GPU NUCLEAR

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November 12, 1999
1940-99-20615

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Sale of a Portion of Land that is Part of the Oyster Creek Nuclear Generating Station Site Including a Portion of the Exclusion Area - Response to Request for Additional Information (TAC No. MA5644)

In response to your referenced request for information dated October 19, 1999, Enclosure I to this letter provides our response and supporting reference documentation.

If you have any questions regarding this information, please contact Mr. Michael Laggart of my staff at 609-971-4184.

Sincerely,

Michael B. Roche
Vice President and Director
Oyster Creek

MBR:MWL

Enclosures

cc: Administrator, NRC Region 1
Oyster Creek NRC Project Manager
Senior Resident Inspector - Oyster Creek

A001

PDR ADOCK

ENCLOSURE 1

Question No. 1:

In accordance with applicable sections in 10 CFR 50.71, state how all records pertaining to release or property on the Forked River Site (FRS) being sold will be maintained until license termination, and provide the location of these records.

Response:

All records pertaining to release of property on the Forked River Site (FRS) being sold will be maintained in accordance with the GPU Nuclear Operational Quality Assurance Plan. Records are located in the Oyster Creek Information Resource Management Center. In addition, because documentation pertaining to the above will eventually be required for the effective decommissioning of Oyster Creek, the records will be assembled and maintained in our 10 CFR 50.75(g) file.

Question No. 2:

GPU Nuclear Calculation C-2820-99-010, "Dose Assessment of Residual Radioactivity on the Forked River Site - Demonstration per 10 CFR 20.1402", dated August 18, 1999, was not enclosed in the submitted package for review. This reference is requested for docketing and NRC staff review.

Response:

GPU Nuclear Calculation C-2820-99-010, "Dose Assessment of Residual Radioactivity on the Forked River Site - Demonstration per 10 CFR 20.1402", dated August 18, 1999 is provided as Attachment 1 to this enclosure.

Question No. 3:

"Sale of the Forked River Site Portion of the Oyster Creek Facility", Attachment 1, Compliance with the Radiological Criteria for License Termination, page 12: Indicates the established screening Derived Concentration Guideline Levels (DCGLS) for soil (pCi/g) are from SECY 98-051. According to SECY 98-242 document, dated October 21, 1998, the only values published, by NRC, were DCGLs for building surface contamination (dpm/100cm2) at the 90th percentile of the output dose distribution. SECY 98-242 included SECY 98-051 (as Attachment 1) and the table for building surface contamination screening DCGLs (as Attachment 2), which was subsequently revised November 11, 1998. Provide the computer code/version along with the parameters used to justify the established DCGLs, and the corresponding outputs.

Response:

SECY 98-242 was published in October of 1998. Our survey was conducted in July of 1998. We therefore designed the survey to the best available information from the NRC at the time.

GPUN is using the default DCGLs, not those developed by our in-house modeling. However, our in-house modeling, using RESRAD 5.82, which changed a few geometry and soil factors, results in similar DCGLs. Our modeling was extremely conservative in assuming that the entire backsite was the area for the contaminated soils, instead of the much smaller parking lot area. Based on information obtained at NRC public meetings, it is our understanding that issues remain with the accuracy of the cesium and transuranic factors in DandD. It therefore appears to be more valid to use the DCGLs we were working with in 1998, and RESRAD 5.82 at this time. However, the actual detection limits for the surveys conducted were substantially less than these DCGLs, providing ample conservative margin in our results. For example, for a class 3 area the MARSSIM suggests sampling and judgmental scanning. Our sampling of the class 3 impacted area included 52 samples. The MARSSIM sample statistics clearly show that less than 15 would be adequate. The detection limits in those samples was, for example, 0.14 pCi/gm of Cs-137 and 0.1 pCi/gm of Co-60, approximately 1% and 3% respectively, of the DCGLs we used. Even if other defaults DCGLs were used, these sample results are well below any default recommendations that we are aware of. The in-situ gamma analysis of the impacted area had detection limits on the order of 0.3 pCi/gm for both Cs137 and Co60. These are also substantially below the DG4006 expectation and also below any other suggested default DCGLs that we are aware of. MARSSIM and DG4006 do not expect in-situ gamma spectroscopy in addition to the scanning and sampling. The in-situ moving gamma spectroscopic scanning performed on the parking lot class 3 area consisted of an estimated 20% of the total area. Since the MARSSIM does not specify an area of coverage for class 3 areas for scanning ('judgmental') but expects '10-100%' in a class 2 area, our scan area clearly exceeds any expectation of scanning extent for a class 3. The detection limits for the scanning measurements were designed to achieve the detection of the DCGLs in use at the time. They vary based on the natural background component but are generally about 30% for the Co-60 DCGL. Since the MARSSIM does NOT require detection limits for scanning in class 3 areas to be below the DCGLw, this also far exceeds the requirements. If different DCGLs are proposed, the detection limits for the scan may or may not be less than the alternative DCGL (for example, we are aware of an approximately 0.9 pCi/gm default DCGL for Cs137 from DandD which we understand to be based on incorrect soil transfer factors). However, since the MDC scan is NOT required to be less than the DCGL for class 3 areas and there is no EMC requirement, the scans performed still fully meet the expectations of MARSSIM, even if the incorrect / lower DCGL for Cs137 is used.

Question No. 4:

"Sale of the Forked River Site Portion of the Oyster Creek Facility", Attachment 1, Compliance with the Radiological Criteria for LicenseTermination, page 13: The 10 CFR 61 waste stream analysis includes tritium, however, no specific sampling was performed to demonstrate the tritium is present on the FRS in quantities greater than background levels. Tritium in groundwater, in the immediate vicinity of the Oyster Creek plant area, was reported to be less than 5% of the Environmental Protection Agency (EPA) drinking water limit of 20,000 pCi/L. Provide information on why specific sampling for tritium in soil should not be required for any part of the FRS.

Response:

Tritium is present in the Oyster Creek waste streams (10CFR61) at concentrations that could conceivably contribute no more than a fraction of 0.0002 to the total dose if present at the abundance in the waste stream. DG4006 provides that analysis of this nuclide would not be required and is adequately characterized by the surrogate gamma emitters. If tritium were present in concentrations consistent with the waste stream, then concentrations on the order of 0.02 pCi/gm might be assumed to be present, which is approximately one-five thousandth of the DCGL. This is equivalent to about 0.005 mrem per year not included in our sampling effort. DG4006 clearly never intended that such analyses be made, since section 2.5.1 expects detection limits 'less than 50% of the DCGLw'. Section 4.7.1 of the MARSSIM expects ''MDC between 10-50% of the DCGL". Even at the most restrictive expectation, the '10%' from the MARSSIM, the hypothetical concentration of tritium at the firing range would be one five-hundredth of the required MDC. Section 2.9 of DG4006 says, "the presence of nuclides that likely contribute less than 10% of the total effective dose equivalent may be ignored". DG4006 also says "When there is a fixed ratio...[such as assumed in the question-assuming tritium is present in the waste stream mix ratio]...Compliance with the radiological criteria for license termination may be demonstrated by comparing the concentration of the single radionuclide that is easiest to measure with its DCGLw."

Question No. 5:

"Sale of the Forked River Site Portion of the Oyster Creek Facility", Attachment 1, Classification of Areas by Residual Radioactivity Levels, page 5: Buildings (1, 12, 14, Spectrum) contain exempt and/or sealed quantities of radioactive material used primarily for training purposes, and for source checking and calibrating instruments. These radiation sources will remain in the buildings (with the exception of the Spectrum building) for use by GPU staff following sale of the property. For clarity, identify the nuclides and activities of the radiation sources. Provide supporting information, in addition to the floor surface contamination survey data submitted, to justify that all areas known to contain radiation sources are classified as non-impacted.

Response:

Attachment 2 is a list of radioactive sources currently located on the Forked River property. These sources are located in buildings that are currently and will remain, after the sale, under the control of the Oyster Creek Nuclear Generating Station. Other than the combustion turbines, GPU is not selling the improvements on the site. The buildings and building contents will still be the property of the licensee. Surveys were conducted in the buildings prior to full clarification of the scope of the sale. The dose assessment based on those surveys was provided in order to be thorough and complete.

Question No. 6:

"Sale of the Forked River Site Portion of the Oyster Creek Facility", Attachment 1, Classification of Areas by Residual Radioactivity Levels, page 5: Buildings (Motor Pool, 8) contained measurable fixed contamination on tools that were either stored or transported to the FRS. An investigation and smear surveys were conducted resulting in no removable contamination. Provide this supporting information to justify that all areas known to contain contaminated material/items are classified as non-impacted.

Response:

Tools with activity from the Oyster Creek Nuclear Generating Station are not stored on the Forked River Site (FRS). In accordance with our procedures, contaminated material is maintained within a "Radiological Controlled Area (RCA)". There was however three occurrences where tools with fixed contamination were inadvertently transported to the FRS. In each case a "Radiological Investigation Report" was initiated. Attached are Radiological Investigation Reports 89-045, 91-002, and 91-057. (See Attachment 3)

Question No. 7:

Historical Site Assessment of the Forked River Site", Attachment 1, Description of Past and Current Operations, page 15: Fourteen truckloads of dirt with activity concentrations up to 0.3 pCi/g Cs-137 and 0.2 pCi/g of Co-60, determined by gamma spectroscopy, were temporarily stored adjacent to/on the Firing Range (FR) parking lot. These areas were classified as Class 3 - impacted. GPU Operations Quality Assurance (QA) Monitoring Report, Serial No. 9114001, dated February 7, 1991, states that the soil was excavated from outside the Radiological Controlled Area (RCA), in June/July 1990, from the area north of the reactor building. The report further mentions that the soil was "spread over the parking lot at the Firing Range by a Facilities contractor unaware of the sampling or concern about the soil." For clarity, define the boundary of the RCA, the volume of soil transported, and the final disposition of the soil onsite. NRC also requests information in isotopic soil analyses in the impacted area for potential alpha/beta emitters which may result from fission, activation, or other licensed activities.

Response:

The boundary of the outside RCA areas at the plant extends from the north east corner of the reactor building, then extends north on the east side of the drywell processing facility, continues north just west of the west wall of new radwaste, then turns eastward just north of new radwaste. At the warehouse it turns south, a few feet west of the warehouse wall and follows (a few feet away) the line of the west and then south wall of the warehouse. About half-way eastward along the south warehouse wall, the RCA boundary turns south and goes essentially straight to the north east corner of the augmented offgas building. It then turns west, along the north wall of

AOG, just north of the fuel oil tank. Just past the fuel oil tank it turns south again until it turns west at a point where it passes just a few feet south of the boiler house. Past the boiler house and stack fan pad, it turns north and connects to the southeast corner of the reactor building. Essentially, the RCA encompasses an extended area only on the east side of the reactor building, but extended north to include the new radwaste building. Small 'satellite' RCAs are present elsewhere, for example around the outside storage tanks west of the turbine building.

The soil consisted of 14 dump truck loads. Each load appeared to be a few (2-3) cubic yards each. As identified in our letter of September 22, 1999, "These soils were removed from the parking lot and placed back on the Oyster Creek site. Reference 7 is the QA monitoring report that documents this event and includes the soil sample results." The exact location of where the soil was deposited is not documented, however the "Oyster Creek site," as referred to in the QA monitoring report, is the area bounded by the intake/discharge canal and Route 9 highway.

Alpha and beta emitting nuclide analyses are not required by the MARSSIM methodology and has not been conducted. Based on the various waste stream analyses used, the alpha and beta emitters, and the other 'hard-to-detect' nuclides (e.g. from 10CFR61) (e.g. Fe55, Sr/Y90, U234, Pu238, Pu239/240, Pu241, Am241, Cm243, Ni59, Ni63, Tc99, C14) are not expected to contribute more than 3% total all combined to the dose assessment. DG4006 clearly never intended that such analyses be made, since section 2.5.1 expects detection limits 'less than 50% of the DCGLw'. Section 4.7.1 of the MARSSIM expects ''MDC between 10-50% of the DCGL". Even at the most restrictive expectation, the '10%' from the MARSSIM, the hypothetical concentration of the highest contributing 'hard-to-detect' at the firing range would be about 2% of the required MDC. Section 2.9 of DG4006 says ''the presence of nuclides that likely contribute less than 10% of the total effective dose equivalent may be ignored'. DG4006 also says 'When there is a fixed ratio...[such as may be assumed based on the waste stream mix ratio]...Compliance with the radiological criteria for license termination may be demonstrated by comparing the concentration of the single radionuclide that is easiest to measure with its DCGLw."

In addition, recent soil sampling immediately around the Oyster Creek plant for strontium-90 showed 15 of 16 samples less than MDA at less than about 0.02 pCi/gm, and one positive at 0.018 pCi/gm (approximately one-onehundredth of the default DCGLs in our 9/22/99 submittal and approximately one-onethousandth of the DCGL from our RESRAD 5.82 modeling). Given the Cesium content of these 'on-site' soils and the Cs137/Sr90 ratios observed, these on-site strontium results further demonstrate that there is no reasonable expectation for 'hard-to-detects' to be relevant for the class 3 area on the Forked River property.

Question No. 8:

"Historical Site Assessment of the Forked River Site", Attachment 1, Potential Contaminated Areas, page 20: Noble gases were observed in the Switchyard Building through a conduit from the condenser bay which was sealed. Provide information that describes this direct exposure pathway to include the time frame at which this event occurred; the identity of the noble gases with emission types, half-lives, and energies; respective concentrations and submersion dose assessment, the method on how the leak was sealed; and a comprehensive analysis that demonstrates a similar event is unlikely to reoccur following sale of the property to justify that the area is classified as non-impacted.

Response:

The Historical Site Assessment (HSA) notation of a possible release of noble gases via a conduit that connected the Condenser Bay to a structure in the switchyard has not been confirmed by a records search. The notation was based solely on personnel interviews, however we believe the information to be correct. It should be noted that the Condenser Bay is normally maintained under a negative pressure with respect to the environment. Therefore any pathways to the environment would not experience a condition leading to noble gases being released to the environment.

Question No. 9:

"Radiological Scoping Survey of the Forked River Site, Soil Sampling, 1998": Soil samples results, provided in Appendix 1, "Laboratory Reports of Gamma Isotropic Analyses of Soil Samples Collected From the Forked River Site" were analyzed by GPU Environmental Radioactivity Laboratory in Harrisburg, PA, in accordance with GPU's procedures and QA plan. Confirm that the QA plan for the Harrisburg lab has been approved by the NRC and that it meets applicable requirements in 10 CFR Part 50, Appendix B. "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants", otherwise submit the QA plan for review.

Response:

The GPU Environmental Radioactivity Laboratory is a department within GPU Nuclear. Specifically, the Laboratory reports to the Radiological Controls department of TMI-1. Activities are conducted in accordance with the "GPU Nuclear Operational Quality Assurance Plan," which is applicable to TMI-1 and OC. NRC Region I has periodically inspected this facility.

ATTACHMENT 1

GPU NUCLEAR CALCULATION NO. C-2820-99-010

DOSE ASSESSMENT OF RESIDUAL RADIOACTIVITY ON THE FORKED RIVER SITE - DEMONSTRATION PER 10 CFR 20.1402

RADIOLOGICAL ENGINEERING CALCULATION SUMMARY

Form 6630-ADM-4010.02-6 Page 1 of 13

Calculation Title: Dose Assessment of Residual Radioactivity on the Forked River Site - Demonstration per 10CFR20.1402	Rev. No. 0	Calculation No.: 2820-99-010
		ETN: Z99

Objective:

Calculate the dose to a member of the public from residual radioactivity on the backsite using existing computer codes identified for use by the NRC

Method/Assumptions:

The data from the July 1998 scoping survey of the Forked River Site is used as input into the NRC recognized computer code RESRAD and RESRAD-BUILD to calculte doses to the hypothetical resident farmer and the building occupant. Other inputs include selected soil parameters, geometry factors and, waste mix.

References/Equations:

See attached reference list.

Results/Conclusions:

The dose to the resident farmer and the building occupant are both zero as a consequence of the activity on the backsite being undetectable.

Reviewer(s) Comments:	Preparer: William J. Cooper CHP	Date: 08/12/99
	Checker: G. SEALS	Date: 8/16/99
	Manager/Designee: Austin Judson	Date: 8/18/99

Dose Assessment of Residual Radioactivity on the Forked River Site Demonstration per 10CFR20.1402

Calculation number 2820-99-010

Summary:
The Forked River Site (henceforth referred to as the backsite) is expected to be sold in the near future. In order to demonstrate compliance with 10CFR20.1402, surveys which have been performed can be used as source term input in dose assessment. Because the was no residual licensed radioactivity detected on the backsite, dose assessment based on the results of those surveys reveal that the dose to any member of the public from residual radioactivity on the backsite will be zero.

In July of 1998, a survey of the backsite was conducted to evaluate the residual radioactivity which might be present. Historical site assessment had indicated that soils from the Oyster Creek site that contained low levels of licensed radioactive material had been temporarily stored on the backsite (the soils were removed and returned to the Oyster Creek site) at the 'firing range' parking lot. Since this one case was identified, it could be assumed that others may have occurred (although no indication of this exists). Therefore a survey of the grounds of the backsite was conducted (reference 2) by selecting 21 areas that were along roads or otherwise could have been disturbed or where it might have been possible for a similar event to occur. These areas were selected by judgement based on ground reconnoitering. In addition. At each of the 21 areas a portable NaI(Tl) based gamma spectroscopy system was used to take scan surveys and to perform fixed in-situ spectra collections.

One of the areas that was selected was the area that was known to contain the Oyster Creek soils. This area in addition to the scan and gamma spectroscopy, was subjected to 52 additional soil samples.

Since the buildings on the backsite were also being sold, the buildings were also evaluated. Historical site assessment showed some areas of potential interest although no conditions that indicated known contamination were identified. Since people travel back and forth between the two sites, and the potential existed for accumulation of low level activity tracked in on shoes, floor surfaces were surveyed. Also an area where sand blasting of free released equipment had been conducted was identified as an area of potential interest.

None of these areas, including the firing range, was expected to contain licensed activity at even a small fraction of the DCGLs shown in the draft NUREG 1549 that was available at the time of the survey.

Of the 74 soil samples taken, the 21 scan areas (which consisted of a total of 5000 individual gamma spectra), the 21 fixed point in-situ gamma spectra, and the 400,000 individual measurements done of the building surfaces NONE showed any activity attributable to the operations of the Oyster Creek plant. The results of the surveys demonstrate that the survey was conducted in a manner adequate to assess the backsite radiological conditions since in two cases detectable activity consistent with non-licensed activity was easily detected. One soil sample had a positive result for Cs-137 that was consistent with normal environmental concentrations, and one small area on a floor was identified to contain excess K40 by the surface scanning.

Calculations performed using the RESRAD computer code have estimated effective DCGLs for soils (attachments 1, 2, and 3) for the residential farmer scenario and for building surfaces (attachments 4, 5, and 6) for the building occupancy scenario. Given the isotopes which have been evaluated to be possible of interest for the backsite, the survey demonstrates that no activity is present well below those DCGLs.

Since no licensed radioactivity was detected in any of the measurements or samples at detection limits well below the DCGLs, and those measurements and samples were selected to provide reasonable assurance of detection of possible residual radioactivity, the backsite is in compliance with the requirements of 10CFR20.1402 and the possible dose to a member of the public from a building occupancy/renovation scenario or from a resident agricultural scenario is zero.

The survey:
The Forked River Site (also referred to as the 'backsite') is an approximately 650 acre land area which extends from the Oyster Creek intake/discharge canal west to the Garden State Parkway right-of-way. This property at one time was to contain the Forked River Nuclear Generating Station. When that project was cancelled, the license for Forked River was terminated. GPU is currently involved in the sale of this property.

Since the Forked River Site (the 'backsite') is adjacent to Oyster Creek and numerous Oyster Creek related activities are conducted on the baksite, radiological evaluation of the property prior to sale was determined to be prudent . The entire site was, for planning purposes, classified as a 'class 3 impacted area' IAW the MARSSIM (reference 1) process as a result of a historical assessment that indicated that soils that potentially contained low levels of Oyster Creek (OC) plant related activity had been placed there as a result of excavations conducted on the Oyster Creek site.

An extensive scoping survey was planned for the FR site, with survey scope, objectives, and expectations outlined in a formal plan (reference 2). This plan provided details and objectives on numerous aspects of ensuring data quality including sampling schemes, number of samples, measurement scope, equipment sensitivities, QA requirements, and survey location reference systems.

Measurement scope included surface measurement of all accessible floor areas in normal travel areas in the buildings, extensive sampling in the area of the firing range parking area (which had been identified as a location that OC soils had been placed), automated spectroscopic scanning of randomly selected large areas of disturbed soils, automated spectroscopic scanning of the firing range parking area, and in-situ fixed point gamma spectroscopy of areas scanned.

The survey was designed based on the draft guidance then available regarding decommissioning concentration limit criteria (reference 3) and the expectation that the most likely detectable isotope from plant operation would be cobalt-60. Cobalt-60 is typically a low-level contaminant in OC site soils. The only other likely isotope of any interest, cesium-137, is normally present in the environment as a consequence of historical nuclear weapons testing and the Chernobyl accident. Cesium-137, based on the HSA, is not normally present in the plant soils in the absence of cobalt-60. In addition, the reference 3 concentration limit is higher for cesium-137 than for cobalt-60. Therefore, scoping surveys which viewed the wide range of possible isotopes but were focused on the cobalt-60 as a limiting criteria were judged to be most effective.

Reference 3 provided conservative screening values for soil concentrations or building surface activities for plant related isotopes. This screening value for cobalt-60 from reference 3 is 3.68 pCi/gm in soils and 6910 dpm/100cm^2 for building surfaces. All of the sampling and measurements conducted for the backsite scoping survey had detection limits below these criteria.

Soils:

Soil measurements consisted of three separate techniques: gamma spectroscopic based large area scanning, in-situ fixed gamma spectroscopy, and sampling.

Twenty one areas (including the firing range parking lot) totaling 47000 square feet were scanned with a moving gamma spectrometer, resulting on over 5000 individual gamma spectra measurements. The MDA of these measurements was variable due to the variation in naturally occurring nuclides. However, the MDA was as low as 0.8 pCi/gm cobalt-60 (20% of the default concentration guideline then in use) and estimated to not exceed 3.1 pCi/gm (84%). Since this scanning technique is based on multiple gamma spectra, this technique would also identify other plant related isotopes other than cobalt-60 if present at similar detection limits. No detectable activity related to the plant was found using the scanning spectroscopy technique. Results of these surveys are reported in reference 4.

In each of the 21 areas scanned, a fixed point gamma spectrum was also collected. Detection limits for this techniques were substantially lower than those of the scanning system. Detection limits were about 0.2 pCi/gm for cobalt-60 and 0.4 pCi/gm for cesium-137. These detection limits are less than 10% of the concentration guidelines in reference 3. No plant related activity was detected in any of the spectra. Results of these spectra are reported in reference 4.

In each of the 21 areas scanned, plus an additional 52 samples in the firing range parking lot (and one additional sample in a run-off ditch near the firing range), a soil sample consisting of a total of 2 liters of soil was collected. These samples were sent to the GPU Environmental Radioactivity Laboratory and counted by high resolution gamma spectroscopy. These samples were counted with a pre-established criteria that each analysis must achieve a detection limit of 0.1 pCi/gm for cobalt-60. Cesium-137 detection limits therefore varied slightly based on the extent of interference from naturally occurring nuclides. The average detection limit for cesium-137 in all of the samples was about .14 pCi/gm. The average detection limit for the 52 samples from the firing range parking lot was also about .14 pCi/gm. No plant related activity was identified in any of the samples. One sample showed cesium-137 at about 0.11 pCi/gm. This concentration is consistent with normal environmental backgrounds previously identified by the Oyster Creek Radiological Environmental Monitoring Program. Results of the samples are shown in reference 5.

Following completion of the surveys, sample results from soils at the firing range parking lot from 1990 were obtained. These samples show cobalt-60 at about 0.2 pCi/gm and cesium-137 on the order of 0.3 pCi/gm in samples collected at that time.

Building Surfaces:

Seventeen areas in 11 FR site buildings were surveyed in normally accessible areas using a position sensitive large area beta proportional counting system. These 17 areas totaled more than 11000 square feet and more than 400,000 individual measurements were collected on that area. The surface measurement system was capable of detecting less than the reference 3 surface contamination limit on a $100cm^2$ basis. No plant related activity was found in these extensive measurements. One area with activity slightly above the reference 3 limit was easily detected that contained only naturally occurring potassium-40. The detection of this small spot of low activity clearly demonstrates the capabilities of the survey system.

Based on the results of the HSA and the extensive surveys and sampling of the Forked River site soils and buildings, the property, with the exception of the firing range parking lot, is assessed to be non-impacted. No plant related radioactivity could be identified in the surveys conducted.

Because the firing range parking lot was identified in the HSA to have previously contained plant related radioactivity, it is classified as a class 3 impacted area. However, the results of the scoping survey, due to the extent and detection quality of the survey, are sufficient to demonstrate that the area is suitable for release. No plant related nuclides could be detected with spectroscopic scanning, fixed in-situ spectroscopy and extensive sampling with laboratory spectroscopy. Reference 1 explains that class 3 impacted areas should be evaluated using a combination of gross scanning and judgmental sampling. In the case of the firing range, the scanning conducted consisted of a much more precise, spectroscopic scanning technique. The sampling was sufficiently extensive, being a sample in each of fifty-two 20 foot by 20 foot grids plus a sample in a run-off ditch, to provide assurance that the sampling was appropriate based on the judgmental nature of the class 3 survey recommendations.

Oyster Creek environmental detection limits do not specify a limit for cobalt-60, but a limit of 0.18 pCi/gm is specified for cesium-137. Soils released from Oyster Creek are therefore analyzed by gamma spectroscopy to a detection limit of 0.18 pCi/gm or less of cesium-137. Resultant detection limits for cobalt-60 are normally slightly lower. As stated above, the average detection limit for the 52 samples was about 0.14 pCi/gm. A few of these samples had detection limits for cesium-137 slightly above the 0.18 pCi/gm criterion. However, the extensive sampling provides assurance that the results of the soil measurements and samples from the firing range parking lot are fully consistent with the detection limits needed for dose assessment of the site.

Dose Calculations/DCGLs:

Dose calculations to potentially exposed members of the public were performed using the DOE computer codes RESRAD and RESRAD-BUILD by calculating the dose from a unit activity on building surfaces (1 pCi/m^2) or in soil(1 pCi/gm) and then calculating a 25 mrem DCGL based on the results of the unit activity.

Soils:

Calculations (attachments 1, 2, and 3) were performed on 22 isotopes which are either known to be present in typical licensed activity mixes or are required to be evaluated for shipping purposes (10CFR61) but are not typically present and have half-lives greater than a half-year. These isotopes were: Ag110m, C14, Ce144, Co57, Co60, Cs134, Cs137, Fe55, H3, I129, Mn54, Ni59, Ni63, Sr90, Tc99, Zn65, Am241, Cm243, Pu238, Pu239, Pu241, and U234. Some of these isotopes (C14, I129, Tc99) are not currently found in the Oyster Creek waste streams (attachments 9, 10, 11, and 12). However, they are included because they are considered to be important dose contributors in the waste disposal context of 10CFR61 for waste classification if they were present.

All of the normal resident farmer scenarios present in the RESRAD model were used in the calculations. Several of the default RESRAD parameters were changed in order to improve the modeling of the backsite and are listed below:

1) The contaminated area was changed to approximate 700 acres (2.6E6 m^2, default 10000)
2) The contaminated zone thickness was changed to 30 cm, which is more likely than the 2 m default (based on the supposition that soils would have been transported to the backsite by the truckload and spread out on the surface)
3) The length parallel to the aquifer flow was changed to 1000 m from the default of 100 m because of the actual size and shape of the backsite and the aquifer flow direction
4) The distribution coefficients (Kd) were changed for each isotope from the various RESRAD defaults. These were changed because data is available on Kds specifically for sandy soil types (reference 6, attachment 13) so these data were used.
5) The saturated zone hydraulic conductivity was changed from 100 to 4930 based on the tables in section E of the RESRAD manual (reference 7, attachment 14)
6) The 'b' parameter was changed to 4.38 from the default of 5.3 per reference 7
7) The saturated zone effective porosity was changed to .3 from the default of .2 per reference 7.

The results of the RESRAD calculations are as follows (25 mrem each):

Isotope	DCGL (pCi/gm)	Isotope	DCGL (pCi/gm)
Ag110m	2.44	C14	0.92
Ce144	131	Co57	81.4
Co60	2.60	Cs134	4.20
Cs137	11.1	Fe55	5.64E4
H3	1380	I129	1.95
Mn54	8.15	Ni59	2.59E4
N63	9420	Sr90	12.0
Tc99	111	Zn65	7.55
Pu238	106	Pu239	96.1
Pu241	3200	U234	98.0
Am241	86.8	Cm243	47.4

The soils deposited on the firing range in 1990 and subsequently removed were known to contain low levels (less than 10% of the DCGLs) of Cs137 and Co60 at that time. Waste stream analyses done for radwaste shipping purposes were used to evaluate whether other isotopes would also be of interest based on possibility to be present and dose contribution. In order to assess this, the 1998 10CFR61 analysis (attachments 9 and 10), a waste mix from 1982 (attachments 11 and 12) decayed 20 years and the 1998 mix decayed by 20 years was used to evaluate the relative contribution from the common gamma emitting nuclides and the 'hard to detect' isotopes listed in 10CFR61.

The % abundance in the mix (or decayed mix) was divided by the DCGL to provide a DCGL weighted contribution from each isotope. This was adjusted to % contribution and then converted to the fraction of the 25 mrem limit. This yields the dose contribution from each isotope if it is assumed that each isotope is actually present in a mix at the abundances from the waste mix analysis so that the total dose is 25 mrem (attachment 8). This is NOT the actual dose calculation for the backsite but is a demonstration only of the relative importance to the dose assessment of each isotope if present at the ratios in the assumed mix.

For the 1998 mix, the Co60 was 85.2% of the dose (21.3 mrem), Cs137 was 7.3%(1.8 mrem), Ag110m was 4.7%(1.2 mrem), Mn54 was 1.8%(0.45 mrem), and all the remaining 18 isotopes evaluated totaled about 1%(0.24 mrem). For the 1998 mix decayed 20 years, which is intended to represent the current contamination conditions if the 1998 mix had been placed in the soil 20 years ago, the Co60 was 56.6% of the dose (14.2 mrem), Cs137 was 42.7%(10.7 mrem), and all the remaining 20 isotopes evaluated totaled less than 1%(0.18 mrem). For the 1982 mix decayed 20 years, which is intended to represent the current contamination conditions if the 1982 mix had been placed in the soil 20 years ago, the Co60 was 50.8% of the dose (12.7 mrem), Cs137 was 46.7%(11.7 mrem), and all the remaining 20 isotopes evaluated totaled less than 3%(0.60 mrem).

From this analysis it can be seen that the readily detectable gamma emitting isotopes completely dominate the dose assessment, even with the assumption that the isotopic mix in the contamination in the soil is consistent with the waste streams. Therefore, because of the negligible contributions from all of the other isotopes for which DCGLs were calculated they are not important to the dose assessment and can be neglected (e.g. 10CFR20.1204g) in the dose assessment and that dose assessment based only on gamma analysis (and specifically only Cs137 and Co60) will be within a very few percent of any assessment that would be done if additional difficult and costly analyses were done for the remaining isotopes listed above.

The soil samples and in-situ fixed point gamma spectra both demonstrate that the activity in the soils on the backsite is non-detectable for Cs137 and Co60 at concentrations well below the DCGLs. The detection limits for the 74 soil samples were 0.1 pCi/gm(4% of the DCGL) for Co60 and averaged 0.14 pCi/gm(1% of the DCGL) for Cs137. No plant related activity was detected in any of the spectra. One sample showed 0.11 pCi/gm of Cs137. This value is completely consistent with normal environmental concentrations typically detected in the REMP soil sampling (last conducted in1994).

In each of the 21 areas scanned, a fixed point gamma spectrum was also collected. Detection limits for this techniques were substantially lower than those of the scanning system. Detection limits were about 0.2 pCi/gm for cobalt-60 and 0.4 pCi/gm for cesium-137. These detection limits are less than 10% of the concentration guidelines. No plant related activity was detected in any of the spectra.

The MDA for the mobile scanning measurements was variable due to the variation in naturally occurring nuclides. However, the MDA was as low as 0.8 pCi/gm cobalt-60 (30% of the newly calculated DCGLs listed above) and estimated to not exceed 3.1 pCi/gm (120%). Detection of the DCGLw is not required for MARSSIM class 3 scanning. In addition and as noted previously, the survey was designed based on the draft default DCGLs in the draft NUREG 1549 which were higher than those calculated here. The scan measurements all had MDAs below the DCGLs in use at the time of the measurements. Since this scanning technique is based on multiple gamma spectra, this technique would also identify other plant related isotopes other than cobalt-60 if present at similar detection limits. No detectable activity related to the plant was found using the scanning spectroscopy technique.

In summary, DCGLs were developed on an isotope unit activity basis for a mix of isotopes which could reasonably be postulated to be of interest based on historical waste stream sampling. Using these DCGLs and the isotopic ratios from those waste streams, it has been shown that Cs137 and Co60, even after long periods of decay and using mixes from earlier in the plant operational history, sufficiently dominate the dose assessment that the remaining isotopes can be eliminated from consideration. The sampling and scanning of the backsite conducted in July of 1998 was consistent with expectations in MARSSIM for non-impacted (the majority of the site) and class 3 impacted (the firing range parking lot) areas. That survey shows that there is no licensed radioactivity present on the backsite to detection limits at a small fraction of the DCGLs. Therefore, per 10CFR20.1402, the dose assessment of the backsite soils, using the resident intruder agriculture scenario with site specific soil and geometry factors in the RESRAD code is zero.

Building surfaces:

Calculations were performed on 22 isotopes which are either known to be present in typical licensed activity mixes or are required to be evaluated for shipping purposes (10CFR61) but are not present (attachments 9 and 10) and have half lives greater than one-half year. These isotopes were: Ag110m, C14, Ce144, Co57, Co60, Cs134, Cs137, Fe55, H3, I129, Mn54, Ni59, Ni63, Sr90, Tc99, Zn65, Am241, Cm243, Pu238, Pu239, Pu241, and U234. Some of these isotopes (C14, I129, Tc99) are not currently found in the Oyster Creek waste streams. However, they are included because they are considered to be important dose contributors in the context of 10CFR61 for waste classification if they were present.

The normal RESRAD-BUILD scenarios were used in the calculations (attachments 4, 5, and 6). The receptor and source construction is listed below:

A single source representing the floor of a 30 m by 50 m building was used.
The area of the source and of the building was defined as 1500 m^2. This is a highly conservative assumption, since those buildings would probably be segmented into separte areas, as they are now.
The room height was set to 3 meters to represent the typical building on the backsite.
No sources were used on the walls or ceilings. No liquid spills or airborne events are credible or were identified in the Historical Site Assessment. For purposes of developing a credible scenario, it is assumed that some contamination of the floor surfaces could have occurred by gradual accumulation over the years of use from workers exiting the plant and then going into buildings on the backsite. It is supposed that some very-low level, undetectable with typical release monitors, activity could scrape off shoes and accumulate. Therefore, the room is modeled with contamination only on the floor.
A single receptor is used, located at the center of the building. Since no wall sources are used, the center of the floor source should maximize the dose consequences.

The results of the RESRAD-BUILD calculations are as follows (25 mrem each)

Isotope	DCGL (dpm/100cm^2)	Isotope	DCGL (dpm/100cm^2)
Ag110m	12000	C14	1.8E7
Ce144	210000	Co57	310000
Co60	13000	Cs134	21000
Cs137	54000	Fe55	4.1E7
H3	5.6E8	I129	120000
Mn54	39000	Ni59	4.3E7
Ni63	1.8E7	Sr90	81000
Tc99	1.2E7	Zn65	58000
Pu238	350	Pu239	320
Pu241	17000	U234	1100
Am241	310	Cm243	460

Waste stream analyses done for radwaste shipping purposes were used to evaluate which isotopes would also be of interest based on possibility to be present and dose contribution. In order to assess this, the 1998 10CFR61 (attachments 9 and 10) and the 1998 mix decayed by 20 years was used to evaluate the relative contribution from the common gamma emitting nuclides and the 'hard to detect' isotopes listed in 10CFR61. Based upon the results form the soil analysis the 1982 mix was sufficiently similar to not be reevaluated for the building surfaces.

The percent abundance in the mix (or decayed mix) was divided by the DCGL to provide a DCGL weighted contribution from each isotope. A 'beta factor' is applied which is a gross estimate of the detectability of the radiation from the isotope by a typical beta sensitive detector. This result was adjusted to % contribution and then converted to the fraction of the 25 mrem limit. This fraction is then used to weight the individual isotope DCGLs. These are then summed to produce a weighted effective DCGL (attachment 7). This is NOT the actual dose calculation for the backsite buildings but is a demonstration only of the relative importance to the dose assessment of each isotope and an estimate of the gross beta surrogate DCGL.

The effective gross beta DCGL is calculated to be 16000 dpm/100cm^2 with no decay and 19000 dpm/100cm^2 with 5 years of decay applied to the mix. Additional decay continues to increase the effective gross beta DCGL. This is because the Co60 and Ag110m with the lowest individual DCGLs decay off faster than the Cs137, Sr90 etc which have higher DCGLs.

Alpha DCGLs are shown to be about one-fiftieth of the lowest beta DCGL. Isotopic ratios in typical waste mixes and observed isotopic ratios in the plant show that alpha activity never approaches this ratio. Typically, beta to alpha ratios exceed 2000. If waste mixes are decayed 20 years, the beta to alpha ratio still does not approach the ratio of the DCGLs. In addition, where the lowest ratios are observed in the plant (typically beta to alpha ratios of about 400) these are associated with old, isolated activity where the cobalt has decayed and the alpha has not, such as overhead contamination in partially abandoned areas of Old RadWaste. Thus, even long decay periods of decay do not change the beta to alpha ratios enough to make alpha contamination a limiting issue in surveys of building surfaces. Therefore, surveys which readily detect the beta DCGLs will assure that no alpha is present which would contribute to the dose assessment.

Seventeen floor/surface areas in 11 backsite buildings were surveyed in normally accessible areas using a position sensitive large area beta proportional counting system. These 17 areas totaled more than 11000 square feet and more than 400,000 individual measurements were collected on that area. The surface measurement system was capable of detecting substantially less than the gross beta DCGL surface contamination limit on a 100cm^2 basis. No plant related activity was found in these extensive measurements. One area with activity at less than the current gross beta DCGL shown above was easily detected that contained only naturally occurring potassium-40. The detection of this small spot of low activity clearly demonstrates the capabilities of the survey system.

In summary, DCGLs were developed on an isotope unit activity basis for a mix of isotopes which could reasonably be postulated to be of interest based on historical waste stream sampling. Using these DCGLs and the isotopic ratios from those waste streams, it has been shown that gross beta measurements, even after long periods of decay, sufficiently dominate the dose assessment that the remaining isotopes can be eliminated from consideration. The surface measurements of the backsite buildings conducted in July of 1998 was consistent with expectations in MARSSIM for non-impacted (none of the buildings are impacted) areas. That survey shows that there is no licensed radioactivity present on the backsite to detection limits at a fraction of the DCGLs. Therefore, per 10CFR20.1402, the dose assessment of the backsite soils, using the building occupancy scenarios with site specific geometry factors in the RESRAD-BUILD code is zero.

MARSSIM:

The methodology in MARSSIM (reference 1) provides specific recommendations on surveys to be conducted for release of licensed areas / facilities. Inherent in that process is the development of a classification of the areas based on the history and potential contamination that might be present. In order to develop that classification, Historical Site Assessment (HSA) is conducted and scoping surveys may be performed in order to frame the decision.

As a part of the process leading to the eventual sale of the backsite property, GPU, in July of 1998, conducted a scoping survey of the backsite. Initial survey scope was designed to evaluate the classification of the backsite. Initially for purposes of the survey design the entire backsite was classified as a class 3 area. However, the HSA indicated that the actual class 3 area was likely limited to the firing range parking lot area. The survey was also designed to apply as a final survey if results allowed by including basic MARSSIM requirements.

Twenty survey areas on the backsite (not including the firing range parking lot) of about 240 square meters each were surveyed by 1) scanning gamma spectroscopy, fixed point in-situ gamma spectroscopy, and 3) a surface soil sample. Use of the MARSSIM sample number tools would suggest that 15 samples was sufficient for a final status survey for a class 3 area. In addition, scan areas are judgmental for class 3 and it is recommended that scan areas be biased to areas most likely to contain areas of activity (chapter 2.5.3). There is no specific requirement for percent scan coverage for class 3 areas.

The firing range parking lot, which the HSA identified as the most likely to be impacted was surveyed by 1) scanning gamma spectroscopy of 240 square meters (about 25%), fixed point in-situ gamma spectroscopy, and 3) 52 surface soil samples. Use of the MARSSIM sample number tools would suggest that 15 samples was sufficient for a final status survey for a class 3 area. In addition, scan areas are judgmental for class 3 and it is recommended that scan areas be biased to areas most likely to contain areas of activity (chapter 2.5.3). There is no specific requirement for percent scan coverage for class 3 areas.

Detection limits for the surface scanning were about equal to the DCGL calculated above. MARSSIM suggests that meeting the DCGLw for scans is not required but any detected activity should be investigated. Detection limits for the in-situ gamma spectroscopy were well below the DCGLs. Detection limits for the floor scanning was also well below the DCGLs. Therefore, the detection capability of the survey techniques, the number of samples, the scanned area, and the scan locations for both the firing range parking lot and the remainder of the backsite are fully consistent with recommendations in MARSSIM.

HSA:

The HSA was conducted predominantly before the conduct of the survey. Collection of HSA related information continued after the conduct of the survey as well. Interviews with employees, review of employee records and other data searches, a review of uses of the backsite, a review of the licensing history of the backsite, and a physical inspection of the site were used to assess the possible condition of the backsite with respect to licensed radioactive material being on the backsite.

The HSA identified that small sealed sources were used in some buildings as training aids, that sand blasting of 'free released' equipment had been performed, and that several truckloads of soil from the Oyster Creek site had been temporarily placed on the backsite.

These locations were therefore specifically targeted in both the building and the land surveys.

References:

1) NUREG 1575 "MARSSIM"
2) 2870-PLN-4520.02 "Radiological Scoping Survey of the Forked River Site"
3) NUREG 1549 summer 1998 draft
4) "Forked River Site Scoping Survey Final Report"
5) "Radiological Scoping Survey of the Forked River Site Soil Sampling 1998"
6) "Default Soil Solid/Liquid Partition Coefficients, Kds, For Four Major Soil Types: A Compendium", Sheppard, M.I. and Thibault, D.H. Health Physics V59No.4
7) "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD, Version 5.0 – working draft – ANL/EAD/LD-2 Yu, C. et. al.
8) "RESRAD-BUILD: Acomputer model for Analyzing the Radiological Doses Resulting from the Remediation and Occupancy of Buildings Contaminated with Radioactive Material" Nov. 1994, ANL/EAD/LD-3 Yu, C. et. al.

Attachments:

1) RESRAD output report file: FRFP.RAD – soil pathways dose calculations for the fission products in the selected mix
2) RESRAD output report file: FRUPU.RAD – soil pathways dose calculations for the Uranium and Plutoniums in the selected mix
3) RESRAD output report file: FRAMCM.RAD – soil pathways dose calculations for Americium and Curium fission products in the selected mix
4) RESRAD-BUILD output report file: FRROOM1A.INP – building dose calculations for a portion of the fission products in the mix
5) RESRAD-BUILD output report file: FRROOM1.INP – building dose calculations for the remainder of the fission products in the mix
6) RESRAD-BUILD output report file: FRROOM1P.INP – building dose calculations for the transuranics in the mix
7) Spreadsheet of RESRAD-BUILD results showing evaluation of gross beta DCGL, alpha DCGLs and decay adjustment of the beta DCGLs. Number and formula views.
8) Spreadsheet showing relative contribution to total dose from the isotopes in the mix and effect of decay adjustment. Numerical and formula views.
9) 1998 filter sludge 10CFR61 analysis results
10) 1998 resin 10CFR61 analysis results
11) 1982 filter sludge waste mix
12) 1982 concentrates waste mix
13) pages from reference 6
14) pages from reference 7

Attachment 1
RESRAD output for
soil doses - Fission Products

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
	Dose conversion factors for inhalation, mrem/pCi:			
	Ag-110m+D	8.030E-05	8.030E-05	DCF2(1)
	C-14	2.090E-06	2.090E-06	DCF2(2)
	Ce-144+D	3.740E-04	3.740E-04	DCF2(3)
	Co-57	9.070E-06	9.070E-06	DCF2(4)
	Co-60	2.190E-04	2.190E-04	DCF2(5)
	Cs-134	4.630E-05	4.630E-05	DCF2(6)
	Cs-137+D	3.190E-05	3.190E-05	DCF2(7)
	Fe-55	2.690E-06	2.690E-06	DCF2(8)
	H-3	6.400E-08	6.400E-08	DCF2(9)
	I-129	1.740E-04	1.740E-04	DCF2(10)
	Mn-54	6.700E-06	6.700E-06	DCF2(11)
	Ni-59	2.700E-06	2.700E-06	DCF2(12)
	Ni-63	6.290E-06	6.290E-06	DCF2(13)
	Sr-90+D	1.810E-03	1.810E-03	DCF2(14)
	Tc-99	8.330E-06	8.330E-06	DCF2(15)
	Zn-65	2.040E-05	2.040E-05	DCF2(16)
	Dose conversion factors for ingestion, mrem/pCi:			
	Ag-110m+D	1.080E-05	1.080E-05	DCF3(1)
	C-14	2.090E-06	2.090E-06	DCF3(2)
	Ce-144+D	2.110E-05	2.110E-05	DCF3(3)
	Co-57	1.180E-06	1.180E-06	DCF3(4)
	Co-60	2.690E-05	2.690E-05	DCF3(5)
	Cs-134	7.330E-05	7.330E-05	DCF3(6)
	Cs-137+D	5.000E-05	5.000E-05	DCF3(7)
	Fe-55	6.070E-07	6.070E-07	DCF3(8)
	H-3	6.400E-08	6.400E-08	DCF3(9)
	I-129	2.760E-04	2.760E-04	DCF3(10)
	Mn-54	2.770E-06	2.770E-06	DCF3(11)
	Ni-59	2.100E-07	2.100E-07	DCF3(12)
	Ni-63	5.770E-07	5.770E-07	DCF3(13)
	Sr-90+D	1.530E-04	1.530E-04	DCF3(14)
	Tc-99	1.460E-06	1.460E-06	DCF3(15)
	Zn-65	1.440E-05	1.440E-05	DCF3(16)
-34	Food transfer factors:			
-34	Ag-110m+D, plant/soil concentration ratio, dimensionless	1.500E-01	1.500E-01	RTF(1,1)
-34	Ag-110m+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-03	3.000E-03	RTF(1,2)
-34	Ag-110m+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.600E-02	2.600E-02	RTF(1,3)
-34				
-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(2,1)
-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(2,2)
-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(2,3)
-34				
-34	Ce-144+D , plant/soil concentration ratio, dimensionless	2.000E-03	2.000E-03	RTF(3,1)
-34	Ce-144+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(3,2)
-34	Ce-144+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-05	3.000E-05	RTF(3,3)
-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
4	Co-57 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(4,1)
4	Co-57 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(4,2)
4	Co-57 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(4,3)
4				
4	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(5,1)
4	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(5,2)
4	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(5,3)
4				
4	Cs-134 , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(6,1)
4	Cs-134 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(6,2)
4	Cs-134 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(6,3)
4				
-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(7,1)
-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(7,2)
-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(7,3)
-34				
-34	Fe-55 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
-34	Fe-55 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(8,2)
-34	Fe-55 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(8,3)
-34				
-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E-00	4.800E-00	RTF(9,1)
-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(9,2)
-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(9,3)
-34				
-34	I-129 , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(10,1)
-34	I-129 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	7.000E-03	7.000E-03	RTF(10,2)
-34	I-129 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(10,3)
-34				
-34	Mn-54 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(11,1)
-34	Mn-54 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-04	5.000E-04	RTF(11,2)
-34	Mn-54 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(11,3)
-34				
-34	Ni-59 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(12,1)
-34	Ni-59 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(12,2)
-34	Ni-59 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(12,3)
-34				
-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(13,1)
-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(13,2)
-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(13,3)
-34				
-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(14,1)
-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(14,2)
-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(14,3)
-34				
-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E-00	5.000E-00	RTF(15,1)
-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(15,3)
-34				
-34	Zn-65 , plant/soil concentration ratio, dimensionless	4.000E-01	4.000E-01	RTF(16,1)
-34	Zn-65 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-01	1.000E-01	RTF(16,2)
-34	Zn-65 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(16,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

Rn	Parameter	Current Value	Default	Parameter Name
-5	Bioaccumulation factors, fresh water, L/kg:			
-5	Ag-110m+D, fish	5.000E-01	5.000E-01	BIOFAC(1,1)
-5	Ag-110m+D, crustacea and mollusks	7.700E-02	7.700E-02	BIOFAC(1,2)
-5				
-5	C-14 , fish	5.000E-04	5.000E-04	BIOFAC(2,1)
-5	C-14 , crustacea and mollusks	9.100E-03	9.100E-03	BIOFAC(2,2)
-5				
-5	Ce-144+D , fish	3.000E-01	3.000E-01	BIOFAC(3,1)
-5	Ce-144+D , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(3,2)
-5				
-5	Co-57 , fish	3.000E-01	3.000E-02	BIOFAC(4,1)
-5	Co-57 , crustacea and mollusks	2.000E-02	2.000E-02	BIOFAC(4,2)
-5				
-5	Co-60 , fish	3.000E-02	3.000E-02	BIOFAC(5,1)
-5	Co-60 , crustacea and mollusks	2.000E-02	2.000E-02	BIOFAC(5,2)
-5				
-5	Cs-134 , fish	4.000E-03	4.000E-03	BIOFAC(6,1)
-5	Cs-134 , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(6,2)
-5				
-5	Cs-137+D , fish	4.000E-03	4.000E-03	BIOFAC(7,1)
-5	Cs-137+D , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(7,2)
-5				
-5	Fe-55 , fish	2.000E-02	2.000E-02	BIOFAC(8,1)
-5	Fe-55 , crustacea and mollusks	3.200E-03	3.200E-03	BIOFAC(8,2)
-5				
-5	H-3 , fish	1.000E-00	1.000E-00	BIOFAC(9,1)
-5	H-3 , crustacea and mollusks	1.000E-00	1.000E-00	BIOFAC(9,2)
-5				
-5	I-129 , fish	4.000E-01	4.000E-01	BIOFAC(10,1)
-5	I-129 , crustacea and mollusks	5.000E-01	5.000E-00	BIOFAC 10,2)
-5				
-5	Mn-54 , fish	4.000E-02	4.000E-02	BIOFAC(11,1)
-5	Mn-54 , crustacea and mollusks	9.000E-04	9.000E-04	BIOFAC(11,2)
-5				
-5	Ni-59 , fish	1.000E-02	1.000E-02	BIOFAC(12,1)
-5	Ni-59 , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(12,2)
-5				
-5	Ni-63 , fish	1.000E-02	1.000E-02	BIOFAC(13,1)
-5	Ni-63 , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(13,2)
-5				
-5	Sr-90+D , fish	6.000E-01	6.000E-01	BIOFAC(14,1)
-5	Sr-90+D , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(14,2)
-5				
-5	Tc-99 , fish	2.000E-01	2.000E-01	BIOFAC(15,1)
-5	Tc-99 , crustacea and mollusks	5.000E-00	5.000E+00	BIOFAC(15,2)
-5				
-5	Zn-65 , fish	1.000E-03	1.000E+03	BIOFAC(16,1)
-5	Zn-65 , crustacea and mollusks	1.000E-04	1.000E+04	BIOFAC(16,2)

Site-Specific Parameter Summary

	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
011	Area of contaminated zone (m**2)	1.000E+06	1.000E+04	---	AREA
011	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICK0
011	Length parallel to aquifer flow (m)	1.000E+03	1.000E+02	---	LCZPAR
011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E-01	---	BRDL
011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
012	Initial principal radionuclide (pCi/g): Ag-110m	1.000E-00	0.000E+00	---	S1(1)
012	Initial principal radionuclide (pCi/g): C-14	1.000E-00	0.000E+00	---	S1(2)
012	Initial principal radionuclide (pCi/g): Ce-144	1.000E-00	0.000E+00	---	S1(3)
012	Initial principal radionuclide (pCi/g): Co-57	1.000E-00	0.000E+00	---	S1(4)
012	Initial principal radionuclide (pCi/g): Co-60	1.000E-00	0.000E+00	---	S1(5)
012	Initial principal radionuclide (pCi/g): Cs-134	1.000E-00	0.000E+00	---	S1(6)
012	Initial principal radionuclide (pCi/g): Cs-137	1.000E-00	0.000E+00	---	S1(7)
012	Initial principal radionuclide (pCi/g): Fe-55	1.000E-00	0.000E+00	---	S1(8)
012	Initial principal radionuclide (pCi/g): H-3	1.000E-00	0.000E+00	---	S1(9)
012	Initial principal radionuclide (pCi/g): I-129	1.000E-00	0.000E+00	---	S1(10)
012	Initial principal radionuclide (pCi/g): Mn-54	1.000E-00	0.000E+00	---	S1(11)
012	Initial principal radionuclide (pCi/g): Ni-59	1.000E-00	0.000E+00	---	S1(12)
012	Initial principal radionuclide (pCi/g): Ni-63	1.000E-00	0.000E+00	---	S1(13)
012	Initial principal radionuclide (pCi/g): Sr-90	1.000E-00	0.000E+00	---	S1(14)
012	Initial principal radionuclide (pCi/g): Tc-99	1.000E-00	0.000E+00	---	S1(15)
012	Initial principal radionuclide (pCi/g): Zn-65	1.000E-00	0.000E+00	---	S1(16)
R012	Concentration in groundwater (pCi/L): Ag-110m	not used	0.000E-00	---	W1(1)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ce-144	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Co-57	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Cs-134	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E-00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Fe-55	not used	0.000E-00	---	W1(8)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E-00	---	W1(9)
R012	Concentration in groundwater (pCi/L): I-129	not used	0.000E-00	---	W1(10)
R012	Concentration in groundwater (pCi/L): Mn-54	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Ni-59	not used	0.000E-00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E-00	---	W1(14)
R012	Concentration in groundwater (pCi/L): Tc-99	not used	0.000E-00	---	W1(15)
R012	Concentration in groundwater (pCi/L): Zn-65	not used	0.000E-00	---	W1(16)
R013	Cover depth (m)	0.000E-00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
13	Density of contaminated zone (g/cm**3)	1.500E-00	1.500E-00	---	DENSCZ
13	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
13	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
13	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
13	Contaminated zone hydraulic conductivity (m/yr)	1.000E-01	1.000E-01	---	HCCZ
13	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
13	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
13	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
13	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
13	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
13	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
13	Irrigation mode	overhead	overhead	---	IDITCH
13	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
13	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
13	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
14	Density of saturated zone (g/cm**3)	1.500E-00	1.500E-00	---	DENSAQ
14	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
14	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
14	Saturated zone hydraulic conductivity (m/yr)	1.000E-02	1.000E-02	---	HCSZ
14	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
14	Saturated zone b parameter	5.300E-00	5.300E+00	---	BSZ
14	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
14	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
14	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
14	Well pumping rate (m**3/yr)	2.500E-02	2.500E-02	---	UW
15	Number of unsaturated zone strata	1	1	---	NS
15	Unsat. zone 1, thickness (m)	4.600E-00	4.000E-00	---	H(1)
15	Unsat. zone 1, soil density (g/cm**3)	1.500E-00	1.500E+00	---	DENSUZ(1)
15	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
15	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
15	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
15	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E-01	1.000E+01	---	HCUZ(1)
16	Distribution coefficients for Ag-110m				
16	Contaminated zone (cm**3/g)	9.000E+01	0.000E+00	---	DCNUCC(1)
16	Unsaturated zone 1 (cm**3/g)	9.000E+01	0.000E+00	---	DCNUCU(1,1)
16	Saturated zone (cm**3/g)	9.000E+01	0.000E+00	---	DCNUCS(1)
16	Leach rate (/yr)	0.000E-00	0.000E+00	1.833E-01	ALEACH(1)
16	Solubility constant	0.000E-00	0.000E-00	not used	SOLUBK(1)
16	Distribution coefficients for C-14				
16	Contaminated zone (cm**3/g)	5.000E-00	0.000E+00	---	DCNUCC(2)
16	Unsaturated zone 1 (cm**3/g)	5.000E-00	0.000E+00	---	DCNUCU(2,1)
16	Saturated zone (cm**3/g)	5.000E-00	0.000E+00	---	DCNUCS(2)
16	Leach rate (/yr)	0.000E-00	0.000E+00	2.131E-01	ALEACH(2)
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK(2)

Site-Specific Parameter Summary (continued)

#	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
6	Distribution coefficients for Ce-144				
6	Contaminated zone (cm**3/g)	5.000E+02	1.000E+03	---	DCNUCC(3,
6	Unsaturated zone 1 (cm**3/g)	5.000E+02	1.000E+03	---	DCNUCU(3,1)
6	Saturated zone (cm**3/g)	5.000E+02	1.000E+03	---	DCNUCS(3,
6	Leach rate (/yr)	0.000E+00	0.000E+00	2.221E-03	ALEACH(3
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3,
6	Distribution coefficients for Co-57				
6	Contaminated zone (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCC(4
6	Unsaturated zone 1 (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCU(4,1)
6	Saturated zone (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCS(4
6	Leach rate (/yr)	0.000E+00	0.000E+00	1.848E-02	ALEACH(4
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4,
6	Distribution coefficients for Co-60				
6	Contaminated zone (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCC(5,
6	Unsaturated zone 1 (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCU(5,1)
6	Saturated zone (cm**3/g)	6.000E-01	1.000E-03	---	DCNUCS(5
6	Leach rate (/yr)	0.000E+00	0.000E+00	1.848E-02	ALEACH(5
6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5
016	Distribution coefficients for Cs-134				
016	Contaminated zone (cm**3/g)	2.800E+02	1.000E+03	---	DCNUCC(6,
016	Unsaturated zone 1 (cm**3/g)	2.800E+02	1.000E+03	---	DCNUCU(6,1)
016	Saturated zone (cm**3/g)	2.800E+02	1.000E+03	---	DCNUCS(6,
016	Leach rate (/yr)	0.000E+00	0.000E+00	3.965E-03	ALEACH(6
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6
016	Distribution coefficients for Cs-137				
016	Contaminated zone (cm**3/g	2.800E+02	1.000E+03	---	DCNUCC(7,
016	Unsaturated zone 1 (cm**3/g)	2.800E+02	1.000E+03	---	DCNUCU(7,1)
016	Saturated zone (cm**3/g)	2.800E+02	1.000E+03	---	DCNUCS(7,
016	Leach rate (/yr)	0.000E+00	0.000E+00	3.965E-03	ALEACH(7)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7,
016	Distribution coefficients for Fe-55				
016	Contaminated zone (cm**3/g)	2.200E+02	1.000E+03	---	DCNUCC(8)
016	Unsaturated zone 1 (cm**3/g)	2.200E+02	1.000E+03	---	DCNUCU(8,1)
016	Saturated zone (cm**3/g)	2.200E+02	1.000E+03	---	DCNUCS(8
016	Leach rate (/yr)	0.000E+00	0.000E+00	5.046E-03	ALEACH(8,
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
016	Distribution coefficients for H-3				
016	Contaminated zone (cm**3/g)	6.000E-02	0.000E+00	---	DCNUCC(9)
016	Unsaturated zone 1 (cm**3/g)	6.000E-02	0.000E+00	---	DCNUCU(9,1)
016	Saturated zone (cm**3/g)	6.000E-02	0.000E+00	---	DCNUCS(9)
016	Leach rate (/yr)	0.000E+00	0.000E+00	4.056E-00	ALEACH(9)
016	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK(9)

Site-Specific Parameter Summary (continued)

#	Parameter	User Input	Default	Used by RESRAD (If different from User Input)	Parameter Name
16	Distribution coefficients for I-129				
16	Contaminated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCNUCC(10,
16	Unsaturated zone 1 (cm**3/g)	1.000E-01	1.000E-01	---	DCNUCU(10,1
16	Saturated zone (cm**3/g)	1.000E-01	1.000E-01	---	DCNUCS(10,
16	Leach rate (/yr)	0.000E+00	0.000E+00	9.153E-01	ALEACH(10)
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10,
16	Distribution coefficients for Mn-54				
16	Contaminated zone (cm**3/g)	5.000E-01	2.000E+02	---	DCNUCC(11
16	Unsaturated zone 1 (cm**3/g)	5.000E-01	2.000E+02	---	DCNUCU(11,1
16	Saturated zone (cm**3/g)	5.000E-01	2.000E+02	---	DCNUCS(11
16	Leach rate (/yr)	0.000E+00	0.000E+00	2.213E-02	ALEACH(11)
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
16	Distribution coefficients for Ni-59				
16	Contaminated zone (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCC(12,
16	Unsaturated zone 1 (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCU(12,1
16	Saturated zone (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCS(12
16	Leach rate (/yr)	0.000E+00	0.000E+00	2.776E-03	ALEACH(12
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12
16	Distribution coefficients for Ni-63				
16	Contaminated zone (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCC(13
16	Unsaturated zone 1 (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCU(13,1
16	Saturated zone (cm**3/g)	4.000E-02	1.000E+03	---	DCNUCS(13,
16	Leach rate (/yr)	0.000E+00	0.000E+00	2.776E-03	ALEACH(13
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13
16	Distribution coefficients for Sr-90				
16	Contaminated zone (cm**3/g)	1.500E-01	3.000E+01	---	DCNUCC(14
16	Unsaturated zone 1 (cm**3/g)	1.500E-01	3.000E+01	---	DCNUCU(14,1
16	Saturated zone (cm**3/g)	1.500E-01	3.000E+01	---	DCNUCS(14
16	Leach rate (/yr)	0.000E+00	0.000E+00	7.303E-02	ALEACH(14
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
16	Distribution coefficients for Tc-99				
16	Contaminated zone (cm**3/g)	1.000E-01	0.000E+00	---	DCNUCC(15)
16	Unsaturated zone 1 (cm**3/g)	1.000E-01	0.000E+00	---	DCNUCU(15,1
16	Saturated zone (cm**3/g)	1.000E-01	0.000E+00	---	DCNUCS(15
16	Leach rate (/yr)	0.000E+00	0.000E+00	3.839E-01	ALEACH(15,
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15
16	Distribution coefficients for Zn-65				
16	Contaminated zone (cm**3/g)	2.000E-02	0.000E+00	---	DCNUCC(16)
16	Unsaturated zone 1 (cm**3/g)	2.000E-02	0.000E+00	---	DCNUCU(16,1
16	Saturated zone (cm**3/g)	2.000E-02	0.000E+00	---	DCNUCS(16)
16	Leach rate (/yr)	0.000E+00	0.000E+00	5.550E-03	ALEACH(16)
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
17	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
17	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH

Site-Specific Parameter Summary (continued

	Parameter	User Input	Default	Used by RESRAD If different from user input	Parameter Name
017	Exposure duration	3.000E+01	3.000E+01	---	ED
017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
017	Radii of shape factor array (used if FS = -1):				
017	Outer annular radius (m), ring 1:	not used	3.000E-01	---	RAD_SHAPE(1)
017	Outer annular radius (m), ring 2:	not used	7.071E-01	---	RAD_SHAPE(2)
017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E-00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E-01	3.650E-01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E-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	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E-00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
9	Livestock fodder intake for meat (kg/day)	6.800E-01	6.800E-01	---	LFI5
9	Livestock fodder intake for milk (kg/day)	5.500E-01	5.500E-01	---	LFI6
9	Livestock water intake for meat (L/day)	5.000E-01	5.000E-01	---	LWI5
9	Livestock water intake for milk (L/day)	1.600E-02	1.600E-02	---	LWI6
9	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
9	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
9	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
9	Depth of roots (m)	[illegible]	[illegible]	---	[illegible]
9	Drinking water fraction from ground water	1.000E-00	1.000E-00	---	FGWDW
9	Household water fraction from ground water	1.000E-00	1.000E-00	---	FGWHH
9	Livestock water fraction from ground water	not used	1.000E-00	---	FGWLW
9	Irrigation fraction from ground water	1.000E-00	1.000E-00	---	FGWIR
9B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
9B	Wet weight crop yield for Leafy (kg/m**2)	1.500E-00	1.500E-00	---	YV(2)
9B	Wet weight crop yield for Fodder (kg/m**2	1.100E-00	1.100E-00	---	YV(3)
9B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
9B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
9B	Growing Season for Fodder (years	8.000E-02	8.000E-02	---	TE(3)
9B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
9B	Translocation Factor for Leafy	1.000E-00	1.000E-00	---	TIV(2)
9B	Translocation Factor for Fodder	1.000E-00	1.000E-00	---	TIV(3)
9B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
9B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
9B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
9B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
9B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
9B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
9B	Weathering Removal Constant for Vegetation	2.000E-01	2.000E-01	---	WLAM
14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12C2
14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
TOR	Storage times of contaminated foodstuffs (days):				
TOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
TOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
TOR	Milk	1.000E-00	1.000E+00	---	STOR_T(3)
TOR	Meat and poultry	2.000E-01	2.000E+01	---	STOR_T(4)
TOR	Fish	7.000E-00	7.000E+00	---	STOR_T(5)
TOR	Crustacea and mollusks	7.000E-00	7.000E+00	---	STOR_T(6)
TOR	Well water	1.000E-00	1.000E+00	---	STOR_T(7)
TOR	Surface water	1.000E-00	1.000E-00	---	STOR_T(8)
TOR	Livestock fodder	4.500E-01	4.500E+01	---	STOR_T(9)

Site-Specific Parameter Summary (continued)

end	Parameter	User Input	Default	Used by RESRAD if different from User Input	Parameter Name
021	Thickness of building foundation (m	not used	1.500E-01	---	FLOOR
021	Bulk density of building foundation (g/cm**3	not used	2.400E+00	---	DENSFL
021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
021	Diffusion coefficient for radon gas (m/sec):				
021	in cover material	not used	2.000E-06	---	DIFCV
021	in foundation material	not used	3.000E-07	---	DIFFL
021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
021	Radon vertical dimension of mixing (m	not used	2.000E+00	---	HMIX
021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
021	Building interior area factor	not used	0.000E+00	---	FAI
021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA 1
021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA 2

Summary of Pathway Selections

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

Contaminated Zone Dimensions

Area:	2800000.00 square meters
ickness:	0.30 meters
er Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Ag-110m	1.000E-00
C-14	1.000E-00
Ce-144	1.000E-00
Co-57	1.000E-00
Co-60	1.000E-00
Cs-134	1.000E-00
Cs-137	1.000E-00
Fe-55	1.000E-00
H-3	1.000E-00
I-129	1.000E-00
Mn-54	1.000E-00
Ni-59	1.000E-00
Ni-63	1.000E-00
Sr-90	1.000E-00
Tc-99	1.000E-00
Zn-65	1.000E-00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 25 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-01	1.000E-01	3.000E-01	1.000E-01	3.000E-02	1.000E-03
TDOSE(t):	6.491E+01	2.319E+01	1.297E-01	1.460E-01	1.220E-01	6.711E-01	3.465E-04	0.000E-00
M(t):	2.596E+00	9.2[illegible]E-01	5.189E-01	5.840E-01	4.8[illegible]E-02	2.684E-01	9.859E-06	0.000E-01

aximum TDOSE(t): 6.491E+01 mrem/yr at t = 0.000E-00 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

Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-110m	1.013E+01	0.1561	8.952E-06	0.0000	0.000E+00	0.0000	4.698E-02	0.0007	7.962E-03	0.0001	8.074E-02	0.0012	2.957E-04	0.0000
-4	8.040E-06	0.0000	1.328E-02	0.0002	0.000E+00	0.0000	1.632E-01	0.2515	7.560E-03	0.1165	3.216E-00	0.0496	5.721E-03	0.0001
-144	1.894E-01	0.0029	4.170E-05	0.0000	0.000E+00	0.0000	1.229E-03	0.0000	1.451E-05	0.0000	3.124E-05	0.0000	5.774E-04	0.0000
-57	3.004E-01	0.0046	1.011E-06	0.0000	0.000E+00	0.0000	2.738E-03	0.0000	3.440E-03	0.0001	4.271E-04	0.0000	3.231E-05	0.0000
-60	9.451E-03	0.1456	2.442E-05	0.0000	0.000E+00	0.0000	6.241E-02	0.0010	7.843E-02	0.0012	9.737E-03	0.0002	7.364E-04	0.0000
-134	5.602E+00	0.0863	5.162E-06	0.0000	0.000E+00	0.0000	8.504E-02	0.0013	1.950E-01	0.0030	6.456E-02	0.0010	3.037E-03	0.0001
-137	2.020E+00	0.0311	3.556E-06	0.0000	0.000E+00	0.0000	5.801E-02	0.0009	1.330E-01	0.0021	4.540E-02	0.0007	1.369E-03	0.0000
-55	0.000E+00	0.0000	2.999E-07	0.0000	0.000E+00	0.0000	1.771E-05	0.0000	4.002E-04	0.0000	8.692E-06	0.0000	1.662E-05	0.0000
3	0.000E+00	0.0000	9.759E-03	0.0002	0.000E+00	0.0000	5.415E-03	0.0001	1.542E-03	0.0000	1.370E-03	0.0000	1.752E-06	0.0000
129	7.740E-03	0.0001	1.940E-05	0.0000	0.000E+00	0.0000	1.606E-01	0.0025	1.167E-01	0.0018	2.212E-01	0.0034	7.656E-03	0.0001
-54	3.042E+00	0.0469	7.470E-07	0.0000	0.000E+00	0.0000	2.410E-02	0.0004	6.370E-04	0.0000	4.587E-04	0.0000	7.583E-05	0.0000
-59	0.000E+00	0.0000	3.010E-07	0.0000	0.000E+00	0.0000	3.045E-04	0.0000	1.081E-04	0.0000	5.476E-04	0.0000	5.749E-06	0.0000
-63	0.000E+00	0.0000	7.012E-07	0.0000	0.000E+00	0.0000	8.368E-04	0.0000	2.970E-04	0.0000	1.508E-03	0.0000	1.881E-05	0.0000
-90	1.470E-02	0.0002	1.460E-04	0.0000	0.000E+00	0.0000	1.331E-00	0.0205	5.680E-01	0.0087	1.699E-01	0.0026	4.188E-03	0.0001
-99	7.560E-05	0.0000	9.287E-07	0.0000	0.000E+00	0.0000	2.107E-01	0.0033	1.047E-03	0.0000	1.099E-02	0.0002	3.497E-05	0.0000
-68	2.172E-00	0.0335	2.274E-06	0.0000	0.000E+00	0.0000	1.670E-01	0.0026	8.679E-01	0.0134	1.038E-01	0.0016	3.948E-04	0.0000
Total	3.293E-01	0.5073	2.330E-02	0.0004	0.000E+00	0.0000	1.848E-01	0.2847	9.529E-00	0.1468	3.929E-00	0.0605	1.737E-02	0.0003

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

Nu-clide	Water		Fish		Radish		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-110m	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.027E-01	0.1582
14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.711E-01	0.4177
-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.913E-01	0.0029
-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.070E-01	0.0047
-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.602E-03	0.1479
-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	5.980E-01	0.0917
-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.257E-00	0.0346
-55	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	4.438E-04	0.0001
3	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.819E-02	0.0003
129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	5.139E-01	0.0079
-54	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.067E-00	0.0473
-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.663E-04	0.0001
-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.655E-03	0.0001
-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.083E-00	0.0001
-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.050E-01	0.0008
-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.311E-01	0.0510
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	6.491E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(j,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.
-110m	3.632E-00	0.1566	3.211E-06	0.0000	0.000E-00	0.0000	1.681E-02	0.0007	2.855E-03	0.0001	2.893E-02	0.0012	1.060E-04	0.0000
14	1.607E-15	0.0000	2.646E-12	0.0000	0.000E-00	0.0000	8.839E-09	0.0000	3.175E-08	0.0000	1.067E-08	0.0000	1.144E-14	0.0000
-144	7.755E-02	0.0033	1.708E-05	0.0000	0.000E-00	0.0000	8.013E-04	0.0000	5.944E-06	0.0000	1.241E-03	0.0001	2.366E-04	0.0000
-57	1.158E-01	0.0050	3.899E-07	0.0000	0.000E-00	0.0000	1.053E-03	0.0000	1.327E-03	0.0001	1.646E-04	0.0000	1.346E-05	0.0000
-60	8.132E-00	0.3506	2.102E-05	0.0000	0.000E-00	0.0000	5.358E-02	0.0023	6.765E-02	0.0029	8.877E-03	0.0004	6.836E-04	0.0000
-134	3.936E-00	0.1719	3.674E-06	0.0000	0.000E-00	0.0000	6.034E-02	0.0026	1.396E-01	0.0060	4.731E-02	0.0020	1.401E-03	0.0001
-137	1.965E-00	0.0847	3.461E-06	0.0000	0.000E-00	0.0000	5.629E-02	0.0024	1.293E-01	0.0056	4.413E-02	0.0019	1.332E-03	0.0001
-55	0.000E+00	0.0000	2.308E-07	0.0000	0.000E-00	0.0000	1.359E-05	0.0000	3.081E-04	0.0000	6.689E-06	0.0000	1.379E-05	0.0000
-3	0.000E-00	0.0000	2.739E-06	0.0000	0.000E-00	0.0000	2.049E-06	0.0000	1.833E-06	0.0000	1.063E-06	0.0000	4.934E-13	0.0000
-129	3.099E-03	0.0001	7.767E-06	0.0000	0.000E-00	0.0000	6.621E-02	0.0029	5.188E-02	0.0022	9.321E-02	0.0040	3.025E-03	0.0001
-54	1.323E-00	0.0570	3.250E-07	0.0000	0.000E-00	0.0000	1.046E-02	0.0005	2.775E-04	0.0000	1.996E-04	0.0000	3.099E-05	0.0000
-59	0.000E-00	0.0000	3.002E-07	0.0000	0.000E-00	0.0000	3.027E-04	0.0000	1.076E-04	0.0000	5.452E-04	0.0000	5.783E-06	0.0000
-63	0.000E-00	0.0000	6.943E-07	0.0000	0.000E-00	0.0000	8.889E-04	0.0000	2.936E-04	0.0000	1.487E-03	0.0001	1.864E-05	0.0000
-90	1.334E-02	0.0006	1.326E-04	0.0000	0.000E-00	0.0000	1.203E-00	0.0521	5.160E-01	0.0222	1.542E-01	0.0066	3.802E-03	0.0001
-99	8.195E-06	0.0000	2.697E-08	0.0000	0.000E-00	0.0000	6.961E-03	0.0003	5.686E-05	0.0000	5.597E-04	0.0000	1.161E-06	0.0000
-65	7.648E-01	0.0330	8.011E-07	0.0000	0.000E-00	0.0000	5.867E-02	0.0025	3.052E-01	0.0132	3.648E-02	0.0016	1.884E-04	0.0000
Total	2.001E-01	0.8629	1.943E-04	0.0000	0.000E-00	0.0000	1.540E-00	0.0664	1.214E-00	0.0523	4.156E-01	0.0179	1.078E-02	0.0005

Total Dose Contributions TDOSE(t,p,t) for Individual Radionuclides (t) and Pathways (p.
As mrem/yr and Fraction of Total Dose At t = 1.0000E-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.
g-110m	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.681E-00	0.1337
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.013E-07	0.0000
e-144	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	7.631E-02	0.0034
u-57	0.000E-00	0.0000	0.000E-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-01	0.0051
u-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	8.160E-00	0.3562
u-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.234E-00	0.1828
s-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.196E-00	0.0947
e-55	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.414E-04	0.0000
-3	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	7.685E-06	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.174E-01	0.0094
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.334E-00	0.0575
i-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.615E-04	0.0000
i-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.603E-03	0.0001
r-90	0.000E-00	0.0000	0.000E-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-01	0.0817
c-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	7.887E-05	0.0000
c-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.165E-01	0.0502
otal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.319E-01	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

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
g-110m	4.670E-01	0.0360	4.130E-07	0.0000	0.000E-00	0.0000	2.147E-03	0.0002	3.651E-04	0.0000	3.700E-03	0.0003	1.364E-05	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.528E-29	0.0000	3.245E-27	0.0000	4.236E-28	0.0000	0.000E-00	0.0000
-144	1.300E-02	0.0010	2.864E-06	0.0000	0.000E-00	0.0000	8.352E-05	0.0000	9.964E-07	0.0000	2.147E-06	0.0000	3.969E-05	0.0000
-57	1.722E-02	0.0013	5.797E-08	0.0000	0.000E-00	0.0000	1.555E-04	0.0000	1.963E-04	0.0000	2.435E-05	0.0000	1.852E-06	0.0000
-60	6.021E-00	0.4642	1.557E-05	0.0000	0.000E-00	0.0000	3.943E-02	0.0037	4.979E-02	0.0039	6.176E-03	0.0018	4.494E-04	0.0001
s-134	2.018E+00	0.1556	1.861E-06	0.0000	0.000E-00	0.0000	3.036E-02	0.0029	6.989E-02	0.0054	2.386E-02	0.0018	7.233E-04	0.0001
s-137	1.861E+00	0.1435	3.279E-06	0.0000	0.000E-00	0.0000	5.296E-02	0.0041	1.219E-01	0.0094	4.164E-02	0.0032	1.262E-03	0.0001
e-55	0.000E+00	0.0000	1.367E-07	0.0000	0.000E-00	0.0000	7.999E-06	0.0000	1.825E-04	0.0000	3.960E-06	0.0000	7.877E-06	0.0000
-3	0.000E+00	0.0000	2.158E-13	0.0000	0.000E-00	0.0000	1.614E-13	0.0000	1.444E-13	0.0000	8.877E-14	0.0000	3.913E-17	0.0000
-129	4.969E-04	0.0000	1.245E-06	0.0000	0.000E+00	0.0000	1.054E-02	0.0008	8.290E-03	0.0006	1.490E-02	0.0011	4.850E-04	0.0000
n-54	2.503E-01	0.0193	6.151E-08	0.0000	0.000E-00	0.0000	1.967E-03	0.0002	5.220E-05	0.0000	3.754E-05	0.0000	6.245E-06	0.0000
-59	0.000E+00	0.0000	2.935E-07	0.0000	0.000E-00	0.0000	2.993E-04	0.0000	1.065E-04	0.0000	5.398E-04	0.0000	8.701E-06	0.0000
-63	0.000E-00	0.0000	6.805E-07	0.0000	0.000E-00	0.0000	8.041E-04	0.0001	2.864E-04	0.0000	1.481E-03	0.0001	1.533E-05	0.0000
r-90	1.099E-02	0.0008	1.092E-04	0.0000	0.000E-00	0.0000	9.883E-01	0.0762	4.225E-01	0.0326	1.263E-01	0.0097	3.138E-03	0.0002
c-99	1.851E-09	0.0000	2.874E-11	0.0000	0.000E-00	0.0000	5.830E-06	0.0000	4.762E-08	0.0000	4.673E-07	0.0000	9.788E-11	0.0000
n-65	9.483E-02	0.0073	9.936E-08	0.0000	0.000E-00	0.0000	7.229E-03	0.0006	3.762E-03	0.0003	4.497E-03	0.0003	1.783E-05	0.0000
otal	1.075E+01	0.8290	1.358E-04	0.0000	0.000E-00	0.0000	1.134E-00	0.0874	7.112E-01	0.0548	2.231E-01	0.0172	6.180E-03	0.0005

Total Dose Contributions TDOSE(t,p,1) 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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
g-110m	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.732E-01	0.3365
-14	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.021E-27	0.0000
e-144	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.311E-12	0.0000
o-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.760E-02	0.0013
o-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	6.117E-00	0.4715
s-134	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.143E-00	0.1652
s-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.079E-00	0.1603
e-55	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.021E-04	0.0000
-3	3.337E-03	0.0003	1.137E-04	0.0000	0.000E+00	0.0000	1.850E-04	0.0000	1.461E-04	0.0000	4.402E-04	0.0000	4.222E-03	0.0003
-129	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.472E-02	0.0027
n-54	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.524E-01	0.0195
i-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.814E-04	0.0001
i-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.559E-03	0.0002
r-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.551E-00	0.1196
c-99	7.685E-02	0.0059	4.664E-02	0.0036	0.000E-00	0.0000	1.185E-02	0.0009	1.728E-04	0.0000	3.728E-03	0.0003	1.389E-01	0.0107
n-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.442E-01	0.0111
otal	8.019E-02	0.0062	4.674E-02	0.0036	0.000E-00	0.0000	1.173E-02	0.0009	3.136E-04	0.0000	4.168E-03	0.0003	1.297E-01	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)

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.
-110m	3.558E-04	0.0000	3.153E-10	0.0000	0.000E-00	0.0000	1.601E-06	0.0000	2.730E-07	0.0000	2.768E-06	0.0000	1.041E-08	0.0000
14	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	[illegible]	[illegible]
-144	2.509E-05	0.0000	5.535E-09	0.0000	0.000E-00	0.0000	1.576E-07	0.0000	1.922E-09	0.0000	4.144E-09	0.0000	7.668E-08	0.0000
-57	2.182E-05	0.0000	7.346E-11	0.0000	0.000E-00	0.0000	1.924E-07	0.0000	2.442E-07	0.0000	3.032E-08	0.0000	2.347E-09	0.0000
-60	2.102E-00	0.1440	5.450E-06	0.0000	0.000E-00	0.0000	1.348E-02	0.0009	1.711E-02	0.0012	2.124E-03	0.0001	1.644E-04	0.0000
-134	1.863E-01	0.0128	1.721E-07	0.0000	0.000E-00	0.0000	2.741E-03	0.0002	6.365E-03	0.0004	2.176E-03	0.0001	6.689E-05	0.0000
-137	1.538E-00	0.1053	2.713E-06	0.0000	0.000E-00	0.0000	4.279E-02	0.0029	9.936E-02	0.0066	3.397E-02	0.0023	1.044E-03	0.0001
-55	0.000E-00	0.0000	2.188E-08	0.0000	0.000E+00	0.0000	1.250E-06	0.0000	2.917E-05	0.0000	6.335E-07	0.0000	1.213E-06	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-129	8.198E-07	0.0000	2.055E-09	0.0000	0.000E+00	0.0000	1.699E-05	0.0000	1.352E-05	0.0000	2.432E-05	0.0000	5.002E-07	0.0000
-54	7.373E-04	0.0001	1.815E-10	0.0000	0.000E-00	0.0000	5.666E-06	0.0000	1.506E-07	0.0000	1.084E-07	0.0000	1.842E-08	0.0000
-59	0.000E-00	0.0000	2.927E-07	0.0000	0.000E-00	0.0000	2.864E-04	0.0000	1.028E-04	0.0000	5.213E-04	0.0000	5.591E-06	0.0000
-63	0.000E-00	0.0000	6.345E-07	0.0000	0.000E-00	0.0000	7.321E-04	0.0001	2.627E-04	0.0000	1.333E-03	0.0001	1.429E-05	0.0000
-90	5.577E-03	0.0004	5.548E-05	0.0000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
-99	3.221E-20	0.0000	3.957E-22	0.0000	0.000E-00	0.0000	9.906E-17	0.0000	8.094E-19	0.0000	7.953E-18	0.0000	1.703E-20	0.0000
-65	6.364E-05	0.0000	6.683E-11	0.0000	0.000E-00	0.0000	4.747E-06	0.0000	2.474E-05	0.0000	2.956E-06	0.0000	1.158E-08	0.0000
tal	3.833E-00	0.2626	6.475E-05	0.0000	0.000E-00	0.0000	5.500E-01	0.0377	3.331E-01	0.0228	1.029E-01	0.0071	2.898E-03	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

adio-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
g-110m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.605E-04	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
e-144	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.534E-05	0.0000
s-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	[illegible]	[illegible]
o-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.035E-00	0.1468
s-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.977E-01	0.0138
s-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.715E-00	0.1179
e-55	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	3.229E-05	0.0001
-3	4.405E-11	0.0000	1.603E-12	0.0000	0.000E-00	0.0000	2.823E-12	0.0000	2.723E-12	0.0000	6.102E-12	0.0000	5.731E-11	0.0000
-129	3.406E+00	0.2333	4.047E+00	0.2772	0.000E-00	0.0000	2.611E-01	0.0179	4.892E-01	0.0335	1.573E-00	0.1078	9.777E-00	0.6697
n-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	7.432E-04	0.0001
i-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	9.163E-04	0.0001
i-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.342E-03	0.0002
r-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	7.697E-01	0.0527
c-99	2.022E-07	0.0000	1.307E-07	0.0000	0.000E-00	0.0000	3.422E-06	0.0002	8.340E-10	0.0000	1.231E-06	0.0001	3.903E-07	0.0000
n-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.609E-15	0.0000
otal	3.406E-00	0.2333	4.047E-00	0.2772	0.000E-00	0.0000	2.611E-01	0.0179	4.892E-01	0.0335	1.573E-00	0.1078	1.460E-01	0.0000

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		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
r-110m	4.385E-13	0.0000	3.911E-19	0.0000	0.000E+00	0.0000	1.644E-15	0.0000	3.183E-16	0.0000	3.234E-15	0.0000	1.892E-17	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
e-144	4.400E-13	0.0000	9.756E-17	0.0000	0.000E+00	0.0000	2.587E-15	0.0000	3.366E-17	0.0000	7.270E-17	0.0000	1.382E-15	0.0000
-57	1.151E-13	0.0000	3.877E-19	0.0000	0.000E+00	0.0000	9.455E-16	0.0000	1.220E-15	0.0000	1.516E-16	0.0000	1.238E-17	0.0000
-60	1.039E-01	0.0883	2.716E-07	0.0000	0.000E+00	0.0000	6.284E-04	0.0005	8.067E-04	0.0007	1.004E-04	0.0001	8.193E-06	0.0000
r-134	2.059E-04	0.0002	1.912E-10	0.0000	0.000E+00	0.0000	2.936E-06	0.0000	6.762E-06	0.0000	2.880E-06	0.0000	7.091E-08	0.0000
r-137	8.903E-01	0.7565	1.579E-06	0.0000	0.000E+00	0.0000	2.318E-02	0.0190	5.528E-02	0.0453	1.997E-02	0.0164	6.076E-04	0.0005
e-55	0.000E+00	0.0000	1.165E-10	0.0000	0.000E+00	0.0000	6.201E-09	0.0000	1.549E-07	0.0000	3.366E-09	0.0000	6.457E-09	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	9.196E-15	0.0000	2.305E-17	0.0000	0.000E+00	0.0000	1.775E-13	0.0000	1.465E-13	0.0000	2.646E-13	0.0000	8.977E-15	0.0000
r-54	4.326E-11	0.0000	1.071E-17	0.0000	0.000E+00	0.0000	3.114E-13	0.0000	8.322E-15	0.0000	5.995E-15	0.0000	1.083E-15	0.0000
i-59	0.000E+00	0.0000	2.769E-07	0.0000	0.000E+00	0.0000	2.522E-04	0.0002	9.260E-05	0.0001	4.713E-04	0.0004	5.288E-06	0.0000
i-63	0.000E+00	0.0000	5.195E-07	0.0000	0.000E+00	0.0000	5.881E-04	0.0005	2.049E-04	0.0002	1.043E-03	0.0009	1.170E-05	0.0000
r-90	8.024E-04	0.0007	7.995E-06	0.0000	0.000E+00	0.0000	6.876E-02	0.0584	2.931E-02	0.0249	8.478E-03	0.0072	2.193E-04	0.0002
r-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
r-65	5.457E-14	0.0000	5.770E-20	0.0000	0.000E+00	0.0000	3.816E-15	0.0000	1.997E-14	0.0000	2.389E-15	0.0000	1.000E-17	0.0000
otal	9.952E-01	0.8460	1.064E-05	0.0000	0.000E+00	0.0000	9.039E-02	0.0741	8.471E-02	0.0695	3.806E-02	0.0312	8.622E-04	0.0007

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

Water Dependent Pathways

Nu-clide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-110m	0.000E+00	0.0000	0.000E+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-13	0.0000
-14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.443E-13	0.0000
-57	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.174E-13	0.0000
-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.054E-01	0.0848
-134	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.178E-04	0.0002
-137	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.693E-01	0.8104
-55	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.710E-07	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000
-129	6.554E-03	0.0054	7.942E-03	0.0065	0.000E-00	0.0000	5.194E-04	0.0004	1.122E-03	0.0009	3.221E-03	0.0026	1.936E-02	0.0159
-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.384E-11	0.0000
-59	0.000E-00	0.0000	0.000E-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-04	0.0007
-63	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.818E-03	0.0015
-90	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.034E-01	0.0848
-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	6.078E-14	0.0000
Total	6.554E-03	0.0054	7.942E-03	0.0065	0.000E-00	0.0000	5.194E-04	0.0004	1.122E-03	0.0009	3.221E-03	0.0026	1.220E-01	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 = 1.0000E+00 years

Water Independent Pathways (Inhalation excludes radon

Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-210m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
14	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-57	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-60	2.723E-06	0.0000	7.503E-12	0.0000	0.000E+00	0.0000	1.283E-06	0.0000	1.766E-08	0.0000	2.283E-09	0.0000	1.143E-10	0.0000
-134	9.376E-15	0.0000	8.743E-21	0.0000	0.000E+00	0.0000	9.607E-17	0.0000	2.598E-16	0.0000	9.046E-17	0.0000	3.399E-16	0.0000
-137	1.292E-01	0.0193	2.373E-07	0.0000	0.000E+00	0.0000	2.582E-03	0.0004	6.976E-03	0.0010	2.431E-03	0.0004	9.134E-05	0.0000
-55	0.000E+00	0.0000	1.284E-18	0.0000	0.000E+00	0.0000	5.074E-17	0.0000	1.689E-16	0.0000	3.678E-17	0.0000	7.118E-17	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-59	0.000E+00	0.0000	2.278E-07	0.0000	0.000E+00	0.0000	1.537E-04	0.0000	6.298E-05	0.0000	8.253E-04	0.0001	4.381E-06	0.0000
-63	0.000E+00	0.0000	2.581E-07	0.0000	0.000E+00	0.0000	2.054E-04	0.0000	8.409E-05	0.0000	4.345E-04	0.0001	5.813E-06	0.0000
-90	8.968E-07	0.0000	9.099E-09	0.0000	0.000E+00	0.0000	5.544E-05	0.0000	2.463E-05	0.0000	7.372E-06	0.0000	2.603E-07	0.0000
-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-65	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.292E-01	0.0193	7.383E-07	0.0000	0.000E+00	0.0000	2.996E-03	0.0004	7.147E-03	0.0011	3.196E-03	0.0005	1.013E-04	0.0000

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

Water Dependent Pathways

Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-110m	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
14	4.316E-03	0.0006	6.523E+00	0.9720	0.000E-00	0.0000	2.993E-02	0.0045	7.010E-03	0.0010	3.871E-03	0.0006	6.569E-00	0.9787
-144	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-57	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	[illegible]	[illegible]
-60	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.756E-06	0.0000
-134	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.806E-13	0.0000
-137	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.413E-01	0.0021
-55	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.849E-15	0.0000
3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
129	0.000E+00	0.0000	1.062E-30	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.062E-30	0.0000
-54	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-59	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	9.465E-04	0.0001
-63	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	7.301E-04	0.0001
-90	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	8.848E-05	0.0000
-99	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
tal	4.316E-03	0.0006	6.693E-00	0.9720	0.000E-00	0.0000	2.993E-02	0.0045	7.010E-03	0.0010	3.871E-03	0.0006	6.711E-00	1.0000

m of all water independent and dependent pathways.

Total Dose Components TDOSE(t,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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
r-110m	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000
-14	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000
e-144	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.148E-25	0.0000	1.242E-24	0.0000	8.001E-26	0.0000	0.000E-00	0.0000
r-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.039E-09	0.0000	2.026E-08	0.0001	3.473E-09	0.0000	0.000E-00	0.0000
e-65	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-3	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-129	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-54	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000
r-59	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.561E-09	0.0001	2.455E-08	0.0001	6.610E-09	0.0003	0.000E-00	0.0000
r-63	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	4.931E-09	0.0000	7.752E-09	0.0000	2.087E-09	0.0001	0.000E-00	0.0000
r-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.818E-17	0.0000	7.962E-17	0.0000	1.593E-17	0.0000	0.000E-00	0.0000
r-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-66	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
otal	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.258E-09	0.0001	5.256E-08	0.0003	9.044E-09	0.0004	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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ag-110m	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
C-14	6.898E-22	0.0000	1.043E-18	0.0000	0.000E+00	0.0000	4.785E-21	0.0000	1.122E-21	0.0000	6.191E-22	0.0000	1.050E-18	0.0001
Ce-144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-57	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.514E-24	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Eu-155	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.877E-18	0.0001
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
I-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Mn-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Nb-59	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ni-63	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.263E-07	0.0004
Np-90	6.850E-05	0.2779	1.537E-04	0.6237	0.000E+00	0.0000	5.688E-06	0.0231	1.194E-05	0.0484	6.466E-06	0.0262	2.463E-04	0.9993
Sr-90	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.850E-05	0.2779	1.537E-04	0.6237	0.000E+00	0.0000	5.688E-06	0.0231	1.194E-05	0.0484	6.466E-06	0.0262	2.465E-04	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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
g-110m	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-14	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
e-144	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.000
o-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
o-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
s-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
s-137	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
e-55	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-3	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-129	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
n-54	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000
-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
c-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
n-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
otal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-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

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
r-110m	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-14	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-144	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-57	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-134	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-137	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
r-55	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-129	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-54	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
-59	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-63	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-90	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-99	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-65	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
tal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000

um of all water independent and dependent pathways.

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

Parent	Product	Branch	DSR(j,t) (mrem/yr)/(pCi/g)							
(i)	(j)	Fraction* 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
Ag-110m	Ag-110m	1.000E+00	1.027E-01	3.681E-02	4.732E-01	3.605E-04	4.439E-13	2.382E-44	0.000E+00	0.000E+00
C-14	C-14	1.000E+00	2.711E+01	1.013E-07	4.021E-27	0.000E+00	0.000E+00	6.868E-00	1.050E-18	0.000E+00
Ce-144	Ce-144	1.000E+00	1.913E-01	7.832E-02	1.313E-02	2.534E-05	4.442E-13	3.113E-40	0.000E+00	0.000E+00
Co-57	Co-57	1.000E+00	3.070E-01	1.184E-01	1.760E-02	2.229E-05	1.174E-13	1.839E-42	0.000E+00	0.000E+00
Co-60	Co-60	1.000E+00	9.602E+00	8.262E-00	6.117E-00	3.136E-00	1.084E-01	2.786E-06	1.546E-24	0.000E+00
Cs-134	Cs-134	1.000E+00	5.950E+00	4.234E+00	2.143E+00	1.977E-01	2.179E-04	9.526E-15	0.000E+00	0.000E+00
Cs-137	Cs-137	1.000E+00	2.257E+00	2.196E+00	2.079E+00	1.715E+00	9.883E-01	1.413E-01	2.577E-08	0.000E+00
Fe-55	Fe-55	1.000E+00	4.435E-04	3.414E-04	2.021E-04	3.229E-05	1.710E-07	1.849E-15	1.200E-41	0.000E+00
H-3	H-3	1.000E+00	1.809E-02	7.685E-06	4.232E-03	5.731E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-129	I-129	1.000E+00	5.139E-01	2.174E-01	3.472E-02	9.777E+00	1.934E-02	2.888E-30	0.000E+00	0.000E+00
Mn-54	Mn-54	1.000E+00	3.067E+00	1.334E+00	2.824E-01	7.432E-04	4.388E-11	2.087E-36	0.000E+00	0.000E+00
Ni-59	Ni-59	1.000E+00	9.663E-04	9.615E-04	9.514E-04	9.163E-04	8.217E-04	5.465E-04	1.063E-07	0.000E+00
Ni-63	Ni-63	1.000E+00	2.655E-03	2.623E-03	2.558E-03	2.342E-03	1.813E-03	7.301E-04	3.356E-08	0.000E+00
Sr-90	Sr-90	1.000E+00	2.082E+00	1.895E+00	1.551E+00	7.697E-01	1.036E-01	9.848E-05	2.463E-24	0.000E+00
Tc-99	Tc-99	1.000E+00	1.052E-01	7.530E-03	1.399E-01	3.803E-07	6.670E-38	0.000E+00	0.000E+00	0.000E+00
Zn-65	Zn-65	1.000E+00	3.311E+00	1.165E+00	1.442E-01	9.609E-05	8.075E-14	0.000E+00	0.000E+00	0.000E+00

*Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 25 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
Ag-110m	2.436E+00	6.792E+00	5.293E-01	6.436E-04	5.632E-13	*4.752E-15	*4.752E-15	*4.752E-15
Al-14	9.221E-01	2.468E+00	*4.454E-12	*4.454E-12	*4.454E-12	3.806E-02	*4.454E-12	*4.454E-12
Ba-144	1.307E+02	3.192E+02	1.904E-03	3.866E-06	5.628E-13	*3.190E-15	*3.190E-15	*3.190E-15
Co-57	8.143E-01	2.112E+00	1.421E-03	1.122E-06	2.129E-14	*8.464E-15	*8.464E-15	*8.464E-15
Co-60	2.604E+00	3.026E+00	4.087E+00	1.171E-01	2.371E-02	9.071E-06	*1.131E-15	*1.131E-15
Cs-134	4.201E+00	5.905E+00	1.167E-01	1.068E-02	1.147E-05	*1.294E-15	*1.294E-15	*1.294E-15
Cs-137	1.107E+01	1.138E+01	1.203E+01	1.488E-01	2.530E-02	1.769E-02	9.700E-15	*9.701E-15
Eu-155	5.637E-04	7.323E-04	1.237E-05	7.743E-05	1.462E-08	*2.409E-15	*2.409E-15	*2.409E-15
H-3	1.382E-03	3.253E-06	8.922E-03	4.862E-11	*9.594E-15	*9.594E-15	*9.594E-15	*9.594E-15
I-129	4.865E-01	1.150E-02	7.201E-02	2.857E-03	1.291E-03	*1.766E-08	*1.766E-08	*1.766E-08
Mn-54	8.151E-03	1.874E+01	9.905E-01	3.364E-04	5.736E-11	*7.744E-15	*7.744E-15	*7.744E-15
Ni-59	2.587E-04	2.600E-04	2.623E-04	2.708E-04	3.043E-04	4.574E-04	2.353E-08	*8.088E-10
Ni-63	9.417E-03	9.532E-03	9.774E-03	1.067E-04	1.375E-04	3.424E-04	7.450E-08	*5.916E-13
Sr-90	1.201E+01	1.319E+01	1.612E+01	3.248E-01	2.413E-02	2.926E-05	1.018E-05	*1.365E-14
Tc-99	1.110E-02	3.298E-03	1.799E-02	6.875E-07	*1.696E-10	*1.696E-10	*1.696E-10	*1.696E-10
Th-65	7.550E-00	2.145E-01	1.734E-02	2.602E-05	3.096E-14	*8.241E-15	*8.241E-15	*8.241E-15

* 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 = 0.000E-00 years

MINIMUM DCGL

Nuclide i	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) pCi/g	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ag-110m	1.000E-00	0.000E+00	1.027E-01	2.436E-00	1.027E-01	2.436E-00
Al-14	1.000E-00	0.000E+00	2.711E-01	9.221E-01	2.711E-01	9.221E-01
Ba-144	1.000E+00	0.000E+00	1.913E-01	1.307E-02	1.913E-01	1.307E-02
Co-57	1.000E+00	0.000E+00	3.070E-01	8.143E-01	3.070E-01	8.143E-01
Co-60	1.000E+00	0.000E+00	9.602E+00	2.604E-00	9.602E+00	2.604E-00
Cs-134	1.000E+00	0.000E+00	5.950E+00	4.201E+00	5.950E+00	4.201E+00
Cs-137	1.000E+00	0.000E+00	2.257E+00	1.107E+01	2.257E+00	1.107E+01
Eu-155	1.000E+00	0.000E+00	4.435E-04	5.637E+04	4.435E-04	5.637E-04
H-3	1.000E+00	0.000E+00	1.809E-02	1.382E-03	1.809E-02	1.382E-03
I-129	1.000E+00	22.87 ± 0.05	1.280E-01	1.953E-00	5.139E-01	4.865E-01
Mn-54	1.000E+00	0.000E+00	3.067E+00	8.151E-00	3.067E+00	8.151E-00
Ni-59	1.000E+00	0.000E-00	9.663E-04	2.587E-04	9.663E-04	2.587E-04
Ni-63	1.000E+00	0.000E+00	2.655E-03	9.417E-03	2.655E-03	9.417E-03
Sr-90	1.000E+00	0.000E+00	2.082E+00	1.201E-01	2.082E+00	1.201E+01
Tc-99	1.000E+00	0.000E+00	2.252E-01	1.110E-02	2.252E-01	1.110E+02
Th-65	1.000E-00	0.000E+00	3.311E+00	7.550E-00	3.311E-00	7.550E-00

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

Nuclide (j)	Parent (i)	BRF(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
-110m	Ag-110m	1.000E+00	1.027E+01	3.681E+00	4.732E-01	3.606E-04	4.439E-13	0.000E+00	0.000E+00	0.000E+00
14	C-14	1.000E+00	2.711E-01	1.013E-07	4.021E-27	0.000E+00	0.000E+00	6.568E+00	1.050E-18	0.000E+00
-144	Ce-144	1.000E+00	1.913E-01	7.832E-02	1.313E-02	2.534E-05	4.442E-13	0.000E+00	0.000E+00	0.000E+00
-57	Co-57	1.000E+00	3.073E-01	1.194E-01	1.760E-02	2.229E-05	1.174E-13	0.000E+00	0.000E+00	0.000E+00
-60	Co-60	1.000E+00	9.602E+00	8.242E+00	6.117E+00	2.135E+00	1.054E-01	2.756E-06	1.546E-24	0.000E+00
-134	Cs-134	1.000E+00	5.950E+00	4.234E+00	2.143E+00	1.977E-01	2.179E-04	9.526E-15	0.000E+00	0.000E+00
-137	Cs-137	1.000E+00	2.257E+00	2.196E+00	2.079E+00	1.715E+00	9.883E-01	1.413E-01	2.577E-03	0.000E+00
-55	Fe-55	1.000E+00	4.435E-04	3.414E-04	2.021E-04	3.229E-05	1.710E-07	1.849E-15	0.000E+00	0.000E+00
	H-3	1.000E+00	1.809E-02	7.685E-06	4.022E-08	5.731E-11	0.000E+00	0.000E+00	0.000E+00	0.000E+00
29	I-129	1.000E+00	5.199E-01	2.174E-01	3.472E-02	9.777E-03	1.936E-02	1.062E-30	0.000E+00	0.000E+00
54	Mn-54	1.000E+00	3.067E+00	1.334E+00	2.524E-01	7.432E-04	4.359E-11	0.000E+00	0.000E+00	0.000E+00
-59	Ni-59	1.000E+00	9.663E-04	9.615E-04	9.514E-04	9.163E-04	8.217E-04	5.465E-04	1.063E-07	0.000E+00
63	Ni-63	1.000E+00	2.655E-03	2.623E-03	2.558E-03	2.342E-03	1.818E-03	7.301E-04	3.356E-08	0.000E+00
90	Sr-90	1.000E+00	2.082E+00	1.898E+00	1.551E+00	7.697E-01	1.036E-01	8.848E-05	1.483E-04	[illegible]
99	Tc-99	1.000E+00	2.282E-01	7.580E-03	1.399E-02	3.803E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00
65	Zn-65	1.000E+00	3.311E+00	1.165E+00	1.442E-01	9.609E-05	8.075E-14	0.000E+00	0.000E+00	0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide	Parent	BRF(i)	S(i,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
Ag-110m	Ag-110m	1.000E+00	1.000E+00	3.847E-01	4.811E-02	8.822E-05	4.348E-14	2.803E-45	0.000E+00	0.000E+00
C-14	C-14	1.000E+00	1.000E+00	1.999E+00	7.998E-01	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Ce-144	Ce-144	1.000E+00	1.000E+00	4.095E-01	6.969E-02	1.328E-04	2.340E-12	1.701E-39	0.000E+00	0.000E+00
Co-57	Co-57	1.000E+00	1.000E+00	3.856E-01	5.733E-02	7.265E-05	3.834E-13	4.093E-42	0.000E+00	0.000E+00
Co-60	Co-60	1.000E+00	1.000E+00	3.840E-01	4.877E-02	5.030E-05	1.118E-12	3.078E-07	2.802E-20	0.000E+00
Cs-134	Cs-134	1.000E+00	1.000E+00	7.117E-01	3.603E-01	3.333E-02	3.704E-06	1.694E-18	4.204E-48	0.000E+00
Cs-137	Cs-137	1.000E+00	1.000E+00	9.733E-01	9.220E-01	7.628E-01	4.439E-01	6.674E-02	2.972E-04	1.752E-12
Fe-55	Fe-55	1.000E+00	1.000E+00	7.697E-01	4.860E-01	7.297E-02	3.896E-04	4.232E-12	7.849E-38	0.000E+00
H-3	H-3	1.000E+00	1.000E+00	3.816E-04	2.180E-11	3.187E-36	0.000E+00	0.000E+00	0.000E+00	0.000E+00
I-129	I-129	1.000E+00	1.000E+00	4.104E-01	8.419E-02	1.089E-04	1.188E-12	1.776E-40	0.000E+00	0.000E+00
Mn-54	Mn-54	1.000E+00	1.000E+00	4.351E-01	8.238E-02	1.430E-04	1.434E-11	7.170E-37	0.000E+00	0.000E+00
Ni-59	Ni-59	1.000E+00	1.000E+00	9.972E-01	9.917E-01	9.725E-01	9.199E-01	7.569E-01	4.336E-01	6.170E-02
Ni-63	Ni-63	1.000E+00	1.000E+00	9.901E-01	9.708E-01	9.049E-01	7.409E-01	3.680E-01	4.984E-02	4.856E-05
Sr-90	Sr-90	1.000E+00	1.000E+00	9.077E-01	7.479E-01	3.797E-01	5.475E-02	6.030E-05	2.419E-13	8.814E-41
Tc-99	Tc-99	1.000E+00	1.000E+00	3.824E-02	1.448E-03	4.261E-16	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Zn-65	Zn-65	1.000E+00	1.000E+00	3.820E-01	4.870E-02	2.938E-05	2.837E-14	0.000E+00	0.000E+00	0.000E+00

F(i) is the branch fraction of the parent nuclide.

Attachment 2
RESRAD OUTPUT FOR
SOIL DOSES - URANIUM &
PLUTONIUM

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: DCSFAC.BIN

nu	Parameter	Current Value	Default	Parameter Name
-1	Dose conversion factors for inhalation, mrem/pCi:			
-1	Ac-227+D	6.720E-00	6.720E-00	DCF2(1)
-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
-1	Co-60	2.190E-04	2.190E-04	DCF2(3)
-1	Np-237+D	5.400E-01	5.400E-01	DCF2(4)
-1	Pa-231	1.280E-00	1.280E+00	DCF2(5)
-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(6)
-1	Pu-238	3.920E-01	3.920E-01	DCF2(7)
-1	Pu-239	4.290E-01	4.290E-01	DCF2(8)
-1	Pu-241+D	8.250E-03	8.250E-03	DCF2(9)
-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(11)
-1	Th-229+D	2.160E+00	2.160E+00	DCF2(12)
-1	Th-230	3.260E-01	3.260E-01	DCF2(13)
-1	U-233	1.350E-01	1.350E-01	DCF2(14)
-1	U-234	1.320E-01	1.320E-01	DCF2(15)
-1	U-235+D	1.230E-01	1.230E-01	DCF2(16)
-1	Dose conversion factors for ingestion, mrem/pCi:			
-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
-1	Co-60	2.690E-05	2.690E-05	DCF3(3)
-1	Np-237+D	4.440E-03	4.440E-03	DCF3(4)
-1	Pa-231	1.060E-02	1.060E-02	DCF3(5)
-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(6)
-1	Pu-238	3.200E-03	3.200E-03	DCF3(7)
-1	Pu-239	3.540E-03	3.540E-03	DCF3(8)
-1	Pu-241+D	6.850E-05	6.850E-05	DCF3(9)
-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(11)
-1	Th-229+D	4.030E-03	4.030E-03	DCF3(12)
-1	Th-230	5.480E-04	5.480E-04	DCF3(13)
-1	U-233	2.890E-04	2.890E-04	DCF3(14)
-1	U-234	2.830E-04	2.830E-04	DCF3(15)
-1	U-235+D	2.670E-04	2.670E-04	DCF3(16)
-34	Food transfer factors:			
-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
-34				
-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
-34				
-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(3,1)
-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(3,3)
-34				
-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(4,1)
-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
-34				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(5,1)
34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(5,2)
34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
34				
34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(6,1)
34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-04	3.000E-04	RTF(6,2)
34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(6,3)
34				
34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(7,3)
34				
34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(8,3)
34				
34	Pu-241+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
34	Pu-241+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
34	Pu-241+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(9,3)
34				
34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(11,1)
34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(11,2)
34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(11,3)
34				
34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
34				
34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
34				
34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(14,1)
34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(14,2)
34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(14,3)
34				
34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(15,1)
34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(15,2)
34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(15,3)
34				
34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
5	Bioaccumulation factors, fresh water, L/kg:			
5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
5				
5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
5				

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: DOSFAC.BIN

nu	Parameter	Current Value	Default	Parameter Name
-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(3,2)
-5				
-5	Np-237+D , fish	3.000E+01	3.000E-01	BIOFAC(4,1)
-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(4,2)
-5				
-5	Pa-231 , fish	1.000E-01	1.000E-01	BIOFAC(5,1)
-5	Pa-231 , crustacea and mollusks	1.100E-02	1.100E-02	BIOFAC(5,2)
-5				
-5	Pb-210+D , fish	3.000E-02	3.000E-02	BIOFAC(6,1)
-5	Pb-210+D , crustacea and mollusks	1.000E-02	1.000E+02	BIOFAC(6,2)
-5				
-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(7,1)
-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(7,2)
-5				
-5	Pu-239 , fish	3.000E-01	3.000E-01	BIOFAC(8,1)
-5	Pu-239 , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(8,2)
-5				
-5	Pu-241+D , fish	3.000E-01	3.000E-01	BIOFAC(9,1)
-5	Pu-241+D , crustacea and mollusks	1.000E-02	1.000E-02	BIOFAC(9,2)
-5				
-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(11,1)
-5	Ra-226+D , crustacea and mollusks	2.500E-02	2.500E-02	BIOFAC(11,2)
-5				
-5	Th-229+D , fish	1.000E-02	1.000E+02	BIOFAC(12,1)
-5	Th-229+D , crustacea and mollusks	5.000E-02	5.000E-02	BIOFAC(12,2)
-5				
-5	Th-230 , fish	1.000E-02	1.000E-02	BIOFAC(13,1)
-5	Th-230 , crustacea and mollusks	5.000E-02	5.000E-02	BIOFAC(13,2)
-5				
-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(14,1)
-5	U-233 , crustacea and mollusks	6.000E+01	6.000E-01	BIOFAC(14,2)
-5				
-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(15,1)
-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
-5				
-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(16,1)
-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E-01	BIOFAC(16,2)

Site-Specific Parameter Summary

nu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
11	Area of contaminated zone (m**2)	2.800E+06	1.000E+04	---	AREA
11	Thickness of contaminated zone (m)	3.000E-01	2.000E+00	---	THICK0
11	Length parallel to aquifer flow (m)	1.000E+03	1.000E+02	---	LCZPAQ
11	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
11	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
11	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
11	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
11	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
11	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
11	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
11	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
11	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
11	Times for calculations (yr)	not used	0.000E+00	---	T(9)
11	Times for calculations (yr)	not used	0.000E+00	---	T(10)
12	Initial principal radionuclide (pCi/g): Co-60	1.000E+00	0.000E+00	---	S1(3)
12	Initial principal radionuclide (pCi/g): Pu-238	1.000E+00	0.000E+00	---	S1(7)
12	Initial principal radionuclide (pCi/g): Pu-239	1.000E+00	0.000E+00	---	S1(8)
12	Initial principal radionuclide (pCi/g): Pu-241	1.000E+00	0.000E+00	---	S1(9)
12	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1(15)
12	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(3)
12	Concentration in groundwater (pCi/L): Pu-238	not used	0.000E+00	---	W1(7)
12	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(8)
12	Concentration in groundwater (pCi/L): Pu-241	not used	0.000E+00	---	W1(9)
12	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(15)
13	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
13	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
13	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
13	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
13	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
13	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
13	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
13	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
13	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
13	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
13	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
13	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
13	Precipitation (m/yr)	1.000E-03	1.000E-00	---	PRECIP
13	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
13	Irrigation mode	overhead	overhead	---	IDITCH
13	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
13	Watershed area for nearby stream or pond (m**2)	1.000E-06	1.000E+06	---	WAREA
13	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
14	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
14	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
14	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
14	Saturated zone hydraulic conductivity (m/yr)	4.930E+03	1.000E+02	---	HCSZ
14	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
14	Saturated zone b parameter	4.380E+00	5.300E+00	---	BSZ

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
015	Number of unsaturated zone strata	1	1	---	NS
015	Unsat. zone 1, thickness (m)	4.600E+00	4.000E+00	---	H(1)
015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
016	Distribution coefficients for Co-60				
016	Contaminated zone (cm**3/g)	6.000E+01	1.000E+03	---	DCNUCC(3)
016	Unsaturated zone 1 (cm**3/g)	6.000E+01	1.000E+03	---	DCNUCU(3,1)
016	Saturated zone (cm**3/g)	6.000E+01	1.000E+03	---	DCNUCS(3)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.845E-02	ALEACH(3)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
016	Distribution coefficients for Pu-238				
016	Contaminated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCC(7)
016	Unsaturated zone 1 (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCU(7,1)
016	Saturated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCS(7)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.019E-03	ALEACH(7)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
016	Distribution coefficients for Pu-239				
016	Contaminated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCC(8)
016	Unsaturated zone 1 (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCU(8,1)
016	Saturated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCS(8)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.019E-03	ALEACH(8)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
016	Distribution coefficients for Pu-241				
016	Contaminated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCC(9)
016	Unsaturated zone 1 (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCU(9,1)
016	Saturated zone (cm**3/g)	5.500E+02	2.000E+03	---	DCNUCS(9)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.019E-03	ALEACH(9)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
016	Distribution coefficients for U-234				
016	Contaminated zone (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCC(15)
016	Unsaturated zone 1 (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCU(15,1)
016	Saturated zone (cm**3/g)	3.500E+01	5.000E+01	---	DCNUCS(15)
016	Leach rate (/yr)	0.000E+00	0.000E+00	3.155E-02	ALEACH(15)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)

Site-Specific Parameter Summary (continued)

Nu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
16	Distribution coefficients for daughter As-237				
16	Contaminated zone (cm**3/g)	2.000E-01	2.000E-01	---	DCNUCC(1)
16	Unsaturated zone 1 (cm**3/g)	2.000E-01	2.000E+01	---	DCNUCU(1,1)
16	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
16	Leach rate (/yr)	0.000E+00	0.000E+00	5.497E-02	ALEACH(1)
16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
016	Distribution coefficients for daughter Am-241				
016	Contaminated zone (cm**3/g)	1.900E-03	3.000E-01	---	DCNUCC(2)
016	Unsaturated zone 1 (cm**3/g)	1.900E-03	2.000E+01	---	DCNUCU(2,1)
016	Saturated zone (cm**3/g)	1.900E-03	2.000E+01	---	DCNUCS(2)
016	Leach rate (/yr)	0.000E+00	0.000E+00	5.847E-04	ALEACH(2)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
016	Distribution coefficients for daughter Np-237				
016	Contaminated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E-02	DCNUCC(4)
016	Unsaturated zone 1 (cm**3/g)	-1.000E+00	-1.000E+00	2.574E-02	DCNUCU(4,1)
016	Saturated zone (cm**3/g)	-1.000E+00	-1.000E+00	2.574E-02	DCNUCS(4)
016	Leach rate (/yr)	0.000E+00	0.000E+00	4.313E-03	ALEACH(4)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
016	Distribution coefficients for daughter Pa-231				
016	Contaminated zone (cm**3/g)	5.000E-01	5.000E+01	---	DCNUCC(5)
016	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E+01	---	DCNUCU(5,1)
016	Saturated zone (cm**3/g)	5.000E-01	5.000E+01	---	DCNUCS(5)
016	Leach rate (/yr)	0.000E+00	0.000E+00	2.213E-02	ALEACH(5)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
016	Distribution coefficients for daughter Pb-210				
016	Contaminated zone (cm**3/g)	1.000E-02	1.000E-02	---	DCNUCC(6)
016	Unsaturated zone 1 (cm**3/g)	1.000E-02	1.000E+02	---	DCNUCU(6,1)
016	Saturated zone (cm**3/g)	1.000E-02	1.000E+02	---	DCNUCS(6)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.109E-02	ALEACH(6)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
016	Distribution coefficients for daughter Ra-226				
016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(11)
016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(11,1)
016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(11)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.582E-02	ALEACH(11)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
016	Distribution coefficients for daughter Th-229				
016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(12)
016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(12,1)
016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(12)
016	Leach rate (/yr)	0.000E+00	0.000E+00	1.852E-05	ALEACH(12)
016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
D16	Distribution coefficients for daughter Th-230				
D16	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(13)
D16	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(13,1)
D16	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(13)
D16	Leach rate (/yr)	0.000E+00	0.000E+00	1.852E-05	ALEACH(13)
D16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
D16	Distribution coefficients for daughter U-233				
D16	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(14)
D16	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(14,1)
D16	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(14)
D16	Leach rate (/yr)	0.000E+00	0.000E+00	2.213E-02	ALEACH(14)
D16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
D16	Distribution coefficients for daughter U-235				
D16	Contaminated zone (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCC(16)
D16	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCU(16,1)
D16	Saturated zone (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCS(16)
D16	Leach rate (/yr)	0.000E+00	0.000E+00	2.213E-02	ALEACH(16)
D16	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
D17	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+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	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E-00	1.000E-00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E-01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E-00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E-00	---	FRACA(3)
R017	Ring 4	not used	0.000E-00	---	FRACA(4)
R017	Ring 5	not used	0.000E-00	---	FRACA(5)
R017	Ring 6	not used	0.000E-00	---	FRACA(6)
R017	Ring 7	not used	0.000E-00	---	FRACA(7)
R017	Ring 8	not used	0.000E-00	---	FRACA(8)
R017	Ring 9	not used	0.000E-00	---	FRACA(9)
R017	Ring 10	not used	0.000E-00	---	FRACA(10)
R017	Ring 11	not used	0.000E-00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E-02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E-01	1.400E-01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E-01	9.200E-01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E-01	6.300E-01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E-00	5.400E-00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E-01	3.650E-01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+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	1.000E+00	1.000E-00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E-00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E-00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E-01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E-01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	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	1.000E+00	1.000E-00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
9B	Translocation Factor for Leafy	1.000E-01	1.000E-00	---	TIV(2)
9B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
9B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
9B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
9B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
9B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
9B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
9B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
9B	Weathering Removal Constant for Vegetation	2.000E-01	2.000E+01	---	WLAM
4	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
4	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
4	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
4	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
4	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
4	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
4	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
4	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
4	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
TOR	Storage times of contaminated foodstuffs (days):				
TOR	Fruits, non-leafy vegetables, and grain	1.400E-01	1.400E+01	---	STOR_T(1)
TOR	Leafy vegetables	1.000E-00	1.000E+00	---	STOR_T(2)
TOR	Milk	1.000E-00	1.000E-00	---	STOR_T(3)
TOR	Meat and poultry	2.000E-01	2.000E+01	---	STOR_T(4)
TOR	Fish	7.000E-00	7.000E+00	---	STOR_T(5)
TOR	Crustacea and molluscs	7.000E-00	7.000E+00	---	STOR_T(6)
TOR	Well water	1.000E-00	1.000E-00	---	STOR_T(7)
TOR	Surface water	1.000E-00	1.000E-00	---	STOR_T(8)
TOR	Livestock fodder	4.500E-01	4.500E-01	---	STOR_T(9)
021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
021	Diffusion coefficient for radon gas (m/sec):				
021	in cover material	not used	2.000E-06	---	DIFCV
021	in foundation material	not used	3.000E-07	---	DIFFL
021	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)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
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:	2900000.00 square meters	Co-60	1.000E+00
hickness:	0.30 meters	Pu-238	1.000E+00
er Depth:	0.00 meters	Pu-239	1.000E+00
		Pu-241	1.000E+00
		U-234	1.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 25 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E-03	3.000E-03	1.000E-01	3.000E-01	1.000E-02	3.000E-02	1.000E-03
TDOSE(t):	1.016E-01	8.813E-00	6.658E-00	2.644E+00	5.366E-01	2.686E-01	1.723E-01	1.505E-02
M(t):	4.063E-01	3.525E-01	2.663E-01	1.057E-01	2.146E-02	1.074E-02	6.891E-03	6.019E-04

aximum TDOSE(t): 1.016E+01 mrem/yr at t = 0.000E+00 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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	9.451E-00	0.9304	2.442E-05	0.0000	0.000E+00	0.0000	6.241E-02	0.0061	7.843E-02	0.0077	9.737E-03	0.0010	7.364E-04	0.0001
-238	9.060E-05	0.0000	4.370E-02	0.0043	0.000E+00	0.0000	9.338E-02	0.0092	1.055E-02	0.0010	1.527E-04	0.0000	8.760E-02	0.0086
-239	1.767E-04	0.0000	4.783E-02	0.0047	0.000E+00	0.0000	1.033E-01	0.0102	1.167E-02	0.0011	1.690E-04	0.0000	9.691E-02	0.0095
-241	1.133E-05	0.0000	9.199E-04	0.0001	0.000E+00	0.0000	1.999E-03	0.0002	2.258E-04	0.0000	3.269E-06	0.0000	1.875E-03	0.0002
-234	2.412E-04	0.0000	1.472E-02	0.0014	0.000E+00	0.0000	2.057E-02	0.0020	3.378E-03	0.0003	8.534E-03	0.0008	7.747E-03	0.0008
otal	9.452E-00	0.9304	1.072E-01	0.0106	0.000E+00	0.0000	2.817E-01	0.0277	1.042E-01	0.0103	1.860E-02	0.0018	1.949E-01	0.0192

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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	9.602E+00	0.9453
-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	2.355E-01	0.0232
-239	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	2.601E-01	0.0256
-241	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	5.034E-03	0.0005
-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	5.819E-03	0.0005
otal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.016E-01	1.0001

*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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	8.132E+00	0.9227	2.102E-05	0.0000	0.000E+00	0.0000	5.358E-02	0.0061	6.755E-02	0.0077	8.377E-03	0.0010	6.338E-04	0.0001
U-238	8.970E-05	0.0000	4.327E-02	0.0049	0.000E+00	0.0000	9.217E-02	0.0105	1.044E-02	0.0012	1.512E-04	0.0000	9.674E-02	0.0098
U-239	1.763E-04	0.0000	4.773E-02	0.0054	0.000E+00	0.0000	1.028E-01	0.0117	1.165E-02	0.0013	1.686E-04	0.0000	9.671E-02	0.0110
Pu-241	5.174E-05	0.0000	9.521E-04	0.0001	0.000E+00	0.0000	2.061E-03	0.0002	2.246E-04	0.0000	3.651E-06	0.0000	1.939E-03	0.0002
I-234	2.337E-04	0.0000	1.426E-02	0.0016	0.000E+00	0.0000	1.989E-02	0.0023	3.279E-03	0.0004	8.270E-03	0.0009	7.507E-03	0.0009
Total	8.133E+00	0.9228	1.062E-01	0.0121	0.000E+00	0.0000	2.705E-01	0.0307	9.314E-02	0.0106	1.697E-02	0.0019	1.935E-01	0.0220

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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.262E+00	0.9378
Pu-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	2.329E-01	0.0026
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.592E-01	0.0294
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.232E-03	0.0006
I-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	8.344E-02	0.0095
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	8.810E+00	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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	6.021E+00	0.9044	1.557E-05	0.0000	0.000E+00	0.0000	3.943E-02	0.0059	4.978E-02	0.0075	6.176E-03	0.0009	4.696E-04	0.0001
-238	8.794E-05	0.0000	4.242E-02	0.0064	0.000E+00	0.0000	8.976E-02	0.0135	1.024E-02	0.0015	1.483E-04	0.0000	8.503E-01	0.0128
-239	1.756E-04	0.0000	4.753E-02	0.0071	0.000E+00	0.0000	1.017E-01	0.0153	1.159E-02	0.0017	1.679E-04	0.0000	9.631E-01	0.0145
-241	1.265E-04	0.0000	1.012E-03	0.0002	0.000E+00	0.0000	2.171E-03	0.0003	2.214E-04	0.0000	4.358E-06	0.0000	2.057E-03	0.0003
-234	2.195E-04	0.0000	1.339E-02	0.0020	0.000E+00	0.0000	1.855E-02	0.0028	3.076E-03	0.0005	7.760E-03	0.0012	7.048E-03	0.0011
otal	6.022E+00	0.9045	1.044E-01	0.0157	0.000E+00	0.0000	2.516E-01	0.0378	7.491E-02	0.0113	1.426E-02	0.0021	1.909E-01	0.0287

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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.117E+00	0.9184
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	2.277E-01	0.0342
u-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.575E-01	0.0387
u-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.592E-03	0.0008
-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	5.004E-02	0.0075
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.659E+00	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)

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	2.102E+00	0.7953	5.450E-06	0.0000	0.000E+00	0.0000	1.348E-02	0.0051	1.711E-02	0.0065	2.124E-03	0.0008	1.644E-04	0.0001
-238	8.205E-05	0.0000	3.958E-02	0.0150	0.000E+00	0.0000	8.178E-02	0.0309	9.540E-03	0.0036	1.383E-04	0.0001	7.933E-02	0.0300
-239	1.730E-04	0.0001	4.686E-02	0.0177	0.000E+00	0.0000	9.788E-02	0.0370	1.142E-02	0.0043	1.653E-04	0.0001	9.494E-02	0.0359
-241	3.337E-04	0.0001	1.174E-03	0.0004	0.000E+00	0.0000	2.451E-03	0.0009	2.116E-04	0.0001	6.303E-06	0.0000	2.377E-03	0.0009
-234	1.770E-04	0.0001	1.074E-02	0.0041	0.000E+00	0.0000	1.452E-02	0.0055	2.461E-03	0.0009	6.210E-03	0.0023	5.652E-03	0.0021
otal	2.103E+00	0.7956	9.835E-02	0.0372	0.000E+00	0.0000	2.101E-01	0.0795	4.074E-02	0.0154	8.644E-03	0.0033	1.835E-01	0.0690

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

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.135E-00	0.8078
-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	2.104E-01	0.0796
u-239	0.000E+00	0.0000	0.000E+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-01	0.0951
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.554E-03	0.0025
-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	3.976E-02	0.0151
otal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.644E-00	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)

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	1.039E-01	0.1936	2.716E-07	0.0000	0.000E+00	0.0000	6.254E-04	0.0012	8.067E-04	0.0015	1.004E-04	0.0002	8.192E-06	0.0000
-238	6.728E-05	0.0001	3.245E-02	0.0605	0.000E+00	0.0000	6.247E-02	0.1164	7.801E-03	0.0145	1.134E-04	0.0002	6.505E-02	0.1212
-239	1.659E-04	0.0003	4.498E-02	0.0838	0.000E+00	0.0000	8.751E-02	0.1631	1.093E-02	0.0204	1.583E-04	0.0003	9.113E-02	0.1698
-241	6.288E-04	0.0012	1.387E-03	0.0026	0.000E+00	0.0000	2.686E-03	0.0050	1.928E-04	0.0004	8.994E-06	0.0000	2.796E-03	0.0052
234	1.009E-04	0.0002	5.717E-03	0.0107	0.000E+00	0.0000	7.199E-03	0.0134	1.301E-03	0.0024	3.285E-03	0.0061	3.009E-03	0.0056
tal	1.049E-01	0.1954	8.453E-02	0.1575	0.000E+00	0.0000	1.605E-01	0.2991	2.103E-02	0.0392	3.666E-03	0.0068	1.620E-01	0.3019

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

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	1.054E-01	0.1965
-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	1.680E-01	0.3130
-239	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	2.349E-01	0.4377
-241	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.699E-03	0.0143
-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	2.061E-02	0.0384
tal	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	5.366E-01	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)

dio-clide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	2.723E-06	0.0000	7.503E-12	0.0000	0.000E+00	0.0000	1.240E-08	0.0000	1.786E-08	0.0000	2.253E-09	0.0000	2.263E-10	0.0000
-238	3.359E-05	0.0001	1.621E-02	0.0604	0.000E+00	0.0000	2.317E-02	0.0863	3.856E-03	0.0144	5.633E-05	0.0002	3.249E-02	0.1210
-239	1.422E-04	0.0005	3.897E-02	0.1451	0.000E+00	0.0000	5.631E-02	0.2097	9.372E-03	0.0349	1.361E-04	0.0005	7.896E-02	0.2940
-241	6.990E-04	0.0026	1.325E-03	0.0049	0.000E+00	0.0000	1.903E-03	0.0071	1.592E-04	0.0006	9.170E-06	0.0000	2.667E-03	0.0099
-234	4.056E-05	0.0002	6.370E-04	0.0024	0.000E+00	0.0000	5.976E-04	0.0022	1.409E-04	0.0005	3.546E-04	0.0013	3.349E-04	0.0012
otal	9.180E-04	0.0034	5.714E-02	0.2128	0.000E+00	0.0000	8.197E-02	0.3052	1.353E-02	0.0504	5.561E-04	0.0021	1.144E-01	0.4262

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

dio-clide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.756E-06	0.0000
-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	7.581E-02	0.2823
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.839E-01	0.6847
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.762E-03	0.0252
-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	2.106E-03	0.0078
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.686E-01	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)

Radionuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.145E-25	0.0000	1.242E-24	0.0000	9.001E-26	0.0000	0.000E+00	0.0000
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.652E-07	0.0000	2.022E-07	0.0000	2.621E-10	0.0000	0.000E+00	0.0000
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.630E-06	0.0000	2.372E-06	0.0000	3.038E-09	0.0000	0.000E+00	0.0000
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.189E-07	0.0000	3.924E-08	0.0000	2.007E-10	0.0000	0.000E+00	0.0000
-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.446E-09	0.0000	1.383E-09	0.0000	4.209E-10	0.0000	0.000E+00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.413E-06	0.0000	2.615E-06	0.0000	3.922E-09	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

Radionuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.546E-24	0.0000
-238	5.316E-06	0.0000	3.107E-06	0.0000	0.000E+00	0.0000	4.084E-07	0.0000	3.845E-08	0.0000	1.491E-07	0.0000	9.787E-06	0.0001
-239	1.355E-10	0.0000	7.190E-10	0.0000	0.000E+00	0.0000	1.041E-11	0.0000	5.752E-14	0.0000	1.266E-13	0.0000	9.006E-06	0.0001
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.583E-07	0.0000
-234	1.015E-01	0.5892	5.934E-02	0.3445	0.000E+00	0.0000	7.805E-03	0.0453	7.374E-04	0.0043	2.852E-03	0.0166	1.722E-01	0.9999
otal	1.015E-01	0.5893	5.935E-02	0.3445	0.000E+00	0.0000	7.805E-03	0.0453	7.374E-04	0.0043	2.852E-03	0.0166	1.723E-01	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)

adio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000
-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	0.000E-00	0.0000
-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-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	0.000E-00	0.0000
otal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+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

adio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
uclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
o-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-238	1.878E-06	0.0001	3.896E-06	0.0003	0.000E-00	0.0000	1.446E-07	0.0000	1.783E-08	0.0000	5.008E-08	0.0000	5.986E-06	0.0004
-239	8.232E-08	0.0000	2.609E-07	0.0000	0.000E-00	0.0000	6.333E-09	0.0000	1.790E-09	0.0000	6.945E-10	0.0000	3.520E-07	0.0000
-241	1.517E-10	0.0000	8.838E-11	0.0000	0.000E-00	0.0000	1.167E-11	0.0000	1.104E-12	0.0000	4.264E-12	0.0000	2.576E-10	0.0000
-234	1.674E-03	0.1113	1.317E-02	0.8754	0.000E-00	0.0000	1.293E-04	0.0086	3.024E-05	0.0020	3.511E-05	0.0023	1.504E-02	0.9996
otal	1.676E-03	0.1114	1.313E-02	0.8756	0.000E-00	0.0000	1.293E-04	0.0086	3.026E-05	0.0020	3.517E-05	0.0023	1.505E-02	1.0000

*Sum of all water independent and dependent pathways.

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

rent	Product	Branch	DSR(j,t) (mrem/yr)/(pCi/g)							
)	(j)	Fraction*	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
-60	Co-60	1.000E+00	9.602E+00	8.262E+00	6.117E+00	2.135E+00	1.054E-01	2.756E-06	1.546E-24	0.000E+00
-238	Pu-238	1.000E+00	2.355E-01	2.329E-01	2.277E-01	2.104E-01	1.680E-01	7.581E-02	7.676E-07	0.000E+00
-238	U-234	1.000E+00	0.000E+00	1.513E-07	4.378E-07	1.257E-06	2.464E-06	2.065E-06	9.013E-06	2.536E-06
-238	Th-230	1.000E+00	0.000E+00	9.081E-13	7.773E-12	7.759E-11	5.291E-10	2.521E-09	6.163E-12	9.247E-10
-238	Ra-226	1.000E+00	0.000E+00	1.487E-14	3.962E-13	1.328E-11	2.667E-10	3.686E-09	1.587E-10	3.091E-07
-238	Pb-210	1.000E+00	0.000E+00	5.117E-17	3.343E-15	3.245E-13	1.644E-11	4.636E-10	1.601E-09	3.141E-06
-238	∑DSR(j)		2.355E-01	2.329E-01	2.277E-01	2.104E-01	1.680E-01	7.581E-02	9.787E-06	5.936E-06
-239	Pu-239	1.000E+00	2.601E-01	2.592E-01	2.575E-01	2.514E-01	2.349E-01	1.839E-01	9.006E-06	0.000E+00
-239	U-235	1.000E+00	0.000E+00	4.907E-10	1.438E-09	4.407E-09	1.048E-08	1.704E-08	1.049E-13	3.920E-08
-239	Pa-231	1.000E+00	0.000E+00	5.662E-14	5.230E-13	5.255E-12	3.374E-11	1.198E-10	3.913E-14	3.005E-08
-239	Ac-227	1.000E+00	0.000E+00	4.551E-16	1.013E-14	2.821E-13	4.053E-12	2.570E-11	8.651E-10	2.828E-07
-239	∑DSR(j)		2.601E-01	2.592E-01	2.575E-01	2.514E-01	2.349E-01	1.839E-01	9.006E-06	3.520E-07
-241	Pu-241	1.000E+00	5.034E-03	4.782E-03	4.314E-03	3.009E-03	1.074E-03	2.899E-05	3.410E-14	1.000E+00
-241	Am-241	1.000E+00	0.000E+00	4.499E-04	1.278E-03	3.545E-03	6.625E-03	6.781E-03	2.578E-07	0.000E+00
-241	Np-237	1.000E+00	0.000E+00	8.804E-10	7.920E-09	7.780E-08	4.759E-07	1.750E-06	5.095E-10	0.000E+00
-241	U-233	1.000E+00	0.000E+00	2.785E-17	6.104E-16	1.818E-14	3.240E-13	3.604E-12	9.569E-16	2.574E-10
-241	Th-229	1.000E+00	0.000E+00	1.311E-20	1.001E-18	1.099E-16	6.582E-15	3.252E-13	6.231E-17	2.069E-13
-241	∑DSR(j)		5.034E-03	5.232E-03	5.592E-03	6.554E-03	7.699E-03	6.762E-03	2.583E-07	2.576E-10
-241	Pu-241	2.450E-05	1.233E-07	1.172E-07	1.057E-07	7.371E-08	2.631E-08	7.102E-10	2.306E-18	0.000E+00
-241	Np-237	2.450E-05	0.000E+00	2.752E-11	7.953E-11	2.186E-10	3.877E-10	3.084E-10	2.048E-14	0.000E+00
-241	U-233	2.450E-05	0.000E+00	1.180E-18	9.857E-18	7.773E-17	4.167E-16	1.004E-15	4.993E-20	4.273E-14
-241	Th-229	2.450E-05	0.000E+00	7.890E-22	2.013E-20	6.495E-19	1.220E-17	1.537E-16	8.029E-21	4.502E-17
-241	∑DSR(j)		1.233E-07	1.172E-07	1.058E-07	7.393E-08	2.670E-08	1.019E-09	2.048E-14	4.277E-14
-234	U-234	1.000E+00	5.519E-02	5.344E-02	5.004E-02	3.976E-02	2.059E-02	2.046E-03	1.722E-01	1.140E-06
-234	Th-230	1.000E+00	0.000E+00	6.300E-07	1.809E-06	5.370E-06	1.194E-05	1.763E-05	1.634E-07	3.363E-06
-234	Ra-226	1.000E+00	0.000E+00	1.584E-08	1.396E-07	1.387E-06	9.056E-06	3.630E-05	1.707E-06	1.347E-03
-234	Pb-210	1.000E+00	0.000E+00	6.845E-11	1.518E-09	4.423E-08	7.186E-07	5.473E-06	1.726E-05	1.369E-02
-234	∑DSR(j)		5.519E-02	5.344E-02	5.004E-02	3.976E-02	2.061E-02	2.106E-03	1.722E-01	1.504E-02

Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
:e DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 25 mrem/yr

:clide (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
:-60	2.604E+00	3.026E+00	4.087E+00	1.171E+01	2.371E+02	9.071E-06	*1.131E-15	*1.131E-15
:-238	1.062E+02	1.074E+02	1.098E+02	1.188E+02	1.488E+02	3.298E-02	2.554E-06	4.176E-06
:-239	9.613E+01	9.645E+01	9.710E+01	9.943E+01	1.064E+02	1.360E+02	2.776E+06	7.101E+07
:-241	4.966E+03	4.778E+03	4.471E+03	3.815E+03	3.247E+03	3.697E+03	9.677E+07	9.705E+10
-234	4.530E+02	4.678E+02	4.996E+02	6.288E+02	1.213E+03	1.187E-04	1.451E-02	1.662E+03

*t 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 = 0.000E+00 years

minimum DCGL

:clide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
:-60	1.000E-00	0.000E+00	9.602E-00	2.604E+00	9.602E-00	2.604E+00
:-238	1.000E-00	0.000E+00	2.355E-01	1.062E+02	2.355E-01	1.062E+02
:-239	1.000E-00	0.000E+00	2.601E-01	9.613E+01	2.601E-01	9.613E+01
:-241	1.000E+00	40.83 ± 0.06	7.799E-03	3.205E-03	5.034E-03	4.966E+03
-234	1.000E+00	701 ± 1	2.551E-01	9.798E+01	5.519E-02	4.530E+02

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

lide (j)	Parent (i)	BRF(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
-60	Co-60	1.000E+00	9.602E+00	8.262E-00	6.117E-00	2.135E+00	1.054E-01	2.756E-06	1.546E-24	0.000E+00
-238	Pu-238	1.000E+00	2.355E-01	2.329E-01	2.277E-01	2.104E-01	1.680E-01	7.581E-02	7.676E-07	0.000E+00
34	Pu-238	1.000E+00	0.000E+00	1.513E-07	4.378E-07	1.257E-06	2.464E-06	2.065E-06	9.018E-06	2.536E-06
34	U-234	1.000E+00	5.519E-02	5.344E-02	5.004E-02	3.975E-02	2.059E-02	2.046E-03	1.722E-01	1.140E-06
34	∑DOSE(j):		5.519E-02	5.344E-02	5.004E-02	3.975E-02	2.059E-02	2.048E-03	1.722E-01	3.675E-06
-230	Pu-238	1.000E+00	0.000E+00	9.081E-13	7.778E-12	7.759E-11	5.291E-10	2.521E-09	6.163E-12	9.247E-10
-230	U-234	1.000E+00	0.000E+00	6.300E-07	1.809E-06	5.370E-06	1.194E-05	1.763E-05	1.634E-07	3.863E-06
-230	∑DOSE(j):		0.000E+00	6.300E-07	1.809E-06	5.370E-06	1.194E-05	1.763E-05	1.634E-07	3.864E-06
-226	Pu-238	1.000E+00	0.000E+00	1.487E-14	3.962E-13	1.328E-11	2.667E-10	3.686E-09	1.587E-10	3.091E-07
-226	U-234	1.000E+00	0.000E-00	1.584E-08	1.396E-07	1.387E-06	9.056E-06	3.630E-05	1.707E-06	1.347E-03
-226	∑DOSE(j):		0.000E-00	1.584E-08	1.396E-07	1.387E-06	9.057E-06	3.631E-05	1.707E-06	1.347E-03
-210	Pu-238	1.000E+00	0.000E-00	5.117E-17	3.343E-15	3.243E-13	1.644E-11	4.636E-10	1.601E-09	3.141E-06
-210	U-234	1.000E-00	0.000E-00	6.845E-11	1.813E-09	4.423E-08	7.186E-07	5.473E-06	1.726E-05	1.369E-02
-210	∑DOSE(j):		0.000E-00	6.845E-11	1.813E-09	4.423E-08	7.186E-07	5.473E-06	1.726E-05	1.369E-02
-239	Pu-239	1.000E+00	2.601E-01	2.592E-01	2.575E-01	2.514E-01	2.349E-01	1.839E-01	9.006E-06	0.000E-00
35	Pu-239	1.000E+00	0.000E-00	4.907E-10	1.438E-09	4.407E-09	1.048E-08	1.704E-08	1.049E-13	3.920E-08
-231	Pu-239	1.000E-00	0.000E+00	5.662E-14	5.230E-13	5.255E-12	3.374E-11	1.193E-10	3.913E-14	3.005E-08
-227	Pu-239	1.000E-00	0.000E-00	4.551E-16	1.013E-14	2.821E-13	4.053E-12	2.570E-11	8.651E-10	2.823E-07
-241	Pu-241	1.000E+00	5.034E-03	4.782E-03	4.314E-03	3.009E-03	1.074E-03	2.899E-05	9.410E-14	0.000E+00
-241	Pu-241	2.450E-05	1.233E-07	1.172E-07	1.057E-07	7.371E-08	2.631E-08	7.102E-10	2.306E-18	0.000E+00
-241	∑DOSE(j):		5.034E-03	4.782E-03	4.314E-03	3.009E-03	1.074E-03	2.899E-05	9.410E-14	0.000E+00
-241	Pu-241	1.000E+00	0.000E+00	4.499E-04	1.278E-03	3.545E-03	6.625E-03	6.731E-03	2.578E-07	0.000E+00
-237	Pu-241	1.000E+00	0.000E+00	8.804E-10	7.920E-09	7.730E-08	4.758E-07	1.750E-06	5.095E-10	0.000E+00
-237	Pu-241	2.450E-05	0.000E+00	2.752E-11	7.953E-11	2.186E-10	3.877E-10	3.084E-10	2.048E-14	0.000E+00
-237	∑DOSE(j):		0.000E+00	9.079E-10	7.999E-09	7.752E-08	4.762E-07	1.751E-06	5.096E-10	0.000E+00
-233	Pu-241	1.000E+00	0.000E+00	2.785E-17	6.104E-16	1.818E-14	3.240E-13	3.604E-12	9.568E-16	2.574E-10
-233	Pu-241	2.450E-05	0.000E+00	1.180E-18	8.857E-18	7.773E-17	4.167E-16	1.004E-15	4.993E-20	4.273E-14
-233	∑DOSE(j):		0.000E+00	2.903E-17	6.192E-16	1.826E-14	3.244E-13	3.605E-12	9.568E-16	2.574E-10
-229	Pu-241	1.000E+00	0.000E+00	1.311E-20	1.001E-18	1.099E-16	6.582E-15	3.252E-13	6.231E-17	2.069E-13
-229	Pu-241	2.450E-05	0.000E+00	7.890E-22	2.013E-20	6.495E-19	1.220E-17	1.537E-16	8.029E-21	4.502E-17
-229	∑DOSE(j):		0.000E+00	1.390E-20	1.021E-18	1.106E-16	6.594E-15	3.253E-13	6.232E-17	2.070E-13

RF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

clide	Parent	BRF(i)	S(j,t), pCi/g							
j)	(i)		t= 0.000E+00	1.000E-03	3.000E-03	1.000E-01	3.000E-01	1.000E+00	3.000E+00	1.000E+01
-60	Co-60	1.000E+00	1.000E+00	8.607E-01	6.377E-01	2.232E-01	1.112E-02	3.073E-07	2.902E-20	0.000E+00
-238	Pu-238	1.000E+00	1.000E+00	9.901E-01	9.707E-01	9.056E-01	7.426E-01	3.709E-01	5.101E-02	4.921E-05
-234	Pu-238	1.000E+00	0.000E+00	2.777E-06	7.993E-06	2.309E-05	4.646E-05	4.301E-05	6.673E-06	6.448E-09
-234	U-234	1.000E+00	1.000E+00	9.689E-01	9.097E-01	7.294E-01	3.880E-01	4.261E-02	7.739E-05	1.974E-14
-234	ΣS(j):		1.000E+00	9.689E-01	9.097E-01	7.294E-01	3.881E-01	4.266E-02	8.406E-05	6.448E-09
-230	Pu-238	1.000E+00	0.000E+00	1.258E-11	1.102E-10	1.114E-09	7.729E-09	3.898E-08	7.508E-08	7.960E-08
-230	U-234	1.000E+00	0.000E+00	8.861E-06	2.577E-05	7.719E-05	1.745E-04	2.726E-04	2.832E-04	2.778E-04
-230	ΣS(j):		0.000E+00	8.861E-06	2.577E-05	7.719E-05	1.745E-04	2.726E-04	2.832E-04	2.778E-04
-226	Pu-238	1.000E+00	0.000E+00	1.816E-15	4.765E-14	1.597E-12	3.264E-11	4.928E-10	1.804E-09	2.124E-09
-226	U-234	1.000E+00	0.000E+00	1.919E-09	1.673E-08	1.666E-07	1.108E-06	4.954E-06	7.439E-06	7.414E-06
-226	ΣS(j):		0.000E+00	1.919E-09	1.673E-08	1.666E-07	1.108E-06	4.955E-06	7.441E-06	7.416E-06
-210	Pu-238	1.000E+00	0.000E+00	1.404E-17	1.090E-15	1.175E-13	6.476E-12	2.330E-10	1.261E-09	1.567E-09
-210	U-234	1.000E+00	0.000E+00	1.975E-11	5.100E-10	1.617E-08	2.842E-07	2.753E-06	5.433E-06	5.468E-06
-210	ΣS(j):		0.000E+00	1.975E-11	5.100E-10	1.617E-08	2.842E-07	2.754E-06	5.434E-06	5.470E-06
-239	Pu-239	1.000E+00	1.000E+00	9.980E-01	9.939E-01	9.797E-01	9.404E-01	8.148E-01	5.409E-01	1.290E-01
-235	Pu-239	1.000E+00	0.000E+00	9.730E-10	2.850E-09	8.742E-09	2.087E-08	3.460E-08	2.647E-08	6.326E-09
-231	Pu-239	1.000E+00	0.000E+00	1.026E-14	8.954E-14	8.938E-13	5.962E-12	2.509E-11	2.745E-11	6.658E-12
-227	Pu-239	1.000E+00	0.000E+00	1.070E-16	2.704E-15	8.038E-14	1.195E-12	8.306E-12	1.027E-11	2.501E-12
-241	Pu-241	1.000E+00	1.000E+00	9.511E-01	8.603E-01	6.056E-01	2.221E-01	6.634E-03	2.920E-07	1.652E-22
-241	Pu-242	2.450E-05	2.450E-05	2.330E-05	2.108E-05	1.484E-05	5.441E-06	1.625E-07	7.155E-12	4.048E-27
-241	ΣS(j):		1.000E+00	9.511E-01	8.603E-01	6.056E-01	2.221E-01	6.635E-03	2.920E-07	1.652E-22
m-241	Pu-241	1.000E+00	0.000E+00	1.562E-03	4.452E-03	1.246E-02	2.388E-02	2.664E-02	1.734E-02	3.748E-03
p-237	Pu-241	1.000E+00	0.000E+00	2.549E-10	2.210E-09	2.163E-08	1.396E-07	6.320E-07	1.181E-06	4.999E-07
p-237	Pu-241	2.450E-05	0.000E+00	7.723E-12	2.196E-11	6.097E-11	1.137E-10	1.113E-10	4.747E-11	2.318E-12
p-237	ΣS(j):		0.000E+00	2.626E-10	2.232E-09	2.169E-08	1.398E-07	6.321E-07	1.181E-06	4.999E-07
-233	Pu-241	1.000E+00	0.000E+00	3.712E-16	9.639E-15	3.120E-13	5.844E-12	7.234E-11	2.211E-10	1.078E-10
-233	Pu-241	2.450E-05	0.000E+00	1.692E-17	1.447E-16	1.350E-15	7.549E-15	2.018E-14	1.156E-14	5.690E-16
-233	ΣS(j):		0.000E+00	3.881E-16	9.784E-15	3.134E-13	5.852E-12	7.236E-11	2.211E-10	1.078E-10
n-229	Pu-241	1.000E+00	0.000E+00	8.799E-21	6.907E-19	7.656E-17	4.625E-15	2.366E-13	3.282E-12	1.464E-11
n-229	Pu-241	2.450E-05	0.000E+00	5.358E-22	1.393E-20	4.526E-19	8.578E-18	1.119E-16	4.230E-16	6.197E-16
n-229	ΣS(j):		0.000E+00	9.334E-21	7.046E-19	7.701E-17	4.634E-15	2.367E-13	3.283E-12	1.464E-11

RF(i) is the branch fraction of the parent nuclide.

ATTACHMENT 3
RESRAD OUTPUT FOR
SOIL DOSES - AMERICIUM & CURIUM

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor and Related Parameter Summary
File: DCSFAC.BIN

Nu	Parameter	Current Value	Default	Parameter Name
1	Dose conversion factors for inhalation, mrem/pCi:			
1	Ac-227+D	6.720E-00	6.720E-00	DCF2(1)
1	Am-241	4.440E-01	4.440E-01	DCF2(2)
1	Am-243+D	4.400E-01	4.400E-01	DCF2(3)
1	Cm-243	3.070E-01	3.070E-01	DCF2(4)
1	Np-237+D	5.400E-01	5.400E-01	DCF2(6)
1	Pa-231	1.280E+00	1.280E-00	DCF2(7)
1	Pu-239	4.290E-01	4.290E-01	DCF2(8)
1	Th-229+D	2.160E-00	2.160E-00	DCF2(9)
1	U-233	1.350E-01	1.350E-01	DCF2(10)
1	U-235+D	1.230E-01	1.230E-01	DCF2(11)
-1	Dose conversion factors for ingestion, mrem/pCi:			
-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
-1	Am-243+D	3.630E-03	3.630E-03	DCF3(3)
-1	Cm-243	2.510E-03	2.510E-03	DCF3(4)
-1	Np-237+D	4.440E-03	4.440E-03	DCF3(6)
-1	Pa-231	1.060E-02	1.060E-02	DCF3(7)
-1	Pu-239	3.640E-03	3.640E-03	DCF3(8)
-1	Th-229+D	4.030E-03	4.030E-03	DCF3(9)
-1	U-233	2.890E-04	2.890E-04	DCF3(10)
-1	U-235+D	2.670E-04	2.670E-04	DCF3(11)
-34	Food transfer factors:			
-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	2.000E-05	2.000E-05	RTF(1,2)
-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d	2.000E-05	2.000E-05	RTF(1,3)
-34				
-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	5.000E-05	5.000E-05	RTF(2,2)
-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
-34				
-34	Am-243+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
-34	Am-243+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(3,2)
-34	Am-243+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d	2.000E-06	2.000E-06	RTF(3,3)
-34				
-34	Cm-243 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(4,1)
-34	Cm-243 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	2.000E-05	2.000E-05	RTF(4,2)
-34	Cm-243 , milk/livestock-intake ratio, (pCi/L)/(pCi/d	2.000E-06	2.000E-06	RTF(4,3)
-34				
-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(6,1)
-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	1.000E-03	1.000E-03	RTF(6,2)
-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d	5.000E-06	5.000E-06	RTF(6,3)
-34				
-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(7,1)
-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	5.000E-03	5.000E-03	RTF(7,2)
-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
-34				

Dose Conversion Factor (and Related) Parameter Summary continued
File: DOSFAC.BIN

	Parameter	Current Value	Default	Parameter Name
34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(8,1)
34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	1.000E-04	1.000E-04	RTF(8,2)
34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d	1.000E-06	1.000E-06	RTF(8,3)
34				
34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(9,1)
34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	1.000E-04	1.000E-04	RTF(9,2)
34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d	5.000E-06	5.000E-06	RTF(9,3)
34				
34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	3.400E-04	3.400E-04	RTF(10,2)
34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d	6.000E-04	6.000E-04	RTF(10,3)
34				
34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d	3.400E-04	3.400E-04	RTF(11,2)
34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d	6.000E-04	6.000E-04	RTF(11,3)
5	Bioaccumulation factors, fresh water, L/kg:			
5	Ac-227+D , fish	1.500E-01	1.500E-01	BIOFAC(1,1)
5	Ac-227+D , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(1,2)
5				
5	Am-241 , fish	3.000E-01	3.000E-01	BIOFAC(2,1)
5	Am-241 , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(2,2)
5				
5	Am-243+D , fish	3.000E-01	3.000E-01	BIOFAC(3,1)
5	Am-243+D , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(3,2)
5				
5	Cm-243 , fish	3.000E-01	3.000E-01	BIOFAC(4,1)
5	Cm-243 , crustacea and mollusks	1.000E-03	1.000E-03	BIOFAC(4,2)
5				
5	Np-237+D , fish	3.000E-01	3.000E+01	BIOFAC(6,1)
5	Np-237+D , crustacea and mollusks	4.000E-02	4.000E+02	BIOFAC(6,2)
5				
5	Pa-231 , fish	1.000E-01	1.000E+01	BIOFAC(7,1)
5	Pa-231 , crustacea and mollusks	1.100E-02	1.100E+02	BIOFAC(7,2)
5				
5	Pu-239 , fish	3.000E-01	3.000E-01	BIOFAC(8,1)
5	Pu-239 , crustacea and mollusks	1.000E-03	1.000E-02	BIOFAC(8,2)
5				
5	Th-229+D , fish	1.000E-02	1.000E-02	BIOFAC(9,1)
5	Th-229+D , crustacea and mollusks	5.000E-02	5.000E+02	BIOFAC(9,2)
5				
5	U-233 , fish	1.000E-01	1.000E+01	BIOFAC(10,1)
5	U-233 , crustacea and mollusks	6.000E-01	6.000E-01	BIOFAC(10,2)
5				
5	U-235+D , fish	1.000E-01	1.000E+01	BIOFAC(11,1)
5	U-235+D , crustacea and mollusks	6.000E-01	6.000E-01	BIOFAC(11,2)

Site-Specific Parameter Summary

#	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
1	Area of contaminated zone (m**2)	2.830E-06	1.000E-04	---	AREA
1	Thickness of contaminated zone (m)	3.000E-01	2.000E-00	---	THICK0
1	Length parallel to aquifer flow (m)	1.000E-03	1.000E-02	---	LCZPAQ
1	Basic radiation dose limit (mrem/yr)	2.500E-01	3.000E-01	---	BRDL
1	Time since placement of material (yr)	0.000E-00	0.000E+00	---	TI
1	Times for calculations (yr)	1.000E-00	1.000E-00	---	T 2
1	Times for calculations (yr)	3.000E-00	3.000E-00	---	T 3
1	Times for calculations (yr)	1.000E-01	1.000E-01	---	T 4
1	Times for calculations (yr)	3.000E-01	3.000E-01	---	T 5
1	Times for calculations (yr)	1.000E-02	1.000E-02	---	T 6
1	Times for calculations (yr)	3.000E-02	3.000E-02	---	T 7
1	Times for calculations (yr)	1.000E-03	1.000E-03	---	T 8
1	Times for calculations (yr)	not used	0.000E+00	---	T 9
1	Times for calculations (yr)	not used	0.000E-00	---	T 10
2	Initial principal radionuclide (pCi/g : Am-241	1.000E-00	0.000E-00	---	S1 2
2	Initial principal radionuclide (pCi/g : Pu-239	1.000E-00	0.000E-00	---	S1 4
2	Concentration in groundwater (pCi/L : Am-241	not used	0.000E-00	---	W1 2
2	Concentration in groundwater (pCi/L : Pu-239	not used	0.000E-00	---	W1 4
3	Cover depth (m)	0.000E-00	0.000E-00	---	COVER0
3	Density of cover material (g/cm**3)	not used	1.500E-00	---	DENSCV
3	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
3	Density of contaminated zone (g/cm**3)	1.500E-00	1.500E-00	---	DENSCZ
3	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
3	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
3	Contaminated zone effective porosity	2.000E-01	2.000E-01	---	EPCZ
3	Contaminated zone hydraulic conductivity (m/yr	1.000E-01	1.000E-01	---	HCCZ
3	Contaminated zone b parameter	5.300E-00	5.300E-00	---	BCZ
3	Average annual wind speed (m/sec	2.000E-00	2.000E-00	---	WIND
3	Humidity in air (g/m**3)	not used	8.000E-00	---	HUMID
3	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
3	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
3	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
3	Irrigation mode	overhead	overhead	---	IDITCH
3	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
3	Watershed area for nearby stream or pond (m**2)	1.000E-06	1.000E-06	---	WAREA
3	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
4	Density of saturated zone (g/cm**3)	1.500E-00	1.500E-00	---	DENSAQ
4	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
4	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
4	Saturated zone hydraulic conductivity (m/yr)	4.930E-03	1.000E+02	---	HCSZ
4	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
4	Saturated zone b parameter	4.380E-00	5.300E+00	---	BSZ
4	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
4	Well pump intake depth (m below water table)	1.000E-01	1.000E-01	---	DWIBWT
4	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
4	Well pumping rate (m**3/yr)	2.500E-02	2.500E+02	---	UW
5	Number of unsaturated zone strata	1	1	---	NS

Site-Specific Parameter Summary (continued)

Row	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
15	Unsat. zone 1, thickness (m)	4.600E-00	4.000E-00	---	H 1
15	Unsat. zone 1, soil density (g/cm**3)	1.600E-00	1.500E-00	---	DENSU 1
15	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPU 1
15	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPU 1
15	Unsat. zone 1, soil-specific b parameter	5.300E-00	5.300E+00	---	BU 1
15	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E-01	1.000E+01	---	HGU 1
16	Distribution coefficients for Am-241				
16	Contaminated zone (cm**3/g)	1.900E-03	2.000E-01	---	DCNUC 1
16	Unsaturated zone 1 (cm**3/g)	1.900E-03	2.000E-01	---	DCNUC 1,1
16	Saturated zone (cm**3/g)	1.900E-03	2.000E-01	---	DCNUC 1,2
16	Leach rate (/yr)	0.000E-00	0.000E+00	5.847E-04	ALEACH 1
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 1
16	Distribution coefficients for Cm-243				
16	Contaminated zone (cm**3/g)	4.000E-03	-1.000E+00	---	DCNUC 4
16	Unsaturated zone 1 (cm**3/g)	4.000E-03	-1.000E-00	---	DCNUC 4,1
16	Saturated zone (cm**3/g)	4.000E-03	-1.000E-00	---	DCNUC 4,2
16	Leach rate (/yr)	0.000E-00	0.000E+00	2.773E-04	ALEACH 4
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 4
16	Distribution coefficients for daughter Ac-227				
16	Contaminated zone (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 2
16	Unsaturated zone 1 (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 2,1
16	Saturated zone (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 2,2
16	Leach rate (/yr)	0.000E-00	0.000E+00	5.497E-02	ALEACH 2
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 2
16	Distribution coefficients for daughter Am-243				
16	Contaminated zone (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 3
16	Unsaturated zone 1 (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 3,1
16	Saturated zone (cm**3/g)	2.000E-01	2.000E+01	---	DCNUC 3,2
16	Leach rate (/yr)	0.000E+00	0.000E+00	5.497E-02	ALEACH 3
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 3
16	Distribution coefficients for daughter Np-237				
16	Contaminated zone (cm**3/g)	-1.000E-00	-1.000E+00	2.574E-02	DCNUC 6
16	Unsaturated zone 1 (cm**3/g)	-1.000E-00	-1.000E+00	2.574E-02	DCNUC 6,1
16	Saturated zone (cm**3/g)	-1.000E-00	-1.000E+00	2.574E-02	DCNUC 6,2
16	Leach rate (/yr)	0.000E-00	0.000E+00	4.313E-03	ALEACH 6
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 6
16	Distribution coefficients for daughter Pa-231				
16	Contaminated zone (cm**3/g)	5.000E-01	5.000E+01	---	DCNUC 7
16	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E+01	---	DCNUC 7,1
16	Saturated zone (cm**3/g)	5.000E-01	5.000E+01	---	DCNUC 7,2
16	Leach rate (/yr)	0.000E-00	0.000E+00	2.213E-02	ALEACH 7
16	Solubility constant	0.000E-00	0.000E+00	not used	SOLUBK 7

[illegible] Parameter Summary (continued)

ens	Parameter	User Input	Default	Used by RESRAD If different from user input	Parameter Name
016	Distribution coefficients for daughter P-213				
016	Contaminated zone (cm**3/g)	2.000E-03	2.000E-03	---	DCNUCC(8
016	Unsaturated zone 1 (cm**3/g)	2.000E-03	2.000E-03	---	DCNUCU(8,1
016	Saturated zone (cm**3/g)	2.000E-03	2.000E-03	---	DCNUCS(8
016	Leach rate (/yr)	0.000E-00	0.000E-00	5.855E-04	ALEACH(8
016	Solubility constant	0.000E-00	0.000E-00	not used	SOLUBK(8
016	Distribution coefficients for daughter Tn-219				
016	Contaminated zone (cm**3/g)	6.000E-04	6.000E-04	---	DCNUCC(9
016	Unsaturated zone 1 (cm**3/g)	6.000E-04	6.000E-04	---	DCNUCU(9,1
016	Saturated zone (cm**3/g)	6.000E-04	6.000E-04	---	DCNUCS(9
016	Leach rate (/yr)	0.000E-00	0.000E+00	1.852E-03	ALEACH(9
016	Solubility constant	0.000E+00	0.000E-00	not used	SOLUBK(9
016	Distribution coefficients for daughter U-233				
016	Contaminated zone (cm**3/g	5.000E-01	5.000E-01	---	DCNUCC(10
016	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCU(10,1
016	Saturated zone (cm**3/g	5.000E-01	5.000E-01	---	DCNUCS(10
016	Leach rate (/yr)	0.000E-00	0.000E-00	2.313E-01	ALEACH(10
016	Solubility constant	0.000E-00	0.000E-00	not used	SOLUBK(10
016	Distribution coefficients for daughter U-238				
016	Contaminated zone (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCC(11)
016	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCU(11,1
016	Saturated zone (cm**3/g	5.000E-01	5.000E-01	---	DCNUCS(11
016	Leach rate (/yr)	0.000E-00	0.000E-00	2.313E-01	ALEACH(11
016	Solubility constant	0.000E-00	0.000E-00	not used	SOLUBK(11
017	Inhalation rate (m**3/yr	8.400E-03	8.400E-03	---	INHALR
017	Mass loading for inhalation (g/m**3	1.000E-04	1.000E-04	---	MLINH
017	Exposure duration	3.000E-01	3.000E+01	---	ED
017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
017	Fraction of time spent outdoors (on site	2.500E-01	2.500E+01	---	FOTD
017	Shape factor flag, external gamma	1.000E-00	1.000E-00	>0 shows circular AREA.	FS
017	Radii of shape factor array (used if FS = -1 :				
017	Outer annular radius (m), ring 1:	not used	5.000E-01	---	RAD_SHAPE(1
017	Outer annular radius (m), ring 2:	not used	7.071E-01	---	RAD_SHAPE(2
017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3
017	Outer annular radius (m), ring 4:	not used	0.000E-00	---	RAD_SHAPE(4
017	Outer annular radius (m), ring 5:	not used	0.000E-00	---	RAD_SHAPE(5
017	Outer annular radius (m), ring 6:	not used	0.000E-00	---	RAD_SHAPE(6
017	Outer annular radius (m), ring 7:	not used	0.000E-00	---	RAD_SHAPE(7
017	Outer annular radius (m), ring 8:	not used	0.000E-00	---	RAD_SHAPE(8
017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9
017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10
017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11
017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12

Site-Specific Parameter Summary (continued)

	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
17	Fractions of annular areas within AREA:				
17	Ring 1	not used	1.000E+00	---	FRACA(1)
17	Ring 2	not used	0.732E-01	---	FRACA(2)
17	Ring 3	not used	0.000E+00	---	FRACA(3)
17	Ring 4	not used	0.000E+00	---	FRACA(4)
17	Ring 5	not used	0.000E+00	---	FRACA(5)
17	Ring 6	not used	0.000E+00	---	FRACA(6)
17	Ring 7	not used	0.000E+00	---	FRACA(7)
17	Ring 8	not used	0.000E+00	---	FRACA(8)
17	Ring 9	not used	0.000E+00	---	FRACA(9)
17	Ring 10	not used	0.000E+00	---	FRACA(10)
17	Ring 11	not used	0.000E+00	---	FRACA(11)
17	Ring 12	not used	0.000E+00	---	FRACA(12)
18	Fruits, vegetables and grain consumption (kg/yr)	1.600E-02	1.600E+02	---	DIET(1)
18	Leafy vegetable consumption (kg/yr)	1.400E-01	1.400E-01	---	DIET(2)
18	Milk consumption (L/yr)	9.200E-01	9.200E-01	---	DIET(3)
18	Meat and poultry consumption (kg/yr)	6.300E-01	6.300E-01	---	DIET(4)
18	Fish consumption (kg/yr)	5.400E-02	5.400E-02	---	DIET(5)
18	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
18	Soil ingestion rate (g/yr)	3.650E-01	3.650E-01	---	SOIL
18	Drinking water intake (L/yr)	5.100E-02	5.100E-02	---	DWI
18	Contamination fraction of drinking water	1.000E-00	1.000E+00	---	FDW
18	Contamination fraction of household water	not used	1.000E+00	---	FHHW
18	Contamination fraction of livestock water	1.000E-00	1.000E+00	---	FLW
18	Contamination fraction of irrigation water	1.000E-00	1.000E-00	---	FIRW
18	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FS9
18	Contamination fraction of plant food	-1	-1	0.800E-00	FPLANT
18	Contamination fraction of meat	-1	-1	0.100E-01	FMEAT
18	Contamination fraction of milk	-1	-1	0.100E-01	FMILK
19	Livestock fodder intake for meat (kg/day)	6.800E-01	6.800E-01	---	LFI5
19	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E-01	---	LFI6
19	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
19	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
19	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
19	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
19	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
19	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
19	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
19	Household water fraction from ground water	1.000E-00	1.000E-00	---	FGWHH
19	Livestock water fraction from ground water	not used	1.000E-00	---	FGWLW
19	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E-00	1.500E+00	---	YV(2)
19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)

Site-Specific Parameter Summary (continued)

Num	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
93	Translocation Factor for Leafy	1.000E-01	1.000E-01	---	TIV(2
93	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3
93	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
93	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
93	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
93	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
93	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
93	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3.
93	Weathering Removal Constant for Vegetation	2.000E-01	2.000E-01	---	WLAM
4	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
4	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
4	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
4	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
4	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
4	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
4	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
4	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
4	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
TOR	Storage times of contaminated foodstuffs (days):				
TOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
TOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2.
TOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
TOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
TOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
TOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6
TOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7
TOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8
TOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9,
021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
021	Diffusion coefficient for radon gas (m/sec):				
021	in cover material	not used	2.000E-06	---	DIFCV
021	in foundation material	not used	3.000E-07	---	DIFFL
021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
021	Building interior area factor	not used	0.000E+00	---	FAI
021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
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:	2000000.00 square meters	Am-241	1.000E+00
Thickness:	0.30 meters	Cm-243	1.000E+00
Cover Depth:	0.00 meters		

Total Dose TDOSE(t) , mrem/yr
Basic Radiation Dose Limit = 25 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):	8.151E-01	8.011E-01	7.740E-01	6.995E-01	5.093E-01	2.459E-01	1.849E-04	1.416E-08
M(t):	3.260E-02	3.204E-02	3.096E-02	2.798E-02	2.037E-02	9.834E-03	7.395E-06	5.663E-10

Maximum TDOSE(t): 8.151E-01 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Nu-clide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	2.622E-02	0.0322	4.950E-02	0.0607	0.000E-00	0.0000	1.062E-01	0.1303	5.999E-03	0.0074	3.475E-04	0.0004	9.965E-01	0.1223
-243	3.491E-01	0.4283	3.423E-02	0.0420	0.000E-00	0.0000	7.325E-02	0.0899	1.655E-03	0.0020	2.396E-04	0.0003	6.871E-02	0.0843
tal	3.753E-01	0.4604	8.373E-02	0.1027	0.000E-00	0.0000	1.795E-01	0.2202	7.654E-03	0.0094	5.871E-04	0.0007	1.684E-01	0.2066

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

Water Dependent Pathways

Nu-clide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	8.079E-01	0.9838
-243	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	5.271E-01	0.6417
tal	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	8.151E-01	1.0000

im 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

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	2.616E-02	0.0327	4.939E-02	0.0617	0.000E+00	0.0000	1.057E-01	0.1319	5.966E-03	0.0075	3.467E-04	0.0004	9.943E-02	0.1241
-243	3.406E-01	0.4251	3.340E-02	0.0417	0.000E+00	0.0000	7.124E-02	0.0889	1.615E-03	0.0020	2.338E-04	0.0003	6.704E-02	0.0837
tal	3.667E-01	0.4578	8.279E-02	0.1033	0.000E+00	0.0000	1.769E-01	0.2208	7.601E-03	0.0095	5.804E-04	0.0007	1.663E-01	0.2076

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

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E+00	0.0000	0.000E+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-01	0.3585
-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.141E-01	0.6419
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.011E-01	1.0000

um 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)

dio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	2.605E-02	0.0337	4.913E-02	0.0635	0.000E+00	0.0000	1.045E-01	0.1350	5.958E-03	0.0077	3.451E-04	0.0004	9.899E-02	0.1279
-243	3.242E-01	0.4189	3.180E-02	0.0411	0.000E+00	0.0000	6.738E-02	0.0871	1.537E-03	0.0020	2.228E-04	0.0003	6.383E-02	0.0825
tal	3.502E-01	0.4526	8.093E-02	0.1046	0.000E+00	0.0000	1.719E-01	0.2221	7.496E-03	0.0097	5.676E-04	0.0007	1.628E-01	0.2104

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

dio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.680E-01	0.3463
-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.889E-01	0.6317
tal	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.740E-01	1.0000

um 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.
Am-241	2.565E-02	0.0373	4.843E-02	0.0703	0.000E+00	0.0000	1.005E-01	0.1460	5.862E-03	0.0085	3.396E-04	0.0005	9.749E-02	0.1416
Am-243	2.729E-01	0.3962	2.677E-02	0.0389	0.000E+00	0.0000	5.541E-02	0.0805	1.295E-03	0.0019	1.872E-04	0.0003	5.375E-02	0.0781
Total	2.985E-01	0.4335	7.520E-02	0.1092	0.000E+00	0.0000	1.559E-01	0.2265	7.157E-03	0.0104	5.267E-04	0.0008	1.512E-01	0.2197

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.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.783E-01	0.4042
Am-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.102E-01	0.5958
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	6.885E-01	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)

Nu-clide	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.	All mrem/yr	All fract.
241	2.456E-02	0.0483	4.635E-02	0.0912	0.000E-00	0.0000	8.962E-02	0.1764	5.596E-03	0.0110	3.243E-04	0.0006	9.331E-02	0.1836
243	1.666E-01	0.3278	1.639E-02	0.0323	0.000E-00	0.0000	3.160E-02	0.0622	7.948E-04	0.0016	1.143E-04	0.0002	3.291E-02	0.0648
Total	1.911E-01	0.3761	6.275E-02	0.1235	0.000E-00	0.0000	1.212E-01	0.2386	6.391E-03	0.0126	4.386E-04	0.0009	1.262E-01	0.2484

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

Nu-clide	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.
241	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	3.693E-01	0.7277
243	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	1.384E-01	0.2723
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	5.078E-01	1.0000

um 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-nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	2.108E-02	0.0857	3.977E-02	0.1618	0.000E-00	0.0000	5.713E-02	0.2324	4.756E-03	0.0193	2.759E-04	0.0011	8.006E-02	0.3256
-243	2.941E-02	0.1196	2.974E-03	0.0121	0.000E-00	0.0000	4.287E-03	0.0173	1.512E-04	0.0006	2.040E-05	0.0001	5.971E-03	0.0243
tal	5.049E-02	0.2054	4.275E-02	0.1739	0.000E-00	0.0000	6.136E-02	0.2497	4.907E-03	0.0200	2.963E-04	0.0012	8.603E-02	0.3499

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-nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.031E-01	0.8261
-243	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	4.278E-02	0.1741
tal	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	2.459E-01	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.
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.548E-06	0.0354	1.174E-06	0.0064	6.002E-09	0.0000	0.000E+00	0.0000
Pu-243	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.772E-08	0.0001	4.788E-09	0.0000	1.060E-11	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.566E-06	0.0355	1.179E-06	0.0064	6.013E-09	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.
Pu-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.728E-06	0.0418
Pu-243	2.594E-05	0.1403	1.491E-04	0.8068	0.000E+00	0.0000	1.995E-06	0.0108	2.778E-08	0.0002	2.431E-09	0.0000	1.771E-04	0.9582
Total	2.594E-05	0.1403	1.491E-04	0.8068	0.000E+00	0.0000	1.995E-06	0.0108	2.778E-08	0.0002	2.431E-09	0.0000	1.849E-04	1.0000

*um 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		All
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
-243	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000	0.000E-00	0.0000
tal	0.000E+00	0.0000	0.000E-00	0.0000	0.000E-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*	
clide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
-241	5.725E-09	0.4043	3.363E-09	0.2368	0.000E-00	0.0000	4.404E-10	0.0311	4.167E-11	0.0029	1.609E-10	0.0114	9.720E-09	0.6864
-243	1.775E-09	0.1253	2.524E-09	0.1782	0.000E-00	0.0000	1.365E-10	0.0096	4.303E-12	0.0003	4.343E-10	0.0031	4.441E-09	0.3136
tal	7.500E-09	0.5296	5.877E-09	0.4150	0.000E-00	0.0000	5.769E-10	0.0407	4.647E-11	0.0033	1.614E-10	0.0114	1.416E-08	1.0000

im of all water independent and dependent pathways.

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

Parent	Product	Branch	DSR(j,t) (mrem/yr)/(pCi/g)							
(j)		Fraction*	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
Pu-241	Am-241	1.000E+00	2.879E-01	2.870E-01	2.850E-01	2.783E-01	2.597E-01	2.031E-01	7.718E-06	2.000E+00
Pu-241	Np-237	1.000E+00	0.000E+00	1.149E-06	3.433E-06	1.123E-05	3.005E-05	6.494E-05	1.608E-04	0.000E+00
Pu-241	U-233	1.000E+00	0.000E+00	4.899E-14	3.796E-13	3.716E-12	2.670E-11	1.489E-10	3.065E-14	9.712E-09
Pu-241	Th-229	1.000E+00	0.000E+00	3.260E-17	3.516E-16	2.980E-14	6.950E-13	1.600E-11	2.191E-18	8.030E-12
Pu-241	ΣDSR(j)		2.879E-01	2.870E-01	2.850E-01	2.783E-01	2.599E-01	2.031E-01	7.728E-06	9.720E-09
Cm-243	Cm-243	9.976E-01	5.259E-01	5.129E-01	4.878E-01	4.092E-01	2.476E-01	4.268E-02	2.851E-08	0.000E+00
Cm-243	Pu-239	9.976E-01	0.000E+00	7.355E-06	2.149E-05	6.816E-05	1.808E-04	2.816E-04	1.670E-08	0.000E+00
Cm-243	U-235	9.976E-01	0.000E+00	7.016E-15	6.127E-14	6.100E-13	4.039E-12	1.693E-11	3.401E-16	3.019E-11
Cm-243	Pa-231	9.976E-01	0.000E+00	5.187E-19	1.472E-17	4.914E-16	9.185E-15	9.329E-14	6.179E-17	1.879E-11
Cm-243	Ac-227	9.976E-01	0.000E+00	3.430E-21	2.248E-19	2.079E-17	9.076E-16	1.837E-14	4.038E-13	1.859E-10
Cm-243	ΣDSR(j)		5.259E-01	5.129E-01	4.878E-01	4.092E-01	2.478E-01	4.268E-02	2.851E-08	2.279E-10
Cm-243	Cm-243	2.400E-03	1.265E-03	1.234E-03	1.173E-03	9.844E-04	5.958E-04	1.021E-04	1.396E-11	0.000E+00
Cm-243	Am-243	2.400E-03	0.000E+00	1.726E-07	4.779E-07	1.206E-06	1.666E-06	4.587E-07	1.771E-04	5.762E-12
Cm-243	Pu-239	2.400E-03	0.000E+00	8.191E-13	6.983E-12	6.414E-11	3.438E-10	8.889E-10	1.891E-09	4.207E-09
Cm-243	U-235	2.400E-03	0.000E+00	5.227E-22	1.344E-20	4.174E-19	6.931E-18	8.760E-17	3.811E-16	6.468E-15
Cm-243	Pa-231	2.400E-03	0.000E+00	3.594E-26	2.412E-24	2.569E-22	1.248E-20	3.831E-19	9.218E-17	1.899E-13
Cm-243	Ac-227	2.400E-03	0.000E+00	3.018E-26	6.038E-26	9.113E-24	1.084E-21	3.282E-20	7.870E-16	1.637E-14
Cm-243	ΣDSR(j)		1.265E-03	1.234E-03	1.174E-03	9.856E-04	5.974E-04	1.026E-04	1.771E-04	4.213E-09

*Branch Fraction is the cumulative factor for the j'th principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 25 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
Pu-241	8.682E+01	8.712E+01	8.771E+01	8.984E+01	9.624E+01	1.231E+02	3.235E-06	2.572E+09
Pu-243	4.743E+01	4.863E+01	5.113E+01	6.094E+01	1.006E+02	5.844E+02	1.411E-05	5.629E+09

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 = 0.000E+00 years

minimum DCGL

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pu-241	1.000E+00	0.000E+00	2.879E-01	8.682E+01	2.879E-01	8.682E-01
Pu-243	1.000E+00	0.000E+00	5.271E-01	4.743E+01	5.271E-01	4.743E-01

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

ide	Parent	BRF i	DOSE(j,t), mrem/yr							
	(i)		t= 1.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
241	Am-241	1.000E+00	2.479E-01	2.870E-01	2.860E-01	2.783E-01	2.597E-01	2.030E-01	7.712E-06	0.000E+00
237	Am-241	1.000E+00	0.000E+00	1.149E-06	3.483E-06	1.123E-05	3.005E-05	6.494E-05	1.603E-03	0.000E+00
33	Am-241	1.000E+00	0.000E+00	4.899E-14	3.793E-13	3.716E-12	2.670E-11	1.488E-10	3.068E-14	9.712E-09
229	Am-241	1.000E+00	0.000E+00	3.860E-17	8.516E-16	2.980E-14	6.950E-13	1.600E-11	2.191E-15	8.230E-12
243	Cm-243	9.976E-01	5.289E-01	5.129E-01	4.879E-01	4.090E-01	2.476E-01	4.245E-02	5.801E-09	0.000E+00
243	Cm-243	2.400E-03	1.268E-03	1.234E-03	1.173E-03	9.844E-04	5.958E-04	1.021E-04	1.396E-11	0.000E+00
243	ΣDOSE(j):		5.271E-01	5.141E-01	4.889E-01	4.102E-01	2.482E-01	4.256E-02	5.815E-09	0.000E+00
239	Cm-243	9.976E-01	0.000E+00	7.355E-06	2.149E-05	6.516E-05	1.508E-04	2.316E-04	1.670E-08	0.000E+00
239	Cm-243	2.400E-03	0.000E+00	8.191E-13	6.983E-12	6.414E-11	3.455E-10	8.889E-10	1.891E-09	4.207E-09
239	ΣDOSE(j):		0.000E+00	7.355E-06	2.149E-05	6.516E-05	1.508E-04	2.316E-04	1.859E-08	4.207E-09
35	Cm-243	9.976E-01	0.000E+00	7.016E-15	6.127E-14	6.100E-13	4.039E-12	1.683E-11	1.804E-16	2.313E-11
35	Cm-243	2.400E-03	0.000E+00	5.227E-22	1.344E-20	4.174E-19	6.932E-18	5.780E-17	3.811E-16	6.468E-15
35	ΣDOSE(j):		0.000E+00	7.016E-15	6.127E-14	6.100E-13	4.039E-12	1.683E-11	1.818E-16	2.313E-11
231	Cm-243	9.976E-01	0.000E+00	5.187E-19	1.472E-17	4.914E-16	9.125E-15	9.329E-14	6.179E-17	1.879E-11
231	Cm-243	2.400E-03	0.000E+00	3.894E-26	2.412E-24	2.568E-22	1.248E-20	2.821E-19	9.218E-17	1.899E-15
231	ΣDOSE(j):		0.000E+00	5.187E-19	1.472E-17	4.914E-16	9.125E-15	9.329E-14	1.540E-16	1.879E-11
227	Cm-243	9.976E-01	0.000E+00	3.430E-21	2.248E-19	2.079E-17	9.076E-16	1.837E-14	4.038E-13	1.859E-10
227	Cm-243	2.400E-03	0.000E+00	3.018E-26	6.089E-26	9.113E-24	1.084E-21	5.292E-20	7.670E-16	1.637E-14
227	ΣDOSE(j):		0.000E+00	3.430E-21	2.248E-19	2.079E-17	9.076E-16	1.837E-14	4.045E-13	1.859E-10
243	Cm-243	2.400E-03	0.000E+00	1.726E-07	4.779E-07	1.206E-06	1.666E-06	4.887E-07	1.771E-04	5.763E-13

(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t=	1.000E+00	1.000E+00	3.100E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pu-241	Am-241	1.000E+00	1.000E+00	9.978E-01	9.938E-01	9.784E-01	9.365E-01	8.034E-01	5.146E-01	1.121E-01
Np-237	Am-241	1.000E+00	0.000E+00	3.228E-07	9.623E-07	3.135E-06	8.816E-06	2.344E-05	3.727E-05	1.505E-05
U-233	Am-241	1.000E+00	0.000E+00	7.015E-13	6.136E-12	6.444E-11	4.829E-10	2.987E-09	7.084E-09	3.246E-09
Th-229	Am-241	1.000E+00	0.000E+00	2.213E-17	5.891E-16	2.076E-14	4.885E-13	1.164E-11	1.184E-10	4.632E-11
Pu-243	Cm-243	9.976E-01	9.976E-01	9.734E-01	9.266E-01	7.801E-01	4.769E-01	8.534E-02	6.223E-04	2.070E-11
Am-243	Cm-243	2.400E-03	2.400E-03	2.342E-03	2.229E-03	1.877E-03	1.147E-03	2.051E-04	1.497E-06	4.979E-14
Am-243	ΣS(j):		1.000E+00	9.757E-01	9.289E-01	7.819E-01	4.781E-01	8.545E-02	6.238E-04	2.074E-11
U-239	Cm-243	9.976E-01	0.000E+00	2.838E-05	8.302E-05	2.540E-04	6.037E-04	1.026E-03	1.003E-03	6.671E-04
U-239	Cm-243	2.400E-03	0.000E+00	3.161E-12	2.698E-11	2.500E-10	1.393E-09	3.939E-09	4.159E-09	2.767E-09
U-239	ΣS(j):		0.000E+00	2.838E-05	8.302E-05	2.540E-04	6.037E-04	1.026E-03	1.003E-03	6.671E-04
U-235	Cm-243	9.976E-01	0.000E+00	1.393E-14	1.213E-13	1.210E-12	8.042E-12	3.419E-11	4.881E-11	3.080E-11
U-235	Cm-243	2.400E-03	0.000E+00	1.039E-21	2.666E-21	8.282E-19	1.380E-17	1.169E-16	1.878E-16	1.268E-16
U-235	ΣS(j):		0.000E+00	1.393E-14	1.213E-13	1.210E-12	8.042E-12	3.419E-11	4.881E-11	3.080E-11
Pa-231	Cm-243	9.976E-01	0.000E+00	9.808E-20	2.558E-18	8.397E-17	1.615E-15	1.954E-14	4.336E-14	2.992E-14
Pa-231	Cm-243	2.400E-03	0.000E+00	5.499E-27	4.238E-25	4.406E-23	2.212E-21	5.911E-20	1.769E-19	1.241E-19
Pa-231	ΣS(j):		0.000E+00	9.808E-20	2.558E-18	8.397E-17	1.615E-15	1.954E-14	4.336E-14	2.992E-14
Ac-227	Cm-243	9.976E-01	0.000E+00	7.699E-22	5.861E-20	5.851E-18	2.669E-16	5.933E-15	1.586E-14	1.105E-14
Ac-227	Cm-243	2.400E-03	0.000E+00	3.466E-29	7.881E-27	2.538E-24	3.181E-22	1.705E-20	6.450E-20	4.582E-20
Ac-227	ΣS(j):		0.000E+00	7.699E-22	5.861E-20	5.851E-18	2.669E-16	5.933E-15	1.586E-14	1.105E-14
Cm-243	Cm-243	2.400E-03	0.000E+00	2.166E-07	6.003E-07	1.819E-06	2.119E-06	6.022E-07	4.616E-09	1.535E-16

BRF(i) is the branch fraction of the parent nuclide.

Title : Default Case for RESRAD-BUILD
Input File : C:\WINBLD\FRROOM1A.I

ATTACHMENT 4
RESRAD-BUILD OUTPUT FOR
SOME OF THE FISSION PRODUCTS

RESRAD-BUILD Table of Contents

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1A.I

RESRAD-BUILD Input Parameters

Number of Sources : 1
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.500000E-01

Receptor Information

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	15.000	25.000	1.000	1.000	1.80E+01	1.00E-04

Receptor-Source Shielding Relationship

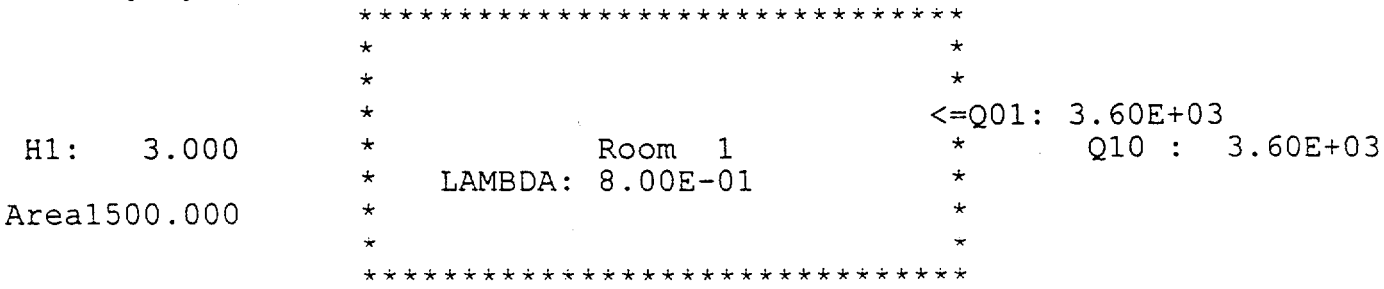
Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1A.I

Building Information

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m] Air Exchanges [m3/hr]
Area [m2]



Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1A.I

Source Information

Source: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00[m]
Geometry:: Type: Area Area:1.50E+03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
CE-144	1.000E+00	2.110E-05	2.160E-04	6.830E-06	2.030E-07	3.290E-04
I-129	1.000E+00	2.760E-04	1.740E-04	3.020E-06	8.110E-09	4.450E-05
TC-99	1.000E+00	1.460E-06	8.330E-06	9.130E-09	7.860E-11	1.900E-07
NI-59	1.000E+00	2.100E-07	2.700E-06	0.000E+00	0.000E+00	0.000E+00
CO-60	1.000E+00	2.690E-05	2.190E-04	2.750E-04	1.020E-05	1.470E-02
CO-57	1.000E+00	1.180E-06	9.070E-06	1.350E-05	3.140E-07	6.560E-04
C-14	1.000E+00	2.090E-06	2.090E-06	1.880E-09	8.420E-12	2.620E-08

tle : Default Case for RESRAD-BUILD
put File : C:\WINBLD\FRROOM1A.IEvaluation Time: 0.000000 years

Assessment for Time: 1
Time =0.00E+00 yr

Source Information

Source: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.50E+03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
CE-144	1.000E+00
I-129	1.000E+00
TC-99	1.000E+00
NI-59	1.000E+00
CO-60	1.000E+00
CO-57	1.000E+00
C-14	1.000E+00

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]

	Source 1	Total
eceptor 1	4.9E-05	4.9E-05
otal	4.9E-05	4.9E-05

Pathway Detail of Doses

[mrem]

)urce: 1

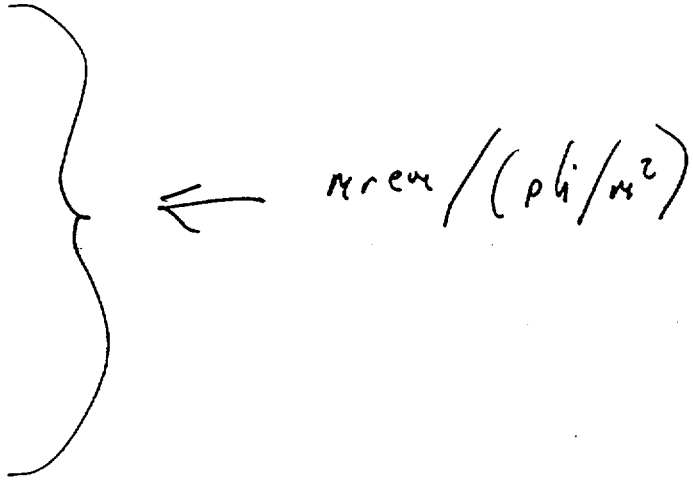
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	4.22E-05	1.68E-06	8.13E-09	1.98E-06	0.00E+00	3.28E-06
Total	4.22E-05	1.68E-06	8.13E-09	1.98E-06	0.00E+00	3.28E-06

Nuclide Detail of Doses

[mrem]

urce: 1

Nuclide	Receptor 1	Total
E-144		
CE-144	1.59E-06	1.59E-06
-129		
I-129	4.42E-06	4.42E-06
C-99		
TC-99	4.77E-08	4.77E-08
I-59		
NI-59	1.27E-08	1.27E-08
O-60		
CO-60	4.13E-05	4.13E-05
O-57		
CO-57	1.80E-06	1.80E-06
-14		
C-14	2.99E-08	2.99E-08



tle : Default Case for RESRAD-BUILD
put File : C:\WINBLD\FRROOM1A.I

RESRAD-BUILD Dose (Time) Tables

Receptor Doses Received for the Exposure Duration

(mrem)

	Evaluation Time [yr]
	0.00E+00
1	4.92E-05

Receptor Dose/Yr Averaged Over Exposure Duration

(mrem/yr)

	Evaluation Time [yr]
	0.00E+00
	4.92E-05

le : Default Case for RESRAD-BUILD
ut File : C:\WINBLD\FRROOM1.IN

ATTACHMENT 5
RESRAD-BUILD OUTPUT FOR
FISSION/ACTIVATION PRODUCTS

RESRAD-BUILD Table of Contents

RESRAD-BUILD Input Parameters

Number of Sources : 1
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.500000E-01

Receptor Information

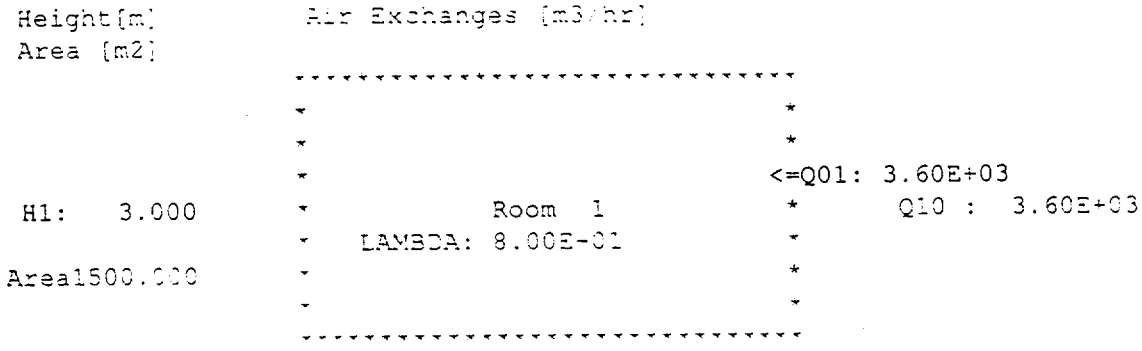
ceptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion/Dust [m2/hr]
1	1	15.000	25.000	1.000	1.000	1.80E-01	1.00E-04

Receptor-Source Shielding Relationship

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete

Building Information

Building Air Exchange Rate: 8.00E-01 1/hr



Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

Source Information

ource: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00[m]
Geometry:: Type: Area Area:1.50E+03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
CS-137	1.000E+00	5.000E-05	3.190E-05	6.490E-05	2.140E-06	3.190E-03
CS-134	1.000E+00	7.330E-05	4.630E-05	1.780E-04	5.930E-06	8.860E-03
AG-110m	1.000E+00	1.080E-05	9.030E-05	3.100E-04	1.080E-05	1.590E-02
SR-90	1.000E+00	1.530E-04	1.310E-03	6.560E-07	1.540E-08	2.310E-05
ZN-65	1.000E+00	1.440E-05	2.040E-05	6.470E-05	2.320E-06	3.390E-03
NI-63	1.000E+00	5.770E-07	6.290E-06	0.000E+00	0.000E+00	0.000E+00
CO-60	1.000E+00	2.690E-05	2.190E-04	2.750E-04	1.020E-05	1.470E-02
FE-55	1.000E+00	6.070E-07	2.690E-06	0.000E+00	0.000E+00	0.000E+00
MN-54	1.000E+00	2.770E-06	6.700E-06	9.500E-05	3.230E-06	4.790E-03
H-3	1.000E+00	6.400E-08	6.400E-08	0.000E+00	0.000E+00	0.000E+00

Title : Default Case for RESRAD-BUILD
Input File : C:\WINBLD FRROOM1.INEvaluation Time: 0.000000 years

Assessment for Time: 1
Time =0.00E+00 yr

Source Information

Source: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.50E-03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E-02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
CS-137	1.000E+00
CS-134	1.000E+00
AG-110m	1.000E+00
SR-90	1.000E+00
[illegible]	1.000E+00
NI-63	1.000E+00
CO-60	1.000E+00
FE-55	1.000E+00
MN-54	1.000E+00
H-3	1.000E+00

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]

	Source 1	Total
Receptor 1	1.5E-04	1.5E-04
Total	1.5E-04	1.5E-04

Pathway Detail of Doses

(mrem)

ource: 1

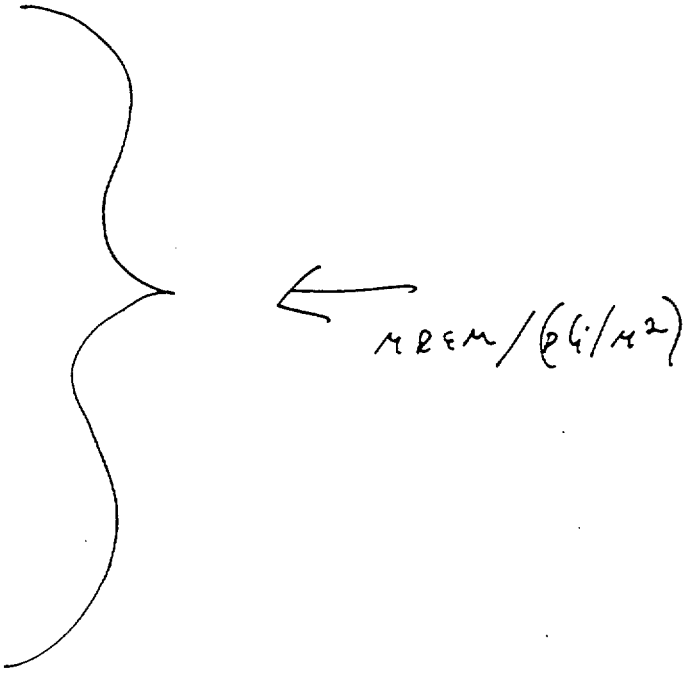
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.40E-04	4.42E-06	2.13E-08	6.28E-06	0.00E+00	3.04E-06
Total	1.40E-04	4.42E-06	2.13E-08	6.28E-06	0.00E+00	3.04E-06

Nuclide Detail of Doses

(mrem)

rce: 1

Nuclide	Receptor 1	Total
-137		
S-137	1.02E-05	1.02E-05
-134		
S-134	2.66E-05	2.66E-05
-110		
G-110m	4.54E-05	4.54E-05
-90		
R-90	6.75E-06	6.75E-06
-65		
N-65	9.53E-06	9.53E-06
-63		
-63	3.04E-08	3.04E-08
-60		
O-60	4.13E-05	4.13E-05
-55		
E-55	1.35E-08	1.35E-08
-54		
N-54	1.40E-05	1.40E-05
-3		
-3	9.87E-10	9.87E-10



Title : Default Case for RESRAD-BUILD
Input File : C:\WINBLD FRRDOM1.IN

RESRAD-BUILD Dose (Time) Tables

Receptor Doses Received for the Exposure Duration

(mrem)

	Evaluation Time [yr]
	0.00E+00
1	1.54E-04

Receptor Dose/Yr Averaged Over Exposure Duration

(mrem/yr)

	Evaluation Time [yr]
	0.00E-00
1	1.54E-04

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1P.I

ATTACHMENT 6
RESRAD-BUILD OUTPUT
FOR TRANSURANICS

RESRAD-BUILD Table of Contents

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1P.I

RESRAD-BUILD Input Parameters

Number of Sources : 1
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 2.500000E-01

Receptor Information

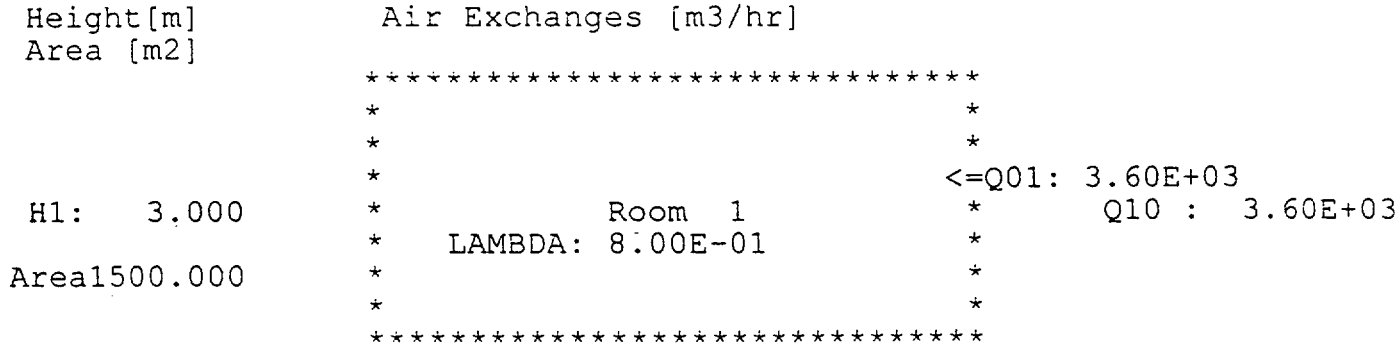
eceptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	15.000	25.000	1.000	1.000	1.80E+01	1.00E-04

Receptor-Source Shielding Relationship

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete

Building Information

Building Air Exchange Rate: 8.00E-01 1/hr



Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

itle : Default Case for RESRAD-BUILD
nput File : C:\WINBLD\FRROOM1P.I

Source Information

Source: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00[m]
Geometry:: Type: Area Area:1.50E+03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E+02 [day]

Radon Release Fraction: 1.000E-01

Contamination::

Nuclide	Concentration	Dose Conversion Factors				
		Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
	[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
CM-243	1.000E+00	2.510E-03	3.070E-01	1.460E-05	3.650E-07	6.880E-04
PU-241	1.000E+00	6.850E-05	8.250E-03	6.070E-10	1.180E-11	2.560E-08
AM-241	1.000E+00	3.640E-03	4.440E-01	3.220E-06	2.740E-08	9.570E-05
PU-239	1.000E+00	3.540E-03	4.290E-01	4.290E-08	1.850E-10	4.960E-07
PU-238	1.000E+00	3.200E-03	3.920E-01	9.800E-08	9.480E-11	5.710E-07
NP-237	0.000E+00	4.440E-03	5.400E-01	2.620E-05	6.880E-07	1.210E-03
U-235	0.000E+00	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.000E+00	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
U-233	0.000E+00	2.890E-04	1.350E-01	8.380E-08	8.750E-10	1.910E-06
PA-231	0.000E+00	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-229	0.000E+00	4.030E-03	2.160E+00	3.680E-05	9.870E-07	1.720E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05
CO-60	1.000E+00	2.690E-05	2.190E-04	2.750E-04	1.020E-05	1.470E-02

Assessment for Time: 1
Time =0.00E+00 yr

Source Information

Source: 1
Location:: Room : 1 x: 15.00 y: 25.00 z: 0.00 [m]
Geometry:: Type: Area Area:1.50E+03 [m2] Direction: z
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 5.000E-01
Time to Remove: 3.650E+02 [day]

Contamination::

Nuclide	Concentration [pCi/m2]
CM-243	1.000E+00
PU-241	1.000E+00
AM-241	1.000E+00
PU-239	1.000E+00
PU-238	1.000E+00
NP-237	0.000E+00
U-235	0.000E+00
U-234	1.000E+00
U-233	0.000E+00
PA-231	0.000E+00
TH-230	0.000E+00
TH-229	0.000E+00
AC-227	0.000E+00
RA-226	0.000E+00
PB-210	0.000E+00
CO-60	1.000E+00

Title : Default Case for RESRAD-BUILD
Input File : C:\WINBLD\FRROOM1P.IEvaluation Time: 0.000000 years

RESRAD-BUILD Dose Tables

Source Contributions to Receptor Doses

[mrem]

		Source 1	Total
Receptor	1	6.8E-03	6.8E-03
Total		6.8E-03	6.8E-03

Pathway Detail of Doses

[mrem]

ource: 1

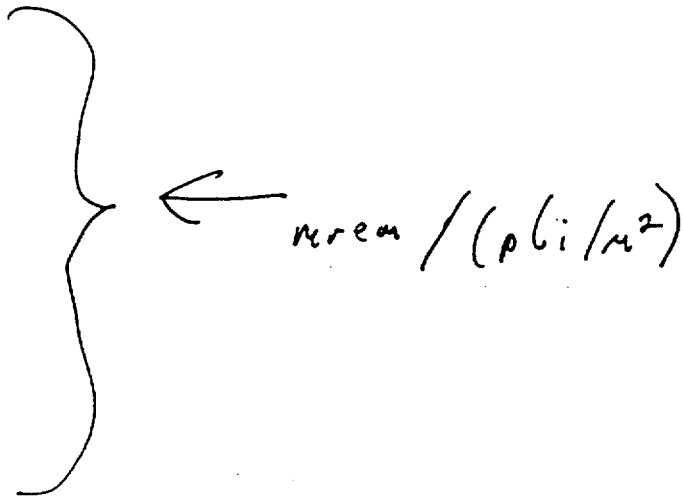
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	4.13E-05	1.69E-06	8.24E-09	6.65E-03	8.35E-27	1.37E-04
Total	4.13E-05	1.69E-06	8.24E-09	6.65E-03	8.35E-27	1.37E-04

Nuclide Detail of Doses

[mrem]

urce: 1

Nuclide	Receptor 1	Total
M-243		
CM-243	1.20E-03	1.20E-03
U-241		
PU-241	3.15E-05	3.15E-05
M-241		
AM-241	1.77E-03	1.77E-03
U-239		
PU-239	1.71E-03	1.71E-03
U-238		
PU-238	1.55E-03	1.55E-03
-234		
U-234	5.19E-04	5.19E-04
O-60		
CO-60	4.13E-05	4.13E-05



Title : Default Case for RESRAD-BUILD
Input File : C:\WINBLD\FRROOM1P.I

RESRAD-BUILD Dose (Time) Tables

Receptor Doses Received for the Exposure Duration

(mrem)

	Evaluation Time [yr]
	0.00E+00
1	6.83E-03

Receptor Dose/Yr Averaged Over Exposure Duration

(mrem/yr)

	Evaluation Time [yr]
	0.00E+00
1	6.83E-03

Resrad Build results - "room1"

Multi isotope / receptor / source summary

	Receptor 1	DCGL Calculation			
	Source #			DCGL	DCGL
Isotope	1	total mrem/pCi/r	dpm/100cn /mrem	dpm/100cm /25 mrem	dpm/100cm2 /15 mrem
Cs-137	1.02E-05	1.02E-05	2.16E+03	5.4E+04	3.2E+04
Cs-134	2.66E-05	2.66E-05	8.27E+02	2.1E+04	1.2E+04
Ag-110m	4.54E-05	4.54E-05	4.85E+02	1.2E+04	7.3E+03
Sr-90	6.75E-06	6.75E-06	3.26E+03	8.1E+04	4.9E+04
Zn-65	9.53E-06	9.53E-06	2.31E+03	5.8E+04	3.5E+04
Ni-63	3.04E-08	3.04E-08	7.24E+05	1.8E+07	1.1E+07
Co-60	4.13E-05	4.13E-05	5.33E+02	1.3E+04	8.0E+03
Fe-55	1.35E-08	1.35E-08	1.63E+06	4.1E+07	2.4E+07
Mn-54	1.40E-05	1.40E-05	1.57E+03	3.9E+04	2.4E+04
H-3	9.87E-10	9.87E-10	2.23E+07	5.6E+08	3.3E+08
Ce144	1.59E-06	1.59E-06	1.38E+04	3.5E+05	2.1E+05
I129	4.42E-06	4.42E-06	4.98E+03	1.2E+05	7.5E+04
Tc99	4.77E-08	4.77E-08	4.61E+05	1.2E+07	6.9E+06
Ni59	1.27E-08	1.27E-08	1.73E+06	4.3E+07	2.6E+07
Co57	1.80E-06	1.80E-06	1.22E+04	3.1E+05	1.8E+05
C14	2.99E-08	2.99E-08	7.36E+05	1.8E+07	1.1E+07
		5.29E+09			
		7.77E+08			

ATTACHMENT 2
EXCEL SPREADSHEET
USED TO CALCULATE THE
GROSS BETA DCGL
AND TO DISCARD DUST
THE WASTE MGT

Resrad Build results - "room1"

Multi isotope / receptor / source summary

10CFR61 DCGL adjustment example

Isotope	Filter Sludge mix	Receptor 1 DCGL(25)	fraction adjusted	%	Beta Factor	Adjusted DCGL	
Cs-137	14.18	5.4E+04	2.6E-04	6.9E+00	1	3.7E+03	
Cs-134	0.23	2.1E+04	1.1E-05	2.9E-01	1	6.1E+01	
Ag-110m	4.4	1.2E+04	3.6E-04	9.6E+00	1	1.2E+03	
Sr-90	0.11	8.1E+04	1.4E-06	3.6E-02	2	5.8E+01	
Zn-65	0.8	5.8E+04	1.4E-05	3.7E-01	0.1	2.1E+01	
Ni-63	0.73	1.8E+07	4.0E-08	1.1E-03	0	0.0E+00	
Co-60	40.99	1.3E+04	3.1E-03	8.1E+01	1	1.1E+04	
Fe-55	8.35	4.1E+07	2.0E-07	5.4E-03	0	0.0E+00	
Mn-54	2.56	3.9E+04	6.5E-05	1.7E+00	0.1	6.7E+01	
H-3	2.95	5.6E+08	5.3E-09	1.4E-04	0	0.0E+00	
Ce144	0.11	3.5E+05	3.2E-07	8.4E-03	2	5.8E+01	
I129	0	1.2E+05	0.0E+00	0.0E+00	0	0.0E+00	
Tc99	0	1.2E+07	0.0E+00	0.0E+00	1	0.0E+00	
Ni59	0.02	4.3E+07	4.6E-10	1.2E-05	0	0.0E+00	
Co57	0.02	3.1E+05	6.5E-08	1.7E-03	0	0.0E+00	
C14	0	1.8E+07	0.0E+00	0.0E+00	0.5	0.0E+00	
	75.45		3.8E-03	1.0E+02		**1.6E+04**	Adjusted Combined DCGL

Resrad Build results - "room1"

Multi isotope / receptor / source summary

10CFR61 DCGL adjustment example with 5 years of decay

Isotope	t 1/2 years	decayed Filter Sludge mix	Receptor 1 DCGL(25)	fraction adjusted	%	Beta Factor	Adjusted DCGL
Cs-137	30.2	12.643	5.4E+04	2.3E-04	1.3E+01	1	6.9E+03
Cs-134	2.06	0.043	2.1E+04	2.1E-06	1.1E-01	1	2.3E+01
Ag-110m	0.69	0.029	1.2E+04	2.4E-06	1.3E-01	1	1.6E+01
Sr-90	28.8	0.098	8.1E+04	1.2E-06	6.5E-02	2	1.1E+02
Zn-65	0.668	0.004	5.8E+04	7.7E-08	4.2E-03	0.1	2.4E-01
Ni-63	100	0.705	1.8E+07	3.9E-08	2.1E-03	0	0.0E+00
Co-60	5.27	21.239	1.3E+04	1.6E-03	8.7E+01	1	1.2E+04
Fe-55	2.68	2.292	4.1E+07	5.6E-08	3.1E-03	0	0.0E+00
Mn-54	0.855	0.044	3.9E+04	1.1E-06	6.2E-02	0.1	2.4E+00
H-3	12.3	2.226	5.6E+08	4.0E-09	2.2E-04	0	0.0E+00
Ce144	0.78	0.001	3.5E+05	3.7E-09	2.0E-04	2	1.4E+00
I129	1.57E+07	0.000	1.2E+05	0.0E+00	0.0E+00	0	0.0E+00
Tc99	2.14E+05	0.000	1.2E+07	0.0E+00	0.0E+00	1	0.0E+00
Ni59	7.50E+04	0.020	4.3E+07	4.6E-10	2.5E-05	0	0.0E+00
Co57	0.742	0.000	3.1E+05	6.1E-10	3.3E-05	0	0.0E+00
C14	5730	0.000	1.8E+07	0.0E+00	0.0E+00	0.5	0.0E+00
		39.344		1.8E-03	1.0E+02		**1.9E+04** Adjusted Combined DCGL

DCGL Calculation - Transuranics

	Receptor 1				
	Source #			DCGL	DCGL
Isotope	1	total mrem/pCi/r	dpm/100cn /mrem	dpm/100cm /25 mrem	dpm/100cm2 /15 mrem
Cm243	1.20E-03	1.20E-03	1.83E+01	4.6E+02	2.8E+02
Pu241	3.15E-05	3.15E-05	6.98E+02	1.7E+04	1.0E+04
Am241	1.77E-03	1.77E-03	1.24E+01	3.1E+02	1.9E+02
Pu239	1.71E-03	1.71E-03	1.29E+01	3.2E+02	1.9E+02
Pu238	1.55E-03	1.55E-03	1.42E+01	3.5E+02	2.1E+02
U234	5.19E-04	5.19E-04	4.24E+01	1.1E+03	6.4E+02

Resrad Bu

Multi isotope

Receptor 1

Isotope	Source # 1
Cs-137	0.0000102
Cs-134	0.0000266
Ag-110m	0.0000454
Sr-90	0.00000675
Zn-65	0.00000953
Ni-63	0.0000000304
Co-60	0.0000413
Fe-55	0.0000000135
Mn-54	0.000014
H-3	0.000000000987
Ce144	0.00000159
I129	0.00000442
Tc99	0.0000000477
Ni59	0.0000000127
Co57	0.0000018
C14	0.0000000299

DCGL Calculation

total mrem/pCi/m2	dpm/100cm2 /mrem	DCGL dpm/100cm2 /25 mrem	DCGL dpm/100cm2 /15 mrem
=SUM(B7:D7)	=1/(E7*100)*2.2	=F7*25	=F7*15
=SUM(B8:D8)	=1/(E8*100)*2.2	=F8*25	=F8*15
=SUM(B9:D9)	=1/(E9*100)*2.2	=F9*25	=F9*15
=SUM(B10:D10)	=1/(E10*100)*2.2	=F10*25	=F10*15
=SUM(B11:D11)	=1/(E11*100)*2.2	=F11*25	=F11*15
=SUM(B12:D12)	=1/(E12*100)*2.2	=F12*25	=F12*15
=SUM(B13:D13)	=1/(E13*100)*2.2	=F13*25	=F13*15
=SUM(B14:D14)	=1/(E14*100)*2.2	=F14*25	=F14*15
=SUM(B15:D15)	=1/(E15*100)*2.2	=F15*25	=F15*15
=SUM(B16:D16)	=1/(E16*100)*2.2	=F16*25	=F16*15
=SUM(B17:D17)	=1/(E17*100)*2.2	=F17*25	=F17*15
=SUM(B18:D18)	=1/(E18*100)*2.2	=F18*25	=F18*15
=SUM(B19:D19)	=1/(E19*100)*2.2	=F19*25	=F19*15
=SUM(B20:D20)	=1/(E20*100)*2.2	=F20*25	=F20*15
=SUM(B21:D21)	=1/(E21*100)*2.2	=F21*25	=F21*15
=SUM(B22:D22)	=1/(E22*100)*2.2	=F22*25	=F22*15

=G7/E7
=G8/E8

Resrad Bu

Multi isotope

10CFR61 DCGL

Isotope	Filter Sludge mix	Receptor 1 DCGL(25)	fraction adjusted	%	Beta Factor	Adjusted DCGL
=A7	14.18	=G7	=B34/C34	=D34*100/$D$50	1	=F34*E34*C34/100
=A8	0.23	=G8	=B35/C35	=D35*100/$D$50	1	=F35*E35*C35/100
=A9	4.4	=G9	=B36/C36	=D36*100/$D$50	1	=F36*E36*C36/100
=A10	0.11	=G10	=B37/C37	=D37*100/$D$50	2	=F37*E37*C37/100
=A11	0.8	=G11	=B38/C38	=D38*100/$D$50	0.1	=F38*E38*C38/100
=A12	0.73	=G12	=B39/C39	=D39*100/$D$50	0	=F39*E39*C39/100
=A13	40.99	=G13	=B40/C40	=D40*100/$D$50	1	=F40*E40*C40/100
=A14	8.35	=G14	=B41/C41	=D41*100/$D$50	0	=F41*E41*C41/100
=A15	2.56	=G15	=B42/C42	=D42*100/$D$50	0.1	=F42*E42*C42/100
=A16	2.95	=G16	=B43/C43	=D43*100/$D$50	0	=F43*E43*C43/100
=A17	0.11	=G17	=B44/C44	=D44*100/$D$50	2	=F44*E44*C44/100
=A18	0	=G18	=B45/C45	=D45*100/$D$50	0	=F45*E45*C45/100
=A19	0	=G19	=B46/C46	=D46*100/$D$50	1	=F46*E46*C46/100
=A20	0.02	=G20	=B47/C47	=D47*100/$D$50	0	=F47*E47*C47/100
=A21	0.02	=G21	=B48/C48	=D48*100/$D$50	0	=F48*E48*C48/100
=A22	0	=G22	=B49/C49	=D49*100/$D$50	0.5	=F49*E49*C49/100
	=SUM(B34:B49)		=SUM(D34:D49)	=SUM(E34:E49)		**=SUM(G34:G49)** Adjusted Combined DC

Resrad Bu

Multi isotope

10CFR61 DCGL :

Isotope	t 1/2 years	decayed Filter Sludge mix	Receptor 1 DCGL(25)	fraction adjusted	%	Beta Factor	Adjusted DCGL
=A7	30.2	=B34*EXP(-0.693/B60*5)	=G7	=C60/D60	=E60*100/$E$76	=F34	=G60*F60*D60/100
=A8	2.06	=B35*EXP(-0.693/B61*5)	=G8	=C61/D61	=E61*100/$E$76	=F35	=G61*F61*D61/100
=A9	0.69	=B36*EXP(-0.693/B62*5)	=G9	=C62/D62	=E62*100/$E$76	=F36	=G62*F62*D62/100
=A10	28.8	=B37*EXP(-0.693/B63*5)	=G10	=C63/D63	=E63*100/$E$76	=F37	=G63*F63*D63/100
=A11	0.668	=B38*EXP(-0.693/B64*5)	=G11	=C64/D64	=E64*100/$E$76	=F38	=G64*F64*D64/100
=A12	100	=B39*EXP(-0.693/B65*5)	=G12	=C65/D65	=E65*100/$E$76	=F39	=G65*F65*D65/100
=A13	5.27	=B40*EXP(-0.693/B66*5)	=G13	=C66/D66	=E66*100/$E$76	=F40	=G66*F66*D66/100
=A14	2.68	=B41*EXP(-0.693/B67*5)	=G14	=C67/D67	=E67*100/$E$76	=F41	=G67*F67*D67/100
=A15	0.855	=B42*EXP(-0.693/B68*5)	=G15	=C68/D68	=E68*100/$E$76	=F42	=G68*F68*D68/100
=A16	12.3	=B43*EXP(-0.693/B69*5)	=G16	=C69/D69	=E69*100/$E$76	=F43	=G69*F69*D69/100
=A17	0.78	=B44*EXP(-0.693/B70*5)	=G17	=C70/D70	=E70*100/$E$76	=F44	=G70*F70*D70/100
=A18	15700000	=B45*EXP(-0.693/B71*5)	=G18	=C71/D71	=E71*100/$E$76	=F45	=G71*F71*D71/100
=A19	214000	=B46*EXP(-0.693/B72*5)	=G19	=C72/D72	=E72*100/$E$76	=F46	=G72*F72*D72/100
=A20	75000	=B47*EXP(-0.693/B73*5)	=G20	=C73/D73	=E73*100/$E$76	=F47	=G73*F73*D73/100
=A21	0.742	=B48*EXP(-0.693/B74*5)	=G21	=C74/D74	=E74*100/$E$76	=F48	=G74*F74*D74/100
=A22	5730	=B49*EXP(-0.693/B75*5)	=G22	=C75/D75	=E75*100/$E$76	=F49	=G75*F75*D75/100
		=SUM(C60:C75)		=SUM(E60:E75)	=SUM(F60:F75)		**=SUM(H60:H75)**

Resrad Bu

Multi isotope

10CFR61 DCGL

Isotope	t 1/2 years	decayed Filter Sludge mix	Receptor 1 DCGL(25)	fraction adjusted	%	Beta Factor	Adjusted DCGL
=A7	30.2	=B34*EXP(-0.693/B86*20)	=G7	=C86/D86	=E86*100/$E$102	=G60	=G86*F86*D86/100
=A8	2.06	=B35*EXP(-0.693/B87*20)	=G8	=C87/D87	=E87*100/$E$102	=G61	=G87*F87*D87/100
=A9	0.69	=B36*EXP(-0.693/B88*20)	=G9	=C88/D88	=E88*100/$E$102	=G62	=G88*F88*D88/100
=A10	28.8	=B37*EXP(-0.693/B89*20)	=G10	=C89/D89	=E89*100/$E$102	=G63	=G89*F89*D89/100
=A11	0.668	=B38*EXP(-0.693/B90*20)	=G11	=C90/D90	=E90*100/$E$102	=G64	=G90*F90*D90/100
=A12	100	=B39*EXP(-0.693/B91*20)	=G12	=C91/D91	=E91*100/$E$102	=G65	=G91*F91*D91/100
=A13	5.27	=B40*EXP(-0.693/B92*20)	=G13	=C92/D92	=E92*100/$E$102	=G66	=G92*F92*D92/100
=A14	2.68	=B41*EXP(-0.693/B93*20)	=G14	=C93/D93	=E93*100/$E$102	=G67	=G93*F93*D93/100
=A15	0.855	=B42*EXP(-0.693/B94*20)	=G15	=C94/D94	=E94*100/$E$102	=G68	=G94*F94*D94/100
=A16	12.3	=B43*EXP(-0.693/B95*20)	=G16	=C95/D95	=E95*100/$E$102	=G69	=G95*F95*D95/100
=A17	0.78	=B44*EXP(-0.693/B96*20)	=G17	=C96/D96	=E96*100/$E$102	=G70	=G96*F96*D96/100
=A18	15700000	=B45*EXP(-0.693/B97*20)	=G18	=C97/D97	=E97*100/$E$102	=G71	=G97*F97*D97/100
=A19	214000	=B46*EXP(-0.693/B98*20)	=G19	=C98/D98	=E98*100/$E$102	=G72	=G98*F98*D98/100
=A20	75000	=B47*EXP(-0.693/B99*20)	=G20	=C99/D99	=E99*100/$E$102	=G73	=G99*F99*D99/100
=A21	0.742	=B48*EXP(-0.693/B100*20)	=G21	=C100/D100	=E100*100/$E$102	=G74	=G100*F100*D100/100
=A22	5730	=B49*EXP(-0.693/B101*20)	=G22	=C101/D101	=E101*100/$E$102	=G75	=G101*F101*D101/100
		=SUM(C86:C101)		=SUM(E86:E101)	=SUM(F86:F101)		**=SUM(H86:H101)**

DCGL Calculation - 1

	Receptor 1				
	Source #			DCGL	DCGL
Isotope	1	total	dpm/100cm2	dpm/100cm2	dpm/100cm2
Cm243	0.0012	mrem/pCi/m2	/mrem	/25 mrem	/15 mrem
Pu241	0.0000315	=SUM(B114:D114)	=1/(E114*100)*2.2	=F114*25	=F114*15
Am241	0.00177	=SUM(B115:D115)	=1/(E115*100)*2.2	=F115*25	=F115*15
Pu239	0.00171	=SUM(B116:D116)	=1/(E116*100)*2.2	=F116*25	=F116*15
Pu238	0.00155	=SUM(B117:D117)	=1/(E117*100)*2.2	=F117*25	=F117*15
U234	0.000519	=SUM(B118:D118)	=1/(E118*100)*2.2	=F118*25	=F118*15
		=SUM(B119:D119)	=1/(E119*100)*2.2	=F119*25	=F119*15

1998 10CFR61 mix

	25mr dcgl	Sludge	Resin	SL/R Avg	weighted	% contrib	dose		T1/2 yrs	decayed	% with dk	dose with dk
Ag110m	2.44	4.4	0.24	2.32	0.95	4.70	1.18	Ag110m	6.90E-01	0.00000	0.00	0.00
C-14	0.92	0	0	0	0.00	0.00	0.00	C-14	5.73E+03	0.00000	0.00	0.00
Ce-144	131	0.11	0.2	0.155	0.00	0.01	0.00	Ce-144	7.81E-01	0.00000	0.00	0.00
Co-57	81.4	0.02	0.01	0.015	0.00	0.00	0.00	Co-57	7.42E-01	0.00000	0.00	0.00
Co-60	2.6	41	48.6	44.8	17.23	85.22	21.30	Co-60	5.27E+00	1.24199	56.60	14.15
Cs-134	4.2	0.23	0.36	0.295	0.07	0.35	0.09	Cs-134	2.06E+00	0.00008	0.00	0.00
Cs-137	11.1	14.2	18.7	16.45	1.48	7.33	1.83	Cs-137	3.02E+01	0.93654	42.68	10.67
Fe-55	56400	8.4	9.14	8.77	0.00	0.00	0.00	Fe-55	2.68E+00	0.00000	0.00	0.00
H-3	1380	2.95	8.67	5.81	0.00	0.02	0.01	H-3	1.23E+01	0.00136	0.06	0.02
I-129	1.95	0	0	0	0.00	0.00	0.00	I-129	1.57E+07	0.00000	0.00	0.00
Mn-54	8.15	2.56	3.35	2.955	0.36	1.79	0.45	Mn-54	8.55E-01	0.00000	0.00	0.00
Ni-59	25900	0.02	0.02	0.02	0.00	0.00	0.00	Ni-59	7.50E+04	0.00000	0.00	0.00
Ni-63	9420	0.73	0.92	0.825	0.00	0.00	0.00	Ni-63	1.00E+02	0.00008	0.00	0.00
Sr-90	12	0.11	0.08	0.095	0.01	0.04	0.01	Sr-90	2.88E+01	0.00489	0.22	0.06
Tc-99	111	0	0	0	0.00	0.00	0.00	Tc-99	2.14E+05	0.00000	0.00	0.00
Zn-65	7.55	0.8	0.71	0.755	0.10	0.49	0.12	Zn-65	6.68E-01	0.00000	0.00	0.00
Am-241	86.8	0.03	0	0.015	0.00	0.0009	0.00	Am-241	4.32E+02	0.00017	0.01	0.00
Cm-243	47.4	0.03	0	0.015	0.00	0.0016	0.00	Cm-243	2.85E+01	0.00019	0.01	0.00
Pu-238	106	0.02	0	0.01	0.00	0.0005	0.00	Pu-238	8.77E+01	0.00008	0.00	0.00
Pu-239	96.1	0.01	0	0.005	0.00	0.0003	0.00	Pu-239	2.41E+04	0.00005	0.00	0.00
Pu-241	3200	0.49	0	0.245	0.00	0.0004	0.00	Pu-241	1.44E+01	0.00003	0.00	0.00
U-234	98	1.77	0	0.885	0.01	0.0447	0.01	U-234	2.45E+05	0.00903	0.41	0.10
					20.22	100.00	25.00			2.194506	100.00	25

Note: Isotopes with t1/2 <.5 yr not included

decay time
20
years

ATTACHMENT 8
EXCEL SPREADSHEET
USED TO SHOW RESULTANT
CONTRIBUTION TO DOSE
BASED ON WASTE MIX
AND DECAYED WASTE MIX

	25mr dcgl	1982 mix Sludge	Conc	SL/R Avg	weighted	% contrib	dose		T1/2 yrs	decayed	% with dk	dose with dk
Ag110m	2.44	0.12	0.1	0.11	0.05	0.22	0.06	Ag110m	6.90E-01	0.00000	0.00	0.00
C-14	0.92	0	0	0	0.00	0.00	0.00	C-14	5.73E+03	0.00000	0.00	0.00
Ce-144	131	0.22	0.15	0.185	0.00	0.01	0.00	Ce-144	7.81E-01	0.00000	0.00	0.00
Co-57	81.4	0	0	0	0.00	0.00	0.00	Co-57	7.42E-01	0.00000	0.00	0.00
Co-60	2.6	65.3	21.8	43.55	16.75	82.15	20.54	Co-60	5.27E+00	1.20734	50.81	12.70
Cs-134	4.2	0.25	5.57	2.91	0.69	3.40	0.85	Cs-134	2.06E+00	0.00083	0.03	0.01
Cs-137	11.1	1.18	37.8	19.49	1.76	8.61	2.15	Cs-137	3.02E+01	1.10962	46.70	11.67
Fe-55	56400	0	0	0	0.00	0.00	0.00	Fe-55	2.68E+00	0.00000	0.00	0.00
H-3	1380	0	0	0	0.00	0.00	0.00	H-3	1.23E+01	0.00000	0.00	0.00
I-129	1.95	0	0	0	0.00	0.00	0.00	I-129	1.57E+07	0.00000	0.00	0.00
Mn-54	8.15	12.6	3.2	7.9	0.97	4.75	1.19	Mn-54	8.55E-01	0.00000	0.00	0.00
Ni-59	25900	0	0	0	0.00	0.00	0.00	Ni-59	7.50E+04	0.00000	0.00	0.00
Ni-63	9420	0	0	0	0.00	0.00	0.00	Ni-63	1.00E+02	0.00000	0.00	0.00
Sr-90	12	0.34	1.91	1.125	0.09	0.46	0.11	Sr-90	2.88E+01	0.05794	2.44	0.61
Tc-99	111	0	0	0	0.00	0.00	0.00	Tc-99	2.14E+05	0.00000	0.00	0.00
Zn-65	7.55	0.98	0.23	0.605	0.08	0.39	0.10	Zn-65	6.68E-01	0.00000	0.00	0.00
Am-241	86.8	0.01	0	0.005	0.00	0.00	0.00	Am-241	4.32E+02	0.00006	0.00	0.00
Cm-243	47.4	0.02	0	0.01	0.00	0.00	0.00	Cm-243	2.85E+01	0.00013	0.01	0.00
Pu-238	106	0.02	0.01	0.015	0.00	0.00	0.00	Pu-238	8.77E+01	0.00012	0.01	0.00
Pu-239	96.1	0.01	0.01	0.01	0.00	0.00	0.00	Pu-239	2.41E+04	0.00010	0.00	0.00
Pu-241	3200	0	0	0	0.00	0.00	0.00	Pu-241	1.44E+01	0.00000	0.00	0.00
U-234	98	0	0	0	0.00	0.00	0.00	U-234	2.45E+05	0.00000	0.00	0.00
					20.39	100.00	25.00			2.376133	100.00	25

Note: Isotopes with t1/2 <.5 yr not included

decay time
20
years

	25mr dcgl	1998 10C Sludge	Resin	SL/R Avg	weighted	% contrib	dose		T1/2 yrs
Ag110m	2.44	4.4	0.24	=(C3+D3)/2	=E3/B3	=F3/$F$26*100	=G3/100*25	Ag110m	=252/365
C-14	0.92	0	0	=(C4+D4)/2	=E4/B4	=F4/$F$26*100	=G4/100*25	C-14	5730
Ce-144	131	0.11	0.2	=(C5+D5)/2	=E5/B5	=F5/$F$26*100	=G5/100*25	Ce-144	=285/365
Co-57	81.4	0.02	0.01	=(C6+D6)/2	=E6/B6	=F6/$F$26*100	=G6/100*25	Co-57	=271/365
Co-60	2.6	41	48.6	=(C7+D7)/2	=E7/B7	=F7/$F$26*100	=G7/100*25	Co-60	5.27
Cs-134	4.2	0.23	0.36	=(C8+D8)/2	=E8/B8	=F8/$F$26*100	=G8/100*25	Cs-134	2.06
Cs-137	11.1	14.2	18.7	=(C9+D9)/2	=E9/B9	=F9/$F$26*100	=G9/100*25	Cs-137	30.2
Fe-55	56400	8.4	9.14	=(C10+D10)/2	=E10/B10	=F10/$F$26*100	=G10/100*25	Fe-55	2.68
H-3	1380	2.95	8.67	=(C11+D11)/2	=E11/B11	=F11/$F$26*100	=G11/100*25	H-3	12.3
I-129	1.95	0	0	=(C12+D12)/2	=E12/B12	=F12/$F$26*100	=G12/100*25	I-129	15700000
Mn-54	8.15	2.56	3.35	=(C13+D13)/2	=E13/B13	=F13/$F$26*100	=G13/100*25	Mn-54	=312/365
Ni-59	25900	0.02	0.02	=(C14+D14)/2	=E14/B14	=F14/$F$26*100	=G14/100*25	Ni-59	75000
Ni-63	9420	0.73	0.92	=(C15+D15)/2	=E15/B15	=F15/$F$26*100	=G15/100*25	Ni-63	100
Sr-90	12	0.11	0.08	=(C16+D16)/2	=E16/B16	=F16/$F$26*100	=G16/100*25	Sr-90	28.8
Tc-99	111	0	0	=(C17+D17)/2	=E17/B17	=F17/$F$26*100	=G17/100*25	Tc-99	214000
Zn-65	7.55	0.8	0.71	=(C18+D18)/2	=E18/B18	=F18/$F$26*100	=G18/100*25	Zn-65	=244/365
Am-241	86.8	0.03	0	=(C20+D20)/2	=E20/B20	=F20/$F$26*100	=G20/100*25	Am-241	432
Cm-243	47.4	0.03	0	=(C21+D21)/2	=E21/B21	=F21/$F$26*100	=G21/100*25	Cm-243	28.5
Pu-238	106	0.02	0	=(C22+D22)/2	=E22/B22	=F22/$F$26*100	=G22/100*25	Pu-238	87.7
Pu-239	96.1	0.01	0	=(C23+D23)/2	=E23/B23	=F23/$F$26*100	=G23/100*25	Pu-239	24100
Pu-241	3200	0.49	0	=(C24+D24)/2	=E24/B24	=F24/$F$26*100	=G24/100*25	Pu-241	14.4
U-234	98	1.77	0	=(C25+D25)/2	=E25/B25	=F25/$F$26*100	=G25/100*25	U-234	245000
					=SUM(F3:F25)	=SUM(G3:G25)	=SUM(H3:H25)		

Note: Isotop

decay time
20
years

decayed	% with dk	dose with dk
=F3*EXP(-0.693/J3*$J$29)	=K3/$K$26*100	=L3/100*25
=F4*EXP(-0.693/J4*$J$29)	=K4/$K$26*100	=L4/100*25
=F5*EXP(-0.693/J5*$J$29)	=K5/$K$26*100	=L5/100*25
=F6*EXP(-0.693/J6*$J$29)	=K6/$K$26*100	=L6/100*25
=F7*EXP(-0.693/J7*$J$29)	=K7/$K$26*100	=L7/100*25
=F8*EXP(-0.693/J8*$J$29)	=K8/$K$26*100	=L8/100*25
=F9*EXP(-0.693/J9*$J$29)	=K9/$K$26*100	=L9/100*25
=F10*EXP(-0.693/J10*$J$29)	=K10/$K$26*100	=L10/100*25
=F11*EXP(-0.693/J11*$J$29)	=K11/$K$26*100	=L11/100*25
=F12*EXP(-0.693/J12*$J$29)	=K12/$K$26*100	=L12/100*25
=F13*EXP(-0.693/J13*$J$29)	=K13/$K$26*100	=L13/100*25
=F14*EXP(-0.693/J14*$J$29)	=K14/$K$26*100	=L14/100*25
=F15*EXP(-0.693/J15*$J$29)	=K15/$K$26*100	=L15/100*25
=F16*EXP(-0.693/J16*$J$29)	=K16/$K$26*100	=L16/100*25
=F17*EXP(-0.693/J17*$J$29)	=K17/$K$26*100	=L17/100*25
=F18*EXP(-0.693/J18*$J$29)	=K18/$K$26*100	=L18/100*25
=F20*EXP(-0.693/J20*$J$29)	=K20/$K$26*100	=L20/100*25
=F21*EXP(-0.693/J21*$J$29)	=K21/$K$26*100	=L21/100*25
=F22*EXP(-0.693/J22*$J$29)	=K22/$K$26*100	=L22/100*25
=F23*EXP(-0.693/J23*$J$29)	=K23/$K$26*100	=L23/100*25
=F24*EXP(-0.693/J24*$J$29)	=K24/$K$26*100	=L24/100*25
=F25*EXP(-0.693/J25*$J$29)	=K25/$K$26*100	=L25/100*25
=SUM(K3:K25)	=SUM(L3:L25)	=SUM(M3:M25)

		1982 mix							
	25mr dcgl	Sludge	Conc	SL/R Avg	weighted	% contrib	dose		T1/2 yrs
Ag110m	=B3	0.12	0.1	=(C34+D34)/2	=E34/B34	=F34/$F$57*100	=G34/100*25	Ag110m	=252/365
C-14	=B4	0	0	=(C35+D35)/2	=E35/B35	=F35/$F$57*100	=G35/100*25	C-14	5730
Ce-144	=B5	0.22	0.15	=(C36+D36)/2	=E36/B36	=F36/$F$57*100	=G36/100*25	Ce-144	=285/365
Co-57	=B6	0	0	=(C37+D37)/2	=E37/B37	=F37/$F$57*100	=G37/100*25	Co-57	=271/365
Co-60	=B7	65.3	21.8	=(C38+D38)/2	=E38/B38	=F38/$F$57*100	=G38/100*25	Co-60	5.27
Cs-134	=B8	0.25	5.57	=(C39+D39)/2	=E39/B39	=F39/$F$57*100	=G39/100*25	Cs-134	2.06
Cs-137	=B9	1.18	37.8	=(C40+D40)/2	=E40/B40	=F40/$F$57*100	=G40/100*25	Cs-137	30.2
Fe-55	=B10	0	0	=(C41+D41)/2	=E41/B41	=F41/$F$57*100	=G41/100*25	Fe-55	2.68
H-3	=B11	0	0	=(C42+D42)/2	=E42/B42	=F42/$F$57*100	=G42/100*25	H-3	12.3
I-129	=B12	0	0	=(C43+D43)/2	=E43/B43	=F43/$F$57*100	=G43/100*25	I-129	15700000
Mn-54	=B13	12.6	3.2	=(C44+D44)/2	=E44/B44	=F44/$F$57*100	=G44/100*25	Mn-54	=312/365
Ni-59	=B14	0	0	=(C45+D45)/2	=E45/B45	=F45/$F$57*100	=G45/100*25	Ni-59	75000
Ni-63	=B15	0	0	=(C46+D46)/2	=E46/B46	=F46/$F$57*100	=G46/100*25	Ni-63	100
Sr-90	=B16	0.34	1.91	=(C47+D47)/2	=E47/B47	=F47/$F$57*100	=G47/100*25	Sr-90	28.8
Tc-99	=B17	0	0	=(C48+D48)/2	=E48/B48	=F48/$F$57*100	=G48/100*25	Tc-99	214000
Zn-65	=B18	0.98	0.23	=(C49+D49)/2	=E49/B49	=F49/$F$57*100	=G49/100*25	Zn-65	=244/365
Am-241	=B20	0.01	0	=(C51+D51)/2	=E51/B51	=F51/$F$57*100	=G51/100*25	Am-241	432
Cm-243	=B21	0.02	0	=(C52+D52)/2	=E52/B52	=F52/$F$57*100	=G52/100*25	Cm-243	28.5
Pu-238	=B22	0.02	0.01	=(C53+D53)/2	=E53/B53	=F53/$F$57*100	=G53/100*25	Pu-238	87.7
Pu-239	=B23	0.01	0.01	=(C54+D54)/2	=E54/B54	=F54/$F$57*100	=G54/100*25	Pu-239	24100
Pu-241	=B24	0	0	=(C55+D55)/2	=E55/B55	=F55/$F$57*100	=G55/100*25	Pu-241	14.4
U-234	=B25	0	0	=(C56+D56)/2	=E56/B56	=F56/$F$57*100	=G56/100*25	U-234	245000
					=SUM(F34:F56)	=SUM(G34:G56)	=SUM(H34:H56		

Note: Isotop

decay time
20
years

decayed	% with dk	dose with dk
=F34*EXP(-0.693/J34*$J$29)	=K34/$K$57*100	=L34/100*25
=F35*EXP(-0.693/J35*$J$29)	=K35/$K$57*100	=L35/100*25
=F36*EXP(-0.693/J36*$J$29)	=K36/$K$57*100	=L36/100*25
=F37*EXP(-0.693/J37*$J$29)	=K37/$K$57*100	=L37/100*25
=F38*EXP(-0.693/J38*$J$29)	=K38/$K$57*100	=L38/100*25
=F39*EXP(-0.693/J39*$J$29)	=K39/$K$57*100	=L39/100*25
=F40*EXP(-0.693/J40*$J$29)	=K40/$K$57*100	=L40/100*25
=F41*EXP(-0.693/J41*$J$29)	=K41/$K$57*100	=L41/100*25
=F42*EXP(-0.693/J42*$J$29)	=K42/$K$57*100	=L42/100*25
=F43*EXP(-0.693/J43*$J$29)	=K43/$K$57*100	=L43/100*25
=F44*EXP(-0.693/J44*$J$29)	=K44/$K$57*100	=L44/100*25
=F45*EXP(-0.693/J45*$J$29)	=K45/$K$57*100	=L45/100*25
=F46*EXP(-0.693/J46*$J$29)	=K46/$K$57*100	=L46/100*25
=F47*EXP(-0.693/J47*$J$29)	=K47/$K$57*100	=L47/100*25
=F48*EXP(-0.693/J48*$J$29)	=K48/$K$57*100	=L48/100*25
=F49*EXP(-0.693/J49*$J$29)	=K49/$K$57*100	=L49/100*25
=F51*EXP(-0.693/J51*$J$29)	=K51/$K$57*100	=L51/100*25
=F52*EXP(-0.693/J52*$J$29)	=K52/$K$57*100	=L52/100*25
=F53*EXP(-0.693/J53*$J$29)	=K53/$K$57*100	=L53/100*25
=F54*EXP(-0.693/J54*$J$29)	=K54/$K$57*100	=L54/100*25
=F55*EXP(-0.693/J55*$J$29)	=K55/$K$57*100	=L55/100*25
=F56*EXP(-0.693/J56*$J$29)	=K56/$K$57*100	=L56/100*25
=SUM(K34:K56)	=SUM(L34:L56)	=SUM(M34:M56)

ATTACHMENT 9

Filter sludge 1 of 2

********** Data Base Summary for Waste Type FM-D-NA 179 **********

..... As of 05/13/1999.....

********** Waste Characteristic Summary **********

Waste	: FM-D-NA	FILTER SLU	Waste Volume(Ft3)	:156.4
Physical Form	: Solid		Density(Lbs/Ft3)	:56.6
Chemical Form	: Metal Oxides		Waste Weight(Lbs)	:8852.0
Package Type	: RADLOK P-179		Activated Metal	:No
Package Vol (Ft3)	: 179 4		Sample Data Units	:uCi/cc
Package Wt(Lbs)	: 10272.0			

********** Waste Stream Sample Information **********

Sample ID number : 9811031-01 Sample Date : 12/23/1998

********** Summary of Waste Sample Data File **********

Nuclide	Sample Data	Abundance (Percent)	Scaling Factor
→ H-3	1.43E-02	2.95	2.08E-01
C-14	< 2.18E-03	<LLD>	<LLD>
Cr-51 27d	9.65E-02	19.85	4.84E-01
→ Mn-54	1.24E-02	2.56	6.23E-02
→ Fe-55	4.06E-02	8.35	2.04E-01
→ Co-57	1.20E-04	0.02	6.04E-04
Co-58 70d	9.08E-03	1.87	4.56E-02
→ Co-60	1.99E-01	40 99	1.00E+00
→ Ni-59	9.84E-05	0.02	4.94E-04
→ Ni-63	3.54E-03	0.73	1.78E-02
→ Zn-65	3.89E-03	0.80	1.95E-02
Sr-89 51d	6.91E-04	0.14	1.00E-02
→ Sr-90	5.48E-04	0.11	1.95E-03
→ Tc-99	< 3.57E-05	<LLD>	<LLD>
→ Ag-110m	2.14E-02	4.40	1.07E-01
Sn-113 115d	6.42E-05	0.01	3 22E-04
→ I-129	< 8.33E-05	<LLD>	<LLD>
→ Cs-134	1.13E-03	0.23	1.64E-02
→ Cs-137	6.89E-02	14.18	1.00E+00
Ce-141 32d	1.54E-03	0.32	2.23E-02
→ Ce-144	5.13E-04	0.11	1.00E+00

< > - indicates LLD Value

Filter Sludge 212

Waste	: FM-O-NA	FILTER SLU	Waste Volume(Ft3)	:156.4
Physical Form	: Solid		Density(Lbs/Ft3)	:56.8
Chemical Form	: Metal Oxides		Waste Weight(Lbs)	:8852.0
Package Type	: RADLOK P-179		Activated Metal	:No
Package Vol (Ft3)	: 179.4		Sample Data Units	:uCi/cc
Package Wt(Lbs)	: 10272.0			

********** Waste Stream Sample Information **********

Sample ID number : 9811031-01 Sample Date : 12/23/1998

********** Summary of Waste Sample Data File **********

Nuclide	Sample Data	Abundance (Percent)	Scaling Factor
→ U-234	8.61E-03	1.77	0.00E+00
Pu-238	1.09E-04	0.02	2.13E-01
Pu-239	4.12E-05	0.01	8.04E-02
Pu-241	2.37E-03	0.49	4.62E+00
Am-241	1.50E-04	0.03	2.93E-01
Cm-242	2.42E-05	0.00	4.72E-02
Cm-243	1.48E-04	0.03	2.89E-01

< > - indicates LLD Value

ATTACHMENT 10

Bead Resin

********** Data Base Summary for Waste Type BR-D-NA 179 **********

..... As of 11/19/1998.....

********** Waste Characteristic Summary **********

Waste	: BEAD RESIN	Waste Volume(Ft3)	:156.4
Physical Form	: Solid	Density(Lbs/Ft3)	:43.7
Chemical Form	: Metal Oxides	Waste Weight(Lbs)	:6835.0
Package Type	: RADLOK P 179	Activated Metal	:No
Package Vol (Ft3)	: 179.4	Sample Data Units	:uCi/cc
Package Wt(Lbs)	: 8255.0		

********** Waste Stream Sample Information **********

Sample ID number : 9811031-01 Sample Date : 12/23/1998

********** Summary of Waste Sample Data File **********

Nuclide	Sample Data	Abundance (Percent)	Scaling Factor
→ H-3	1.47E-02	8.67	4.63E-01
C-14	< 2.18E-03	<LLD>	<LLD>
→ Mn-54	5.69E-03	3.35	6.90E-02
→ Fe-55	1.55E-02	9.14	1.88E-01
Fe-59 γγd	3.66E-03	2.16	4.44E-02
→ Co-57	2.28E-05	0.01	2.76E-04
Co-58	1.87E-03	1.10	2.27E-02
→ Co-60	8.25E-02	48.63	1.00E+00
→ Ni-59	4.10E-05	0.02	4.97E-04
→ Ni-63	1.56E-03	0.92	1.89E-02
→ Zn-65	1.21E-03	0.71	1.46E-02
Sr-89	5.10E-04	0.30	1.61E-02
→ Sr-90	1.36E-04	0.08	4.27E-03
Nb-95 γγd	3.72E-04	0.22	1.17E-02
→ Tc-99	< 3.57E-05	<LLD>	<LLD>
→ Ag-110m	4.03E-04	0.24	4.88E-03
→ I-129	< 8.33E-05	<LLD>	<LLD>
→ Cs-134	6.10E-04	0.36	1.92E-02
→ Cs-137	3.17E-02	18.70	1.00E+00
→ Ce-144	3.43E-04	0.20	1.00E+00
→ U-234	8.61E-03	5.07	0.00E+00

< > - indicates LLD Value

Bead Resin

Waste	: BEAD RESIN	Waste Volume(Ft3)	:156.4
Physical Form	: Solid	Density(Lbs/Ft3)	:43.7
Chemical Form	: Metal Oxides	Waste Weight(Lbs)	:6835.0
Package Type	: RADLOK P-179	Activated Metal	:No
Package Vol (Ft3)	: 179.4	Sample Data Units	:uCi/cc
Package Wt(Lbs)	: 8255.0		

********** Waste Stream Sample Information **********

Sample ID number : 9811031-01 Sample Date : 12/23/1998

********** Summary of Waste Sample Data File **********

Nuclide	Sample Data	Abundance (Percent)	Scaling Factor
Pu-238	1.94E-06	0.00	5.66E-03
Pu-239	1.75E-06	0.00	5.11E-03
Pu-241	1.78E-04	0.10	5.19E-01
Am-241	6.25E-06	0.00	1.82E-02
Cm-242	3.19E-06	0.00	9.31E-03
Cm-243	2.10E-06	0.00	6.13E-03

< > - indicates LLD Value

ATTACHMENT II

********** DATA BASE SUMMARY FOR WASTE TYPE 3 **********
..... AS OF 11 30 92.....

****** WASTE CHARACTERISTIC FILE (WASDAT.DAT) SUMMARY ******

RSR INFORMATION

WASTE:L-FILTER SLUDGE
PHYSICAL FORM: SOLID
CHEMICAL FORM: CEMENT

CALCULATION INFORMATION

WASTE VOLUME(FT3): 111.0
DENSITY(LBS/FT3): 102.5
WASTE WEIGHT(LBS): 11380.0

PACKAGE TYPE:STEEL LINER
PACKAGE VOL(FT3): 170.0
PACKAGE WT(LBS): 13300.0

LIMIT FACTOR: 1
SHIELD FACTOR:1.000

********** SUMMARY OF WASTE SAMPLE DATA FILE **********

NUCLIDE	SAMPLE DATA	ABUNDANCE (PERCENT)	MEV/DIS GAMMA	DOSE (PERCENT)
CR-51	8.65E-03	2.42	7.02E-04	.04
MN-54	4.49E-02	12.60	1.06E-01	5.94
CO-58	1.57E-03	.44	3.52E-03	.20
CO-60	2.33E-01	65.30	1.63E+00	91.56
FE-59	3.87E-03	1.08	6.59E-03	.37
SB-124	1.49E-03	.42	5.85E-03	.33
SB-125	2.05E-03	.57	1.61E-03	.09
ZN-65	3.46E-03	.98	5.36E-03	.30
AG-110m	4.21E-04	.12	1.53E-03	.09
SR-90	1.23E-03	.34	0.00E+00	0.00
NB-95	5.92E-04	.17	1.26E-03	.07
RU-106	7.38E-03	2.07	3.31E-03	.19
CS-134	8.75E-04	.25	3.43E-03	.19
CS-137	4.22E-03	1.18	6.61E-03	.37
CE-141	2.52E-02	7.06	4.87E-03	.27
CE-144	8.04E-04	.22	3.37E-05	.00
SR-89	1.68E-02	4.71	0.00E+00	0.00
PU-238	5.87E-05	.02	0.00E+00	0.00
PU239/40	2.46E-05	.01	0.00E+00	0.00
AM-241	2.81E-05	.01	1.73E-05	.00
CM-242	6.31E-05	.02	0.00E+00	0.00
CM243/44	7.30E-05	.02	0.00E+00	0.00

AVERAGE GAMMA MEV:1.7830

ATTACHMENT 12

********** DATA BASE SUMMARY FOR WASTE TYPE 4 **********
..... AS OF 11 30 82.....

****** WASTE CHARACTERISTIC FILE (WASDAT.DAT) SUMMARY ******

RSR INFORMATION

WASTE: CONCENTRATE
PHYSICAL FORM: SOLID
CHEMICAL FORM: CEMENT
PACKAGE TYPE:STEEL LINER
PACKAGE VOL(FT3): 170.0
PACKAGE WT(LBS): 15215.0

CALCULATION INFORMATION

WASTE VOLUME(FT3): 131.0
DENSITY(LBS/FT3): 101.0
WASTE WEIGHT(LBS): 13300.0
LIMIT FACTOR: 1
SHIELD FACTOR:1.000

********** SUMMARY OF WASTE SAMPLE DATA FILE **********

NUCLIDE	SAMPLE DATA	ABUNDANCE (PERCENT)	MEV/DIS GAMMA	DOSE (PERCENT)
CR-51	1.42E-03	1.02	2.96E-04	.03
MN-54	4.47E-03	3.20	2.69E-02	3.05
CO-58	1.08E-04	.08	6.19E-04	.07
CO-60	3.04E-02	21.80	5.45E-01	61.88
FE-59	5.03E-04	.36	2.20E-03	.25
SB-124	2.64E-04	.19	2.65E-03	.30
SB-125	8.51E-04	.61	1.71E-03	.19
ZN-65	3.20E-04	.23	1.26E-03	.14
AG-110m	1.46E-04	.10	1.36E-03	.15
SR-90	2.67E-03	1.91	0.00E+00	0.00
ZR-95	1.45E-03	1.04	7.49E-03	.85
NB-95	9.27E-05	.07	5.05E-04	.06
RU-106	8.10E-04	.58	9.30E-04	.11
CS-134	7.77E-03	5.57	7.80E-02	8.85
CS-137	5.28E-02	37.80	2.12E-01	24.03
CE-141	2.84E-04	.20	1.41E-04	.02
CE-144	2.05E-04	.15	2.21E-05	.00
SR-89	3.49E-02	25.00	0.00E+00	0.00
PU-238	1.84E-05	.01	0.00E+00	0.00
PU239/40	7.69E-06	.01	0.00E+00	0.00
AM-241	2.77E-06	.00	4.38E-06	.00
CM-242	4.65E-06	.00	0.00E+00	0.00
CM243/44	4.28E-06	.00	0.00E+00	0.00

AVERAGE GAMMA MEV: .8807

ATTACHMENT 13

Table 1. Summary of GM K_d values (L kg^{-1}) for each element by soil type.[a,b]

Element	Sand	Loam	Clay	Organic
Ac	450[a]	1 500	2 400	5 400
Ag	*90*[b]	*120*	*180*	*15 000*
Am	*1 900*	*9 600*	*8 400*	*112 000*
Be	250	800	1 300	3 000
Bi	100	450	600	1 500
Br	15	50	75	180
C	*5*	20	1	70
Ca	5	30	50	90
Cd	*80*	*40*	*560*	*800*
Ce	*500*	*8 100*	*20 000*	*3 300*
Cm	*4 000*	*18 000*	6 000	*6 000*
Co	*60*	*1 300*	*550*	*1 000*
Cr	*70*	*30*	1 500	*270*
Cs	*280*	*4 600*	*1 900*	*270*
Fe	*220*	*800*	*165*	*600*
Hf	450	1 500	2 400	5 400
Ho	250	800	1 300	3 000
I	*1*	*5*	*1*	*25*
K	15	55	75	200
Mn	*50*	*750*	*180*	*150*
Mo	*10*	125	*90*	*25*
Nb	160	550	900	2 000
Ni	*400*	300	*650*	*1 100*
Np	*5*	*25*	*55*	*1 200*
P	5	25	35	90
Pa	550	1 800	2 700	6 600
Pb	*270*	*16 000*	550	*22 000*
Pd	55	180	270	670
Po	*150*	*400*	3 000	7 300
Pu	*550*	*1 200*	*5 100*	*1 900*
Ra	*500*	*36 000*	*9 100*	2 400
Rb	55	180	270	670
Re	10	40	60	150
Ru	*55*	*1 000*	*800*	*66 000*
Sb	*45*	150	250	550
Se	150	500	740	1 800
Si	35	110	180	400
Sm	245	800	1 300	3 000
Sn	130	450	670	1 600
Sr	*15*	*20*	*110*	*150*
Ta	220	900	1 200	3 300
Tc	*0.1*	*0.1*	*1*	*1*
Te	125	500	720	1 900
Th	*3 200*	3 300	*5 800*	*89 000*
U	*35*	*15*	*1 600*	*410*
Y	170	720	1 000	2 600
Zn	*200*	*1 300*	*2 400*	*1 600*
Zr	600	2 200	3 300	7 300

[a] Values with regular numbering are default values predicted using CRs.
[b] Values with italic bold numbering come from the *literature*.

matter and were either classic peat or muck soils, or the litter horizon of a mineral soil.

If a time series of K_d values was reported, we used only the K_d values for the longest time since these values would most closely approximate equilibrium conditions. Only one value was entered for each soil reported in the literature. For example, where K_d values were reported for the same soil for a range of soil:solution ratios, competing cations, contact solution concentrations, or pH values, the results were ln-transformed and averaged to provide a single geometric mean (GM) value. The transformation was justified because soil K_d values are lognormally distributed (Sheppard et al. 1984; Sheppard and Evenden 1989). The single values for each soil were also ln-transformed, and GMs and geometric standard deviations (GSDs) were determined for each element by soi texture for the mineral soils and also for organic soils.

If no data existed in the literature for a given element the soil-to-plant concentration ratio (CR) was used as an indicator of the element's mobility and to predict a default K_d value (Baes et al. 1984; Sheppard 1985). The CR values used were taken from Baes et al. (1984). This technique is successful because of the strong negative correlation between CR and K_d (Sheppard and Sheppard 1989). The model used had the following form:

$$\ln K_d = a + \mathrm{STEX} + b\,(\ln \mathrm{CR}). \qquad (2$$

where a, b, and STEX are constants. The values for the coefficients were $a = 4.62$, and $b = -0.5$. The followin

STEX values for each soil classification: sand, STEX = −2.51; loam, STEX = −1.26; clay, STEX = −0.84; organic, STEX = 0. The full regression analysis, all final tables, and the references are given in Thibault et al. (1990) and can be obtained on diskette from the authors.

RESULTS AND DISCUSSION

Factors affecting solute transport

The factors affecting element behavior in soil relate primarily to speciation and reactiveness (Bond and Smiles 1977). Nonreactive elements do not interact with the solid phase, and the K_d value is zero; this is the case with H. If an element is reactive, it may behave either as an anion or a cation. The relationship between the porewater and sorbed or exchangeable phases can be linear or nonlinear. If this relationship is nonlinear, the distribution between the phases is best described by the Freundlich isotherm (Sheppard et al. 1987; Sheppard and Thibault 1990). If the isotherm is or is assumed to be linear, then the Freundlich and K_d models are equivalent. Other adsorption models are discussed in Rai and Zachara (1984). At usual environmental concentrations, the differences between linear and nonlinear isotherms are often very small. The simplicity of the K_d model and the lack of data to accurately define the coefficient for the Freundlich isotherm favors the K_d model for preliminary or screening environmental assessments.

Factors affecting K_d

Although much of the ancillary data needed to assess overall trends in K_d values are not reported, soil texture is generally available. The data for all elements were analyzed using analysis of variance (SAS 1985). This showed that in all elements, the texture of mineral soils did not affect the K_d value. Certain elements, however, such as Ce, Pu, Sr, and Zn, showed an increase in K_d values across the whole texture range (Table 1). Other elements, such as Am, Cm, Co, Cs, Mn, Np, Ra, and Ru, had the lowest K_d values in sand soils, but showed no consistent trend for loam and clay soils. Grouping the elements by K_d and soil type emphasizes the variable dependence of the elements on texture (Table 2). We have highlighted Tc, I, and U in Table 2 to illustrate some of the trends in the data.

Including organic soils in this compilation adds another dimension of variation. Organic soils have an inherently complicated chemistry, including a broad range of redox conditions, and have the potential to form complexes with contaminant elements entering the system. We have not included K_d values determined under anoxic or anaerobic conditions because the greatest need is for information about predominantly unsaturated soils. It is these unsaturated soils that are used for upland crop production, urban development, etc., and form some of the direct exposure pathways to humans. The data for anoxic conditions can be found in the detailed report of Thibault et al. (1990). Higher K_d values in organic soils were found for Ag, Am, Cd, I, Ni, Np, Ru, Sr, and Th, compared to mineral soils. K_d values were similar between organic and mineral soils for Ce, Cm, Co, Cs, Fe, Mn, Mo, Pu, Tc, U, and Zn. Cerium and Pu are more affected by clay content and pH than by organic matter content (Coughtrey et al. 1985). Cobalt is known to have complex reactions in low-organic matter sand aquifers (Killey et al. 1984). For Cs, Gillham et al. (1980) found that stable Cs concentrations affected the K_d value more than any other soil parameter. Enhanced Tc sorption with increasing organic matter content has been reported previously (Sheppard et al. 1990), and yet our data do not indicate that

Table 2. Grouping of elements by K_d values and soil type using GMs from this study. Default values are not shown here. Technetium, I, and U are highlighted to show the general trend with soil type.

K_d values exp (u)	This Study			
	Sand	Loam	Clay	Organic
<1	H (Tc)	(Tc)		
1-10	◇I Mo,Np	◇I	(I) (Tc)	(Tc)
10-100	Ag,Cd,Co, Cr,Mn,Ru, Sr▽U	Cd,Cr,Np, Sr▽U	Mo,Np	◇I Mo
100-1 000	Ce,Cs,Fe, Ni,Pb,Po, Pu,Ra,Zn	Ag,Fe,Mn, Po	Ag,Cd,Co, Fe,Mn,Ni, Sr	Cd,Co,Cr, Cs,Sr▽U
1 000-10 000	Am,Cm,Th	Am,Ce,Co, Cs,Pu,Zn	Am,Cs,Pu, Ra,Th▽U Zn	Ni,Np,Pu, Zn
>10 000		Cm,Pb,Ra	Ce	Ag,Am,Pb, Ru,Th

Appendix

Table A-1. Sand soil K_d values (L kg^{-1}).

Element	# Observations	μ [a]	σ [b]	exp (μ) [c]	Range
Ac		6.1		450	
Ag	12	4.5	1.8	90	2.7 to 1 000
Am	29	7.6	2.6	1 900	8.2 to 300 000
Be		5.5		250	
Bi		4.6		100	
Br		2.7		15	
C	3	1.1	0.8	5	1.7 to 7.1
Ca		1.8		5	
Cd	14	4.3	1.5	80	2.7 to 625
Ce	12	6.2	1.6	500	40 to 3 968
Cm	2	8.4	2.4	4 000	780 to 22 970
Co	33	4.1	2.8	60	.07 to 9 000
Cr	15	4.2	2.1	70	1.7 to 1 729
Cs	81	5.6	2.5	280	0.2 to 10 000
Fe	16	5.4	2.6	220	5 to 6 000
H	3	−2.7	0.4	0.06	0.04 to 0.1
Hf		6.1		450	
Ho		5.5		250	
I	22	0.04	2.2	1.0	0.04 to 81
K		2.6		15	
Mn	54	3.9	1.4	50	6.4 to 5 000
Mo	15	2.0	1.1	10	1.0 to 52
Nb		5.1		160	
Ni	11	6.0	1.5	400	60 to 3 600
Np	16	1.4	1.7	5	0.5 to 390
P		1.8		5	
Pa		6.3		550	
Pb	3	5.6	2.3	270	19 to 1 405
Pd		4.0		55	
Po	36	5.0	1.6	150	9 to 7 020
Pu	39	6.3	1.7	550	27 to 36 000
Ra	3	6.2	3.2	500	57 to 21 000
Rb		4.0		55	
Re		2.3		10	
Ru	7	4.0	1.4	55	5 to 490
Sb	1	3.8		45	
Se	3	4.0	0.4	55	36 to 70
Si		3.5		35	
Sm		5.5		245	
Sn		4.9		130	
Sr	81	2.6	1.6	15	0.05 to 190
Ta		5.4		220	
Tc	19	−2.0	1.8	0.1	0.01 to 16
Te		4.8		125	
Th	10	8.0	2.1	3 200	207 to 150 000
U	24	3.5	3.2	35	0.03 to 2 200
Y		5.1		170	
Zn	22	5.3	2.6	200	0.1 to 8 000
Zr		6.4		600	

a Mean of the natural logarithms of the observed values.
b Standard deviation of the natural logarithms of the observed values.
c Geometric mean rounded to two significant digits. Default values for μ and exp (μ) have been predicted using CRs for nuclides with no "# Observations."

ATTACHMENT 14

$$R_s = \theta/\theta_{sat} = \theta/p_t \ . \qquad \text{(E.6)}$$

When the medium is saturated, R_s equals unity. Under unsaturated infiltration conditions, the saturation ratio is a function of the infiltration rate, the saturated hydraulic conductivity, and the texture of the soil. The saturation ratio can be estimated by using the following equation (Clapp and Hornberger 1978):

$$R_s = \left(\frac{I}{K_{sat}}\right)^{\frac{1}{2b+3}} , \qquad \text{(E.7)}$$

where

I = infiltration rate (m/yr),

K_{sat} = saturated hydraulic conductivity (m/yr), and

b = soil-specific exponential parameter (dimensionless).

Representative values of K_{sat}, θ_{sat}, and b for various soil textures are listed in Table E.2.

TABLE E.2 Representative Values of Saturated Hydraulic Conductivity, Saturated Water Content, and the Soil-Specific Exponential Parameter

Texture	Hydraulic Conductivity, K_{sat} (m/yr)	Saturated Water Content, θ_{sat}	Soil-Specific Exponential Parameter, b
Sand	5.55×10^3	0.395	4.05
Loamy sand	4.93×10^3	0.410	4.38 ←
Sandy loam	1.09×10^3	0.435	4.90
Silty loam	2.27×10^2	0.485	5.30
Loam	2.19×10^2	0.451	5.39
Sandy clay loam	1.99×10^2	0.420	7.12
Silty clay loam	5.36×10^1	0.477	7.75
Clay loam	7.73×10^1	0.476	8.52
Sandy clay	6.84×10^1	0.426	10.40
Silty clay	3.26×10^1	0.492	10.40
Clay	4.05×10^1	0.482	11.40

Source: Data from Clapp and Hornberger (1978).

TABLE E.7 Representative Porosity Values

Material	Total Porosity, p_t		Effective Porosity, p_e	
	Range	Arithmetic Mean	Range	Arithmetic Mean
Sedimentary material				
Sandstone (fine)	-	-	0.02-0.40	0.21
Sandstone (medium)	0.14-0.49	0.34	0.12-0.41	0.27
Siltstone	0.21-0.41	0.35	0.01-0.33	0.12
Sand (fine)	0.25-0.53	0.43	0.01-0.46	0.33
Sand (medium)	-	-	0.16-0.46	0.32
Sand (coarse)	0.31-0.46	0.39	0.18-0.43	0.30
Gravel (fine)	0.25-0.38	0.34	0.13-0.40	0.28
Gravel (medium)	-	-	0.17-0.44	0.24
Gravel (coarse)	0.24-0.36	0.28	0.13-0.25	0.21
Silt	0.34-0.51	0.45	0.01-0.39	0.20
Clay	0.34-0.57	0.42	0.01-0.18	0.06
Limestone	0.07-0.56	0.30	-0-0.36	0.14
Wind-laid material				
Loess	-	-	0.14-0.22	0.18
Eolian sand	-	-	0.32-0.47	0.38
Tuff	-	-	0.02-0.47	0.21
Igneous rock				
Weathered granite	0.34-0.57	0.45	-	-
Weathered gabbro	0.42-0.45	0.43	-	-
Basalt	0.03-0.35	0.17	-	-
Metamorphic rock				
Schist	0.04-0.49	0.38	0.22-0.33	0.26

Source: Data from McWorter and Sunada (1977).

Distribution coefficients depend strongly on soil type, the pH and Eh of the soil, and the presence of other ions (see Tables E.4 through E.6). Thus, considerable uncertainty can be introduced by using default values for the distribution coefficients. This uncertainty is a critical matter, particularly in cases in which the water-dependent pathways are the dominant contributors to the total dose/source concentration ratios. Default values for the distribution coefficients are provided only for the purpose of obtaining preliminary estimates; site-specific values should be used for deriving soil guidelines whenever possible.

ATTACHMENT 2

OYSTER CREEK NUCLEAR GENERATING STATION

SOURCES STORED ON BACK SITE

OCNGS Sources Stored On The Backsite

Exempt Quantity

Number	Location	Date Acquired	Original Activity	Isotope	Notes
Dosimetry					
S-1657	WBC	*Unknown*	1.119 uCi	Cs-137	RM-14 check source.
50123-79	WBC	05/10/1995		Mixed	Orig. Act.: 0.148 uci Co-60 Orig. Act.: 0.177 uci Cs-137 Solid in 1.75 x 4.5cm mini vial. (used for daily calibration)
Emer. Prep					
NEN	FRAA (Bldg. 14)	11/01/1981	10 uCi	Cs-137	Current Activity 7.5 uCi as of 6/94 EP Source # 9
Training					
S-3	Ed. Cen. Cabinet #4	*Unknown*	0.5 uCi	Tl-204	Model S-10 Backscatter Kit (1982) Deb Piana, Public affairs, used in demonstrations
KB-1	Ed Griffin	*Unknown*		Mixed	Mn-54 = 1 uCi Unknown = 1 uCi Co-57=1 uCi Na-22=1 uCi Ba-133=1 uCi Cd-109=1 uCi Cs-137=1 uCi Co-60=1 uCi (Sep 1982) Deb Piana Public Affairs, used for demonstrations.
D	Ed Griffin	*Unknown*		Mixed	Po-210 = 0.1 uCi Co-60 = 1 uCi Sr-90 = 0.1 uCi Mfg. = The Nucleus Source set owned by Communications for use in demonstrations (D. Piana) Leak tested = 1/8/99
B	Ed Griffin	*Unknown*		Mixed	Po-210 = 0.1 uCi Co-60 = 1 uCi Sr-90 = 0.1 uCi Mfg. = Oxford Inst. Source set owned by Communications for use in demonstrations (D. Piana) Leak tested = 1/8/99

Licensed Quantity

SCN	Serial Number	Isotope	Cal. Date	Date Acquired	Original Activity	Current Activity	Location	Custodian	Notes
380	53995-79	Mixed Gamma	06/02/1997	06/05/1997	*See Notes*	*See Notes*	Whole Body Counter	R. Hurley	Solid in 1.75 x 5.4 cm Mini Vial. Manufacturer = Analytics. Cd-109 = 5.2 Co-57 = .15 Ce-139 = .24 Hg-203 = .54 Sn-113 = .41 Cs-137 = .21 Y-88 = .7 Co-60 = .33
399	55723-79	Mixed gamma	04/01/1998	05/13/1998	*See Notes*	*See Notes*	Whole Body Counter	R. Hurley	Solid in 1.75 cm x 5.4 cm Mini Vial Manufacturer = Analytics. Cd-109 = 5.39 Co-57 = .17 Ce-139 = .27 Hg-203 = .54 Sn-113 = .44 Cs-137 = .23 Y-88 = .75 Co-60 = .35

Printed: *Friday, October 15, 1999*

ATTACHMENT 3

RADIOLOGICAL INVESTIGATION REPORTS

89-045, 91-002, 91-057

OYSTER CREEK

NUCLEAR GENERATING STATION

9300-ADM-1201.01-1
Radiological Investigative Report

RIR # 890645

I.

DATE OF OCCURRENCE 11-10-89 TIME 1500

LOCATION Bldg. #8 on the backsite

DATE SUBMITTED 11-15-89 TIME 0900

II. PERSONNEL INVOLVED

NAME	S.S. #	EMPLOYER/DEPARTMENT
Austin Judson	[redacted]	JCP&L / RadCon
Jim Richwine		Bartlett / RadCon

PREPARED BY: Austin Judson RESPONSIBLE DEPT. MGR.: D. SMITH

III. BRIEF DESCRIPTION OF INCIDENT

RCT's Judson and Richwine were frisking items on the Bldg. #8 mezz. @ 1500 when (2) air recievers were found with activity > 100cpm above background (Reference surveys #QQQ-89-A555 and QQQ-89-A556). The (2) air recievers were brought over to the T.B. Spare Exciter for further surveys. GRCS B. Sands, Storeroom Supv. G. Shriner were notified.

PREPARED BY: Austin Judson TITLE: RCT

IV. IMMEDIATE CORRECTIVE ACTION TAKEN AND RESULTS
The air recievers were moved over to the T.B. Spare Exciter Area for further surveying.

PREPARED BY: A. Judson [signature] TITLE: RCT

V. REVIEWED BY: [signature] DCSMITH DATE/TIME: 11/15/89/1315

VI. RAD ENGINEER REVIEW: R. FARRELL [signature] DATE/TIME: 11/16/89
CHECK BLOCK IF CRITIQUE REQUIRED [ ]

VII. POSSIBLE CAUSES OF INCIDENT AND METHODS FOR CORRECTING
SEE ATTACHED MEMO 6631-90-0005

PREPARED BY: [signature] DCSMITH TITLE: RCTO MANAGER

VIII. COMMENTS
N/A

RESPONSIBLE DEPT. MGR.: [signature] DCSMITH DATE: 1/30/90

IX. COMMENTS
THIS RIR WAS HELD OPEN TO COLLECTIVELY ADDRESS ITEMS WITH FIXED CONTAMINATION ABOVE OUR CURRENT LIMIT FROM RIR # 8.

RAD ENGINEERING MGR.: KEVIN G. WOLF (KEVIN G. WOLF) DATE: 1/31/90

X. COMMENTS
These items could have been released under previously established limits.

RAD CON DIRECTOR/DEPUTY DIR: [signature] DATE: 2/1/90

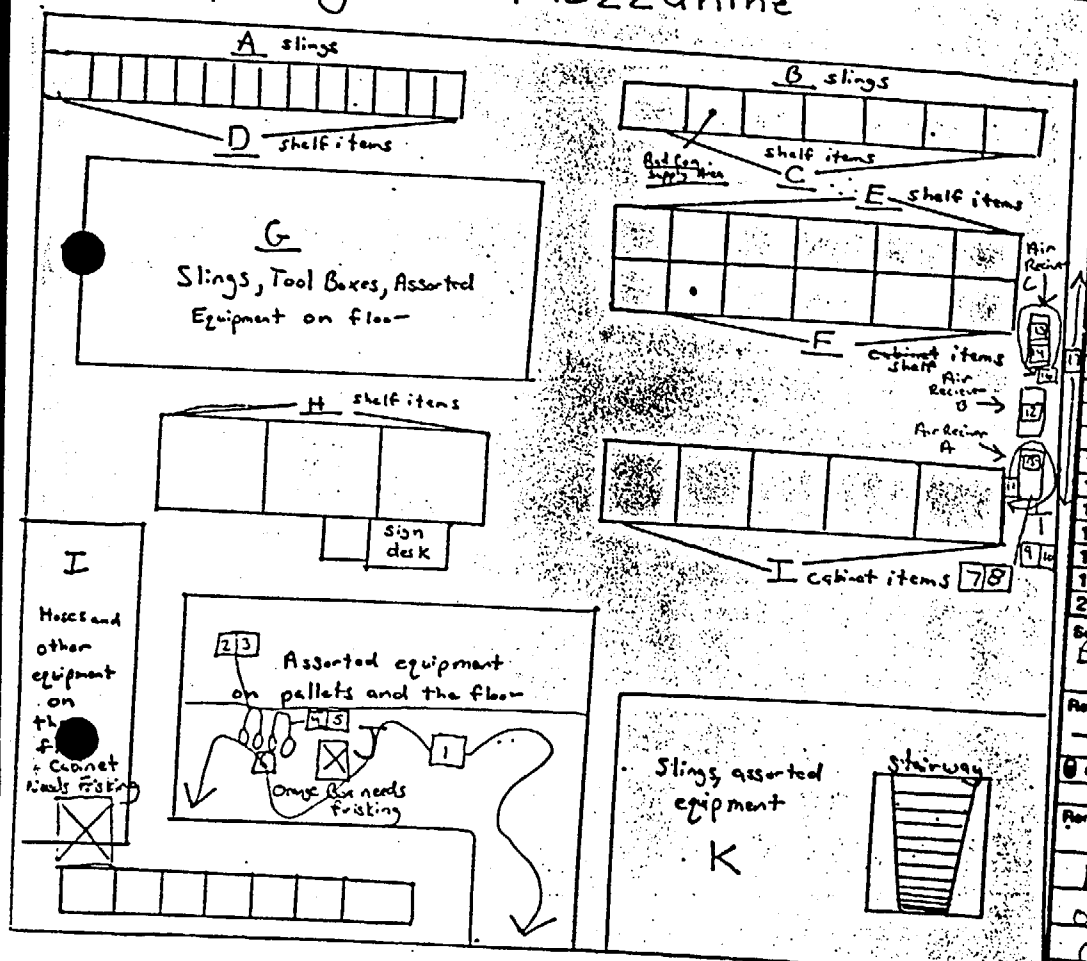
Original: Radiological Engineering

cc: Deputy Director Oyster Creek
Director of Plant Operations
Human Resources
Responsible Dept. Mgr.

JJ Nuclear OCNGS RADIOLOGICAL SURVEY

No QQC-89-A338 | Date 11-10-89 | Time 1015

Bldg. #8 Mezzanine



RWP 891000 | ☐ No Beta Detected

Location Bldg. #8 : Mezz

Reason Equipment Frisk

Rx Power N/A

SMEARABLE CONTAMINATION

	LOCATION	B β DPM	CDPM	<DPM	AREA
1	Complete Sector-J	<100cpm		NT	DF
2	Sling	200cpm		↑	DF
3	Sling	<100cpm			GW
4	Sling	200cpm			DF
5	Sling	<100cpm			GW
6	Floor under Sling	<100cpm			GW
7	Air Reciever-A power cord	300cpm			DF
8	Air Reciever-A power cord	100cpm			GW
9	Air Reciever-A-T pipe	800cpm			DF
10	Air Reciever-A-T pipe	150cpm			GW
11	Air Reciever-Floor	<100cpm			GW
12	Air Reciever-B	<100cpm			GW
13	Air Reciever-C	<100cpm			DF
14	Air Reciever-C-filter housing	<100cpm			GW
15	Part of Air Reciever-A	300cpm			DF
16	Air Reciever Floor	<100cpm		V	GW
17	hoses	<100cpm		NT	GW
18		<100cpm		NT	DF
19					
20					

Surveyor A. Judson A. Judson Jr. Print/Sign — 11-10-89 Date

Reviewer K. Stultz K. Stultz Print/Sign — 11-13-89 Date

● contact dose rates are circled ▯ smear locations are boxed

All Dose Rates Are General Area Readings in mr/hr Unless Otherwise Noted

INST. DATA

RADIATION SURVEY
INST N/A
S/N BCF
CDD

INST N/A
S/N BCF
CDD

CONTAM SURVEY
INST E140N
S/N 1246
CDD 3-14-90

EFF 10% BKG 700 CPM
INST E140N
S/N 1257
CDD 3-14-90

GF EFF 10% BKG 700 CPM

AIR SAMPLE DATA

FC ucm

NOTES

ND - Not Detected
GW - Gross Wipe
NA - Not Applicable
NT - Not Taken
NBD - No Beta Detected

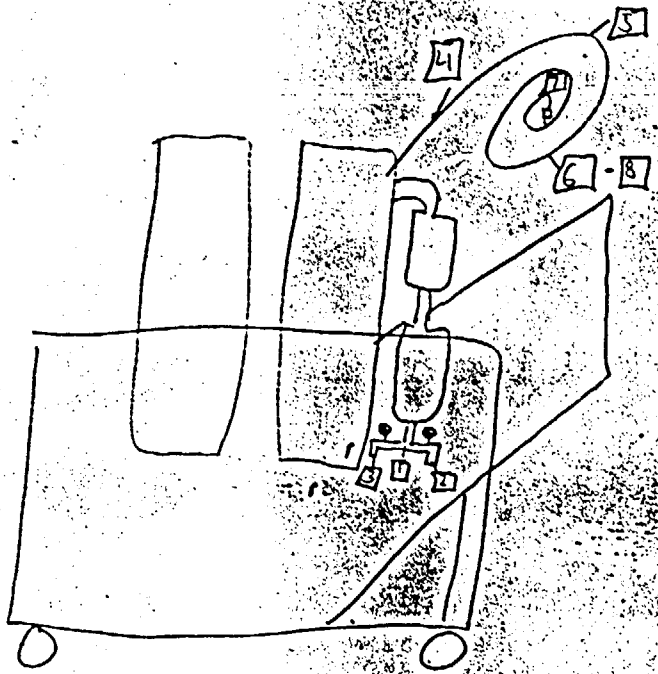
Remarks

Boxes locked needing frisk have a black + white 'X' on them. The rest of the Mezz. except for (2) boxes of tools are done. Air Recievers taken to the T.B. Truck Bay. Slings are in the RCT Count Room

Nuclear **OCNGS RADIOLOGICAL SURVEY** No. TE2-89-A556 Date 11-10-89 Time 1700 Location T.B. Truck Bay

RWP 891000 Reason Smearable Verification on Air Reciever #861GO141 Rx Power N/A

☐ No Beta Detected



SMEARABLE CONTAMINATION

	LOCATION	β γ DPM	BKG DPM	∝ DPM	AREA
1	Outside of Pipe	<1K	NT	100cm²	
2	End of Pipe	↑	↑	↑	
3	End of Pipe				
4	Power Cord				
5	↑				
6	↓				
7	Power Cord	<1K	NT	100cm²	
8	Power Cord (Switch)	758dpm	NT	100cm²	
9	NT	NT	NT	NT	
10	↑	↑	↑	↑	
11					
12					
13					
14					
15					
16					
17					
18					
19					
20	NT	NT	NT	NT	

INST. DATA

RADIATION SURVEY
INST NT
S/N BCF
CDD
INST NT
S/N BCF
CDD

CONTAM SURVEY
INST Rm-14
S/N 3429
CDD 11-25-89
EFF 10% BKG 100 CPM
INST Ludlum 2000 (6,7)
S/N 18836
CDD 12-25-89
CF 7.9 BKG 36.1 CPM

AIR SAMPLE DATA
FC N1

Surveyor Austin Jedra Austin Jedra 11-10-89
Print/Sign Date

Reviewed T.R. SPRUCINSKI
Print/Sign NOV 10 1989
Date

NOTES
ND - Not Detected
GW - Gross Wipe
NA - Not Applicable
NT - Not Taken
NBD - No Beta Detected

● contact dose rates are circled ▣ smear locations are boxed
All Dose Rates Are General Area Readings in m/hr Unless Otherwise Noted

Remarks

2/13C

GPU Nuclear

Memorandum

Subject: *RIR 89-045 RESPONSE*

Date: *January 30, 1990*

From: *D. C. Smith - RCFO Manager*

Location: *Oyster Creek*
6631-90-0005

To: *RIR 89-045 File*

The material identified in Section III of RIR 89-045 was discovered during an investigative survey of all materials located in Building 8. This survey was initiated due to a number of prior RIRs resulting from the discovery of contaminated materials outside of the RCA. It is believed that some of the contaminated materials previously discovered outside of the RCA may have been items released under release criteria at a time when contamination limits for free release were less restrictive than our current limits.

During the course of the referenced investigative survey a number of items with contamination levels in excess of our current limits were identified. These items were:

ITEM	MAXIMUM FIXED CONTAMINATION (CPM)
2 slings	200
2 air receivers	300
Hack saw	800
2 block & tackle assemblies	200
Chain fall	4000
Leak tester	500
Electrical distribution unit	900
12 weld heaters	400
2 pipe beveling tools	1400
5 grinding stones	400
1 welder	200
1 welding power box	150
1 strap (from welding equipment	200
1 piece of metal (from welding equipment	150
1 welding gauge	200
15 bricks (from welding equipment	200

No items were found to have smearable contamination in excess of our limits.

All items found to be contaminated by our current limits have either been returned to the RCA or disposed of as radioactive waste. Since these items were identified as part of an investigation into previous RIRs, I propose no further corrective action and will consider all actions for RIR 89-045 as complete unless notified that further action is required.

Dann C. Smith
Ext. 2160

DCS:mz
DANN89/15

A0000648 8 8

OYSTER CREEK NUCLEAR GENERATING STATION

Radiological Investigation Report

I. Date of Occurrence 1-16-91 Time 1400 RIR # 91-002

Location BACK SITE BUILDING # 5

Date Submitted 1-16-91 Time 1518

II. Personnel Involved

Name	SS #	Company/Location
ED MORRIS	[redacted]	JCP&L
CHARLES BROWN		JCP&L
MIKE FASH		JCP&L
ROCKY STEVENS		BARTLETT
STEVE JACOBS		BARTLETT

Prepared By H Starbird Responsible Dept. Manager K. WOLF/C. POLLARD

III. Brief Description of Incident MAINTENANCE & CONSTRUCTION WORKERS REPAIRING TRUCK # 5611 IN BLDG # 5 FOUND TOOLS MARKED WITH PURPLE PAINT BEHIND THE PASSENGER SEAT.
RCT's JACOBS & STEVENS SENT OUT TO SURVEY TOOLS & TRUCK.
CONTAMINATION SURVEY OF TOOLS & TRUCK RESULTS <1000 dpm/100cm²
DIRECT FRISK OF TRUCK - <100 NCPM
DIRECT FRISK OF TOOLS; ELECTRIC IMPACT WRENCH - <100 NCPM
TIN SNIPS - <100 NCPM
CRESCENT WRENCH - 2000 NCPM
CROW BAR - 1000 NCPM
CRESCENT WRENCH WAS NOT MARKED WITH PURPLE PAINT

DIRECT FRISK OF M&C PERSONNEL RESULTS:
ED MORRIS 099-38-8373 <100 NCPM
RJS 1-17-91 ~~CHARLES~~ CHARLES BROWN 154-62-8953 <100 NCPM
MIKE FASH 156-50-5780 <100 NCPM

(See Attached Sheets)

Prepared by H Starbird/H Starlind Title: upgrade GRCS

IV. Immediate corrective actions taken and results

TOOLS WITH FIXED CONTAMINATION BAGGED UP AND BROUGHT BACK TO THE RCA.

V. Reviewed by C.A. Pelland Title Mgr RCED

Date 1-22-91 Time 1400

VI. Radiological Engineering Review D. ALAN DAY / D. Alan Day

Date 1-22-91 Time 1445

Critique Required [ ] No Critique required [X]

HPES Required [ ]

Comments RADIOLOGICAL ENGINEERING DEPT WILL INVESTIGATE POSSIBLE CAUSES, CLARIFY EVENTS, AND MAKE/RECOMMEND CORRECTIVE ACTIONS AS APPROPRIATE. STATEMENT OF EVENTS BY H. STARBIRD, AND CAUSES OF INCIDENT ARE NOT CONSIDERED COMPLETE.

VII. Possible causes of incident and methods for correcting

(1) ROOT CAUSE IS INADEQUATE SURVEY FOR RELEASE. TRUCK HAD BEEN IN RCA > 1 MONTH AND USED FOR NEW FUEL TRANSFER, WARRENTING A MORE THOROUGH SURVEY. RCT DID NOT SEE PURPLE PAINTED TOOLS ON TRUCK FLOOR OR CHECK BEHIND SEAT FOR OTHER POSSIBLE STORAGE. OTHER TRUCKS AND TOOL BOXES WERE SURVEYED, NO OTHER CONTAM. ITEMS FOUND OUTSIDE RCA. INCIDENT WAS REVIEW AT RCT MORNING MEETING TO HEIGHTEN RCT AWARENESS.

(2) CONTRIBUTING FACTOR WAS POOR WORK PRACTICES OF THOSE INDIVIDUALS WHO STORED CONTAM AND NON-CONTAM TOOLS IN THE TRUCK. EVEN THOUGH THIS TRUCK WAS IN AN RCA AND WAS USED SEVERAL DAYS FOR THIS JOB, TOOLS SHOULD HAVE BEEN PROPERLY STORED. FURTHERMORE, THESE TOOLS WERE STILL SIGNED OUT AND HAD NOT BEEN RETURNED TO THE TOOL CAGES. TOOLS WERE TRACED, INDIVIDUAL AND JOB SUPERVISOR WERE INFORMED/COUNSELLED OF INCIDENT.

(3) ANOTHER POSSIBLE FACTOR COULD HAVE BEEN INADEQUATE TRAINING IN THAT SOME PERSONNEL INVOLVED WERE NOT CERTAIN THAT PURPLE PAINTED TOOLS MEANT FIXED CONTAM/RCA TOOLS FOR RCA USE ONLY. GET AND RAD CON INSTRUCTORS CONTACTED AGREED TO INCREASE THE SENSITIVITY OF THIS SUBJECT IN EMPLOYEE TRAINING ALTHOUGH ALREADY COVERED IN GET/RCT TRAINING.

If Action Items are assigned check this block ☐
Action items will be listed on attached sheets if necessary

D. ALAN DAY
@. Alan Day 2/18/91

VIII. Responsible Managers Comments I have reviewed cause analysis of B Starbird & A. Day and I agree with their comments

C.A. Pollard Supervisor RCT
C A Pollard 2/20 91 1100

Print/signature

Date/Time

IX. Radiological Engineering Manager's Comments

INCOMPLETE RADIOLOGICAL SURVEY HAS BEEN IDENTIFIED AS THE ROOT CAUSE. OTHER CONTRIBUTING CAUSES HAVE ALSO BEEN IDENTIFIED.

Does this potentially constitute an unreviewed safety question as defined in 10 CFR 50.59, or present conditions adverse to quality that could affect nuclear safety, Technical Specifications, or require reporting to the NRC in accordance with 10 CFR 20 or 10 CFR 21.

YES [ ] No [✓]

Print/Signature KENT F/Kent F Date/Time 2/21/91 @ 0935

X. Radiological Controls Director's Comments

Print/Signature MJ Slobodien/MJ Slobodien Date/Time 2/20/91 1000

RIR # 91-002

Truck #5611 was brought into the yard area approximately one month prior to January 16, 1991, by house mechanics. The battery died on the truck and with the cold weather it was impossible to start the truck. On January 15, 1991, the weather warmed up and Bill Barkoszy decided to attempt to have the truck started and driven back to transportation for repairs. The truck was started and Barkoszy had Heavy Equipment Operator Steve Beigl drive the truck out of Gate #20. RCT Harry Davis (Bartlett RCT5) smeared, frisked and released the truck. It was then driven out of the North Gate where it was taken by one of the Transportation mechanics to Building #5 for repairs. When Charlie Brown went to work on the truck he noticed the contaminated tools and the call to Rad Con was made.

The first problem here is that Steve Beihl (who drove the truck out of Gate #20) is a Non RCA worker from Farmingdale. Bill Barkoszy was his RCA escort but he never entered the truck. Had an experienced RCA worker driven the truck out of Gate #20, he would have noticed the contaminated tools. The tin snips were painted purple with a "Caution Radiolactive Material" sticker on them, the crowbar was painted purple and the socket on the electric impact wrench was painted purple. These tools were lying on the passenger side of the truck on the floor along with a 1/2 inch wrench and a hammer. Some tools were also found behind the seat of the truck none of these tools were marked in any way byt one crescent wrench had 2000 cpm fixed on it.

The Bartlett RCT did the normal job to release the truck he checked the tires and checked the pedals and floor on the drivers side. When questioned he said he was aware that tools with purple paint on them were not to leave the RCA, he wasn't sure but thought they were painted purpel because they were contaminated. There is no formal training done by Rad Con or GET on this, Harry Davis had just picked up on this from being here for a few weeks. I contacted Gian Campesi in RAd Con Training and he said Training could start putting out this information if we would put out a formal memo.

Charlie Brown was a Station Helper for several years before he became a mechanic for Transportation and that is the reason he recognized the tools as being contaminated, when he went to work on the truck.

We have checked all trucks back in Transportation and all trucks on site and found no other contamianted tools. We have also checked the Transportation mechanics tool boxes and found nothing (see attached list).

H. Starbird

wpgrcs91/6

GPU Nuclear **OCNGS RADIOLOGICAL SURVEY** | No. 88Q-91-654 | Date 1-16-91 | Time 1420 | Location BACK SITE BLDG # 5

RWP N/A | Reason SURVEY OF TRACTOR & TOOLS AFTER PURPLE PAINTED TOOLS FOUND NEAR | Rx Power N/A %

☒ If No Beta Detected

1 ELECTIC IMPACT WRENCH — < 100 NCPM — < 1000 dpm/100cm²
1 TIN SNIP - PURPLE — < 100 NCPM — < 1000 dpm/100cm²
1 CROW BAR - PURPLE — 1000 NCPM — < 1000 dpm/100cm²
1 ~~BREAKER~~ (RS) 1-16-91 CRESCENT WRENCH UNMARKED — 2000 NCPM — < 1000 dpm/100cm²

TRUCK # 5611 — < 100 NCPM — ALL SMEARS < 1000 dpm/100cm²

PERSONNEL FRISK'S

ED MORRIS	099-38-8373	< 100 NCPM	DIRECT FRISK
CHARLES BROWN	154-62-8953	< 100 NCPM	
MIKE FASH	156-50-5780	< 100 NCPM	

SMEARABLE CONTAMINATION

	LOCATION	β γ CPM	DPM	α DPM	AREA
1					
2					
3					
4					
5					
6					
7					
8					
9					
10		N/A			
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

INST. DATA

RADIATION SURVEY
INST
S/N BCF
CDD N/A
INST
S/N BCF
CDD

CONTAM SURVEY
INST E140N
S/N 130
CDD 6-15-91
EFF 10% BKG 50 CPM
INST
S/N
CDD N/A
CP BKG CPM

AIR SAMPLE DATA
FC A.I. uci/cc

Surveyor R.C. STEVENS / R.C. Stevens Print/Sign — 1-16-91 Date

Reviewer H Starbird / H Starbird Print/Sign — 1-16-91 Date

NOTES
ND - Not Detected
GW - Gross Wipe
NA - Not Applicable
NT - Not Taken
NBD - No Beta Detected

(#) contact dose rates are circled [#] smear locations are boxed

All Dose Rates Are General Area Readings in mr/hr Unless Otherwise Noted

Remarks
FIXED CONTAMINATION ONLY FOUND ON TOOLS, TOOLS WERE BAGGED AND BROUGHT BACK TO RCA

JC/BK/AR/JJC

N 5268 (05-89)

TRUCK #	PLATE #
2813	XH34CD SAT
2792	XH95CC Locked Unchecked (Fire Truck MOB)
2790	XH94CC SAT
2926	XT13VT SAT
2930	XT80VV SAT
2842	XK922A SAT
2847	XH96CC SAT
2928	XT78TZ SAT
2817	XH71XH SAT
2796	SAT
2849	XK90ZA SAT
5165	XC85ZM SAT

TOOL BOXES

E140N	1096/04-03-91
E140N	1310/06-17-91
2846	XK91ZA
2728	------
2726	------
2767	XD80BV
5611	HZ32
2919	XSZ4TB
2868	XR46DJ
2692	92077U
3640	XK39YX
2653	FCT10G
2866	XR420G
2790	XH94CC
2870	XR45DJ
2927	XT80TY

GPU Nuclear

Memorandum

Subject: TAGGING OF TOOLS DESIGNATED FOR USE IN RCA

Date: February 25, 1991

From: M. J. Slobodien - Rad Con Director

Location: Oyster Creek
6630-91-0038

To:
All Radiological Controls Personnel

All hand tools used within the RCA except for specialty items and those exempted by memo are supposed to originate from the contaminated tool issue area adjacent to the MAC. These tools should have purple (magenta) paint on them to designate them as potentially contaminated.

When the contaminated tool room does not have an item in stock, it will be transferred into the contaminated tool room from the clean tool room. If there is insufficient time to paint the new tool, the tool room personnel will affix a piece of adhesive yellow and magenta "Rad Tape". The tool must be painted as soon as practicable with the magenta paint. The tags are not to be used when there is adequate time to apply the paint. NOTE: tools often have to be cleaned prior to paint application. This should be taken into consideration by RCFO in judging whether or not there is sufficient time to accomplish painting prior to use.

M. J. Slobodien

cc: Outage Command Center
L. L. Lammers - Plant Maintenance Director
W. J. Muelheisen - Maintenance Supt. Support
D. C. Smith - Corporate Assessor R&EC

OYSTER CREEK NUCLEAR GENERATING STATION

Radiological Investigation Report

I. Date of Occurrence 11-14-91 Thru 11-15-91 Time 1000 RIR # 91057

Location FORKED RIVER SITE - TRANSPORTATION B&G. REPAIR BAY

Date Submitted 11-15-91 Time 1330

II. Personnel Involved

Name	SS #	Company/Location
CHARLES BROWN	[redacted]	JCP&L - TRANSPORTATION O.C.
KATHY PORTER		JCP&L - STATION SERV. O.C.
WILLIAM PERRY		JCP&L - RADCON O.C.
Gary SHUNK		JCP&L - RAD CON O.C.

Prepared By G. Shunk / G. Shunk Responsible Dept. Manager C. POLLARD R.C.F.O.

III. Brief Description of Incident AT APPROX 1335 ON THURS. 11-14-91 STATION SERVICES NEEDED FORKLIFT # 8657 RELEASED FROM RCA YARD AREA THROUGH GATE 20 FOR REPAIRS AT TRANSPORTATION AT FORKED RIVER SITE. RCT(B) WILLIAM PERRY SURVEYED SAID FORKLIFT AND RELEASED IT FROM RCA "CLEAN" AND DRIVER KATHY PORTER DROVE FORKLIFT TO NORTH GUARD HOUSE. SECURITY RELEASED FORKLIFT FROM PROTECTED AREA AND IT WAS DRIVEN TO TRANSPORTATION THE AFTERNOON OF 11-14-91. ON 11-15-91 AT APPROX 1000 TRANS. MECH. CHARLES BROWN NOTICED A 14" PIPE WRENCH WITH A "CAUTION: RADIOACTIVE MATERIAL" STICKER ATTACHED TO IT. WITHOUT TOUCHING WRENCH HE CALLED THE SHIFT RCT @ 4660 EXT. GRCS STUMP AND RCT G. SHUNK TOOK EMERGENCY VAN TO TRANSPORT. DEPT TO INVESTIGATE. C. BROWN POINTED OUT LOCATION OF WRENCH BETWEEN DASHBOARD AND WINDSHIELD (SEE SURVEY). GRCS J. STUMP INTERVIEWED BROWN AND HIS SUPERVISOR AS RCT SHUNK SURVEYED WRENCH AND FORKLIFT. RESULTS: DIRECT FRISK OF WRENCH 600-1200 CPM AND <1K DPM/100cm². INSIDE OF LIFT WAS SURVEYED CLEAN AS WELL AS OTHER TOOLS FOUND NEAR WRENCH.

Prepared by G. Shunk / G. Shunk Title: RCT

IV. Immediate corrective actions taken and results AS SOON AS CONTAMINATED WRENCH WAS REPORTED TO SHIFT RCT A GRCS AND RCT TOOK EMERGENCY VAN TO BACKSITE TO INVESTIGATE. RCT SURVEYED WRENCH, TOOLS AND INSIDE OF FORKLIFT AND DETERMINED THAT NO SMEARABLE CONTAM WAS FOUND ON WRENCH, NEARBY TOOLS OR INSIDE CAB OF FORKLIFT. 600-1200 NCPM FIXED CONTAM WAS DISCOVERED ON THE 14" PIPE WRENCH. GRCS INTERVIEWED MECHANIC WHO DISCOVERED THE CONTAM. WRENCH AND MECHANIC STATED HE HAD NOT TOUCHED THE WRENCH.

WRENCH WAS BROUGHT BACK TO BLDNG #3 TO BE RESURVEYED AND STORED IN COUNT RM FOR LATER MOVEMENT TO THE CONTAMINATED TOOL CRIB.

GRCS INTERVIEWED RCT PERRY WHO HAD SAID HE HAD RELEASED THE FORKLIFT FROM GATE 20 THE DAY BEFORE.

AS NOTED ON SURVEY, WRENCH WAS LOCATED IN AN AREA NOT EASILY SEEN

~~RIR # 91-0150 Deviation Report~~ submitted on 11-20-91 by CA Pollard

V. Reviewed by C A Pollard **Title** Mgr RCFO

Date 11/15/91 **Time** 1455

VI. Radiological Engineering Review Austin Judson / Austin Judson

Date 11-18-91 **Time** 1130

Critique Required [ ] **No Critique required** [X]

HPES Required [ ]

Comments No critique required. An investigation was held and the root cause identified. Transportation followed the rad con guidelines sent to them to respond to purple tools found inside vehicles.

The levels of fixed contamination on the wrench caused no potential dose or contamination hazard to the workers handling, surveying, or finding the wrench. A.J. 12-17-91

VII. Possible causes of incident and methods for correcting

This Fork Lift has an area which cannot be seen from the drivers seat inside or through the front window from outside (see survey). It is not understood why a pipe wrench is needed to operate a fork lift.
This RIR will become required reading for all RCT's and CRCS's with instructions to ensure this hidden storage area is emptied before conducting a survey, to release it from the RCA

If Action Items are assigned check this block [✓]
Action items will be listed on attached sheets if necessary

VIII. Responsible Managers Comments This RIR will be sent out as required reading as soon as it is processed.
The attached memo will accompany the RIR

Print/signature C A Pollard
C A Pollard

Date/Time 11-22-91
11:30

IX. Radiological Engineering Manager's Comments This RIR is one of 3 consecutive reports dealing with contaminated material outside of the RCA. The cause of each incident apparently appears to be personnel error, however, effort is needed to reduce this incidence rate by re-training the plant staff of RCA boundary requirements and by efforts to reduce the challenges to the survey system. Two action items which are relevant to this RIR were assigned in RIR 91056

Does this potentially constitute an unreviewed safety question as defined in 10 CFR 50.59, or present conditions adverse to quality that could affect nuclear safety, Technical Specifications, or require reporting to the NRC in accordance with 10 CFR 20 or 10 CFR 21.

YES [ ] No [X]

Print/Signature William J Cooper / William J Cooper Date/Time 12/19/91 / 0850

X. Radiological Controls Director's Comments

Actions taken on the 4 RIRs of similar nature ~~are~~ will be tracked to assess effectiveness see RIR 91-056

Print/Signature MJ Slobodian / MJ Slobodian Date/Time 1/8/92 0900

RIR # 91057

OYSTER CREEK NUCLEAR GENERATING STATION

Radiological Investigative Report

ACTION ITEMS

Assigned Action Item Required Reading for Rad Con Technicians.

9202 was assigned on 1-15-92.

Assigned to C. Pollard **Date/Time** 11-22-91/1130

Assigned Action Item

Assigned to **Date/Time**

GPU Nuclear **OCNGS RADIOLOGICAL SURVEY** No. 2-30 Date 11-15-91 Time 1030 Location TURBINE POWER SUITE FOR TRANSPORTATION

RWP (1)-1400 Reason MECH. DISCOVERED PIPEWRENCH BETWEEN DASHBOARD AND WINDSHIELD

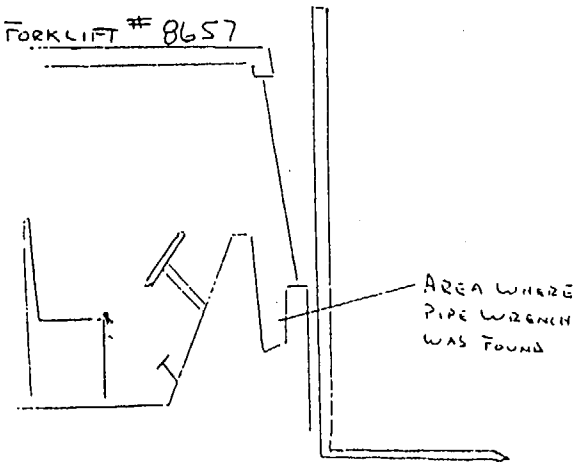
☐ No Beta Detected Rx Power 100 %

[1] 14" PIPEWRENCH WITH "CAUTION: RADIOACTIVE MATERIAL" STICKER ATTACHED
DIRECT FRISK - 600 to 1200 cpm OVER ENTIRE WRENCH

[2] FORKLIFT DASH AREA WHERE WRENCH WAS FOUND
DIRECT FRISK < 100 cpm

[3] FORKLIFT CONTROLS AND STEERING WHEEL
DIRECT FRISK < 100 cpm

[4] (2) FOCUSING RODS AND (1) SHACKLE FOUND SAME AREA AS PIPEWRENCH: < 100 cpm DIRECT FRISK



SMEARABLE CONTAMINATION

	LOCATION	β γ LJCPM DPM	DPM	AREA
1	WRENCH	< 1K	NT	100 cm²
2	DASH AREA	< 100 cpm		GW
3	CONTROLS/STEERING WH	< 100 cpm		GW
4	TOOLS	< 100 cpm	NT	GW
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

INST. DATA

RADIATION SURVEY
INST
S/N BCF
CDD

INST
S/N BCF
CDD

CONTAM SURVEY
INST E140N
S/N 1300
CDD 3-9-92
EFF 10% BKG 50 CP

INST
S/N
CDD
CF BKG CPM

AIR SAMPLE DATA
FC NT uci/cc

Surveyor G. Shunk/[signature] Print/Sign 11-15-91 Date

Reviewer J. D. Stump/[signature] Print/Sign 11/15/91 Date

NOTES
ND - Not Detected
GW - Gross Wipe
NA - Not Applicable
NT - Not Taken
NBD - No Beta Detected

(W) contact dose rates are circled [W] smear locations are boxed

All Dose Rates Are General Area Readings In mr/hr Unless Otherwise Noted

Remarks
TRANSPORTATION MECH CHAS BROWN CALLED SUPERVISOR UPON DISCOVERING WRENCH AND STATED HE DID NOT TOUCH WRENCH

DOSE RATE SURVEY NOT REQUIRED PER GRCS

JC/BK/AR/JJC

N 5268 (05-89)

COPY

GPU Nuclear

Memorandum

Subject: SURVEY OF VEHICLES LEAVING RCA

Date: January 7, 1992

From: C. A. Pollard - Manager RCFO

Location: Oyster Creek
6631-92-0001B

To: All RCFO & Station Services Personnel

Recently contaminated tools have been found on the Forked River Site by Transportation personnel. Typically this problem has occurred when one of the on site fork trucks has gone to Transportation for repairs/surveillance. These tools have been found between the vehicle instrument panel and the front window where the fork truck has a recessed area which cannot be seen from the drivers seat or from outside the vehicle when looking through the window.

To prevent a recurrence of this problem I am asking that station services personnel remove all items from this recessed area before having a RCT survey the vehicle.

RCT's who survey fork trucks exiting the RCA are to ensure all items have been removed from the recessed area before conducting their survey.

C A Pollard

Charlie A. Pollard
Extension 2580

W J Quinlan

W. J. Quinlan
Station Services Mgr.

/cr

cc: A. Judson
M. J. Slobodien

GPU Nuclear

Memorandum

Subject: CONTROL OF CONTAMINATED TOOLS

Date: December 24, 1991

From: M. J. SLOBODIEN
RAD CON DIRECTOR

Location: Oyster Creek
6630-91-0172

To: L. L. Lammers - Plant Maintenance Director
R. J. Barrett - Plant Operations Director
J. E. Frew - Site Services Director

Reference: RIRs #91056
91057
91058
91060

There have been four recent instances in which contaminated or potentially contaminated tools have been removed from the RCA inadvertently. Rad Con needs the help of all production workers who take vehicles across RCA boundaries to make thorough checks for the presence of restricted tools. It is especially important to check hidden areas such as under seats, tool boxes, glove compartments and built in storage compartments.

A review of the attached Radiological Investigative Reports may be helpful. Part of a Radiation Worker's job is to know that a vehicle presented for release from the RCA is free from contaminated tools.

Your assistance is greatly appreciated.

M. J. Slobodien

Attachment

cc: J. J. Barton - Director OC

MJS9-91\24

GPU Nuclear

FOR RIK HILL A.J.

Memorandum

Subject: Control of Contaminated Tools

Date: December 27, 1991

From: D. L. Pysher
Site Services Director, OC (Acting)

Location: Oyster Creek
A100-91-P118

To:
J. K. Hadden
T. D. Jenkins
R. Luty
J. J. Pfadenhauer
T. W. Snider
D. Storey

Reference: RIRs #91056
91057
91058
91060

There have been four recent instances in which contaminated or potentially contaminated tools have been removed from the RCA inadvertently. Rad Con needs the help of all Production workers who take vehicles across RCA boundaries to make thorough checks for the presence of restricted tools and equipment. It is especially important to check hidden areas such as under seats, tool boxes, glove compartments and built-in storage compartments.

Please review the attached Radiological Investigative Reports with your staffs and appropriate workers. Part of a Radiation Worker's job is to know that a vehicle presented for release from the RCA is free from contaminated tools and equipment. Please respond to this writer by January 15, 1992 indicating that the above action item has been completed. Your assistance in this matter is greatly appreciated.

D. Pysher 12/27/91

D. L. Pysher

DLP/dh
attachment

cc: J. J. Barton
M. J. Slobodien

GPU Nuclear

Memorandum

Subject: CONTROL OF CONTAMINATED TOOLS

Date: December 24, 1991

From: M. J. SLOBODIEN
RAD CON DIRECTOR

Location: Oyster Creek
6630-91-0172

To: L. L. Lammers - Plant Maintenance Director
R. J. Barrett - Plant Operations Director
J. E. Frew - Site Services Director

Reference: RIRs #91056
91057
91058
91060

There have been four recent instances in which contaminated or potentially contaminated tools have been removed from the RCA inadvertently. Rad Con needs the help of all production workers who take vehicles across RCA boundaries to make thorough checks for the presence of restricted tools. It is especially important to check hidden areas such as under seats, tool boxes, glove compartments and built in storage compartments.

A review of the attached Radiological Investigative Reports may be helpful. Part of a Radiation Worker's job is to know that a vehicle presented for release from the RCA is free from contaminated tools.

Your assistance is greatly appreciated.

M. J. Slobodien

Attachment

cc: J. J. Barton - Director OC

MJS9-91\24