major grade breaks, and 12-inch (min.) normal to the liner surface.

Construction of the granular drainage/filter layer will be monitored by the CQA Officer to:

1. Exercise professional judgment to certify that all materials used for the granular drainage layer meet the required size and hydraulic conductivity requirements.
2. Certify materials used for the granular drainage layer are placed in accordance with the design plans.
3. Certify the granular drainage layer is a minimum of 1-foot thick.

15. PROTECTIVE LAYER

The final protective layer will consist of a minimum of 24 inches of clean soil. The lower 18 inches of soil should be a free draining soil and slightly compacted as necessary to hold the soil in place and resist erosion. The remaining 6 inches should not be compacted and should be the best readily available soil for supporting vegetation. The thickness of the final protective layer should be documented by comparing the finished elevation of the granular drainage layer with the final surface. Upon installation of the granular drainage/filter layer, a minimum of 24 inches of final protective cover must be placed. The minimum thickness of the final protective layer will be placed as soon as possible after placement of the granular drainage layer.

Loams of the USDA soils classification system or USCS classes GM, GC, SM, SC, ML, and CL are all considered suitable protective soils. The final protective layer may include soils from offsite sources and compost.

The finished surface of the final cover system will be surveyed on a spacing that should not exceed 25 feet in any ordinate direction. The minimum required thickness of protective soil is 24 inches. There will be no tolerances for thicknesses less than 24 inches.

Construction of the protective soil layer will be monitored by the CQA Officer to:

1. Exercise professional judgment to certify that materials used for the protective soil layer are of the proper type.
2. Certify the protective soil layer is a minimum of 24 inches thick.

16. VEGETATIVE COVER

Finalized areas will be prepared and seeded as soon as practicable to prevent deterioration. Composite soil sample testing may be done to determine the amount of lime and/or fertilizer needed. Seed will typically be incorporated into the upper surface of the final protective layer using a disk or harrow or by using hydroseeding techniques. The seed mixture selected must be amenable to the soil quality/thickness, slopes and moisture/climatological conditions that exist without the need for continued maintenance and with minimal potential for root penetration into the low permeability layer. It will also be consistent with an "open space" post-capping land use. Fertilizer, lime, and mulch should be used at rates necessary to establish proper growth of the seed.

Landscaping or seeding professionals knowledgeable of Massac County's climatological conditions may be consulted in determining necessary soil amendments and application rates based upon specific seasonal conditions at the time of closure. As a guide, the design procedures and specifications presented in the *Illinois Urban Manual* or *Procedures and Standards for Urban Soil Erosion and Sediment Control in Illinois* may be utilized.

Mulch consisting of straw, jute, and/or wood excelsior will be used as necessary to hold the seed in place and conserve moisture.

The CQA Officer will monitor seeding activities and record the amount of seed and amendments (lb/acre) and the boundaries of seeded areas on the as-built drawings.

17. SURFACE WATER CONTROL STRUCTURES

The CQA Officer will monitor installation of surface water control structures, such as ditches, culverts, and sediment control devices to ensure design specifications are met.

As shown in Table 9, ditches cross sections and slopes will be surveyed at 50-foot intervals. Any deviations from the design plans will be noted on the as-built drawings with appropriate calculations showing the hydraulic carrying capacity remains sufficient. Ditches will be completed with appropriate erosion control coverings as soon as practicable.

The CQA Officer will monitor construction of the surface water control structures to:

1. Certify the structures meet the design slopes
2. Certify the structures meet the design depth and width

18. EXCEPTIONS

The CQA Officer shall have the authority to modify the design shown on the plans based upon unexpected conditions encountered in the field. Small changes or modifications are historically required on any construction job of this size. Accordingly, any changes or modifications will be incorporated into the Construction Acceptance Report and/or record drawings. Calculations, supporting discussion, etc. shall also be included in the Construction Acceptance Report to validate the adequacy of the changes in relation to the original design.

ANDREWS
ENGINEERING, INC.

Corporate Headquarters
Springfield Branch Office
3300 Ginger Creek Drive
Springfield, IL 62711
Tel: (217) 787-2334
Fax: (217) 787-9495
marketing@andrews-eng.com

Pontiac Branch Office
215 West Washington Street
Pontiac, IL 61764
Tel: (815) 842-2042
Fax: (815) 842-2159
pont@andrews-eng.com

Indianapolis Branch Office
7478 Shadeland Station Way
Indianapolis, IN 46256
Tel: (317) 595-6492
Fax: (317) 598-9929
indy@andrews-eng.com

Naperville Branch Office
1701 Quincy Avenue, Suite 25
Naperville, IL 60540
Tel: (630) 544-3332
Fax: (630) 544-3398
naperville@andrews-eng.com

St. Louis Branch Office
131 W. Booneslick Road
Warrenton, MO 63383
Tel: (636) 456-6387
Fax: (636) 456-6389
stl@andrews-eng.com

HONEYWELL INTERNATIONAL INC.
Metropolis Works

POND CLOSURE PLAN
CQA PLAN
TABLE 1 - MATERIAL STABILIZATION AND GRADING

TEST/PROCEDURE	TEST METHOD	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Unconfined Compressive Strength	ASTM D5102	1 per 5,000 yd^3 (minimum 2 per pond)	25 psi @ 28 days (min.)
Survey Line and Grade Control		25-foot intervals and at major grade breaks	NA
Survey Location of Cured Sludge Samples		All Cured Sample Locations	NA

POND CLOSURE PLAN
CQA PLAN
TABLE 2 - COMMON FILL

TEST/PROCEDURE	TEST METHOD	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Modified Proctor Moisture Density	ASTM D1557	1 per 10,000 yd^3 or soil change	NA
In-Place Density and Moisture	ASTM D6938	2 per lift per acre	Density: 85% of optimum (min.) Moisture: 1 - 5% above optimum
Survey Line and Grade Control		25-foot intervals and at major grade breaks	± 0.1 foot compared to design grades

POND CLOSURE PLAN
CQA PLAN
TABLE 3 - ANCHOR TRENCHES

TEST/PROCEDURE	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Survey Line and Grade Control	25-foot intervals	NA
Visual Inspection of Trench Corners	Continuous	Rounded Corners

HONEYWELL INTERNATIONAL INC.
Metropolis Works

POND CLOSURE PLAN
CQA PLAN
TABLE 4 - GEOSYNTHETIC CLAY LINER (GCL)

TEST/PROCEDURE	TEST METHOD	TEST FREQUENCY	ACCEPTABLE VALUES
Bentonite (as received)			
Swell Index	ASTM D5890	1 per 50 tons	24 ml/2g (min)
Fluid Loss	ASTM D5891	1 per 50 tons	18 ml (max.)
Geotextiles (as received)			
Mass Per Unit Area (nonwoven)	ASTM D5261	1 per 25,000 yd^2	5.8 oz/yd^2 (min.)
Mass Per Unit Area (nonwoven composite)	ASTM D5261	1 per 25,000 yd^2	5.9 oz/yd^2 (min.)
GCL (as manufactured)			
Mass of Bentonite Per Unit Area	ASTM D5993	1 per 40,000 ft^2	0.75 lb/ft^2 (min.)
Moisture Content	ASTM D5993	1 per 5,000 yd^2	20 - 40%
Tensile Strength	ASTM D6768	1 per 200,000 ft^2	25 lb/in (min.)
Peel Strength	ASTM D6496	1 per 40,000 ft^2	3 lb/in (min.)
Permeability	ASTM D5887	1 per week	5 x 10^{-9} cm/sec (max.)
OR			
Flux	ASTM D5887	1 per week	1 x 10^{-8} $m^3/sec\text{-}m^2$ (max.)
GCL Hydrated Internal Shear Strength	ASTM D5321 ASTM D6243	periodic	500 psf typ. at 200 psf
GCL Permeability (5 psi)	ASTM D6766	yearly	1 x 10^{-6} cm/sec (max.)
GCL Permeability (70 psi)	ASTM D6766 modified	yearly	5 x 10^{-8} cm/sec (max.)
Component Durability			
Geotextile and Reinforcing Yarns	GRI-GCL2 Section 5.6.2	yearly	65 % strength retained (min.)

HONEYWELL INTERNATIONAL INC.
Metropolis Works

POND CLOSURE PLAN
CQA PLAN
TABLE 5 - HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANES

TEST/PROCEDURE	TEST METHOD	TEST FREQUENCY	ACCEPTABLE VALUES
Laboratory Conformance - Geomembrane Sheet Properties			
Thickness (minimum average)	ASTM D5994	1 per roll	57 mil (min.)
Thickness (lowest individual of 8 of 10 readings)	ASTM D5994	1 per roll	54 mil (min.)
Thickness (lowest individual of 10 readings)	ASTM D5994	1 per roll	51 mil (min.)
Asperity Height	GRI GM12 / ASTM D7466	every 2nd roll	10 mil (min.)
Sheet Density	ASTM D792 or ASTM D1505	1 per 200,000 lb	0.94 g/cc (min.)
Strength at Yield	ASTM D6693	1 per 20,000 lb	126 lb/in (min.)
Strength at Break	ASTM D6693	1 per 20,000 lb	90 lb/in (min.)
Elongation at Yield	ASTM D6693	1 per 20,000 lb	12% (min.)
Elongation at Break	ASTM D6693	1 per 20,000 lb	100% (min.)
Tear Resistance	ASTM D1004	1 per 45,000 lb	42 lb (min.)
Puncture Resistance	ASTM D4833	1 per 45,000 lb	90 lb (min.)
Stress Crack Resistance	ASTM D5397	per GRI GM10	300 hrs (min.)
Carbon Black Content	ASTM D1603	1 per 20,000 lb	2-3%
Carbon Black Dispersion	ASTM D5596	1 per 45,000 lb	For 10 Views: 9 in Categories 1 or 2 1 in Category 3
Oxidative Induction Time	ASTM D3895	1 per 200,000 lb	100 minutes (min.)
Oven Aging with High Pressure OIT % Retained	ASTM D5721 ASTM D5885	1 per each formulation	80% (min.)
UV Resistance with High Pressure OIT (at 1,600 hrs)	GRI GM11 / ASTM D5885	1 per each formulation	50% (min.)

POND CLOSURE PLAN
CQA PLAN
TABLE 5 - HIGH DENSITY POLYETHYLENE (HDPE) GEOMEMBRANES

TEST/PROCEDURE	TEST METHOD	TEST FREQUENCY	ACCEPTABLE VALUES
Field Seam Testing - Machine Pre-Weld Testing			
Seam Peel Specimens (3 specimens) Seam Shear Specimens (1 specimen)	ASTM D6392	1 at startup 1 after machine shutdown exceeding 20 minutes 1 every 5 hours of continuous seaming	Peel Strength (hot wedge): 91 lb/in (min.) Peel Strength (extrusion): 78 lb/in (min.) Shear Strength: 120 lb/in (min.)
Field Seam Testing - Destructive Seam Testing			
Sample Collection (30-inches along seam, 12-inches wide)	ASTM D6392	1 per 500 ft of seam	NA
Seam Peel Adhesion	ASTM D6392	5 specimens per destructive sample location	Hot Wedge: 91 lb/in (min.) Extrusion: 78 lb/in (min.)
Seam Shear Strength	ASTM D6392	5 specimens per destructive sample location	120 lb/in (min.)
Field Seam Testing - Non-Destructive Seam Testing			
Air Channel Test (30 psi for 5 minutes)	ASTM D4437	All Double Wedge Welds	3 psi loss (max.)
Vacuum Box Test	ASTM D5641	All Double Wedge Welds Not Air Channel Tested All Extrusion Welds	No Apparent Leaks
Seam Length & Location		100% of All Seams	NA

POND CLOSURE PLAN
CQA PLAN
TABLE 6 - GEOCOMPOSITE DRAINAGE LAYER

TEST/PROCEDURE	TEST METHOD	TEST FREQUENCY	ACCEPTABLE VALUES
Geocomposite			
Transmissivity	ASTM D4716	1 per 500,000 ft^2	9x10-4 m^2/s (min.)
Peel Adhesion	ASTM D7005	1 per 50,000 ft^2	1 lb/in (min.)
Geonet Component			
Thickness	ASTM D5199	1 per 50,000 ft^2	300 mil (min.)
Peak Tensile Strength	ASTM D5035	1 per 50,000 ft^2	75 lb/in (min.)
Melt Flow Index	ASTM D1238	1 per resin lot	≤ 1 g/10 minutes
Density	ASTM D792 B	1 per 50,000 ft^2	0.94 g/cm^3 (min.)
Carbon Black Content	ASTM D4218	1 per 50,000 ft^2	2-3%
Transmissivity	ASTM D4716	1 per 500,000 ft^2	8x10-3 m^2/sec (min.)
Geotextile Component			
Mass Per Unit Area	ASTM D5261	1 per 100,000 ft^2	6 oz/yd^2 (min.)
Grab Tensile Strength	ASTM D4632	1 per 100,000 ft^2	170 lbs (min.)
Grab Elongation	ASTM D4632	1 per 100,000 ft^2	50% (min.)
Trapeziodal Tear Strength	ASTM D4533	1 per 100,000 ft^2	70 lbs (min.)
Puncture Strength	ASTM D4833	1 per 100,000 ft^2	95 lbs (min.)
Permitivity	ASTM D4491	1 per 100,000 ft^2	1.6 sec^{-1} (min.)
Water Flow	ASTM D4491	1 per 100,000 ft^2	125 gpm/ft^2 (min.)
Apparent Opening Size US Standard Seive	ASTM D4751	1 per 100,000 ft^2	70 (max.)
UV Resistance	ASTM D4355	1 per resin lot	70% after 500 hrs (min.)
Finised Grades			
Top Surface of Geotextile Drainage Layer		25-foot intervals and major grade breaks	NA

POND CLOSURE PLAN
CQA PLAN
TABLE 7 - GRANULAR DRAINAGE/FILTER LAYER

TEST/PROCEDURE	TEST METHOD	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Grain Size Distribution	ASTM C-136	1 per 2,500 yd^3	$P_{200} \leq 10\%$
Hydraulic Conductivity	ASTM D2434	1 per 8,000 yd^3	1×10^{-3} cm/sec (min.)
Top Elevation Survey	NA	25 foot intervals and at major grade breaks	1 ft (min.)

HONEYWELL INTERNATIONAL INC.
Metropolis Works

POND CLOSURE PLAN
CQA PLAN
TABLE 8 - PROTECTIVE SOIL LAYER

TEST/PROCEDURE	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Top Elevation Survey	25-foot intervals and at major grade breaks	2 feet (min.)

HONEYWELL INTERNATIONAL INC.
Metropolis Works

POND CLOSURE PLAN
CQA PLAN
TABLE 9 - SURFACE WATER CONTROL STRUCTURES

TEST/PROCEDURE	MINIMUM FREQUENCY	ACCEPTABLE VALUES
Ditch Slope	50-foot intervals	design slope (min.)
Ditch Width	50-foot intervals	design width (min.)
Ditch Depth	50-foot intervals	design depth (min.)