

RADIOLOGICAL ASSESSMENT
FOR
REVERE, PENNSYLVANIA SITE

Prepared for:

**Cabot Corporation
County Line Road
Boyertown, PA 19512**

Prepared by:

**ST Environmental Professionals, Inc.
114 Lutz Road
Boyertown, PA 19512**

**Revision 1
February 28, 2001**



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1.0 INTRODUCTION

The purpose of this Radiological Assessment is to support the termination of the U.S. Nuclear Regulatory Commission (NRC) license for radioactive materials at the Cabot Performance Materials, Inc. Site at Revere, Pennsylvania. NRC's new rule (10 CFR Part 20, Radiological Criteria for License Termination; Final Rule) became effective on August 20, 1997 (FR, 1997). This Radiological Assessment is a complement to a Decommissioning Plan (STEP, 2001) being submitted to meet the requirements of the new rule. This report is intended to demonstrate that concentrations of radionuclides in materials on the Site are sufficiently low that the Site qualifies for release without restriction on use and are also as low as reasonably achievable (ALARA).

Cabot Corporation (Cabot) located at County Line Road, Boyertown, Pennsylvania holds US Nuclear Regulatory Commission (NRC) License SMC-1562 for source materials associated with former ore processing activities at their Revere, Pennsylvania facility (Site). The license also covers materials located at a site in Reading, Pennsylvania. This Radiological Assessment applies only to the Revere Site.

During the decommissioning process Cabot performed comprehensive site characterization and analysis including: surface gamma measurements at 1cm and 1m above the surface, test pits, radiological analysis of surface and subsurface samples, characterization of the site topography, climate, physiography, geology, and surface water hydrology, measurement of the leach rate of uranium from the slag, determination of the leach rates of thorium and radium, evaluation of the weathering rate of the slag, preparation of a Radiological Assessment (STEP, 1997a, Rev. 0) and a Decommissioning Plan (STEP, 1997b, Rev. 0). This revised Radiological Assessment (Rev. 1) and a Decommissioning Plan (STEP, 2001, Rev. 1) have been prepared to address a request for additional information by the NRC.

The characterization information was used to develop scenarios and input parameter values for computation of maximum doses. Two base case scenarios, a site worker who occasionally walks across the slag in the course of his work, and resident who lives in a house on slag covered with a thin layer of topsoil. These scenarios are considered representative of the most likely uses of the site.

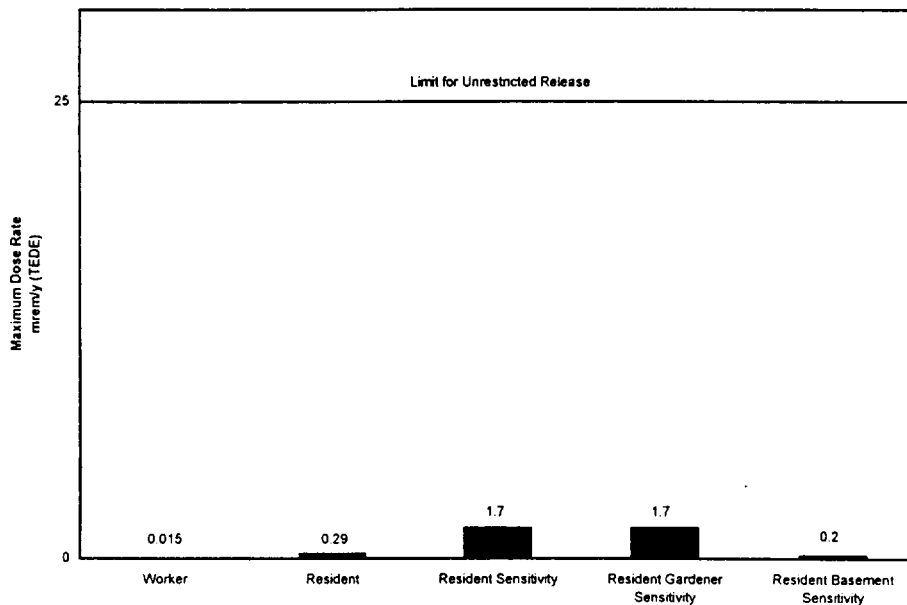
Three sensitivity scenarios were also evaluated. These included a resident who lives in a house constructed directly on the slag (RS), a resident who lives in a house constructed directly on the slag and who grows a garden directly in the slag (RG), and a resident who lives in the basement of a house with slag as fill beneath the basement and outside basement walls (RB). These scenarios are not considered reasonably likely for the Revere site. However, these sensitivity scenarios are a closer match to NRC scenarios used for generic screening purposes than the scenarios considered most likely for Revere site. Thus, they can serve as a separate benchmark.

Test calculations showed that calculated doses varied only slightly between the four slag areas. Calculated doses are only slightly sensitive to source area and thickness over the range represented by the four slag areas. Consequently, the assessment was simplified by using a single 1-meter thick source area representing the entire volume of slag in the four areas distributed over a single contiguous area of 23,000 square meters. Dose results calculated for this artificial source can be considered representative of the dose that would be calculated for any of the four individual sources.

Detailed descriptions of the modeling input parameters and results are contained in this Radiological Assessment. The maximum calculated dose for each scenario is summarized in the table below.

EXPOSURE SCENARIO	MAXIMUM ANNUAL TOTAL DOSE (mrem/y TEDE)
Worker	0.015
Resident	0.29
Resident sensitivity	1.7
Resident gardener sensitivity	1.7
Resident basement sensitivity	0.2
The 10 CFR Part 20 dose criterion for license termination with no restrictions on use is 25 mrem/y.	

These results are graphically depicted below and compared to the 25-mrem/y limit (10 CFR 20 Subpart E) for unrestricted release. As shown, they are all at least one order of magnitude less than the limit for unrestricted release.



* Unrestricted Release = Less Than 25 mrem/year (10 CFR 20 Subpart E)

The doses calculated for all scenarios were substantially below the 25 mrem/y limit for unrestricted release. Furthermore, an ALARA analysis, contained in the Radiological Assessment (RA) concluded that release without restrictions was ALARA. As a result no decommissioning activities are required.

Summary Site Description

Comprehensive information on the Site, operations at the Site, and the license termination in general are provided in the Decommissioning Plan. For that reason, only a summary description is provided here.

The Cabot Site is located in Revere, Bucks County, Pennsylvania. Figure 1-2 shows the location of the Revere Site. In the early 1970's, Kawecki Chemical, a predecessor to Cabot, obtained a source materials license from the United States Nuclear Regulatory Commission (USNRC) in order to process ores containing niobium (formerly called columbite). The license was required because the ores also contained naturally occurring uranium and thorium at levels equaling those defined as source materials under the Atomic Energy Act of 1954. Source materials are defined as natural materials (such as soil, rock and ores) that contain greater than 0.05% by weight uranium or thorium individually or in any combination. For a short period after the USNRC license was obtained, the Revere plant processed pyrochlore and columbite (ores containing niobium) using powdered aluminum in a thermite reduction process, to produce a steel-grade (low purity) niobium metal alloy. This process resulted in a silica slag that contained uranium and thorium originally contained in the pyrochlore. The slag was separated and deposited at four locations on the Revere Site. The four areas are designated the Parking Area, the Former Container Storage Area, the Building 4 & 5 Area, and the Old Pit Area. The locations of the areas of slag deposition are shown on Figure 1-2.

The processing of radiological ore was discontinued in 1976. No source material is currently being used on the Site. Cabot holds license SMC-1562 which authorizes the company to possess the slag material resulting from the niobium processing that occurred in the early 1970's.

In 1990, 1992, and 1993, Cabot performed decommissioning activities (slag removal) at the Revere Site. The Oak Ridge Institute for Science and Education (ORISE, 1993) performed a confirmatory survey and found that although average concentrations satisfied the existing NRC guidelines, individual fragments of slag at and below the surface exceed guidelines for natural uranium and thorium. In the spring of 1994, Enserch Environmental Corporation (Enserch) performed a radiological characterization survey of the Revere facility (Enserch, 1994). In the summer of 1994, NES, Inc. (NES), performed radiological subsurface sampling (NES, 1994) to determine the depth and extent of the slag deposits and to confirm the findings of Enserch. The survey showed that some slag remained on-site. NES also determined that the radioactivity is limited to the slag and that no detectable contamination had leached into the soil.

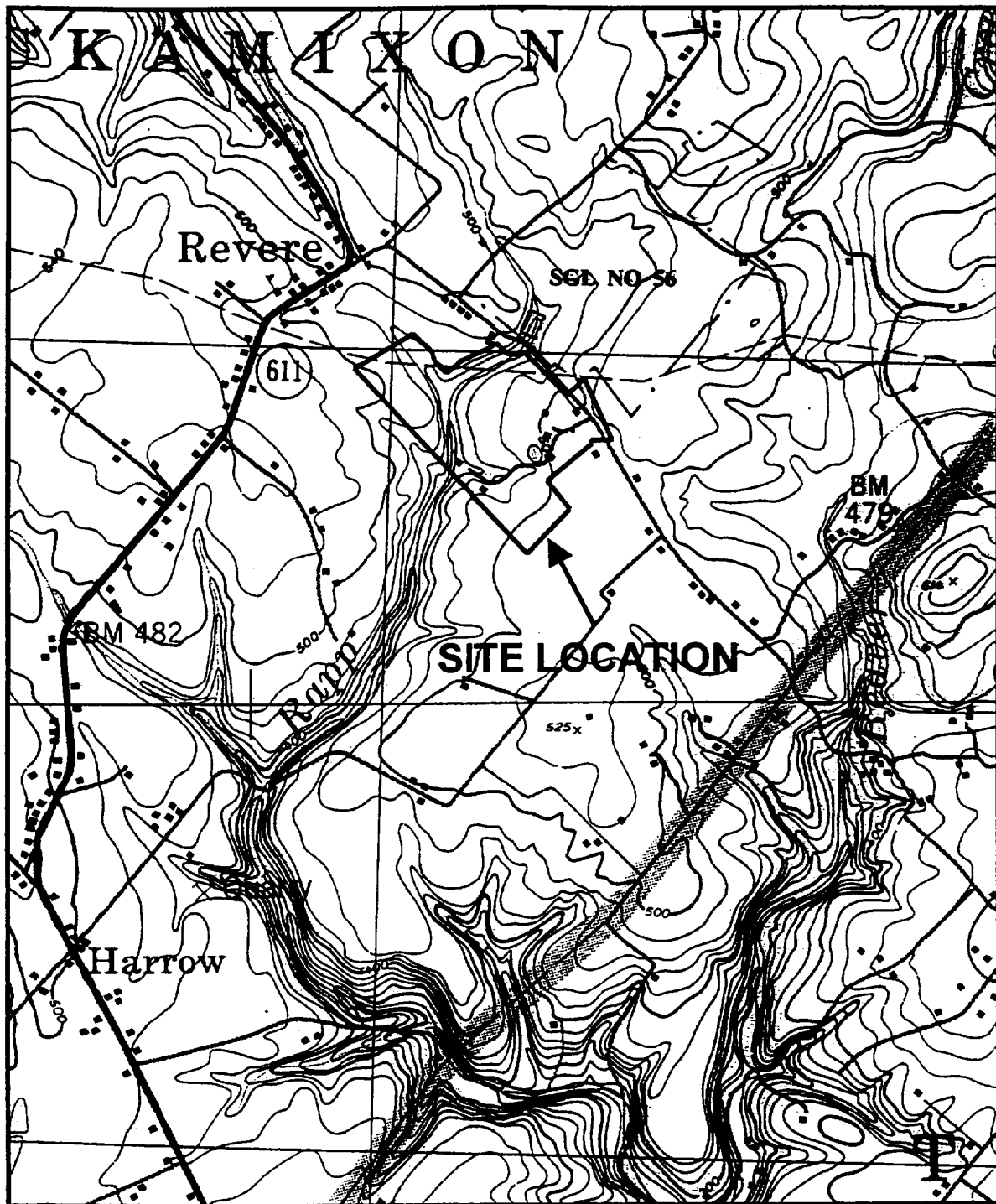
Radiological Assessment

The NRC radiological criteria for license termination are expressed in terms of radiation dose that might reasonably be expected from residual radioactive material after decommissioning. As used in this report, the term "dose" means total effective dose equivalent (TEDE), which is the quantity expressed in the NRC regulation. At the Revere Site this dose would depend upon concentrations of residual radioactive materials in soils and other remaining materials. The dose would also depend on Site-specific factors that might control potential resource use, potential migration of radioactive materials, and potential access to radioactive materials. Finally, this dose would also depend on potential activities of future users of the Site.

The radiation dose assessment process, as applied herein, includes the estimation of the maximum radiation dose (TEDE) that might be received by a typical member of a small group of people that could be expected to receive the highest doses from use of the Site. The assessment evaluates doses for periods as far as 1,000 years into the future, as required in the radiological criteria for license termination. Thus, the assessment considers not only the expected conditions at the Site, soon after remediation, but conditions projected for the distant future, as well. The assessment evaluates potential uses of the Site and potential migration of radioactive materials through the environment over time, taking account of both natural processes and human activities that could be expected to alter the patterns or rates of constituent movement.

In general, the dose assessment process consists of two steps: 1) development of representations of site physical conditions and potentially exposed populations, and expression of these representations in mathematical terms; and 2) use of a mathematical model with input from the representations and/or technical literature to estimate future exposures and radiation doses (TEDE) as a function of time. The dual objective in the development of simplified representations is that the representations be realistic and not result in underestimation of exposures and doses. The following sections describe the representations of the radioactive material source, the Site environs, and potential exposure scenarios (step 1), and the dose assessment methodology and results (step 2).

Remaining sections of this report describe the radioactive material source (Section 2.0), potential radiation exposure scenarios (Section 3.0), the dose assessment methodology (Section 4.0), results (Section 5.0), ALARA analysis, (Section 6.0), and conclusions (Section 7.0).



SCALE FEET
0 2,000 4,000

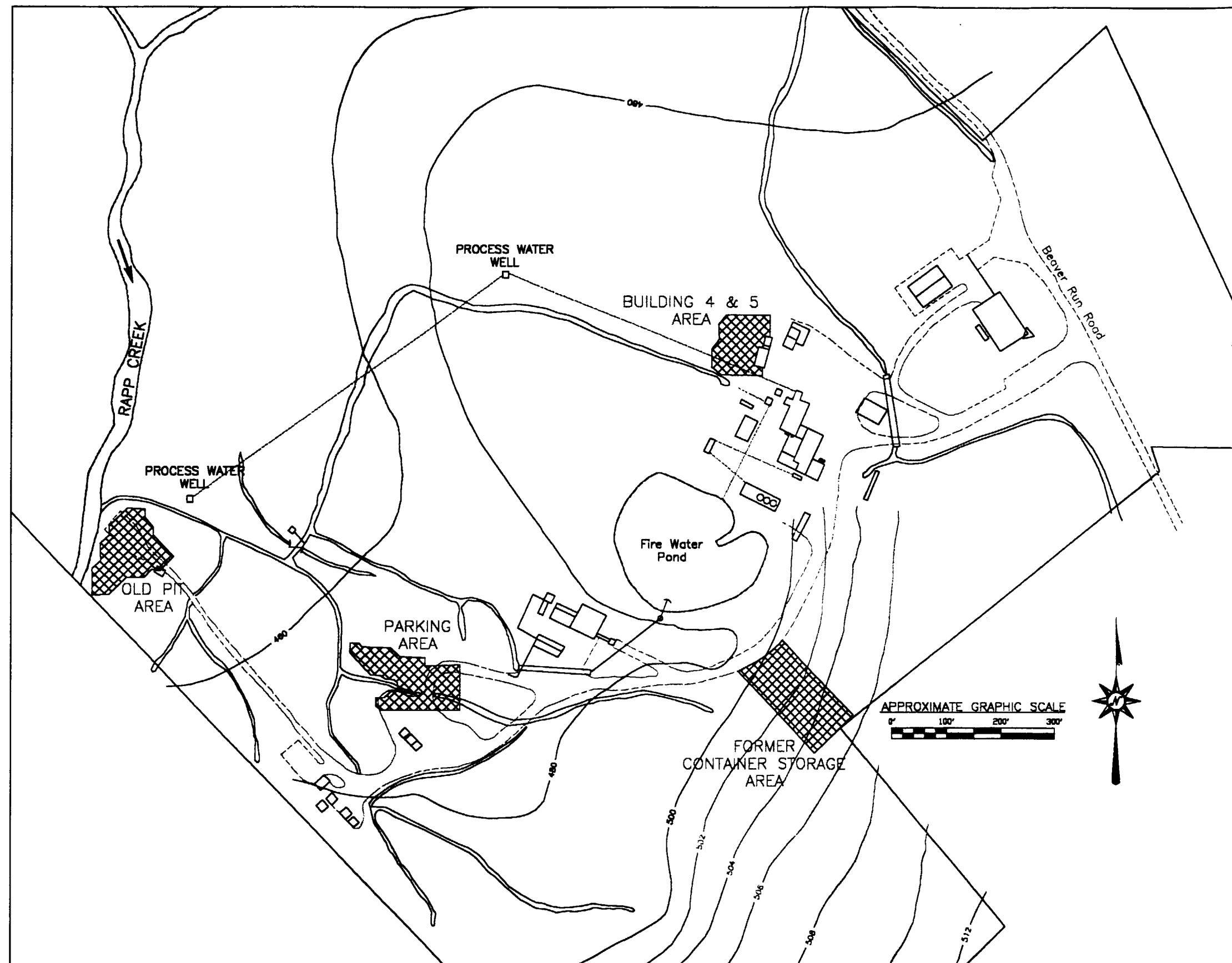
NORTH
↑

SOURCE: USGS, County Map Series, Bucks County,
Pennsylvania, 1:50,000 Scale

FIGURE 1-1 Site Location Map

Revere, Pennsylvania, Site
Cabot Corporation

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STEP Project Number 97C048
Revision 1, February 28, 2001



LEGEND

-  **AFFECTED AREAS**
-  **PROPERTY BOUNDARY**
-  **SURFACE WATER**
-  **PROCESS WATER SUPPLY WELL**
-  **20 FOOT ELEVATION CONTOUR LINE**
-  **2 FOOT ELEVATION CONTOUR LINE**

SOURCE: This drawing was digitized from Figure 2-2, KBI - REVERE PLANT BUILDING LOCATIONS, contained in the Radiological Characterization Survey Report for Cabot Performance Materials, April 1994. Scale is approximate.

FIGURE 1-2 SITE MAP

Revere, Pennsylvania Site
Cabot Corporation

ST Environmental Professionals, Inc.
Revision 1, February 28, 2001 Project No. 97C048

2.0 RADIOACTIVE MATERIAL SOURCE

Potential radiation doses from residual radionuclides remaining on the Site after decommissioning will depend upon the types and inventories of radionuclides present, the concentrations of nuclides in materials, and the physical distribution of the materials on the Site. This section describes the development of the Site source representation for dose assessment purposes. This development consists of the definition, in spatial terms, of source units within which nuclide distributions and/or physical characteristics can be considered reasonably uniform and at the same time reasonably representative of Site conditions. Such a representation of the Site is necessary to permit description of the Site conditions in a mathematical form.

The radionuclides of interest for evaluation are known from the history of operations of the Site and from Site characterization measurements. They are naturally occurring uranium (U-238, U-234, and U-235) and naturally occurring thorium (Th-232 and Th-228) and their radioactive progeny.

Previous characterization has determined that radioactive materials of interest are confined to silica slag in four small, distinct areas on the Revere Site. The four areas are illustrated on Figure 1-2 and are described as follows:

Parking Area - This area is located to the west of the principal manufacturing buildings and encompasses 35,500 square feet. The material of interest consists of building rubble mixed with slag and some soil to a depth of approximately six feet.

Former Container Storage Area - This area encompasses 19,900 square feet in the central portion of the property. It consists of a slag and soil mixture to a depth of approximately four feet.

Building 4 & 5 Area - This area is a 16,000 square feet area behind Building 4 & 5 which consists of slag and rock mixed with some soil to a depth of approximately two feet.

Old Pit Area - This area is located at the western-most portion of the property away from the manufacturing facilities. It encompasses 54,900 square feet and consists of building debris mixed with slag and some soil to a depth of approximately nine feet.

These areas, each in the range of 0.4 to 1.3 acres, together constitute only a small part of the total Site area of about 100 acres. As indicated in Figure 1-2, the areas are separated by distances of at least 120 meters.

At most sites bearing residual radioactive materials, the radioactive materials are present in the form of soils bearing the radionuclides in low concentrations. In contrast, radioactive materials of interest at Revere are contained in dilute form within discrete, highly stable pieces of slag, most substantial in size relative to particles of importance for the inhalation pathway, for example. As indicated in Section 1.5.1 of the Decommissioning Plan, the physical and chemical stability of these slag pieces render the contained radioactive materials substantially less mobile in the environment than they might be in more commonly encountered soil forms. The slag containing radioactive material of interest is diluted by much larger volumes of materials that contain no licensed radioactive material—slags from other processes, demolition rubble, etc.

Production records and previous reports of the quantities processed were used to estimate average concentrations of the radionuclides of interest in the slag in the four slag areas. The data and evaluation methodology are described in Appendix A. The derived average concentrations of the radionuclide inventory distributed throughout the waste are 0.14 pCi/g thorium (Th-232+Th-228) and 0.34-pCi/g uranium (U-234+U-238). These represent small increments above the concentrations of naturally occurring thorium and uranium in site soils, which average about 1.7 pCi/g thorium and 3 pCi/g uranium. The increments are comparable to the range in concentrations of naturally occurring thorium and uranium in site soil samples. The results for eight background soil samples varied from 1.2 to 2.2 pCi/g for thorium, a range of 1 pCi/g. The uranium results varied from 1.7 to 5.0 pCi/g, a range of 3.3 pCi/g (Berger, 1993).

3.0 POTENTIAL EXPOSURE SCENARIOS

The decision to terminate the NRC license for Revere with unrestricted use of lands will depend on a finding that future exposure to residual radioactive materials at the Site would be within NRC limits for exposure of members of the public. Assessment of potential future exposure must include development of reasonably expected scenarios by which exposure to residual radioactive material might occur.

In general, people could conceivably receive radiation doses from radioactive materials on the Site through either internal or external exposure. In external exposure, the body absorbs radiation emitted by radioactive material outside the body. For example, radioactive materials deposited on the ground surface can cause external exposure of a person standing on the surface if the radiation emitted is sufficiently penetrating to reach internal body tissues. In internal exposure, the body absorbs radiation emitted by radioactive material that has been introduced into the body by inhalation of radioactive material constituents in air, or by ingestion of radioactive material constituents in food or water. In general, the level of the radiation dose received decreases as the quantity of radioactive material available for exposure decreases, but the exact relationships are sometimes complex. External radiation exposure can be mitigated by dilution of the source material, by increasing the distance between the receptor and the source, by limiting exposure time, and by shielding, i.e., radiation-absorbing material between the receptor and the source. Internal exposure can be mitigated by isolation or dilution of the source material to minimize inhalation or ingestion of radioactive material.

For the Revere site, there are important site-specific considerations that tend to define likely potential exposure scenarios. These have been considered, as described below, in the development of scenarios for potential radiation exposure to residual radioactive materials at the Revere site.

The distribution and form of the residual radioactive materials of interest at the Revere Site and other site-specific features are important considerations in developing radiation exposure scenarios appropriate for evaluation to form a decision basis for terminating the NRC license with unrestricted use of the lands. As noted in Section 2.0, radioactive materials of interest are confined to silica slag in four discrete areas on the Revere site. For radiological dose assessment purposes, these may be considered isolated sources of potential exposure. That is, it is unlikely that a person using the Site would be exposed to radioactive materials at more than one of the four locations in a way that would lead to a dose higher than he would likely receive from exposure at any one of the locations. However, for this dose assessment, the site was modeled as one area containing the combined area and volume of all four areas. This model ensures that the calculated dose conservatively overestimated the potential dose.

As noted in Section 2.0, the radioactive materials at the Revere Site are contained in dilute form within discrete, highly stable pieces of slag, mixed with much larger volumes

of slag and building rubble that do not contain licensed radioactive material. The limited environmental availability of the radionuclides of interest in the slag and the inability of the areas containing the slag to support vegetation are important site-specific considerations in radiological dose assessment.

Other site-specific features are also important. For example, the Site is presently used only for industrial purposes and is likely to continue to be used only for those purposes in the future. For this reason, future residential use is highly unlikely. Even if portions of the site were eventually used to be used for residential purposes, it is not likely that the slag areas would be used for such purposes. As noted, these slag areas represent only a small fraction of the total area of the site. The slag areas are poorly suited for locating a residence or garden, as may be readily determined by visual inspection. Furthermore, the slag areas are surrounded by large areas of land that potential users would easily recognize as much better suited for such purposes.

As another example of important site-specific considerations, on-site well water is not used for human consumption, but is used only for industrial processes. This industrial process water is drawn only from deep wells (up to 2,000 feet). Thus, the use of a shallow well for human consumption is highly unlikely. All of these considerations, taken together, tend to define the radiation exposure scenarios that might reasonably be expected in the near or even distant future. In particular, direct application of commonly used generic exposure scenarios developed for screening purposes is not appropriate for this site.

License termination decisions can sometimes be based on analysis using simplified generic screening exposure scenarios (USNRC, 2000). Screening exposure scenarios are based on conservative exposure assumptions that typically cause doses to be overestimated. While they may be useful for screening purposes, they are not suitable representations of exposure scenarios that might reasonably be expected to arise at the Revere site. In particular:

- The present and likely future use of the Site for industrial purposes make resident and resident-farmer scenarios unlikely, at least in the near future.
- The size and locations of the areas bearing radioactive materials of interest are not compatible with a resident-farmer scenario, in which the resident spends a very large fraction of his time, and raises a large portion of his food, including meat and milk, on the land bearing the licensed radioactive material.
- The slag materials containing the radioactive materials of interest do not currently support vegetation and would not even in the distant future, which would make them unusable for producing food as assumed in the some screening scenarios.

- The residual radioactive materials of interest on the Site have been shown to be tightly bound within the slag materials of substantial particle size and are likely to remain so in the future. This characteristic of the material is discussed in more detail in Section 1.5.1 of the Decommissioning Plan. This characteristic makes the radionuclides much less available for inhalation, uptake into vegetation (either that consumed directly by people or that consumed by animals in the process of producing meat or milk for consumption by people) than radionuclide forms in soils, which serve as the basis for screening analysis assumptions.
- Housing designed to meet current standards would not be constructed on the slag materials in ways consistent with assumptions in resident scenario assumptions. Any housing on slag materials would most likely be constructed only after covering the slag materials, which effectively provides greater dose mitigation than typically assumed for structures in screening scenarios.
- Industrial/commercial facilities designed to meet current standards would not be constructed on the slag materials in ways consistent with assumptions in screening scenarios. Such facilities would also most likely be constructed only after covering the slag materials, and the facilities would be constructed with structural features, such as concrete floors/slabs and block walls that would effectively provide greater dose mitigation than typically assumed for structures in screening scenarios.
- In the unlikely event that well water is used at all, it would most likely be drawn from a much deeper formation than is assumed in typical screening scenarios.

Consequently, screening scenarios should be used cautiously for the Revere site. In this analysis, they have been used as points of departure for the development of more realistic exposure scenarios or for sensitivity studies.

Based on the foregoing, two groups of scenarios have been developed and analyzed. The first (base case) group represents those scenarios that are considered reasonably likely. Development of assumptions for these scenarios begins with the generic screening scenarios as a point of departure and makes changes as necessary to develop most likely exposure scenarios. The second (sensitivity) group, more similar to screening scenarios described above, is included for purposes of sensitivity interpretations.

The most likely exposure scenarios consist of a worker scenario, designated "W," and a resident scenario, designated "R." The worker scenario recognizes that the Site is an industrial site and areas bearing slag materials are not used for any purpose. Consequently, the time a worker might spend in any or all areas would be very small, and it is quite likely that a worker might spend no time in the areas. In the event that a worker

might have occasion to visit the areas of interest, the only potential exposure pathways would be external exposure and inhalation of resuspended dust that might occur during walking over the areas. For purposes of conservative analysis, the worker is assumed to be exposed outdoors in an area containing residual radioactive material for a period of 40 hours per year. No indoor exposure is assumed because there are no buildings on the areas of interest. If, as is likely, the areas of interest continue not to be used in the future, the W scenario can also serve as representative scenarios for exposure of workers on the Site in the future.

The resident scenario, R, considers the possible, but unlikely, future use of the Site for residences. In the resident scenario, it is assumed that residences are constructed entirely on an area containing residual radioactive materials, and that the resident spends 78% of his time on the area—85% of that indoors and 15% outdoors. Exposure through the ground, inhalation, and soil ingestion pathways is assumed. Only limited structural reduction in dose rate for the external and inhalation pathways is assumed. It is also assumed that water is obtained from a shallow well. These assumptions are consistent with screening scenarios (NRC, 2000). This scenario departs from the screening scenarios in assuming no garden in keeping with the form of the residual radioactive materials, as explained above. A 6-inch layer of topsoil is assumed to be maintained over the slag over the period of assessment. This layer of topsoil would support grass, but would not be deep enough to support edible vegetation.

Given potential land and water uses in the W and R scenarios, exposure to residual radioactive material in slag on the Site could possibly occur through one or more of three terrestrial pathways (water independent pathways) and, for the R scenario, one water dependent pathway. Exposure could occur from radiation emitted directly from radioactive material in place in the slag, from inhalation of dusts containing residual radioactive material (resuspended from slag at the ground surface), or from direct incidental ingestion of residual radioactive material in small quantities of slag (e.g., present as dust on hands). The sole water dependent pathway for the R scenario would be direct ingestion of well water.

Because radon-222 and radon-220 are progeny of the uranium-238 and thorium-232 decay chains, respectively, inhalation of radon daughter products is a possible indoor radiation exposure pathway at this site. However, because radiation doses from these nuclides are best controlled by measures commonly incorporated in new structures, radiation doses from these nuclides have been excluded from the new radiological criteria for decommissioning, and are not included in this assessment. This approach is consistent with current NRC radiological criteria for license termination in 10 CFR 20, Subpart E. (In any event, as explained in Section 2, the concentration increment represented by the radionuclides of interest over the same nuclides occurring naturally is small enough that, other factors being equal, radon emanation should be within the normal range of natural variation.)

The set of base case exposure scenarios for consideration in dose assessment was developed based on the nuclides of interest, the anticipated distribution of the nuclides on the site, reasonably likely potential uses of the site, and potential environmental migration pathways. A list of all of the exposure pathways warranting analysis for one or more of the base case scenarios is provided below:

1. Ground - Direct radiation from material in soil
2. Dust - Resuspension of surface particulate material (air inhalation)
3. Soil - Ingestion of soil
4. Water - Release of materials in soil to infiltrating water (groundwater ingestion)

Although exposure pathways may be the same for different exposure scenarios, values for key parameters, such as site occupation time, may differ between scenarios.

There are certain analytical elements common to both base case scenarios:

- Use of measured uranium leach concentration and assumption of progeny equilibrium in leachate: For dose calculation purposes, uranium leaching was modeled as a desorption process in which the uranium concentration in the leachate was assumed to be directly proportional to the concentration in the solid source. The value selected for K_d , the ratio of uranium concentration in solid to uranium concentration in leachate—commonly called the distribution coefficient, was adjusted so that the dose model would produce a leachate uranium concentration equal to the readily available uranium (RAU) concentration measured in leaching tests on slag from the Revere site. These leach tests consisted of exposure of ground-up representative samples of slag to highly acidic leaching conditions that are far more aggressive than would be encountered in the natural environment. The experimental leach solutions were at least 10 times more acidic than natural waters. The concentrations of dissolved nuclides measured in such a test are far higher than would be expected from leaching into natural waters percolating through the slag materials. Because radiation dose from exposure to such waters would increase with increasing nuclide concentration, assumption of conservatively high concentrations of nuclides in leachate leads to conservatively high estimates of radiation dose. The raw data from the leach test is provided in Appendix B. The use of these data in the derivation of the uranium K_d value for use in the dose model is shown in Table 3-1. The derivation in Table 3-1 is fully consistent with the interpretation of leach test data by Environmental Resources Management, Inc. (ERM), which has been

submitted to NRC previously (Cabot, 1996). The leach test methodology and the ERM interpretation methodology used for the Revere slag leach test was approved by the NRC staff (USNRC, 1997).

Uranium progeny nuclides were assumed to be present in leachate in equilibrium with the uranium parent. This assumption implicitly assumes congruent leaching. As noted in Section 1.5.1 of the Decommissioning Plan, leaching would be incongruent, with concentrations of important uranium progeny in leachate lower than concentrations of uranium. Thus, assumption of equilibrium and congruent leaching results in conservatively high estimates of progeny nuclide concentrations in leachate.

The K_d value derived for uranium for dose calculations was also used for the thorium chain. As explained in the ERM analysis, a higher K_d value for thorium and its progeny nuclides, which would result in a lower concentration of those nuclides in leachate, would be warranted based on data from experiments of sorption/desorption using various materials from other sites. Therefore, use of the same K_d value as that derived for uranium would result in conservatively high concentrations of thorium and progeny nuclides in leachate, as calculated in the dose model.

- Exclusion of radon pathways from evaluation for reasons described above
- Use of RESRAD default input parameter values, except as noted: Complete lists of parameter values are provided in RESRAD documentation (Yu, 1993, Yu, 1993b). Where most appropriate, i.e., where the pathway contributes significantly to dose, exposure parameter values for the worker or resident exposure scenario were selected in accordance with NRC decommissioning dose assessment guidance (USNRC, 2000). Except for site-specific values, default RESRAD parameter values were used.

The first of three sensitivity scenarios analyzed, resident sensitivity (RS) is identical to the base case R scenario, except that no covering of slag is assumed. The exposure pathways evaluated again include ground exposure, dust inhalation, and soil and water ingestion.

The second of three sensitivity scenarios (RG) is identical to RS, except that the vegetable ingestion pathway is added to represent a garden in the slag. Radionuclide transport through three routes is assessed. They include deposition of airborne dust, deposition of irrigation water, and uptake from soil. To account for the limited environmental availability of radionuclides in slag, plant/soil transfer factors for radionuclides of interest were adjusted by multiplying them by the fraction

environmentally available (percent TAU), as calculated in Table 3-1 from solubility test data.

The last sensitivity scenario (RB) examines the potential impact from using the slag as excavation and as foundation fill in the construction of a house. Because there are no screening scenarios quite like this scenario, cautious judgment was used in defining the scenario and in selecting parameter values. It was assumed that a person spends half his time in the basement in a room 36 square meters in floor area. Slag is assumed to be used as fill to the extent that slabs one meter thick lie against the outside basement walls up to a height of 3 meters and a 1-meter thick slab underlies the floor. Because the slag is not likely to be good for making concrete, it was assumed that the concrete walls and floor, constituting a shielding equivalent to 6" of concrete were slag-free. It was also assumed that the concrete walls and floor would preclude exposure to radionuclides of interest from pathways other than direct radiation.

The key assumptions for each of the base case and sensitivity exposure scenarios developed for the Revere Site are summarized in the Table 3-2.

TABLE 3-1 **DERIVATION OF K_d VALUES FROM LEACH TEST DATA**

Derive pseudo- K_d to apply to hot slag/clean slag-rubble mix
for RESRAD runs.

Define K_d based on measured U in leachate and slag.

DATA (concentrations from Appendix B,
other data from Cabot, 1996)

SLAG

220 CSU, U, ug/g as rcd
10.8 CSAC, Ac-228, pCi/g dry
6.62 CSBI, Bi-212, pCi/g dry
9.61 CSPB, Pb-212, pCi/g dry
3.82 CSTL, Tl-208, pCi/g dry

LEACHATE

0.031 U, ug/g OXSU4
0.052 U, ug/g OXSU6
0.081 U, ug/g OXSUT

0.128 RAU, readily available uranium, ug/g slag
0.034 SAU, slowly available uranium, ug/g slag
0.824 TAU, total available uranium, ug/g slag

80 VRAU, total liquid contact volume for RAU test, mL
1 SMRAU, slag mass for RAU test, g

CALCULATED RESULTS

1.60E-03 CLRAU, U conc in liq phase RAU test, ug/ml
CLRAU=RAU/VRAU
1.08E+00 ALRAU, U conc in liq phase RAU test, pCi/L
ALRAU=CLRAU*1000 mL/L*6.75E-1 pCi/ug

137500 KD, mL/g
KD=CSU/CLRAU

0.374545 TAU%
TAU%=TAU/CSU*100

TABLE 3-2
SCENARIO PATHWAYS AND KEY PARAMETER VALUES
USED FOR SCENARIOS

PATHWAY	SCENARIO				
	W Worker	R Resident	RS Resident Sensitivity	RSG Resident Gardener Sensitivity	RB Resident Basement Sensitivity
Water-Independent					
External					
Indoor exposure time (h/y)	0	5760	5760	5760	4380 bsmt
Structural shielding factor	0	0.59	0.59	0.59	Calculated
Outdoor exposure time (h/y)	40	1030	1030	1030	0
Other		6" topsoil			
Inhalation (dust)					
Indoor exposure time (h/y)	0	5760	5760	5760	4380
Structural shielding factor	0	0.5	0.5	0.5	0
Outdoor exposure time (h/y)	40	1030	1030	1030	0
Dust loading (g/m3)	3.40E-05	3.40E-05	3.40E-05	3.40E-05	3.40E-05
Other		6" topsoil			
Inhalation (radon)	No	No	No	No	No
Ingestion of vegetables	No	No garden	No garden	Yes	No
Ingestion of meat	No	No	No	No	No
Ingestion of milk	No	No	No	No	No
Ingestion of soil	No	Yes--6" topsoil	Yes	Yes	No
Water-dependent					
Ingestion of water	No	Shallow well	Shallow well	Shallow well	No
Ingestion of aquatic food	No	No	No	No	No
Ingestion of vegetables (irrigated)	No	No	No	Yes	No
Ingestion of meat (irrigated)	No	No	No	No	No
Ingestion of milk (irrigated)	No	No	No	No	No
Inhalation (radon from water)	No	No	No	No	No

Resident exposure times, and structural dose reduction factors are mean values from Beyeler, 1998.
Dust loading for inhalation is the 90%-tile value from Biwer, 2000.

4.0 DOSE ASSESSMENT METHODOLOGY

Potential future radiation doses are computed from estimates of potential intake rates and exposure rates. Radiation doses from internal exposure (inhalation or ingestion) are computed using dose factors developed using current methodology, specifically those in Federal Guidance Report 11 (USEPA, 1988). In conformance with this guidance, the term "dose," as it is used in this report, means "committed effective dose equivalent" (CEDE) in reference to doses from internal exposure, "deep dose" in reference to external exposure, and "total effective dose equivalent" (TEDE) in reference to combined internal and external exposure. Annual doses totaled over all applicable exposure pathways are computed for each of a number of times after license termination for each potentially important receptor. In this analysis, annual doses were evaluated at 0, 1, 3, 10, 30, 100, 300, 500, 700, and 1,000 years after license termination. However, the computer code used includes capability to compute the peak annual dose reasonably accurately if the peak falls between times specified for analysis. Results for each of these periods are tabulated in the computer code output. For this assessment, the peak calculated annual dose any time within the 1,000-year period of interest is the quantity used to compare against limits.

The computation of nuclide concentrations in media and radiation doses associated with exposure to those media is complex, and is usually performed using computer codes specially designed for the purpose. Except for the resident basement sensitivity scenario, The RESRAD code (Gilbert, 1989 and Yu, 1993) was selected as suitable for evaluation of all pathways in the analysis. The version used was Version 6.0, the latest available at the time the analysis was performed. The RESRAD-BUILD code was used to evaluate the resident basement sensitivity scenario, because it is more capable of explicit evaluation of the direct dose to a basement resident assumed to be exposed to slab surfaces outside the basement walls and beneath the floor.

5.0 RESULTS

Complete listings of the summary output data file for a RESRAD run representative of each scenario analyzed are provided along with the output in Appendix C. Each output data file also lists the input data used. This section describes the results of those analyses.

The total dose (TEDE) results calculated for each scenario are listed in Table 5-1. The same results are presented graphically in Figure 5-1.

As may be seen by inspection of the RESRAD results, direct radiation from material in the slag, labeled "Ground" in RESRAD output, accounted for practically all of the total calculated dose. Examination of the detailed RESRAD output and consideration of the long half-life of nuclides contributing to measured direct radiation indicates that annual doses (TEDE) do not change significantly over the 1,000-year period of interest. These results are.

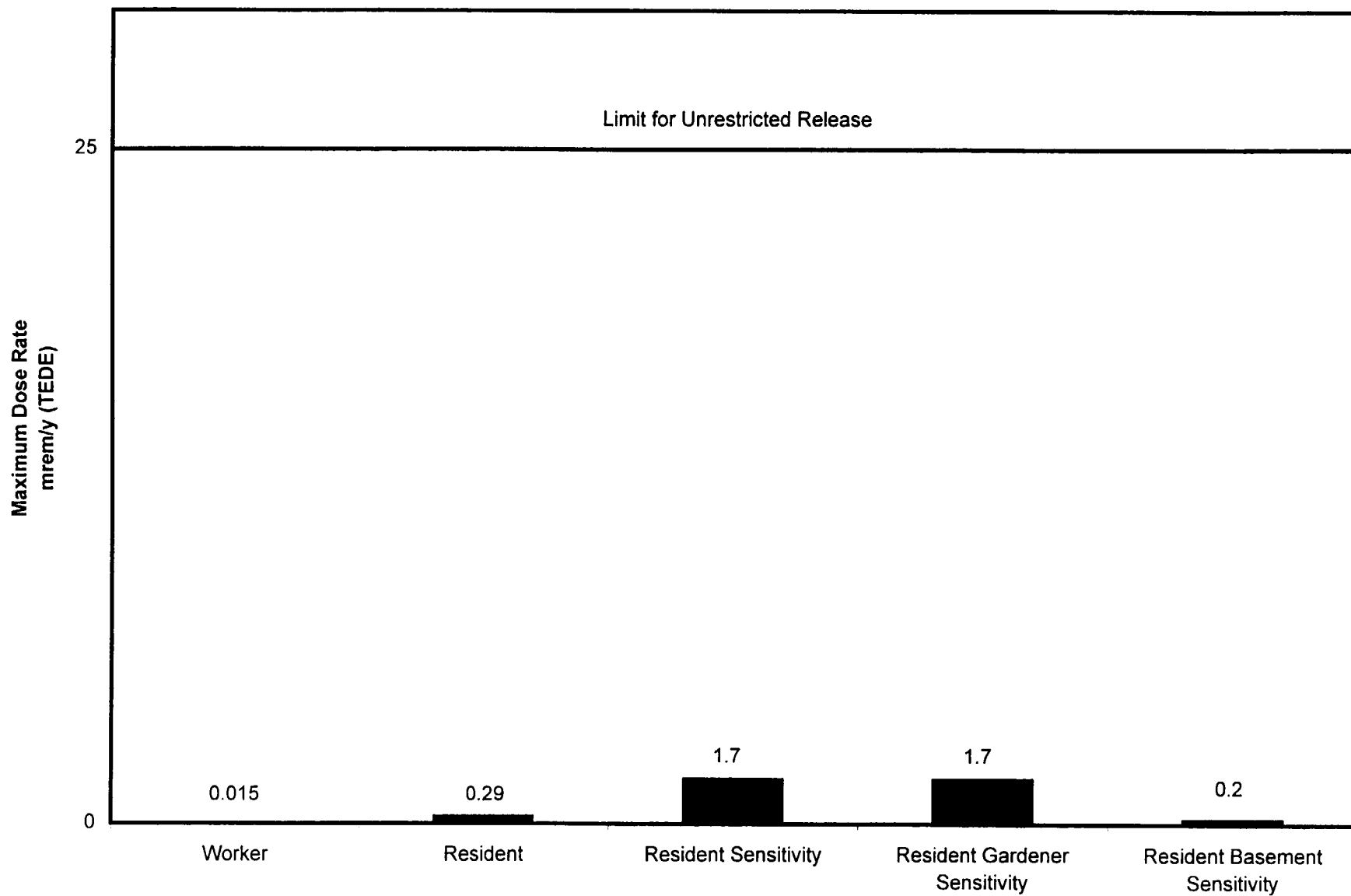
The maximum dose (TEDE) calculated for the worker base case scenario is 0.015 mrem/y. A higher maximum dose (TEDE) was calculated for the resident base case scenario, 0.29 mrem/y. The maximum doses (TEDE) calculated for the resident and resident-gardener sensitivity scenarios were practically identical, 1.7 mrem/y. The only exposure difference between the two, dose from ingestion of vegetables grown in the slag, was not a significant contributor to total dose. The maximum dose calculated for the resident basement sensitivity scenario was 0.20 mrem/y. (The dose (TEDE) calculated for this scenario was significantly lower than the dose calculated for the two resident sensitivity scenarios because of attenuation of radiation from the fill material by concrete in the basement walls and floor. Attenuation of radiation from surface soils by above-grade structural materials, particularly in a frame house, is relatively less effective.) The maximum doses (TEDE) calculated for all scenarios are all substantially less than the 10 CFR Part 20 limit of 25 millirem per year (TEDE) for release with unrestricted use.

**TABLE 5-1
RESULTS SUMMARY**

EXPOSURE SCENARIO	MAXIMUM ANNUAL TOTAL DOSEmrem/y TEDE
Worker	0.015
Resident	0.29
Resident Sensitivity	1.7
Resident Gardener Sensitivity	1.7
Resident Basement Sensitivity	0.20

The 10 CFR Part 20 dose criterion for license termination with no restrictions on use is 25 mrem/y.

FIGURE 5-1
MAXIMUM ANNUAL RADIATION DOSE (TEDE) SUMMARY



* Unrestricted Release = Less Than 25 mrem/y (10 CFR 20 Subpart E)

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6.0 ALARA ANALYSIS

The principle that radiation doses should be kept as low as reasonably achievable (ALARA) has been applied for many years in radiation protection. In conjunction with dose limits for workers and members of the public, application of the ALARA principle is an important element in the NRC standards for radiation protection (10 CFR Part 20). This section of the report describes an analysis designed to determine whether reduction of the concentration of uranium and thorium and progeny nuclides in slag on the Revere Site would be warranted by the ALARA principle.

Elements of ALARA Analysis

In the context of slag remediation, ALARA analysis is fundamentally a balancing of the value of remedial action against its cost. If the expected value of the dose reduction exceeds the cost of remediation required to achieve the dose reduction, the action is warranted. The test is applied successively in a way that implements the most cost-effective actions first. When no further remedial actions are warranted by the ALARA test, remediation has reached the ALARA condition and the potential radiation dose has been reduced to a level as low as reasonably achievable.

Rigorous ALARA analysis can be complex, but ALARA analysis for situations such as the Revere slag remediation can be simplified greatly if the value of dose saved can be estimated on the conservatively high side and the cost of remediation can be estimated on the conservatively low side. If, in spite of such conservative assumptions, the cost of any proposed remediation exceeds the value of the dose expected to be saved, the ALARA condition has already been reached and no further dose reduction is warranted. If, on the other hand, the conservatively high estimated value of the dose expected to be saved exceeds the conservatively low estimate of the cost of any proposed remediation, the proposed action may be warranted. At a minimum, more rigorous analysis would be necessary to demonstrate that the ALARA point has been reached and no further dose reduction is warranted.

In the case at hand, a dose limit of 25 millirem per year is to be tested. This is the recently adopted limit in 10 CFR 20, Subpart E, for license termination without restrictions on use. (As shown elsewhere in this report, reasonably expected doses from Revere slag are at least an order of magnitude below the limit. The assumption of the higher annual dose leads to a proportionately higher aggregate dose and proportionately higher potential dose savings from remedial action. Consequently, the use of the 25 mrem/y limit as the annual dose in the ALARA analysis only tilts the balance in favor of remediation. This adds considerable conservatism to the ALARA analysis.) The question to be answered by ALARA analysis is whether slag cleanup would be warranted by the ALARA principle. Thus, the analysis must balance the value of the dose saved by reducing the dose from nuclides in slag to levels below 25 millirem per year against the cost of the required cleanup.

Value of Dose Saved

In determining the value of dose saved, the radiation dose quantity of interest is population dose, which can be thought of as an aggregate dose. It is the sum, over the future time period of interest and over the entire exposed population, of all of the individual annual doses received by each member of the exposed population. A population dose is expressed in units of person-rem. For example, ten people, each receiving 0.1 rem per year for a period of 20 years would result in a population dose of 20 person-rem.

The population dose depends upon the duration of the exposure period, the annual dose received by each person exposed, and the total number of people exposed each year. Each of these factors is examined further below.

The maximum time period of interest is fixed by regulation at 1,000 years. Shorter time periods can be considered more appropriate, and have been used in NRC environmental analyses, but, for purposes of conservatism, shorter periods are not considered in this analysis. If a shorter period were to be used, the calculated aggregate dose would be less and the potential dose savings from any remedial action would be less than that calculated in this analysis.

The annual dose received by an exposed person can vary with time. However, the analysis can be simplified by conservatively assuming that the annual dose is constant with time at the maximum calculated in the 1,000-year period of interest. For purposes of this analysis the annual dose rate is assumed constant at 25 millirem per year for the entire exposure period.

The total number of people exposed depends upon the population density in the area and the area of the zone containing the radioactive materials of interest. Reasonably conservative estimates of the population density in the area can be derived from consideration of likely future land uses that are consistent with exposure scenario assumptions. The highest doses are calculated for residential use of the land, even though the potential for that use is low. For example, a population of 4 persons per acre would appear to be reasonably consistent with low-density residential land, which would be most likely if residential use occurred at all. This population density can be conservatively assumed to be constant with time. The area of the zone containing radioactive materials of interest can be established reasonably accurately from Site characterization data. However, as described below, both the value of the dose saved and the cost of the remedial action can be determined on a unit area basis, which makes the actual area of the zone containing radioactive materials relatively unimportant in this analysis.

The dose saved by a remedial action is the difference between two population doses--the population dose without the proposed remedial action less the population dose residual

after implementation of the remedial action. The analysis can be simplified greatly if the population dose after remedial action is conservatively assumed to be zero (i.e., the remedial action is assumed to be entirely effective in eliminating the potential for radiation exposure). This assumption results in the maximum possible dose savings. Any more realistic estimate of potential dose savings from any remedial action can only be less, and, consequently, its value can only be less. With this simplification, it is possible to derive a conservatively high estimate of the expected dose to be saved from further remedial action by calculating only one population dose--the population dose based on the assumption that no further remedial action occurs.

The discussion of the benefit of remedial action has thus far focused on the dose saved. However, for ALARA analysis, the value of dose saved and the cost of remedial action must be expressed in the same units (monetary units). NRC has provided guidance for estimating the monetary value of population dose saved (USNRC, 1995a and USNRC, 1995b). These documents establish the value of a person-rem for purposes of ALARA analysis at \$2,000, and provide guidance for accommodating the differences in the time distributions of benefits realized from dose savings and costs incurred in remedial action.

In the context of this analysis, in which the value of dose saving is realized at a relatively low rate over a large portion of the time period of interest and the costs of remedial action are incurred entirely at the beginning of the time period, NRC guidance recommends consideration of the use of the present value of dose savings in the ALARA balance against remedial action costs. For periods of interest less than about 100 years, NRC recommends use of a 7% per year discount rate in valuing future dose savings. For longer periods, NRC recommends two approaches: (1) calculation of the value of dose savings on a present worth basis using a discount rate of 3% per year, and (2) displaying benefits and costs at the time they occur, with no present value conversion. For a time period of 1,000 years and a constant annual dose, the first approach is equivalent to using an undiscounted value of a person-rem of approximately \$70. For the conservative assumption, noted above, of a constant annual dose with time, the realization of the value of dose savings can be considered to occur at a rate constant with time.

The above discussion leads to a simple algorithm for deriving a conservatively high estimate of the value of dose savings from reducing the concentration of radionuclides in slag to levels below the equivalent of 25 millirem per year. The value estimate is the product of the area of the zone containing radioactive material, the population density (4 persons per acre), the maximum annual dose without further remedial action (i.e., 25 mrem/y, the limit for unrestricted release), the time period of interest (1,000 years), the monetary value of a person-rem (\$2,000 if discounting is ignored, or \$70 if the effect of a 3% per year discount rate is to be included), and factors to provide consistency in units.

The algorithm is simplified further by dropping the area of the zone containing radioactive material from the algorithm above so that the value of dose savings is calculated on a unit area basis. This is done only for convenience of calculation and expression. The maximum calculated annual dose used in this simplified algorithm must

still be derived by assuming a realistic or conservatively high estimate of the area of the zone containing radioactive material, as has been done in the Radiological Assessment. In addition, remediation, if warranted, must be conducted throughout the entire zone containing radioactive material.

Cost of Remedial Action

The residual radionuclides at the Revere Site are almost entirely contained within discrete pieces of slag greater than 1-inch in diameter. This slag constitutes at most about 5% of the material within which it is mixed. The remaining material is almost entirely other slag not containing elevated levels of radionuclides or various kinds of rubble and debris. The material is located in four areas:

Zone	Area m ²	Depth m	Volume m ³
Parking	3.3E+03	1.8E+00	4.4E+03
Container Storage	1.8E+03	1.2E+00	1.7E+03
Building 4 & 5	1.5E+03	6.1E-01	6.7E+02
Old Pit	5.1E+03	2.7E+00	1.0E+04

The total volume is approximately 17,000 cubic meters. The only practical remedial action for the Revere slag would be a sift-and-sort approach that would separate the slag containing elevated radionuclide concentrations for shipment to a licensed disposal facility. The remaining materials would remain onsite.

In this process, the material located in the four areas would be excavated and brought to an established processing area on the Revere site. The excavated material would consist of slag, building rubble, and some soil. The material would be sifted in the process area with a 6-inch sifter. All material not sifted through the 6-inch sifter would be directed to a conveyor belt where materials not containing elevated levels of radioactive material would be removed. Remaining materials would be crushed for packing efficiency and shipped to a licensed disposal facility. Materials that pass through the 6-inch sifter would be passed through a 1-inch sifter. Because Site characterization demonstrated that elevated levels of radioactive material are contained within the slag, it may be assumed that materials that pass through the 1-inch sifter qualify for remaining onsite. Material not passing through the 1-inch sifter would be loaded into 55-gallon drums and monitored with a radiation monitor. The contents of drums containing materials over the maximum permissible concentrations for remaining onsite would be crushed and shipped to a licensed disposal facility. The contents of drums containing materials below the maximum permissible concentrations for remaining onsite would be retained onsite.

The estimated costs of the remediation described above are provided in the table below:

Task	Cost, 1996\$
Project Planning/Document Preparation	24,100
Mobilization/Demobilization	484,700
Site Activities	3,637,900
Restoration	32,800
Waste Disposal	4,645,500
Total	8,825,000

The cost of soil remediation by this method can be assumed to be proportional to volume and average about \$520 per cubic meter—the total cost of \$8.8 million divided by the total volume of 17,000 cubic meters. Over half of this cost is the fee for disposal.

The value of dose savings is expressed in terms of savings per unit area. To develop an estimate of remedial action cost comparable to the estimate of the value of dose savings per unit area, derived as described above, the volumetric cost (cost per cubic meter of volume remediated) must be converted to an areal cost (cost per square meter of surface remediated). This is done by assuming a minimum practical remediation depth for remedial action. For remediation of the Revere Site the minimum excavation depth would be approximately 0.6 meter as indicated for the Building 4 & 5 area in the table above. The maximum depth would be about 3 times higher. Thus, the remedial action cost per unit area can be calculated using the volumetric unit cost of \$520 per cubic meter and a minimum depth of 0.6 meter.

ALARA Analysis and Conclusions

ALARA analyses performed as described above can be summarized in the equations below:

$$B = PD \times D \times T \times V / (4047 \times 1000) \quad \text{Equation 1}$$

where

B is the benefit of dose saved in terms of dollars per square meter remediated,

PD is the population density, 4 persons per acre,

D is the constant annual dose, 25 mrem/y (TEDE) per person,

T is the aggregation time, 1,000 years,

V is the value of 1 person-rem dose savings, as described below,

4047 is the number of square meters per acre, and

1000 is the number of mrem per rem.

$$C = TH \times UC$$

Equation 2

where

C is the remedial action cost in terms of dollars per square meter remediated,
 TH is the thickness of the zone to be remediated, m, and
 UC is the remedial action cost per unit volume, dollars per cubic meter.

Because the value of potential dose savings would be realized only over a very long period of time, the value has been calculated in two ways. The first approach calculates the benefit based on a value of V of \$2,000 per person-rem saved, discounted at a rate of 3% per year. This is one approach recommended by NRC, as discussed above. (This is effectively equivalent to use of an undiscounted value of \$70 per person-rem for a constant dose rate and an aggregation period of 1,000 years.) The discounted value of the dose savings derived using Equation 1 above is \$2 per square meter remediated.

The second approach considers the value of dose savings of \$2,000 per person-rem undiscounted. This constitutes an extremely conservative case that departs markedly from NRC guidance described above. This approach was used to derive a simplified conservative estimate of the value of the dose savings and the costs of remedial action at the time they occur, with no present value conversion. As noted above, this approach is the second of two approaches recommended in NRC guidance for evaluation of situations with long periods of interest. By ignoring discounting, this approach effectively treats the value of dose savings as though it would be realized immediately. This treatment effectively increases the value of dose savings to \$49 per square meter remediated. The undiscounted value of the dose savings, \$49 per square meter remediated, would be realized at a uniform rate of \$0.05 per square meter remediated in each year of the 1,000-year period of interest.

The cost of remediation derived from the equations above is \$312 per square meter remediated. The cost of remedial action would be incurred in one lump at the time of decommissioning.

This analysis shows that the cost of remediation would be approximately 6 to 150 times greater than the value of the dose savings, even though the simplifications in the analysis skew the results substantially to inflate the value of dose savings. By this analysis, remediation of slag at the 25 mrem/y level would clearly be unwarranted by the ALARA principle. The calculated doses for the Revere site are below 2.5 millirem/y. Therefore, a more detailed ALARA analysis would increase the ratio by a factor of 10.

7.0 RADIOLOGICAL ASSESSMENT CONCLUSIONS

Detailed results of the radiological assessment are provided and discussed in Section 5.0.

In summary, results from the base case and sensitivity analyses show that the maximum radiation dose (TEDE) that might be expected from unrestricted use of the Site is far below the 10 CFR Part 20 limit of 25 millirem per year (TEDE) for release with unrestricted use. Specifically, the maximum base case doses (TEDE) calculated are 0.29 mrem/y for the resident base case and 0.015 mrem/y for the worker. The higher of these calculated doses is only slightly more than 1% of the limit of 25 millirem per year (TEDE) for release with unrestricted use.

The sensitivity cases analyzed are not considered likely exposure scenarios for the site. But the maximum calculated doses for these scenarios are also substantially less than the 10 CFR Part 20 limit of 25 millirem per year (TEDE) for release with unrestricted use. The maximum doses (TEDE) calculated for the resident and resident-gardener sensitivity scenarios were practically identical, 1.7 mrem/y. The maximum dose (TEDE) calculated for the resident basement sensitivity scenario was 0.20 mrem/y. The maximum dose calculated for a sensitivity case is more than a factor of 10 below the limit.

The ALARA analysis shows that no remedial action is warranted by the ALARA principle to reduce doses further. Because the maximum calculated annual doses (TEDE) are below the limit for release with unrestricted use, and the ALARA analysis shows that no remedial action is warranted, the Site qualifies for license termination with no restrictions on use.

8.0 REFERENCES

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APPENDIX A

SOURCE TERM DETERMINATION

A mass balance approach was used to calculate the source term at the Revere site. The reported total quantity of ore processed was confirmed through review of detailed available production records. Those records also provided an estimate of the total quantity of slag produced. The average concentration of thorium and uranium reported in ore and slag were estimated from available records and previous reports. The total inventory of thorium and uranium was calculated as the product of the quantity of ore times the average concentration. The records of the quantity of slag and soil/debris removed during decommissioning activities were used to estimate the remaining quantity of slag and inventory of thorium and uranium. The concentration of thorium and uranium used in the dose assessment was calculated as the inventory distributed within the quantity of material reported in the disposal areas. As discussed below, the values used were intentionally selected such that the final number used is likely to conservatively overestimate the inventory of thorium and uranium used in the dose assessment.

A.1 Quantity of Ore Used

Previous Reports

Several references reported the total quantity of radiological ore received was 50,000 lb. 1992 NRC Inspection Report (contained in this Appendix as Attachment A.1) and by Applied Health Physics, Inc. (AHPI), (Attachment A.2). One reference stated that "some 60,000 pounds of QIT ore was processed" (AHPI, 1972). License SMB-920 allowed for a total of 100,000 pounds of pyrochlore or columbite ore.

Production Records

Several sources of information were obtained that provided information on the quantity of ore processed. The site assigns lot numbers to each heat of a particular process. The radiological ore was used to produce "ferro-columbium-tantalum" alloy. Daily records of all "heats" or "melts" processed were maintained since 1976. Those records indicate that the final ten heats (Lot 252-261) of "FERRO-TA" alloy were processed on October 13 and 14, 1976 (Attachment A.3). The quality assurance (QA) department performed laboratory analyses of alloys. Records for all lots, except number 6, were available from number 1 on February 14, 1972 through number 261 on October 14 (Attachment A.4). Based on both sets of records, the total number of production lots was 261.

A test of the thermite process was performed in 1970 using pyrochlore ore in five melts. Applied Health Physics, Inc. (AHPI) performed radiological monitoring and thorium recovery calculations of the test (Attachment A.2). Based on that report 3,500 pounds of ore were mixed with the thermite mixture to produce 2,500 pounds of alloy and 2,135 pounds of slag. Although it is possible that the five test melts were the same as the first five melts analyzed by the QA laboratory, it has been assumed for this analysis that they

were separate and in addition to the production quantity. Those test melts used a higher percentage of ore and lower percentage of other ingredients than the later production melts. This resulted in a smaller volume of slag than ore and activity in the slag that was approximately 1.6 times higher than in the original ore.

Three records were located that showed a total of 33.35 pounds of ore were removed from inventory for laboratory testing and analysis. No other records of pyrochlore or columbite ore processing were found. These records are summarized in Table A.1.

The quality assurance laboratory also maintained records of the ingredients used for lots number 14 through number 123 (Attachment A.4). The average quantity of ore used for those lots was 166 pounds per heat. Based on the 261 production lots at 166 pounds of ore each, the test melt, and the laboratory analyses, a total of 46,924 pounds of ore were processed (see Table A.1). The close agreement between the approximate quantity of ore stated in the various reports and the production records is a strong indication that those records provide a good representative estimate of the total quantity of ore processed. For this source-term determination, a quantity of 50,000 pounds was used.

A.2 Quantity of Slag

The average quantity of alloy produced and ingredients used for lots 22 through 123 were used to estimate the total quantity of slag produced (Table A.1). As shown in Table A.1, approximately $\frac{1}{2}$ of each melt ended up as product and the remaining $\frac{1}{2}$ would be left as slag. This is consistent with statements made by current Revere personnel (Attachment A.5). The estimated quantity of slag produced was 125,000 pounds. This number is not critical to the dose assessment because the radionuclide inventory, based on the quantity of ore processed, was used to calculate the activity in the waste (Section A.3 through A.5 below).

A.3 Radionuclide Inventory in Ore

The radiological inventory of thorium and uranium was based on the total quantity of ore processed and the average activity in the ore. Analyses of thorium and uranium concentrations in the ore were limited. To evaluate the radionuclide concentrations in the ore, available analyses or references to concentrations in ore, slag, recovered slag samples, biased slag/waste samples, unbiased slag/waste samples, and background were tabulated (Table A.2).

All of the values listed as ore were from various reports by Applied Health Physics, Inc. Most of those values were statements in the text of the reports and did not reference specific analytical results. Where a range of activities was reported the average was used (one value for each endpoint of the range). The average reported activities for those ore samples were 286-pCi/g thorium and 475-pCi/g uranium.

The values reported for slag samples (samples collected directly from the process waste) and recovered slag/biased waste samples (samples collected from the waste piles during characterization or decommissioning activities) all appear to represent actual analytical tests. The average reported activity was 309-pCi/g thorium and 726-pCi/g uranium for slag samples and 284-pCi/g thorium and 243-pCi/g uranium for recovered slag samples. Five of the nine thorium results for slag were from the 1970 test melts. Because these melts concentrated the radionuclides from the ore into the slag by factor of approximately 1.6, the reported average thorium activity for the slag samples likely overestimated the true activity in the slag.

Table A.2 also summarizes the average reported activities for samples referred to as mixed slag and soil, unbiased waste samples, and the background samples. As shown, the mixed slag and soil sample averages were essentially indistinguishable from the unbiased waste samples and both were only slightly higher than background.

To ensure that the activity used for the dose assessment did not underestimate the potential dose, the highest average activities for thorium and uranium from the slag samples was used to represent the activity in the original ore. Therefore, the concentration of 309-pCi/g thorium and 726-pCi/g uranium in 50,000 pounds of ore was used. This represents a total initial radionuclide inventory of **0.007 Ci thorium** and **0.016 Ci uranium**.

A.4 Radionuclide Inventory Removed During Previous Decommissioning Activities

Three distinct decommissioning efforts were conducted by Cabot in 1990, 1992, and 1993 and are documented. A review of billing records (Attachment A.6) submitted by the contractor indicated that in 1990 a total of 26 tons and 4 drums of recovered slag was removed from the site. Therefore, at least 52,000 pounds of material was removed in 1990. Remediation activities were also conducted in 1992. Internal memos (Attachment A.7) indicated that a total of 45,000 to 51,000 pounds of slag were removed during that effort. A report by the remediation contractor (Attachment A.8) indicated that from August 30, 1993 through October 31, 1993 a total of 47 drums of slag, at 700 pounds per drum, (32,900 pounds) were removed from the site. Therefore, the total documented slag removed during those three efforts was approximately 130,000 pounds.

The material removed was selected on the basis of hand instrument measurements. To be distinguishable from background, the concentrations would need to be at approximately twice the background level or higher. The 1993 report stated that all material with a reading above 20 uR was removed. The reported background was 12 uR to 13 uR. The average activity of the material likely that was much higher than twice background. However, it has been assumed for this assessment that the average activity of the removed material was twice the average reported activity for unbiased waste samples of 4.0-pCi/g thorium and 2.2-pCi/g uranium (Table A.2).

Therefore, the total estimated radionuclide inventory removed during the 1990, 1992, and 1993 efforts was 0.00047 Ci thorium and 0.00026 Ci uranium with a maximum of **0.0065 Ci thorium and 0.016 Ci uranium** remaining on site.

A.5 Radionuclide Inventory in Waste

Based on the area and depth of each of the four affected areas reported in the NES Risk Assessment (NES, 1996), the total volume of the waste was approximately 820,000 cubic feet. At a density of 2.0 g/cm³ this represents a total of 4.64 E10 g of waste. The average concentration of the radionuclide inventory distributed throughout the waste is, therefore, **0.14 pCi/g thorium and 0.34-pCi/g uranium.**

A.6 Distribution of Radiological Slag

The dose assessment used the total radionuclide inventory distributed evenly throughout the waste. This assumption is justified because it is supported by the available information and potential exposed pathways would average the concentration over large areas relative to the size of the waste areas.

Additional Disposal Areas

Comprehensive surveys of the all the potential handling or waste disposal areas of the site where conducted in 1993 (Enserch, 1994). Numerous characterization efforts and NRC inspections of the site have not identified additional areas of elevated activity. Because the slag is easily recognizable from the natural soils and it does not support active plant growth, it is very unlikely that any additional slag disposal areas have been overlooked.

The loading dock/warehouse area has been identified as a potential affected area in the past but is now considered an unaffected area. The 1992 NRC Inspection Report (Attachment A.1) stated that direct measurements in that area were not above background. The potential that the loading dock/warehouse area was still affected was evaluated for this dose assessment. During the ORISE confirmatory survey (ORISE, 1993) two small samples of radiological slag were identified in the loading dock/warehouse area. Removal and testing of those two pieces essentially decommissioned this area. The Enserch characterization performed in November and December 1993, subsequent to the ORISE survey, demonstrated that the instrument readings and samples collected were all below the guidelines for affected areas. The NES Radiological Subsurface Sampling Report (NES, 1994) noted that no slag samples were found but direct readings in the loading dock/warehouse area were two to three times background. The subsequent NES Decommissioning Plan (NES, 1996) stated that the elevated readings in the loading dock/warehouse area were due to potassium-40 activity only with no natural uranium or thorium above background.

An historic aerial photograph of the warehouse area from April 1970 (Attachment A.9) was evaluated. That photograph shows that the loading dock and the original warehouse

("bubble building") were in place prior to the initial radiological slag experiments. Interviews with employees at the time (Attachment A.5) and their statements (Attachment A.10) confirm this information. The small isolated pieces of radiological material identified at the surface during the 1993 ORISE survey likely resulted from the shipping of slag during the previous decommissioning activities. The loading dock has been paved and the approach to the loading dock has not been changed during the period when slag was handled at the site. The only known excavation in the loading dock area were two exploratory trenches during the NES subsurface characterization effort (NES, 1994). No radiological slag was identified in those excavations. Because the area has not been disturbed any slag in this area would still be at or near the surface and easily detected. Therefore, the existence of any significant quantity of radiological slag in the warehouse loading dock area is highly unlikely. Because the source term is based on the total inventory of radionuclides, the existence of slag in the warehouse/loading dock, or any other area on the site, would result in lower average concentrations and a lower calculated dose.

The four discrete waste areas are physically separated such that there is little or no additive dose to a potentially exposed individual. The vicinity of each of the four areas has been thoroughly surveyed and any additional waste area would be separated from the four considered. If there were more than the four waste areas, then the quantity of soil/debris would be increased, the radionuclide inventory would be more dispersed at a lower average activity, and the calculated dose for each area would be lower. It is possible that small discrete pieces of slag may exist outside the four areas being considered. However, the mass balance method used to determine the source term provides an upper bound to the potential dose independent of additional locations of slag.

Distribution in Disposal Areas

The distribution of radiological slag within each disposal area and between the four disposal areas was evaluated. Key personnel at the facility were employed from the initiation of work with the radiological material through the decommissioning activities. They were aware of all of the slag disposal areas. Elevated readings and radiological slag have been unambiguously identified in each of the four areas. Therefore, it is certain that slag was deposited in each of the areas.

Several decommissioning efforts in the four areas all relied on direct readings to identify material for removal. The use of a common procedure with similar minimum detection levels in each area would have resulted in similar concentrations remaining in each area.

There were several decommissioning efforts at the site. The procedure used involved spreading the material containing slag into thin layers, surveying and removing material based on elevated direct readings, stockpiling the "clean material", and surveying the clean stockpile. Representative descriptions of these procedures are described for the former drum storage area (Attachment A.8) and for the old pit area (Attachment A.1).

These procedures would have homogenized the waste material. Therefore, the distribution of slag within each waste area is likely to be fairly uniform.

A.7 References

AHPI, 1972. Applied health Physics, Inc., Annual Radiological Safety Audit of KBI Facilities, November 13, 1972.

TABLE A.1
SUMMARY OF ORE INVENTORY RECORDS
Revere, PA Site

DATE FIRED	DATE OF QA LABORATORY ANALYSIS	LOT NUMBERS	NUMBER OF HEATS	POUNDS OF ORE PER HEAT	TOTAL ORE	TOTAL POUNDS PER HEAT	ALLOY PER HEAT	POUNDS OF SLAG PER HEAT
7/2/70	1971	TEST LABORATORY	5 4 Samples	700	3500 33.35	1000	500	427
	2/14/72	1	1					
	2/21/72	2, 3	2					
	3/20/72	4, 5	2					
		6	1					
	4/3/72	7C	1					
	4/11/72	8, 9	2					
	5/4/72	10	1					
	8/11/72	11C	1					
	4/29/74	12	1					
	5/14/74	13	1					
	5/27/05	14-21	8	158	1264	888		
7/1/74	9/6/74	22-32	11	192	2112	654		
9/20/74	9/25/74	33-43	11	175	1925	978		
10/4/74	10/15/74	44-64	21	188	3948	978	595	383
11/19/74	11/22/74	65-72	8	188	1504	1048		
12/18/74	12/26/74	73-94	22	196	4312	1009	454	555
1/23/75	2/17/75	95-116	22	122	2684	1079		
1/28/75	2/17/75	117-123	7	111	777	987		
	2/17/75	124-138	15					
	3/24/75	139-158	20					
	3/24/75	159-178	20					
	11/17/75	179-199	21				476	
	2/5/76	200-220	21					
	4/15/76	221-239	19					
	6/10/76	240-251	12					
	10/14/76	252-261	10				409	
TOTAL LOTS			261					
AVERAGE LOTS 1 THROUGH 261				166		953	484	469
TOTAL LOTS 1 THROUGH 261 = AVERAGE * 261				43,391		248,635	126,194	122,409
TEST AND LABORATORY SAMPLES				3,533		1,000	2,000	2,135
TOTALS				46,924		249,635	128,194	124,544

TABLE A.2
SUMMARY OF THORIUM AND URANIUM ANALYSES
Revere, PA Site

Th - Ore	U - Ore	Th - Slag	U - Slag	Th - Recovered Slag/Biased Waste Sample	U - Recovered Slag/Biased Waste Sample	Th - Slag & Soil/Waste Samples	U - Slag & Soil/Waste Samples	Th - Unbiased Waste Samples	U - Unbiased Waste Samples	Th - Back- ground	U - Back- ground	Date	Source
264	271												HP Rpt
176		286											
		338											
		282											
		198											
		290											
242													
352													
308	678												
		308	678										2/21/71 Cabot Analyses
		308	678										
		328	641										3/20/72 Cabot Analyses
		445	908										
176	271												HP 11/13/72 Audit
638	881												
132	271												
		29.5	242	2.61	18.44	1.86	2.82						Aug-94 NES Subsurf. Invst
				3.06	18.66	1.94	3.66						
				3.41	0	0	0						
						1.5	2.24						
						2.66	0						
		1.48	2.06	1.48	0.64	2.45	0						
				1.95	2.24	0.98	1.22						
				1.95	1.66	2.25	0						
						2.83	0						
						1.88	0						
				2.85	3	1.66	0						
				2.07	0	1	0.8						
				2.38	1.88	0.36	0						
						3.23	1.88						
						2.25	0						
						3.4	2.12						
		28.4	294	2.36	1.76	2.32	0						
				2.6	1.34	2.44	0						
				2.05	1.28	1.89	0						
				2.7	0	1.7	1.84						
				2.2	0	1.43	0						
						0.88	1						
						2.16	0						

Revere, PA Site

[illegible]

TABLE A.2
SUMMARY OF THORIUM AND URANIUM ANALYSES
Revere, PA Site

Th - Ore	U - Ore	Th - Slag	U - Slag	Th - Recovered Slag/Biased Waste Sample	U - Recovered Slag/Biased Waste Sample	Th - Slag & Soil/Waste Samples	U - Slag & Soil/Waste Samples	Th - Unbiased Waste Samples	U - Unbiased Waste Samples	Th - Back- ground	U - Back- ground	Date	Source
						2.9	1.6	0.3	2.5	1.7	1.2	Apr-93	ORISE
						3.9	2.4	3.9	2.5	3.1	1.3		
						3.9	2.8	4.7	2.6	1.9	1.6		
								4.2	2.6	5	2.2		
								1.1	0	4.2	1.6		
								3.7	1.6	3.8	1.6		
								0	2.4	2.1	1.8		
								4.5	2.7	0	2.3		
						2.9	1.1						
						1.9	2.5						
						4.6	1.5						
						4.1	1.4	5.4	2.5				
						8.2	5.3	5	2.7				
								0	3				
								6.5	2.9				
								0	0.8				
								3.8	2.8				
								2.3	1.3				
								3.2	2.3				
								3.2	2.3				
								1.9	1.3				
								4.1	2.7				
								4.2	2.9				
								3.8	1.5				
								5.7	2.3				
								0	2.8				

TABLE A.2
SUMMARY OF THORIUM AND URANIUM ANALYSES
Revere, PA Site

Th - Ore	U - Ore	Th - Slag	U - Slag	Th - Recovered Slag/Biased Waste Sample	U - Recovered Slag/Biased Waste Sample	Th - Slag & Soil/Waste Samples	U - Slag & Soil/Waste Samples	Th - Unbiased Waste Samples	U - Unbiased Waste Samples	Th - Back- ground	U - Back- ground	Date	Source
								4.3	2.5				
								2.5	2.3				
								13	15				
								2.2	2.4				
								5.3	1.7				
								2.6	1.6				
								2.9	2.9				
								3.9	4.7				
								2.5	2.6				
								2.1	2.6				
								4.7	3.2				
								4.3	3.2				
								3.3	2.9				
								5.5	2.6				
								3.8	2.6				
								3.9	3.3				
								4.4	3.2				
								6.1	2.4				
								3.7	2.9				
								0	2.7				
				21	15								
				20	3.5			4.7	2.4				
				160	2200								
				4.5	2.6								
286	475	309	726	284	243	3.06	3.30	4.00	2.19	2.73	1.70		AVERAGES
289	325	Ore, Pure Slag, and Biased Samples Collected				3.89	2.32	Soil & Slag and Unbiased					

Attachment A.1

NRC Inspection Report Containing Description of Remediation Procedure in the Old Pit Area



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

NOV 17 1992

PC: M. H. Hagan

IRC
KRR
MCN

Docket No. 040-06940

License No. SMB-920

Cabot Corporation
ATTN: Mr. Fred White
Plant Manager
County Line Road
Boyertown, Pennsylvania 19512

To ATC
WCG from MHH
RSB

Dear Mr. White:

Subject: Routine Inspection No. 040-06940/92-001

It is not clear whether you were
combed.

M

On September 22, 1992, James M. Bondick of this office conducted a routine safety inspection at Revere, Pennsylvania of activities authorized by the above listed NRC license. The inspection was limited to site familiarization, spot check surveys, personnel interviews, and inspection of work in progress. The findings of the inspection were discussed with Bill Gannon, Fred White, and Chuck McGee (consultant to licensee), at the conclusion of the inspection. A copy of the inspection report is enclosed.

Within the scope of this inspection, no violations were identified.

In accordance with Section 2.790 of the NRC's "Rules of Practice", Part 2, Title 10, Code of Federal Regulations, a copy of this letter will be placed in the Public Document Room. No reply to this letter is required.

Your cooperation with us is appreciated.

Sincerely,

John D. Kinneman
for John D. Kinneman, Chief
Research Development &
Decommissioning Section
Division of Radiation Safety
and Safeguards

Enclosure:

NRC Region I Inspection Report No. 040-06940/92-001

M. H. H.

19 NOV 1992

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 40-06940/92-001

Docket No. 40-06940

License No. SMB-920 Priority 3 Category E Program Code 11700

Licensee: Cabot Corporation
County Line Road
Boyertown, Pennsylvania 19512

Facility Name: Cabot Corporation
County Line Road
Boyertown, Pennsylvania 19512

Inspection At: Revere, Pennsylvania

Inspection Conducted: September 22, 1992

Inspector: *Elizabeth S. Williams*
for James M. Bondick
Health Physicist

11/17/92
Date

Approved by: *Elizabeth S. Williams*
for John D. Kinneman
Research, Development &
Decommissioning Section

11/17/92
Date

Inspection Summary: Routine, announced Safety Inspection conducted September 22, 1992.

Areas Inspected: Organization and scope of licensed activities; radiation protection procedures; receipt and transfer of material; personnel protection - external; personnel protection - internal; effluent control; and site resolution.

Radiological surveys were performed by Bullinger's Mills, Inc. in February 1990 at the Revere Plant Site, and reported detecting elevated direct radiation levels at the Old Pit, the Drum Storage area, and the Buildings 4 and 5 Storage Area, and the area north of the Warehouse. In August 1990, Bullinger's Mills, Inc. began decontamination operations in these areas, which involved the excavation and removal of slag at the Old Pit, the Drum Storage Area, and the Buildings 4 and 5 Storage area. The remediation and final survey were completed in October 1990. The final survey report indicates that the direct radiation levels were below the NRC guideline values and the addendum to the final report indicates that soil concentrations were also below the Guideline values.

The NRC's Headquarters Office of the Division of Industrial and Medical Nuclear Safety, the Environmental Survey and Site Assessment Program (ESSAP) of Oak Ridge Associated Universities (ORAU) conducted a radiological survey of portions of the Cabot Corporation Revere Plant Site. The survey was performed to provide supporting information to confirm the radiological status of the designated areas relative to the applicable NRC guidelines for release of the site for unrestricted use.

The ORAU report is currently being reviewed by the NRC, and has prompted additional areas to be investigated and is the impetus for the current inspection.

No violations were identified.

3. Radiation Protection Procedures

- a. At the current low levels of contamination found at the Revere site, the licensee relies on instrumentation to detect slag and debris that contains residual contaminants. The levels of exposure are practically indiscernible from background. The RSO is responsible for overseeing radiation safety at the three licensee locations. At the Revere Site, the remaining radioactive material had been found in the Old Pit area, and at the Drum storage area, and at the Building 4 and 5 Storage area, and outside the loading dock area at the Warehouse.

The inspector toured the Old Pit Area, the Crushing Area, the Current Operating Facility, the Drum Storage Area, the outside area of the Warehouse, where ground contamination had been found, and the exterior of Buildings 4 and 5 Storage area where ground contamination had been previously found. The inspector observed and

interviewed personnel working in the above listed facilities, and made independent measurements of radiation levels and contamination levels. No instances of poor radiation practices, contamination, and high radiation levels were observed.

b. OLD PIT AREA

The licensee is actively pursuing cleanup in the Old Pit area on the southwest corner of the Revere site. The main work area is approximately 45 feet in diameter, nearly circular. The inspector verified that the ambient background is approximately 10 micro R per hour. The licensee uses the criteria that a piece greater than 20 micro R per hour is separated from the debris and put into drum which are transported to the mausoleums. The licensee is reassessing material dug from the east and west sides of the raised circular area.

The Old Pit area is the only area where active reclamation work was in progress. In this work area, the licensee has provided workers with two micro R meters to survey the for radioactive materials. The inspector noted that the instruments they observed had current calibration stickers. The licensee personnel performed comparative instrument readings to ascertain consistent background readings of the instrumentation since the working levels were in the 10 to 20 micro R level. Individuals using the instrument were familiar with the use of the instrument in the work area.

The west side of the Old Pit (west slope area) contains large aggregates of slag and building materials. To sort the large aggregates and building rubble, the workers survey the rubble, then use earth moving equipment to lift portions of the rubble to the level, circular area, where each portion is spread out, resurveyed, and hand sorted. Work gloves are used to protect the hands of individuals that do the hand sorting. When sorting materials from the rubble, a garden hose is used as a temporary marker. The inspector verified that there was a demarcation in micro R readings between sorted and unsorted material in the rubble area.

The east side of the Old Pit (eastern slope area) consists of material mixed with friable soil. To separate aggregates from friable soil, hand sorting with a large grid sifting screen is used to remove "contaminated" pieces of material identified from the

slag and building rubble from the eastern slope of the raised area.

The sorted debris is placed into 55 gallons drums, and moved away from the immediate work area. Then drums were at the edge of the work area. Each drum was reported to contain 700 lbs. of slag and/or debris. The weight of the drums varied, however, since a few drums which could be moved easily may not contain 700 lbs. of material. The inspector verified that the reading on these staged drums was from 50 to 80 micro R per hour. One individual stated that the highest reading found on an individual piece was 65 to 70 micro R per hour. The licensee has not documented the weight of the material removed from the Old Pit thus far, however, but will determine approximate weights of drums shipped in the future. The drums of sorted material are shipped to the Boyertown site mausoleums for storage.

c. CRUSHING AREA

In this area, the licensee uses a mechanical crushing device housed in a vertical structure. Numerous drums are stored on the surface of the ground to the southwest of the crushing operations building. A representative of the licensee stated that no radioactive materials were stored in the area. An independent measurement by the inspector verified that none of the drums that could be reached at arms length read greater than background of approximately 10 to 12 micro R per hour. Several drums were open and filled with water above a gray sediment. None of the open drums measured greater than 10 to 12 micro R per hour.

d. CURRENT OPERATING FACILITY

The current operating facility is located to the southeast of the fire water pond. The product from this facility is stored under a roofed area, open on all sides, and is only about 30 feet from the production building. The licensee stated that no radioactive materials were currently used in production runs. The inspector verified that no readings on the materials stored under the open roofed area were greater than 7 to 12 micro R per hour.

e. DRUM STORAGE AREA

This area is being used as a liquid storage area. The inspector scanned the drum storage area for evidence of contamination, and no remarkable areas above background were found. The area where the two previous trenches were dug was found to read 15 micro R per hour above the trench to the west of the gate opening, and 12 to 13 micro R per hour above the trench area to the east of the gate opening, where some drums and metal duct work and a large glass tube is stored. No remarkable readings above background were found. Beyond the southwest end of the drum storage area, some fragments of slag were noted on the surface of the ground, however, no increased reading were determined by the inspector. The licensee intends to reassess the drum storage area, and may perform additional studies in order to determine if additional decontamination work needs to be done. The licensee consistently remarked that they still did not know the results of the ORAU radiological survey.

f. WAREHOUSE

The interior of the warehouse was not surveyed. NOTE: the licensee remarked that the plot plan identified from "Figure 2: Revere Plant - Plot Plan from ORAU Draft Report January 1992 for Confirmatory Radiological Survey for Portions of the Cabot Corporation Revere Plant" was incorrect. The licensee remarked that the warehouse was the building to the west of the administration building, where two soil samples with elevated radioactivity were found and removed. The inspector verified that no residual radiation levels were found above a background reading of 10 to 12 micro R per hour.

g. BUILDINGS 4 AND 5, STORAGE AREA

This area to the northwest of Building 4 and 5 was surveyed by the inspector, and found to have average readings of 10 to 12 micro R per hour. The licensee intends to petition the NRC to partially release this portion of the site.

No violations were identified.

4. Receipt and Transfer of Material

According to statements made by a representative of the licensee, there is currently no radioactive material incoming

to the Revere Site. The licensee intends to purchase a radiation detection instrument to avert the possibility of receiving any radioactive material. Current process operations do not use any radioactive starting materials. The inspector surveyed a dispensing of a batch of blended material, and determined that the reading was not greater than background of 10 to 12 micro R per hour.

No violations were identified.

5. Personnel Protection - External

Film badges are not required in any areas visited. The inspector verified that the average and maximum levels of external exposure encountered were 10 to 12 micro R per hour and 80 micro R per hour in proximity to ten drums of accumulated slag stored out of the way of the general working area. One individual stated that the highest contact reading found on an individual piece of slag was 65 to 70 micro R per hour.

No violations were identified.

6. Personnel Protection - Internal

The licensee does not conduct a bioassay program for internal dosimetry associated with the site reclamation. Some of the soil appeared to be dry and friable, and might become airborne and inhaled, especially during sifting operations. While it does not appear that there is sufficient opportunity for exposure to airborne radioactivity, the inspector suggested that some type of airborne sampling program should be instituted to prove that no internal deposition is occurring. Ambient air, or breathing zone air sampling might be considered. Since no samples had been taken, the inspector inquired whether any nasal samples had been taken to ascertain whether any materials had been inhaled. A representative of the licensee responded that none were performed, but agreed to consider performing air sampling. *We did!*

No violations were identified.

7. Effluent Control

Liquid effluent from the current Operating Facility, which uses no radioactive material, is released to Rapp Creek which is some distance from the nearest drinking water supply source, according to the licensee. The licensee stated that they had just sampled the Rapp Creek water as part of their environmental sampling program, however, to ensure that no

run-off of radioactive materials are being released from the reclamation activities at the Old Pit area. The licensee agreed to the suggestion to sample and analyze the water from Rapp creek during the re-excavation process.

8. Site Resolution

we did!

When the Old Pit area is completely reclaimed, and approved by the NRC, the licensee intends to fill the area with clean fill, and replant the area with grass, and allow natural reforestation to occur. The licensee has no plans to rebuild any facility in the area.

The licensee intends to purchase a radiation detection instrument and periodically check shipments of raw materials to avoid accepting any radioactive materials which could be incorporated into future products.

9. Exit Interview

The inspector conducted a brief exit meeting with individuals identified in Paragraph 1 to discuss the results of this inspection.

Attachment A.2
Report on 1970 Initial Test

HEALTH PHYSICS REPORT

of

RADIOLOGICAL SAFETY STUDY OF THE EXPERIMENTAL PROCESSING of COLUMBIUM-TANTALUM ORE

at the
Revere Plant
Kawecki Lerylco Industries, Inc.
Revere, Pa.

July 2 and 29, 1970

SUMMARY

This report briefly describes the experimental processing of columbium-tantalum ore by alumina thermic reduction. The thermite reaction is completed in less than 5 minutes, reducing approximately 3500 pounds of ore containing 0.12% natural thorium plus 0.04% natural uranium to columbium-tantalum alloy which contains less than 0.01% of these materials and a slag containing 0.14% source materials. The slag has been stored pending decision as to appropriate disposal methods. Samples of air particulate and settled dust indicated the air concentrations were well below 1/10 of the MPC's. Our study of the experimental processing did not detect any significant risk to personnel or the environs. The processing methods and safety practices are essentially the same as those currently used by Union Carbide Corp. at their plant in Marietta, Ohio under AEC license SMB-933.

INTRODUCTION

The initial experimental processing of columbium-tantalum ore containing traces of source materials at KBI's plant in Revere, Pa. was carried out on July 2, 1970. This work was performed as a pilot plant study in accordance with the terms and conditions of AEC Source Materials License #SMB-920 (Docket #40-6940) as amended on May 28, 1970. This report has been prepared for submission to the AEC per commitments to AEC dated December 19, 1969 and May 7, 1970.

DESCRIPTION OF PROCESS

Approximately 50,000 pounds of columbium-tantalum ores were received at KBI's Revere plant in 100 pound burlap sacks. The ore was repackaged into 50 gallon steel drums and stored in a warehouse at the plant site. The drums were transferred to the blending building where the ore was loaded into a blender along with fine particulate aluminum. After blending, the mix was discharged to a transfer hopper and moved by crane to the Reaction Building containing a number of large steel pots lined with magnesium-oxide. Each of five pots were loaded with approximately one thousand pounds of the thermite ore mixture. The mixture was remotely ignited. The alumina thermic reduction took less than five minutes. The resultant molten mass in each pot was allowed to cool for several days, then the pots were inverted. The metal fractures into small pieces, separated from the slag which contained the source material. The slag was loaded into 55 gallon drums and stored in the warehouse pending decision as to method of disposal.

RADIOLOGICAL SAFETY SURVEY OF PROCESS

On July 2, 1970, William Cannon, Asst. Radiological Safety Officer, KBI and R. G. Gallagher, Consultant Health Physicist, made a thorough radiological survey of the initial processing of 3500 pounds of columbium-tantalum ore. This ore contains 0.11-0.16% thorium by weight. External radiation measurements of the steel drums at contact were 0.5 - 0.7 mR/hr.

All personnel involved in the experimental processing of the columbium-tantalum ore wore respiratory protection during those operations likely to produce airborne particulate activity. High volume air samples were taken of the loading, blending, and reduction operations. The results of alpha analyses of these air samples in a low background N/C gas proportional counter are shown in Table 1.

These data indicate airborne particulate activity was not in excess of the current maximum permissible concentrations (MPC's) for natural thorium of 3×10^{-11} $\mu\text{Ci/cc}$.

Seven samples were taken of settled dust on various exposed surfaces within the Blending Building and the Reaction Building using self-adhesive smears which were alpha counted in an NEC gas proportional counter. The results of analyses of these samples are shown in Table 2.

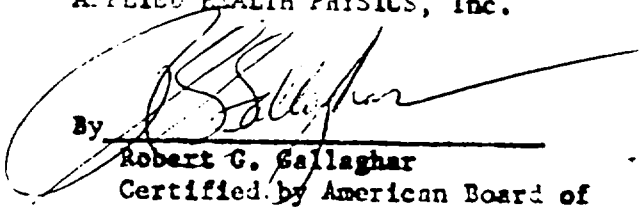
Samples were also obtained and analyzed to evaluate the radioactivity of (a) raw materials, (b) product and (c) slag. Results of these analyses are contained in Table 3.

CONCLUSIONS

The storage and processing of the columbite ores at the Severe plant were conducted in a manner that did not result in any significant risk to employees or to the environs. These procedures are very similar to those currently used and licensed by the AEC.

Respectfully submitted,

APPLIED HEALTH PHYSICS, Inc.

By 

Robert G. Gallagher
Certified by American Board of
Health Physics

dm

TABLE 3 = THORIUM MATERIAL BALANCE

$$3500 \text{ lbs. columbite} \times \frac{.08\%}{100} = 2.80 \text{ lbs. thorium}$$

SLAG

$$Q17-1 \quad 422 \text{ lbs.} \times \frac{0.13\% \text{ Th}}{100} = 0.5486 \text{ lbs. thorium}$$

$$Q17-2 \quad 410 \text{ lbs.} \times \frac{0.108\% \text{ Th}}{100} = 0.4428 \text{ lbs. thorium}$$

$$Q17-3 \quad 442 \text{ lbs.} \times \frac{0.128\% \text{ Th}}{100} = 0.5658 \text{ lbs. thorium}$$

$$Q17-4 \quad 417 \text{ lbs.} \times \frac{0.090\% \text{ Th}}{100} = 0.3353 \text{ lbs. thorium}$$

$$Q17-5 \quad 446 \text{ lbs.} \times \frac{0.132\% \text{ Th}}{100} = 0.5887 \text{ lbs. thorium}$$

Slag Total 2.49 lbs. thorium

ALLOY

$$Q17-1 \text{ to } 5 \quad 500 \text{ lbs.} \times \frac{<0.01\% \text{ Th}}{100} \times 5 = <0.25 \text{ lbs. thorium}$$

Recovered Total 2.74 lbs. thorium

$$\frac{2.74}{2.80} \times 100 = 98\% \text{ Recovery}$$

TABLE 1 - RESULTS OF AIR SAMPLING

July 2, 1970 Survey

<u>Sample No.</u>	<u>Operation Sampled</u>	<u>Results ($\mu\text{Ci/cc}$)</u>
1	Loading Cb-Ta ore into blender	4.49×10^{-13}
2	Discharging blender mix into transfer hopper	Background
3	Loading reduction pots	4.29×10^{-13}
4	Alumina thermic reaction	6.77×10^{-14}

July 29, 1970 Survey

Attachment A.3

1976 Production Records

1-5-76

MANUFACTURED

1-6-76

5 heat N-83-1-2-3-4-5

no scrap

1-7-76

5 heat N-83-6-7-8-9-10

no scrap

1-8-76

5 heat N-83-11-12-13-14-15

no scrap

1-9-76

4 heat N-83-16-17-18-19

no scrap

1-10-76

1-11-76

1-12-76

R-1-5-10-11-12-13-14-15-16-17-18-19-20-21-22-23-24-25-26-27-28-29-30-31-32-33-34-35-36-37-38-39-40-41-42-43-44-45-46-47-48-49-50-51-52-53-54-55-56-57-58-59-60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-75-76-77-78-79-80-81-82-83-84-85-86-87-88-89-90-91-92-93-94-95-96-97-98-99-100

FIRE ON 1-13-76

1-13-76

5 heat N-84-1-2-3-4-5

1-14-76

1-15-76

5 heat N-84-6-7-8-9-10

1-16-76

5 heat N-84-11-12-13-14-15

1-17-76

1-18-76

1-19-76

5 heat N-84-16-17-18-19-20

1-20-76

3 heat N-85-1-2-3

1-21-76

5 heat N-85-4-5-6-7-8

1-22-76

5 heat N-85-9-10-11-12-13

1-23-76

5 heat N-85-14-15-16-17-18

1-24-76

5 heat N-85-19-20-21-22-23

1-25-76

5 heat N-85-24-25-26-27-28

1-26-76

4 heat N-85-29-30-31-32

1-27-76

2 heat N-85-33-34-35-36

1-28-76

2 heat N-85-37-38-39-40

1-29-76

1-30-76

1-31-76

1-32-76

1-33-76

1-34-76

February 2 - 1976 - Alloy

Sunday	1	
Monday	2	
Tuesday	3	FERRO- TA- Lot- 200-220- heat- 13-14-15 ³ SCRAP 45 LBS
Wednesday	4	FERRO- TA- Lot- 200-220- heat- 16-17-18-19-20-21 SCRAP 90 LBS
Thursday	5	
Friday	6	
Saturday	7	
Sunday	8	
Monday	9	
Tuesday	10	
Wednesday	11	
Thursday	12	
Friday	13	6- heat- FERRO- LOT- 238- SCRAP- 69 LBS
Saturday	14	
Sunday	15	
Monday	16	6- heat- FERRO- LOT- 238 - No- Scrap
Tuesday	17	
Wednesday	18	
Thursday	19	
Friday	20	6- heat- FERRO- LOT- 238- No- Scrap
Saturday	21	
Sunday	22	
Monday	23	3- heat- FERRO- LOT- 238- No- Scrap- 1- ingot # 608 SCRAP 10 LBS
Tuesday	24	4- heat- FERRO- LOT- 239- No- Scrap- 1- ingot # 609 SCRAP 8 LBS
Wednesday	25	5- heat- FERRO- LOT- 239- No- Scrap
Thursday	26	3- heat- FERRO- LOT- 239- No- Scrap 1- ingot # 610 no SCRAP
Friday	27	
Saturday	28	
Sunday	29	

March 3 - 1976 - Alloy

CB - ingot

Monday	1	4-heat-FERRO-LOT-239-	1-heat-#558-85-P.A.C
Tuesday	2	3-heat-FERRO-LOT-239-	1-ingot-#611-13.2R
Wednesday	3	5-heat-FERRO-LOT-240-	No. scrap
Thursday	4	4-heat-FERRO-LOT-240-	No. scrap 2-ingot #612-10.2
Friday	5	5-heat-FERRO-LOT-240-	No. scrap
Saturday	6		
Sunday	7		
Monday	8		
Tuesday	9	3-heat-FERRO-LOT-240-	No. scrap 1-ingot #613-10.2
Wednesday	10		
Thursday	11	2-heat-FERRO-LOT-240-	No. scrap 2-ingot #614-6.1
Friday	12		
Saturday	13		
Sunday	14		
Monday	15	2-heat-FERRO-LOT-241-	2-ingot #616-#617-10.2
Tuesday	16	2-heat-FERRO-LOT-241-	2-ingot #618-#619-10.2
Wednesday	17	4-heat-FERRO-LOT-241-	1-ingot #620-13.2R
Thursday	18	5-heat-FERRO-LOT-241-	No. scrap
Friday	19	6-heat-FERRO-LOT-241-	No. scrap
Saturday	20		
Sunday	21		
Monday	22		2-ingot #621-#622-10.2
Tuesday	23		1-ingot #623-8.05
Wednesday	24	5-heat-NICKEL-LOT-N-86-	1-ingot #624-10.2
Thursday	25	3-heat-NICKEL-LOT-N-86-	2-ingot #625-#626-10.2
Friday	26	3-heat-NICKEL-LOT-N-86-	
Saturday	27		
Sunday	28	3-heat-NICKEL-LOT-N-86-	2-ingot #627-#628-10.2
Monday	29	3-heat-NICKEL-LOT-N-86-	1-ingot #629-10.2
Tuesday	30	2-heat-NICKEL-LOT-N-86-	2-ingot #630-#631-10.2
Wednesday	31	3-heat-NICKEL-LOT-N-87-	1-ingot #632-10.2

April 4 - 1976 alloy

Day	Heat	Material	Lot	Weight	Notes	Ingot #	Notes
Thursday 1	3-heat	NICKEL	LOT-N-87	no	SCRAP	2 ingot #633 + #634	no SCRAP
Friday 2	3-heat	NICKEL	LOT-N-87	no	SCRAP	2 ingot #635 + #636	no SCRAP
Saturday 3	3-heat	NICKEL	LOT-N-87	no	SCRAP	2 ingot #637 + #638	no SCRAP
Sunday 4							
Monday 5	4-heat	NICKEL	LOT-N-87	no	SCRAP	1 ingot #639	no SCRAP
Tuesday 6	3-heat	NICKEL	LOT-N-87	no	SCRAP		
Wednesday 7						2 ingot #640 + #641	no SCRAP
Thursday 8						2 ingot #642 + #643	no SCRAP
Friday 9	3-heat	FERRO-TA	LOT-221-239	30 LBS	SCRAP	2 ingot #644 + #645	no SCRAP
Saturday 10	3-heat	FERRO-TA	LOT-221-239	30 LBS	SCRAP		
Sunday 11	5-heat	FERRO-TA	LOT-221-239	no	SCRAP	2 ingot #646 + #647	no SCRAP
Monday 12							
Tuesday 13	3-heat	FERRO-TA	LOT-221-239	30 LBS	SCRAP	1 ingot #648	no SCRAP
Wednesday 14	5-heat	FERRO-TA	LOT-221-239	50 LBS	SCRAP		
Thursday 15						2 ingot #649 + #650	no SCRAP
Friday 16							
Saturday 17							
Sunday 18							
Monday 19						2 ingot #651 + #652	no SCRAP
Tuesday 20						2 ingot #653 + #654	no SCRAP
Wednesday 21						2 ingot #655 + #656	no SCRAP
Thursday 22							
Friday 23	5-heat	FERRO-TA	LOT-240-251	50 LBS	SCRAP		
Saturday 24						2 ingot #657 + #658	no SCRAP
Sunday 25	4-heat	FERRO-TA	LOT-240-251	no	SCRAP	2 ingot #659 + #660	no SCRAP
Monday 26	3-heat	FERRO-TA	LOT-240-251	no	SCRAP		
Tuesday 27							
Wednesday 28						2 ingot #661 + #662	no SCRAP
Thursday 29	5-heat	FERRO	LOT-242	45 LBS	SCRAP		
Friday 30	5-heat	FERRO	LOT-242	10 LBS	SCRAP		

May - 5 1976 Alloy

Saturday	1				2 ingot - #663-#664-	no SCRAP
Sunday	2				2 ingot - #665-#666-	no SCRAP
Monday	3				2 ingot - #667-#668-	no SCRAP
Tuesday	4	3 heat-FERRO-	LOT 242	45 LBS SCRAP	2 ingot - #669-#670-	no SCRAP 20 LBS
Wednesday	5	6 heat-FERRO-	LOT 242	90 LBS SCRAP		
Thursday	6				2 ingot - #671-#672-	no SCRAP 20 LBS
Friday	7	3 heat-FERRO-	LOT 243	45 LBS SCRAP	2 ingot - #673-#674-	no SCRAP 20 LBS
Saturday	8	3 heat-FERRO-	LOT 243	no SCRAP	2 ingot - #675-#676-	no SCRAP 20 LBS
Sunday	9					
Monday	10	3 heat-FERRO-	LOT 243	no SCRAP	2 ingot - #677-#678-	no SCRAP
Tuesday	11	3 heat-FERRO-	LOT 243	no SCRAP	2 ingot - #679-#680-	no SCRAP
Wednesday	12	3 heat-FERRO-	LOT 243	45 LBS SCRAP	2 ingot - #681-#682-	no SCRAP 20 LBS
Thursday	13	4 heat-FERRO-	LOT 243	no SCRAP	2 ingot - #683-#684-	no SCRAP 20 LBS
Friday	14	3 heat-FERRO-	LOT 244	no SCRAP	2 ingot - #685-#686	20 LBS
Saturday	15	6 heat-FERRO-	244	no SCRAP		
Sunday	16	5 heat-FERRO-	244	no SCRAP		
Monday	17	5 heat-FERRO-	244	no SCRAP	2 ingot - #687-#688	SCRAP! 17 LBS
Tuesday	18	5 heat-FERRO-	LOT 245	no SCRAP	1 ingot - #689	no SCRAP
Wednesday	19	6 heat-FERRO-	LOT 245	no SCRAP	no ingot	
Thursday	20	6 heat-FERRO-	LOT 245	no SCRAP	no ingot	
Friday	21	6 heat-FERRO-	LOT 246	78 LBS SCRAP	no ingot	
Saturday	22					
Sunday	23	6 heat-FERRO-	LOT 246	no SCRAP	TOTAL 19	
Monday	24	7 heat-FERRO-	LOT 246	no SCRAP	heat 246	
Tuesday	25	5 heat-FERRO-	LOT 247	no SCRAP		
Wednesday	26	5 heat-FERRO-	LOT 247	no SCRAP		
Thursday	27	4 heat-FERRO-	LOT 247	no SCRAP		
Friday	28					
Saturday	29					
Sunday	30					
Monday	31					

June 6 1976 Alloy

Tuesday 1	5-FERRO - ^{LOT} 247 - ^{no} SCRAP - TOTAL heat ^{LOT} 247	
Wednesday 2		2-ingot-#690-#691 SCRAP 10 LBS
Thursday 3	4-FERRO - ^{LOT} 248 - ^{no} SCRAP -	1-ingot-#692 SCRAP 5 LBS
Friday 4	3-FERRO - 248 -	2-ingot-#693-#694 SCRAP 10 LBS
Saturday 5		
Sunday 6		
Monday 7		
Tuesday 8		1-ingot-#709-P no-SCRAP
Wednesday 9	4-FERRO - ^{LOT} 248 - ^{no} SCRAP	
Thursday 10	4-FERRO - 248 - ^{no} SCRAP	
Friday 11	4-FERRO - 248 ^{no} SCRAP - TOTAL-19-heat	
Saturday 12		^{LOT} 248
Sunday 13		
Monday 14	7-NICKEL - ^{LOT} N-88 - ^{no} SCRAP 70 LBS	
Tuesday 15	5-NICKEL - N-88 - ^{no} SCRAP	
Wednesday 16	7-NICKEL - N-88 - ^{no} SCRAP - TOTAL-19-heat	
Thursday 17	3-NICKEL - ^{LOT} N-89 - ^{no} SCRAP -	2-ingot-#695-#696 no-SCRAP
Friday 18	6-NICKEL - N-89 - ^{no} SCRAP	
Saturday 19		
Sunday 20		
Monday 21	3-NICKEL - ^{LOT} N-89 - ^{no} SCRAP 30 LBS	2-ingot-#697-#698 no-SCRAP
Tuesday 22	4-NICKEL - N-89 - ^{no} SCRAP 40 LBS	1-ingot-#699 no-SCRAP
Wednesday 23	3-NICKEL - N-89 - ^{no} SCRAP	2-ingot-#700-#701 no-SCRAP
Thursday 24		
Friday 25	5-NICKEL - ^{LOT} N-90 - ^{no} SCRAP	
Saturday 26	5-NICKEL - N-90 - ^{no} SCRAP	
Sunday 27		
Monday 28	1-NICKEL - N-90 - ^{no} SCRAP 10 LBS	2-ingot-#702-#703 no-SCRAP
Tuesday 29	4-NICKEL - N-90 - ^{no} SCRAP 40 LBS	1-ingot-#710-R no-SCRAP
Wednesday 30	4-NICKEL - N-90 - ^{no} SCRAP 40 LBS	2-ingot-#704-#705 no-SCRAP
	TOTAL-19-heat. N-90	

-July 7 - 1976 - Alloy-

1	4-NICKEL-N-91	SCRAP 40 LBS	1- Ingot #706	SCRAP 90	no SCRAP	Thu Thursday	31
2	3-NICKEL-N-91	SCRAP 30 LBS	2- Ingot #707-708	SCRAP 90	no SCRAP	Fri Friday	30
3						Sat Saturday	29
4						Sun Sunday	28
5						Mon Monday	27
6	5 NICKEL-N-91	SCRAP 90				Tue Tuesday	26
7	5-NICKEL-N-91	SCRAP 90				Wed Wednesday	25
8	2-NICKEL-N-91	SCRAP 90				Thu Thursday	24
9	5 NICKEL-N-91	SCRAP 90				Fri Friday	23
10						Sat Saturday	22
11						Sun Sunday	21
12	3-NICKEL-N-92	SCRAP 30 LBS	2- Ingot #730-R #731-R	SCRAP 90	no SCRAP	Mon Monday	20
13	4-NICKEL-N-92	SCRAP 40 LBS	1- Ingot #732-R	SCRAP 90	no SCRAP	Tue Tuesday	19
14	3-NICKEL-N-92	SCRAP 30 LBS	2- Ingot #713-714	SCRAP 90	no SCRAP	Wed Wednesday	18
15	4-NICKEL-N-92	SCRAP 40 LBS	1- Ingot #733-P	SCRAP 90	no SCRAP	Thu Thursday	17
16			1- Ingot #734-P	SCRAP 90	no SCRAP	Fri Friday	16
17						Sat Saturday	15
18						Sun Sunday	14
19	2-FERRO-F-249	SCRAP 90	2- Ingot #715-716	SCRAP 90	no SCRAP	Mon Monday	13
20	3-FERRO-F-249	SCRAP 90	1- Ingot #717-	SCRAP 90	no SCRAP	Tue Tuesday	12
21	4-FERRO-F-249	SCRAP 90	2- Ingot #718-719	SCRAP 90	no SCRAP	Wed Wednesday	11
22	3-FERRO-F-249	SCRAP 90	1- Ingot #720	SCRAP 90	no SCRAP	Thu Thursday	10
23						Fri Friday	9
24						Sat Saturday	8
25						Sun Sunday	7
26	4-FERRO-F-249	SCRAP 80 LBS	1- Ingot #728	SCRAP 90	no SCRAP	Mon Monday	6
27	19-Heat-F-249	SCRAP 90	2- Ingot #723-724	SCRAP 90	no SCRAP	Tue Tuesday	5
28			1- Ingot #725	SCRAP 90	no SCRAP	Wed Wednesday	4
29			2- Ingot #726-727	SCRAP 90	no SCRAP	Thu Thursday	3
30			1- Ingot #728	SCRAP 90	no SCRAP	Fri Friday	2
31						Sat Saturday	1

August 8 1976 alloy

		END OF LOT	NEW LOT	
Sunday 1				
Monday 2				
Tuesday 3				
Wednesday 4	1-FERRO-F-250 5 LBS LOT SCRAP	2. ingot # 729-# 735	# 729	SCRAP-5
Thursday 5	ZR-AL-#7876-#1	2. ingot # 736-# 737		no SCRAP
Friday 6	ZR-AL-#7876-#2	1. ingot # 738		no SCRAP
Saturday 7		2. ingot # 739-# 740		no SCRAP
Sunday 8				
Monday 9				
Tuesday 10		1. ingot # 741		no SCRAP
Wednesday 11	1-FERRO-F-250 5 LBS LOT SCRAP	2. ingot # 742-# 743		no SCRAP
Thursday 12		2. ingot # 744-# 745		no SCRAP
Friday 13		2. ingot # 746-# 747		no SCRAP
Saturday 14		2. ingot # 748-# 749		no SCRAP
Sunday 15				
Monday 16	3-FERRO-F-250 15 LBS LOT SCRAP	1. ingot # 750		no SCRAP
Tuesday 17	2-FERRO-F-250 10 LBS LOT SCRAP	2. ingot # 751-# 752	END OF LOT	no SCRAP
Wednesday 18	4 FERRO-F-250 15 LBS SCRAP	No. ingot. To day		
Thursday 19	2-FERRO-F-250 10 LBS SCRAP	2. ingot # 753-# 754	NEW LOT	no SCRAP
Friday 20	3-FERRO-F-250 15 LBS SCRAP	1. ingot # 755		no SCRAP
Saturday 21				
Sunday 22				
Monday 23	2-FERRO-F-250 10 LBS SCRAP	2. ingot # 756-# 757		no SCRAP
Tuesday 24	2-FERRO-F-250 10 LBS SCRAP	1. ingot # 758		no SCRAP
Wednesday 25	19. heat-Total. 95 LBS SCRAP	2. ingot # 759-# 760		no SCRAP
Thursday 26		2. ingot # 761-# 762		no SCRAP
Friday 27		2. ingot # 763-# 764		no SCRAP
Saturday 28				
Sunday 29				
Monday 30		# 765-# 766		10 # SCRAP
Tuesday 31		2. ingot # 767-# 768		no. SCRAP

September - 9 - 1976 - Alloy

Tuesday	1	No - heat - To day			
Wednesday	2	No - heat - To day			
Thursday	3				
Friday	4				
Saturday	5				
Sunday	6				
Monday	7	No - heat - To day			
Tuesday	8				
Wednesday	9	4-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{20 LBS}	2 ingot - #769	#770	No.
Thursday	10	4-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{20 LBS}	1 ingot - #771	END LOT	No.
Friday	11				
Saturday	12				
Sunday	13	No - heat - To day			
Monday	14	5-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{25 LBS}			
Tuesday	15	2-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{10 LBS}	2 ingot - #772	#773 NEW LOT	No.
Wednesday	16	2-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{10 LBS}	2 ingot - #774	#775	No.
Thursday	17	2-FERRO. 251. ^{LOT} 251. ^{SCRAP} 251. ^{10 LBS}	2 ingot - #776	#777	No.
Friday	18				
Saturday	19				
Sunday	20				
Monday	21	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}	2 ingot - #778	#779	No.
Tuesday	22	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}	2 ingot - #780	#781	No.
Wednesday	23	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}	2 ingot - #782	#783	No.
Thursday	24	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}	2 ingot - #784	#785	No.
Friday	25	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}	2 ingot - #786	#787	No.
Saturday	26				
Sunday	27	3-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{15 LBS}	2 ingot - #788	#789	No.
Monday	28	3-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{15 LBS}	1 ingot - #790	END OF LOT	No.
Tuesday	29	3-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{15 LBS}			
Wednesday	30	2-NICKEL-N-93. ^{LOT} 93. ^{SCRAP} 93. ^{10 LBS}			
Thursday					
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October - 10 - 1976 - alloy

new-Lot

2 ingot - 791 - #792 no-Scrap

Friday	1				
Sat	2				
Sunday	3				
Monday	4			2 ingot - #793 - #794	no-Scrap
Tuesday	5			2 ingot - #795 - #796	10 LBS
Wednesday	6	3-NICKEL - LOT N-94 - 10 LBS	SCRAP	2 ingot - #797 - #798	10 LBS
Thursday	7	2-NICKEL - N-94 - 10 LBS		2 ingot - #799 - #800	no-Scrap
Friday	8	5-NICKEL - N-94 - 25 LBS			
Saturday	9				
Sunday	10				
Monday	11	5-NICKEL - N-94 - 25 LBS	SCRAP		
Tuesday	12	4-NICKEL - N-94 - 20 LBS	SCRAP	END-OF-LOT	
Wednesday	13	5-FERRO - TA - 252 - 261 - 50 LBS	SCRAP		
Thursday	14	5-FERRO - TA - 252 - 261 - 50 LBS	SCRAP	END-OF-LOT	
Friday	15				
Sat	16	5-FERRO - 252 - 25 LBS	SCRAP		
Sunday	17	5-FERRO - 252 - 25 LBS	SCRAP		
Monday	18				
Tuesday	19				
Wednesday	20				
Thursday	21				
Friday	22	4-FERRO - 252 - 25 LBS	SCRAP		
Saturday	23				
Sunday	24				
Monday	25				
Tuesday	26	5-FERRO - 252 - 25 LBS	SCRAP	END-OF-LOT	
Wednesday	27				
Thursday	28				
Friday	29				
Saturday	30				
Sun	31				

Attachment A.4

Cabot QA Laboratory Records

PC: RAE
FWM

Fuzzy -

I WOULD LIKE YOU TO
CONDUCT THE FOLLOWING EXPERIMENT.
THE PURPOSE IS TO DETERMINE
HOW MUCH TITANIUM REPORTS TO
ALLOY - IN FeCb PRODUCTION FROM
PYROCHLORES. I WANT THIS INFORMATION
BECAUSE WE MAY BE ABLE TO
USE PYROCHLORES FOR HUNTINGTON
ALLOYS HIGH Ta FINES OR
FOR AN INTERMEDIATE GRADE
FERROCALCIBIUM.

PREHEAT — IN CLAY CRUCIBLE. 1000°F

~902g. PYROCHLORES (Cb_2O_3)	43.1%
ALUMINUM 1592g. 100	100%
Fe PWD 423A	86.1%
CaO	7.1%
CaF ₂	7.1%

SAMPLE ALLOY FOR %Cb, AL, Ti
SAVE BALANCE OF ALLOY FOR LATER ANALYSIS
IF NEEDED.

Thom
Cg

FBW ✓
AJF ✓
FWM 008
RT
KRR ✓

JES
BAA

ANALYTICAL

~~PERIODICUM~~

Slag from RAG FeCbTa
Test

LAB NO: 74792
LOT NO:
DATE: 2/14/72
ANALYSIS REQUESTED
Ta₂O₅ + Cb₂O₅

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	2/14/72				
Cb	60.0 MIN.		2.5% Cb ₂ O ₅				
Al	.4-1.0 MAX	0.001					
Ta	0.20 "	0.050	2.0 Ta ₂ O ₅				
Si	0.20 "	0.001					
Ni	0.10 "	0.001					
B	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001					
Sn	0.005 "	0.001					
Ti	0.01 "	0.001					
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001					
Sb	0.005 "	0.001					
C	0.05 "						
P	0.01 "						
S	0.01 "						
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te		0.0005					
V		0.0001					
Mo		0.001					
Ga		0.001					
Ag		0.0001					
Cd		<0.001					
In		<0.001					
Ge		0.001					

ANALYTICAL
MISCELLANEOUS

Index

445

 ΔT^v

YPR

FWV

FBIW

MATERIAL:

FeCl-Ta

LAB NO. 74759

LOT NO. AIF 12271

DATE 12/27/71

ANALYSIS REQUESTED

ANALYSIS REQUESTED
9% Cl, 9% Ta

1/3/72

[illegible]

COPIES: RMA BLC JES
AJF ✓ KRR ✓
FWMorg FBW ✓
ANALYTICAL
MISCELLANEOUS

LAB NO. 74701
LOT NO. 459-67-2
DATE 10/19/71

MATERIAL:

Fe Cl-Ta

complete

%Cl 60.0
%Ta ~5.0

ANALYSIS REQUESTED

Cl, Ta, C, S, P,
Spec to include max
S, Al, Ti, Sn + Pb

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	56.6	10/24/71	(wet)							
Ta	1-5	1-08	10/26/71							
Sn	1-5									
As										
Al	1.5-1.0									
Ca										
Bi	01-05									
Cr	01-05									
Cu										
Fe										
Pb	1-5									
Mo										
Mg	201									
	01-05									
	01-05									
Si	1-10	Request	wet Si	3.1	10/29/71					
W										
Ti	1-5									
Sb										
B	201									
Co										
V	201									
Zr	11-05									
Zn										
Te										
O ₂										
N ₂										
Bc	1-5									
P	2015									
C	012									
S	0135									

RECEIVED FROM:

GRADE:

WEIGHT:

DATE RECEIVED:

ANALYTICAL
MISCELLANEOUS

ANALYSIS REQUESTED

Fe Cl Ta

$^{90}\text{Cl} - 60.0$ $^{70}\text{Ta} \sim 5.0$ ^{70}Zr

Complete

Spec. to include, Non
Se, Al, Ti, Sn & Pb

[illegible]

ANALYTICAL
MISCELLANEOUS

MATERIAL:

1 org FBW ✓ MISCELLANEOUS
Fe Ta (Resampled) comp
Material made with Tanco ore
Material not cleaned prior to crushing

LAB NO. 73951
LOT NO. 459-47-5
DATE 9/13/71
ANALYSIS REQUESTED
Wet Al, Wet Mn, —
Wet Si. & Wet Ti

[illegible]

VNS

FBW ✓

AJF ✓

FWM Org

P

; KRR ✓

JES

BAA

ANALYTICAL

FERROCOLUMBIUM

Ta

LAB NO: 74791

LOT NO: 1st RAG Ferb-12

DATE: Test 2/14/12

ANALYSIS REQUESTED

Ta, Nb, Si, Fe, Sn
Ti, Mn + Au

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	2/21/11					
Cb	60.0 MIN.		31.18	met				
Al	.4-1.0 MAX	0.001						
Ta	0.20 "	0.050	22.69	met				
Si	0.20 "	0.001	5.90	met				
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010	1.22	met				
Cu	0.02 "	0.001				Fe	19.0 %	met
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001	2.81	met				
Sn	0.005 "	0.001	3.35	met				
Ti	0.01 "	0.001	3.10	met				
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0001						
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		0.001						

FBW ✓
 AJF ✓
 FWM orig
 C
 S KKK ✓

JES
 BAA

ANALYTICAL
FERROCOLUMBIUM Ta

LAB NO: 076401
 LOT NO: RAG #245
 DATE: 2/21/72
 ANALYSIS REQUESTED:
 Ta, Nb, Si, Fe, Sn
 H, W & Mn

2/24/72 ✓ complete

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	2	3				
Cb	60.0 MIN.		37.67	36.94				
Al	.4-1.0 MAX	0.001						
Ta	0.20 "	0.050	24.44	24.08				
Si	0.20 "	0.001	5.66	5.66				
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010	1.35	1.22				
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001	2.91	2.77				
Sn	0.005 "	0.001	5.31	4.94				
Ti	0.01 "	0.001	2.15	2.34				
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Fe		0.001	17.4	15.9				
Te		0.0005						
V		0.0005						
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		0.001						
Mn		<0.001						

DMS

FBW ✓

AJF / KRR ✓

FWM org

F

S

JES

BAA

ANALYTICAL

FERROCOLUMBIUM

Ta

RAG

84 85

LAB NO: 076435

LOT NO: 4445

DATE: 3/20/72

ANALYSIS REQUESTED

Ta, Cb, Fe, Sn, Ti,

W, Mn

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
Cb	60.0 MIN.		30.78	31.02				
Al	.4-1.0 MAX	0.001	10.4	8.5	Reported	#11/72		
Ta	0.20 "	0.050	23.21	24.19				
Si	0.20 "	0.001	6.0	6.13				
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010	0.96	0.93				
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001	2.82	3.82				
Sn	0.005 "	0.001	3.1	3.26				
Ti	0.01 "	0.001	2.7	2.9				
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0005						
Mo		0.001						
Ga		0.001						
Ag Fe		0.0001	16.75	11.53				
Cd		<0.001						
In		<0.001						
Ge		0.001						

FBW
AJF
FWM
FEC
S
JES
BAA

ANALYTICAL

FERROCOLUMBIUM

Huntington

Ta
Huntington Spec

LAB NO: 076423

LOT NO: 4C

DATE: 3/14/72

ANALYSIS REQUESTED

200g, Ta, wet Ti,
wet Al, wet Si,
Spec, C, S+P.

ELEMENT	SPECIFICATION	LIMIT OF DETECTION		3/20				
Cb	60.0 MIN.			66.75	55-60			
Al	.4-1.0 MAX	0.001	.5-1.0	.80	1.0 max			
Ta	0.20 "	0.050		1.85	3.0 max			
Si	0.20 "	0.001	1-10	2.40	3.0 max			
Ni	0.10 "	0.001	01-05					
B	0.005 "	0.001	201					
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001	.1-.5					
Mg		0.001	01-05					
Mn	0.02 "	0.001	.1-.5		1.7 max			
Sn	0.005 "	0.001	01-05		.20 max			
Ti	0.01 "	0.001	.1-.5	4.5	1.0 max			
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001	<.01					
Pb	0.001 "	0.0001	.01-05		.02 max			
Sb	0.005 "	0.001						
C	0.05 "		1250	3/20/72	.15 max			
P	0.01 "				.03 max			
S	0.01 "		.08	3/20/72	.03 max	:08	JF	
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Ce		0.001						
Te		0.0005						
V		0.0005	.1-.5					
Mo		0.001						
Ga		0.001						
Aq		0.0001						
Cd		<0.001						
La		<0.001						
Ca		0.001						
Tl		<0.001						

FBW ✓
AJF/KAR ✓
FWM org
S
JES
BAA

ANALYTICAL
FERROCOLUMBIUM Ta
Resampled
Huntington

LAB NO: 076436
LOT NO: 4C
DATE: 3/21/72
ANALYSIS REQUESTED
0% Ta + 0% S

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	3/23		Huntington Spec		
Cb	60.0 MIN.						
Al	.4-1.0 MAX	0.001					
Ta	0.20 "	0.050	2.21	3/23/72	3.0 % Min		
Si	0.20 "	0.001					
Ni	0.10 "	0.001					
B	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001					
Sn	0.005 "	0.001					
Ti	0.01 "	0.001					
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001					
Sb	0.005 "	0.001					
C	0.05 "						
P	0.01 "						
S	0.01 "		0.052	3/23/72			
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te		0.0005					
V		0.0005					
Mo		0.001					
Ga		0.001					
Ag		0.0001					
Cd		<0.001					
In		<0.001					
Ge		0.001					
Tl		<0.001					

ANALYTICAL
MISCELLANEOUS

LOT NO. 41

DATE 2/7/72

ANALYSIS REQUESTED

Gold, Fe, $\frac{3}{2}$ H, Al

Spec

MATERIAL:

Feta cli

complete

RECEIVED FROM:
GRADE:
WEIGHT:
DATE RECEIVED:

FBW
AJF
FWM Org

S KRIC
JES
BAA

ANALYTICAL
FERROCOLUMBIUM

identifying tone

LAB NO: 676403

LOT NO: #2

DATE: 2/22/77

ANALYSIS REQUESTED

Full TK, IT, PL

Spec

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	2/28/77	2/29/77			
Cb	60.0 MIN.		110	64.50			
Al	.4-1.0 MAX	0.001	.1-.5	.40			
Ta	0.20 "	0.050	.1-.5	✓ 3.67			
Si	0.20 "	0.001	1-10				
Ni	0.10 "	0.001	0.05				
B	0.005 "	0.001	<0.1				
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001	.1-.5				
Mg		0.001	<0.1				
Mn	0.02 "	0.001	.1-.5				
Sn	0.005 "	0.001	0.05				
Ti	0.01 "	0.001	.1-.5	0.5			
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001	0.05				
Sb	0.005 "	0.001					
C	0.05 "						
P	0.01 "						
S	0.01 "						
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te		0.0005					
V		0.0001	.1-.5				
Mo		0.001					
Ga		0.001					
Aq		0.0001					
Cd		<0.001					
Fe		<0.001	<10				
Ge		0.001					

PNR
FBW
AJF
FWM
RUC
JES
BAA

ANALYTICAL
FERROCOLUMBIUM

Composite of E 6 + 7

LAB NO: 67645C
LOT NO: 7C
DATE: 4/13/72
ANALYSIS REQUESTED
Tat S
Requested by
31572

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
Cb	60.0 MIN.		13.2					
Al	.4-1.0 MAX	0.001						
Ta	0.20 "	0.050	2.95					
Si	0.20 "	0.001						
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001						
Sn	0.005 "	0.001						
Ti	0.01 "	0.001						
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "		.088	4/6/72				
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0005						
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		0.001						
As		0.001						

DRA
 FBW ✓
 AJF ✓
 FWM org
 KKK ✓
 JES
 BAA

ANALYTICAL
FERROCOLUMBIUM

LAB NO: 676457
 LOT NO: 68449
 DATE: 4/11/72
 ANALYSIS REQUESTED
 Sulfur

FeCb-Ta
 #8
 VG FeCb-std
 #9 used as std
 for sulfur

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	335					
Cb	60.0 MIN.							
Al	.4-1.0 MAX	0.001						
Ta	0.20 "	0.050						
Si	0.20 "	0.001						
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001						
Sn	0.005 "	0.001						
Ti	0.01 "	0.001						
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "		.06	<.005				
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0005						
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		0.001						

FBW
AJF
FWM
RLC
JES
BAA

ANALYTICAL
FERROCOLUMBIUM

Decant fines

LAB NO: 076473
LOT NO: #9
DATE: 4/19/72
ANALYSIS REQUESTED -
C/C, Ta, Spec,
Wet Si, Wet Ti, S,
C & P

Analysis for
Spec

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	4/21					
Cb	60.0 MIN.		58.49					
Al 1.0 max	.4-1.0 MAX	0.001	.1-.5					
Ta 3.0 max	0.20 "	0.050	.1-.5	2.02				
Si 3.0 max	0.20 "	0.001	.5-1.0	1.03				
Ni	0.10 "	0.001	01-05					
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001	.01-05					
Mg		0.001	01-05					
Mn 1.7 max	0.02 "	0.001	05-.1					
Sn .20 max	0.005 "	0.001	<01					
Ti 1.0 max	0.01 "	0.001	.05-.1	<.5				
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb .02 max	0.001 "	0.0001	<01					
Sb	0.005 "	0.001						
C .015 max	0.05 "		.022					
P .03 max	0.01 "		.0067					
S .03 max	0.01 "		.024					
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001	01-05					
Te		0.0005						
V		0.0005	.1-.5					
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		0.001						
Tl		<0.001						

FBW
AJF
FWM
RLC

ANALYTICAL
FERROCOLUMBIUM *Ta*

LAB NO: 076479
LOT NO: 49
DATE: 4/24/72
ANALYSIS REQUESTED

JES
BAA

*Analysis
5/1/72*

92 Ta

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
Cb	60.0 MIN.							
Al	.4-1.0 MAX	0.001						
Ta	0.20 "	0.050	.16					
Si	0.20 "	0.001						
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001						
Sn	0.005 "	0.001						
Ti	0.01 "	0.001						
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0001						
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		<0.001						
In		<0.001						
Ge		<0.001						
Tl		<0.001						

FBW
AJF
FWM
RLC

ANALYTICAL
FERROCOLUMBIUM *Ta*

LAB NO: 076490
LOT NO: #10
DATE: 5/4/72
ANALYSIS REQUESTED
Rock, Ta, Spec
Wet Si, Wet Ti, S, C + P

JES
BAA

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
~~Cb~~	60.0 MIN.		<i>58.17</i>					
Al ✓	.4-1.0 MAX	0.001	<i>.1-.5</i>					
Ta ✓	0.20 "	0.050		<i>4.15</i>				
Si ✓	0.20 "	0.001		<i>.64</i>				
Ni	0.10 "	0.001	<i>01-05</i>					
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001	<i>01-05</i>					
Mg		0.001	<i>< .1</i>					
Mn ✓	0.02 "	0.001	<i>01-05</i>					
Sn ✓	0.005 "	0.001	<i>< .1</i>					
Ti ✓	0.01 "	0.001		<i>< .5</i>				
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb ✓	0.001 "	0.0001	<i>< .1</i>					
Sb	0.005 "	0.001						
C	0.05 "		<i>026</i>					
P	0.01 "		<i>< .1</i>					
S ✓	0.01 "		<i>.04</i>					
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001	<i>01-05</i>					
Te		0.0005						
V		0.0005	<i>05-.1</i>					
Mo		0.001						
Ga		0.001						
Ag		0.0001						
Cd		< 0.001						
In		< 0.001						
Ge		0.001						
Tl Fe		< 0.001	<i>> .1</i>					

FBW ✓
 AJF ✓
 FWM org
 RIC
 KRR
 JES
 BAA

ANALYTICAL

~~PERMANENT~~

Slag from RAG
 Fe Cl Ta

2/25/72

LAB NO: 74800
 LOT NO: # 243
 DATE: 2/21/71
 ANALYSIS REQUESTED
 Ta₂O₅ + Cl₂O₅

Th & U reported
 on 3/2/72

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	# 2	# 3		
Cb	60.0 MIN.		1.36	1.111	cb ₂ O ₅	
Al	.4-1.0 MAX	0.001				
Ta	0.20 "	0.050	3.39	3.85	Ta ₂ O ₅	
Th	0.20 "	0.001	0.14	0.14		
U	0.10 "	0.001	0.10	0.10		
B	0.005 "	0.001				
W	0.01 "	0.010				
Cu	0.02 "	0.001				
Cr	0.01 "	0.001				
Mg		0.001				
Mn	0.02 "	0.001				
Sn	0.005 "	0.001				
Ti	0.01 "	0.001				
Zn	0.005 "	0.001				
As	0.001 "	0.0005				
Bi	0.001 "	0.0001				
Pb	0.001 "	0.0001				
Sb	0.005 "	0.001				
C	0.05 "					
P	0.01 "					
S	0.01 "					
O ₂	0.06 "					
N ₂	0.02 "					
H ₂	0.003 "					
Co		0.001				
Te		0.0005				
V		0.0005				
Mo		0.001				
Ga		0.001				
Ag		0.0001				
Cd		<0.001				
In		<0.001				
Ge		0.001				
Tl		<0.001				

DKS

FBW ✓

AJF / RRR ✓

FWM org

R.L.C

JES

BAA

ANALYTICAL

FERROCOLUMBIUM

Ta Sleg

RAG

#4 #5

LAB NO: 676434

LOT NO: #4 #5

DATE: 3/20/72

ANALYSIS REQUESTED

Ta₂O₅, Pb₂O₃U₃O₈ + ThO₂

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
Cb	60.0 MIN.		0.8	1.6	CS ₂ O ₅			
Al	.4-1.0 MAX	0.001	~~2.4~~					
Ta	0.20 "	0.050	2.4	1.2	Ta ₂ O ₅			
Si	0.20 "	0.001						
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001						
Sn	0.005 "	0.001						
Ti	0.01 "	0.001						
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "							
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te		0.0005						
V		0.0001						
Mo		0.001						
Ga	U ₃ O ₈	0.001	0.17	0.23				
Ag	U ₃ O ₈	0.0001	0.12	0.17				
Cd		<0.001						
In		<0.001						
Ge		0.001						

To: Ken Rinehold
Copy to: Don M.

22 Heats

12/18/74

Ferrocolumbium Tantalum (3%)

Lot 73-94

Pyrochlore lot 1553A.	98 ^{lb}
Pyrochlore lot 1553	98 ^{lb}
Cl ₂ O ₅ , Vacuum Grade	364 ^{lb}
Al Powder	192 ^{lb}
Iron Powder	175 ^{lb}
NaClO ₃	46 ^{lb}
Tantalum Fine's	18 ^{lb}
Silicon Fine's	3 ^{lb}
QIT Scrap	5 ^{lb}
Any Previous FeCl ₃ -Ta melt	10 ^{lb}

Crack

Use 364 per heat

To: Ken Knickold
Copy to: Don M.

11/19/74

Ferrocolumbium Tantalum (3%)
Lot 65-72
8 Heats

Pyroclore hf 1553A 188#
G-2 C- Vacuum Grade 370#
Al Powder 192#
Iron Powder 175#
Na₂CO₃ 46#
Tantalum Fines 19#
Silicon Fines 3#
QIT Scrap 5#
Cung Previous Fe-Al-Ta Ranoff 10#

Note: After Cussing add 50# of old Fe-Al-Ta
material to each heat before grinding.

(Lot 42 & 72)

2 runs

Don: Lot 1553A Drums are:

1096
1097
1098

1100
1101
1102

1104
1105
1106

Requester J. H. Hunt Dept./Sec. W. H. L. L. Date Rec'd 1/31/72
Report to " Dept./Sec. " P.N. 42-000-1 G.N. 157

Material

Chem Code _____ Spec. No. _____

History

Justification

[illegible]

400 Authorized Signature CPL

5/72

COPIES: RAA DKS
RLC JES
AJF KES
FWM 07 FBW ✓

ANALYTICAL
MISCELLANEOUS

LAB NO. 78716
LOT NO. #11C
DATE 8/11/22

MATERIAL: Fe Cb Ta

Don spec 8/16

ANALYSIS REQUESTED
%Cb, %Ta, C, P, S, —

Wet Si, Wet Ti, Spec to include Al, S, & Pb

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	55 min 40 max	58.95								
Ta	3.0 min	3.87								+60 0.0
Sn	20 max	<.01								+100 25.0 25.0
As										
Al	1.0 max	<.5								+150 19.0 44.0
Ca										
Bi		<.01								+200 14.0 58.0
Cr		<.01								
Cu		<.01								+270 9.0 67.0
Fe										
Pb	.02 max	<.01								+325 8.0 75.0
Mo										
Mn		<.05								-325 25.0
Ni	1.7 max	<.05								
Si	3.0 max	<1.0	.6							
W										
Ti	1.0 max	<.1	<.5							
Sb										
B										
Co		<.05								
V		<.5								
Zr										
Zn										
Te										
O ₂										
N ₂										
C	.15 max	.0305								
S	.03 max	.0155								
P	.03 max	<.01								

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GRADE:
WEIGHT:
DATE RECEIVED:

COPIES:

FBW
KRR
FWM
RHR
JUDYANALYTICAL
MISCELLANEOUSLAB NO. 87003LOT NO. 21CDATE 5/28/74ANALYSIS REQUESTED Cl-
Ta, Cs, P, Spec JoMATERIAL: re Cl-Ta (32s)

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	55mm 60max			60.77			60.0	60.0		include Mn, Si
Ta	3.0 min			3.57			3.5	3.5		Al, Ti, Sn, Pb +
Sn	0.20 max			1.008	ok			0.008		Sh
As				<0.005						
Al	1.0 max		.5-1.0	2.24	1.0			1.0		
Ca										
Bi				0.001						
Cr			01-05	02						
Cu			05-1	.01						
Fe										
Pb	0.02 max			0.05	ok			0.005		
Mo				0.05						
Mg				0.025						
	1.70 max		.1-1.5	2.1	ok			<0.5		
Ni				04						
Si	3.0 max		1-10	7.1	7.0			0.50		
W			<0.1	<0.1						
Ti	1.0 max		.5-1.0	7.1	ok			<1.0		
Sb	0.05 max			.02	✓			0.02		
B				0.005						
Co				0.05						
V			01-05	06				Ag <0.001		
Zr			01-05					Mo <0.001		
Zn				<0.01				Ca <0.001		
Te				<0.005				In 01		
O ₂								Te <0.001		
N ₂										
C	0.15 max	0.025			✓			0.028		
S	0.03 max	0.02			✓			0.02		
P	0.03 max	0.048						0.017		

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DATE RECEIVED:

Semi-quant
quant

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KRR
FWM
JUDY

ANALYTICAL
FERROCOLUMBIUM

LAB NO: 86277

LOT NO: #13

DATE: 5/14/74

ANALYSIS REQUESTED

pl, wet Ti, wet Si, 2% Ta
Spec to include all Sn &
pl, C, P, S

ELEMENT	SPECIFICATION	LIMIT OF DETECTION					
Cb	60.0 MIN		58.64				
Al	.4-1.MAX	0.001	1.86				
Ta	0.20 "	0.050	3.38				
Si	0.20 "	0.001					
Ni	0.10 "	0.001					
B	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001					
Sn	0.005 "	0.001					
Ti	0.01 "	0.001					
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001					
Sb	0.005 "	0.001					
C	0.05 "		0165				
P	0.01 "		0189				
S	0.01 "		~~0185~~	0230			
O ₂	0.06 "		~~0185~~				
N ₂	0.02 "		~~0185~~				
H ₂	0.003 "						
Co		0.001					
Te	0.001 "	0.0005					
V		0.0001					
Mo		0.001					
Ga	0.01 "	0.001					
Ag	0.001 "	0.0001					
Cd		< 0.001					
In		< 0.001					
Ge		0.001					
Tl	0.001 "	< 0.001					

MATERIAL:

Fe-Cb-Ta

84244
lot 12 (1 hea
4/29/74
Spec Cb, Ta, hot Ti, C, P, S
Spec to include Al, Sn + Pb

100% max
Spec

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE
									MESH SIZE
Cb	57.41								55 min 60 max
Ta	4.04								3.0 min
Sn									.20 max
As									
Al	.5-1.0	.60							1.0 max
Ca	01-05								
Si									
Cr									
Cu									
Fe									
Pb									.02 max
Mo									
Ni	.1-.5								1.7 max
SE	61-05								
SI	.1-.5								3.0 max
W									
IL	.1-.5								1.0 max
SO	61-05								300-400
B									Comment by customer OK
Co									
V	05-01								
Zr									
Zn									
Te									
O ₂									
N ₂									
?	0586								.15 max
S	.0255								.03 max
O	.022								.03 max

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DATE:

FWW - FWM

3-25-14

F2 C6 + T2

PRESENT INVENTORY

# 4 C	FINES	1,043 #	4 drums
# 4 C	OVERSIZE	142 #	1 drum
# 7 C	FINES	7 #	1 drum
# 7 C	OVERSIZE	710 #	4 drums
# 8		351 #	1 drum
# 91011	11 C	<u>227</u> #	1 drum
		2,480 #	

Frank - please give me analysis on
4C, 7C, 8, and 11C

Frank
- Fred.

FBI-FWM

For 06 + 12

PRESENT INVENTORY

# 4 C	FINES	1043	#	4 drums
# 4 C	OVERSIZE	142	#	1 drum
# 7 C	FINES	7	#	1 drum
# 7 C	OVERSIZE	710	#	4 drums
# 8		351	#	1 drum
# 91011	11 C	227	#	1 drum
		2,480	#	

KRM

COPIES:

NLC
ATF
FWMJES
KES
FBWANALYTICAL
MISCELLANEOUS

LOT NO.

DATE

ANALYSIS REQUESTED

MATERIAL:

Fe (C-Ta)

SPC-19
110 40 70 8

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	55 min 6.0 max	58-95	6.175	6.302						
Ta	3.2 min 3.0 max	3.87	1.45 2.21	2.45						
Sn	0.2 max	<0.1								
As										
Al	1.0 max	<0.5	0.80							
Ca										
Bi		<0.1	<0.1							
Cr		<0.1	0.1-0.5							
Cu		<0.1								
Fe										
Pb	0.02 max	<0.1	0.1-0.5							
Mo										
Mg		<0.5	0.1-0.5							
	1.0 max	<0.5	0.1-0.5							
Ni										
Si	3.0 max	0.6	2.40							
W										
Ti	1.0 max	<0.5	<0.5							
Sb	0.05 max									
B										
Co		<0.05								
V		<0.5	0.1-0.5							
Zr										
Zn										
Te										
O ₂										
N ₂										
H	0.5 max	0.31	0.125							
B.S	0.05 max	0.11	0.088	0.06						
F	0.05 max	<0.1								

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GRADE:

WEIGHT:

DATE RECEIVED:

227 717 351

RA
-WMA

8 HEPs

FeCbTa 14-21

Piprocklow	LOT 1424	300	158 ²
Cb ₂ O ₃	VG.	(can be high in Sb)	292 ⁴
AL	PWD.		193 ⁴
Fe	PWD		175 ⁴
NaClO ₃			46 ⁴
Ta	finer		21 ⁴
Si	finer		3 ⁴

Tot. KRR
PC: FWM.

7. 4. 1952

FECOTA HEATS 22-52
11 HEATS.

seed 38502

Pyrochlore	LOT 1484	51.4% 1.16.7	} = 100%
Pyrochlore	LOT 1105	31.3% 1.16.7	
Cb_2O_3	Var. grade (Sb ~ 400 ppm)		350%
Al Powder			193%
Fe Powder			175%
$NaClO_3$			46%
Ta Fines			20%
Si Fines			8%
QIT SCRAP			5%
ANY PREVIOUS FECOTA PRODUCT IF ANY.			10%

after crushing cable 50%
all FECOTA material etc. and
heat before grinding.

ANALYTICAL

FERROCOLUMBIUM

TK (3%)

Huntington
2X500#

Huntington

LOT NO: 22-32

DATE: 9/10/74

ANALYSIS REQUESTED

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	Spec ↓	22-32	7C		
Ch	60.0 MIN		55 min 60 max	58.36	63.2		58.8
Al	.4-1.0 MAX	0.001	1.0 max	2.32			1.0
Ta	0.20 "	0.050	3.0 max	3.54	2.95		3.4
Si	0.20 "	0.001	3.0 max	1.0			1.0
Ni	0.10 "	0.001					
R	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001	1.7 max	4.5			4.5 < 0.5
Sn	0.005 "	0.001	0.20 max	0.2			0.10
Ti	0.01 "	0.001	1.0 max	4.0			2.0
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001	0.02 max	0.02			0.01
Sb	0.005 "	0.001	0.15 max	0.15			0.015
C	0.05 "		0.15 max	0.21			0.021
P	0.01 "		0.3 max	0.15			0.03
S	0.01 "		0.3 max	0.28	0.88		0.03
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te		0.0005					
V		0.0001					
Mo		0.001					
Ga		0.001					
As		0.0001					
Cd		<0.001					
In		<0.001					
Ge		0.001					
Tl		<0.001					

Particle Size Distribution

- 35 mesh 100.0 %
+ 325 mesh 70.0 %

COPIES: FBW
KRR
FWM
RHR
JUDY

ANALYTICAL
MISCELLANEOUS

LAB NO. 88055
LOT NO. 22-32
DATE 9/6/74

MATERIAL: Fe Cl-Ta (3%)

ANALYSIS REQUESTED cl-
To, C, P, S, Spec to include

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	58.36									max / Si, Al, Ti, Sn, Pb + Sb
Ta	3.54									
Sn	.02									
As	<0005									
Al	2.32%									
Ca										
Bi	<0001									
Cr	.004									
Cu	.003									
Fe										
Pb	.002									
Mo	<001									
Mg	<001									
Ni	2.10									
Si	1.0									
W	<01									
Ti	4.10									
Sb	.015									
B	.0005									
Co	.005									
V	.045									
Zr										
Zn	<001									
Te	<0001									
O ₂										
N ₂										
C	.021									
S	.028									
O	.015									
-C	<001									
Me	<001									

RECEIVED FROM:
GRADE:
WEIGHT:
DATE RECEIVED:

Ag
Ag
Ag
10
008
0001
0001
-AA

1000#
300#
200#
100#

FACTA HENS 22-32

11 HAT

Pyrochlore LOT 1494 81.46% }
Pyrochlore LOT 1105 106.2% }
CB₂O₃ Var. grade (SL ~ 400 ppm)

AL powder
Fe powder
NaClO₃
Ta fines
SL fines
QIT SCRAP
Any previous FACTA Remelt if avail.

after crushing call 50#
call FACTA material to call
first before grinding - HENR

193
175
368
46
414
80
434
2/37

360
106
466
86
352

352
86
466
106
360

For Ken Runkel
Copy to: Ed Frey

Fe O₂ Ta 33-43

Pythelone lot 73 38 #

Pythelone lot 1105 137 #

Various Vae Grade 353 #

Al Powder 192 #

Fe Powder 175 #

Nu 2203 46 #

Ta Fine's 19 #

Se Fine's 3 #

QIT Scrap 5 #

Camp Previous Fe O₂-Ta Runkel 10 #

9/22/74

COPIES: FBW
KRR
FWM
JUDY

ANALYTICAL
FERROCOLUMBIUM

Ta (370)

LAB NO: 88093
LOT NO: 33-43
DATE: 10/2/74
ANALYSIS REQUESTED
Pb only

ELEMENT	SPECIFICATION	LIMIT OF DETECTION					
Cb	60.0 MIN						
Al	.4-1.MAX	0.001					
Ta	0.20 "	0.050					
Si	0.20 "	0.001					
Ni	0.10 "	0.001					
B	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001					
Sn	0.005 "	0.001					
Ti	0.01 "	0.001					
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001	.06				
Sb	0.005 "	0.001					
C	0.05 "						
P	0.01 "						
S	0.01 "						
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te	0.001 "	0.0005					
V		0.0001					
Mo		0.001					
Ga	0.01 "	0.001					
Ag	0.001 "	0.0001					
Cd		< 0.001					
In		< 0.001					
Ge		0.001					
Tl	0.001 "	< 0.001					

Fe Ch Ta

9/14/74

Drum # 4

364 #

-321 35 #

Drum # 7 101 #

500 #

Drum # 5

351

-321 25

Drum # 7 124

500 #

Drum # 6

473 #

-321 27 #

500 #

Drum # 9

464

-321 36

500 #

Drum # 8

211 #

Drum # 7 149 #

-321 46 #

Drum # 9 94

500 #

F2ClT9

#10

#11

#12

+60

21.0

24.0

23.0

+325

59.0

57.0

57.0

-325

20.0

19.0

20.0

For Ken Rinehold

10/2/74

Copy to Don M

Columbium Oxide Blend 44-64

Ferrocolumbium Tantalum (3%)

	Lot	Wt	Ca	
21.0	1881	1572#	1.0	This lot is in the Blender
36.1	1880	2705#	.9	All
42.9	1882	3220#	1.9	10 Drums + 220#
		<u>7497#</u>		

Use 357# per heat.

Truck

To: Ken Ruchold
Copy to Ed Frey

10/4/74

Ferrocolumbium Tantalum (3%)

Lot 44-64

Pyrochlore lot 1553 A	188#
Cr ₂ O ₃ , Vacuum Grade	357#
Al Powder	192#
Iron Powder	175#
NaClO ₃	46#
Tantalum Fines	19# (18) 121
Silicon Fines	3#
QIT Scrap	5#
Any Previous FeCb-Ta Melt	10#

Note:

After crushing add 50# of old

FeCb-Ta material to each heat before grinding

(lot 4C or 7C)

Trunk

Lot 1553 A and Drums 1096-1107

PO 75-653

lot.
44-64B

FERROCOLUMBIUM

TR (3%)
12,000 #
24x 500 # Drums

ANAL NO:

DATE:

10/22/74

ANALYSIS REQUESTED

Houding
Spec.

19.5

80.5

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	33-43	44-64	
Ch	60.0 MIN	55-60 max	59.0	59.0	59.0
Al	.4-1.0 MAX	0.001	1.0 max	1.0	1.46
Ta	0.20 "	0.050	3.0 max	3.67	3.63
Si	0.20 "	0.001	3.0 max	1.3	1.7
Ni	0.10 "	0.001			1.6
B	0.005 "	0.001			
W	0.01 "	0.010			
Cu	0.02 "	0.001			
P	0.01 "	0.001			
Mo		0.001			
Mn	0.02 "	0.001	1.70 max	.05	.10
Sn	0.005 "	0.001	.20 max	.035	.02
Ti	0.01 "	0.001	1.0 max	1.5	1.5
Zn	0.005 "	0.001			
As	0.001 "	0.0005			
Bi	0.001 "	0.0001			
Pb	0.001 "	0.0001	.02 max	.06	.002
Sb	0.005 "	0.001	.015 max	.015	.001
C	0.05 "		.15 max	.022	.026
P	0.01 "		.03 max	.0063	
S	0.01 "		.03 max	.013	.015
O ₂	0.06 "				
N ₂	0.02 "				
H ₂	0.003 "				
Co		0.001			
Te		0.0005			
V		0.0001			
Mo		0.001			
Ga		0.001			
As		0.0001			
Cd		<0.001			
In		<0.001			
Ce		0.001			
Fl		<0.001			

Particle Size Distribution

- 35 mesh 100.0
+ 32.5 mesh 70.0

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ANALYTICAL
FERROCOLUMBIUM

Ta 375

LAB NO: 89008
LOT NO: 44-64
DATE: 10/15/74

ANALYSIS REQUESTED

W, Ta, U, Al, U, Si
W, Ti, U, Mn, C, P, S
Spec

ELEMENT	SPECIFICATION	LIMIT OF DETECTION		
Cb	60.0 MIN	0.001	84.38 = 59.0	
Al	.4-1. MAX	0.001	1.0	1.46 wet
Ta	0.20 "	0.050	1.44	3.63
Si	0.20 "	0.001		1.7
Ni	0.10 "	0.001	0.15	
B	0.005 "	0.001	0.01	
W	0.01 "	0.010	0.10	
Cu	0.02 "	0.001	0.07	
Cr	0.01 "	0.001	0.12	
Mg		0.001	0.01	
Mn	0.02 "	0.001	0.10	
Sn	0.005 "	0.001	0.2	
Ti	0.01 "	0.001	0.1-0.5	
Zn	0.005 "	0.001	0.01	
As	0.001 "	0.0005	0.0005	
Bi	0.001 "	0.0001	0.0001	
Pb	0.001 "	0.0001	0.02	
Sb	0.005 "	0.001	0.01	
C	0.05 "		0.26	
P	0.01 "		0.185	
S	0.01 "		0.15	
O ₂	0.06 "			
N ₂	0.02 "			
H ₂	0.003 "			
Co		0.001	0.05	
Te	0.001 "	0.0005	0.0005	
V		0.0001	0.45	
Mo		0.001	0.01	
Ga	0.01 "	0.001	0.08	
Ag	0.001 "	0.0001	0.0001	
Cd		< 0.001	0.01	
In		< 0.001	0.01	
Ge		0.001	0.01	
Tl	0.001 "	< 0.001	0.01	

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ANALYTICAL
FERROCOLUMBIUM

LAB NO: 59047
LOT NO: 65-72
DATE: 11/24/78

ANALYSIS REQUESTED

Handwritten: Ob, Ta, W, Al, W, Si, W, Ti
Wet Mn, Spec, C, P, S

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	<i>Handwritten:</i> 55 min 60 max ↓ Spec	<i>Handwritten:</i> 57.82	<i>Handwritten:</i> 57.0	<i>Handwritten:</i> 59.0
Cb	60.0 MIN					
Al	.4-1. MAX	0.001	1.0 max	~~2.0~~	2.0	~~4.0~~
Ta	0.20 "	0.050	3.4 min	~~3.0~~	2.87	~~3.0~~
Si	0.20 "	0.001	3.0 max	~~1.3~~	1.3	1.3
Ni	0.10 "	0.001		1.15		
B	0.005 "	0.001		001		
W	0.01 "	0.010		20.0		
Cu	0.02 "	0.001		01		
Cr	0.01 "	0.001		008		
Mg		0.001		2001		
Mn	0.02 "	0.001	1.70 max	065		0.07
Sn	0.005 "	0.001	.20 max	01		0.01
Ti	0.01 "	0.001	1.0 max	1.15		20.5
Zn	0.005 "	0.001		2001		
As	0.001 "	0.0005		20005		
Bi	0.001 "	0.0001		0005		
Pb	0.001 "	0.0001	.02 max	002		0.002
Sb	0.005 "	0.001	0.5 max	2001		0.001
C	0.05 "		1.5 max	~~0.14~~	0.14	0.026
P	0.01 "		.03 max	.019		0.019
S	0.01 "		.03 max	~~0.085~~	0.085	0.015
O ₂	0.06 "					
N ₂	0.02 "					
H ₂	0.003 "					
Co		0.001		604		
Te	0.001 "	0.0005		20005	-35 mesh	100.0
V		0.0001		03	+325	70.0
Mo		0.001		2001		
Ga	0.01 "	0.001		007		
Ag	0.001 "	0.0001		20001		
Cd		< 0.001		2001		
In		< 0.001		2001		
Ge		0.001		2001		
Tl	0.001 "	< 0.001		2001		

Handwritten: Particle Size Distribution

COPIES: FBW
KRR
FWM
JUDY

ANALYTICAL
FERROCOLUMBIUM Ta 3%

LAB NO: 89055

LOT NO: 45-72

DATE: 12/4/74

ANALYSIS REQUESTED

Resample
complete

cl, Ta + metal

ELEMENT	SPECIFICATION	LIMIT OF DETECTION				
Cb	60.0 MIN	60.0	59.14			
Al	.4-1.MAX	0.001	1.92			
Ta	0.20 "	0.050	3.61			
Si	0.20 "	0.001				
Ni	0.10 "	0.001				
B	0.005 "	0.001				
W	0.01 "	0.010				
Cu	0.02 "	0.001				
Cr	0.01 "	0.001				
Mg		0.001				
Mn	0.02 "	0.001				
Sn	0.005 "	0.001				
Ti	0.01 "	0.001				
Zn	0.005 "	0.001				
As	0.001 "	0.0005				
Bi	0.001 "	0.0001				
Pb	0.001 "	0.0001				
Sb	0.005 "	0.001				
C	0.05 "					
P	0.01 "					
S	0.01 "					
O ₂	0.06 "					
N ₂	0.02 "					
H ₂	0.003 "					
Co		0.001				
Te	0.001 "	0.0005				
V		0.0001				
Mo		0.001				
Ga	0.01 "	0.001				
Ag	0.001 "	0.0001				
Cd		< 0.001				
In		< 0.001				
Ge		0.001				
Tl	0.001 "	< 0.001				

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NLC

ATF

FWM 012

11K26

JES

K29

FBW

ANALYTICAL

MISCELLANEOUS

LAB NO.

LOT NO.

DATE _____

ANALYSIS REQUESTED

Fe Cl Ta

To Only (should be $\sim 3.0\%$)

[illegible]

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JUDY

2ry

10,000
20 Drums
Hunt Spec

ANALYTICAL

FERROCOLUMBIUM

Ta (3%)

LAB NO: 89085

LOT NO: 73-931

DATE: 12/26/74

ANALYSIS REQUESTED

Cb, Ta, wet Al, wet Si, wet Ti
wet Hm, C, P, S & Spec

ELEMENT	SPECIFICATION	LIMIT OF DETECTION				
Cb	60.0 MIN	55 min 60 max	57.3			59.33
Al	.4-1. MAX	0.001	1.0 max	1.86		1.0
Ta	0.20 "	0.050	3.0 min	3.78		3.7
Si	0.20 "	0.001	3.0 max	1.42		1.42
Ni	0.10 "	0.001		0.5		
B	0.005 "	0.001		0.005		
W	0.01 "	0.010		<0.10		
Cu	0.02 "	0.001		0.03		
Cr	0.01 "	0.001		0.06		
Mg		0.001		<0.01		
Mn	0.02 "	0.001	1.7 max	1.5		<0.5
Sn	0.005 "	0.001	0.20 max	0.25		0.03
Ti	0.01 "	0.001	1.0 max	1.0		<0.5
Zn	0.005 "	0.001		<0.01		
As	0.001 "	0.0005		<0.001		
Bi	0.001 "	0.0001		<0.001		
Pb	0.001 "	0.0001	0.2 max	<0.03		<0.003
Sb	0.005 "	0.001	0.15 max	0.02		0.002
C	0.05 "		0.15 max	0.17		0.017
P	0.01 "		0.03 max	0.03		<0.03
S	0.01 "		0.03 max	0.015		0.012
O ₂	0.06 "					
N ₂	0.02 "					
H ₂	0.003 "					
Co		0.001		0.04		
Te	0.001 "	0.0005		<0.001		
V		0.0001		0.4		Particle Size Distribution
Mo		0.001		<0.01		
Ga	0.01 "	0.001		0.07		- 35 mesh 100.0
Ag	0.001 "	0.0001		<0.001		+ 325 70.0
Cd		<0.001		<0.01		
In		<0.001		<0.01		
Ge		0.001		<0.01		
Tl	0.001 "	<0.001		<0.01		

COPIES:

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FWM

JUDY

ANALYTICAL

LAB NO: 96335

FERROCOLUMBIUM

Tantalum (3%)

LOT NO:

DATE: 2/17/75

ANALYSIS REQUESTED

Wet Spec, Wet Mn, C, P, S
95-116 117-123 124-138

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	95-116	117-123	124-138	95-116	117-123	124-138
Cb 55.60 max	60.0 MIN		58.0	57.9	59.0			
Al 1.0 max	.4-1. MAX	0.001	2.36	2.44	1.58			
Ta 3.0 max	0.20 "	0.050	4.2	4.12	4.34			
Si 3.0 max	0.20 "	0.001	.5-1.0	.5-1.0	.5-1.0	1.0	0.8	0.5
Ni	0.10 "	0.001	.05-.1	.1-.15	.1-.15	.05	.075	.05
B	0.005 "	0.001				.001	.001	.001
W	0.01 "	0.010				<.01	<.01	<.01
Cu	0.02 "	0.001	.01-.05	.01-.05	.01-.05	.005	.005	.005
Cr	0.01 "	0.001	.01-.05	.01-.05	.01-.05	.02	.01	.01
Mg		0.001				.05	.001	<.001
Mn 1.7 max	0.02 "	0.001	.05-.1	.05-.1	.05-.1	.075	.050	.030
Sn .20 max	0.005 "	0.001	.05-.1	ND	ND	.075	.005	.005
Ti 1.0 max	0.01 "	0.001	.05-.1	.05-.1	.05-.1	>.1	>.1	>.1
Zn	0.005 "	0.001				<.001	<.001	<.001
As	0.001 "	0.0005				<.0005	<.0005	<.0005
Bi	0.001 "	0.0001				.0001	.0001	.0001
Pb .02 max	0.001 "	0.0001	.0075	.0075	.0075	.0075	.0075	.0075
Sb .005 max	0.005 "	0.001	.0075	.0075	.0075	.005	.005	.005
C .15 max	0.05 "		.0345	.04	.0395			
P .03 max	0.01 "		.006	<.005	<.005			
S .03 max	0.01 "		.012	.012	.013			
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001				.005	.005	.005
Te	0.001 "	0.0005						
V		0.0001	.01-.05	.01-.05	.01-.05	.075	.075	.050
Mo		0.001				<.001	<.001	<.001
Ga	0.01 "	0.001				.009	.009	.009
Ag	0.001 "	0.0001				.0001	<.0001	<.0001
Cd		<.0001				<.001	<.001	<.001
In		<.0001				.003	.002	<.001
Ge		0.001				<.001	<.001	<.001
Tl	0.001 "	<.0001				.0025	<.0005	<.0005

To: Ken Richold
Copy to: Don M

7 Heats

1/28/71-
lot 117-123

Ferrocolumbium Tantalum (3%) lot 117-~~123~~¹²³

Use Remainder of oxide Blend from Ni-Cr-N-70

Pyrochlore lot 1553A	8#	(8) #
Pyrochlore lot 1553	53 #	53 #
Moly Corp lot C-177	50 #	(61) #
Ch ₂ O ₅ , Vacuum Grade	380 #	50 #
	491 #	(110) #
		380 #
		491 #

Al Powder	197 #	(197) #
Iron Powder	175 #	175 #
NaClO ₃	44 #	(360) #
Fluorspar	50 #	44 #
Tantalum Fines	18 #	(410) #
Silicon Fines	3 #	50 #
	482 #	(460) #
		18 #
		(478) #
		3 #
		(482) #

QIT Scrap 5 #
Any Previous Fe-Cr-Ta Remelt 10 #

Frank

1/28/78

1553 A 90 #

1553 288 #

Fro: Ken Rinehold
Copy to: Don M.

22 Heats

1/23/75-

Columbium Oxide Blend #95-110
Ferrocolumbium Tantalum

	lot	wt	Ca	Sn	Ta
42.9	1930	3600 [±]	?	500	
42.9	1931	3600 [±]	?	700	
14.2	932	1200 [±]	?	150	
		8400 [±]	1.0	536	1.3

Notes:

Use 380[±] per heat.

Should have ~ ~~400~~ of Cr_2O_3 leftover
~ 400[±]

Crack

To: Ken Rinehold
Copy to: Don M

22 Heats

1/23/75

Ferrocolumbium Tantalum (3%) 6f95-16

		Drum #1
Pyrochlore lot 1553A	8	(8) #
Pyrochlore lot 1553	53	53 #
		(61) #
Moly Corp. Cl_2O_5 C-177	50	50 #
		(111) #
Cl_2O_5 , Vacuum Grade	380	380 #
	491 #	(491) #

		Drum #2
Al Powder	192 #	(192) #
Tm Powder	175 #	175 #
		(367) #
NaClO_3	46 #	46 #
		(413) #
Fluorspar	50 #	50 #
		(463) #
Tantalum Fines	18 #	18 #
		(481) #
Silica Fines	3 #	3 #
	484 #	(484) #

QIT Scrap	5 #	5 #
Any Previous FeCl ₃ Ta Remelt	10 #	10 #
		15 #

FBW
 AJF
 FWM
 JES
 BAA

ANALYTICAL
 FERROCOLUMBIUM Ta Blend
 10,000 #

LAB NO: _____
 LOT NO: _____
 DATE: _____
 ANALYSIS REQUESTED _____

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	7567 #	2,279 #	154 #	117-138C	10,000 #
Cb	60.0 MIN.		124-138	117-123	73-93	58.8	59.0
Al	.4-1.0 MAX	0.001	1.0	1.0	1.0	1.0	1.0
Ta	0.20 "	0.050	3.6	3.4	3.7	3.5	3.4
Si	0.20 "	0.001	<1.0	<1.0	1.42	<1.0	<1.0
Ni	0.10 "	0.001					
B	0.005 "	0.001					
W	0.01 "	0.010					
Cu	0.02 "	0.001					
Cr	0.01 "	0.001					
Mg		0.001					
Mn	0.02 "	0.001	<0.1	<0.1	<0.5	<0.5	<0.5
Sn	0.005 "	0.001	ND	ND	0.3	<0.1	<0.1
Ti	0.01 "	0.001	<0.1	<0.1	<0.5	<0.5	<0.5
Zn	0.005 "	0.001					
As	0.001 "	0.0005					
Bi	0.001 "	0.0001					
Pb	0.001 "	0.0001	0.075	0.075	0.03	0.009	0.008
Sb	0.005 "	0.001	0.05	0.05	0.02	0.005	0.005
C	0.05 "		0.4	0.4	0.7	0.04	0.035
P	0.01 "				<0.3		
S	0.01 "		0.13	0.12	0.12	0.013	0.012
O ₂	0.06 "						
N ₂	0.02 "						
H ₂	0.003 "						
Co		0.001					
Te		0.0005					
V		0.0001					
Mo		0.001					
Ga		0.001				- 35 mesh	100.0
Ag		0.0001				+ 325 mesh	70.0
Cd		<0.001					
In		<0.001					
Ge		0.001					

Particle Size Distribution

To: Ken Reinhold

15 Heats

1/29/75

Pyro: Don M.

Ferrocolumbium Tantalum (3%) lot 124-138

Use Remainder of oxide blend from Ni-Ce-N-70

Pyrochlore lot 1553	6 #	<u>6</u> #
Pyrochlore lot 1553 A	19 #	<u>19</u> #
Moly Corp lot C-177	97 #	<u>97</u> #
Cl ₂ O ₅ , Vacuum Grade	404 #	<u>404</u> #
	526 #	<u>526</u> #

Al Powder	200 #	<u>200</u> #
Iron Powder	195 #	<u>195</u> #
NaClO ₃	46 #	<u>46</u> #
Fluorspar	74 #	<u>74</u> #
Tantalum Finer	20 #	<u>20</u> #
Silicon Finer	3 #	<u>3</u> #
	538 #	<u>538</u> #

Q IT Scrap 5 #
Any Previous Fe-Cl-Ta Remelt 10 #

Increase Al Pwd from 191 # to 200 #
" CeFe " 50 # to 74 #
" Fe Pwd " 175 # to 195 #
" NaClO₃ " 44 # to 46 #
" Ta Finer " 18 # to 20 #

Use 404 # of Vacuum Grade Cl₂O₅. (High Ca)
Crank

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ANALYTICAL

FERROCOLUMBIUM

Tantalum (3%)

LAB NO: 90368

LOT NO: ~~90368~~

DATE: 3/24/75

ANALYSIS REQUESTED

Huntington
Spec

Ch, Ta, W, Al Spec
Wet Ti, Wet Si, Wet Mn
C, P & S

ELEMENT	SPECIFICATION	LIMIT OF DETECTION	139-158	154-178		
Cb ⁵⁶	60.0 MIN		59.04	58.99		
Al 1.0 max	.4-1. MAX	0.001	2.02	1.60		
Ta 3.0 max	0.20 "	0.050	3.39	3.71		
Si 3.0 max	0.20 "	0.001	.5-1.0	.5-1.0		
Ni	0.10 "	0.001	05	05		
B	0.005 "	0.001	<0001	<0001		
W	0.01 "	0.010	<000	<010		
Cu	0.02 "	0.001	01	01		
Cr	0.01 "	0.001	01	02		
Mg		0.001	<0001	<001		
Mn 1.0 max	0.02 "	0.001	.03	.03		
Sn .20 max	0.005 "	0.001	01	005		
Ti 1.0 max	0.01 "	0.001	.1-.5	.1-.5		
Zn	0.005 "	0.001	005	005		
As	0.001 "	0.0005	<0005	<0005		
Bi	0.001 "	0.0001	0005	001		
Pb .02 max	0.001 "	0.0001	0075	0075		
Sb .015 max	0.005 "	0.001	0025	0025		
C .15 max	0.05 "		.029	.0475		
P .03 max	0.01 "		009	0085		
S .03 max	0.01 "		013	012		
O ₂	0.06 "					
N ₂	0.02 "					
H ₂	0.003 "					
Co		0.001	008	008		
Te	0.001 "	0.0005	<0001	<0001		
V		0.0001	05	05		
Mo		0.001	<001	<001		
Ga	0.01 "	0.001	01	01		
Ag	0.001 "	0.0001	<0001	<0001		
Cd		<0.001	<001	<001		
In		<0.001	<001	<001		
Ge		0.001	<001	<001		
Tl	0.001 "	<0.001	<001	<001		

COPIES: FBW
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RHR
JUDY

ANALYTICAL
MISCELLANEOUS

LAB NO. 42858
LOT NO. 200-220
DATE 2/5/76

MATERIAL:

Fe Cb-Ta (3%)

ANALYSIS REQUESTED Cb, Ta

Wet Al, Spec, Wet Ti, Wet Si,

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	58.2						58.2			Wet Mn, C, P+S
Ta	3.4						3.4			
Sn	02						0.02			
As	<0005									
Al	1.8	1.2					1.6			
Ca										
Bi	<0001									
Cr	603									
Cu	005									
Fe										
Pb	0001						<0.001			
Mo	<001									
Mg	<001									
	015						0.015			
	.03									
Si	.30						0.30			
W	<01									
Ti	02						0.02			
Sb	004						0.004			
B	0005									
Co	005									
V	03									
~~P~~							(P) 001			
Zn	<001									
Te	<0005									
~~S~~							(S) <0.01			
N ₂										
C	025						0.025			
ga	008									
Hy	<0001									
Se	<001									
cd	<001									

RECEIVED FROM:

GRADE:

WEIGHT:

DATE RECEIVED:

90th

In
tl
n
OT 43

COPIES: FBW
KRR
FWM
RHR
JUDY

ANALYTICAL
MISCELLANEOUS

LAB NO. 96753
LOT NO. 221-239
DATE 4/15/76
ANALYSIS REQUESTED Cl, Ta

MATERIAL: Fe Cl-Ta (3%) Hunt Spec.

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	58.4			58.37		55.60		58.4		Wet Al, Wet Ti, Wet Mn Wet Si, Spec, C, P, S
Ta	3.65					3.04		3.65		
Sn	0.08					.20		0.008		
As	<0.005									
Al	1.76					1.25		~~1.25~~ 1.5		
Ca										
Bi	<0.005									
Cr	0.03									
Cu	0.06									
Fe										
Pb	<0.005					0.2		<0.001		
Mo	0.03									
Mg	<0.01									
"	0.15					1.76 max		0.015		
"	0.3									
Si	0.15					3.0		0.15		
W	<0.01									
Ti	0.15					1.0		0.015		
Sb	0.02					0.15		0.002		
B	0.01									
Co	0.05									
V	0.35									
P	<0.1					0.03		<0.01		
Zn	<0.01									
Te	<0.005									
O ₂										
N ₂										
C										
"	0.0085					0.3		<0.01		
"	0.0265					0.15		0.027		
"	0.075									
"	<0.01									

RECEIVED FROM:

GRADE:

WEIGHT:

DATE RECEIVED:

CC <0.01
D₂ <0.01
IL <0.01

COPIES: FBR
KRR
FWM
RHR
JUDY

ANALYTICAL
MISCELLANEOUS

LAB NO. 98217
LOT NO. 240-251
DATE 6/10/76

MATERIAL: Fe Cl-Ta 30%

ANALYSIS REQUESTED Cl, Ti
wet al, wet Ti, wet Mn

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	58.59					58.6			wet Si, spec, C, P & S
Ta	3.49					3.49			
Sn	01					0.01			
As	<0001								
Al	2.24					1.5			
Ca									
Bi	<0001								
Cr	003								
Cu	004								
Fe									
Pb	0001					<0.001			
Mo	003								
Mg	<001								Particle Size Distribution
	015					0.015			
Ni	025								-35 mesh 100.0 max
Si	012					0.12			+325 mesh 70.0 max
W	<01								-325 mesh 30.0 max
Ti	015					0.015			
Sb	003					0.003			
B	0001								
Co	005								
V	045								
P	0069					0.01			
Zn	<001								
Te	<0001								
O ₂									
N ₂									
C									
S	009					<0.01			
C	0225					0.023			
Ida	007								
Ag	<0001								
Se	<001								
Co	<001								
Sn	<001								

RECEIVED FROM:
GRADE:
WEIGHT:
DATE RECEIVED:

TL <001

COPIES: FBW
KRR
FWM
RHR
JUDY

2984 lbs.
2/20/76

ANALYTICAL
MISCELLANEOUS

LAB NO. 96159
LOT NO. 252-261
DATE 10/14/76

MATERIAL:

Fe-Cr-Ta

ANALYSIS REQUESTED Cr, Ta, Spec, C, P+S

	DATE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	MESH SIZE
Cb	56.32								
Ta	2.82	.7501	Resample 2.38			Aug 2.6			
Sn	002								
As	<0005								
Al									
Ca									
Bi	<0001								
Cr	008								
Cu	008								
Fe									
Pb	<0001								
Mo	002								
Mg	<001								
	03								
Ni	05								
Si	.11					252-261	750	252-261	750
W	<01					lines	809	lines	809
Ti	011					lines	936	lines	936
Sb	007					Dec lines	200	lines	200
B	0005					558-80	408	558-80	408
Co	007								
V	004								
Zr									
Zn	<001								
Te	<0005								
O ₂									
N ₂									
C	0195								
S	<0005								
Ja	006								
Hy	<0001								

3760
290
50.2

252-261 750
lines 809
lines 936
Dec lines 200
558-80 408

RECEIVED FROM: 29-
GRADE:
WEIGHT:
DATE RECEIVED: 10/14/76

COPIES: FBW
KRR
FWM
JUDY

ANALYTICAL
FERROCOLUMBIUM
Fe Cb Ta

LAB NO: 166585
LOT NO: 252-261
DATE: 9-11-86
ANALYSIS REQUESTED
Wet Al, Phos.

ELEMENT	SPECIFICATION	LIMIT OF DETECTION						
Cb	60.0 MIN							
Al	.4-1.MAX	0.001	2.90					
Ta	0.20 "	0.050	~~2.90~~					
Si	0.20 "	0.001						
Ni	0.10 "	0.001						
B	0.005 "	0.001						
W	0.01 "	0.010						
Cu	0.02 "	0.001						
Cr	0.01 "	0.001						
Mg		0.001						
Mn	0.02 "	0.001						
Sn	0.005 "	0.001						
Ti	0.01 "	0.001						
Zn	0.005 "	0.001						
As	0.001 "	0.0005						
Bi	0.001 "	0.0001						
Pb	0.001 "	0.0001						
Sb	0.005 "	0.001						
C	0.05 "							
P	0.01 "		0.051					
S	0.01 "							
O ₂	0.06 "							
N ₂	0.02 "							
H ₂	0.003 "							
Co		0.001						
Te	0.001 "	0.0005						
V		0.0001						
Mo		0.001						
Ga	0.01 "	0.001						
Ag	0.001 "	0.0001						
Cd		< 0.001						
In		< 0.001						
Ge		0.001						
Tl	0.001 "	< 0.001						

Attachment A.5

Interview of Revere Employees

On January 23, 2001, two current employees (Joseph Cassarella and Dale Stangle) at the Revere facility were interviewed by Steffan R. Helbig (STEP) regarding paving in the loading dock area, production records, records relating to the inventory of radiological slag, and information on historical, archeological, or endangered species issues. This summarizes the highlights of that interview

They stated that they recalled that the paving in the loading dock area was present from approximately 1967 to date. Statements to that effect from employees at the time were requested. They stated that the production "melts" typically resulted in ½ product and ½ slag. They were not aware of any historical, archeological, or endangered species issues related to the site.

They provided the following information:

- Production records for 1976 showing the last production "melts" of radiological ore
- Records from the quality assurance (QA) laboratory that recorded the analyses of numerous production lots and the proportions of ingredients used for those lots
- Four thorium and uranium analyses of slag samples performed by the QA laboratory
- A report by the remediation contractor on the 1993 decommissioning of the old pit area

This information has been used in the evaluation and included in the attachments to this appendix.

Attachment A.6

Bullinger's Mill, Inc., 1990 Invoices for Remediation



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

February 12, 1990

Cabot Corporation
County Line Road
Boyertown, PA. 19512
Attn: Mr. William Gannon

REF: Initial Survey at Penn Rare Metals Div., Cabot Corp.

Dear Mr. Gannon:

Bullinger's Mill, Inc., hereafter referred to as the Contractor, will provide to Cabot Corporation, hereafter referred to as the Company, the following, on a time and material basis:

Supervisor and one labor at the rate of \$42.00 per hour.
Travel time at the rate of \$30.00 per day per man.
Office time (maps, reports, etc.) at the rate of \$20.00 per hour.

The Contractor will provide all usual hand tools.

The Company will provide all survey instruments.

The Contractor will maintain records of all surveys and submit maps, samples, and smears to the Company. The Contractor will work to the best of his ability, and to the best of the instruments furnished him by the Company, but he cannot guarantee his work.

Bullinger's Mill, Inc.
Joseph J. Bullinger,
President

Invoice

BULLINGER'S MILL, INC.
 Grade K.D. Native Hardwoods
 RD 4 Box 4363 Rapp Rd.
 FLEETWOOD, PENNSYLVANIA 19522

No.

Date April 16, 1990

Your Order No.

Shipped to

- Penn Rare Metals
- Revere, Pa.

Sold To

- Cabot Corp.
- County Line Rd.
- Boyertown, Pa. 19512

Our Order No.		Salesman	Terms	F.O.B.	Date Shipped		Shipped VIA	
Quantity Ordered	Quantity Shipped	Stock Number/Description			Unit Price		Unit	Amount
Feb 13		Travel Time - 2 men @ \$30 ee			42	00	hr	60 00
		2 men 7.5 hrs			20		hr	315 00
Feb 14		Office Time 2 hrs					hr	40 00
Feb 20		Travel Time 2 men @ 30 ee			42		hr	60 00
		2 men 7.5 hrs			20		hr	315 00
March 14		Travel Time 2 men @ 30 ee			42		hr	60 00
		2 men 7.5 hrs			20		hr	315 00
April 13		Office Time 4 hrs					hr	80 00
		Office expence - photo - Phone - Postage						17.60
		Total Due						1262.60

Wilson Jones
 GRAYLINE FORM 44-411 3-PART
 ©1983 • PRINTED IN U.S.A.

Original / Invoice

85



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Received
4/18/90 WCG

April 16, 1990

Mr. William C. Gannon
Cabot Corporation
County Line Road
Boyertown, PA 19512

Dear Mr. Gannon:

The results of our survey at the Revere Plant are as follows:

February 13, 1990: A walk-around survey was done. A high reading was found behind Building #5. An elevated reading was found beside the warehouse - Building #25. At several spots in the empty-drum storage area, elevated readings were noted. First drafts of Key Maps were made, and one survey was completed at the Old Pit.

February 20, 1990: Survey was completed at the Old Pit and one survey was completed behind Building #5.

March 14, 1990: Sample and picture of same were taken behind Building #5. Survey of drum storage area, Key Map 31, was completed.

Enclosed please find survey maps and pictures. If I can be of additional assistance, please notify me.

Thank you,

Joseph J. Bullinger
Joseph J. Bullinger
President



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Sept. 13, 1990

Cabot Corp.
Beaver Run Road
Revere, Pa. 18953
Att: Mr. Joseph Casseralla

Report of cleanup at Revere Plant:

Sept. 4, 1990: Area on Map 1A. Clean up areas F5, E5, & C5.
Map 1 (The old pit) C1, C2, B2. About 2000# slag found in the
above areas.

Time:

Equpment 10.5 hrs.
Labor 8
Travel 2 men

Sept. 5, 1990 Working on empty drum and used equpt. area.
No. 31 on plant map. Map #2. Areas E2, D1, D2, D3, & C3.

Time:

Equpt: 8 hrs.
Labor 8 hrs.
Travel 2 men

Sept. 10, 1990 Key 31. Map #2. E2, D1, D2, D3, C3, B1, B2, A1, A2.
Map #4, E1, E2, D1, & D2. Cleaning above areas.

Time:

Equpt: 8.5 hrs.
Labor; 8.5 hrs.
Travel 2 men

Sept. 11, 1990 Key Map 31. Map #2. A1, A2, B1, B2. Map #4. E1, E2, D1 & D2.
Load and haul approx. 5 ton slag to Boyertown.

Time:

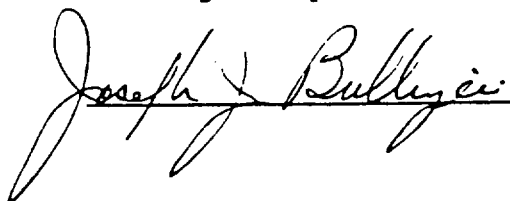
Equpt 11 hrs.
Labor 7 hrs.
Travel 1 man.

Sept. 12, 1990. Map #2. D5. Map #1 D1.

Time:

Equpt: 8 hrs.
Labor: 8 hrs.
Travel: 2 men.

Large chunks of slag were found in all the above areas, with a
reading of up to "200" on the Ludium Meter.

 Joseph J. Bullinger.



BULLINGER'S MILL, INC.
RD 4 Box 4363 Rapp Rd.
FLEETWOOD, PENNSYLVANIA 19522

(215) 944-8364

TO Cabot Corp.
Beaver Run Rd.
Revere, Pa. 18953

ATT: J. Casseralla.

*Copy to
Bill
and J. R.
JWC*

0086

INVOICE DATE Sept 13, 1990	SALESPERSON
SHIP TO Work @ Revere Plant. Cleanup	

YOUR ORDER NO.	DATE SHIPPED		SHIPPED VIA	FOB POINT	TERMS	Due.	
QTY. ORDERED	B/O	QTY. SHIPPED	DESCRIPTION		UNIT PRICE	TOTAL	
46 hrs			Egypt.		\$34	\$1564	
39.5 hrs			Labor		\$15	592.50	
9 ea.			Travel Time		30	270.00	
1 hr. MATH			Office Time			28.00	
1 hr. MATH	2nd Check	Final OK	Batteries for meter			9.04	
DATE			Accts. Cleared	Due.		\$2458.59	
IBM ACCT. NO.	6173-0433						

ORIGINAL

PRODUCT 121-2, AVECO, Inc., Groton Mass 01471 To Order PHONE TOLL FREE 1-800-225-6380

Thank You



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Sept. 13, 1990

Cabot Corp.
Beaver Run Road
Revere, Pa. 18953
Att: Mr. Joseph Casseralla

Report of cleanup at Revere Plant:

Sept. 4, 1990: Area on Map 1A. Clean up areas F5, E5, & C5.
Map 1 (The old pit) C1, C2, B2. About 2000# slag found in the
above areas.

Time:

Equipment 10.5 hrs.
Labor 8
Travel 2 men

Sept. 5, 1990 Working on empty drum and used equpt. area.
No. 31 on plant map. Map #2. Areas E2, D1, D2, D3, & C3.

Time:

Equpt: 8 hrs.
Labor 8 hrs.
Travel 2 men

Sept. 10, 1990 Key 31. Map #2. E2, D1, D2, D3, C3, B1, B2, A1, A2.
Map #4, E1, E2, D1, & D2. Cleaning above areas.

Time:

Equpt: 8.5 hrs.
Labor; 8.5 hrs.
Travel 2 men

Sept. 11, 1990 Key Map 31. Map #2. A1, A2, B1, B2. Map #4. E1, E2, D1 & D2.
Load and haul approx. 5 ton slag to Boyertown.

Time:

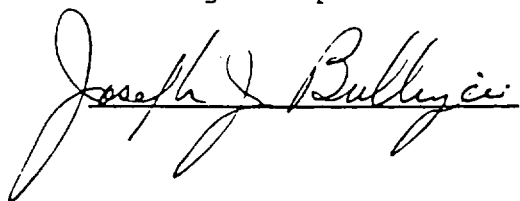
Equpt 11 hrs.
Labor 7 hrs.
Travel 1 man.

Sept. 12, 1990. Map #2. D5. Map #1 D1.

Time:

Equpt: 8 hrs.
Labor: 8 hrs.
Travel: 2 men.

Large chunks of slag were found in all the above areas, with a
reading of up to "200" on the Ludium Meter.

 Joseph J. Bullinger.



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Oct. 1, 1990

Cabot Corp.
Beaver Run Rd.
Revere, Pa. 18953
Att. Mr. J. Casseralla.
Ref. Clean up at Revere Plant.

Sept. 18, 1990. Key Map 31. Map 1, A1. Map 3, E1&D1. Clean up heavy chunks of slag. Haul 4 tons to Boyertown.

Time: Eqp't. 12 hrs.
Labor 8
Travel 1 man.

Sept. 19, 1990 Key map 31. Map 3, E1&D1. Map 4, E4, E5, D4&D5. Clean up heavy chunks of slag. Haul 5 tons slag to Boyertown.

Time: Eqp't. 11 hrs.
Labor 8
Travel 1 man.

Sept. 20, 1990 Key Map 31. Map 4, E4, E3, & D3. Map 3, D2. Slag again. Haul 5 ton slag to Boyertown.

Time Eqp't. 10.5 hrs
Labor 8
Travel 1 man

Sept. 24, 1990 Key Map 31, Map 3, D1. Finish area. Haul 5 tons slag to Boyertown.

Time: Eqp't. 10.5 hrs.
Labor 8
Travel 1 man

Sept. 25, 1990. Key Map 31. Map 6, A5. Clean up area. 4 drums loose material removed. D1. Loose slag on surface removed.

Map 5, C1, C2, D1&D2. Slag removed. C1, remove surface slag.

Map 6, D1&E1. Clean area. Haul 4 drums & 2 ton slag to Boyertown.

Time: Eqp't: 10 hrs.
Labor 8
Travel 1 man

Sept. 26, 1990 Haul eqp't. home.

Time: Eqp't. 3 hrs.

A final survey will be made when finish grading is completed by the company.

Joseph J. Bullinger for Bullinger's Mill, Inc.
Joseph J. Bullinger Pres.

cc William Gannon.

Received
10/22/90



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Oct. 19, 1990

Cabot Corp.
Bever Run Road.
Revere, Pa. 18953
Att: Mr. Joseph Casseralla.

The results of our final survey at the Revere Plant are as follows:

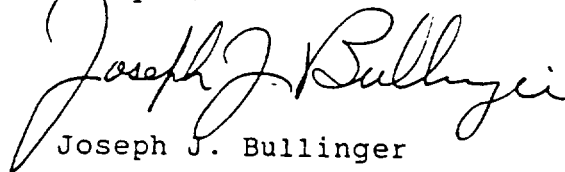
Oct. 17, 1990. All areas that were cleaned up were surveyed. (See enclosed maps.) All areas were well under the approved limits. Three small drums of slag were found at the drum storage area. (Key map 31, C4). These were hauled to Boyertown.

We can find no further evidence of any elevated readings on the site.

Drum storage area has been graded.

Enclosed please find survey maps and pictures. If I can be of additional assistance, please contact me.

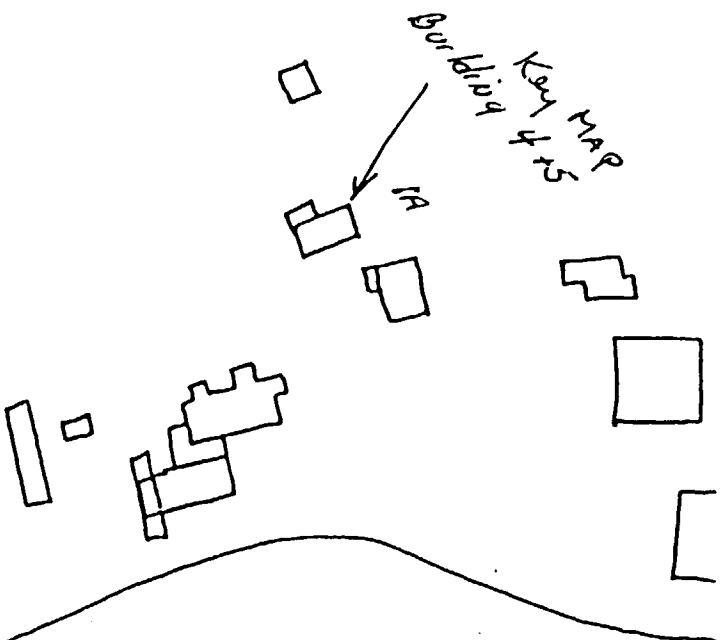
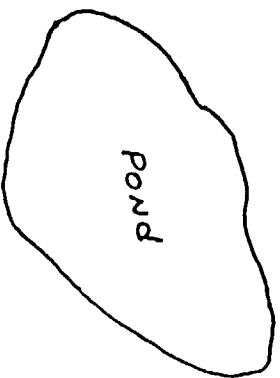
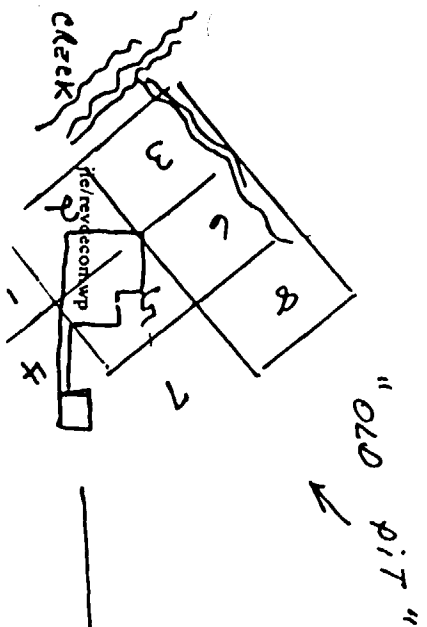
Thank you,


Joseph J. Bullinger

cc Bill Gannon.

KBI- REVERE AREA MAP

Note: hand drawn map
NOT TO SCALE used
before 1982 for quarterly
survey work by WDC



1	2	3	4	5	6	7	8

Key Map 31

David D 1990
by Joe/Barni
meeting 2/19

W/8/82

Attachment A.7

Cabot Internal Memos Regarding 1992 Remediation

CABOT

TO: RS Barron

DATE: November 5, 1992

FROM: WC Gannon

SUBJECT: Historical Review of REVERE Decontamination (1990 - 1992)

cc: Dr. C McGee (RMC), ATCampitelli, FBWhite, AJHickl

1990	January 15	Letter to Gerry LeRoche NRC. All Revere slag was returned to Boyertown.
	May 7, 8	NRC <u>visit</u> Boyertown, Revere, Reading; Tin Mo, Jerry Swift, Keith McDaniel
1991	February 4	<u>Blue Report</u> to NRC Clean up - Survey of Revere; awaiting Core sample
	March 5	Letter to NRC 10 Core samples (Drum Storage Area and Lower Pit)
	March 27	Letter to NRC Release Revere for Unrestricted Use
	July	ORAU Confirmatory Survey Team at Revere
1992	May	SDMP - News Release "CABOT" 3 sites
	July 23	ORAU Revere Report sent to Pete Kostmayer
	July 27	Visit Pete Kostmayer, (3) NRC at Revere
	July 28	K. McDaniel with J. Bullinger at Revere; Decision to dig a trench at Lower Pit
	August 3	To Boyertown with 1st four drums of Radio Slag from Lower Pit (estimate 12 to 15 thousand pounds were eventually removed)
	September 22	Visited Revere with Jim Bondick, Region I NRC and Dr. C. McGee, RMC consultant. Learned about J. Bullinger find of hot spot behind Sand Blast area.
	October 26	Finished clean up of road bed at Sand Blast (removed estimate 33-36 thousand pounds of slag)
	October 28	Dig a confirmatory trench at barrel storage area 20' long in the center (removed 450 pounds of slag)
	October 29	Keith McDaniel NRC Washington called for a report on our progress. Keith suggests that his management have lost faith in our effort; (1) We submitted a letter 3-27-91 for release for unrestricted use with confirmatory survey and core samples indicating nothing found. (2) We continue to find large deposits at each confirmatory trench. He requested by November 10th I supply to him a written plan for decontamination and decommissioning.
	November 2	Plan with R. Barron and A. Campitelli to meet Wednesday 11-4-92 to review.
	November 4	Meeting with R. Barron, A. Campitelli, conference call with Fred B. White. Decide a professional D & D company is needed to finish the job as we have insufficient equipment and/or expertise to finish because of the extent of the contamination found. W. Gannon to ask Dr. McGee RMC Radiation Safety consultant for help in finding D & D companies.

CABOT

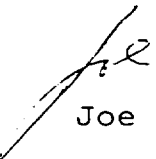
TO: A.T. Campitelli DATE: 10/14/92
FROM: J.R. Cassarella
SUBJECT: Update On Revere Radiation Issues.
COPIES: Mark Hague, Bill Gannon, Fred White.

Work has been completed at the old pit site. Samples of Rapp Creek were taken as requested by Bill Gannon and he has received the results.

We also monitored one of Cabot's employees, while he was removing the slag, for airborne dust. John Stankas has the samples and they are to be analyzed. We are planing to restore the old pit site to a more natural condition. Please let us know if the NRC will release this area so we may proceed.

We found an area of radioactive slag at the ravine burial site and are ~90% complete in removal. Our plans are to refill the hole we dug with the clean slag we removed. Do we need to have this area surveyed by the NRC? Should we even discuss this area with the NRC? The area by our boiler room showed no indication of buried radioactive material.

We will be ready to trench at the drum storage area in ~1 week. Please let us know where and how you want this trenched.


Joe Cassarella

Cabot Corporation
Beaver Run Road
Revere, Pennsylvania 18953
Phone: 215 847-5121

Attachment A.8

Bullinger's Mill, Inc. Report on 1993 Remediation Effort



BULLINGER'S MILL, INC.

RD 4 BOX 4363 RAPP RD. FLEETWOOD, PENNSYLVANIA 19522
(215) 944-8364

Dec. 4, 1993

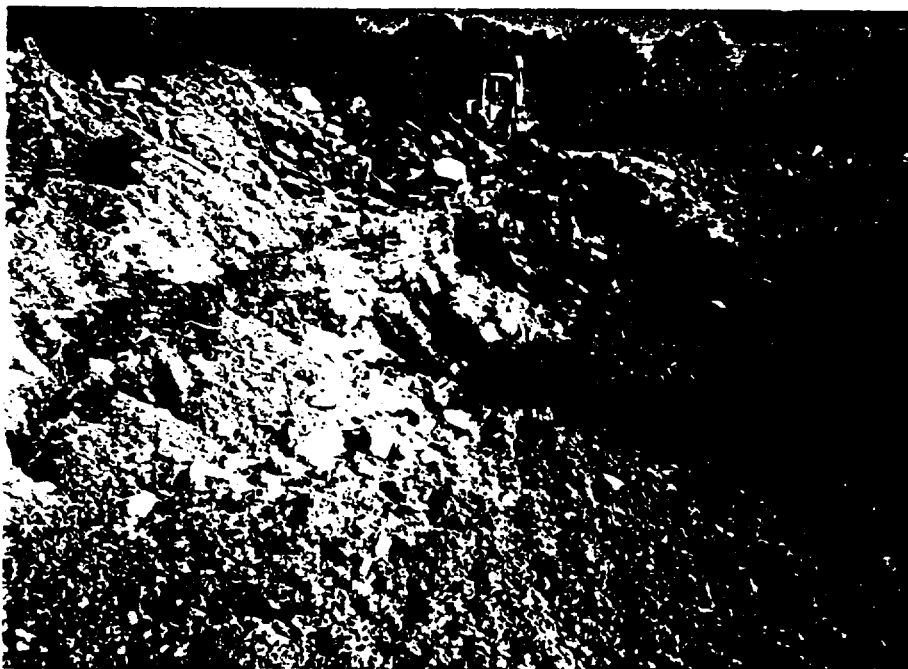
On Aug. 30, 1993 Bullinger's Mill, Inc. started to clean up the Drum Storage area at the Revere, Pa. plant of Cabot Corp.

Meters used were Ludlum, Model 19. Background readings were taken each day at the front of the office in the Revere Plant. Background readings ranged from 12 to 13 Micro R's. All material above 20 Micro R's was to be removed.

The first step was to clear the area of drums and machinery. This was done by Cabot's workers.

Person
KK P-1624

Then the area was excavated to virgin soil



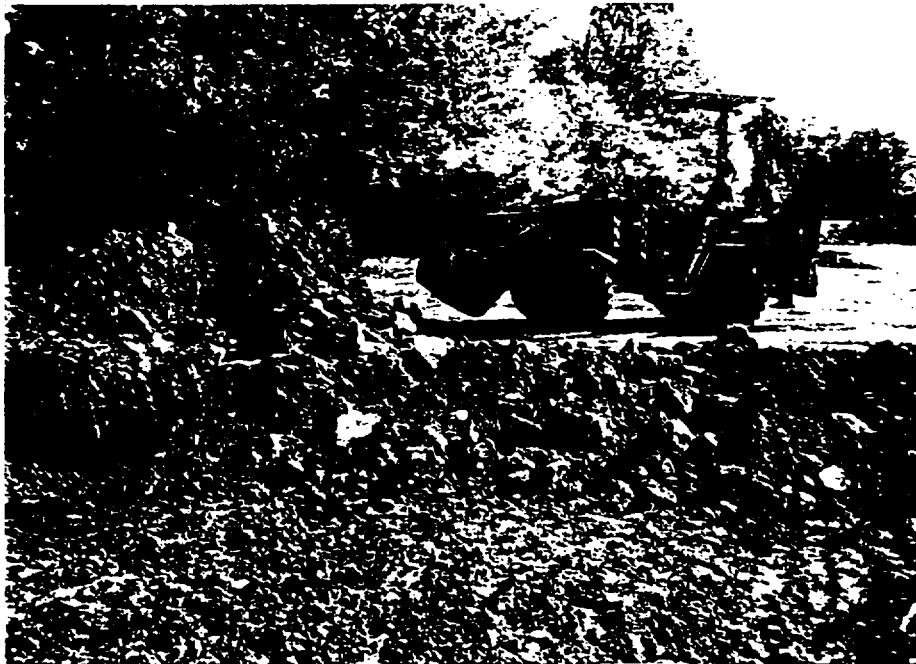
The material removed averaged 1 meter deep and consisted of slag, soil, shale, and stones.



Material was piled up by the primary excavator.



Then rehandled and spread with a smaller front end loader



The material was then spread out in thin layers and surveyed with the Ludlum meters. All material reading over 20 m/r was hand picked and placed in drums. The area was double checked either by the same person or another worker, at ground level.



Material with readings below 20 m/r was then pushed into a windrow.



More of the fill material was then spread.



The clean material was then pushed into a stockpile to be used to refill the excavation. This pile was repeatedly resurveyed.



The excavated area was surveyed and all "hot" slag removed.



Clean up stopped Oct.31, 1993, due to the weather, and can resume in the spring of 1994.

A total of 47 drums of slag, averaging 700 lbs.each was removed and hauled to Boyertown Plant of Cabot, Inc.

Attachment A.9

Aerial Photograph of Warehouse Area (April 8, 1970)



Attachment A.10
Cabot Employee Statements

CABOT

February 7, 2001

Mr. Stefan Helbig, P.G.
ST Environmental Professionals, Inc.
114 Lutz Road
Boyertown, PA 19512

Dear Mr. Helbig,

I was employed by Penn Rare Metals(Kawecki Chemical Co.)(Cabot Berylco Industries)(Cabot Performance Materials) during the months of June, July and August of 1967, as a part-time employee. I am currently a full time employee of Cabot Performance Materials.

To the best of my recollection during the months stated above, the warehouse(which was a balloon) was situated on the paved macadam which is still present today.

Sincerely,


Greg Snyder

Cabot Performance Materials

P.O. Box 239

377 Beaver Run Road

Revere, Pennsylvania 18953

Phone: 610-847-5121

Fax: 610-847-8086

CABOT

February 8, 2001

Mr. Stefan Helbig, P.G.
ST Environmental Professionals, Inc.
114 Lutz Road
Boyertown, PA 19512

Dear Mr. Helbig,

I have been employed by Penn Rare Metals(Kawecki Chemical Co.)(Cabot Berylco Industries)(Cabot Performance Materials) as of 1966, as a full-time employee. I am currently a full time employee of Cabot Performance Materials.

To the best of my recollection, the warehouse(which was a balloon) was situated on the paved macadam prior to 1970.

Sincerely,

 2/8/01

Dale Stangil

Cabot Performance Materials

P.O. Box 239

377 Beaver Run Road

Revere, Pennsylvania 18953

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APPENDIX B

Gamma Spectroscopy and Leach Test Results

PROJECT NUMBER 1295073V L202
FIELD GROUP RNESB2

PROJECT NAME NES
LAB COORDINATOR JEFF SHAMIS

				URANIUM		THORIUM DECAY PRODUCTS				
PARAMETER:				U	AC-228	BI-212	PB-212	TL-208		
UNITS:				UG/G	PCI/G	PCI/G	PCI/G	PCI/G		
				AS RECEIVED	DRIED	DRIED	DRIED	DRIED		
FLD.GRP.	#	SAMPLE ID	DATE							

RDSLAG1										

RNESB2	1	RDSLAG1	11/07/95	676	316 +/- 2.43	2.17 +/- 0.153	297 +/- 1.58	105 +/- 0.976		
RNESB2	11	RDS-OXSU4	11/07/95	6.90	NRQ	NRQ	NRQ	NRQ		
RNESB2	21	RDS-OXSU6	11/07/95	1.68	NRQ	NRQ	NRQ	NRQ		
RNESB2	31	RDS-OXSUT	11/07/95	8.93	NRQ	NRQ	NRQ	NRQ		
RNESB2	41	RDS-RAU	11/07/95	1.81	NRQ	NRQ	NRQ	NRQ		
RNESB2	51	RDS-SAU	11/07/95	0.201	NRQ	NRQ	NRQ	NRQ		
RNESB2	61	RDS-TAU	11/07/95	85.8	NRQ	NRQ	NRQ	NRQ		

RVSLAG1										

RNESB2	2	RVSLAG1	11/07/95	220	10.8 +/- 0.666	6.62 +/- 1.31	9.61 +/- 0.390	3.82 +/- 0.237		
RNESB2	12	RVS-OXSU4	11/07/95	0.031	NRQ	NRQ	NRQ	NRQ		
RNESB2	22	RVS-OXSU6	11/07/95	0.052	NRQ	NRQ	NRQ	NRQ		
RNESB2	32	RVS-OXSUT	11/07/95	0.081	NRQ	NRQ	NRQ	NRQ		
RNESB2	42	RVS-RAU	11/07/95	0.128	NRQ	NRQ	NRQ	NRQ		
RNESB2	52	RVS-SAU	11/07/95	0.034	NRQ	NRQ	NRQ	NRQ		
RNESB2	62	RVS-TAU	11/07/95	0.824	NRQ	NRQ	NRQ	NRQ		

RSP#41										

RNESB2	3	RSP#41	11/07/95	49.6	37.5 +/- 0.964	<0.276 +/- 0.061	39.3 +/- 0.699	12.8 +/- 0.413		
RNESB2	43	RSP-RAU	11/07/95	0.186	NRQ	NRQ	NRQ	NRQ		
RNESB2	53	RSP-SAU	11/07/95	0.826	NRQ	NRQ	NRQ	NRQ		
RNESB2	63	RSP-TAU	11/07/95	8.13	NRQ	NRQ	NRQ	NRQ		

*ES2 Samples 1-3 received from NES.

Others numbers setup in-house to document results of RAU/SAU/TAU and oxidation-state determinations.

**IDs of OXSUi = Oxidation State of Uranium where i = 4, 6, or Total.

 **** GAMMA SPECTRUM ANALYSIS ****

Report Generated On : 1-01-90 12:51:29 AM

Sample Title : Marinelli Beaker
 Spectrum Description : SLAG-REVERE
 Sample Identification : RVSLAG1
 Sample Type : mar
 Sample Geometry :

Peak Locate Threshold : 5.00
 Peak Locate Range (in channels) : 1 - 4096
 Peak Area Range (in channels) : 1 - 4096
 Identification Energy Tolerance : 1.500 keV

Sample Size : 1.045E+03 grams

Sample Taken On : 11-21-95 11:38:23 AM
 Acquisition Started : 11-21-95 11:38:23 AM

Live Time : 600.0 seconds
 Real Time : 615.4 seconds

Energy Calibration Used Done On : 11-21-95
 Efficiency Calibration Used Done On : 11-21-95

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

Detector Name: DET01

Sample Title: Marinelli Beaker

Peak Analysis Performed on: 1-01-90 12:51:40 AM

Peak Analysis From Channel: 1

Peak Analysis To Channel: 4096

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
	1	50-	67	58.66	25.97	3.50E+03	291.71	5.74E+03
M	2	103-	145	119.89	56.67	1.94E+03	231.94	1.10E+04
m	3	103-	145	133.41	63.45	1.49E+03	192.88	1.24E+04
M	4	145-	199	159.60	76.59	4.46E+03	249.97	6.96E+03
m	5	145-	199	173.34	83.47	8.77E+02	128.86	6.93E+03
m	6	145-	199	179.91	86.77	1.94E+03	161.62	7.61E+03
m	7	145-	199	190.66	92.16	3.09E+03	200.49	6.90E+03
	8	290-	298	293.34	143.65	6.75E+02	233.39	6.36E+03
	9	371-	385	376.91	185.56	5.49E+03	344.96	8.86E+03
	10	411-	428	420.94	207.64	4.29E+02	335.45	8.88E+03
M	11	469-	496	481.85	238.18	4.06E+03	192.95	3.36E+03
M	12	469-	496	488.41	241.47	5.61E+03	236.05	3.53E+03
	13	501-	528	518.80	256.71	8.56E+02	388.80	8.55E+03
	14	538-	551	544.95	269.83	7.72E+02	220.73	4.33E+03
A	15	583-	610	594.66	294.75	1.16E+04	347.39	2.37E+03
m	16	583-	610	604.12	299.50	3.23E+02	76.77	2.49E+03
M	17	656-	687	660.39	327.71	1.46E+02	67.40	1.71E+03
m	18	656-	687	680.51	337.81	6.97E+02	134.73	1.90E+03
	19	694-	717	707.59	351.38	2.12E+04	385.19	4.35E+03
	20	906-	933	922.71	459.26	5.61E+02	220.37	2.68E+03
M	21	953-	983	963.60	479.77	7.71E+01	55.07	5.89E+02
m	22	953-	983	977.37	486.67	1.06E+02	68.14	5.75E+02
	23	1013-	1046	1026.33	511.22	8.09E+02	233.89	2.56E+03
	24	1156-	1174	1168.12	582.32	1.33E+03	151.56	1.38E+03
	25	1203-	1229	1220.82	608.75	1.55E+04	299.07	1.79E+03
	26	1327-	1341	1332.99	665.00	4.13E+02	99.75	7.57E+02
	27	1449-	1463	1456.35	726.86	3.00E+02	92.66	6.73E+02
	28	1525-	1549	1537.63	767.62	1.46E+03	156.61	1.19E+03
M	29	1569-	1621	1573.11	785.41	3.57E+02	68.67	4.59E+02
m	30	1569-	1621	1591.18	794.47	1.36E+02	41.52	5.17E+02
m	31	1569-	1621	1613.73	805.78	3.34E+02	62.75	4.74E+02
	32	1670-	1688	1678.76	838.39	1.14E+02	107.93	8.65E+02
	33	1718-	1727	1721.34	859.74	1.46E+02	62.86	3.93E+02
	34	1816-	1833	1823.03	910.74	7.95E+02	114.63	8.08E+02
	35	1861-	1875	1868.49	933.54	6.97E+02	95.17	5.77E+02
M	36	1913-	1946	1929.36	964.06	2.36E+02	48.04	4.77E+02
m	37	1913-	1946	1938.15	968.46	5.52E+02	80.87	4.73E+02
	38	1997-	2019	2004.18	1001.58	2.18E+02	110.16	7.59E+02
	39	2226-	2254	2239.73	1119.70	3.10E+03	163.09	8.27E+02
	40	2299-	2319	2309.56	1154.71	3.83E+02	91.15	4.91E+02
	41	2464-	2485	2474.79	1237.57	1.16E+03	104.52	4.48E+02
	42	2550-	2570	2560.35	1280.47	2.78E+02	83.60	4.25E+02

	Peak No.	ROI start	ROI end	Peak centroid	Energy (keV)	Net Peak Area	Net Area Uncert.	Continuum Counts
M	43	2744-	2774	2752.95	1377.06	8.06E+02	91.75	2.64E+02
M	44	2744-	2774	2768.11	1384.66	9.50E+01	29.67	2.72E+02
M	45	2793-	2821	2800.77	1401.04	2.33E+02	45.49	2.53E+02
M	46	2793-	2821	2813.29	1407.31	4.37E+02	67.95	2.72E+02
	47	2911-	2925	2918.12	1459.88	1.38E+02	60.65	2.85E+02
	48	3008-	3022	3015.04	1508.49	2.82E+02	70.83	3.56E+02
	49	3154-	3175	3165.26	1583.82	1.74E+02	74.71	3.41E+02
	50	3307-	3325	3318.18	1660.50	1.90E+02	54.29	1.71E+02
	51	3445-	3464	3454.69	1728.96	5.32E+02	61.29	1.27E+02
	52	3509-	3540	3524.22	1763.82	2.53E+03	116.17	1.96E+02
	53	3680-	3699	3689.78	1846.84	2.94E+02	53.64	1.30E+02

M = First peak in a multiplet region
O = Other peak in a multiplet region
S = Fitted singlet

Errors quoted at 1.960 sigma

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

Sample Title: Marinelli Beaker
Nuclide Library Used: C:\PROCOUNT\CAMFILES\CABOT.NLB

IDENTIFIED NUCLIDES

Nuclide Name	Id Confidence	Energy (keV)	Yield (%)	Activity (pCi/gram)	Activity Uncertainty
K-40	0.941	1460.81*	10.67	8.062E+00	1.845E+00
SR-92	0.964	1383.94*	90.00	6.404E-01	1.259E-01
RU-106	0.523	511.85*	20.60	1.166E+01	1.797E+00
		621.84	9.80		
CD-109	0.893	88.03*	3.72	2.687E+01	1.864E+01
LA-140	0.308	328.77*	20.50	1.461E+00	3.470E-01
		487.03*	45.50	6.632E-01	2.191E-01
		815.85	23.50		
		1596.49	95.49		
TL-208	0.961	510.84*	21.60	2.870E+01	4.421E+00
		583.14*	86.00	1.333E+01	9.866E-01
BI-212	0.754	452.83	0.35		
		727.17*	11.80	1.014E+01	1.644E+00
		1620.56	2.75		
PB-212	0.985	77.11*	17.50	6.569E+00	8.110E+00
		238.63*	44.60	1.587E+01	7.341E-01
BI-214	0.975	609.31*	46.30	1.159E+02	5.396E+00
		1120.29*	15.10	1.061E+02	4.140E+00
		1764.49*	15.80	1.295E+02	2.784E+01
PB-214	0.985	295.00*	19.20	1.156E+02	3.594E+00
		351.92*	37.20	1.226E+02	4.219E+00
RA-226	0.970	186.21*	3.28	2.738E+02	2.493E+01
AC-228	0.962	338.32*	11.40	1.278E+01	1.324E+00
		911.60*	27.70	1.325E+01	1.017E+00
		969.11*	16.60	1.588E+01	1.236E+00
PA-234M	0.979	1001.03*	0.59	1.798E+02	4.655E+01
U-235	0.998	143.76*	10.50	9.607E+00	2.030E+00
		185.71*	54.00	1.663E+01	1.538E+00

* = Energy line found in the spectrum.

Energy tolerance used was 1.500

Nuclide confidence index threshold = 0.30

Errors quoted at 1.960 sigma

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

Peak Locate Performed on: 1-01-90 12:51:32 AM
Peak Locate From Channel: 1
Peak Locate To Channel: 4096

Peak No.	Energy (keV)	Peak Size in Counts per Second	Peak CPS ± Uncertainty
1	25.97	5.8288E+00	8.34
M 2	56.67	3.2292E+00	11.97
m 3	63.45	2.4825E+00	12.95
m 5	83.47	1.4621E+00	14.69
m 7	92.16	5.1517E+00	6.49
10	207.64	7.1542E-01	78.15
m 12	241.47	9.3503E+00	4.21
13	256.71	1.4267E+00	45.42
14	269.83	1.2862E+00	28.60
m 16	299.50	5.3775E-01	23.79
20	459.26	9.3583E-01	39.25
M 21	479.77	1.2854E-01	71.40
26	665.00	6.8750E-01	24.18
28	767.62	2.4337E+00	10.72
M 29	785.41	5.9567E-01	19.21
m 30	794.47	2.2732E-01	30.44
m 31	805.78	5.5734E-01	18.76
32	838.39	1.9083E-01	94.26
33	859.74	2.4250E-01	43.20
35	933.54	1.1625E+00	13.64
M 36	964.06	3.9403E-01	20.32
40	1154.71	6.3854E-01	23.79
41	1237.57	1.9379E+00	8.99
42	1280.47	4.6292E-01	30.10
M 43	1377.06	1.3438E+00	11.38
M 45	1401.04	3.8894E-01	19.49
m 46	1407.31	7.2817E-01	15.55
48	1508.49	4.6958E-01	25.14
49	1583.82	2.9000E-01	42.93
50	1660.50	3.1667E-01	28.57
51	1728.96	8.8583E-01	11.53
53	1846.84	4.9000E-01	18.25

M - First peak in a multiplet region
m - Other peak in a multiplet region
F - Fitted singlet

Errors quoted at 1.960 sigma

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

Detector Name: DET01
Sample Geometry:
Sample Title: Marinelli Beaker
Nuclide Library Used: C:\PROCOUNT\CAMFILES\CABOT.NLB

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gram)	Nuclide MDA (pCi/gram)
	BE-7	477.59	10.42	7.87E+00	7.87E+00
+	K-40	1460.81*	10.67	5.66E+00	5.66E+00
	SC-46	889.25	99.98	9.10E-01	9.10E-01
		1120.51	99.99	1.61E+00	
	CO-56	846.75	99.96	8.91E-01	8.91E-01
		1238.25	67.00	1.77E+00	
	CO-57	122.06	85.51	1.07E+00	1.07E+00
		136.48	10.60	1.00E+01	
	CO-60	1173.22	100.00	8.34E-01	8.07E-01
		1332.49	100.00	8.07E-01	
	SE-75	121.11	16.70	5.42E+00	1.60E+00
		136.00	59.20	1.79E+00	
		264.65	59.80	1.60E+00	
		279.53	25.20	3.62E+00	
	KR-85	513.99	0.43	1.99E+02	1.99E+02
	KR-85M	151.18	75.30	1.55E+00	1.55E+00
		304.87	14.00	7.05E+00	
	SR-85	513.99	99.27	8.63E-01	8.63E-01
	Y-88	898.02	93.40	9.89E-01	9.89E-01
		1836.01	99.38	9.98E-01	
+	CD-109	88.03*	3.72	5.67E+00	5.67E+00
	SN-113	391.69	64.90	1.32E+00	1.32E+00
	CS-134	604.70	97.60	2.23E+00	1.12E+00
		795.84	85.40	1.12E+00	
	CS-136	340.57	48.50	2.02E+00	8.58E-01
		818.50	99.70	8.58E-01	
	CS-137	661.65	85.12	1.02E+00	1.02E+00
	CS-138	462.79	30.70	3.05E+00	1.25E+00
		1009.78	29.80	3.33E+00	
		1435.86	76.30	1.25E+00	
	CE-139	165.85	80.35	1.39E+00	1.39E+00
	BA-141	190.22	49.00	3.02E+00	3.02E+00
		276.99	24.60	4.58E+00	
		304.24	26.60	5.13E+00	
	HG-203	279.19	77.30	1.19E+00	1.19E+00
	BI-207	569.67	97.72	8.76E-01	8.76E-01
		1063.62	74.90	1.14E+00	
	TL-207	897.83	0.24	7.41E+02	7.41E+02
+	TL-208	510.84*	21.60	1.36E+01	2.27E+00
		583.14*	86.00	2.27E+00	
+	PB-212	77.11*	17.50	5.76E-01	5.76E-01
		238.63*	44.60	1.07E+00	

	Nuclide Name	Energy (keV)	Yield (%)	Line MDA (pCi/gram)	Nuclide MDA (pCi/gram)
+	BI-214	609.31*	46.30	2.20E+00	2.20E+00
		1120.29*	15.10	7.05E+00	
		1764.49*	15.80	5.40E+00	
+	PB-214	295.00*	19.20	2.29E+00	2.29E+00
		351.92*	37.20	2.53E+00	
+	AC-228	338.32*	11.40	3.77E+00	2.85E+00
		911.60*	27.70	2.85E+00	
		969.11*	16.60	2.99E+00	
	TH-230	67.67	0.37	2.09E+01	2.09E+01
	PA-234	131.20	20.40	4.95E+00	4.95E+00
		569.50	11.00	7.85E+00	
		883.24	12.00	7.55E+00	
		946.00	12.00	7.15E+00	
	TH-234	63.29*	3.80	7.02E-01	7.02E-01
		92.38*	2.72	9.48E+00	-

+ = Nuclide identified during the nuclide identification

* = Energy line found in the spectrum

> = MDA value not calculated

@ = Half-life too short to be able to perform the decay correction

APPENDIX C

RESRAD/RESRAD-BUILD Output

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Dose Conversion Factor (and Related) Parameter Summary ...	2
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Time = 0.000E+00	12
Time = 1.000E+00	13
Time = 3.000E+00	14
Time = 1.000E+01	15
Time = 3.000E+01	16
Time = 1.000E+02	17
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Dose Conversion Factor (and Related) Parameter Summary
 File: 99775332.LIB

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(5)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(11)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(10)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(11)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)

D-34	Th-229-D , plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(6,1)
1	Th-229-D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
34	Th-229-D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)

D-34
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 Summary : RVWCS--REVERE WORKER--COMBINED SOURCE File: RVWCS.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: 99775332.LIB

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-230 , plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(7,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(8,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(8,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(8,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(9,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(10,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(11,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(5,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5,2)
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(8,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)

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Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: 99775332.LIB

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(11,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)

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 Summary : RVWCS--REVERE WORKER--COMBINED SOURCE File: RVWCS.RAD

Site-Specific Parameter Summary

Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
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R011	Area of contaminated zone (m**2)	2.300E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.000E+00	2.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	5.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	7.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	7.700E-03	0.000E+00	---	SI(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	7.700E-03	0.000E+00	---	SI(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.700E-01	0.000E+00	---	SI(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	1.700E-01	0.000E+00	---	SI(4)
R012	Initial principal radionuclide (pCi/g): Ra-228	8.300E-02	0.000E+00	---	SI(5)
R012	Initial principal radionuclide (pCi/g): Th-228	8.300E-02	0.000E+00	---	SI(6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.700E-01	0.000E+00	---	SI(7)
R012	Initial principal radionuclide (pCi/g): Th-232	8.300E-02	0.000E+00	---	SI(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.700E-01	0.000E+00	---	SI(9)
R012	Initial principal radionuclide (pCi/g): U-235	7.700E-03	0.000E+00	---	SI(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.700E-01	0.000E+00	---	SI(11)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	WI(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	WI(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	WI(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	WI(4)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	WI(5)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	WI(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	WI(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	WI(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	WI(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	WI(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	WI(11)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERO
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
R013	Density of contaminated zone (g/cm**3)	1.900E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.400E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.600E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	3.340E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	1.000E-03	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	1.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP

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 Summary : RVWCS--REVERSE WORKER--COMBINED SOURCE File: RVWCS.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by IRESRAD (If different from user input)	Parameter Name
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	0.000E+00	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.300E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	WWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIEWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	QW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)

R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
5	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
5	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	1.375E+05	2.000E+01	---	DCNUCC(1)
R016	Unsat. zone 1 (cm**3/g)	not used	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(2)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.375E+05	1.000E+02	---	DCNUCC(3)
R016	Unsat. zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

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 Summary : RVWCS--REVERE WORKER--COMBINED SOURCE File: RVWCS.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC(4)
R016	Unsat. zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Ra-228				
6	Contaminated zone (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC(5)
.6	Unsat. zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(6)
R016	Unsat. zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(7)
R016	Unsat. zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(8)
R016	Unsat. zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(9)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(10)
R016	Unsat. zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(10)
.6	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.400E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	5.900E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	4.600E-03	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)
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)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E+01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHRW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E-01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT

R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
9	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
9	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	1.234E+02	---	CO2F

STOR Storage times of contaminated foodstuffs (days):
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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
OR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2CCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2CFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIK
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NETS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

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Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	23000.00 square meters	Ac-227	7.700E-03
Thickness:	1.00 meters	Pa-231	7.700E-03
Cover Depth:	0.00 meters	Pb-210	1.700E-01
		Ra-226	1.700E-01
		Ra-228	8.300E-02
		Th-228	8.300E-02
		Th-230	1.700E-01
		Th-232	8.300E-02
		U-234	1.700E-01
		U-235	7.700E-03
		U-238	1.700E-01

0
 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	5.000E+02	7.000E+02	1.000E+03
TDOSE(t):	1.504E-02	1.504E-02	1.504E-02	1.504E-02	1.504E-02	1.503E-02	1.502E-02	1.501E-02	1.500E-02	1.499E-02
M(t):	6.015E-04	6.015E-04	6.015E-04	6.015E-04	6.014E-04	6.013E-04	6.009E-04	6.005E-04	6.001E-04	5.994E-04

OMaximum TDOSE(t): 1.504E-02 mrem/yr at t = 0.000E+00 years
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 Summary : RVWCS--REVERE WORKER--COMBINED SOURCE File: RVWCS.RAD

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.
Ac-227	6.703E-05	0.0045	6.691E-05	0.0044	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.416E-06	0.0006
Pa-231	7.564E-06	0.0005	1.402E-05	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.303E-06	0.0005
Pb-210	4.638E-06	0.0003	5.102E-06	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.022E-04	0.0068
Ra-226	8.327E-03	0.5537	2.000E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.057E-05	0.0014
Ra-228	2.618E-03	0.1741	6.340E-06	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.032E-05	0.0007
Th-228	3.108E-03	0.2067	3.156E-05	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.723E-06	0.0003
Th-230	2.721E-06	0.0002	7.281E-05	0.0048	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.825E-06	0.0005
Th-232	1.499E-04	0.0100	1.791E-04	0.0119	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.964E-05	0.0013
U-234	3.069E-07	0.0000	2.948E-05	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.039E-06	0.0003
U-235	2.577E-05	0.0017	1.244E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.727E-07	0.0000
U-238	1.021E-04	0.0068	2.635E-05	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.839E-06	0.0003
Total	1.441E-02	0.9585	4.349E-04	0.0289	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.897E-04	0.0126

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.434E-04	0.0095
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.859E-05	0.0019
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.119E-04	0.0074
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.349E-03	0.5552
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.635E-03	0.1752
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.144E-03	0.2091
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.335E-05	0.0055
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.486E-04	0.0232
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.383E-05	0.0022
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.713E-05	0.0018
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.323E-04	0.0088

Sum of all water independent and dependent pathways.
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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	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	Milk	Soil
Ac-227	6.443E-05	0.0043	6.443E-05	0.0043	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	9.663E-06	0.0006	1.612E-05	0.0011	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	4.496E-06	0.0003	4.946E-06	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	8.323E-03	0.5535	2.155E-06	0.0001	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-228	3.1207E-03	0.2133	1.462E-05	0.0010	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	2.163E-03	0.1439	2.197E-05	0.0015	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	6.327E-06	0.0004	7.281E-05	0.0048	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	5.051E-04	0.0336	1.904E-04	0.0120	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	3.069E-07	0.0000	2.948E-05	0.0022	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	2.577E-05	0.0017	1.245E-06	0.0001	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	1.021E-04	0.0068	2.635E-05	0.0019	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	1.441E-02	0.3585	4.349E-04	0.0299	0.000E+00	0.000E+00	0.000E+00	0.000E+00

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	mrem/yr	fract.	Fish	Radon	Plant	Meat	Milk	All Pathways*
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	1.389E-04
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	3.308E-05
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	1.058E-04
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	8.343E-03
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	3.233E-03
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	3.233E-03
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	8.697E-05
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	7.065E-04
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	3.353E-05
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	2.719E-05
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	1.323E-04
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	1.504E-02

0*Sum of all water independent and dependent pathways
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Summary : RWGCS--SEVERE WORKER--COMBINED SOURCE
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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	mrem/yr	fract.	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
Ac-227	6.093E-05	0.0041	6.093E-05	0.0041	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.559E-06
Pa-231	1.367E-05	0.0009	2.011E-05	0.0013	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.360E-06
Pb-210	4.225E-05	0.0003	4.647E-06	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.306E-05
Ra-226	8.316E-03	0.5533	2.451E-06	0.0002	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.963E-05
Ra-228	3.149E-03	0.2136	2.441E-05	0.0014	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.773E-06
Th-228	1.048E-03	0.0697	1.064E-05	0.0007	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.593E-06
Th-230	1.354E-05	0.0009	7.291E-05	0.0049	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.958E-06
Th-232	1.131E-03	0.0985	1.149E-04	0.0123	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.336E-05
U-234	3.071E-07	0.0000	2.948E-05	0.0022	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.039E-06
U-235	2.577E-05	0.0017	1.245E-06	0.0001	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.719E-07
U-238	1.021E-04	0.0068	2.635E-05	0.0019	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.893E-06
Total	1.441E-02	0.3585	4.349E-04	0.0299	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.507E-04

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	mrem/yr	fract.	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.303E-04
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.164E-05
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.019E-04
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.006E-03
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.748E-03
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.552E-03
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.608E-03
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.0705

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Radio- Nuclide	Total Dose Contributions (DOSE(i, p, t)) for Individual Radionuclides (i) and Pathways (p)													
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
0	As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years													
0	Water Independent Pathways (Inhalation excludes Radon)													
0	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	4.875E-05	0.0032	4.966E-05	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	2.599E-05	0.0017	3.226E-05	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.399E-06	0.0002	3.719E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	8.229E-03	0.5514	3.351E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.771E-05	0.0032
Ra-228	3.355E-03	0.1537	1.180E-05	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.623E-06	0.0003
Th-228	2.299E-05	0.0035	9.425E-07	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.371E-05	0.0026	7.281E-05	0.0048	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.975E-06	0.0005
Th-232	3.733E-03	0.2466	2.013E-04	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.954E-05	0.0029
U-234	3.087E-07	0.0000	2.249E-05	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.039E-06	0.0003
U-235	2.571E-05	0.0017	1.249E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.744E-07	0.0000
U-238	1.021E-04	0.0065	2.635E-05	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.939E-06	0.0003
Total	1.441E-02	0.9555	4.349E-04	0.0289	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.897E-04	0.0126

	Total Dose Contributions TDOSE(i,P,t) for Individual Radionuclides (i) and Pathways (p) As mrem/yr and Fraction of Total Dose At t = 1.00E+01 years												
0	Water		Fish		Radon		Plant		Wast		Milk		All Pathways*
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
*-227	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	1.043E-04
-231	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	6.766E-05
-210	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	8.300E-05
Ra-226	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	8.343E-03
Ra-228	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	3.993E-03
Th-230	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	2.075E-03
Th-232	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	8.394E-05
Th-230	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	1.195E-04
Th-232	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	3.969E-04
U-234	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	3.963E-05
U-235	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	2.730E-05
U-238	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	1.335E-04
Total	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	0.00E+00	0.0000	1.554E-02

*Sum of all water independent and dependent pathways.
RESRAD, Version 6.0 Tk Limit = 0.5 year 02/17/2001 14:19 Page 16
Summary: RWQCS-RIVER WORKER-COMBINED SOURCE File: RWQCS.RAD

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All Pathways

Summary : RWMC--REVERSE WORKER--COMBINED SOURCE

File: RWMC.FAC

Parent Product Branch

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

(1)	Fraction	* 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	7.000E+02	1.000E+03
Ac-227	Ac-227	1.000E+00	1.462E-02	1.492E-02	1.692E-02	1.354E-02	7.163E-03	7.712E-04	1.324E-06	2.272E-09	3.892E-12
Pa-231	Pa-231	1.000E+00	3.114E-03	3.114E-03	3.114E-03	3.114E-03	3.114E-03	3.114E-03	3.114E-03	3.114E-03	3.114E-03
Pa-231	Ac-227	1.000E+00	2.079E-04	8.113E-04	1.594E-03	5.373E-03	1.175E-02	1.912E-02	1.179E-02	1.860E-02	1.947E-02
Pa-231	Pa-231	1.000E+00	3.712E-03	4.496E-03	5.405E-03	8.787E-03	1.516E-02	2.152E-02	2.218E-02	2.107E-02	2.196E-02
Pa-231	Pa-231	1.000E+00	5.582E-04	6.338E-04	5.996E-04	4.824E-04	2.590E-04	2.340E-05	5.864E-09	1.170E-10	2.033E-13
Pa-231	Pa-231	1.000E+00	4.102E-02	4.308E-02	4.304E-02	4.389E-02	4.446E-02	4.470E-02	4.470E-02	4.470E-02	4.470E-02
Pa-231	Pa-231	1.000E+00	1.028E-05	3.042E-05	6.883E-05	1.357E-04	4.263E-04	6.130E-04	5.945E-04	5.945E-04	5.945E-04
Pa-231	Pa-231	1.000E+00	4.911E-02	4.911E-02	4.911E-02	4.909E-02	4.887E-02	4.762E-02	4.367E-02	4.002E-02	3.667E-02
Pa-231	Pa-231	1.000E+00	2.476E-02	2.155E-02	1.725E-02	7.115E-03	6.654E-04	1.440E-07	4.368E-18	1.646E-28	5.566E-39
Pa-231	Pa-231	1.000E+00	6.384E-03	1.150E-02	2.526E-02	1.752E-02	1.712E-03	3.702E-07	1.254E-17	4.233E-29	1.433E-38
Pa-231	Pa-231	1.000E+00	3.785E-02	2.637E-02	1.375E-02	1.011E-03	7.209E-07	6.365E-18	0.000E+00	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	4.797E-04	4.797E-04	4.797E-04	4.796E-04	4.795E-04	4.795E-04	4.795E-04	4.795E-04	4.795E-04
Pa-231	Pa-231	1.000E+00	1.064E-05	3.190E-05	7.441E-05	2.229E-04	6.445E-04	2.091E-03	5.981E-03	9.535E-03	1.279E-02
Pa-231	Pa-231	1.000E+00	1.489E-09	1.033E-09	5.350E-09	4.459E-07	3.111E-06	1.984E-05	7.314E-05	1.222E-04	1.671E-04
Pa-231	Pa-231	1.000E+00	4.903E-04	5.116E-04	5.541E-04	7.030E-04	1.127E-03	2.590E-03	6.532E-03	1.013E-02	1.342E-02
Pa-231	Pa-231	1.000E+00	2.386E-02	2.386E-02	2.386E-02	2.386E-02	2.386E-02	2.386E-02	2.386E-02	2.386E-02	2.386E-02
Pa-231	Pa-231	1.000E+00	1.522E-03	4.334E-03	9.036E-03	1.886E-02	2.561E-02	2.627E-02	2.625E-02	2.625E-02	2.625E-02
Pa-231	Pa-231	1.000E+00	2.920E-04	1.791E-03	7.121E-03	2.656E-02	4.0344E-02	4.514E-02	4.514E-02	4.514E-02	4.514E-02
Pa-231	Pa-231	1.000E+00	4.000E-03	8.512E-02	1.854E-02	4.781E-02	7.144E-02	7.375E-02	7.375E-02	7.375E-02	7.375E-02
Pa-231	Pa-231	1.000E+00	1.990E-04	1.390E-04	1.990E-04	1.999E-04	1.999E-04	1.999E-04	1.999E-04	1.999E-04	1.999E-04
Pa-231	Pa-231	1.000E+00	2.159E-09	6.477E-09	1.511E-08	4.534E-08	1.317E-07	4.336E-07	1.294E-06	2.151E-06	3.005E-06
Pa-231	Pa-231	1.000E+00	3.612E-08	1.054E-07	2.528E-07	7.585E-07	2.202E-06	7.122E-07	8.126E-07	9.134E-07	1.022E-06
Pa-231	Pa-231	1.000E+00	1.107E-09	1.461E-09	7.569E-09	6.370E-07	4.339E-06	8.813E-05	1.073E-04	1.266E-04	1.565E-04
Pa-231	Pa-231	1.000E+00	3.531E-03	3.531E-03	3.531E-03	3.531E-03	3.531E-03	3.531E-03	3.531E-03	3.531E-03	3.531E-03
Pa-231	Pa-231	1.000E+00	7.790E-04	7.790E-04	7.790E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04
Pa-231	Pa-231	1.000E+00	2.320E-10	9.461E-10	1.374E-09	3.323E-09	1.120E-09	5.668E-09	1.693E-07	5.693E-07	1.693E-07
Pa-231	Pa-231	1.000E+00	2.408E-15	1.439E-14	7.549E-14	6.753E-13	5.685E-12	6.172E-11	5.625E-10	5.525E-09	5.525E-09
Pa-231	Pa-231	1.000E+00	2.162E-17	3.339E-16	3.339E-16	1.049E-15	2.559E-12	5.025E-11	2.373E-09	1.073E-08	8.775E-08
Pa-231	Pa-231	1.000E+00	1.905E-01	5.972E-00	1.462E-01	1.099E-06	6.014E-15	6.773E-13	2.299E-11	2.299E-11	2.299E-11
Pa-231	Pa-231	1.000E+00	7.780E-04	7.780E-04	7.780E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04	7.779E-04

* Branch Fraction is the cumulative factor for the 1st principal radionuclide daughter: CMBR(F) = BR(F1)*BR(F2)*... BR(Fn).

The DSR includes contributions from associated half-life 6.05 Yr daughters.

186RAD, Version 6.0 TW Limit = 0.5 year 02/21/2001 14:58 Page 23

Summary : RWMC--REVERSE WORKER--COMBINED SOURCE

File: RWMC.FAC

Single Radionuclide Soil Guidelines G1,1 in pci/g

Basic Radiation Dose Limit = 25 mrem/yr

Radionuclide	(1)	* 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	7.000E+02	1.000E+03
Ac-227	Ac-227	1.000E+00	1.336E-03	1.477E-03	1.946E-03	3.490E+03	3.042E-04	1.989E-07	1.408E-10	6.441E-12	7.030E-13
Pa-231	Pa-231	1.000E+00	5.790E-02	4.622E-02	4.622E-02	1.645E+03	1.162E+03	1.107E+03	1.107E+03	1.107E+03	1.107E+03
Pa-231	Pa-231	1.000E+00	3.138E-04	3.138E-04	3.138E-04	3.138E-04	3.138E-04	3.138E-04	3.138E-04	3.138E-04	3.138E-04
Pa-231	Pa-231	1.000E+00	5.030E-02	5.091E-02	5.091E-02	5.115E+02	5.115E+02	5.115E+02	5.115E+02	5.115E+02	5.115E+02
Pa-231	Pa-231	1.000E+00	7.175E-02	6.419E-02	5.881E-02	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03
Pa-231	Pa-231	1.000E+00	6.533E-02	9.419E-02	1.957E-03	2.472E+04	3.465E-07	8.192E-14	8.192E-14	8.192E-14	8.192E-14
Pa-231	Pa-231	1.000E+00	5.530E-01	4.837E+04	4.512E+04	3.556E+04	2.225E-04	3.654E-03	3.827E+03	3.827E+03	3.827E+03
Pa-231	Pa-231	1.000E+00	2.937E+03	1.349E+03	1.349E+03	3.498E+02	3.387E+02	3.390E+02	3.390E+02	3.390E+02	3.390E+02
Pa-231	Pa-231	1.000E+00	1.356E+05	1.356E+05	1.356E+05	1.356E+05	1.356E+05	1.356E+05	1.356E+05	1.356E+05	1.356E+05
Pa-231	Pa-231	1.000E+00	7.050E-03	7.050E-03	7.050E-03	7.050E-03	7.050E-03	7.050E-03	7.050E-03	7.050E-03	7.050E-03
Pa-231	Pa-231	1.000E+00	3.014E-04	3.014E-04	3.014E-04	3.014E-04	3.014E-04	3.014E-04	3.014E-04	3.014E-04	3.014E-04

* At specific activity limit

Summary Dose/Source Ratios DSR(F1) in (mrem/yr)/(pci/g)

and Single Radionuclide Soil Guidelines G1,1 in pci/g

at tmin = time of minimum single radionuclide soil guideline

and at tmax = time of maximum total dose = 0.000E+00 years

Radionuclide Initial DSR(F1)min G1,1min DSR(F1)max G1,1max

(1) pci/g (years) (pci/g) (pci/g)

Ac-227 1.000E+00 1.000E+00 1.336E-03 1.477E-03 1.946E-03 1.946E-03

Pa-231 1.000E+00 1.000E+00 5.790E-02 4.622E-02 4.622E-02 1.645E+03

Pa-231 1.000E+00 1.000E+00 3.138E-04 3.138E-04 3.138E-04 3.138E-04

Pa-231 1.000E+00 1.000E+00 5.030E-02 5.091E-02 5.091E-02 5.115E+02

Pa-231 1.000E+00 1.000E+00 7.175E-02 6.419E-02 5.881E-02 1.000E+03

Pa-231 1.000E+00 1.000E+00 6.533E-02 9.419E-02 1.957E-03 2.472E+04

Pa-231 1.000E+00 1.000E+00 5.530E-01 4.837E+04 4.512E+04 3.556E+04

Pa-231 1.000E+00 1.000E+00 2.937E+03 1.349E+03 1.349E+03 3.498E+02

Pa-231 1.000E+00 1.000E+00 1.356E+05 1.356E+05 1.356E+05 1.356E+05

Pa-231 1.000E+00 1.000E+00 7.050E-03 7.050E-03 7.050E-03 7.050E-03

Pa-231 1.000E+00 1.000E+00 3.014E-04 3.014E-04 3.014E-04 3.014E-04

Th-232 4.100E+00 4.71E-02 7.380E-02 4.387E-02 4.000E-03 5.195E-03
 U-234 1.700E-01 1.000E+00 2.455E-04 4.746E-04 1.990E-04 1.166E-05
 Pa-231 1.000E+00 1.000E+00 3.973E-03 6.293E-03 2.531E-03 1.090E+03
 -38 1.000E+00 0.000E+00 7.780E-04 3.214E-04 7.780E-04 3.214E-04

IRESRAD, Version 6.0 "K Limit = 0.5 year 02/21/2001 14:58 Page 24
 Summary : RWCC--REVERSE WORKER--COMBINED SOURCE File: RWCCS-RAD

Individual Nuclide Dose Summed Over All Pathways													
Nuclide		Parent	BRF(1)	Parent Nuclide and Branch Fraction Indicated									
(5)		(1)		DOSE(1,1) mrem/yr									
				t = 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 1.000E+02 3.000E+02 5.000E+02 7.000E+02 1.000E+03									
Ac-227	Ac-227	1.000E+00	1.434E-04	1.393E-04	1.303E-04	1.043E-04	5.516E-05	5.939E-06	1.019E-08	1.749E-11	3.00E-14	2.133E-18	
Ac-227	Pa-231	1.000E+00	2.294E-06	6.786E-06	1.595E-05	4.137E-05	9.045E-05	1.394E-04	1.447E-04	1.440E-04	1.433E-04	1.422E-04	
Ac-227	U-235	1.000E+00	1.622E-11	1.125E-10	5.359E-10	4.933E-09	3.384E-08	2.166E-07	8.126E-07	1.436E-06	2.042E-06	2.946E-06	
Ac-227	DOSE(1)		1.457E-04	1.457E-04	1.456E-04	1.456E-04	1.456E-04	1.456E-04	1.456E-04	1.456E-04	1.456E-04	1.456E-04	
Pa-231	Pa-231	1.000E+00	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	
Pa-231	U-235	1.000E+00	2.781E-10	8.334E-10	1.347E-09	5.840E-09	1.596E-08	5.583E-08	1.665E-07	2.765E-07	3.959E-07	5.488E-07	
Pa-231	DOSE(1)		2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	
Pa-231	Pa-231	1.000E+00	1.119E-04	1.035E-04	1.019E-04	9.200E-05	4.404E-05	4.998E-06	3.969E-09	1.988E-11	3.866E-14	3.534E-18	
Pa-231	U-235	1.000E+00	1.749E-06	5.11E-06	1.105E-05	3.157E-05	6.307E-05	1.052E-04	1.011E-04	9.126E-05	8.498E-05	7.446E-05	
Pa-231	DOSE(1)		2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	2.629E-05	
Pa-231	Pa-231	1.000E+00	2.531E-10	1.756E-09	3.095E-09	7.581E-09	5.089E-07	3.372E-06	1.243E-05	2.078E-05	2.840E-05	3.962E-05	
Pa-231	U-238	1.000E+00	5.704E-16	8.449E-15	9.787E-14	2.457E-12	5.052E-11	1.239E-09	4.552E-08	4.552E-08	8.973E-08	1.903E-07	
Pa-231	DOSE(1)		3.238E-12	9.893E-11	2.485E-10	1.862E-09	1.175E-08	9.814E-08	4.075E-07	2.066E-06	5.934E-06	1.712E-05	
Pa-231	U-238	1.000E+00	1.136E-04	1.166E-04	1.136E-04	1.136E-04	1.136E-04	1.136E-04	1.136E-04	1.136E-04	1.136E-04	1.136E-04	
Pa-231	DOSE(1)		9.339E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	
Pa-231	Pa-231	1.000E+00	1.808E-06	5.44E-06	1.655E-05	3.769E-05	1.096E-04	3.554E-04	1.017E-03	1.621E-03	2.173E-03	2.913E-03	
Pa-231	U-238	1.000E+00	5.426E-12	3.759E-11	2.007E-10	1.793E-09	1.509E-08	1.620E-07	1.405E-06	3.795E-06	7.201E-06	1.407E-05	
Pa-231	DOSE(1)		3.846E-12	5.782E-11	6.778E-10	1.793E-09	1.435E-08	1.520E-07	1.403E-06	3.795E-06	7.201E-06	1.407E-05	
Pa-231	U-238	1.000E+00	9.339E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	8.337E-03	
Pa-231	DOSE(1)		2.655E-03	1.512E-03	1.411E-03	6.156E-04	5.122E-03	1.195E-02	4.041E-02	1.360E-02	3.500E+00	0.000E+00	
Pa-231	Pa-231	1.000E+00	1.264E-04	3.572E-04	7.550E-04	1.566E-03	3.126E-03	2.151E-03	2.179E-03	2.179E-03	2.179E-03	2.174E-03	
Pa-231	DOSE(1)		3.191E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	2.11E-03	
Pa-231	U-238	1.000E+00	5.797E-04	1.411E-03	2.097E-03	1.452E-03	1.121E-03	3.073E-08	1.041E-05	3.513E-05	0.000E+00	0.000E+00	
Pa-231	DOSE(1)		3.144E-03	2.147E-03	1.060E-03	9.394E-05	5.183E-08	5.183E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	
Pa-231	U-238	1.000E+00	2.422E-03	1.447E-04	5.911E-04	2.205E-03	3.606E-03	3.744E-03	3.744E-03	3.744E-03	3.744E-03	3.735E-03	
Pa-231	DOSE(1)		3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	3.748E-03	
Pa-231	U-238	1.000E+00	9.155E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	8.142E-03	
Pa-231	DOSE(1)		3.468E-16	2.439E-15	2.599E-09	1.707E-09	2.238E-08	7.371E-08	2.200E-07	3.657E-07	5.103E-07	7.276E-07	
Pa-231	U-238	1.000E+00	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	8.155E-05	
Pa-231	DOSE(1)		3.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	1.393E-05	
Pa-231	U-238	1.000E+00	4.785E-11	1.445E-10	3.386E-10	1.007E-09	9.324E-09	9.633E-09	2.877E-08	4.788E-08	6.695E-08	9.548E-08	
Pa-231	DOSE(1)		2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	2.719E-05	
Pa-231	U-238	1.000E+00	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	1.353E-04	

BRF(1) is the Branch Fraction of the Parent Nuclide.
 IRESRAD, Version 6.0 "K Limit = 0.5 year 02/21/2001 14:58 Page 25
 Summary : RWCC--REVERSE WORKER--COMBINED SOURCE File: RWCCS-RAD

Nuclide		Parent	BRF(1)	Individual Nuclide Soil Concentration Parent Nuclide and Branch Fraction Indicated S(f), pCi/g											
(1)		(1)		t = 0.000E+00 1.000E+00 3.000E+00 1.000E+01 3.000E+01 1.000E+02 3.000E+02 5.000E+02 7.000E+02 1.000E+03											
Ac-227	Ac-227	1.000E+00	7.700E-03	7.49E-03	6.999E-03	5.600E-03	2.963E-03	3.190E-04	5.474E-07	9.393E-10	1.612E-12	1.146E-16	1.456E-19		
Ac-227	Pa-231	1.000E+00	0.000E+00	2.433E-04	7.013E-04	2.039E-03	4.735E-03	7.367E-03	7.564E-03	7.611E-03	7.574E-03	7.518E-03	7.508E-03		
Ac-227	U-235	1.000E+00	0.000E+00	0.66E-03	2.25E-03	2.33E-07	1.739E-06	1.137E-05	4.359E-05	7.592E-05	1.073E-04	1.557E-04	1.949E-04		
Ac-227	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.692E-03	7.692E-03	7.691E-03	7.674E-03	7.670E-03		
Pa-231	Pa-231	1.000E+00	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-235	1.000E+00	0.000E+00	1.629E-07	4.887E-07	1.639E-06	1.684E-06	1.627E-05	4.367E-05	5.082E-05	1.122E-04	1.607E-04	2.199E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235	1.000E+00	0.000E+00	0.405E-12	6.039E-12	3.235E-12	7.433E-08	1.514E-06	2.314E-05	6.179E-05	1.241E-04	2.695E-04	4.69E-04		
Pa-231	DOSE(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03	7.699E-03		
Pa-231	U-238	1.000E+00	1.700E-01	1.549E-01	1.236E-01	6.690E-02	7.593E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01	1.511E-01		
Pa-231	DOSE(1)		0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00		
Pa-231	Pa-231	1.000E+00	0.000E+00	1.133E-06	9.949E-06	1.033E-04	7.689E-04	5.010E-03	1.957E-02	3.105E-02	4.46E-02	5.774E-02	7.44E-02		
Pa-231	U-235</														

Th-228	Th-228	1.000E+00	8.300E-02	5.777E-02	2.799E-02	2.216E-03	1.579E-06	1.527E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	Th-232	1.000E+00	0.000E+00	1.547E-03	1.032E-02	4.684E-02	7.965E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
Th-228	S(j):		8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
Th-230	Th-230	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.698E-01	1.694E-01	1.689E-01	1.685E-01	1.679E-01
Th-230	U-234	1.000E+00	0.000E+00	1.530E-06	4.591E-06	1.530E-05	4.590E-05	1.529E-04	4.578E-04	7.616E-04	1.064E-03	1.516E-03
Th-230	U-238	1.000E+00	0.000E+00	2.169E-12	1.952E-11	2.169E-10	1.952E-09	2.168E-08	1.948E-07	5.403E-07	1.057E-06	2.153E-06
Th-230	S(j):		1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.698E-01	1.697E-01	1.696E-01	1.694E-01
Th-232	Th-232	1.000E+00	8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
U-234	U-234	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.695E-01	1.693E-01	1.689E-01
U-234	U-238	1.000E+00	0.000E+00	4.819E-07	1.446E-06	4.819E-06	1.446E-05	4.817E-05	1.444E-04	2.404E-04	3.362E-04	4.796E-04
U-234	S(j):		1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.698E-01	1.697E-01	1.696E-01	1.694E-01
U-235	U-235	1.000E+00	7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.692E-03	7.687E-03	7.681E-03	7.674E-03
U-238	U-238	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.698E-01	1.697E-01	1.696E-01	1.694E-01

BRF(i) is the branch fraction of the parent nuclide.
 ORESMAIN5.EXE execution time = 950.54 seconds
 Total water/soil iteration failures = 144.

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Dose Conversion Factor (and Related) Parameter Summary
File: 99775332.LIB

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	9.600E-03	9.600E-03	DCF2(4)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(5)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(11)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(5)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(10)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(11)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	9.000E-04	8.000E-04	RTF(3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(5,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)

0	Menu	Parameter	Current Value	Default	Parameter Name
0-34	Th-228+D	plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(6.1)
0-34	Th-228+D	beef/livestock-intake ratio, (pci/kg)/(pci/d)	1.000E-04	1.000E-04	RTF(6.2)
0-34	Th-228+D	milk/livestock-intake ratio, (pci/L)/(pci/d)	5.000E-06	5.000E-06	RTF(6.3)
0-34	Th-230	plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(7.1)
0-34	Th-230	beef/livestock-intake ratio, (pci/kg)/(pci/d)	1.000E-04	1.000E-04	RTF(7.2)
0-34	Th-230	milk/livestock-intake ratio, (pci/L)/(pci/d)	5.000E-06	5.000E-06	RTF(7.3)
0-34	Th-232	plant/soil concentration ratio, dimensionless	3.700E-06	1.000E-03	RTF(8.1)
0-34	Th-232	beef/livestock-intake ratio, (pci/kg)/(pci/d)	1.000E-04	1.000E-04	RTF(8.2)
0-34	Th-232	milk/livestock-intake ratio, (pci/L)/(pci/d)	5.000E-06	5.000E-06	RTF(8.3)
0-34	U-234	plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(9.1)
0-34	U-234	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF(9.2)
0-34	U-234	milk/livestock-intake ratio, (pci/L)/(pci/d)	6.000E-04	6.000E-04	RTF(9.3)
0-34	U-235+D	plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(10.1)
0-34	U-235+D	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF(10.2)
0-34	U-235+D	milk/livestock-intake ratio, (pci/L)/(pci/d)	6.000E-04	6.000E-04	RTF(10.3)
0-34	U-238+D	plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(11.1)
0-34	U-238+D	beef/livestock-intake ratio, (pci/kg)/(pci/d)	3.400E-04	3.400E-04	RTF(11.2)
0-34	U-238+D	milk/livestock-intake ratio, (pci/L)/(pci/d)	6.000E-04	6.000E-04	RTF(11.3)
D-5	Bioaccumulation factors, fresh water, L/kg:				
D-5	Ac-227+D	fish	1.500E+01	1.500E+01	BIOFAC(1.1)
D-5	Ac-227+D	crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1.2)
D-5	Pa-231	fish	1.000E+01	1.000E+01	BIOFAC(2.1)
D-5	Pa-231	crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2.2)
D-5	Pb-210+D	fish	3.000E+02	3.000E+02	BIOFAC(3.1)
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(3.2)
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC(4.1)
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4.2)
D-5	Ra-228+D	fish	5.000E+01	5.000E+01	BIOFAC(5.1)
D-5	Ra-228+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(5.2)
D-5	Th-229+D	fish	1.000E+02	1.000E+02	BIOFAC(6.1)
D-5	Th-229+D	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6.2)
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC(7.1)
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7.2)
D-5	Th-232	fish	1.000E+02	1.000E+02	BIOFAC(8.1)
D-5	Th-232	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(8.2)
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC(9.1)
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9.2)
D-5	U-235+D	fish	1.000E+01	1.000E+01	BIOFAC(10.1)
D-5	U-235+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10.2)
D-5	U-238+D	fish	1.000E+01	1.000E+01	BIOFAC(11.1)
D-5	U-238+D	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11.2)
Summary : RVRVRC--REVERSE RES--COMBINED SOURCE	T* Limit = 0.5 year				
02/21/2001 14:09 Page 3	File: RVRCS.RAD				
User	Site-Specific Parameter Summary				
Based on RESRAD	If different from user input				
Parameter	Parameter Name				
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1	Area of contaminated zone (m**2)	2.300E+04	1.000E+04	---	AREA
	Thickness of contaminated zone (m)	1.000E+00	2.000E+00	---	THICKO
	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	5.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	7.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	7.700E-03	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	7.700E-03	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.700E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Pa-226	1.700E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Ra-229	8.300E-02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Th-228	8.300E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.700E-01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	8.300E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.700E-01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	7.700E-03	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.700E-01	0.000E+00	---	S1(11)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Pa-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Ra-229	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(11)
R013	Cover depth (m)	1.500E-01	0.000E+00	---	COVERO
3	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	EENSCV
.3	Cover depth erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.900E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.400E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.600E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	3.340E-01	1.000E-01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	1.000E-03	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	2.000E+00	---	HUMID
R013	Evapotranspiration coefficient	1.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP

RESRAD, Version 6.0 T₀ Limit = 0.5 year 02/21/2001 14:29 Page 6
Summary : RVRVRES--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	0.000E+00	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENCAQ
R014	Saturated zone total porosity	5.000E-02	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	4.000E-02	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	4.000E-02	2.000E-01	---	FCCZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E-01	1.000E+02	---	HCCZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BCZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	WWT
R014	Well pump intake depth (m below water table)	1.000E-01	1.000E-01	---	DWIEWT
R014	Model: Mondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E-02	---	EW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E-02	4.000E-02	---	H(1)
15	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUB(1)
15	Unsat. zone 1, total porosity	3.000E-01	4.000E-01	---	TPUZ(1)

R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EP02 (1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FC02 (1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ (1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HC02 (1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	1.375E+05	2.000E+01	---	DCNUCC (1)
R016	Unsat. zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU (1,1)
R016	Saturated zone (cm**3/g)	1.000E+01	2.000E+01	---	DCNUCS (1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC (2)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU (2,1)
R016	Saturated zone (cm**3/g)	1.000E+01	5.000E+01	---	DCNUCS (2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.375E+05	1.000E+02	---	DCNUCC (3)
R016	Unsat. zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU (3,1)
R016	Saturated zone (cm**3/g)	1.000E+01	1.000E+02	---	DCNUCS (3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (3)

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 Summary : RVRVRCs--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by IRESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC (4)
R016	Unsat. zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU (4,1)
R016	Saturated zone (cm**3/g)	1.000E+01	7.000E+01	---	DCNUCS (4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (4)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC (5)
R016	Unsat. zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU (5,1)
R016	Saturated zone (cm**3/g)	1.000E+01	7.000E+01	---	DCNUCS (5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (5)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC (6)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU (6,1)
R016	Saturated zone (cm**3/g)	1.000E+01	6.000E+04	---	DCNUCS (6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC (7)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU (7,1)
R016	Saturated zone (cm**3/g)	1.000E+01	6.000E+04	---	DCNUCS (7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (7)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC (8)
R016	Unsat. zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU (8,1)
R016	Saturated zone (cm**3/g)	1.000E+01	6.000E+04	---	DCNUCS (8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC (9)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU (9,1)
R016	Saturated zone (cm**3/g)	1.000E+01	5.000E+01	---	DCNUCS (9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC (10)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU (10,1)
R016	Saturated zone (cm**3/g)	1.000E+01	5.000E+01	---	DCNUCS (10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH (10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK (10)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.375E-05	5.000E-01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	5.000E-01	5.000E-01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	1.000E-01	5.000E-01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.445E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R017	Inhalation rate (m**3/yr)	8.400E-03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.400E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E-01	3.000E-01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	5.900E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.571E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.200E-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)
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)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI

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Summary : RVRVACS--REVERE RES--COMBINED SOURCE

File: RVRCS.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Contamination fraction of drinking water	1.000E+00	1.000E-00	---	FDW
R018	Contamination fraction of household water	not used	1.000E-00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E-00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFIS
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFIM
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWIS
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWIM
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT

R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	1.234E+02	---	CO2F

STOR Storage times of contaminated foodstuffs (days):
 IRESRAD, Version 6.0 Tc Limit = 0.5 year 02/21/2001 14:25 Page 10
 Summary : RVRVRCSS--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

Site-Specific Parameter Summary (Continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
R	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TFFL
R021	Volumetric water content of the cover material	not used	9.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LPMAX
TITL	Maximum number of integration points for risk	257	---	---	RYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active

Summary : RYRHOOD--FEVERE REC-COMBINED SOURCE

11-15-2019

Total Dose Contributors (TDCS), (47) for individual radionuclides (1) and isotopes (2) as given/yr and fraction of Total Dose At = 0.005600 years

Radio- Nucleide	Second	Inhalation	Radon	Plant	Meat	Milk	Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.13E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	5.93E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	7.60E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.39E-01	0.5600	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-228	4.17E-02	0.1601	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	6.16E-02	0.2355	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.13E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.34E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.19E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.23E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.29E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.46E-01	0.9975	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TOCS(1,P,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.002E+00 years

Radio- Nuclide	Water	Fish	Radon	Water- Dependent Pathways	Meat	Milk	All Pathways*
	mrem/yr	frac.	mrem/yr	mrem/yr	frac.	mrem/yr	frac.
Ac-227	2.73E-04	0.0011	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.00332
Pa-231	1.05E-04	0.0004	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.643E-04
Pb-210	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.603E-06
Bi-212	2.43E-05	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.38E-01
Ra-226	3.94E-05	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.15605
Ra-228	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.1693
Th-232	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.129E-02
Th-230	3.80E-09	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.133E-05
Th-232	4.93E-07	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.345E-03
U-234	5.76E-05	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.794E-05
U-235	2.46E-05	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.257E-04
U-238	5.47E-05	0.0003	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.339E-03
Total	6.16E-04	0.0025	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.471E-01
*Sum of all water independent and dependent pathways.							1.0000

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RESRAD, version 6.0      Tk Limit = 0.5 year
Summary : RVRPCS--REVERS RES--COMBINED SOURCE
                                02/27/2001  14:29  Page 14
                                File:  RVRPCS.AAD

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Total Dose Contributors TOCSEI, P, F for individual: Radon/soil gas (1) and Gateways (1)

[illegible]

Total Case Contributions (MOSSEI, P_T) for individual nations/states (*i*) and Railways (*r*) are provided and reported as Total Deaths = 0.07690 years.

Radio- Nucleide	Water Conc. (ppm)	Fish Conc. (ppm)	Radon Conc. (ppm)	Water Dependent Pathways		Milk Conc. (ppm)	All Pathways*
				Fa	Fr		
Ac-227	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Am-241	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Am-243	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-210	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-212	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-214	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-218	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-219	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-220	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-222	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-224	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-226	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-228	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-230	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-232	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-235	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-236	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-238	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-240	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-242	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-244	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-246	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-250	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-252	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-254	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-256	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-258	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-260	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-262	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-264	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-266	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-268	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-272	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-274	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-276	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-278	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-280	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-282	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-284	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-286	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-288	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-290	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-292	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-294	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-296	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-298	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-300	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-302	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-304	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-306	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-308	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-310	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-312	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-314	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-316	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-318	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-320	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-322	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-324	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-326	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-328	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-330	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-332	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-334	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-336	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-338	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-340	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-344	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-346	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-350	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-352	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-354	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-356	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-358	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-360	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-362	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-364	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-366	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-368	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-370	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-372	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-374	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-376	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-378	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-380	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-382	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-384	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-386	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-388	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-390	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-392	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-394	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-396	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-398	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-400	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-402	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-404	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-406	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-408	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-410	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-412	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-414	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-416	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-418	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-420	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-422	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-424	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-426	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-428	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-430	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-432	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-434	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-436	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-438	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-440	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-442	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-444	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-446	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-448	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-450	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-452	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-454	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-456	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-458	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-460	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-462	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-464	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-466	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bi-468	0.0000	0.0000	0.0000	0.0000			

Pa-230 4.574E-01 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 9.174E-05 0.0000
 Pa-231 3.297E-01 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.299E-03 0.0329
 Pb-210 6.924E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.677E-04 0.0007
 Ra-226 1.1674E-01 0.0007 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.304E-04 0.0005
 Ra-228 7.1604E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.444E-03 0.0057
 U-238 1.6374E-01 0.0006 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.519E-01 1.0000

Total Dose Contributions TD0SE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 3.000E+00 Years

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.
Ac-227	4.665E-04	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	1.366E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	6.924E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.382E-01	0.5464	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	6.244E-02	0.2469	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-229	2.097E-02	0.0925	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.115E-01	0.0608	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.272E-02	0.0898	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.223E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.332E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.298E-03	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.465E-01	0.9741	0.000E+00	0.0000	0.000E+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 TD0SE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 3.000E+00 Years

AS mrem/yr and fraction of total dose due to = 0.001800 years										
Radio- Nuclide	Water		Fish		Radon		Water Dependent Pathways		All Pathways*	
	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.		
Ac-227	3.548E-04	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.213E-04	0.0012
Pa-231	3.297E-04	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.357E-04	0.0017
Pb-210	3.859E-03	0.0150	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.865E-03	0.0153
Ra-226	2.194E-03	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.394E-01	0.5510
Ra-228	2.733E-04	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.271E-02	0.2479
Th-229	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.165E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.133E-04	0.0009
Th-232	2.176E-04	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.294E-02	0.0907
U-234	1.674E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.677E-04	0.0007
U-235	7.177E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.304E-04	0.0005
U-238	1.639E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.444E-03	0.0057
Total	6.550E-03	0.0259	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.530E-01	1.0000

Total Dose Contributions TD0SE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+01 Years

Summary : RORVRES--REPERE RES--COMBINED SOURCE									
file: RORVRES.DAT									
Total Dose Contributions TD0SE(I,P,t) for Individual Radionuclides (I) and Pathways (P)									
As mrem/yr and Fraction of Total Dose At t = 1.00E+01 Years									
Water Independent Pathways (Inhalation excludes radon)									
0									
0									

Total Dose Contributions TD0SE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 1.000E+01 Years

Radio- Nuclide	Water	Fish	Radon	Meat	Milk	All Pathways*		
mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	
Ac-227	3.648E-04	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	8.213E-04	0.0012
Pa-231	3.297E-04	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	4.357E-04	0.0017
Pb-210	3.859E-03	0.0150	0.000E+00	0.0000	0.000E+00	0.0000	3.865E-03	0.0153
Ra-226	2.194E-03	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	1.394E-01	0.5510
Ra-228	2.733E-04	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	6.271E-02	0.2479
Th-229	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.165E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.133E-04	0.0009
Th-232	2.176E-04	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	2.294E-02	0.0907
U-234	1.674E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	1.677E-04	0.0007
U-235	7.177E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.304E-04	0.0005
U-238	1.639E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	1.444E-03	0.0057
Total	6.550E-03	0.0259	0.000E+00	0.0000	0.000E+00	0.0000	2.530E-01	1.0000

Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	0.934E-04	0.6011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fa-231	0.405E-04	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.193E-03	0.0123	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	1.931E-03	0.0076	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	1.175E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	9.627E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	6.833E-04	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.674E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	7.231E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.591E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	6.863E-03	0.0271	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

0-Sum of all water independent and dependent pathways.
 IRESRAD, Version 6.0 T₀ Limit = 0.5 year 02/21/2001 14:29 Page 17
 Summary : RVRVCS--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

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	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	Milk	Soil
Ac-227	1.975E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Fa-231	3.748E-04	0.0015	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	2.993E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	1.366E-01	0.5375	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-228	3.614E-03	0.0142	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	1.178E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	1.818E-03	0.0072	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	1.042E-01	0.4029	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	5.693E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	1.234E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	1.284E-03	0.0051	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	2.444E-01	0.9495	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00

Total Dose Contributions TDOSE(I,P,T) for Individual Radionuclides (I) and Pathways (P)
 As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years
 Water Dependent Pathways

Radio- Nuclide	mrem/yr	fract.	Fish	Radon	Plant	Meat	Milk	All Pathways*
Ac-227	1.502E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Fa-231	5.340E-04	0.0021	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	1.667E-03	0.0066	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	3.344E-03	0.0132	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-228	1.055E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	4.021E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	1.678E-03	0.0066	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	1.674E-04	0.0007	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	7.432E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	1.552E-04	0.0006	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	7.759E-03	0.0305	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00

0-Sum of all water independent and dependent pathways.
 IRESRAD, Version 6.0 T₀ Limit = 0.5 year 02/21/2001 14:29 Page 19
 Summary : RVRVCS--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

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	mrem/yr	fract.	Inhalation	Radon	Plant	Meat	Milk	Soil
Ac-227	2.156E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Fa-231	5.560E-04	0.0021	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	3.337E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	2.355E-01	0.9150	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-228	7.824E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	1.133E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	5.965E-03	0.0229	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	1.060E-01	0.4100	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	2.066E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00	0.000E+00

[illegible]

CU-238	U-238	1.000E+00	7.878E-03	8.492E-03	8.492E-03	8.492E-03	8.491E-03	8.489E-03	8.484E-03	8.478E-03	8.472E-03	8.463E-03
38	U-234	1.000E+00	7.979E-10	4.194E-09	9.787E-09	2.937E-08	8.530E-08	2.910E-07	9.394E-07	1.397E-06	1.952E-06	2.784E-06
38	Th-230	1.000E+00	2.734E-14	3.653E-13	1.268E-12	4.346E-12	1.320E-11	4.496E-11	1.422E-10	2.489E-10	3.456E-10	2.340E-09
38	Ra-226	1.000E+00	5.746E-11	7.361E-10	2.430E-09	8.191E-09	2.468E-08	8.371E-08	2.960E-07	5.898E-07	1.019E-06	1.868E-06
U-238	Pb-210	1.000E+00	2.035E-10	3.135E-09	9.978E-09	3.273E-08	9.779E-08	3.253E-07	9.751E-07	1.626E-06	2.136E-06	2.047E-06
U-238	DSR(j)		7.878E-03	8.492E-03	8.492E-03	8.492E-03	8.492E-03	8.490E-03	8.486E-03	8.481E-03	8.477E-03	8.469E-03

*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.

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Summary : RVRVRCs--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g

Basic Radiation Dose Limit = 25 mrem/yr

ONuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	7.000E+02	1.000E+03
Ac-227	2.448E+02	2.199E+02	2.344E+02	2.929E+02	5.537E+02	5.143E+03	2.997E+06	1.746E+09	1.018E+12	*7.230E+13
Pa-231	1.172E+03	5.043E+02	4.418E+02	3.210E+02	2.119E+02	1.582E+02	1.542E+02	1.550E+02	1.557E+02	1.569E+02
Pb-210	5.589E+05	1.396E+03	1.100E+03	1.367E+03	2.546E+03	2.243E+04	1.124E+07	5.637E+09	2.827E+12	*7.631E+13
Ra-226	3.068E+01	3.051E+01	3.048E+01	3.041E+01	3.036E+01	3.098E+01	3.376E+01	3.684E+01	4.020E+01	4.582E+01
Ra-228	4.960E+01	3.769E+01	3.309E+01	5.469E+01	5.724E+02	2.644E+06	*2.726E+14	*2.726E+14	*2.726E+14	*2.726E+14
Th-228	3.353E+01	4.816E+01	9.941E+01	1.256E+03	1.762E+06	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14	*8.192E+14
Th-230	1.257E+05	4.633E+04	1.993E+04	6.648E+03	2.286E+03	6.976E+02	2.424E+02	1.518E+02	1.132E+02	8.402E+01
Th-232	8.846E+02	2.500E+02	9.045E+01	3.086E+01	1.994E+01	1.873E+01	1.731E+01	1.606E+01	1.503E+01	1.496E+01
U-234	7.335E+04	2.534E+04	2.534E+04	2.533E+04	2.530E+04	2.494E+04	2.218E+04	1.828E+04	1.459E+04	1.036E+04
U-235	1.531E+03	1.476E+03	1.476E+03	1.475E+03	1.472E+03	1.454E+03	1.399E+03	1.348E+03	1.301E+03	1.237E+03
U-238	3.173E+03	2.944E+03	2.944E+03	2.944E+03	2.944E+03	2.945E+03	2.946E+03	2.948E+03	2.949E+03	2.952E+03

*At specific activity limit

0

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 = 725 & n 1 years

ONuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin) (mrem/yr)/(pCi/g)	G(i,tmin) (pCi/g)	DSR(i,tmax) (mrem/yr)/(pCi/g)	G(i,tmax) (pCi/g)
Ac-227	7.700E-03	0.3435 & n 0.0007	1.159E-01	2.156E+02	1.098E-11	2.276E+12
Pa-231	7.700E-03	214.8 & n 0.4	1.623E-01	1.540E+02	1.604E-01	1.558E+02
210	1.700E-01	1.334 & n 0.303	2.392E-02	1.045E+03	4.031E-12	6.202E+12
226	1.700E-01	24.82 & n 0.05	8.235E-01	3.036E+01	6.151E-01	4.064E+01
Ra-228	9.300E-02	3.030 & n 0.006	7.555E-01	3.309E+01	0.000E+00	*2.726E+14
Th-228	8.300E-02	0.000E+00	7.457E-01	3.353E+01	0.000E+00	*8.192E+14
Th-230	1.700E-01	1.000E+03	2.975E-01	9.402E+01	2.295E-01	1.090E+02
Th-232	8.300E-02	725 & n 1	1.672E+00	1.495E+01	1.672E+00	1.495E+01
U-234	1.700E-01	1.000E+03	2.414E-03	1.036E+04	1.764E-03	1.417E+04
U-235	7.700E-03	1.000E+03	2.020E-02	1.237E+03	1.929E-02	1.296E+03
U-238	1.700E-01	0.990 & n 0.002	8.492E-03	2.944E+03	8.476E-03	2.950E+03

*At specific activity limit

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Summary : RVRVRCs--REVERE RES--COMBINED SOURCE File: RVRCS.RAD

Individual Nuclide Dose Summed Over All Pathways

Parent Nuclide and Branch Fraction Indicated

ONuclide (j)	Parent (i)	BRF(i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	7.000E+02	1.000E+03
Ac-227	Ac-227	1.000E+00	7.864E-04	8.752E-04	8.213E-04	6.572E-04	3.476E-04	3.743E-05	6.423E-08	1.102E-10	1.991E-13	1.345E-17
Ac-227	Pa-231	1.000E+00	1.543E-05	4.667E-05	1.007E-04	2.647E-04	5.740E-04	8.829E-04	9.157E-04	9.113E-04	9.067E-04	9.000E-04
Ac-227	U-235	1.000E+00	1.157E-10	8.122E-10	3.932E-09	3.143E-08	2.158E-07	1.373E-06	5.231E-06	9.092E-06	1.293E-05	1.865E-05
Ac-227	DOSE(j):		8.019E-04	9.219E-04	9.219E-04	9.219E-04	9.218E-04	9.216E-04	9.210E-04	9.204E-04	9.196E-04	9.186E-04
OPa-231	Pa-231	1.000E+00	1.488E-04	3.351E-04	3.351E-04	3.350E-04	3.348E-04	3.343E-04	3.326E-04	3.310E-04	3.293E-04	3.269E-04
Pa-231	U-235	1.000E+00	2.251E-09	1.064E-08	2.482E-08	7.444E-08	2.162E-07	7.116E-07	2.122E-06	3.524E-06	4.917E-06	6.994E-06
Pa-231	DOSE(j):		1.488E-04	3.351E-04	3.351E-04	3.351E-04	3.351E-04	3.350E-04	3.348E-04	3.345E-04	3.342E-04	3.339E-04
OPb-210	Pb-210	1.000E-00	7.605E-06	3.045E-03	3.865E-03	3.109E-03	1.670E-03	1.895E-04	3.780E-07	7.539E-10	1.503E-12	1.339E-16
Pb-210	Ra-226	1.000E+00	2.362E-06	1.429E-04	3.963E-04	1.150E-03	2.572E-03	3.945E-03	3.791E-03	3.474E-03	3.182E-03	2.792E-03
Pb-210	Th-230	1.000E-00	8.409E-11	4.896E-08	3.892E-07	3.137E-06	2.090E-05	1.305E-04	4.776E-04	7.948E-04	1.282E-03	1.464E-03
Pb-210	U-234	1.000E-00	9.561E-12	1.735E-10	2.176E-10	3.119E-10	2.309E-09	4.799E-08	5.981E-07	1.746E-06	3.463E-06	6.892E-06
Pb-210	U-238	1.000E-00	3.459E-11	5.329E-10	1.696E-09	5.564E-09	1.662E-08	5.530E-09	1.658E-07	2.765E-07	3.631E-07	3.480E-07
Pb-210	DOSE(j):		9.667E-06	3.188E-03	4.261E-03	4.262E-03	4.262E-03	4.265E-03	4.263E-03	4.271E-03	4.268E-03	4.263E-03
ORA-226	Ra-226	1.000E-00	1.385E-01	1.391E-01	1.390E-01	1.386E-01	1.374E-01	1.333E-01	1.321E-01	1.119E-01	1.025E-01	8.996E-02
Ra-226	Th-230	1.000E-00	2.999E-05	9.035E-05	2.115E-04	6.348E-04	1.837E-03	5.960E-03	1.705E-02	2.720E-02	3.646E-02	4.880E-02
Ra-226	U-234	1.000E-00	9.449E-11	6.588E-10	3.366E-09	3.003E-08	2.526E-07	2.715E-06	2.357E-05	6.348E-05	1.208E-04	2.360E-04
Ra-226	U-238	1.000E-00	9.768E-12	1.251E-10	4.130E-10	1.392E-09	4.196E-09	1.423E-08	4.863E-08	1.003E-07	1.732E-07	3.175E-07
Ra-226	DOSE(j):		1.385E-01	1.392E-01	1.392E-01	1.392E-01	1.392E-01	1.392E-01	1.392E-01	1.392E-01	1.391E-01	1.390E-01
ORa-228	Ra-228	1.000E-00	3.042E-02	2.728E-02	2.144E-02	2.912E-03	9.271E-04	1.790E-07	6.051E-19	2.046E-28	0.000E+00	0.000E+00
228	Th-232	1.000E-00	1.869E-03	5.371E-03	1.131E-02	2.982E-02	3.311E-02	3.703E-02	4.613E-02	5.554E-02	6.440E-02	6.431E-02
228	DOSE(j):		3.022E-02	3.265E-02	3.274E-02	3.305E-02	3.393E-02	3.705E-02	4.613E-02	5.554E-02	6.440E-02	6.431E-02

OT-239	RA-224	1.000E+00	1.141E-02	2.177E-02	4.127E-02	2.877E-02	2.799E-03	6.057E-07	2.047E-17	6.729E-24	0.000E+00	0.000E+00
OT-239	TH-234	1.000E+00	6.189E-02	4.329E-02	2.087E-02	1.652E-03	1.179E-06	1.139E-17	2.000E+00	0.000E+00	0.000E+00	0.000E+00
OT-239	U-238	1.000E+00	4.170E-04	2.922E-03	1.164E-02	4.340E-02	7.094E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02
OT-239	LOSE-131	1.000E+00	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02	7.376E-02
OT-239	TH-230	1.000E+00	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06
OT-239	U-234	1.000E+00	4.250E-12	2.842E-11	5.804E-11	1.614E-10	1.567E-10	1.495E-09	4.432E-09	7.365E-09	1.021E-08	9.118E-07
OT-239	TH-230	1.000E+00	4.649E-15	6.212E-14	1.556E-13	7.398E-13	2.245E-12	7.644E-12	2.417E-11	4.231E-11	5.876E-11	3.977E-10
OT-239	LOSE-131	1.000E+00	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06	1.341E-06
OT-239	TH-230	1.000E+00	1.660E-07	1.662E-07	1.662E-07	1.660E-07	1.660E-07	1.660E-07	1.659E-07	1.657E-07	1.657E-07	1.657E-07
OT-239	U-234	1.000E+00	5.794E-05	1.677E-04	1.677E-04	1.677E-04	1.677E-04	1.676E-04	1.677E-04	1.676E-04	1.676E-04	1.676E-04
OT-239	DOSE-131	1.000E+00	5.794E-05	1.677E-04	1.677E-04	1.677E-04	1.677E-04	1.677E-04	1.677E-04	1.676E-04	1.676E-04	1.676E-04
OT-239	U-238	1.000E+00	1.257E-03	1.304E-04	1.304E-04	1.304E-04	1.304E-04	1.303E-04	1.302E-04	1.302E-04	1.302E-04	1.302E-04
OT-239	U-238	1.000E+00	1.339E-03	1.444E-03	1.444E-03	1.444E-03	1.444E-03	1.444E-03	1.442E-03	1.441E-03	1.440E-03	1.439E-03

BRF(1) is the branch fraction of the parent nuclide.
 IRESRAD, Version 5.0
 Summary : RVRPCS--REVERSE REG-COMBINED SOURCE

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File: RVRPCS.RAD

Individual Nuclide Soil Concentration
 Parent Nuclide and Branch Fraction Indicated
 S(1), t(1), P(1)/g

ONuclide	Parent	BRF(1)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	5.000E+02	7.000E+02	1.000E+03
AC-227	AC-227	1.000E+00	7.700E-03	7.453E-03	6.993E-03	5.600E-03	2.363E-03	3.190E-04	5.474E-07	9.393E-10	1.612E-12	1.146E-16
AC-227	Pa-231	1.000E+00	0.000E+00	2.413E-04	7.013E-04	2.099E-03	4.735E-03	7.367E-03	7.648E-03	7.611E-03	7.574E-03	7.515E-03
AC-227	U-238	1.000E+00	0.000E+00	2.566E-09	2.261E-08	2.338E-07	1.733E-06	1.137E-05	4.352E-05	7.582E-05	1.079E-04	1.557E-04
AC-227	S(1):	1.000E+00	7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.687E-03	7.687E-03	7.681E-03	7.674E-03
OPa-231	Pa-231	1.000E+00	7.700E-03	7.700E-03	7.699E-03	7.698E-03	7.694E-03	7.681E-03	7.645E-03	7.606E-03	7.569E-03	7.512E-03
OPa-231	U-238	1.000E+00	0.000E+00	1.622E-07	4.897E-07	1.629E-06	4.986E-06	1.621E-05	4.867E-05	8.089E-05	1.129E-04	1.607E-04
Pa-231	S(1):	1.000E+00	7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.687E-03	7.687E-03	7.681E-03	7.674E-03
OPa-231	Pa-231	1.000E+00	1.700E-01	1.643E-01	1.549E-01	1.246E-01	6.690E-02	7.523E-03	1.514E-05	3.021E-08	6.026E-11	5.368E-15
Pa-231	Pa-231	1.000E+00	5.122E-03	5.113E-03	5.113E-03	4.533E-04	1.023E-01	1.575E-01	1.575E-01	1.396E-01	1.270E-01	1.114E-01
Pa-231	U-238	1.000E+00	0.000E+00	1.133E-06	9.984E-06	1.033E-04	7.685E-04	5.010E-03	1.857E-02	4.246E-02	5.774E-02	8.271E-02
Pa-231	U-238	1.000E+00	0.000E+00	3.432E-12	3.958E-11	3.182E-09	7.433E-09	1.314E-06	2.314E-05	6.792E-05	1.341E-04	2.695E-04
Pa-231	S(1):	1.000E+00	0.000E+00	2.413E-04	1.935E-04	2.288E-04	1.650E-03	1.443E-03	8.063E-09	3.091E-08	9.702E-08	2.557E-07
Pa-231	U-238	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.696E-01	1.694E-01
ORa-226	Pa-231	1.000E+00	1.700E-01	1.692E-01	1.698E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01
ORa-226	U-238	1.000E+00	0.000E+00	3.311E-13	2.982E-09	3.310E-09	2.970E-07	3.265E-06	3.952E-05	7.693E-05	1.464E-04	2.862E-04
Pa-226	U-238	1.000E+00	0.000E+00	3.132E-16	8.455E-15	3.123E-12	5.442E-12	3.097E-10	9.174E-09	3.700E-08	9.927E-08	2.302E-07
Pa-226	S(1):	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
Pa-226	U-238	1.000E+00	8.300E-02	7.357E-02	5.781E-02	2.486E-02	1.231E-03	4.828E-04	1.632E-11	5.511E-08	1.666E-08	0.000E+00
Pa-226	U-238	1.000E+00	0.000E+00	9.442E-03	2.519E-02	5.814E-02	9.076E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
Pa-226	S(1):	1.000E+00	0.000E+00	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
OT-228	Pa-228	1.000E+00	0.000E+00	2.366E-02	4.469E-02	3.394E-02	3.341E-03	7.223E-07	2.145E-17	8.270E-28	2.796E-38	0.000E+00
OT-228	TH-232	1.000E+00	8.300E-02	5.777E-02	2.799E-02	2.216E-03	1.578E-06	1.522E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00
OT-228	TH-232	1.000E+00	0.000E+00	1.474E-03	1.032E-02	4.684E-02	7.965E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
OT-228	S(1):	1.000E+00	8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
OT-230	TH-230	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	TH-230	1.000E+00	0.000E+00	1.453E-06	4.591E-06	1.530E-05	4.530E-05	1.529E-04	4.579E-04	7.615E-04	1.067E-03	1.516E-03
OT-230	S(1):	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	TH-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	U-238	1.000E+00	4.302E-02	5.330E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.291E-02	8.286E-02	8.280E-02	8.271E-02
OT-230	U-234	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	U-238	1.000E+00	0.000E+00	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	S(1):	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01
OT-230	U-238	1.000E+00	7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.687E-03	7.687E-03	7.681E-03	7.674E-03
OT-230	U-238	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.699E-01	1.697E-01	1.697E-01	1.696E-01	1.694E-01

BRF(1) is the branch fraction of the parent nuclide.
 ORESRAD, Version 5.0
 Total Water/Soil Interaction failures = 144.

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Dose Conversion Factor (and Related) Parameter Summary File: 99775332.LIB

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227-D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210-D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226-D	8.600E-03	8.600E-03	DCF2(4)
B-1	Ra-228-D	5.080E-03	5.080E-03	DCF2(5)
B-1	Th-228-D	3.450E-01	3.450E-01	DCF2(6)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(7)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(8)
B-1	U-234	1.320E-01	1.320E-01	DCF2(9)
B-1	U-235-D	1.230E-01	1.230E-01	DCF2(10)
B-1	U-238-D	1.180E-01	1.180E-01	DCF2(11)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227-D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210-D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226-D	1.330E-03	1.330E-03	DCF3(4)
D-1	Ra-228-D	1.440E-03	1.440E-03	DCF3(5)
D-1	Th-228-D	8.080E-04	8.080E-04	DCF3(6)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(7)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(8)
D-1	U-234	2.830E-04	2.830E-04	DCF3(9)
D-1	U-235-D	2.670E-04	2.670E-04	DCF3(10)
D-1	U-238-D	2.690E-04	2.690E-04	DCF3(11)
D-34	Food transfer factors:			
D-34	Ac-227-D , plant/soil concentration ratio, dimensionless	9.250E-06	2.500E-03	RTF(1,1)
D-34	Ac-227-D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227-D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,3)
D-34	Pb-210-D , plant/soil concentration ratio, dimensionless	3.700E-05	1.000E-02	RTF(3,1)
D-34	Pb-210-D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	9.000E-04	9.000E-04	RTF(3,2)
D-34	Pb-210-D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34	Ra-226-D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(4,1)
D-34	Ra-226-D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-226-D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Ra-228-D , plant/soil concentration ratio, dimensionless	1.480E-04	4.000E-02	RTF(5,1)
D-34	Ra-228-D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,2)
D-34	Ra-228-D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(5,3)

R011	Area of contaminated zone (m**2)	2.300E+04	1.000E+04	---	AREA
1	Thickness of contaminated zone (m)	1.000E+00	2.000E+00	---	THICKO
1	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	5.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	7.000E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)

R012	Initial principal radionuclide (pCi/g): Ac-227	7.700E-03	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pa-231	7.700E-03	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.700E-01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Ra-226	1.700E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Ra-228	8.300E-02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Th-228	8.300E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.700E-01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): Th-232	8.300E-02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-234	1.700E-01	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): U-235	7.700E-03	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.700E-01	0.000E+00	---	S1(11)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(11)

R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVERD
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)	1.900E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.400E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.600E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	3.340E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	1.000E-03	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	1.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP

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 Summary : RVRVRSOS--REVERE RES SENS--COMBINED SOURCE File: RVRSCMEM.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	0.000E+00	2.000E-01	---	RUNCOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	Romberg failures occurred	EPS
R014	Density of saturated zone (g/cm**3)	2.000E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	5.000E-02	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	4.000E-02	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	4.000E-02	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E-01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	WJ
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E-02	4.000E+00	---	H(1)
5	Unsat. zone 1, soil density (g/cm**3)	1.630E+00	1.500E+00	---	DENSUE(1)
5	Unsat. zone 1, total porosity	3.000E-01	4.000E-01	---	TPUZ(1)

R015 Unsat. zone 1, effective porosity 2.000E-01 2.000E-01 --- EPZ(1)
 5 Unsat. zone 1, field capacity 2.000E-01 2.000E-01 --- FCZ(1)
 5 Unsat. zone 1, soil-specific b parameter 5.300E+00 5.300E+00 --- BUZ(1)
 R015 Unsat. zone 1, hydraulic conductivity (m/yr) 1.000E+01 1.000E+01 --- HCUZ(1)

R016 Distribution coefficients for Ac-227
 R016 Contaminated zone 1 (cm**3/g) 1.375E+05 2.000E+01 --- DCNUCC(1)
 R016 Unsaturated zone 1 (cm**3/g) 2.000E+01 2.000E+01 --- DCNUCU(1,1)
 R016 Saturated zone 1 (cm**3/g) 1.000E+01 2.000E+01 --- DCNUGS(1)
 R016 Leach rate (/yr) 0.000E+00 0.000E+00 4.134E-06 ALEACH(1)
 R016 Solubility constant 0.000E+00 0.000E+00 not used SOLUBK(1)

R016 Distribution coefficients for Pa-231
 R016 Contaminated zone 1 (cm**3/g) 1.375E+05 5.000E+01 --- DCNUCC(2)
 R016 Unsaturated zone 1 (cm**3/g) 5.000E+01 5.000E+01 --- DCNUCU(2,1)
 R016 Saturated zone 1 (cm**3/g) 1.000E+01 5.000E+01 --- DCNUGS(2)
 R016 Leach rate (/yr) 0.000E+00 0.000E+00 4.134E-06 ALEACH(2)
 R016 Solubility constant 0.000E+00 0.000E+00 not used SOLUBK(2)

R016 Distribution coefficients for Pb-210
 R016 Contaminated zone 1 (cm**3/g) 1.375E+05 1.000E+02 --- DCNUCC(3)
 R016 Unsaturated zone 1 (cm**3/g) 1.000E+02 1.000E+02 --- DCNUCU(3,1)
 R016 Saturated zone 1 (cm**3/g) 1.000E+01 1.000E+02 --- DCNUGS(3)
 R016 Leach rate (/yr) 0.000E+00 0.000E+00 4.134E-06 ALEACH(3)
 R016 Solubility constant 0.000E+00 0.000E+00 not used SOLUBK(3)

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 Summary : RVRVSCS--REVERSE RES SENS--COMBINED SOURCE File: RVRSCMBM.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	7.000E+01	---	DCNUGS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)

R016	Distribution coefficients for Ra-228				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	7.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(5,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	7.000E+01	---	DCNUGS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

R016	Distribution coefficients for Th-228				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	6.000E+04	---	DCNUGS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

R016	Distribution coefficients for Th-230				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	6.000E+04	---	DCNUGS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)

R016	Distribution coefficients for Th-232				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	6.000E+04	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(8,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	6.000E+04	---	DCNUGS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

R016	Distribution coefficients for U-234				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	5.000E+01	---	DCNUGS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)

R016	Distribution coefficients for U-235				
R016	Contaminated zone 1 (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone 1 (cm**3/g)	1.000E+01	5.000E+01	---	DCNUGS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)

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Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.375E+05	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	1.000E+01	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.134E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	3.400E-05	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	5.900E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.571E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.200E-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)
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)	1.120E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.140E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.825E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	4.785E+02	5.100E+02	---	DWI

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Summary : RVRVRSOS--REVERE RES SENS--COMBINED SOURCE

File: RVSRCMBM.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	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
9	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
9	Livestock water fraction from ground water	not used	1.000E+00	---	FGNLW
9	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)	not used	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)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.900E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	1.234E+02	---	CO2F

STOR Storage times of contaminated foodstuffs (days):
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 Summary : RVRVRS--REVERE RES SENS--COMBINED SOURCE File: RVSRCEM.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (if different from user input)	Parameter Name
R	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
UR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMX
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)
ITIL	Number of graphical time points	32	---	---	NPTS
ITIL	Maximum number of integration points for dose	17	---	---	LYMAX
ITIL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active

Summary : RVRVRSOS--SEVERE RES SENS--COMBINED SOURCE

File: RVRRCMB4.RAD

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)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
---	--------	------------	-------	-------	------	------	------

Ac-227	7.139E-03	0.0014	6.524E-03	0.0039	0.000E+00	0.0000	1.591E-03	0.0010
Pa-231	5.348E-04	0.0005	1.367E-03	0.0009	0.000E+00	0.0000	1.193E-03	0.0007
Pb-210	5.113E-04	0.0003	4.875E-04	0.0003	0.000E+00	0.0000	1.726E-02	0.0103
Ra-226	9.190E-01	0.5489	1.950E-04	0.0001	0.000E+00	0.0000	3.475E-03	0.0021
Ra-228	2.899E-01	0.1726	6.192E-04	0.0004	0.000E+00	0.0000	1.744E-03	0.0010
Th-230	3.430E-01	0.2049	3.077E-03	0.0019	0.000E+00	0.0000	7.979E-04	0.0005
Th-232	3.603E-04	0.0002	7.100E-03	0.0042	0.000E+00	0.0000	1.322E-03	0.0008
U-232	1.654E-02	0.0009	1.746E-02	0.0104	0.000E+00	0.0000	3.318E-03	0.0020
U-234	3.387E-03	0.0000	2.875E-03	0.0001	0.000E+00	0.0000	6.823E-04	0.0004
U-235	2.444E-03	0.0017	1.213E-04	0.0001	0.000E+00	0.0000	2.917E-05	0.0000
U-238	1.126E-02	0.0067	2.570E-03	0.0015	0.000E+00	0.0000	6.485E-04	0.0004
Total	1.591E+00	0.3501	4.241E-02	0.0253	0.000E+00	0.0000	3.205E-02	0.0191

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

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
---	-------	------	-------	-------	------	------	---------------

Ac-227	2.900E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	1.596E-02	0.0095
Pa-231	1.327E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	3.779E-03	0.0023
Pb-210	0.036E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.198E-02	0.0131
Ra-226	0.002E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	9.253E-01	0.5527
Ra-228	9.156E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.926E-01	0.1742
Th-230	0.000E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.468E-01	0.2072
Th-232	2.102E-02	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.460E-03	0.0053
Th-234	2.709E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.759E-02	0.0224
U-234	7.281E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.728E-05	0.0002
U-235	3.156E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.001E-03	0.0018
U-238	7.016E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.461E-02	0.0087
Total	8.670E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	1.674E+00	1.0000

*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.0 Tk Limit = 0.5 year 02/21/2001 13:31 Page 14

Summary : RVRVRSOS--SEVERE RES SENS--COMBINED SOURCE File: RVRRCMB4.RAD

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)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
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Ac-227	7.136E-03	0.0013	6.320E-03	0.0038	0.000E+00	0.0000	1.541E-03	0.0009
Pa-231	1.067E-03	0.0006	1.571E-03	0.0009	0.000E+00	0.0000	1.233E-03	0.0007
Pb-210	4.963E-04	0.0003	4.822E-04	0.0003	0.000E+00	0.0000	1.673E-02	0.0100
Ra-226	9.186E-01	0.5463	2.102E-04	0.0001	0.000E+00	0.0000	4.006E-03	0.0024
Ra-228	3.540E-01	0.2127	1.426E-03	0.0008	0.000E+00	0.0000	1.774E-03	0.0011
Th-230	2.898E-01	0.1421	2.142E-03	0.0013	0.000E+00	0.0000	5.554E-04	0.0003
Th-232	6.393E-04	0.0004	7.100E-03	0.0042	0.000E+00	0.0000	1.324E-03	0.0008
U-234	5.575E-02	0.0032	1.752E-02	0.0105	0.000E+00	0.0000	3.531E-03	0.0021
U-235	3.288E-03	0.0000	2.875E-03	0.0017	0.000E+00	0.0000	6.823E-04	0.0004
U-238	1.124E-02	0.0067	2.570E-03	0.0015	0.000E+00	0.0000	2.912E-05	0.0000
U-238	1.126E-02	0.0067	2.570E-03	0.0015	0.000E+00	0.0000	6.485E-04	0.0004
Total	1.591E+00	0.3463	4.241E-02	0.0252	0.000E+00	0.0000	3.205E-02	0.0191

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

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
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Ac-227	2.791E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.557E-02	0.0093
Pa-231	1.261E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.456E-03	0.0027
Pb-210	3.444E-01	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.644E-02	0.0151
Ra-226	9.100E-01	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.264E-01	0.5514
Ra-228	3.174E-01	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.596E-01	0.2136
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.116E-01	0.1197

Th-230 1.455E-03 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.560E-04 0.0000 0.000E+00 0.0000 0.000E-03 0.0000 5.301E-03 0.0005
U-232 4.022E-03 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.940E-06 0.0000 0.000E+00 0.0000 0.000E-03 0.0000 7.134E-02 0.0460
Ra-226 1.474E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.296E-05 0.0000 0.000E+00 0.0000 0.000E-03 0.0000 2.029E-03 0.0023
Th-232 1.161E-04 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 5.546E-07 0.0000 0.000E+00 0.0000 0.000E-03 0.0000 3.005E-03 0.0016
U-238 1.191E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.122E-05 0.0000 0.000E+00 0.0000 0.000E-03 0.0000 1.471E-02 0.0099
Total 6.223E-03 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 4.741E-04 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.680E+00 1.0000
0 Sum of all water independent and dependent pathways.
0 IRECRAD, Version 6.0 TW Limit = 0.5 year 02/21/2001 13:31 Page 15
Summary : RVRVRC03--REVISED RES SENS--COMBINED SOURCE File: RVRVRCBM.RAD

Total Dose Contributions (DOSE(I,P,T)) for Individual Radionuclides (I) and Pathways (P)
As mem/yr and Fraction of Total Dose At t = 3.000E+00 years

0 Ground Inhalation Radon Plant Meat Milk Soil
0 mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract.
Nuclide

Ac-227 5.703E-03 0.0040 5.330E-03 0.0035 0.000E+00 0.0000 1.226E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.446E-03 0.0009
Pa-231 1.509E-03 0.0009 1.961E-03 0.0012 0.000E+00 0.0000 2.635E-04 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 1.328E-03 0.0008
Pb-210 4.663E-04 0.0003 4.532E-04 0.0003 0.000E+00 0.0000 3.395E-03 0.0020 0.000E+00 0.0000 0.000E+00 0.0000 1.572E-02 0.0094
Ra-226 3.279E-01 0.5162 2.390E-04 0.0001 0.000E+00 0.0000 2.755E-03 0.0016 0.000E+00 0.0000 0.000E+00 0.0000 5.006E-03 0.0030
Ra-228 3.490E-01 0.5297 2.087E-03 0.0012 0.000E+00 0.0000 8.563E-04 0.0005 0.000E+00 0.0000 0.000E+00 0.0000 1.644E-03 0.0010
Th-230 1.157E-01 0.0648 1.038E-03 0.0006 0.000E+00 0.0000 1.579E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.631E-04 0.0002
Th-232 1.194E-03 0.0002 7.100E-03 0.0042 0.000E+00 0.0000 8.139E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.327E-03 0.0008
Th-234 1.469E-01 0.0814 1.803E-02 0.0107 0.000E+00 0.0000 6.251E-04 0.0004 0.000E+00 0.0000 0.000E+00 0.0000 3.946E-03 0.0023
U-234 3.399E-05 0.0000 2.875E-03 0.0017 0.000E+00 0.0000 5.794E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 6.423E-04 0.0004
U-235 2.844E-03 0.0017 1.214E-04 0.0001 0.000E+00 0.0000 2.491E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.925E-05 0.0000
U-238 1.126E-03 0.0007 2.570E-03 0.0015 0.000E+00 0.0000 5.439E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 6.485E-04 0.0004
Total 1.591E-03 0.3466 4.241E-02 0.0252 0.000E+00 0.0000 8.223E-03 0.0049 0.000E+00 0.0000 0.000E+00 0.0000 3.205E-02 0.0191

Total Dose Contributions (DOSE(I,P,T)) for Individual Radionuclides (I) and Pathways (P)
As mem/yr and Fraction of Total Dose At t = 3.000E+00 years

0 Water Fish Radon Plant Meat Milk All Pathways*
0 mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract.
Nuclide

Ac-227 3.548E-04 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.747E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.460E-02 0.0097
Pa-231 3.294E-04 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.550E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 5.416E-03 0.0032
Pb-210 3.858E-03 0.0003 0.000E+00 0.0000 0.000E+00 0.0000 9.297E-04 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 2.418E-02 0.0144
Ra-226 1.189E-03 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 9.204E-03 0.0020 0.000E+00 0.0000 0.000E+00 0.0000 9.471E-01 0.5517
Ra-228 2.732E-01 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.144E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 3.740E-01 0.2356
Th-230 0.000E-01 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.702E-01 0.0696
Th-232 2.259E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.799E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.597E-01 0.1010
Th-234 3.333E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.289E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.000E-03 0.0003
U-234 1.674E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.266E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 3.623E-03 0.0023
U-235 7.177E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 5.557E-07 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 3.700E-03 0.0023
U-238 1.591E-04 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.122E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.471E-02 0.0099
Total 6.570E-03 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 5.089E-04 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 1.680E+00 1.0000
0 Sum of all water independent and dependent pathways.
0 IRECRAD, Version 6.0 TW Limit = 0.5 year 02/21/2001 13:31 Page 16
Summary : RVRVRC03--REVISED RES SENS--COMBINED SOURCE File: RVRVRCBM.RAD

Total Dose Contributions (DOSE(I,P,T)) for Individual Radionuclides (I) and Pathways (P)
As mem/yr and Fraction of Total Dose At t = 1.000E+01 years

0 Ground Inhalation Radon Plant Meat Milk Soil
0 mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract.
Nuclide

Ac-227 5.393E-03 0.0010 4.745E-03 0.0028 0.000E+00 0.0000 2.948E-03 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 1.157E-03 0.0007
Pa-231 5.481E-03 0.0000 3.115E-03 0.0013 0.000E+00 0.0000 2.983E-03 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 1.616E-03 0.0010
Pb-210 3.858E-04 0.0000 3.645E-04 0.0002 0.000E+00 0.0000 2.755E-03 0.0016 0.000E+00 0.0000 0.000E+00 0.0000 1.565E-02 0.0075
Ra-226 3.115E-03 0.0003 3.288E-04 0.0000 0.000E+00 0.0000 3.411E-03 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 8.602E-03 0.0048
Ra-228 2.732E-01 0.0000 1.443E-03 0.0003 0.000E+00 0.0000 3.766E-01 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 8.488E-04 0.0005
Th-230 2.124E-03 0.0002 8.115E-05 0.0000 0.000E+00 0.0000 1.262E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.130E-05 0.0000
Th-232 4.022E-03 0.0000 7.100E-03 0.0042 0.000E+00 0.0000 9.077E-03 0.0002 0.000E+00 0.0000 0.000E+00 0.0000 1.347E-03 0.0008
Th-234 1.194E-03 0.0001 7.100E-03 0.0042 0.000E+00 0.0000 1.175E-03 0.0001 0.000E+00 0.0000 0.000E+00 0.0000 4.490E-03 0.0030
U-234 3.490E-03 0.0002 2.875E-03 0.0017 0.000E+00 0.0000 5.794E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 6.424E-04 0.0004
U-235 2.844E-03 0.0017 1.214E-04 0.0001 0.000E+00 0.0000 2.491E-06 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 2.947E-05 0.0000
U-238 1.126E-03 0.0007 2.570E-03 0.0015 0.000E+00 0.0000 5.439E-05 0.0000 0.000E+00 0.0000 0.000E+00 0.0000 6.485E-04 0.0004
Total 1.591E-03 0.3466 4.241E-02 0.0252 0.000E+00 0.0000 8.223E-03 0.0049 0.000E+00 0.0000 0.000E+00 0.0000 3.205E-02 0.0191

Total Dose Contributions (DOSE(I,P,T)) for Individual Radionuclides (I) and Pathways (P)
As mem/yr and Fraction of Total Dose At t = 1.000E+01 years

0 Water Fish Radon Plant Meat Milk All Pathways*
0 mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract. mem/yr fract.
Nuclide

Radio- iside	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	2.315E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	2.134E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.169E-02	0.0070
Pa-231	4.062E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	3.039E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.332E-03	0.0050
Pb-210	3.103E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	2.492E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.745E-02	0.0116
Ra-226	1.939E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	1.502E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	9.380E-01	0.5527
Ra-228	1.175E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	3.144E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.396E-01	0.1366
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.162E-03	0.0055
Th-232	9.641E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.500E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.482E-02	0.0076
U-234	7.034E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	5.441E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.390E-01	0.2612
U-235	1.634E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.234E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.930E-03	0.0023
U-238	7.231E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.539E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.006E-03	0.0018
U-239	1.591E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.033E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.471E-02	0.0098
Total	6.590E-03	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	5.335E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.681E-00	1.0000

0Sum of all water independent and dependent pathways.
RESRAD, Version 6.0 Tk Limit = 0.5 year 02/21/2001 13:31 Page 17
Summary : RVSRCMS--REVERSE RES SENS-COMBINED SOURCE File: RVSRCMSM.RAD

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- iside	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	2.315E-03	0.0017	2.510E-03	0.0015	0.000E+00	0.0000	5.198E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.120E-04	0.0004
Pa-231	5.393E-03	0.0032	5.378E-03	0.0032	0.000E+00	0.0000	3.342E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	2.160E-03	0.0013
Pb-210	2.015E-04	0.0001	1.958E-04	0.0001	0.000E+00	0.0000	1.446E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	6.791E-03	0.0040
Ra-226	9.073E-01	0.5396	4.919E-04	0.0003	0.000E+00	0.0000	4.633E-03	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	1.382E-02	0.0082
Ra-228	2.157E-02	0.0128	1.405E-04	0.0001	0.000E+00	0.0000	3.395E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.898E-05	0.0000
Th-230	6.517E-06	0.0000	5.855E-08	0.0000	0.000E+00	0.0000	8.903E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.518E-08	0.0000
Th-232	1.217E-02	0.0072	7.122E-03	0.0042	0.000E+00	0.0000	1.266E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	1.444E-03	0.0009
U-234	6.263E-01	0.3758	2.102E-02	0.0135	0.000E+00	0.0000	1.163E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	3.555E-05	0.0000	2.876E-03	0.0017	0.000E+00	0.0000	5.788E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.760E-03	0.0034
U-238	2.816E-03	0.0017	1.297E-04	0.0001	0.000E+00	0.0000	2.664E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.825E-04	0.0004
U-239	1.166E-02	0.0067	2.570E-03	0.0015	0.000E+00	0.0000	5.499E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.029E-05	0.0000
Total	1.591E-00	0.9458	4.240E-02	0.0252	0.000E+00	0.0000	9.222E-03	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	3.204E-02	0.0191

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

Radio- iside	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	1.502E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.166E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.192E-03	0.0037
Pa-231	5.337E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	4.133E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.393E-02	0.0082
Pb-210	1.666E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	1.233E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.045E-02	0.0062
Ra-226	3.351E-03	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	2.594E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	9.299E-01	0.5530
Ra-228	1.351E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.201E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.184E-02	0.0130
Th-230	4.073E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.139E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.602E-06	0.0000
Th-232	1.713E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.0000	1.334E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.089E-02	0.0124
U-234	1.674E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.266E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.570E-01	0.3907
U-235	7.431E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.753E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.832E-03	0.0023
U-238	1.592E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.011E-03	0.0018
Total	7.560E-03	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	6.040E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	1.682E+00	1.0000

0Sum of all water independent and dependent pathways.
RESRAD, Version 6.0 Tk Limit = 0.5 year 02/21/2001 13:31 Page 18
Summary : RVSRCMS--REVERSE RES SENS-COMBINED SOURCE File: RVSRCMSM.RAD

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- iside	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	3.505E-04	0.0002	3.003E-04	0.0002	0.000E+00	0.0000	5.586E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.589E-05	0.0000
Pa-231	7.240E-04	0.0004	7.673E-03	0.0043	0.000E+00	0.0000	3.500E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	2.702E-03	0.0016
Pb-210	2.292E-03	0.0008	2.222E-05	0.0000	0.000E+00	0.0000	1.633E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	7.707E-04	0.0005
Ra-226	4.422E-01	0.5525	5.471E-04	0.0004	0.000E+00	0.0000	5.755E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.330E-02	0.0115
Ra-228	4.674E-06	0.0000	3.041E-08	0.0000	0.000E+00	0.0000	7.348E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.709E-08	0.0000
Th-230	6.353E-07	0.0000	3.660E-19	0.0000	0.000E+00	0.0000	2.610E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.467E-19	0.0000
Th-232	3.315E-03	0.0023	1.113E-03	0.0004	0.000E+00	0.0000	2.431E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.976E-03	0.0012
U-234	6.315E-01	0.5548	1.113E-02	0.0012	0.000E+00	0.0000	1.499E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	5.357E-03	0.0035
U-235	5.178E-05	0.0000	3.792E-03	0.0017	0.000E+00	0.0000	5.774E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.933E-04	0.0004
Total	7.560E-03	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	6.040E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	1.682E+00	1.0000

Nucleide	mrem/yr	fract.	Total Dose Contributions (mrem/yr) for Individual Radionuclides (I) and Pathways (P) As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years										mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
			Water Dependent Pathways	Meat	Milk	All Pathways*																
Ac-227	1.61E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.61E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pa-231	6.66E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	5.16E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.89E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.44E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.69E-03	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	3.67E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-228	2.22E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.77E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.96E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.52E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	4.90E-03	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	3.55E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.67E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.46E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	8.35E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.46E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.59E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	1.22E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.10E-02	0.0065	0.000E+00	0.0000	0.000E+00	0.0000	8.53E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

1. RESRAD, Version 6.0 Tk Limit = 0.5 year

Summary : RYRVERGCS-REVERE RES SENS-COMBINED SOURCE

02/27/2001 13:31 Page : 9

File: RYRVERGCS-REVERE

Total Dose Contributions TOOSELP, (1) for Individual Radionuclides (1) and Pathways (P) As mrem/yr and Fraction of Total Dose At t = 3,000E+02 years Water Independent Pathways Inhalation excludes radon														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Sell	
Radio- Nuclide	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.
Ac-227	5.155E-07	0.0000	4.631E-07	0.0000	0.000E+00	0.0000	9.581E-09	0.0000	3.000E+00	0.0000	0.000E+00	0.0000	1.131E-07	0.0000
Pa-231	8.115E-03	0.0045	7.835E-03	0.0046	0.000E+00	0.0000	3.938E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	4.754E-03	0.0016
Pb-210	4.565E-04	0.0000	4.431E-04	0.0003	0.000E+00	0.0000	3.302E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.531E-06	0.0000
Th-232	8.006E-01	0.41763	0.000E+00	0.0000	0.000E+00	0.0000	5.143E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	1.540E+02	0.0019
Th-230	1.574E-16	0.0000	1.023E-16	0.0000	0.000E+00	0.0000	0.441E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.779E-19	0.0000
U-238	0.000E+00	0.0000	3.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.111E-01	0.0062	7.150E-03	0.0042	0.000E+00	0.0000	7.789E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	3.462E+03	0.0002
Th-232	6.445E-01	0.3825	2.113E-02	0.0125	0.000E+00	0.0000	1.489E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	5.853E-03	0.0005
U-234	1.598E-04	0.0001	2.198E-03	0.0017	0.000E+00	0.0000	1.388E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.574E+04	0.0004
U-235	2.895E-03	0.0017	1.668E-04	0.0001	0.000E+00	0.0000	4.921E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.561E+05	0.0009
U-238	1.111E-02	0.0066	1.556E-03	0.0015	0.000E+00	0.0000	5.149E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.449E+04	0.0004
Total	1.553E+00	0.9383	4.235E-02	0.0250	0.000E+00	0.0000	9.013E-03	0.0049	3.000E+00	0.0000	0.000E+00	0.0000	3.701E+02	0.0189

Total Dose Contributions TOOSELP, (1) for Individual Radionuclides (1) and Pathways (P) As mrem/yr and Fraction of Total Dose At t = 3,000E+02 years Water Dependent Pathways														
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio- Nuclide	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.	mrem/yr	frac.
Ac-227	5.155E-07	0.0000	4.631E-07	0.0000	0.000E+00	0.0000	9.581E-09	0.0000	3.000E+00	0.0000	0.000E+00	0.0000	1.131E-07	0.0000
Pa-231	8.115E-03	0.0045	7.835E-03	0.0046	0.000E+00	0.0000	3.938E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	4.754E-03	0.0016
Pb-210	4.565E-04	0.0000	4.431E-04	0.0003	0.000E+00	0.0000	3.302E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.531E-06	0.0000
Th-232	8.006E-01	0.41763	0.000E+00	0.0000	0.000E+00	0.0000	5.143E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	1.540E+02	0.0019
Th-230	1.574E-16	0.0000	1.023E-16	0.0000	0.000E+00	0.0000	0.441E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.779E-19	0.0000
U-238	0.000E+00	0.0000	3.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	1.111E-01	0.0062	7.150E-03	0.0042	0.000E+00	0.0000	7.789E-04	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	3.462E+03	0.0002
Th-232	6.445E-01	0.3825	2.113E-02	0.0125	0.000E+00	0.0000	1.489E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	5.853E-03	0.0005
U-234	1.598E-04	0.0001	2.198E-03	0.0017	0.000E+00	0.0000	1.388E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.574E+04	0.0004
U-235	2.895E-03	0.0017	1.668E-04	0.0001	0.000E+00	0.0000	4.921E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.561E+05	0.0009
U-238	1.111E-02	0.0066	1.556E-03	0.0015	0.000E+00	0.0000	5.149E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.449E+04	0.0004
Total	1.553E+00	0.9383	4.235E-02	0.0250	0.000E+00	0.0000	9.013E-03	0.0049	3.000E+00	0.0000	0.000E+00	0.0000	3.701E+02	0.0189

[illegible]

Radio- Nuclide	Water	Fish	Radon	Water Dependent Pathways	Meat	Milk	All Pathways*
mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	9.025E-10	0.0000	7.956E-10	0.0000	0.000E+00	0.000E+00	0.000E+00
Pa-231	8.134E-03	0.0048	7.796E-03	0.0046	0.000E+00	0.000E+00	0.000E+00
Pb-210	9.794E-11	0.0000	8.837E-11	0.0000	0.000E+00	0.000E+00	0.000E+00
Ra-226	7.389E-01	0.4341	5.621E-04	0.0003	0.000E+00	0.000E+00	0.000E+00
Ra-228	5.333E-27	0.0000	3.476E-29	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-228	8.300E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-230	1.786E-01	0.1049	7.187E-03	0.0042	0.000E+00	0.000E+00	0.000E+00
Th-232	6.472E-01	0.3802	2.112E-02	0.0124	0.000E+00	0.000E+00	0.000E+00
U-234	4.509E-04	0.0003	1.997E-04	0.0001	0.000E+00	0.000E+00	0.000E+00
U-235	2.920E-03	0.0017	1.997E-04	0.0001	0.000E+00	0.000E+00	0.000E+00
U-238	1.124E-02	0.0066	2.569E-03	0.0015	0.000E+00	0.000E+00	0.000E+00
Total	1.587E+00	0.9325	4.232E-02	0.0249	0.000E+00	0.000E+00	0.000E+00

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 5,000E+02 Years

Water Dependent Pathways

Radio- Nuclide	Ground	Inhalation	Radon	Water Dependent Pathways	Meat	Milk	All Pathways*
mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	4.759E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pa-231	6.757E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pb-210	7.523E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Ra-226	4.105E-03	0.0024	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Ra-228	2.604E-30	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-228	8.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-230	1.109E-03	0.0007	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-232	6.140E-02	0.0140	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-234	1.693E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-235	1.407E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-238	1.594E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Total	3.003E-02	0.0176	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00

*Sum of all water independent and dependent pathways.

IREGRAD, Version 6.0 T* Limit = 0.5 year 02/21/2001 13:31 Page 11

Summary : RVRVRSOS-REVERSE RES SENS-COMBINED SOURCE File: RVSRCMEM.RAD

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 7,000E+02 Years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground	Inhalation	Radon	Water Independent Pathways	Meat	Milk	Soil
mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	1.548E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pa-231	8.092E-03	0.0047	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pb-210	1.814E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Ra-226	6.770E-01	0.3970	5.150E-04	0.0003	0.000E+00	0.000E+00	0.000E+00
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-230	2.393E-01	0.1403	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-232	6.466E-01	0.3792	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-234	8.071E-04	0.0005	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-235	2.952E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-238	1.123E-02	0.0066	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Total	1.586E+00	0.9300	4.229E-02	0.0248	0.000E+00	0.000E+00	0.000E+00

Total Dose Contributions TDose(i,p,t) for Individual Radionuclides (i) and Pathways (p)

As mrem/yr and Fraction of Total Dose At t = 7,000E+02 Years

Water Dependent Pathways

Radio- Nuclide	Water	Fish	Radon	Water Dependent Pathways	Meat	Milk	All Pathways*
mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	8.166E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pa-231	6.724E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Pb-210	1.500E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Ra-226	3.760E-01	0.0022	0.000E+00	0.0003	0.000E+00	0.000E+00	0.000E+00
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-230	1.770E-03	0.0010	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Th-232	6.770E-02	0.0162	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-234	1.718E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-235	1.691E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
U-238	1.594E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00
Total	3.027E-02	0.0201	0.000E+00	0.0000	0.000E+00	0.000E+00	0.000E+00

*Sum of all water independent and dependent pathways.

IREGRAD, Version 6.0 T* Limit = 0.5 year 02/21/2001 13:31 Page 11

Summary : RIVERRC03-REVERSE RES SENS-COMBINED SOURCE

File: RIVERRC03.RAD

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)

0	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil
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Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	1.100E-16	0.0000	9.703E-17	0.0000	0.100E-00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	2.366E-17	0.0000
Pa-231	9.103E-03	0.0047	7.698E-03	0.0045	0.100E-00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	2.705E-03	0.0016
Pb-210	1.615E-17	0.0000	1.570E-17	0.0000	0.100E-00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	5.446E-16	0.0000
Ra-226	5.238E-01	0.2486	4.517E-04	0.0003	0.100E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.355E-02	0.0080
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.100E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.100E-00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.207E-01	0.1493	7.244E-03	0.0043	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	2.373E-03	0.0049
Th-232	6.458E-01	0.3192	2.107E-02	0.0124	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	5.925E-03	0.0034
U-234	1.583E-03	0.0003	2.919E-03	0.0017	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	7.125E-04	0.0004
U-235	2.992E-03	0.0019	2.811E-04	0.0002	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	2.585E-05	0.0001
U-238	1.122E-02	0.0066	2.567E-03	0.0015	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	6.479E-04	0.0004
Total	1.584E-00	0.9300	4.223E-02	0.0248	0.100E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	3.192E-02	0.0187

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

0	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*
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Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Ac-227	5.404E-18	0.0000	0.000E+00	0.0000	0.100E+00	0.0000	4.193E-19	0.0000	0.100E+00	0.0000
Pa-231	6.674E-04	0.0004	0.000E+00	0.0000	0.100E+00	0.0000	5.167E-05	0.0000	0.100E+00	0.0000
Pb-210	1.336E-16	0.0000	0.000E+00	0.0000	0.100E-00	0.0000	1.034E-17	0.0000	0.100E+00	0.0000
Ra-226	3.292E-03	0.0019	0.000E+00	0.0000	0.100E+00	0.0000	2.553E-04	0.0000	0.100E+00	0.0000
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	0.100E+00	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.100E+00	0.0000	0.000E+00	0.0000	0.100E+00	0.0000
Th-230	2.124E-03	0.0013	0.000E+00	0.0000	0.100E+00	0.0000	1.735E-04	0.0000	0.100E+00	0.0000
Th-232	2.167E-03	0.0013	0.000E+00	0.0000	0.100E+00	0.0000	2.146E-03	0.0013	0.100E+00	0.0000
U-234	1.176E-04	0.0001	0.000E+00	0.0000	0.100E+00	0.0000	1.169E-05	0.0000	0.100E+00	0.0000
U-235	2.114E-05	0.0000	0.000E+00	0.0000	0.100E+00	0.0000	1.337E-06	0.0000	0.100E+00	0.0000
U-238	1.584E-04	0.0001	0.100E+00	0.0000	0.100E+00	0.0000	1.034E-05	0.0000	0.100E+00	0.0000
Total	3.423E-02	0.0201	0.100E+00	0.0000	0.100E+00	0.0000	2.654E-03	0.0016	0.100E+00	0.0000

Sum of all water independent and dependent pathways.
IRISRAD, Version 6.3
Summary : RIVERRC03-REVERSE RES SENS-COMBINED SOURCEParent and Property Ratios Summed Over All Pathways
Dose/Source Ratios Summed Over All Pathways
Dose/Source Ratios Summed Over All Pathways

Parent	Product	Station	Ratio	Station	Ratio	Station	Ratio	Station	Ratio	Station	Ratio	Station	Ratio
Ac-227	Ac-227	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-231	Pa-231	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	Pb-210	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-226	Ra-226	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Ra-228	Ra-228	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-228	Th-228	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-234	U-234	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-235	U-235	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
U-238	U-238	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Total	Total	1.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

07h-229	Pa-232	1.000E+00	6.267E-03	1.557E-01	2.311E-01	1.610E-01	1.568E-02	3.395E-06	1.149E-16	3.441E-27	0.000E+00	0.000E+00
07h-228	Th-232	1.000E+00	3.449E-01	2.415E-01	1.110E-01	3.422E-02	6.672E-02	6.131E-17	6.000E+00	1.000E+00	0.000E+00	0.000E+00
07h-227	Th-232	1.000E+00	2.641E-03	6.611E-02	6.522E-02	2.433E-01	1.679E-01	4.134E-01	4.131E-01	4.131E-01	4.131E-01	4.131E-01
07h-226	DOSE(1)	1.000E+00	4.116E-01	4.136E-01	4.136E-01	4.136E-01	4.136E-01	4.134E-01	4.131E-01	4.131E-01	4.131E-01	4.131E-01
07h-225	Th-230	1.000E+00	8.600E-03	6.599E-03	6.599E-03	6.599E-03	6.599E-03	6.598E-03	6.566E-03	6.543E-03	6.569E-03	8.933E-03
07h-224	U-234	1.000E+00	3.972E-04	1.161E-07	2.710E-07	9.195E-07	2.350E-06	7.772E-06	2.319E-05	3.853E-05	5.415E-05	7.791E-05
07h-223	Th-230	1.000E+00	4.448E-14	3.354E-13	1.600E-12	1.293E-11	1.345E-10	1.116E-09	9.910E-09	2.742E-08	5.363E-08	1.097E-07
07h-222	DOSE(1)	1.000E+00	8.600E-03	8.600E-03	8.599E-03	8.599E-03	8.599E-03	8.599E-03	8.589E-03	8.582E-03	8.522E-03	8.911E-03
07h-221	Th-232	1.000E+00	2.066E-02	2.066E-02	2.066E-02	2.066E-02	2.066E-02	2.065E-02	2.084E-02	2.082E-02	2.165E-02	2.162E-02
07h-220	U-234	1.000E+00	3.729E-03	3.829E-03	3.829E-03	3.829E-03	3.829E-03	3.826E-03	3.821E-03	3.816E-03	3.811E-03	3.803E-03
07h-219	U-234	1.000E+00	5.346E-03	1.608E-03	3.799E-03	1.110E-07	3.312E-07	1.090E-06	3.357E-06	5.418E-06	7.575E-06	1.080E-05
07h-218	DOSE(1)	1.000E+00	3.729E-03	3.829E-03	3.829E-03	3.829E-03	3.829E-03	3.828E-03	3.828E-03	3.821E-03	3.818E-03	3.813E-03
07h-217	U-235	1.000E+00	3.001E-03	3.005E-03	3.005E-03	3.004E-03	3.004E-03	3.004E-03	3.001E-03	2.999E-03	2.996E-03	2.992E-03
07h-216	U-235	1.000E+00	1.461E-02	1.471E-02	1.471E-02	1.471E-02	1.471E-02	1.470E-02	1.469E-02	1.468E-02	1.467E-02	1.465E-02

BRF(1) is the branch fraction of the parent nuclide.

REGRAD, Version 6.0

TK Limit = 0.5 year

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Summary : RTRVRCO--REVERSE REGS SENS-COMBINED SOURCE File: RTRVRCHEM.RAD

Nuclide		Parent	BRF(1)	Individual Nuclide Soil Concentration											
		(1)		Parent Nuclide and Branch Fraction Indicated											
		(1)		S(1), pCi/g											
Ac-227	Ac-227	1.000E+00	7.700E-03	7.439E-03	6.999E-03	5.600E-03	2.263E-03	3.190E-04	5.473E-07	9.390E-10	1.611E-12	1.145E-16	1.000E+00	1.000E+00	1.000E+00
Ac-227	Pa-231	1.000E+00	0.000E+00	2.413E-04	7.013E-04	2.099E-03	4.735E-03	7.366E-03	7.646E-03	7.609E-03	7.570E-03	7.513E-03	0.000E+00	0.000E+00	0.000E+00
Ac-227	U-235	1.000E+00	0.000E+00	2.566E-03	2.261E-08	2.338E-07	1.739E-06	1.137E-05	4.352E-05	7.581E-05	1.074E-04	1.555E-04	0.000E+00	0.000E+00	0.000E+00
Ac-227	S(1)		7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.690E-03	7.684E-03	7.678E-03	7.668E-03	7.668E-03	7.668E-03	7.668E-03
Pa-231	Pa-231	1.000E+00	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.699E-03	7.691E-03	7.641E-03	7.603E-03	7.565E-03	7.508E-03	7.508E-03	7.508E-03	7.508E-03
Pa-231	U-235	1.000E+00	0.000E+00	1.629E-07	4.987E-07	1.629E-06	4.885E-06	1.627E-05	4.866E-05	8.086E-05	1.129E-04	1.605E-04	1.605E-04	1.605E-04	1.605E-04
Pa-231	S(1)		7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.699E-03	7.697E-03	7.690E-03	7.684E-03	7.678E-03	7.668E-03	7.668E-03	7.668E-03	7.668E-03
Pb-213	Pb-213	1.000E+00	1.700E-01	1.648E-01	1.549E-01	1.246E-01	6.800E-02	7.592E-03	1.514E-05	3.023E-09	6.023E-11	5.365E-15	0.000E+00	0.000E+00	0.000E+00
Pb-213	Th-232	1.000E+00	0.000E+00	5.202E-03	1.513E-02	4.531E-02	1.023E-01	1.573E-01	1.512E-01	1.395E-01	1.069E-01	1.113E-01	1.113E-01	1.113E-01	1.113E-01
Pb-213	Th-232	1.000E+00	0.000E+00	1.332E-06	9.384E-06	1.033E-04	7.688E-03	5.310E-03	1.552E-02	1.104E-02	4.044E-02	5.770E-02	5.770E-02	5.770E-02	5.770E-02
Pb-213	U-234	1.000E+00	0.000E+00	3.449E-12	9.083E-11	3.180E-09	7.432E-08	1.814E-06	5.814E-05	6.790E-05	1.141E-04	2.693E-04	2.693E-04	2.693E-04	2.693E-04
Pb-213	U-238	1.000E+00	0.000E+00	2.419E-19	1.352E-16	2.289E-14	1.650E-12	1.142E-10	6.006E-09	3.092E-09	8.704E-08	2.555E-07	2.555E-07	2.555E-07	2.555E-07
Pb-210	S(1)		1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01
Pa-232	Pa-232	1.000E+00	1.700E-01	1.689E-01	1.689E-01	1.689E-01	1.689E-01	1.687E-01	1.680E-01	1.674E-01	1.668E-01	1.658E-01	1.658E-01	1.658E-01	1.658E-01
Pa-232	Th-232	1.000E+00	0.000E+00	7.363E-03	2.029E-04	7.349E-03	2.195E-03	7.101E-03	2.066E-02	3.026E-02	4.419E-02	5.924E-02	5.924E-02	5.924E-02	5.924E-02
Pa-232	U-234	1.000E+00	0.000E+00	3.314E-13	2.982E-09	3.310E-09	2.970E-07	3.265E-06	2.551E-05	7.689E-05	1.463E-04	2.860E-04	2.860E-04	2.860E-04	2.860E-04
Pa-232	U-238	1.000E+00	0.000E+00	3.132E-16	8.455E-15	3.129E-13	8.429E-12	3.097E-10	8.172E-09	3.699E-08	9.937E-08	2.800E-07	2.800E-07	2.800E-07	2.800E-07
Pa-232	S(1)		1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.692E-01	1.686E-01	1.680E-01	1.670E-01	1.670E-01	1.670E-01	1.670E-01
Pa-232	Th-232	1.000E+00	8.300E-02	7.357E-02	5.791E-02	2.486E-02	2.231E-03	4.926E-07	1.632E-17	5.516E-29	1.853E-38	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-232	Th-232	1.000E+00	8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.297E-02	8.290E-02	8.283E-02	8.276E-02	8.266E-02	8.266E-02	8.266E-02	8.266E-02
Pa-232	Th-232	1.000E+00	0.000E+00	2.362E-02	4.469E-02	3.394E-02	3.341E-03	7.023E-07	2.144E-17	8.267E-29	2.795E-38	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-232	Th-232	1.000E+00	8.300E-02	5.777E-02	2.799E-02	2.116E-03	1.579E-06	1.527E-17	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pa-232	Th-232	1.000E+00	0.000E+00	1.547E-03	1.032E-02	4.684E-02	7.365E-02	8.229E-02	8.230E-02	8.233E-02	8.236E-02	8.266E-02	8.266E-02	8.266E-02	8.266E-02
Pa-232	Th-232	1.000E+00	8.300E-02	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.290E-02	8.283E-02	8.276E-02	8.266E-02	8.266E-02	8.266E-02	8.266E-02
Pa-232	Th-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01
Pa-232	Th-232	1.000E+00	0.000E+00	1.500E-06	4.591E-06	1.530E-05	4.590E-05	1.529E-04	4.573E-04	4.548E-04	4.523E-04	4.515E-04	4.515E-04	4.515E-04	4.515E-04
Pa-232	Th-232	1.000E+00	2.149E-12	1.952E-11	2.169E-10	1.952E-09	2.167E-08	2.148E-07	2.148E-07	2.141E-07	2.134E-07	2.125E-06	2.125E-06	2.125E-06	2.125E-06
Pa-232	Th-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01
Pa-232	Th-232	1.000E+00	8.300E-02	8.300E-02	8.300E-02	8.299E-02	8.297E-02	8.290E-02	8.283E-02	8.276E-02	8.266E-02	8.266E-02	8.266E-02	8.266E-02	8.266E-02
Pa-232	Th-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01
Pa-232	Th-232	1.000E+00	0.000E+00	4.819E-07	1.446E-06	4.819E-06	1.446E-05	4.817E-05	1.443E-04	2.403E-04	3.861E-04	4.793E-04	4.793E-04	4.793E-04	4.793E-04
Pa-232	Th-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01
Pa-232	Th-232	1.000E+00	7.700E-03	7.700E-03	7.700E-03	7.700E-03	7.699E-03	7.697E-03	7.690E-03	7.684E-03	7.678E-03	7.668E-03	7.668E-03	7.668E-03	7.668E-03
Pa-232	Th-232	1.000E+00	1.700E-01	1.700E-01	1.700E-01	1.700E-01	1.699E-01	1.697E-01	1.690E-01	1.684E-01	1.678E-01	1.668E-01	1.668E-01	1.668E-01	1.668E-01

BRF(1) is the branch fraction of the parent nuclide.

REGRAD, Version 6.0

TK Limit = 0.5 year

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Summary : RTRVRCO--REVERSE REGS SENS-COMBINED SOURCE File: RTRVRCHEM.RAD

Total water/soil iteration failures = 493.

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 0 : 1 **
Title : Cabot Revere Basement Resident
Input File : C:\PROGRA~1\RESBLD30

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff                                     fff
fff      RESRAD-BUILD Table of Contents      fff
fff                                     fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

```

Input Parameters..... 0-1
For Each Time (I) :.....
    Time Specific Parameters..... I-1
    Receptor-Source Dose Summary..... I-2
    Dose by Pathway Detail..... I-3
    Dose by Nuclide Detail..... I-4
Full Summary..... F-1

```

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 1 : 2 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii                                     iii
iii      RESRAD-BUILD Input Parameters      iii
iii                                     iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

```

Number of Sources : 5
Number of Receptors: 1
Total Time : 3.650000E+02 days
Fraction Inside : 5.000000E-01
  
```

iiiiiiiiiii Receptor Information iiiiiiiiiii

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	3.000	3.000	1.000	1.000	1.80E+01	1.00E-04

iii Receptor-Source Shielding Relationship iii

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA				
1	1	2.40E+00	1.50E+01	Concrete
1	2	2.40E+00	1.50E+01	Concrete
1	3	2.40E+00	1.50E+01	Concrete
1	4	2.40E+00	1.50E+01	Concrete
1	5	2.40E+00	1.50E+01	Concrete

iiiiiiii Building Information iiiiiiii

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

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

	*	*
	*	*
	*	*
H1: 3.000	* Room 1	<=Q01: 8.64E+01
	* LAMBDA: 8.00E-01	* Q10 : 8.64E+01
Area 36.000	*	*
	*	*

Deposition velocity: 0.00E+00 [m/s] Resuspension Rate: 0.00E+00 [1/s]

Source Information

Source: 1

Location:: Room : 1 x: 3.00 y: 0.00 z: 3.00[m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Density [g/cm3] :2.40E+00
 Material :Concrete
 Erosion Rate [cm/day] :0.00E+00
 Porosity :1.00E-01
 Eff. Diffusion [m2/s] :2.00E-05
 Emanation Fractions(1):0.00E+00
 (2):0.00E+00

Contamination::

Nuclide Concentration	Dose Conversion Factors					
	Ingestion Inhalation External (Surface) External (Volume) Submersion					
[pCi/g]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]	
U-238	1.700E-01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	7.700E-03	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.700E-01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	7.700E-03	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-232	8.300E-02	2.730E-03	1.640E+00	6.450E-08	3.260E-10	1.020E-06
TH-230	1.700E-01	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-228	8.300E-02	8.080E-04	3.450E-01	1.650E-04	6.390E-06	9.410E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-228	8.300E-02	1.440E-03	5.080E-03	1.090E-04	3.740E-06	5.590E-03
RA-226	1.700E-01	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	1.700E-01	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 3 : 5 **
 ie : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

Source: 2

Location:: Room : 1 x: 0.00 y: 3.00 z: 3.00[m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Density [g/cm3] :2.40E+00
 Material :Concrete
 Erosion Rate [cm/day] :0.00E+00
 Porosity :1.00E-01
 Eff. Diffusion [m2/s] :2.00E-05
 Emanation Fractions(1):0.00E+00
 (2):0.00E+00

Contamination::

	Dose Conversion Factors					
	Nuclide Concentration					
	Ingestion Inhalation External External Submersion					
	(Surface) (Volume)					
	[pCi/g]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]
U-238	1.700E-01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	7.700E-03	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.700E-01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	7.700E-03	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-232	8.300E-02	2.730E-03	1.640E+00	6.450E-08	3.260E-10	1.020E-06
TH-230	1.700E-01	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-228	8.300E-02	8.080E-04	3.450E-01	1.650E-04	6.390E-06	9.410E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-228	8.300E-02	1.440E-03	5.080E-03	1.090E-04	3.740E-06	5.590E-03
RA-226	1.700E-01	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	1.700E-01	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 3 : 6 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

Source: 3

Location:: Room : 1 x: 3.00 y: 6.00 z: 3.00[m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Density [g/cm3] :2.40E+00
 Material :Concrete
 Erosion Rate [cm/day] :0.00E+00
 Porosity :1.00E-01
 Eff. Diffusion [m2/s] :2.00E-05
 Emanation Fractions(1):0.00E+00
 (2):0.00E+00

Contamination::

Nuclide Concentration

Dose Conversion Factors

AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

Ingestion Inhalation External External Submersion
 (Surface) (Volume)

[pCi/g] [mrem/pCi] [mrem/pCi] [mrem/yr/ [mrem/yr/ [mrem/yr/
 (pCi/m2)] (pCi/m3)] (pCi/m3)]

U-238	1.700E-01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	7.700E-03	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.700E-01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	7.700E-03	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-232	8.300E-02	2.730E-03	1.640E+00	6.450E-08	3.260E-10	1.020E-06
TH-230	1.700E-01	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-228	8.300E-02	8.080E-04	3.450E-01	1.650E-04	6.390E-06	9.410E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-228	8.300E-02	1.440E-03	5.080E-03	1.090E-04	3.740E-06	5.590E-03
RA-226	1.700E-01	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	1.700E-01	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 3 : 7 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

Source: 4

Location:: Room : 1 x: 6.00 y: 3.00 z: 3.00[m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Density [g/cm3] :2.40E+00
 Material :Concrete
 Erosion Rate [cm/day] :0.00E+00
 Porosity :1.00E-01
 Eff. Diffusion [m2/s] :2.00E-05
 Emanation Fractions(1):0.00E+00
 (2):0.00E+00

Contamination::

Nuclide Concentration	Dose Conversion Factors					
	Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion	
[pCi/g] [mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]		
U-238	1.700E-01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	7.700E-03	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.700E-01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	7.700E-03	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-232	8.300E-02	2.730E-03	1.640E+00	6.450E-08	3.260E-10	1.020E-06
TH-230	1.700E-01	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-228	8.300E-02	8.080E-04	3.450E-01	1.650E-04	6.390E-06	9.410E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-228	8.300E-02	1.440E-03	5.080E-03	1.090E-04	3.740E-06	5.590E-03
RA-226	1.700E-01	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	1.700E-01	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:45 Page: 0- 3 : 8 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

Source: 5

Location:: Room : 1 x: 3.00 y: 3.00 z: 0.00[m]
 Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: z
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Density [g/cm3] :2.40E+00
 Material :Concrete
 Erosion Rate [cm/day] :0.00E+00
 Porosity :1.00E-01
 Eff. Diffusion [m2/s] :2.00E-05
 Emanation Fractions(1):0.00E+00
 (2):0.00E+00

Contamination::

Nuclide Concentration

Dose Conversion Factors

AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA

Ingestion Inhalation External External Submersion
 (Surface) (Volume)

[pCi/g] [mrem/pCi] [mrem/pCi] [mrem/yr/ [mrem/yr/ [mrem/yr/
 (pCi/m2)] (pCi/m3)] (pCi/m3)]

U-238	1.700E-01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	7.700E-03	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	1.700E-01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	7.700E-03	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-232	8.300E-02	2.730E-03	1.640E+00	6.450E-08	3.260E-10	1.020E-06
TH-230	1.700E-01	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
TH-228	8.300E-02	8.080E-04	3.450E-01	1.650E-04	6.390E-06	9.410E-03
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-228	8.300E-02	1.440E-03	5.080E-03	1.090E-04	3.740E-06	5.590E-03
RA-226	1.700E-01	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	1.700E-01	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 1 : 9 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii      Assessment for Time: 1      iii
iii      Time =0.00E+00 yr      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

iiiiiiii Source Information iiii

Source: 1
 Location:: Room : 1 x: 3.00 y: 0.00 z: 3.00 [m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y
 Pathway ::
 Direct Ingestion Rate :0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Fraction Contaminated :1.00E+00
 Density [g/cm3] :2.40E+00

Contamination::	Nuclide	Concentration [pCi/g]
	U-238	1.700E-01
	U-235	7.700E-03
	U-234	1.700E-01
	PA-231	7.700E-03
	TH-232	8.300E-02
	TH-230	1.700E-01
	TH-228	8.300E-02
	AC-227	1.214E-04
	RA-228	8.300E-02
	RA-226	1.700E-01
	PB-210	1.700E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 1 : 10 **
File : Cabot Revere Basement Resident
Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 2

Location:: Room : 1 x: 0.00 y: 3.00 z: 3.00 [m]
Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate :0.000E+00 [gm/hr]
Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
Region : 1
Thickness [cm] :1.00E+02
Fraction Contaminated :1.00E+00
Density [g/cm3] :2.40E+00

Contamination::	Nuclide	Concentration [pCi/g]
	U-238	1.700E-01
	U-235	7.700E-03
	U-234	1.700E-01
	PA-231	7.700E-03
	TH-232	8.300E-02
	TH-230	1.700E-01
	TH-228	8.300E-02
	AC-227	1.214E-04
	RA-228	8.300E-02
	RA-226	1.700E-01
	PB-210	1.700E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 1 : 11 **
Title : Cabot Revere Basement Resident
Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 3

Location:: Room : 1 x: 3.00 y: 6.00 z: 3.00 [m]
Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y
Pathway ::
Direct Ingestion Rate :0.000E+00 [gm/hr]
Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
Region : 1
Thickness [cm] :1.00E+02
Fraction Contaminated :1.00E+00
Density [g/cm3] :2.40E+00

Contamination::	Nuclide	Concentration [pCi/g]
	U-238	1.700E-01
	U-235	7.700E-03
	U-234	1.700E-01
	PA-231	7.700E-03
	TH-232	8.300E-02
	TH-230	1.700E-01
	TH-228	8.300E-02
	AC-227	1.214E-04
	RA-228	8.300E-02
	RA-226	1.700E-01
	PB-210	1.700E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 1 : 12 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA-1\RESBLD30Evaluation Time: 0.000000 years

Source: 4

Location:: Room : 1 x: 6.00 y: 3.00 z: 3.00 [m]
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x
 Pathway ::
 Direct Ingestion Rate :0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Fraction Contaminated :1.00E+00
 Density [g/cm3] :2.40E+00

Contamination::	Nuclide	Concentration [pCi/g]
	U-238	1.700E-01
	U-235	7.700E-03
	U-234	1.700E-01
	PA-231	7.700E-03
	TH-232	8.300E-02
	TH-230	1.700E-01
	TH-228	8.300E-02
	AC-227	1.214E-04
	RA-228	8.300E-02
	RA-226	1.700E-01
	PB-210	1.700E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 1 : 13 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 5

Location:: Room : 1 x: 3.00 y: 3.00 z: 0.00 [m]
 Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: z
 Pathway ::
 Direct Ingestion Rate :0.000E+00 [gm/hr]
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1
 Region : 1
 Thickness [cm] :1.00E+02
 Fraction Contaminated :1.00E+00
 Density [g/cm3] :2.40E+00

Contamination::	Nuclide	Concentration [pCi/g]
	U-238	1.700E-01
	U-235	7.700E-03
	U-234	1.700E-01
	PA-231	7.700E-03
	TH-232	8.300E-02
	TH-230	1.700E-01
	TH-228	8.300E-02
	AC-227	1.214E-04
	RA-228	8.300E-02
	RA-226	1.700E-01
	PB-210	1.700E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 2 : 14 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA-1\RESBLD30Evaluation Time: 0.000000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii                                                                iii
iii      RESRAD-BUILD Dose Tables                                iii
iii                                                                iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

Source Contributions to Receptor Doses
 [mrem]

	Source 1	Source 2	Source 3	Source 4	Source 5	Total
Receptor 1	2.9E-02	2.9E-02	2.9E-02	2.9E-02	8.4E-02	2.0E-01
Total	2.9E-02	2.9E-02	2.9E-02	2.9E-02	8.4E-02	2.0E-01

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 3 : 15 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Pathway Detail of Doses
 ffffffffffffffffffffffff
 [mrem]

Source: 1						
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 2						
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 3						
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 4						
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	2.89E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Source: 5						
Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	8.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total	8.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 4 : 16 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Nuclide Detail of Doses
 ~~~~~  
 [mrem]

Source: 1

| Nuclide | Receptor<br>1 | Total    |
|---------|---------------|----------|
| U-238   |               |          |
| U-238   | 1.40E-04      | 1.40E-04 |
| U-234   | 4.90E-15      | 4.90E-15 |
| TH-230  | 9.26E-20      | 9.26E-20 |
| RA-226  | 6.28E-18      | 6.28E-18 |
| PB-210  | 0.00E+00      | 0.00E+00 |
| U-235   |               |          |
| U-235   | 6.77E-06      | 6.77E-06 |
| PA-231  | 4.69E-11      | 4.69E-11 |
| AC-227  | 3.73E-12      | 3.73E-12 |
| U-234   |               |          |
| U-234   | 3.46E-09      | 3.46E-09 |
| TH-230  | 9.81E-14      | 9.81E-14 |
| PA-226  | 1.05E-11      | 1.05E-11 |
| B-210   | 1.40E-18      | 1.40E-18 |
| PA-231  |               |          |
| PA-231  | 4.44E-06      | 4.44E-06 |
| AC-227  | 5.86E-07      | 5.86E-07 |
| TH-232  |               |          |
| TH-232  | 1.53E-09      | 1.53E-09 |
| TH-228  | 5.70E-05      | 5.70E-05 |
| RA-228  | 2.14E-04      | 2.14E-04 |
| TH-230  |               |          |
| TH-230  | 2.18E-08      | 2.18E-08 |
| RA-226  | 3.52E-06      | 3.52E-06 |
| PB-210  | 6.21E-13      | 6.21E-13 |
| TH-228  |               |          |
| TH-228  | 7.41E-03      | 7.41E-03 |
| RA-228  |               |          |
| TH-228  | 1.36E-03      | 1.36E-03 |
| RA-228  | 3.48E-03      | 3.48E-03 |
| RA-226  |               |          |
| RA-226  | 1.62E-02      | 1.62E-02 |
| PB-210  | 4.29E-09      | 4.29E-09 |
| PB-210  |               |          |
| PB-210  | 2.75E-07      | 2.75E-07 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 4 : 17 \*\*  
 File : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 2

| Nuclide | Receptor<br>1 | Total    |
|---------|---------------|----------|
| U-238   |               |          |
| U-238   | 1.40E-04      | 1.40E-04 |
| U-234   | 4.90E-15      | 4.90E-15 |
| TH-230  | 9.26E-20      | 9.26E-20 |
| RA-226  | 6.28E-18      | 6.28E-18 |
| PB-210  | 0.00E+00      | 0.00E+00 |
| U-235   |               |          |
| U-235   | 6.77E-06      | 6.77E-06 |
| PA-231  | 4.69E-11      | 4.69E-11 |
| AC-227  | 3.73E-12      | 3.73E-12 |
| U-234   |               |          |
| U-234   | 3.46E-09      | 3.46E-09 |
| TH-230  | 9.81E-14      | 9.81E-14 |
| RA-226  | 1.05E-11      | 1.05E-11 |
| PB-210  | 1.40E-18      | 1.40E-18 |
| PA-231  |               |          |
| PA-231  | 4.44E-06      | 4.44E-06 |
| AC-227  | 5.86E-07      | 5.86E-07 |
| -232    |               |          |
| TH-232  | 1.53E-09      | 1.53E-09 |
| TH-228  | 5.70E-05      | 5.70E-05 |
| RA-228  | 2.14E-04      | 2.14E-04 |
| TH-230  |               |          |
| TH-230  | 2.18E-08      | 2.18E-08 |
| RA-226  | 3.52E-06      | 3.52E-06 |
| PB-210  | 6.21E-13      | 6.21E-13 |
| TH-228  |               |          |
| TH-228  | 7.41E-03      | 7.41E-03 |
| RA-228  |               |          |
| TH-228  | 1.36E-03      | 1.36E-03 |
| RA-228  | 3.48E-03      | 3.48E-03 |
| RA-226  |               |          |
| RA-226  | 1.62E-02      | 1.62E-02 |
| PB-210  | 4.29E-09      | 4.29E-09 |
| PB-210  |               |          |
| PB-210  | 2.75E-07      | 2.75E-07 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 4 : 18 \*\*  
 Title : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 3

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| U-238   |          |          |
| U-238   | 1.40E-04 | 1.40E-04 |
| U-234   | 4.90E-15 | 4.90E-15 |
| TH-230  | 9.26E-20 | 9.26E-20 |
| RA-226  | 6.28E-18 | 6.28E-18 |
| PB-210  | 0.00E+00 | 0.00E+00 |
| U-235   |          |          |
| U-235   | 6.77E-06 | 6.77E-06 |
| PA-231  | 4.69E-11 | 4.69E-11 |
| AC-227  | 3.73E-12 | 3.73E-12 |
| U-234   |          |          |
| U-234   | 3.46E-09 | 3.46E-09 |
| TH-230  | 9.81E-14 | 9.81E-14 |
| RA-226  | 1.05E-11 | 1.05E-11 |
| PB-210  | 1.40E-18 | 1.40E-18 |
| PA-231  |          |          |
| PA-231  | 4.44E-06 | 4.44E-06 |
| AC-227  | 5.86E-07 | 5.86E-07 |
| -232    |          |          |
| TH-232  | 1.53E-09 | 1.53E-09 |
| TH-228  | 5.70E-05 | 5.70E-05 |
| RA-228  | 2.14E-04 | 2.14E-04 |
| TH-230  |          |          |
| TH-230  | 2.18E-08 | 2.18E-08 |
| RA-226  | 3.52E-06 | 3.52E-06 |
| PB-210  | 6.21E-13 | 6.21E-13 |
| TH-228  |          |          |
| TH-228  | 7.41E-03 | 7.41E-03 |
| RA-228  |          |          |
| TH-228  | 1.36E-03 | 1.36E-03 |
| RA-228  | 3.48E-03 | 3.48E-03 |
| RA-226  |          |          |
| RA-226  | 1.62E-02 | 1.62E-02 |
| PB-210  | 4.29E-09 | 4.29E-09 |
| PB-210  |          |          |
| PB-210  | 2.75E-07 | 2.75E-07 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 4 : 19 \*\*  
 Title : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 0.000000 years

Source: 4

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| U-238   |          |          |
| U-238   | 1.40E-04 | 1.40E-04 |
| U-234   | 4.90E-15 | 4.90E-15 |
| TH-230  | 9.26E-20 | 9.26E-20 |
| RA-226  | 6.28E-18 | 6.28E-18 |
| PB-210  | 0.00E+00 | 0.00E+00 |
| U-235   |          |          |
| U-235   | 6.77E-06 | 6.77E-06 |
| PA-231  | 4.69E-11 | 4.69E-11 |
| AC-227  | 3.73E-12 | 3.73E-12 |
| U-234   |          |          |
| U-234   | 3.46E-09 | 3.46E-09 |
| TH-230  | 9.81E-14 | 9.81E-14 |
| RA-226  | 1.05E-11 | 1.05E-11 |
| PB-210  | 1.40E-18 | 1.40E-18 |
| PA-231  |          |          |
| PA-231  | 4.44E-06 | 4.44E-06 |
| AC-227  | 5.86E-07 | 5.86E-07 |
| -232    |          |          |
| TH-232  | 1.53E-09 | 1.53E-09 |
| TH-228  | 5.70E-05 | 5.70E-05 |
| RA-228  | 2.14E-04 | 2.14E-04 |
| TH-230  |          |          |
| TH-230  | 2.18E-08 | 2.18E-08 |
| RA-226  | 3.52E-06 | 3.52E-06 |
| PB-210  | 6.21E-13 | 6.21E-13 |
| TH-228  |          |          |
| TH-228  | 7.41E-03 | 7.41E-03 |
| RA-228  |          |          |
| TH-228  | 1.36E-03 | 1.36E-03 |
| RA-228  | 3.48E-03 | 3.48E-03 |
| RA-226  |          |          |
| RA-226  | 1.62E-02 | 1.62E-02 |
| PB-210  | 4.29E-09 | 4.29E-09 |
| PB-210  |          |          |
| PB-210  | 2.75E-07 | 2.75E-07 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:47 Page: 1- 4 : 20 \*\*  
 File : Cabot Revere Basement Resident  
 Input File : C:\PROGRA-1\RESBLD30Evaluation Time: 0.000000 years

Source: 5

| Nuclide | Receptor | Total    |
|---------|----------|----------|
|         | 1        |          |
| U-238   |          |          |
| U-238   | 3.83E-04 | 3.83E-04 |
| U-234   | 9.21E-15 | 9.21E-15 |
| TH-230  | 1.81E-19 | 1.81E-19 |
| RA-226  | 1.79E-17 | 1.79E-17 |
| PB-210  | 0.00E+00 | 0.00E+00 |
| U-235   |          |          |
| U-235   | 1.47E-05 | 1.47E-05 |
| PA-231  | 1.10E-10 | 1.10E-10 |
| AC-227  | 8.91E-12 | 8.91E-12 |
| U-234   |          |          |
| U-234   | 6.50E-09 | 6.50E-09 |
| TH-230  | 1.92E-13 | 1.92E-13 |
| RA-226  | 3.01E-11 | 3.01E-11 |
| PB-210  | 3.76E-18 | 3.76E-18 |
| PA-231  |          |          |
| PA-231  | 1.04E-05 | 1.04E-05 |
| AC-227  | 1.40E-06 | 1.40E-06 |
| H-232   |          |          |
| H-232   | 2.88E-09 | 2.88E-09 |
| TH-228  | 1.75E-04 | 1.75E-04 |
| RA-228  | 5.88E-04 | 5.88E-04 |
| TH-230  |          |          |
| TH-230  | 4.26E-08 | 4.26E-08 |
| RA-226  | 1.00E-05 | 1.00E-05 |
| PB-210  | 1.67E-12 | 1.67E-12 |
| TH-228  |          |          |
| TH-228  | 2.27E-02 | 2.27E-02 |
| RA-228  |          |          |
| TH-228  | 4.18E-03 | 4.18E-03 |
| RA-228  | 9.57E-03 | 9.57E-03 |
| RA-226  |          |          |
| RA-226  | 4.63E-02 | 4.63E-02 |
| PB-210  | 1.15E-08 | 1.15E-08 |
| PB-210  |          |          |
| PB-210  | 7.39E-07 | 7.39E-07 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 1 : 21 \*\*  
 Title : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii      Assessment for Time: 2      iii
iii      Time =1.00E+00 yr      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

iiiiiiii Source Information iiiiiiii

Source: 1

Location:: Room : 1 x: 3.00 y: 0.00 z: 3.00 [m]  
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y  
 Pathway ::  
 Direct Ingestion Rate :0.000E+00 [gm/hr]  
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1  
 Region : 1  
 Thickness [cm] :1.00E+02  
 Fraction Contaminated :1.00E+00  
 Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | U-238   | 1.700E-01                |
|                 | U-235   | 7.700E-03                |
|                 | U-234   | 1.700E-01                |
|                 | PA-231  | 7.700E-03                |
|                 | TH-232  | 8.300E-02                |
|                 | TH-230  | 1.700E-01                |
|                 | TH-228  | 8.300E-02                |
|                 | AC-227  | 3.593E-04                |
|                 | RA-228  | 8.300E-02                |
|                 | RA-226  | 1.700E-01                |
|                 | PB-210  | 1.700E-01                |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 1 : 22 \*\*  
 Title : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 2

Location:: Room : 1 x: 0.00 y: 3.00 z: 3.00 [m]  
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x  
 Pathway ::  
 Direct Ingestion Rate :0.000E+00 [gm/hr]  
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1  
 Region : 1  
 Thickness [cm] :1.00E+02  
 Fraction Contaminated :1.00E+00  
 Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | U-238   | 1.700E-01                |
|                 | U-235   | 7.700E-03                |
|                 | U-234   | 1.700E-01                |
|                 | PA-231  | 7.700E-03                |
|                 | TH-232  | 8.300E-02                |
|                 | TH-230  | 1.700E-01                |
|                 | TH-228  | 8.300E-02                |
|                 | AC-227  | 3.593E-04                |
|                 | RA-228  | 8.300E-02                |
|                 | RA-226  | 1.700E-01                |
|                 | PB-210  | 1.700E-01                |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 1 : 23 \*\*  
 File : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 3

Location:: Room : 1 x: 3.00 y: 6.00 z: 3.00 [m]  
 Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: y  
 Pathway ::  
 Direct Ingestion Rate :0.000E+00 [gm/hr]  
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1  
 Region : 1  
 Thickness [cm] :1.00E+02  
 Fraction Contaminated :1.00E+00  
 Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | U-238   | 1.700E-01                |
|                 | U-235   | 7.700E-03                |
|                 | U-234   | 1.700E-01                |
|                 | PA-231  | 7.700E-03                |
|                 | TH-232  | 8.300E-02                |
|                 | TH-230  | 1.700E-01                |
|                 | TH-228  | 8.300E-02                |
|                 | AC-227  | 3.593E-04                |
|                 | RA-228  | 8.300E-02                |
|                 | RA-226  | 1.700E-01                |
|                 | PB-210  | 1.700E-01                |

ESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 1 : 24 \*\*  
Title : Cabot Revere Basement Resident  
Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 4

Location:: Room : 1 x: 6.00 y: 3.00 z: 3.00 [m]  
Geometry:: Type: Volume Area:1.80E+01 [m2] Direction: x  
Pathway ::  
Direct Ingestion Rate :0.000E+00 [gm/hr]  
Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1  
Region : 1  
Thickness [cm] :1.00E+02  
Fraction Contaminated :1.00E+00  
Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | U-238   | 1.700E-01                |
|                 | U-235   | 7.700E-03                |
|                 | U-234   | 1.700E-01                |
|                 | PA-231  | 7.700E-03                |
|                 | TH-232  | 8.300E-02                |
|                 | TH-230  | 1.700E-01                |
|                 | TH-228  | 8.300E-02                |
|                 | AC-227  | 3.593E-04                |
|                 | RA-228  | 8.300E-02                |
|                 | RA-226  | 1.700E-01                |
|                 | PB-210  | 1.700E-01                |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 1 : 25 \*\*  
 le : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 5

Location:: Room : 1 x: 3.00 y: 3.00 z: 0.00 [m]  
 Geometry:: Type: Volume Area:3.60E+01 [m2] Direction: z  
 Pathway ::  
 Direct Ingestion Rate :0.000E+00 [gm/hr]  
 Fraction released to air: 0.000E+00

Containment :: Number of Regions: 1 Contaminated Region: 1  
 Region : 1  
 Thickness [cm] :1.00E+02  
 Fraction Contaminated :1.00E+00  
 Density [g/cm3] :2.40E+00

| Contamination:: | Nuclide | Concentration<br>[pCi/g] |
|-----------------|---------|--------------------------|
|                 | U-238   | 1.700E-01                |
|                 | U-235   | 7.700E-03                |
|                 | U-234   | 1.700E-01                |
|                 | PA-231  | 7.700E-03                |
|                 | TH-232  | 8.300E-02                |
|                 | TH-230  | 1.700E-01                |
|                 | TH-228  | 8.300E-02                |
|                 | AC-227  | 3.593E-04                |
|                 | RA-228  | 8.300E-02                |
|                 | RA-226  | 1.700E-01                |
|                 | PB-210  | 1.700E-01                |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 2 : 26 \*\*  
 Sample : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff                                                         fff
fff      RESRAD-BUILD Dose Tables                          fff
fff                                                         fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

Source Contributions to Receptor Doses  
 iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii  
 [mrem]

|            | Source<br>1 | Source<br>2 | Source<br>3 | Source<br>4 | Source<br>5 | Total   |
|------------|-------------|-------------|-------------|-------------|-------------|---------|
| Receptor 1 | 2.9E-02     | 2.9E-02     | 2.9E-02     | 2.9E-02     | 8.4E-02     | 2.0E-01 |
| Total      | 2.9E-02     | 2.9E-02     | 2.9E-02     | 2.9E-02     | 8.4E-02     | 2.0E-01 |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 3 : 27 \*\*  
 File : Cabot Revere Basement Resident  
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Pathway Detail of Doses  
 ifffffffffffffffffffffff  
 [mrem]

|           |          |            |           |            |          |           |
|-----------|----------|------------|-----------|------------|----------|-----------|
| Source: 1 |          |            |           |            |          |           |
| Receptor  | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
| 1         | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |
| Total     | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |

|           |          |            |           |            |          |           |
|-----------|----------|------------|-----------|------------|----------|-----------|
| Source: 2 |          |            |           |            |          |           |
| Receptor  | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
| 1         | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |
| Total     | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |

|           |          |            |           |            |          |           |
|-----------|----------|------------|-----------|------------|----------|-----------|
| Source: 3 |          |            |           |            |          |           |
| Receptor  | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
| 1         | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |
| Total     | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |

|           |          |            |           |            |          |           |
|-----------|----------|------------|-----------|------------|----------|-----------|
| Source: 4 |          |            |           |            |          |           |
| Receptor  | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
| 1         | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |
| Total     | 2.89E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |

|           |          |            |           |            |          |           |
|-----------|----------|------------|-----------|------------|----------|-----------|
| Source: 5 |          |            |           |            |          |           |
| Receptor  | External | Deposition | Immersion | Inhalation | Radon    | Ingestion |
| 1         | 8.39E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |
| Total     | 8.39E-02 | 0.00E+00   | 0.00E+00  | 0.00E+00   | 0.00E+00 | 0.00E+00  |

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 4 : 28 \*\*  
 File : Cabot Revere Basement Resident  
 Input File : C:\PROGRA-1\RESBLD30 Evaluation Time: 1.00000 years

Nuclide Detail of Doses  
 ~~~~~  
 [mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.40E-04	1.40E-04
U-234	1.47E-14	1.47E-14
TH-230	6.49E-19	6.49E-19
RA-226	1.13E-16	1.13E-16
PB-210	0.00E+00	0.00E+00
U-235		
U-235	6.77E-06	6.77E-06
PA-231	1.41E-10	1.41E-10
AC-227	3.33E-11	3.33E-11
U-234		
U-234	3.46E-09	3.46E-09
TH-230	2.94E-13	2.94E-13
A-226	7.39E-11	7.39E-11
B-210	2.09E-17	2.09E-17
PA-231		
PA-231	4.44E-06	4.44E-06
AC-227	2.08E-06	2.08E-06
TH-232		
TH-232	1.53E-09	1.53E-09
TH-228	3.50E-04	3.50E-04
RA-228	6.09E-04	6.09E-04
TH-230		
TH-230	2.18E-08	2.18E-08
RA-226	1.06E-05	1.06E-05
PB-210	4.31E-12	4.31E-12
TH-228		
TH-228	5.15E-03	5.15E-03
RA-228		
TH-228	3.32E-03	3.32E-03
RA-228	3.09E-03	3.09E-03
RA-226		
RA-226	1.62E-02	1.62E-02
PB-210	1.27E-08	1.27E-08
PB-210		
PB-210	2.66E-07	2.66E-07

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 4 : 29 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 2

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.40E-04	1.40E-04
U-234	1.47E-14	1.47E-14
TH-230	6.49E-19	6.49E-19
RA-226	1.13E-16	1.13E-16
PB-210	0.00E+00	0.00E+00
U-235		
U-235	6.77E-06	6.77E-06
PA-231	1.41E-10	1.41E-10
AC-227	3.33E-11	3.33E-11
U-234		
U-234	3.46E-09	3.46E-09
TH-230	2.94E-13	2.94E-13
RA-226	7.39E-11	7.39E-11
PB-210	2.09E-17	2.09E-17
PA-231		
PA-231	4.44E-06	4.44E-06
AC-227	2.08E-06	2.08E-06
-232		
TH-232	1.53E-09	1.53E-09
TH-228	3.50E-04	3.50E-04
RA-228	6.09E-04	6.09E-04
TH-230		
TH-230	2.18E-08	2.18E-08
RA-226	1.06E-05	1.06E-05
PB-210	4.31E-12	4.31E-12
TH-228		
TH-228	5.15E-03	5.15E-03
RA-228		
TH-228	3.32E-03	3.32E-03
RA-228	3.09E-03	3.09E-03
RA-226		
RA-226	1.62E-02	1.62E-02
PB-210	1.27E-08	1.27E-08
PB-210		
PB-210	2.66E-07	2.66E-07

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 4 : 30 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 3

Nuclide	Receptor 1	Total
U-238		
U-238	1.40E-04	1.40E-04
U-234	1.47E-14	1.47E-14
TH-230	6.49E-19	6.49E-19
RA-226	1.13E-16	1.13E-16
PB-210	0.00E+00	0.00E+00
U-235		
U-235	6.77E-06	6.77E-06
PA-231	1.41E-10	1.41E-10
AC-227	3.33E-11	3.33E-11
U-234		
U-234	3.46E-09	3.46E-09
TH-230	2.94E-13	2.94E-13
RA-226	7.39E-11	7.39E-11
PB-210	2.09E-17	2.09E-17
PA-231		
PA-231	4.44E-06	4.44E-06
AC-227	2.08E-06	2.08E-06
Th-232		
Th-232	1.53E-09	1.53E-09
TH-228	3.50E-04	3.50E-04
RA-228	6.09E-04	6.09E-04
TH-230		
TH-230	2.18E-08	2.18E-08
RA-226	1.06E-05	1.06E-05
PB-210	4.31E-12	4.31E-12
TH-228		
TH-228	5.15E-03	5.15E-03
RA-228		
TH-228	3.32E-03	3.32E-03
RA-228	3.09E-03	3.09E-03
RA-226		
RA-226	1.62E-02	1.62E-02
PB-210	1.27E-08	1.27E-08
PB-210		
PB-210	2.66E-07	2.66E-07

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 4 : 31 **
 Title : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30Evaluation Time: 1.00000 years

Source: 4

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.40E-04	1.40E-04
U-234	1.47E-14	1.47E-14
TH-230	6.49E-19	6.49E-19
RA-226	1.13E-16	1.13E-16
PB-210	0.00E+00	0.00E+00
U-235		
U-235	6.77E-06	6.77E-06
PA-231	1.41E-10	1.41E-10
AC-227	3.33E-11	3.33E-11
U-234		
U-234	3.46E-09	3.46E-09
TH-230	2.94E-13	2.94E-13
RA-226	7.39E-11	7.39E-11
PB-210	2.09E-17	2.09E-17
PA-231		
PA-231	4.44E-06	4.44E-06
AC-227	2.08E-06	2.08E-06
-232		
TH-232	1.53E-09	1.53E-09
TH-228	3.50E-04	3.50E-04
RA-228	6.09E-04	6.09E-04
TH-230		
TH-230	2.18E-08	2.18E-08
RA-226	1.06E-05	1.06E-05
PB-210	4.31E-12	4.31E-12
TH-228		
TH-228	5.15E-03	5.15E-03
RA-228		
TH-228	3.32E-03	3.32E-03
RA-228	3.09E-03	3.09E-03
RA-226		
RA-226	1.62E-02	1.62E-02
PB-210	1.27E-08	1.27E-08
PB-210		
PB-210	2.66E-07	2.66E-07

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: 2- 4 : 32 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30 Evaluation Time: 1.00000 years

Source: 5

Nuclide	Receptor	Total
	1	
U-238		
U-238	3.83E-04	3.83E-04
U-234	2.76E-14	2.76E-14
TH-230	1.27E-18	1.27E-18
RA-226	3.23E-16	3.23E-16
PB-210	0.00E+00	0.00E+00
U-235		
U-235	1.47E-05	1.47E-05
PA-231	3.30E-10	3.30E-10
AC-227	7.96E-11	7.96E-11
U-234		
U-234	6.50E-09	6.50E-09
TH-230	5.75E-13	5.75E-13
RA-226	2.11E-10	2.11E-10
PB-210	5.61E-17	5.61E-17
PA-231		
PA-231	1.04E-05	1.04E-05
AC-227	4.97E-06	4.97E-06
U-232		
TH-232	2.88E-09	2.88E-09
TH-228	1.07E-03	1.07E-03
RA-228	1.67E-03	1.67E-03
TH-230		
TH-230	4.26E-08	4.26E-08
RA-226	3.01E-05	3.01E-05
PB-210	1.16E-11	1.16E-11
TH-228		
TH-228	1.58E-02	1.58E-02
RA-228		
TH-228	1.02E-02	1.02E-02
RA-228	8.48E-03	8.48E-03
RA-226		
RA-226	4.63E-02	4.63E-02
PB-210	3.42E-08	3.42E-08
PB-210		
PB-210	7.17E-07	7.17E-07

RESRAD-BUILD Program Output, Version 3.0 02/25/01 23:50 Page: F- 1 : 33 **
 File : Cabot Revere Basement Resident
 Input File : C:\PROGRA~1\RESBLD30

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iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii
iii      RESRAD-BUILD Dose (Time) Tables      iii
iii      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

Receptor Doses Received for the Exposure Duration
 iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
 (mrem)

	Evaluation Time [yr]	
	0.00E+00	1.00E+00
1	2.00E-01	2.00E-01

Receptor Dose/Yr Averaged Over Exposure Duration
 iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
 (mrem/yr)

	Evaluation Time [yr]	
	0.00E+00	1.00E+00
1	2.00E-01	2.00E-01

APPDENDIX D

GAMMA MEASUREMENTS

As part of Site characterization, gamma exposure rate measurements at 1 meter above the ground were performed at unbiased sampling locations numbering between 25 and 134 measurement points in each of the four areas of interest (ENSERCH, 1994) and at carefully selected background locations. These data were used to estimate the mean difference from background for each of the four areas. The data and analysis are provided in Table D-1. While uncertainties associated with the estimates of the mean increment above background are large, the measurements do provide independent assurance that the most significant doses calculated in this assessment are not grossly underestimated.

TABLE D-1
ANALYSIS OF GAMMA EXPOSURE RATE MEASUREMENTS* AT REVERE

BACKGROUND GAMMA uR/h		OLD PIT GAMMA uR/h		FRM CONT STRG GAMMA uR/h		BLDG 4&5 STRG GAMMA uR/h		PARKING GAMMA uR/h	
LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h
1	14	1	13	1	13	1	14	1	14
2	13	2	12	2	12	2	13	2	13
3	15	3	15	3	12	3	12	3	30
4	9	4	13	4	12	4	12	4	13
5	9	5	12	5	11	5	13	5	18
6	12	6	12	6	13	6	13	6	15
7	8	7	13	7	14	7	15	7	16
8	12	8	14	8	15	8	14	8	15
		9	12	9	15	9	13	9	13
		10	11	10	24	10	12	10	13
		11	11	11	17	11	11	11	14
		12	11	12	13	12	11	12	15
		13	12	13	12	13	11	13	13
		14	15	14	14	14	14	14	13
		15	12	15	15	15	15	15	15
		16	11	16	18	16	15	16	13
		17	15	17	17	17	15	17	13
		18	14	18	14	18	14	18	12
		19	11	19	11	19	12	19	12
		20	11	20	12	20	13	20	14
		21	15	21	12	21	13	21	13
		22	15	22	14	22	14	22	14
		23	11	23	15	23	14	23	13
		24	15	24	17	24	15	24	13
		25	15	25	12	25	14	25	14
		26	14			26	14	26	15
		27	14			27	13	27	13
		28	11			28	15	28	14
		29	12			29	15	29	11
		30	15			30	13	30	12
		31	15			31	13	31	14
		32	15			32	14	32	12
		33	12			33	14	33	13
		34	15			34	15	34	14
		35	13			35	14	35	13
		36	11			36	15	36	13
		37	11			37	12	37	12
		38	10			38	13	38	12
		39	13			39	15	39	14
		40	13			40	13	40	14
		41	15			41	12	41	13
		42	14			42	14	42	13
		43	14			43	14	43	12

TABLE D-1
ANALYSIS OF GAMMA EXPOSURE RATE MEASUREMENTS* AT REVERE

BACKGROUND GAMMA uR/h		OLD PIT GAMMA uR/h		FRM CONT STRG GAMMA uR/h		BLDG 4&5 STRG GAMMA uR/h		PARKING GAMMA uR/h	
LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h
		44	10			44	15	44	13
		45	8			45	13	45	13
		46	10			46	13	46	14
		47	10			47	12	47	13
		48	12			48	13	48	14
		49	13			49	15	49	14
		50	15			50	13	50	14
		51	13			51	13	51	11
		52	10			52	13	52	12
		53	9			53	14	53	11
		54	10			54	12	54	12
		55	10			55	12	55	12
		56	9			56	15	56	11
		57	12			57	14	57	12
		58	12			58	16	58	13
		59	13			59	15	59	13
		60	11			60	15	60	13
		61	10			61	13	61	13
		62	13			62	14	62	12
		63	14			63	16	63	13
		64	10			64	15	64	13
		65	11			65	15	65	13
		66	12			66	14	66	13
		67	13			67	13	67	14
		68	14			68	14	68	13
		69	12			69	13	69	13
		70	16			70	13	70	12
		71	10			71	14	71	10
		72	12			72	14	72	11
		73	15			73	15	73	13
		74	12			74	13	74	13
		75	13			75	13	75	13
		76	12			76	13	76	12
		77	12			77	14	77	12
		78	13			78	14	78	13
		79	12			79	13	79	12
		80	9			80	14	80	13
		81	16			81	14	81	14
		82	11			82	14	82	11
		83	13			83	13	83	12
		84	13			84	14	84	11
		85	14			85	14	85	12
		86	12			86	14	86	10

TABLE D-1
ANALYSIS OF GAMMA EXPOSURE RATE MEASUREMENTS* AT REVERE

BACKGROUND GAMMA uR/h		OLD PIT GAMMA uR/h		FRM CONT STRG GAMMA uR/h		BLDG 4&5 STRG GAMMA uR/h		PARKING GAMMA uR/h	
LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h
		87	10			87	14	87	11
		88	13			88	14	88	11
		89	11			89	15	89	11
		90	14			90	14	90	12
		91	14			91	14	91	12
		92	13			92	14	92	11
		93	16					93	9
		94	15					94	10
		95	12					95	10
		96	10					96	9
		97	13					97	10
		98	15					98	10
		99	14					99	10
		100	15					100	10
		101	15					101	11
		102	15					102	10
		103	11					103	9
		104	12					104	10
		105	13					105	9
		106	15					106	9
		107	15					107	10
		108	15					108	9
		109	16					109	11
		110	12					110	12
		111	14					111	11
		112	13					112	11
		113	12					113	8
		114	13					114	8
		115	16					115	10
		116	14					116	10
		117	13					117	8
		118	14					118	8
		119	14					119	8
		120	16					120	7
		121	13					121	7
		122	13					122	7
		123	14					123	7
		124	14					124	7
		125	14					125	8
		126	14					126	11
		127	15					127	8
		128	15					128	7
		129	15					129	7

TABLE D-1
ANALYSIS OF GAMMA EXPOSURE RATE MEASUREMENTS* AT REVERE

BACKGROUND GAMMA uR/h		OLD PIT GAMMA uR/h		FRM CONT STRG GAMMA uR/h		BLDG 4&5 STRG GAMMA uR/h		PARKING GAMMA uR/h	
LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h	LOC	uR/h
		130	14					130	7
		131	15						
		132	15						
		133	14						
		134	15						

* MEASUREMENTS AT 1 M ABOVE GROUND AT UNBIASED LOCATIONS (ENSERCH, 1994)
 MEASUREMENTS ARE FOR GROSS GAMMA.

SUMMARY OF ENSERCH ENVIRONMENTAL CORP, 4/94 REVERE DATA
 GAMMA AT 1 M ABOVE SURFACE, uR/h, UNBIASED LOCATIONS ONLY

	BKGRND	OLD PIT	FRM CONT STRG	BLD 4&5	PRKG
MEAN	11.50	12.9	14.2	13.7	11.9
SIG X	2.56	1.8	2.9	1.1	2.7
SIG XBAR	0.91	0.16	0.57	0.11	0.24
MEAN DIFF ABV BKD uR/h		1.4	2.7	2.2	0.4
SIGMA		0.92	1.07	0.91	0.94

MEAN--sample arithmetic average

SIG X--sample standard deviation, s^2

SIG XBAR--standard deviation of the mean, $SIG X/SQRT(N)$

SIGMA--standard deviation of the difference between the means, $SQRT(s_1^2/n_1 + s_2^2/n_2)$