50-155

Consumers Energy

A CMS Energy Company

Big Rock Point Nuclear Plant
10269 US-31 North
Charlevoix, MI 49720

Kurt M. Haas
General Manager

May 18, 2001

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT: BIG ROCK POINT PLANT
DOCKET 55-155/LICENSE DPR-6
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES IN ACCORDANCE WITH 10 CFR 20.2002

Gentlemen:

By letter dated March 14, 2001 Consumers Energy submitted a request for NRC approval of proposed procedures for disposal of demolition debris in accordance with provisions of 10 CFR 20.2002. The application required that the demolition debris be deposited in a State of Michigan licensed Type II landfill.

The application had incorporated findings of NEI Topical Report NEI-97-02 as a bounding concentration limit for licensed radioactive material contained in the demolition debris. During a teleconference with members of the NRC staff held on April 18, 2001, we were informed that our requested bounding concentration limit could not be based on NEI-97-02 since it has not been reviewed and approved by the NRC. Because of this, we have revised our application to include a bounding concentration limit and conservative quantities of radioactivity derived from site-specific data using NRC-adopted computer codes MicroShield and RESRAD. Therefore, we request that the application dated March 14, 2001 be replaced in its entirety by the application included as Attachment 2 to this letter.

Consumers Energy requests approval of the 10 CFR 20.2002 request within 12 months of the date of this letter.

Should you have any questions, please contact Mr. George Petitjean, Licensing Lead and point of contact for NRR at 231-547-8355.

Sincerely,

Kurt M. Haas
Site General Manager

A001

SUBJECT: BIG ROCK POINT PLANT
DOCKET 55-155/LICENSE DPR-6
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES IN ACCORDANCE WITH 10 CFR 20.2002

Attachment(s)
1. Affidavit
2. Request for Approval of Proposed Disposal Procedures In Accordance With 10 CFR 20.2002.

cc: Regional Administrator, Region III, USNRC
NRC Reactor Decommissioning Inspector, Region III - BRP
NRC/NRR Project Manager – (David Wrona) USNRC

ATTACHMENT 1
CONSUMERS ENERGY COMPANY

Request for Approval of Proposed Disposal Procedures
In Accordance with 10 CFR 20.2002

Affidavit

CONSUMERS ENERGY COMPANY
LICENSE DPR-6
DOCKET 50-155

Request for Approval of Proposed Disposal Procedures
In Accordance with 10 CFR 20.2002

CONSUMERS ENERGY COMPANY

To the best of my knowledge, information and belief, the contents of this submittal are truthful and complete.

By: _____

Kurt M. Haas
Site General Manager

Sworn and subscribed to me before this 18th day of May 18, 2001

Notary: Brenda Weis

Brenda Weis, Notary Public
Charlevoix County, Michigan

My commission expires January 16, 2006

SEAL

ATTACHMENT 2
CONSUMERS ENERGY COMPANY

Request for Approval of Proposed Disposal Procedures In Accordance with 10 CFR 20.2002

Request for Approval / Environmental Impact Determination

For the reasons hereinafter set forth, it is requested that approval be granted to the Consumers Energy Big Rock Point Plant (BRP), as licensed by Facility Operating License DPR-6, Docket 50-155, issued on May 1, 1964, for procedures controlling the disposal of demolition debris in accordance with provisions of 10 CFR 20.2002. A description of the waste material for disposal that potentially contains licensed materials, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal is provided in the following sections. The content of this application follows the guidance of NUREG-1101, Volume 1, Onsite Disposal of Radioactive Waste – Guidance for Disposal by Subsurface Burial, March 1986 as applicable.

I. PROPOSED ACTIVITIES

This request for approval of proposed disposal procedures in accordance with the provisions of 10 CFR 20.2002 allows Consumers Energy to dispose of demolition debris originating from decommissioning activities at BRP in a State of Michigan licensed Type II landfill. The request is justified in the analysis discussed in the later sections of this document.

II. BACKGROUND

By letters dated June 18, 1997, and June 26, 1997, Consumers Energy notified the NRC, pursuant to 10 CFR 50.82(a)(1)(i), that BRP would permanently cease operation on August 30, 1997. On August 29, 1997, the reactor was permanently shutdown, ending 35 years of electric power generation. On September 22, 1997, another letter was forwarded to the NRC certifying that the fuel had been removed from the reactor vessel and placed in the spent fuel pool for storage.

The BRP site is located on the northeast shore of Lake Michigan in Charlevoix County in the northern part of Michigan's Lower Peninsula. The site is approximately 60 miles northeast of Traverse City, Michigan, and about 4 miles north of the small town of Charlevoix along US Route 31.

The reactor at the BRP was of relatively small size (75 MWe) and contained a significantly small radioactive source term, only about 10 percent that of a standard boiling water reactor (BWR). Consumers Energy's goal is to dismantle BRP in a safe, environmentally conscious, and cost effective manner. This action will result in the timely removal of the existing nuclear plant in accordance with the DECON option found acceptable to the NRC in its Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, NUREG-0586. Decommissioning activities started in June 1997, and are expected to culminate in 2005 after which its Part 50 license will be terminated.

As a part of the decommissioning process, Consumers Energy plans to dismantle the individual structures when they are empty and when they have been decontaminated and

radiologically surveyed, as required. It is estimated that a total 84.5 million pounds of predominately concrete debris will originate from the decommissioning project. Approximately one half of this is non-impacted (*i.e.*, has never had the potential for neutron activation or to be exposed to licensed radioactive materials). The other half has a potential to contain residual surface activity and/or neutron activation products in a limited quantity. This submission deals with the disposition of demolition debris from the BRP decommissioning.

III. JUSTIFICATION

10 CFR 20, Subpart K, §20.2001 requires that licensed radioactive material be disposed of only through (1) transfer to an authorized recipient, (2) decay in storage, (3) release in effluents within the limits in §20.1301, or (4) as authorized under §§20.2002, 20.2003, 20.2004, or §20.2005. This request for approval of proposed disposal procedures demonstrates compliance with 10 CFR 20.2001 requirements prior to disposal of demolition debris in a State of Michigan licensed landfill.

For demolition debris at BRP, three decommissioning options have been considered.

(1) License Termination with Structures Intact

This option would involve removal of licensed radioactive materials from the existing structures to residual radioactivity levels acceptable for termination of the license. Verification of achieving these residual radioactivity levels would require conducting a final status survey (FSS) for license termination on the remaining structures as well as the site environs. Specific disadvantages for application of this option at BRP include a delay in our management's environmental stewardship goal and commitment for restoration of the site to greenfield status. This option would also result in an increased expenditure of ratepayer decommissioning funds necessary to perform a much expanded FSS and demobilization followed by remobilization of the construction work force necessary for ultimate removal of site structures.

(2) Demolition Followed by License Termination

The initial process is similar to license termination with structures intact. Removal of licensed radioactive materials from existing structures to residual radioactivity levels acceptable for license termination with unrestricted access would still be performed. However, prior to performing the FSS, the remaining structures would be demolished and the concrete rubble left on site. The FSS would then be performed on the site environs. After license termination, the concrete rubble could be used as construction fill or disposed of in a State of Michigan licensed landfill facility. While this methodology

appears to be able to meet all NRC requirements and public health and safety goals, the disadvantages are that the debris would be expensive to stabilize over the long-term context. Furthermore, redevelopment of the site after license termination for other uses may require that debris be removed at some later date and relocated to another location on-site or off-site.

This option could be performed with somewhat less expenditure of ratepayer decommissioning funds than Option (1).

(3) Demolition and Disposal Followed by License Termination

This option involves removal of licensed radioactive materials from the existing structures and installations. After decontamination of a work area, debris would be disposed of in a State of Michigan licensed landfill facility. After removal of all demolition debris, the FSS would then be performed on the site environs, the license terminated by the NRC and the site released for unrestricted future use. This option is the most cost-effective use of ratepayer decommissioning funds and will result in the most expedient environmental restoration of the site.

The option that is most attractive to Consumers Energy and the public stakeholders is the disposition of demolition debris in a landfill prior to license termination; therefore, BRP has selected Option (3) as the preferred option. The criterion used in the License Termination Rule (10 CFR 20, Subpart E) for termination of the site license for unrestricted use is a total effective dose equivalent (TEDE) of 25 mrem/year. In comparison, the TEDE of this submission for Option (3) (demolition debris disposal in a State of Michigan licensed landfill) is 1 mrem/year. Therefore, selection of Option (3) is protective of the public health and safety, is consistent with As Low as Reasonably Achievable (ALARA), as well as being most cost-effective.

Consumers Energy is committed to conducting and completing decommissioning in a safe and cost efficient manner consistent with all regulatory requirements. Furthermore, Consumers Energy has determined that it is in the best interest to restore the site to greenfield conditions. Given the location of the site on the shore of Lake Michigan, the land is a valuable resource to the company and to the citizens of the area. The demolition debris that will originate from the demolition and removal of structures at BRP is included in this submission. This demolition debris includes flooring materials, concrete, rebar, roofing materials, structural steel, the soils associated with digging up foundations and concrete and/or asphalt pavement or other similar solid materials.

While Options (1) and (2) can be conducted under 10 CFR 20, Subpart E, Consumers Energy believes that Option (3) should be conducted under Subpart K. Although Subpart E allows small quantities of detectable licensed material to be left onsite for

license termination, until the license is terminated, no amount of licensed material may be released from the site unless it is authorized under Subpart K. Consumers Energy does not intend to make this submittal for intentional disposal of radioactive waste. However; it is recognized that a potential will exist for trace quantities of licensed material to be present in the demolition debris at levels below instrument detection capabilities. Therefore, this submittal is being made in accordance with provisions of 10 CFR 20.2002 because of the potential presence of licensed material in the demolition debris.

IV. DESCRIPTION OF WASTE

A. Physical Properties

The demolition debris that will originate from the demolition and removal of structures and paved surfaces at BRP includes flooring materials, concrete, rebar, roofing materials, structural steel, soils associated with digging up foundations and concrete and/or asphalt pavement or other similar solid materials.

The physical form of this demolition debris will be that of bulk material with various screen sizes ranging from particles the size of sand up to occasional monoliths with a volume of several cubic feet. For the purpose of analyses performed for this application, the demolition debris is assumed to be a homogenous mixture with a density of 150 pounds per cubic foot (2.4 g/cm^3).

The demolition debris will exist as a dry solid waste containing no absorbents or chelating agents.

B. Estimated Waste Volume and Burials Each Year

It is estimated that the mass of both contaminated and non-contaminated demolition debris originating from the decommissioning of BRP will total approximately 84.5 million pounds. With an assumed demolition debris density of 150 pounds per cubic foot, the estimated volume of demolition debris for disposal at a State of Michigan licensed landfill will be approximately 563,000 cubic feet. This represents approximately two percent of the annual volume of waste disposed at the landfill most likely to receive BRP demolition debris.

For the purpose of analyses performed for this application, completion of landfill disposal of demolition debris is assumed to occur within a one-year period of time. BRP demolition debris will not be isolated or dedicated to a single burial cell at the landfill. Rather, it will be co-mingled with other landfill materials that are available for disposal when the demolition debris is delivered to the landfill facility.

Institutional controls required at a State of Michigan licensed landfill are discussed in a later section of this application. However, one of these requirements is that materials deposited in a burial cell are required to be covered with an interim 6-inch layer of soil each day. Final closure of the burial cell will not occur until the burial cell has reached its design capacity.

Therefore, if a burial for purposes of this application is defined as final closure of the burial cell in which BRP demolition debris has been deposited, the number of burials per year will be dependent on the total volume of other landfill materials delivered to the landfill for disposal. However, it should be noted that each day that demolition debris is deposited in a burial cell, it would be covered with an interim 6-inch layer of soil.

C. Radiological Characterization of Structural Concrete

To date, over 200 core borings (2 inch diameter by 6 inch depth) have been taken from rooms or areas on the BRP site. Selection of the sampling location was biased toward areas expected to have the highest contamination potential. Each core has been analyzed onsite by gamma spectrometry and direct frisk to determine what types of radioactive material are present and how far the contaminants have penetrated into the concrete. The results of these onsite analyses are summarized in Enclosure 1 to this submittal. In addition, portions of 14 core samples have been analyzed by an offsite laboratory (General Engineering Laboratories) at typical environmental monitoring lower limits of detection (LLD) using alpha and gamma spectrometry as well as liquid scintillation to analyze for the presence of the following radionuclides:

Ac-227	Ac-228	Ag-108m	Ag-110m	Am-241
C-14	Cd-109	Ce-144	Cm-242	Cm-243/244
Co-60	Cs-134	Cs-135	Cs-137	Eu-152
Eu-154	Fe-55	H-3	I-129	K-40
Mn-54	Ni-59	Ni-63	Nb-94	Pb-214
Pm-147	Pu-241	Pu-238	Pu-239/240	Ru-106
Sb-125	Sr-90	Tc-99	U-233/234	U-235/236
U-238	Zn-65			

One-half inch thick, near surface wafers from 12 of the core samples were submitted to represent potential radioactive materials remaining after remediation of the structural surfaces. Laboratory analysis of these samples identified only Co-60, Cs-137, Fe-55 and H-3 at levels greater than the LLD values. K-40, Pb-214, U-233/234 and U-238 were also detected in these samples but at levels that were indistinguishable from naturally occurring background levels measured in plant

concrete samples that were not contaminated by licensed radioactive materials. The results of these samples with concentration values representing the average concentration in the one-half inch thick wafer are detailed in Table 1. Copies of the General Engineering Laboratories Certificate of Analysis for these samples are included as Enclosure 2 to this submittal.

Table 1

Remediated Concrete Core Sample Results

Sample Number	Radionuclide			
	Co-60 pCi/g	Cs-137 pCi/g	Fe-55 pCi/g	H-3 pCi/g
19	<LLD	<LLD	<LLD	<LLD
31	<LLD	<LLD	<LLD	<LLD
83	<LLD	0.130 ± 0.088	<LLD	<LLD
104	<LLD	0.094 ± 0.054	0.181 ± 1.70	<LLD
112	0.084 ± 0.065	<LLD	0.682 ± 1.64	6.24 ± 2.51
123	<LLD	<LLD	0.841 ± 1.63	9.47 ± 2.88
128	<LLD	0.166 ± 0.062	<LLD	<LLD
7	<LLD	<LLD	<LLD	<LLD
90	0.245 ± 0.141	0.241 ± 0.125	<LLD	<LLD
149	0.458 ± 0.114	0.152 ± 0.057	<LLD	<LLD
117	0.697 ± 0.280	0.292 ± 0.179	<LLD	5.18 ± 2.22
100	<LLD	0.177 ± 0.101	<LLD	<LLD
119*	2.47 ± 0.739	0.281 ± 0.282	9.63 ± 3.32	16.9 ± 11.9
153*	0.261 ± 0.249	0.261 ± 0.165	8.21 ± 3.41	10.1 ± 8.89

*Remediated high surface contamination samples

The final two core samples listed above were taken from areas having a high potential for surface contamination and are average values of subsurface samples taken at various concrete depths. Laboratory analysis of these samples identified only Co-60, Cs-137, Fe-55 and H-3. K-40, Pb-214, U-233/234 and U-238 were also detected in these samples but at levels that were indistinguishable from naturally occurring background levels measured in plant concrete samples that were not contaminated by licensed radioactive materials.

D. Calculated Licensed Radioactive Material Content of Demolition Debris

Results of the radiological characterization of structural concrete and current remedial action contamination surveys were used to classify the surfaces as either uncontaminated, shallow surface contaminated or deep surface contaminated. Uncontaminated surfaces were defined as surfaces having no detectable contamination as evidenced by historical records review, current remedial action contamination surveys and laboratory analysis of representative core samples.

Shallow surface contamination is defined as surfaces having no detectable contamination ($\geq$5,000 dpm/100 cm^2 total activity) as evidenced by contamination surveys performed after remedial action (if required) but detectable shallow subsurface contamination identified by laboratory analysis of representative core samples. Shallow subsurface contamination is assumed (based on core sample profiling) to penetrate to a depth of 1 inch after surface remediation.

Deep surface contamination is defined as highly contaminated surfaces prior to remediation with no detectable contamination as evidenced by contamination surveys performed after remedial action, but with some detectable deep subsurface contamination identified by laboratory analysis of representative core samples. This subsurface contamination is assumed to penetrate to a depth of 6 inches after surface remediation.

Based on the results of the radiological characterization of structural concrete on a room-by-room basis, a total surface area of 10,200 square feet have been calculated to have deep surface contamination. 51,835 square feet have been calculated to have shallow surface contamination and the remainder is considered to be uncontaminated. This results in a calculated 5,100 cubic feet of deep surface contaminated concrete and 4,320 cubic feet of shallow surface contaminated concrete.

Averaging the greater than LLD results from Table 1 and applying the resulting concentrations to the 4,320 cubic feet of shallow surface contaminated concrete and 5,100 cubic feet of deep surface contaminated concrete results in concentrations and total activity as reported in Table 2.

Table 2

Volumetric Contamination of Remediated Surface Contaminated Concrete

Radionuclide	Concentration (pCi/g)	Total Activity (mCi)
Co-60	0.70	0.449
Cs-137	0.20	0.128
Fe-55	3.91	2.506
H-3	9.58	6.140
Total	14.39	9.223

All 42.25 million pounds of impacted concrete will be treated as potentially contaminated. The volumes of 4,320 cubic feet of shallow and 5,100 cubic feet of deep contamination as calculated from structural characterization analyses, will not be separated from impacted concrete debris. Therefore, as a conservative estimate of activity potentially present, activity concentrations from Table 2 were applied to the impacted demolition debris mass of 42.25 million pounds resulting in total activity as reported in Table 3.

Table 3

Impacted Demolition Debris Total Activity (42.25 million pounds)

Radionuclide	Concentration (pCi/g)	Total Activity (mCi)
Co-60	0.70	13.5
Cs-137	0.20	3.8
Fe-55	3.91	75.2
H-3	9.58	184
Total	14.39	277

E. Requested Limiting Demolition Debris Concentration

To allow operational flexibility and ensure monitoring capability, Consumers Energy requests a bounding principal gamma emitter concentration limit of 5 pCi/gm for licensed radioactive materials contained as trace contamination in demolition debris for disposal in a State of Michigan licensed Type II landfill. Adjusting the total

activity reported in Table 3 to a bounding principal gamma emitter concentration limit of 5 pCi/gm results in the bounding activity reported in Table 4.

Table 4

Impacted Demolition Debris Bounding Activity (42.25 million pounds)

Radionuclide	Concentration (pCi/g)	Total Activity (mCi)
Co-60	3.89	74.8
Cs-137	1.11	21.3
Fe-55	21.7	75.2
H-3	53.2	417
Total	79.9	588

To ensure that the 5 pCi/gm principal gamma emitter limit is not exceeded, structural surfaces will be surveyed prior to demolition to verify that surface contamination does not exceed 5,000 dpm/100 cm^2 averaged over areas appropriate for the detection system utilized and all demolition debris will be monitored by a bulk assay system with an alarm setpoint established at or below the 5 pCi/gm principal gamma emitter limit prior to disposal.

Establishment of this bounding concentration limit will ensure that any uncertainties in the content of licensed radioactive material in demolition debris sent to a State of Michigan licensed landfill will not present a dose impact problem.

F. Dose Impacts

Dose impacts of the requested impacted demolition debris bounding activity were evaluated by performing calculations using the Table 4 radionuclide concentrations as source terms. These calculations are bounding because release at a principal gamma emitter limit of 5 pCi/gm is assumed for all 42.25 million pounds of impacted demolition debris. In practice, release surveys to a minimum detection limit of 5 pCi/gm of principal gamma emitters results in release of demolition debris from zero to 5 pCi/gm, or a mean of approximately 2.5 pCi/gm.

1. Transport Worker Dose Assessment

An evaluation of transport worker dose was performed using MicroShield, Version 5.03, from Grove Engineering and site-specific assumptions including bounding concentration values presented in Table 4. The transport system

chosen for this evaluation was a roll-off container system with dimensions of 21.5 feet long, 8 feet wide and 3.5 feet high.

In addition to the above, the following assumptions were also applied to the analysis. In each case, the driver's seat is assumed to be 1 foot away from the cabin wall, which is conservatively assumed to be 0.12 inches thick, made of iron. The material hauler part of the truck is assumed to be made of iron with 0.25-inch thick sides, floor and tailgates. The distance between the hauler part and the driver's cabin is assumed to be 4 feet.

It is assumed that three truck drivers will be used for the total duration of the project and that the number of loads transported will be divided equally between each driver. Given the anticipated volumes of the impacted demolition debris (10,000 cubic yards), combined with the assumptions of standard load volumes, transport of all demolition debris within a one year period and the driving time of 2 hours per load to the landfill, each truck driver will be potentially exposed to radiation from residual radioactivity for 300 hours.

Applying the above assumptions, results in a calculated dose rate to the driver of 1.16E-03 mrem/hour or an annual dose of 0.348 mrem to each of the truck drivers. Output from the MicroShield analysis is provided as Enclosure 3 to this submittal and an electronic file (*Rolloff.ms5*) of the analysis is included on the enclosed computer compact disk.

2. Landfill Worker Dose Assessment

An evaluation of landfill worker dose was performed using RESRAD, Version 6.0. For landfill operation, the landfill is assumed to close after placement of the demolition debris. Post-closure monitoring of the landfill is required by the State of Michigan for a 30-year period. Therefore, it is assumed that a member of the public, other than a landfill worker will not have access to a burial cell containing the demolition debris until 30 years after debris placement.

The following assumptions were made in the evaluation:

a. The most exposed individual at the landfill is a bulldozer operator, positioning and spreading the demolition debris and placing a soil cap on it at the end of the day.

b. The landfill most likely to receive BRP demolition debris currently has three bulldozer operators and, for purposes of this assessment, dose was assumed to be equally distributed between each bulldozer operator.

c. The 281,500 cubic feet (7,930 cubic meters) of impacted demolition debris are assumed to be deposited in a uniform 2-meter thick, 3,965 square meter (0.98 acre) layer.

d. Based on the 0.98 acre surface area estimate of impacted demolition debris and a burial cell surface area of 8 acres, each landfill worker is assumed to spend 12.25 percent (0.98 acre/8 acres) of each worker's time working over or exposed to impacted demolition debris or 245 hours per occupational year of 2000 hours. This total of 245 hours equates to a RESRAD outdoor time fraction of 0.028.

e. A 0.15 m soil cover (which is a daily cover requirement) was assumed. No credit was taken for any other engineering controls required by the State of Michigan.

f. No credit was taken for shielding provided to the workers by the bulldozer.

g. The bounding concentration values presented in Table 4 were used as the impacted demolition debris source terms.

The above assumptions result in a calculated annual TEDE dose of 0.276 mrem for each landfill worker. Output from the RESRAD analysis is provided as Enclosure 4 to this submittal and an electronic file (*Worker.rad*) of the analysis is included on the enclosed computer compact disk.

3. Landfill Resident / Farmer Dose Assessment

An evaluation of dose to an individual member of the public was performed using RESRAD, Version 6.0. Post-closure monitoring of the landfill is required by the State of Michigan for a 30-year period. For purposes of this evaluation, it is assumed that a residence, including a basement to the residence and a vegetable garden, is established on the burial cell containing the demolition debris 30 years after debris disposal.

The following assumptions were made in the evaluation:

a. All RESRAD exposure pathways are active for the Resident / Farmer scenario except for the radon pathway (not regulated by the NRC).

b. The impacted demolition debris is assumed to be soil like material with the bounding concentration values presented in Table 4 even though its density is somewhat higher than most soils. Additionally, resuspension

of demolition debris radioactivity is not expected to vary significantly from that for soil. Therefore, the RESRAD default soil parameters are considered appropriate for use in this analysis.

c. It is assumed that all licensed radioactive material in the impacted demolition debris is dispersed throughout the volume of impacted material originating at BRP and no dilution of the demolition debris occurs from other landfill materials deposited in the burial cell. This is very conservative since Michigan law requires a 6-inch soil cover over the debris at the end of each day and the demolition debris is expected to be only two percent of the total waste volume processed at the landfill over a one-year period.

d. For the Resident / Farmer scenario, it is assumed that the resident spends 50 percent of the time indoors, 25 percent outdoors at the site, and 25 percent of the time away from the site. These assumptions are consistent with those suggested in the NRC Policy and Guidance Directive PG-8-08, Scenarios for Assessing Potential Doses Associated with Residual Radioactivity.

e. Fifty percent effectiveness is assumed for the leachate collection system required by the State of Michigan (resulting in a 50 percent reduction in calculated annual dose). Also, the required 18-inch infiltration layer, 24-inch erosion layer and 6-inch earthen material layer capable of sustaining native plant growth are considered to be intact at the end of the 30-year period.

f. No credit is taken for landfill material originating elsewhere which may be deposited on top of the demolition debris.

g. The 281,500 cubic feet (7,930 cubic meters) of impacted demolition debris are assumed to be deposited in a uniform 2-meter thick, 3,965 square meter (0.98 acre) layer.

h. For the RESRAD model, root depth was extended from the default value of 0.9 m to a depth of 1.4 m. This was done to ensure communication between vegetation and the contaminated zone.

i. All other RESRAD parameters were set at their default values for this evaluation. An Engineering Analysis was performed on RESRAD parameter selections and concluded that, when applied to the northern Michigan climate and State of Michigan licensed Type II landfill

requirements discussed in Section VIII, the use of default parameters will result in conservative dose estimates.

Applying the above assumptions, results in a calculated maximum annual dose of 0.011 mrem for a resident / farmer. This maximum annual dose occurs the first year of public access following the 30-year post-closure monitoring period.

Output from the RESRAD analysis is provided as Enclosure 5 to this submittal and an electronic file (*Public.rad*) of the analysis is included on the enclosed computer compact disk.

4. Dose Impact Conclusions

Assuming that all impacted demolition debris would be released for State of Michigan licensed Type II landfill disposal at a bounding principal gamma emitter concentration limit of 5 pCi/gm as trace contamination in demolition debris would result in a maximum dose impact to an individual member of the public of 0.348 mrem/year to each of three transport workers. Maximum dose to each landfill worker was calculated to be 0.276 mrem/year during impacted demolition debris disposal. Maximum calculated dose to a resident / farmer was calculated to be 0.011 mrem/year which would not occur until after completion of the required 30-year post-closure monitoring period. These maximum calculated doses are well below the public dose objective of 1 mrem/year.

Actual maximum dose impact to an individual member of the public is expected to be much less than these calculated values using a bounding principal gamma emitter concentration limit of 5 pCi/gm.

To ensure that the 5 pCi/gm principal gamma emitter limit is not exceeded, structural surfaces will be surveyed prior to demolition to verify that surface contamination does not exceed 5,000 dpm/100 cm^2 averaged over areas appropriate for the detection system utilized and all demolition debris will be monitored by a bulk assay system with an alarm setpoint established at or below the 5 pCi/gm principal gamma emitter limit prior to disposal.

G. Prohibition on Burial of Hazardous Waste

Hazardous waste as defined in the regulations of the Environmental Protection Agency (EPA), 40 CFR Parts 260 through 265, is not permitted to be included in the BRP demolition debris. Hazardous waste is required to be disposed of in a manner set out in EPA regulations and in accordance with applicable local and State laws

and codes, and will not be disposed of in conjunction with the debris considered here.

V. PACKAGING OF WASTE

Big Rock Point demolition debris to be disposed of at a State of Michigan licensed Type II landfill will not be packaged. Since the radiological survey process used to determine that the demolition debris is acceptable for landfill disposal will ensure that trace quantities of licensed material potentially present in the demolition debris are at levels below the requested bounding concentration limit, BRP demolition debris will be processed the same as debris generated from the demolition of any non-nuclear industrial facility.

The existing Radiation Protection Program, which is continually audited by the NRC, will ensure the radiological safety of BRP workers during generation and packaging of demolition debris. The dose evaluations discussed previously demonstrate that dose to members of the public from transportation and disposal of demolitions debris would not be measurable with state-of-the-art personnel monitoring instrumentation and is insignificant in comparison to the average annual dose received by individuals from natural sources (approximately 300 mrem per year).

Demolition debris will be transported from the BRP site to the landfill facility by truck transportation using either of three types of truck transport systems that are generally the common practice for carrying demolition debris. These transport systems include a roll-off container system, a dual-trailer mule system or a wide-bodied demolition hauler.

Roll-off container systems have the dimensions of 21.5 feet long by 8 feet wide by 3.5 feet high. Dual-trailer mule systems use two trailers, each having the dimensions of 50 feet long by 8 feet wide by 5 feet high. Wide-bodied demolition haulers have the dimensions of 30 feet long by 8 feet wide by 6 feet high.

Type II landfills licensed by the State of Michigan are required to implement controls to isolate the contents of burial cells from the environment. These controls will provide isolation of the BRP demolition debris from the environment over a reasonable period of time similar to the use waste packaging. The controls are discussed in Section VIII, Nature of the Burial Site.

VI. BURIAL LOCATION

The State of Michigan licensed Type II landfill selected for burial of BRP demolition debris will be located within approximately 60 miles of the BRP site.

The State of Michigan Solid Waste Management Act Administrative Rules Promulgated Pursuant To Part 115 Of the Natural Resources and Environmental Protection Act, 1994 Pa

451, As Amended contains restrictions on the location of Type II landfill facilities. Among these are restrictions on groundwater isolation, horizontal isolation distances, floodplains, wetlands, fault areas and seismic impact zones, and unstable areas. These restrictions are discussed in Section VIII, Nature of the Burial Site.

VII. INSTITUTIONAL CONTROLS

Part 115 of the State of Michigan Administrative Rules contains institutional controls that restrict access to Type II licensed landfills. The landfill operator is required to control public access to the landfill and prevent unauthorized vehicular traffic and illegal dumping of wastes by using artificial or natural barriers, or both, as appropriate.

After the final closure of a burial cell, the landfill operator is required to conduct post-closure care for not less than 30 years. This post-closure care includes:

- Maintaining the integrity and effectiveness of any final cover,
- Maintaining, operating, and monitoring the leachate collection system,
- Monitoring the groundwater,
- Monitoring all secondary collection systems and leak detection systems, and
- Maintaining and operating the gas monitoring and collection system.

VIII. NATURE OF THE BURIAL SITE

The Type II landfill where the BRP demolition debris will be sent for disposal will meet State of Michigan Part 115 Administrative Rules that will limit migration of licensed radioactive material potentially mixed with the demolition debris in trace amounts. These requirements include but are not limited to:

- Location restrictions,
- A composite liner,
- Leachate collection and removal systems,
- Leak detection systems,
- Daily 6 inch interim soil covers,
- Explosive gas control and monitoring,
- Groundwater monitoring,
- Surface and Groundwater Performance,
- Run-On and Run-Off Control Systems, and
- Final cover composite liner designed to minimize infiltration and erosion.

A. Location Restrictions

The location of each burial cell will be isolated from groundwater sources. Permanent minimum clearances of ten feet to the natural groundwater level and 7 feet to a permanently depressed groundwater level is required to be maintained from the top of the primary liner.

The active work area at the landfill is required to not be located closer than 100 feet to adjacent property lines or road rights-of-way or closer than 300 feet to domiciles that exist at the time a landfill license is requested. It is also not allowed to be located within 400 feet of inland lakes and streams or within 2,000 feet of the Great Lakes. The active work area is also required to be a minimum of 2,000 feet from wells that serve Type I and Type IIa water supplies and a minimum distance of 800 feet from wells that serve Type IIb and Type III public water supplies.

If a landfill is located within a floodplain, the landfill operator is required to demonstrate that:

- The cell will not restrict the flow of the 100-year flood,
- The cell will not reduce the temporary water storage capacity of the floodplain,
- The cell will not result in washout of solid waste so as to pose a hazard to human health and the environment,
- The cell does not encroach upon the floodway and will not increase upstream or downstream flood stages,
- The cell has a natural or compacted soil base which is not less than 10 feet thick,
- The distance from the normal water line of the water body to the solid waste boundary of the landfill will not be less than 500 feet, and
- The design of the landfill will include a dike to preclude floodwater inundation with a top elevation that is not less than 5 feet above the 100-year flood elevation.

Landfills are not allowed to be located in wetlands unless extensive measures are taken for protection of the wetlands.

Landfill burial cells are not permitted to be located within 200 feet of a fault that has had displacement in holocene time, unless the landfill operator demonstrates that an alternative setback distance of less than 200 feet will prevent damage to the

structural integrity of the cell and will be protective of human health and the environment. They are also not permitted to be located in seismic impact zones, unless the landfill operator demonstrates that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

B. Composite Liners

Burial cells are required to be constructed with a composite liner and a leachate collection system that is designed and constructed to maintain less than a 1-foot depth of leachate over the liner, excluding the sump.

Burial cells are required to be located, designed, and constructed so that the risks posed by leakage through the composite liner are minimized. To do so, a cell is required to be either a monitorable cell that is located over a natural soil barrier so as to restrict the migration of leakage from the unit or designed with a double liner system that is capable of detecting and collecting leakage through the primary composite liner.

C. Leachate Collection and Removal Systems

Each burial cell is required to have a leachate collection system that is designed and constructed to maintain less than a 1-foot depth of leachate over the primary liner. To do so, the system is required to be designed to do all of the following:

- Limit the head at any point in the system, excluding the sump, to not more than 1 foot,
- Extend across the entire bottom of the system,
- Be chemically resistant to the waste that is managed in the landfill and the leachate that is expected to be generated and be of sufficient strength and thickness to prevent collapse under the pressures that are exerted by overlying wastes, waste cover materials, and equipment that is used at the landfill,
- Minimize clogging during the active life and postclosure care period,
- Drain leachate to sumps using pumps that are of a sufficient size to collect and remove liquids from the sump and prevent liquids from backing up into the drainage layer. The design of each sump and removal system provides a method for measuring and recording the volume of liquids removed and the depth of leachate in the sump.

A secondary collection system is required to be provided and be capable of detecting, collecting, and removing leaks of hazardous constituents at the earliest practicable time through all areas of the top liner that are likely to be exposed to waste or leachate during the active life and postclosure care period.

The landfill operator is required to remove leachate from a burial cell as frequently as necessary to ensure that the leachate depth on the liner, excluding the sump, is not more than 1 foot, except after a significant storm event. The leachate depth on the liner is not allowed to be more than 1 foot for more than seven days after a significant storm event. A significant storm event is a storm that generates 0.1 inches or more of rainfall in 24 hours.

D. Leak Detection Systems

Each burial cell is required to have a leak detection system. For unmonitorable units, the secondary collection system is also a leak detection system. A response flow rate is established in the operating license for each landfill to evaluate the performance of a leak detection system.

If the average daily flow rate removed from the sump of a leak detection system is more than the action flow rate for that burial cell, the landfill operator is required to evaluate the chemical characteristics of liquid in the leak detection system by sampling and analyzing the system and evaluating for the presence of a leak by a statistical test, a trend analysis, or other means. Before solid waste is placed in any new burial cell that has a leak detection system, the landfill operator may, at his discretion, establish a baseline concentration of constituents in the secondary collection system based on an analysis of representative samples from the system.

The landfill operator must conduct required response actions if monitoring of the leak detection system determines that both of the following apply to liquid that is removed from the system:

- The average daily flow rate is more than the response flow rate that is established for the unit and
- The liquid contains hazardous substances indicative of leachate from the unit.

A landfill operator who is required to conduct response actions is required to take all of the following actions:

- Within seven days of a determination that the response flow rate has been exceeded, notify the State of Michigan, in writing, that the response flow rate has been exceeded,

- Submit a preliminary written assessment to the State of Michigan within 14 days of a determination that the response flow rate has been exceeded. A preliminary written assessment is required to include all of the following information for the landfill cell in which the response flow rate was exceeded:
    - The amount of liquids removed from the leak detection system,
    - The likely sources of liquids, including the depth of leachate in the leachate collection system,
    - The possible location, size, and cause of any leaks, and
    - The short-term actions taken and planned.
- Determine, to the extent practicable, the location, size, and cause of any leak.
- Determine whether waste receipt should cease or be curtailed, whether any waste should be removed from the landfill cell for inspection, repairs, or controls, and whether or not the cell should be closed.
- Determine any other short-term and longer-term actions to be taken to mitigate or stop any leaks.
- After a determination that the response flow rate has been exceeded, and for as long as the flow rate in the system exceeds the response flow rate, the landfill operator is required to submit to the State of Michigan, within 30 days of the end of the calendar quarter, a report that summarizes the results of any remedial actions taken and planned.
- To make the leak or remediation determinations required, the landfill operator is required to do all of the following:
    - Assess the source of liquids and amounts of liquids by source,
    - Conduct a fingerprint, hazardous constituent, or other analysis of the liquids in the system to identify the source of liquids and possible location of any leaks and the hazard and mobility of the liquid, and
    - Assess the seriousness of any leaks in terms of potential for escaping into the environment or document why the assessments are not needed.

E. Daily Six-Inch Soil Covers

The landfill operator is required to cover disposed of solid waste with 6 inches of earthen material at the end of each operating day or at more frequent intervals, if necessary, to control disease vectors, fires, odors, blowing litter, and scavenging. If clay or other low-permeability material is used as daily cover, then the operator is required to scrape back the previous day's cover to allow the free movement of liquids and gases through the landfill.

If an active burial cell will lie idle for a period of three months or more before additional lifts are constructed, the landfill operator is required to place 1 foot of compacted cover, which may include the 6-inch daily cover, on the surface to minimize nuisance conditions.

F. Explosive Gas Control and Monitoring

The landfill operator is required to ensure that the concentration of methane gas generated by the facility is not more than 25 percent of the lower explosive limit for methane in facility structures, excluding gas control or recovery system components, and the leachate collection system and that the concentration of methane gas is not more than the lower explosive limit at or beyond the facility property boundary. To demonstrate compliance with this requirement the landfill operator is required to implement a routine methane monitoring program.

G. Groundwater Monitoring

Detection monitoring is required at all required groundwater monitoring wells. At a minimum, a detection-monitoring program for a landfill is required to include monitoring for all of the following constituents:

- The listed primary indicators and pH, at least quarterly during the active life and semiannually during the postclosure period and
- The following constituents listed at least semiannually during the active life of the facility and the postclosure period:
  - Heavy metals that are listed,
  - Listed primary volatile organic constituents, and
  - Listed secondary organic constituents.

The landfill operator of a cell that contains a secondary collection system may conduct sampling and analysis for listed primary indicators in place of the heavy metals if all of the following conditions are met:

- Leachate monitoring shows that the concentration of all of the indicators in leachate is not less than ten times the concentration in groundwater and
- Secondary collection system monitoring shows all of the following:
  - That the allowable flow rate has not been exceeded,
  - That the concentration of two or more indicators in the system is not more than the following threshold values for two consecutive sampling events:
    - For chlorides, 250 mg/l,
    - For iron, 0.3 mg/l,
    - For sulfates, 250 mg/l,
    - For total inorganic nitrogen, 10 mg/l, and
    - For total dissolved solids, 500 mg/l.
  - That listed volatile organics have not been detected in the secondary collection system,
  - That the listed concentration of metals has not exceeded 1/10 the specified value,
- The unit is a monitorable unit, and
- The concentration of the indicators in groundwater is normally distributed.

Assessment monitoring is required at a landfill if a statistically significant increase over background has been detected for one or more of the listed constituents.

Within 90 days of the triggering of an assessment monitoring program, and annually thereafter, the landfill operator is required to sample and analyze the groundwater for all constituents listed in 40 CFR part 258, Appendix II. A minimum of one sample from each downgradient well is required to be collected and analyzed during each sampling event. For any constituent that is detected in the downgradient wells as a result of the complete Appendix II constituent analysis, a minimum of four independent samples from each background and downgradient well are required to be collected and analyzed to establish background for the constituents.

H. Surface and Groundwater Performance

Operation of a State of Michigan licensed landfill is not allowed to cause a discharge of pollutants into waters of the United States, including wetlands, that is in violation of any of the requirements of the federal clean water act, including the national

pollutant discharge elimination system (NPDES) requirements under Section 402 of the Federal Clean Water Act. Also, the landfill is not allowed to cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that is in violation of any of the requirements of an areawide or statewide water quality management plan that has been approved under Section 208 or 319 of the Federal Clean Water Act.

To demonstrate compliance with these requirements, the landfill operator is required to conduct a surface water-monitoring program approved by the State of Michigan for any surface water that may receive run-off from the active work area. Monitoring results are required to be submitted to the State of Michigan not more than 30 days after the end of the calendar quarter.

I. Run-On and Run-Off Control Systems

Two systems are required to control the flow of rainwater over burial cells. A run-on control system is required to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year, 24-hour storm. Also, a run-off control system from the active portion of the landfill is required to collect and control at least the water volume that results from a 24-hour, 25-year storm.

J. Final Cover Composite Liner

A final cover system is required to be installed on each burial cell which is designed to minimize infiltration and erosion and which is comprised of an erosion layer underlain by an infiltration layer. The final cover system is required to be comprised of the following components:

- An infiltration layer that is comprised of either a minimum of 18 inches of earthen material that has a permeability which is less than or equal to 1.0×10^{-5} cm/sec or a bentonite geocomposite liner which is underlain by not less than 18 inches of earthen material to protect the liner from waste and minimize the effect of settlement.

- An erosion layer that consists of both a soil layer which is not less than 2 feet thick, which is immediately above the composite cover liner, and which is designed to do all of the following:

  - Provide for the lateral drainage of precipitation off the cover of the landfill,

  - Minimize frost penetration into the infiltration layer, and

- Protect the flexible membrane liner from root penetration, ultraviolet light, and other deleterious effects.

A minimum of 6 inches of earthen material capable of sustaining native plant growth is required to be placed over the final cover system. To prevent the ponding of water on completed fill surfaces, the grading contours are required to be sufficient to prevent the development of local depressions due to post construction settlement. Slopes of the final cover are required to be not less than four percent at any location.

IX. BURIAL PROCEDURES

Please refer to Section VIII, Nature of the Burial Site regarding the burial of BRP demolition debris at a State of Michigan licensed landfill facility.

X. RADIATION SAFETY PROCEDURES

BRP is currently conducting decommissioning activities under a Radiation Protection Program and implementing procedures that comply with NRC regulatory requirements contained in 10 CFR 20, Standards for Protection Against Radiation. The Radiation Protection Program and implementing procedures are a requirement of the BRP Defueled Technical Specifications 6.6.1 and 6.6.2. The NRC Region III Office routinely reviews the Radiation Protection Program and implementing procedures and their implementation.

Disposal of BRP demolition debris will be performed in accordance with the Radiation Protection Program and implementing procedures as applicable.

XI. RECORDKEEPING

Recordkeeping requirements for landfill disposal of demolition debris are specified in BRP procedures.

As a minimum, these records will include:

- Surface contamination monitoring reports and
- Bulk container assay records for each container which will include but not be limited to:
  - Date and time the assay was performed,
  - Source of the demolition debris,
  - Mass, volume and composition of the demolition debris,

- Landfill destination for the demolition debris, and
- Assay results.

XII. ANALYSIS OF NO SIGNIFICANT ENVIRONMENTAL IMPACTS EVALUATION

Consumers Energy finds, in compliance with 10 CFR 50.82(a)(6)(ii), that activities associated with this application involve no significant environmental impacts. The following evaluation in conjunction with the foregoing discussion supports that finding.

A. Will the proposed activity result in significant environmental impacts not previously reviewed?

No significant environmental impacts are expected from the disposal of demolition debris with trace concentrations of licensed radioactive materials in a State of Michigan licensed landfill. Total volume of waste projected for BRP decommissioning is 635,100 cubic feet including 72,100 cubic feet of radioactive waste and 563,000 cubic feet of demolition debris. In comparison, NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities" (GEIS) lists a volume for the reference boiling water reactor (BWR) of 18,975 cubic meters (670,096 cubic feet), including disposable containers.

Although the GEIS evaluation of waste disposal volumes did not address the removal and disposal of non-radioactive structures and materials beyond that necessary to terminate the NRC license, the volume of waste evaluated in the GEIS (670,096 cubic feet) exceeds the total waste volume (including demolition debris and radioactive waste) projected for BRP decommissioning of 635,100 cubic feet.

Non-radiological environmental impacts evaluated in the GEIS included:

- Demography and human activities in the area,
- Hydrology,
- Aquatic resources/ecosystems in the area surrounding the plant site,
- Terrestrial resources,
- Endangered and threatened species,
- Land use,
- Air pollution control requirements,
- Water pollution control requirements,
- Hazardous materials and waste control,
- Occupational safety, and
- Public safety.

Radiological environmental impacts evaluated in the GEIS included:

- Occupational radiation exposure,
- Radiation exposure to the public,
- Radioactive waste management systems,
- Liquid radioactive effluents, and
- Airborne radioactive effluents.

The GEIS concludes that the major environmental impact of decommissioning is the commitment of small amounts of land for waste burial in exchange for reuse of the facility and site for other purposes. Since in many instances, such as at a reactor facility, the land is a valuable resource, return of this land to the commercial or public sector is highly desirable. Therefore, the GEIS evaluation bounds disposal of all BRP demolition debris including disposal of the demolition debris containing trace concentrations of licensed radioactive materials requested by this application.

NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES
UNDER 10 CFR 20.2002 PROVISIONS

ENCLOSURE 1

Onsite Core Sample Analysis Results

Big Rock Point Concrete Core Boring Sample Data

		Surface to be Removed by Remediation																	* 100 CCPM = 5000 dpm/100cm2												
	Location/Date/Sample ID#	Iso Data: pCi/g Surface-1/2"	Co-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1/2 - 1"	Depth "	C0-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1 - 1.5"	Co-60	Mn-54	Cs-137	Other	Surface	.5"	1"	1.5"	2"	2.5"	3"	3.5"	4"	4.5"	5"	5.5"	6"
1	ASD Bldg s #184 Floor	none detected					none detected						none detected					<100	<100	<100		<100								
2	ASD Bldg Wall s #185A	none detected					none detected						none detected					<100	<100			<100								
3	ASD Bldg Wall s #185B	none detected					none detected						none detected					<100	<100		<100									
4	Cal Shack s #182	none detected					none detected						none detected					<100		<100		<100	<100	to	3.5"					
5	Cal Shack s #183	none detected					none detected						none detected					<100	<100		<100		<100	<100		<100				
6	Contaminated Whse s #192	1.158			1.158		none detected						none detected					<100	<100	<100		<100								
7	Contaminated Whse s #193	1.734			1.734		none detected						none detected					<100	<100		<100		<100							
8	Equipment Lock s #1 Under Bridge	0.3313			0.3313													<100	one	piece										
9	Equipment Lock s #2 Under Bridge	43.3	6.566		36.73													200	2	2"	sampl	<100								
10	Loading Dock s #1A	none detected					none detected						none detected					<100	<100	<100										
11	Loading Dock s #3	none detected																<100	one	piece										
12	Loading Dock s #4	0.139			0.139													<100	one	piece										
13	Loading Dock s#2A	0.4929			0.4929		none detected						none detected					<100	<100	<100	<100									
14	Maint. Bldg s #186	none detected					none detected						none detected					<100	<100	<100	<100	<100								
15	Maint. Bldg s #187	none detected					none detected						none detected					<100	<100	<100	<100		<100							
16	Radwaste Bldg s #178	3.247	1.889		1.358		none detected						none detected					<100	<100	<100	<100	<100		<100	<100					
17	Radwaste Bldg s #179	none detected					none detected						none detected					<100	<100	<100		<100	<100							
18	Rm 1 Rad Waste Op Gallery Wall s # 168	25.84	4.301		21.54		3.165	.5-1"			3.165		2.271			2.271		100	<100	<100	<100	<100	<100		<100	activity		to 3"		
19	Rm 1 s #167 11/1/00 RW Op Gallery wall	3.141	2.373		0.7681		0.7743	0.5-1"	0.774				none detected					<100	<100	<100	<100		<100		<100	<100	<100			
20	Rm 1 s #169 11/1/00 RW Op Gallery wall	25.39	1.741		23.65		none detected						none detected					100	<100	<100	<100	<100	<100	<100						
21	Rm 1 s #170 11/1/00 RW Op Gallery Floor	291.5	93.35	3.192	195		21.84	0.5-1"	3.675		17.97		1.385			1.385		1000	<100	<100	<100	<100			<100	<100	<100			
22	Rm 101 sample #10 7/12/00 Lobby	none detected																<100	<100	<100	<100	<100	<100							
23	Rm 102 sample #11 7/13/00 Station Batt	none detected																<100	<100	<100	<100	<100								
24	Rm 103B sample #12 7/12/00	none detected																<100	<100	<100	<100	<100			<100	<100	<100	<100		
25	Rm 104 sample #13 7/12/00 Shop	1.135			1.135		none detected						none detected					<100	<100	<100	<100	<100	<100	<100		<100	<100			
26	Rm 104 sample #62 7/27/00 lunchroom	none detected																<100	<100	<100	<100									
27	Rm 105 sample #14 7/12/00 air compressor	none detected																<100	<100		<100		<100		<100	<100		<100		
28	Rm 107 sample #16 7/12/00 heating boiler	none detected																<100	<100	<100	<100	<100	<100		<100	<100	<100			
29	Rm 108 sample #17 7/12/00 stair #2	1.561			1.561		none detected						none detected					<100	<100	<100	<100	<100	<100		<100	<100	<100			
30	Rm 109 sample #93 8/16/00 wall from 121	4.267			4.267		none detected						none detected					<100			<100									
31	Rm 110 sample #18 7/12/00 O/S Cable Pen	none detected																<100	<100	<100			<100	<100		<100				
32	Rm 111 sample #19 7/13/00 Lube Oil Rm	none detected																<100	<100	<100	<100		<100	<100			<100	<100		
33	Rm 112 sample #20 7/13/00 lube oil tk	none detected																<100	<100	<100		<100		<100						
34	Rm 113 sample #21 7/13/00 stair #8	0.269			0.269		none detected						none detected					<100	<100	<100	<100	<100	<100	<100	<100			<100		
35	Rm 114 s #85 10/24/00 Pipe Tunnel Floor	78.23	64.83	1.884	11.52		0.5511	.5-1"	0.551				0.6927	0.693				500	<100	<100		<100	<100							
36	Rm 114 s #86 11/1/00 Pipe Tunnel W. floor	45.95	34.91		11.04		1.221	0.5-1"	1.221				0.4257	0.426				350	<100	<100	<100									
37	Rm 114 s #87 10/24/00 pipe tunnel wall	2.3687	1.705		0.6637		0.6465	.5-1"	0.647				none detected					<100	<100	<100		<100								
38	Rm 114 s #88 10/24/00 pipe tunnel	1.1006	0.753		0.3476		0.8029	.5-1"	0.803				0.9523	0.783		0.1695		<100	<100		<100	<100								
39	Rm 115 sample #22 8/14/00 Air ejector	56.98	50.7		6.27		none detected											400	<100		<100	<100	<100	<100						
40	Rm 119 sample #23 7/13/00 condenser w	16.21	14.7		1.23		none detected						none detected					<100	<100	<100	<100	<100			<100			<100	<100	
41	Rm 119 sample #24 7/13/00 condenser	78.61	54.01		24.59		1.86	.5-1"			1.86		0.789			0.789		250	<100	<100	<100	<100			<100		<100		<100	
42	Rm 119 sample #25 7/13/00	52.3	43.3	1.36	7.6		none detected						none detected					200	<100	<100	<100		<100		<100		<100	<100		
43	Rm 120 sample #20 7/13/00 passage	none detected																<100	<100	<100	<100	<100	<100	<100	<100	<100	<100			
44	Rm 121 sample #90 8/16/00	46.92	24.78		22.14		none detected						none detected					250	<100	<100	<100		<100	<100	<100					
45	Rm 121 sample #91 8/16/00	110.3	53.8		56.52		none detected						none detected					350	<100	<100	<100	<100								
46	Rm 121 sample #92 8/16/00 wall	1.4608	0.589		0.872		none detected						none detected					<100	<100	<100	<100	<100					<100	<100		
47	Rm 121 sample #93 8/16/00 wall	1.142	0.506		0.6358		none detected						none detected					<100	<100		<100		<100	<100	<100	<100	<100	<100	<100	
48	Rm 122 sample #27 7/13/00 Instr repair	0.77			0.77		none detected						none detected					<100	<100	<100	<100	<100	<100	<100			<100	<100	<100	
49	Rm 123 sample #28 7/13/00 elec shop	none detected																<100	<100	<100		<100	<100		<100		<100		<100	
50	Rm 124 sample #27 8/14/00 Track Alley	none detected																<100	<100	<100	<100	<100	<100	<100	<100	<100				
51	Rm 125 sample #30 8/14/00 Cond Pump Rm	none detected																<100	<100	<100	<100	<100	<100	<100	<100					
52	Rm 126 sample #31 8/14/00 cond demin	5.4			5.4		none detected						none detected					<100	<100	<100										
53	Rm 150 sample #1 7/7/00	none detected																<100	<100	<100	<100		<100		<100	<100				
54	Rm 152 sample #2 7/12/00 passage to shop	0.237			0.237		none detecte						none detected					<100	<100	<100			<100	<100	<100	<100		<100		
55	Rm 153 sample #3 7/7/00	none detected																<100	<100	<100	<100		<100	<100	<100	<100	<100			
56	Rm 154 sample #4 7/7/00	none detected																<100	<100	<100			<100	<100	<100	<100		<100		
57	Rm 155 sample #5 7/7/00	none detected																<100	<100		<100		<100		<100			<100	<100	
58	Rm 156 sample #6 7/7/00	none detected																<100	<100	<100	<100	<100	<100	<100	<100			<100	<100	
59	Rm 157 sample #7 7/7/00	none detected																<100	<100	<100	<100	<100	<100		<100	<100	<100	<100		
60	Rm 158 sample #8 7/7/00	none detected																<100	<100		<100	<100		<100	<100					
61	Rm 159 sample #9 7/7/00	none detected																<100	<100	<100	>100	<100	<100	<100						
62	Rm 2 s #174 11/20/00 Resin Storage	1361	109.5	4.24	1247		87.92	0.5-1"	14.07		73.85		71.94	21.09	1.523	49.32		2800	<100	<100	500		1200		suspect cross contamination					
63	Rm 202 sample #105 9/28/00 men's locker	0.2999			0.2999		none detected						none detected					<100	<100											
64	Rm 206 s #32 Old Laundry	1.499			1.499		none detected											<100	<100											
65	Rm 207 s #33 12/6/00 Old Access Control	0.2393			0.2393		none detected						none detected					<100	<100											
66	Rm 209 s #35 computer rm	none detected					none detected						none detected					<100	<100	<100	<100									
67	Rm 210 s #36 Record Storage	none detected					none detected						none detected					<100	<100											
68	Rm 211 s #37 old HP office	none detected					none detected											<100	<100											
69	Rm 212 s #38 Janitor Closet?	0.1819			0.1819		none detected						none detected					<100	<100	<100										
70	Rm 212 s #39 Janitor Closet?	none detected					none detected						none detected					<100	<100	<100	<100									
71	Rm 250 sample #40 7/19/00	none detected																<100	<100	<100										
72	Rm 251 sample #41 7/19/00	none detected																<100	<100	<100										
73	Rm 252 sample #42 7/19/00	none detected																<100	<100	<100										
74	Rm 253 sample #43 7/19/00 corridor	none detected																<100		<100										
75	Rm 254 sample #44 7/19/00	none detected																<100	<100	<100	<100									
76	Rm 255 sample #45 7/19/00	none detected																<100	<100											
77	Rm 256 sample #46 7/19/00	none detected																<100	<100	<100										
78	Rm 261 sample #49 7/19/00	none detected																<100	<100	<100	<100									
79	Rm 262 sample #50 7/19/00	none detected																<100	<100		<100									
80	Rm 263 sample #51 7/19/00	none detected																<100	<100	<100	<100	<100								
81	Rm 264 sample #52 7/26/00	none detected																<100		<100										

Note: Data includes samples of concrete not suitable for disposal. Highlighted results would require remediation.

Big Rock Point Concrete Core Boring Sample Data

		Surface to be Removed by Remediation																* 100 CCPM = 5000 dpm/100cm2													
	Location/Date/Sample ID#	Iso Data: pCi/g Surface-1/2"	Co-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1/2 - 1"	Depth "	C0-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1 - 1.5"	Co-60	Mn-54	Cs-137	Other	Surface	.5"	1"	1.5"	2"	2.5"	3"	3.5"	4"	4.5"	5"	5.5"	6"
82	Rm 265 sample #53 7/19/00 Corridor	none detected																<100	<100	<100	<100	<100								
83	Rm 266 sample #54 7/19/00	none detected																<100	<100	<100										
84	Rm 267 sample #55 7/19/00	none detected																<100		<100										
85	Rm 268 sample #56 7/19/00	none detected																<100	<100											
86	Rm 269 sample #57 7/19/00	none detected																<100	<100		<100									
87	Rm 3 s #165 11/20/00 RW Tank Rm	1641	224.7		1410	6.25	97.47	0.5-1"	52.97		44.49		74	35.94		38.06		10000	300	600		<100		400	3-3.5"	194pCi/gm		suspect		
88	Rm 3 s #166 11/20/00 RW Tk Rm Floor	306.6	38.05		268.8	1.66	34.8	0.5-1"	17.39		17.21		121.1	58.15		53.98		2800	200	300										
89	Rm 3 s #172 11/20/00 RW Tk Rm Wall	329.6	30.93		298.6		18.65	0.5-1"	9.549		9.104		16.73	7.724		9.007		2500	350	<100										
90	Rm 3 S#171 RW Tank Rm	109.8	67.84	1.872	40.08		32.98	1.5-3"	22.24		10.72		activity to 3"					1200			400									
91	Rm 300 sample #58 7/26/00 lobby	none detected																<100	<100	<100	<100	<100								
92	Rm 301 sample #59 7/26/00	none detected																<100	<100		<100									
93	Rm 303 sample #61 7/27/00 I&C Sup	none detected																<100	<100	<100	<100									
94	Rm 305 sample #63 7/27/00 storage rm	none detected																<100	<100	<100	<100		<100							
95	Rm 306 sample #64 7/27/00 Kitchen	none detected																<100	<100	<100										
96	Rm 307 sample #65 7/27/00 Control Rm	none detected																<100	<100											
97	Rm 308 sample #66 7/26/00	none detected																<100	<100	<100	<100									
98	Rm 309 sample #67 7/26/00 Corridor	none detected																<100	<100											
99	Rm 310 sample #68 7/26/00 ss office	none detected																<100	<100	<100		<100								
100	Rm 311 sample #69 7/26/00	none detected																<100	<100	<100										
101	Rm 312 sample #70 7/26/00 Ops Sup	none detected																<100	<100	<100	<100									
102	Rm 313 sample #71 7/26/00 Instr Lab	none detected																<100	<100	<100	<100	<100								
103	Rm 314 sample #72 7/26/00 Inst Lab	none detected																<100	<100	<100										
104	Rm 315 sample #73 7/28/00	none detected																<100	<100	<100	<100									
105	Rm 317 sample #74 7/28/00 count lab	none detected																<100	<100	<100	<100									
106	Rm 318 sample #75 7/28/00 chem lab	none detected																<100	<100	<100	<100	<100								
107	Rm 319B sample #76 7/27/00 Security	none detected																<100	<100	<100	<100									
108	Rm 320 sample #77 7/27/00 janitor closet	none detected																<100	<100	<100										
109	Rm 321 sample #78 7/27/00	none detected																<100	<100	<100	<100	<100								
110	Rm 322 sample #79 7/27/00 men's rm	none detected																<100	<100											
111	Rm 323 sample #80 7/27/00 Vestibule	none detected																<100	<100	<100	<100									
112	Rm 325 sample #82 7/28/00 Feed Pump	5.419			5.419		none detected						none detected					<100	<100	<100										
113	Rm 326 sample #83 7/28/00 turbine	7.817	6.805		0.848		none detected						none detected					<100	<100	<100	<100	<100								
114	Rm 327 sample #84 7/29/00	none detected																<100	<100		<100									
115	Rm 400 'A' Pmp s #137	14450	9237	1486	3730		123.6	.5-1"	50.83		72.74		73.14	54.03		19.12		70K	200		<100		<100	activity		to	3.5"			
116	Rm 400 A&B Pump Fl s #138	1994	795.3	22.23	1171	5.25	included on surface	-1					116.3	31		85.26		70K			100									
117	Rm 400 B Pmp Fl s #177	1063	519.3	27	517.2		13.8	.5-1"	2.359		11.44		8.749	2.88		5.863		7K	<100		<100	<100	<100							
118	Rm 400 s #139 11/1/00 B Pump Floor	53660	12390	406.7	40810	46.2	9973	0.5-1"	2704	122.3	7146		5112	2627	108.1	2377		60K	10K	6K	1700	700	700	sample taken through crack						
119	Rm 400 s #142 11/1/00 steam drum e. wall	142.8	5.898		136.9		1.107	0.5-1"	1.107				2.143	2.143				1000	<100	<100			<100		3"sample					
120	Rm 400 s #143 w.wall Sdenclosure 579	4760	41.16		4718		3.785	.5-1"	3.785				5.03					42k	<100	<100	<100	<100	<100							
121	Rm 400 s #144 Steam Drum/ RCP @ 599	324.9	14.24		310.7		none detected						none detected					2600	<100	<100	<100	<100		<100	activity	to	3.5"			
122	Rm 400 s #145 11/1/00 steam drum w. wall	35.95	6.596		29.36		2.2335	0.5-1"	1.871		0.3625		1.34	1.34				350	<100	<100	<100		<100	<100		co-60	0.49	2.5-3		
123	Rm 400 SD Encl 579' E Wall s #140	2150	30.9		2112	6.4	none detected						none detected					22K	<100	<100	<100	<100	<100	<100	<100					
124	Rm 400 Steam Drum Encl 599' E wall s #141	284.8	11.81		273		1.315	.5-1"	1.315				none detected					3K	<100	<100	<100									
125	Rm 401 CRD Fl s #176	38380	30780	618.9	4981		95.4	0.5-1"	13.58		81.81		20.45	12.8		7.652		140K	150	<100	<100	<100	acytivity		to at	least	3"			
126	Rm 401 s #158 11/3/00 CRD floor	4111	3003	85.08	1020		751.3	0.5-1"	111.6		639.8		346.2	68.31		277.9		240K	1400	700	500	220	300			sample taken through crack all3.5				
127	Rm 401 s #159 11/3/00 Crd wall	380.6	150.6	7.049	222.9		24.23	0.5-1"	6.79		16.86	0.58	6.075	6.075				2400	<100	<100	<100		<100							
128	Rm 403 sample #113 10/11/00 crd pmp rm	28.39	24.49	3.902			none detected						none detected					250	<100	<100	<100	<100		<100						
129	Rm 405 s #118 10/12/00 acc rm	841.4	594	60.42	187		2.001	.5-1"			2.001		0.3114			0.3114		3800	<100	<100	<100	<100		<100						
130	Rm 405 s #119 10/12/00 accrm fl	89.766	80.4	6.348	3.026		4.877	.5-1"	4.877				4.536	3.853		0.6834		1000	<100	<100	<100	<100	<100	<100	4.6 pCi/gm					
131	Rm 405 s #120 10/12/00 Acc rm wall	381.1	330.5	20.47	30.12		25.76	.5-1"	24.77		0.9908		5.192	5.192				3000	<100	<100	<100		<100			sample 6"		from	floor	
132	Rm 405 sample #117 10/12/00 acc rm wall	218	128.8	8.486	80.73	?	none detected						none detected					1200	<100	<100	<100			<100		sample 6"		from	floor	
133	Rm 406 sample #114 10/10/00 pass. Lowerac	2.152	1.4		0.7515		none detected						none detected					<100	<100		<100		<100							
134	Rm 407 s #157 11/2/00 crd access wall	146.5	121.3	10.69	14.46		none detected						none detected					1500	<100	<100	<100	<100	<100							
135	Rm 416 s #14611/1/00 RCP labyrinth floor	40.11	25.25		14.86								none detected					300	<100	<100	<100	<100								
136	Rm 416 s #147 11/1/00 RCP labyrinth wall	3.6401	2.803		0.8371		0.7551	0.5-1"	0.755				none detected					<100	<100	<100	<100	<100	<100	<100						
137	Rm 417 s #123 10/11/00 sdhx rm floor	145.6	113.9	7.055	24.68		none detected						none detected					1300	<100	<100	<100	<100		<100						
138	Rm 417 s #124 10/11/00 sdhx rm wall	15.36	11.56		3.805		none detected						none detected					300	<100	<100	<100		<100		<100					
139	Rm 417 s #125 10/11/00 sdhx floor	1445	1300	51.43	93.75		none detected						none detected					14000	<100	<100	<100									
140	Rm 417 s #126 10/11/00 sdhx rm wall	7.2	2.601		4.599		none detected						none detected					150	<100	<100		<100		<100						
141	Rm 418 sample #122 10/10/00 fphx	38.78	14.21	1.263	23.31		none detected						none detected					500	<100	<100		<100		<100						
142	Rm 419 s #129 Old FPHxRm	1.1583	0.742		0.4168		none detected						none detected					<100	<100	<100	<100	<100	<100	<100						
143	Rm 419 s #130 10/12/00 old fphx rm wall	none detected					none detected						none detected					<100	<100			<100	<100							
144	Rm 420 s #121 10/10/00 rcwhx	3.552	2.406		1.146		none detected						none detected					<100	<100	<100	<100			<100						
145	Rm 421 s #115 10/10/00 passage crd temp	1.3956	0.81		0.5854		none detected						none detected					<100	<100		<100				<100					
146	Rm 423 s #128 10/10/00 Flux Wire Rm	none detected					none detected						none detected					<100	<100	<100	<100	<100		<100						
147	Rm 424 s #131 10/17/00 rcp instr. Floor	6.075	4.064		2.012		none detected						none detected					100	<100	<100		<100		<100						
148	Rm 424 s #132 10/17/00 RCP Instr Rm floor	44.9	31.88		13.02		none detected						none detected					300	<100	<100	<100	<100	<100							
149	Rm 424 s #134 10/17/00 RCP Instr. Rm wall	26.45	25.7		0.7478		0.4809	0.5-1"	0.481				none detected					300	<100	<100	<100	<100		<100						
150	Rm 424 sample #133 10/17/00 rcp inst wall	2.44	1.172		1.268		none detected						none detected					<100	<100	<100		<100		<100						
151	Rm 426 s # 151 10/25/00 cupmprm	0.5472			0.5472		0.7391	.5-1"	0.739				0.3088	0.309				<100	<100	<100		<100								
152	Rm 426 s #148 10/23/00 cuprm fl	1352	501.6	42.81	807.4		8.807	.5-1	5.555		3.252		1.0657	0.807		0.26		5000	<100	<100		<100								
153	Rm 426 s #149 10/23/00 cupmprm	38.91	5.702		31.2		none detected						none detected					900	<100	<100	<100		<100							
154	Rm 426 s #150 10/23/00 cupmprm	7.646	4.083		3.564		none detected						none detected					150	<100	<100	<100	<100	<100	<100						
155	Rm 427 sample #102 10/5/00 core spray	none detected																<100	<100	<100	<100		<100	<100	<100		<100			
156	Rm 427 sample #127 10/10/00 core spray tk	4.683	2.845		1.838		none detected						none detected					<100	<100	<100	<100			<100						
157	Rm 428 sample #103 10/10/00 stair 125	0.5086			0.509		none detected						none detected					<100	<100	<100	<100	<100	<100		<100		<100			
158	Rm 429 s #153 10/24/00 pipeway floor	190.5	179.5		11		0.5415	.5-1"	0.542				1.187	1.187				700	<100	<100	<100	<100								
159	Rm 429 s #153 Pipeway Fl	78.63	61.6	2.381	14.65		7.556	.5-1"	7.556				5.097	4.732		0.3654		700	<100	<100	<100	<100		<100						
160	Rm 429 s #154 11/1/00 Pipeway wall	2.2056	1.669	0.538			none detected						none detected					<100	<100	<100		<100	<100							
161	Rm 429 s #155 10/25/00 pipeway wall	8.158	4.641		3.516		1.598	.5-1"	1.302		0.2954		0.7662	0.766				150	<100	<100		<100								
162	Rm 429 s #156 11/2/00 Pipe3way	2100	1390	25.5	683.8		0.9978	0.5-1"			0.9978		none detected					2200	<100	<100		<100	<100		<100					

Note: Data includes samples of concrete not suitable for disposal. Highlighted results would require remediation.

Big Rock Point Concrete Core Boring Sample Data

		Surface to be Removed by Remediation																	* 100 CCPM = 5000 dpm/100cm2														
	Location/Date/Sample ID#	Iso Data: pCi/g Surface-1/2"	Co-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1/2 - 1"	Depth "	C0-60	Mn-54	Cs-137	Other	Iso Data pCi/g 1 - 1.5"	Co-60	Mn-54	Cs-137	Other	Surface	.5"	1"	1.5"	2"	2.5"	3"	3.5"	4"	4.5"	5"	5.5"	6"
163	Rm 431 sample #104 9/26/00 Vent Shed	1.746			1.746		none detected						none detected					<100	<100	<100	<100	<100		<100		<100				
164	Rm 435 sample #112 10/10/00 laydown area	15.23			15.23		none detected						none detected					100	<100	<100	<100	<100	<100							
165	Rm 436 sample #109 10/10/00 pipe & cable	14.69	2.918		11.77		none detected						none detected					100		<100										
166	Rm 438 Rx Deck 10/26/00 s #163	1210	859.8	20.8	329.8		36.91	0.5-1"	30	1.076	5.832		5.622	4.188		1.437		7000	100	<100	<100									
167	Rm 438 s #162 10/26/00 Rx Deck	91.09	65.78	4.783	20.53		1.573	0.5-1"	1.188		0.3847		2.382	2.382				2100	<100	<100	<100	<100								
168	Rm 438 s #164 Rx Deck	301	156.5	6.188	138.7		10.98	0.5-1"	3.661		7.317		4.832	4.832				3k	<100	<100	<100	<100	<100		activity	to at	least	3"		
169	Rm 440 10/31/00 s #160 cudemin o/s wall						none detected						none detected					<100	<100	<100	<100			<100	<100		<100			<100
170	Rm 440 10/31/00 s #161 cudemin o/s wall	1.672	1.203		0.469		none detected						none detected					<100	<100	<100		<100		<100	<100	<100	<100		<100	
171	Rm 440 s #160 10/31/00 cudemin l/s wall	1.854			1.854		none detected						none detected					<100	<100	<100	<100	<100	<100	<100		<100		<100		
172	Rm 440 s #161 10/31/00 cudemin o/s wall	1.932	1.932				none detected						none detected					<100	<100	<100	<100		<100		<100	<100		<100		<100
173	Rm 441 sample # 107 9/26/00	2.686	1.095		1.59		none detected						none detected					<100	<100											
174	Rm 442 sample #108 10/5/00	1.395			1.395		none detected						none detected					<100	<100	<100	<100		<100							
175	Rm 445 sample #110 10/5/00 Vent Panel	1.005	1.005				none detected						none detected					<100												
176	Rm 446 sample #111 10/10/00 supply fan	4.626	1.476		3.15		none detected						none detected					<100	<100	<100										
177	Rm 452 s #135 10/18/00 ECS	8.236	1.758		6.478		none detected						none detected					100	<100	<100										
178	Rm 452 sample #136 10/18/00 ecs	55.63	10.66		44.97		none detected						none detected					800	<100			<100				<100				
179	Rm 504 s #94A	none detected					none detected						none detected					<100	one	piece										
180	Rm 504 s #94B Screen House Pmp Area	none detected					none detected						none detected					<100	one	piece										
181	Rm 504 s #94C	none detected					none detected						none detected					<100	<100	<100	<100									
182	Rm 504 s #96 Screen House Pmp Area	none detected					none detected						none detected					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	>100	<100
183	Rm 504 s #96A Screen House Pmp Area	none detected					none detected						none detected					<100	one	piece										
184	Rm 506 Screen Well Area s #97A	none detected					none detected						none detected					<100	one	large	piece									
185	Rm 506 Screen Well Area s #97B	none detected					none detected						none detected					<100	one	large	piece									
186	Rm 506 Screen Well Area s #97C	none detected					none detected						none detected					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
187	Rm 507 sample #101 9/14/00 EDG	none detected																<100	<100	<100		<100								
188	South Parking Lot Garage	none detected					none detected						none detected					<100	<100	<100	<100		<100							
189	Stack Base Inside s #98	none detected					none detected						none detected					<100					<100			<100				
190	Stack Base Outside s #98	none detected					none detected						none detected					<100	<100	<100		<100		<100					<100	
191	Stack Lower I/S s #175	25.82	2.075		23.74		only 1"sample											300												
192	Stack Lower O/S s #175	none detected					none detected						none detected					<100	<100	<100										
193	Stack Middle Inside s #99	19.5			19.5		none detected						none detected					350	<100											
194	Stack Middle Outside s #99	none detected					none detected						none detected					<100	<100		<100									
195	Stack Top Inside s #100	107	5.469		101.6		0.6568	.5-1"	0.657				none detected					2000	<100	<100	<100									
196	Stack Top Outside s #100	0.3634			0.3634		none detected						none detected					<100	<100	<100		<100								
197	Swamp Storage Garage s #190	none detected					none detected						none detected					<100	one	large	piece			ashphalt						
198	Swamp Whse s #188	none detected					none detected						none detected					<100	<100	<100	<100		<100	<100	<100					
199	Swamp Whse s #189	0.5937	0.594				none detected						none detected					<100	<100	<100	<100	<100	<100	<100						
200	West Warehouse s #180	none detected					none detected						none detected					<100	<100		<100		<100							
201	West Warehouse s #181	none detected					none detected						none detected					<100	<100	<100	<100									

Note: Data includes samples of concrete not suitable for disposal. Highlighted results would require remediation.

NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES
UNDER 10 CFR 20.2002 PROVISIONS

ENCLOSURE 2

General Engineering Laboratories Radio-Chemical Analyses Results

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

May 2, 2001

Mr. Leon Brown
Consumers Energy Corporation

Re: Guidance on General Engineering Labs, Inc. (GEL) certificate of analysis (COA)

Dear Mr. Brown:

This document is intended to clarify the headings and abbreviations found on GEL's COA. A brief explanation for the various headings on the COA are included below.

"Parameter" This is simply the test name for the isotope that was quantified by the laboratory. The parameter list is grouped by the type of test utilized such as alpha spectrometry, gamma spectrometry, gas flow proportional counting or liquid scintillation counting.

"Qualifier" This is a means of flagging certain conditions that exist with the data. For example a "U" flag means the isotope was not detected and a "J" flag means the result very close to the limit of detection and therefore an estimated value.

"Result" This is a calculated value representing the amount of analyte present and includes the uncertainty of the measurement. Radiological results are reported with a plus or minus sign "±" followed by a 2 sigma total propagated uncertainty.

"DL" This abbreviation stands for detection limit and refers to the calculated minimum detectable activity. This limit is based on a 95% confidence interval for radiological parameters.

"RL" This abbreviation stands for reporting limit and refers to a static target detection limit. This limit is either requested by the client or will default to a standard value.

"Units" This represents the units of measured employed in the calculated result. DL and RL. Typical results are reported in activity units per gram or liter depending on the physical form of the sample.

"DF" This abbreviation stands for the dilution factor used in calculating the final results. This field is not applicable to radiological reporting and in normally empty.

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
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"Analyst Date Time" This refers to the person who processed the sample in question and when the analysis was performed.

"Batch" This refers to the internally assigned batch number that was assigned to up to 20 samples. The batch number is used for data archival purposes and also contains specific information on the samples and quality control parameters.

"Method" This is a numeric value that cross references the source method used in performing the analysis. The COA will contain a table with numbers and methods employed.

Hopefully this gives you the information needed to use our COA. Thank you for considering GEL for your analytical needs and if you have any questions please feel free to call me at (843) 556-8171.

Sincerely,

James B Westmoreland

James B. Westmoreland
Director, Radiochemistry Division

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: February 9, 2001

Client Sample ID:	#19	Project:	ROCK2000
Sample ID:	37029006	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	13-JUL-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Fe55, solid												
Iron-55	U	-0.809	+/-7.49	13.4	2.00	pCi/g		AEA	02/08/01	1632	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1118	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

Notes:
The Qualifiers in this report are defined as follows :

** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit

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Lee M Heath
Reviewed by

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: January 26, 2001

Client Sample ID: #19
Sample ID: 35574006
Matrix: Misc Solid
Collect Date: 13-JUL-00
Receive Date: 19-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	-0.0165	+/-0.053	0.190	1.00	pCi/g		TOH2	01/02/01	2210	58610	1
Curium-242	U	0.00	+/-2.00	0.130	1.00	pCi/g						
Curium-243/244	U	0.00	+/-2.00	0.0629	1.00	pCi/g						
Curium-245/246	U	0.00	+/-2.00	0.0717	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0856	+/-0.226	0.667	1.00	pCi/g		TOH2	01/02/01	1720	58611	2
Plutonium-239/240	U	0.0453	+/-0.130	0.329	1.00	pCi/g						
haspec U, solid												
Uranium-233/234		0.552	+/-0.263	0.261	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0144	+/-0.0786	0.220	1.00	pCi/g						
Uranium-238		0.735	+/-0.292	0.135	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	5.09	+/-8.09	13.7	15.0	pCi/g		SWM	01/10/01	0112	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.0085	+/-0.294	0.385	1.00	pCi/g		SRB	01/08/01	1949	58092	5
Gamma Ni59, solid												
Nickel-59	U	4.77	+/-5.33	6.16	15.0	pCi/g		RDD	01/02/01	1631	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.135	+/-0.442	0.699	0.500	pCi/g		SRB	01/01/01	1819	58296	7
Actinium-228	U	0.353	+/-0.394	0.433	0.500	pCi/g						
Americium-241	U	0.00322	+/-0.057	0.0717	0.200	pCi/g						
Antimony-125	U	-0.0198	+/-0.128	0.200	0.100	pCi/g						
Cadmium-109	U	0.00	+/-0.719	0.841	1.00	pCi/g						
Cerium-144	U	-0.127	+/-0.283	0.399	0.500	pCi/g						
Cesium-134	U	-0.0102	+/-0.0647	0.088	0.050	pCi/g						
Cesium-135	U	0.136	+/-0.175	0.281	0.200	pCi/g						
Cesium-137	U	-0.0252	+/-0.052	0.0797	0.050	pCi/g						
Cobalt-60	U	0.0167	+/-0.0614	0.108	0.050	pCi/g						
Europium-152	U	-0.0741	+/-0.119	0.181	0.100	pCi/g						
Europium-154	U	0.0627	+/-0.179	0.314	0.500	pCi/g						
Lead-214		0.212	+/-0.162	0.131	0.100	pCi/g						
Manganese-54	U	0.085	+/-0.0758	0.136	0.100	pCi/g						
Niobium-94	U	-0.0276	+/-0.0504	0.0767	1.00	pCi/g						
Potassium-40		5.00	+/-1.51	1.04	0.500	pCi/g						
Promethium-147	U	16000	+/-56700	82000	50000	pCi/g						
Ruthenium-106	U	0.0351	+/-0.636	1.01	0.500	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #19
Sample ID: 35574006

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Silver-108m	U	0.00371	+/-0.0426	0.0675	0.050	pCi/g						
Silver-110m	U	0.0789	+/-0.0744	0.127	0.050	pCi/g						
Uranium-235	U	0.00	+/-0.244	0.334	0.500	pCi/g						
Zinc-65	U	-0.033	+/-0.196	0.326	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		3.09	+/-1.13	1.48	4.00	pCi/g		JEN	01/04/01	0646	59156	8
Beta		7.68	+/-1.66	2.50	10.0	pCi/g						
GFPC, Sr90, solid												
[illegible]rontium-90	U	-0.0543	+/-0.166	0.378	1.00	pCi/g		LOM1	01/09/01	1636	58459	9
[illegible] Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	-2.29	+/-4.59	8.21	6.00	pCi/g		SGL1	12/22/00	1829	58329	10
Liquid Scint C14, solid												
Carbon-14	U	0.538	+/-0.677	1.14	1.00	pCi/g		CAF1	12/28/00	0838	58334	11
Liquid Scint Fe55, solid												
Iron-55		8.58	+/-3.26	6.52	2.00	pCi/g		RDD	01/05/01	1431	58554	12
Liquid Scint Ni63, solid												
Nickel-63	U	-1.73	+/-0.443	1.07	2.00	pCi/g		RDD	12/30/00	0347	58555	13
Liquid Scint Tc99, solid												
Technetium-99	U	-2.31	+/-2.18	5.69	5.00	pCi/g		CAF1	12/27/00	1111	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
[illegible]	DOE EML HASL 300

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Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: January 26, 2001

Client Sample ID: #19
Sample ID: 35574006

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: February 9, 2001

Client Sample ID:	#31	Project:	ROCK2000
Sample ID:	37029002	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	14-AUG-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Liquid Scint											
Liquid Scint Fe55, solid											
Iron-55	U	-0.177	+/-1.64	2.93	2.00	pCi/g		AEA 02/08/01	1429	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1117	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

Notes:
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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: January 26, 2001

Client Sample ID: #31
Sample ID: 35574002
Matrix: Misc Solid
Collect Date: 14-AUG-00
Receive Date: 19-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.00	+/-2.00	0.0729	1.00	pCi/g		TOH2	01/02/01	2205	58610	1
Curium-242	U	-0.016	+/-0.032	0.257	1.00	pCi/g						
Curium-243/244	U	-0.00886	+/-0.0178	0.143	1.00	pCi/g						
Curium-245/246	U	0.00	+/-2.00	0.0845	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.00131	+/-0.242	0.605	1.00	pCi/g		TOH2	01/02/01	1717	58611	2
Plutonium-239/240	U	-0.0157	+/-0.0223	0.204	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	U	0.191	+/-0.148	0.212	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0554	+/-0.0905	0.186	1.00	pCi/g						
Uranium-238		0.502	+/-0.221	0.150	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	8.56	+/-8.00	13.4	15.0	pCi/g		SWM	01/09/01	2103	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.101	+/-0.340	0.459	1.00	pCi/g		SRB	01/03/01	1747	58092	5
Gamma Ni59, solid												
Nickel-59	U	-2.25	+/-4.85	5.58	15.0	pCi/g		RDD	01/02/01	2100	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.192	+/-0.309	0.484	0.500	pCi/g		SRB	01/01/01	1817	58296	7
Actinium-228	U	0.220	+/-0.145	0.263	0.500	pCi/g						
Americium-241	U	0.0148	+/-0.105	0.143	0.200	pCi/g						
Antimony-125	U	0.0709	+/-0.0829	0.142	0.100	pCi/g						
Cadmium-109	U	0.137	+/-0.600	0.911	1.00	pCi/g						
Cerium-144	U	0.0819	+/-0.192	0.296	0.500	pCi/g						
Cesium-134	U	-0.0924	+/-0.0417	0.0587	0.050	pCi/g						
Cesium-135	U	0.150	+/-0.124	0.200	0.200	pCi/g						
Cesium-137	U	0.00454	+/-0.0477	0.0513	0.050	pCi/g						
Cobalt-60	U	0.00995	+/-0.0427	0.0673	0.050	pCi/g						
Europium-152	U	-0.0152	+/-0.0783	0.118	0.100	pCi/g						
Europium-154	U	0.0678	+/-0.107	0.181	0.500	pCi/g						
Lead-214		0.308	+/-0.130	0.0845	0.100	pCi/g						
Manganese-54	U	-0.0142	+/-0.0425	0.0676	0.100	pCi/g						
Niobium-94	U	-0.00497	+/-0.0298	0.0482	1.00	pCi/g						
Potassium-40		3.94	+/-1.06	0.607	0.500	pCi/g						
Promethium-147	U	-5760	+/-39800	59900	50000	pCi/g						
Ruthenium-106	U	-0.261	+/-0.330	0.508	0.500	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #31 Project: ROCK2000
Sample ID: 35574002 Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec											
Gammaspec, Gamma, solid											
Silver-108m	U	-0.01	+/-0.0253	0.0405	0.050	pCi/g					
Silver-110m	U	-0.0476	+/-0.049	0.0626	0.050	pCi/g					
Uranium-235	U	0.0795	+/-0.212	0.217	0.500	pCi/g					
Zinc-65	U	-0.0321	+/-0.116	0.168	0.100	pCi/g					
Rad Gas Flow											
GFPC, Gross A/B, solid											
Alpha	U	1.52	+/-1.62	3.00	4.00	pCi/g		JEN 01/03/01	1820	59156	8
Beta		6.33	+/-2.53	4.62	10.0	pCi/g					
GFPC, Sr90, solid											
Strontium-90	U	-0.0034	+/-0.157	0.352	1.00	pCi/g		LOM1 01/09/01	1636	58459	9
Liquid Scint											
LSC, Tritium Dist, solid											
Tritium	U	4.20	+/-2.94	4.80	6.00	pCi/g		SGL1 12/22/00	1622	58329	10
Liquid Scint C14, solid											
Carbon-14	U	-0.0395	+/-0.468	0.801	1.00	pCi/g		CAF1 12/28/00	0222	58334	11
Liquid Scint Fe55, solid											
Iron-55		10.0	+/-3.55	7.09	2.00	pCi/g		RDD 01/05/01	1227	58554	12
Liquid Scint Ni63, solid											
Nickel-63	U	-2.34	+/-0.442	1.06	2.00	pCi/g		RDD 12/29/00	0646	58555	13
Liquid Scint Tc99, solid											
Technetium-99	U	2.03	+/-3.09	7.27	5.00	pCi/g		CAF1 12/27/00	0902	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
7	DOE EML HASL 300

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Project: Routine Analytical

Report Date: January 26, 2001

Client Sample ID: #31
Sample ID: 35574002

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#83	Project:	ROCK2000
Sample ID:	37029005	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	28-JUL-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Fe55, solid												
Iron-55	U	-0.785	+/-1.78	3.26	2.00	pCi/g		AEA	02/08/01	1601	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1118	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

Notes:
The Qualifiers in this report are defined as follows :

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #83
Sample ID: 35574005
Matrix: Misc Solid
Collect Date: 28-JUL-00
Receive Date: 19-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0814	+/-0.0877	0.132	1.00	pCi/g		TOH2	01/02/01	2210	58610	1
Curium-242	U	0.00	+/-2.00	0.112	1.00	pCi/g						
Curium-243/244	U	0.0386	+/-0.0548	0.0579	1.00	pCi/g						
Curium-245/246	U	0.0441	+/-0.0626	0.0662	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0136	+/-0.244	0.666	1.00	pCi/g		TOH2	01/02/01	1720	58611	2
Plutonium-239/240	U	-0.0097	+/-0.110	0.393	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	U	0.319	+/-0.223	0.350	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0369	+/-0.0866	0.203	1.00	pCi/g						
Uranium-238		0.324	+/-0.182	0.124	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	3.53	+/-5.30	8.95	15.0	pCi/g		SWM	01/10/01	0010	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.242	+/-0.278	0.416	1.00	pCi/g		SRB	01/08/01	1708	58092	5
Gamma Ni59, solid												
Nickel-59	U	2.06	+/-5.02	5.49	15.0	pCi/g		RDD	01/02/01	1733	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.0536	+/-0.357	0.542	0.500	pCi/g		SRB	01/01/01	1818	58296	7
Actinium-228	U	0.00	+/-0.259	0.304	0.500	pCi/g						
Americium-241	U	0.0818	+/-0.121	0.157	0.200	pCi/g						
Antimony-125	U	0.0138	+/-0.089	0.146	0.100	pCi/g						
Cadmium-109	U	0.843	+/-0.621	0.975	1.00	pCi/g						
Cerium-144	U	-0.00505	+/-0.212	0.319	0.500	pCi/g						
Cesium-134	U	0.0058	+/-0.0436	0.0626	0.050	pCi/g						
Cesium-135	U	-0.0748	+/-0.135	0.198	0.200	pCi/g						
Cesium-137		0.130	+/-0.0881	0.0537	0.050	pCi/g						
Cobalt-60	U	0.036	+/-0.0484	0.0894	0.050	pCi/g						
Europium-152	U	0.137	+/-0.0844	0.141	0.100	pCi/g						
Europium-154	U	-0.0203	+/-0.106	0.181	0.500	pCi/g						
Lead-214		0.386	+/-0.140	0.0968	0.100	pCi/g						
Manganese-54	U	0.0187	+/-0.0518	0.0868	0.100	pCi/g						
Niobium-94	U	0.00289	+/-0.0346	0.0564	1.00	pCi/g						
Potassium-40		3.74	+/-1.21	0.688	0.500	pCi/g						
Promethium-147	U	51300	+/-43900	69100	50000	pCi/g						
Ruthenium-106	U	0.591	+/-0.692	0.666	0.500	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #83
Sample ID: 35574005

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec											
Gammaspec, Gamma, solid											
Silver-108m	U	0.0262	+/-0.0298	0.0508	0.050	pCi/g					
Silver-110m	U	-0.0233	+/-0.051	0.0693	0.050	pCi/g					
Uranium-235	U	0.0705	+/-0.159	0.243	0.500	pCi/g					
Zinc-65	U	0.0184	+/-0.120	0.211	0.100	pCi/g					
Rad Gas Flow											
GFPC, Gross A/B, solid											
Alpha		4.39	+/-2.34	2.95	4.00	pCi/g		JEN 01/03/01	1957	59156	8
Beta		6.23	+/-2.54	4.65	10.0	pCi/g					
GFPC, Sr90, solid											
Strontium-90	U	0.0466	+/-0.142	0.309	1.00	pCi/g		LOM1 01/09/01	1636	58459	9
Liquid Scint											
LSC, Tritium Dist, solid											
Tritium	U	-0.629	+/-2.51	4.44	6.00	pCi/g		SGL1 12/22/00	1758	58329	10
Liquid Scint C14, solid											
Carbon-14	U	-0.127	+/-0.653	1.12	1.00	pCi/g		CAF1 12/23/00	2040	58334	11
Liquid Scint Fe55, solid											
Iron-55		9.95	+/-3.23	6.50	2.00	pCi/g		RDD 01/05/01	1400	58554	12
Liquid Scint Ni63, solid											
Nickel-63	U	-1.46	+/-0.678	1.63	2.00	pCi/g		RDD 12/29/00	2341	58555	13
Liquid Scint Tc99, solid											
Technetium-99	U	-3.12	+/-2.34	6.20	5.00	pCi/g		CAF1 12/27/00	1039	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
7	DOE EML HASL 300

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Company : Consumers Energy
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Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #83
Sample ID: 35574005

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Lee M Heath

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#104	Project:	ROCK2000
Sample ID:	37029001	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	26-SEP-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Fe55, solid												
Iron-55	U	0.181	+/-1.70	3.00	2.00	pCi/g		AEA	02/08/01	1358	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1117	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#104	Project:	ROCK2000
Sample ID:	35574001	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	26-SEP-00		
Receive Date:	19-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.00523	+/-0.0419	0.130	1.00	pCi/g		TOH2	01/02/01	2205	58610	1
Curium-242	U	0.00	+/-2.00	0.0854	1.00	pCi/g						
Curium-243/244	U	-0.00151	+/-0.0445	0.148	1.00	pCi/g						
Curium-245/246	U	0.0217	+/-0.0434	0.065	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.261	+/-0.375	0.767	1.00	pCi/g		TOH2	01/02/01	1717	58611	2
Plutonium-239/240	U	-0.00743	+/-0.147	0.457	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.384	+/-0.204	0.212	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.074	+/-0.0926	0.157	1.00	pCi/g						
Uranium-238		0.377	+/-0.192	0.119	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	12.5	+/-7.71	12.7	15.0	pCi/g		SWM	01/09/01	2001	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.107	+/-0.265	0.374	1.00	pCi/g		SRB	01/02/01	2043	58092	5
Gamma Ni59, solid												
Nickel-59	U	1.67	+/-6.58	4.97	15.0	pCi/g		RDD	01/03/01	1604	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.00598	+/-0.311	0.483	0.500	pCi/g		SRB	01/01/01	1810	58296	7
Actinium-228	U	0.00	+/-0.244	0.299	0.500	pCi/g						
Americium-241	U	0.120	+/-0.156	0.178	0.200	pCi/g						
Antimony-125	U	-0.0199	+/-0.0823	0.127	0.100	pCi/g						
Cadmium-109	U	0.719	+/-0.861	0.859	1.00	pCi/g						
Cerium-144	U	0.0225	+/-0.200	0.290	0.500	pCi/g						
Cesium-134	U	0.0248	+/-0.037	0.0557	0.050	pCi/g						
Cesium-135	U	0.152	+/-0.138	0.201	0.200	pCi/g						
Cesium-137		0.0937	+/-0.0536	0.0577	0.050	pCi/g						
Cobalt-60	U	0.00686	+/-0.0361	0.0644	0.050	pCi/g						
Europium-152	U	-0.00771	+/-0.0803	0.125	0.100	pCi/g						
Europium-154	U	-0.0181	+/-0.107	0.182	0.500	pCi/g						
Lead-214		0.366	+/-0.122	0.0851	0.100	pCi/g						
Manganese-54	U	0.0179	+/-0.0447	0.0667	0.100	pCi/g						
Niobium-94	U	-0.0194	+/-0.0312	0.0492	1.00	pCi/g						
Potassium-40		4.52	+/-1.05	0.515	0.500	pCi/g						
Promethium-147	U	29900	+/-44500	65700	50000	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #104
Sample ID: 35574001

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Gamma Spec											
Gammaspec, Gamma, solid											
Ruthenium-106	U	-0.117	+/-0.320	0.517	0.500	pCi/g					
Silver-108m	U	-0.0079	+/-0.0287	0.0441	0.050	pCi/g					
Silver-110m	U	0.0214	+/-0.0437	0.0655	0.050	pCi/g					
Uranium-235	U	0.243	+/-0.167	0.253	0.500	pCi/g					
Zinc-65	U	-0.0418	+/-0.100	0.167	0.100	pCi/g					
Rad Gas Flow											
GFPC, Gross A/B, solid											
Alpha	U	2.79	+/-2.20	3.87	4.00	pCi/g		JEN 01/03/01	1820	59156	8
Beta		6.58	+/-2.57	4.68	10.0	pCi/g					
GFPC, Sr90, solid											
Strontium-90	U	0.055	+/-0.131	0.284	1.00	pCi/g		LOM1 01/09/01	1636	58459	9
Rad Liquid Scint											
LSC, Tritium Dist, solid											
Tritium	U	-2.17	+/-2.68	4.86	6.00	pCi/g		SGL1 12/22/00	1550	58329	10
Liquid Scint C14, solid											
Carbon-14	U	-0.355	+/-0.648	1.12	1.00	pCi/g		CAF1 12/28/00	0015	58334	11
Liquid Scint Fe55, solid											
Iron-55		7.49	+/-3.32	6.52	2.00	pCi/g		RDD 01/05/01	1156	58554	12
Liquid Scint Ni63, solid											
Nickel-63	U	-1.64	+/-0.428	1.03	2.00	pCi/g		RDD 12/29/00	0240	58555	13
Liquid Scint Tc99, solid											
Technetium-99	U	-4.62	+/-2.36	6.47	5.00	pCi/g		CAF1 12/27/00	0830	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1526	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1

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Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #104
Sample ID: 35574001

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#112	Project:	ROCK2000
Sample ID:	37029003	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	10-OCT-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Fe55, solid												
Iron-55	U	0.682	+/-1.64	2.83	2.00	pCi/g		AEA	02/08/01	1459	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1117	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

Notes:
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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #112
Sample ID: 35574003
Matrix: Misc Solid
Collect Date: 10-OCT-00
Receive Date: 19-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0436	+/-0.0618	0.0654	1.00	pCi/g		TOH2	01/02/01	2205	58610	1
Curium-242	U	0.00	+/-2.00	0.0938	1.00	pCi/g						
Curium-243/244	U	0.00	+/-2.00	0.0659	1.00	pCi/g						
Curium-245/246	U	0.0253	+/-0.0507	0.0759	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.0346	+/-0.145	0.361	1.00	pCi/g		TOH2	01/02/01	1717	58611	2
Plutonium-239/240	U	0.00833	+/-0.0644	0.207	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.493	+/-0.240	0.244	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0537	+/-0.147	0.340	1.00	pCi/g						
Uranium-238		0.563	+/-0.251	0.205	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	9.78	+/-7.84	13.1	15.0	pCi/g		SWM	01/09/01	2205	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.213	+/-0.311	0.401	1.00	pCi/g		SRB	01/04/01	1110	58092	5
Gamma Ni59, solid												
Nickel-59	U	0.840	+/-4.90	5.22	15.0	pCi/g		RDD	01/02/01	1945	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.205	+/-0.368	0.583	0.500	pCi/g		SRB	01/01/01	1818	58296	7
Actinium-228	U	0.198	+/-0.161	0.292	0.500	pCi/g						
Americium-241	U	0.0153	+/-0.282	0.314	0.200	pCi/g						
Antimony-125	U	-0.0268	+/-0.0974	0.148	0.100	pCi/g						
Cadmium-109	U	0.694	+/-1.06	1.07	1.00	pCi/g						
Cerium-144	U	-0.0186	+/-0.190	0.290	0.500	pCi/g						
Cesium-134	U	-0.00107	+/-0.0417	0.0607	0.050	pCi/g						
Cesium-135	U	0.130	+/-0.149	0.240	0.200	pCi/g						
Cesium-137	U	0.0252	+/-0.0853	0.0645	0.050	pCi/g						
Cobalt-60		0.0838	+/-0.0654	0.0766	0.050	pCi/g						
Europium-152	U	-0.0903	+/-0.109	0.139	0.100	pCi/g						
Europium-154	U	-0.0148	+/-0.114	0.200	0.500	pCi/g						
Lead-214		0.327	+/-0.151	0.105	0.100	pCi/g						
Manganese-54	U	0.0268	+/-0.0477	0.0827	0.100	pCi/g						
Niobium-94	U	0.00279	+/-0.0356	0.0593	1.00	pCi/g						
Potassium-40		5.47	+/-1.44	0.716	0.500	pCi/g						
Promethium-147	U	-30000	+/-45400	67600	50000	pCi/g						
Ruthenium-106	U	-0.114	+/-0.373	0.607	0.500	pCi/g						

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #112
Sample ID: 35574003

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Silver-108m	U	-0.00173	+/-0.0332	0.0512	0.050	pCi/g						
Silver-110m	U	0.0193	+/-0.0465	0.0712	0.050	pCi/g						
Uranium-235	U	0.0435	+/-0.331	0.245	0.500	pCi/g						
Zinc-65	U	0.0542	+/-0.116	0.182	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	0.436	+/-1.52	3.70	4.00	pCi/g		JEN	01/03/01	1957	59156	8
Beta	U	4.29	+/-2.50	4.94	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.0968	+/-0.130	0.306	1.00	pCi/g		LOM1	01/09/01	1636	58459	9
Liquid Scint												
LSC, Tritium Dist, solid												
Tritium		6.24	+/-2.51	3.91	6.00	pCi/g		SGL1	12/22/00	1654	58329	10
Liquid Scint C14, solid												
Carbon-14	U	0.159	+/-0.632	1.07	1.00	pCi/g		CAF1	12/28/00	0428	58334	11
Liquid Scint Fe55, solid												
Iron-55		10.5	+/-3.18	6.51	2.00	pCi/g		RDD	01/05/01	1258	58554	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.658	+/-0.477	1.15	2.00	pCi/g		RDD	12/29/00	1528	58555	13
Liquid Scint Tc99, solid												
Technetium-99	U	-0.793	+/-2.31	5.76	5.00	pCi/g		CAF1	12/27/00	0935	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
7	DOE EML HASL 300

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #112
Sample ID: 35574003

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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> Actual result is greater than amount reported
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U Indicates the compound was analyzed for but not detected above the detection limit

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#123	Project:	ROCK2000
Sample ID:	37029004	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	11-OCT-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Liquid Scint											
Liquid Scint Fe55, solid											
Iron-55	U	0.841	+/-1.63	2.79	2.00	pCi/g		AEA 02/08/01	1530	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1118	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#123	Project:	ROCK2000
Sample ID:	35574004	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	11-OCT-00		
Receive Date:	19-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0386	+/-0.0547	0.0578	1.00	pCi/g		TOH2	01/02/01	2205	58610	1
Curium-242	U	0.0276	+/-0.0552	0.0827	1.00	pCi/g						
Curium-243/244	U	-0.021	+/-0.0244	0.152	1.00	pCi/g						
Curium-245/246		0.0671	+/-0.0779	0.0671	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.0799	+/-0.208	0.479	1.00	pCi/g		TOH2	01/02/01	1717	58611	2
Plutonium-239/240	U	-0.0261	+/-0.0304	0.252	1.00	pCi/g						
phaspec U, solid												
Uranium-233/234		0.354	+/-0.185	0.151	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0602	+/-0.0766	0.115	1.00	pCi/g						
Uranium-238		0.289	+/-0.168	0.151	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	2.87	+/-7.55	12.8	15.0	pCi/g		SWM	01/09/01	2307	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.0413	+/-0.286	0.370	1.00	pCi/g		SRB	01/04/01	1209	58092	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-8.68	4.56	15.0	pCi/g		RDD	01/02/01	1840	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.0704	+/-0.404	0.632	0.500	pCi/g		SRB	01/02/01	1259	58296	7
Actinium-228	U	0.212	+/-0.159	0.311	0.500	pCi/g						
Americium-241	U	-0.0769	+/-0.142	0.190	0.200	pCi/g						
Antimony-125	U	0.00	+/-0.155	0.174	0.100	pCi/g						
Cadmium-109	U	0.520	+/-0.689	1.10	1.00	pCi/g						
Cerium-144	U	-0.223	+/-0.226	0.330	0.500	pCi/g						
Cesium-134	U	0.0456	+/-0.044	0.073	0.050	pCi/g						
Cesium-135	U	-0.166	+/-0.153	0.218	0.200	pCi/g						
Cesium-137	U	0.0629	+/-0.0496	0.0911	0.050	pCi/g						
Cobalt-60	U	0.0188	+/-0.0495	0.0945	0.050	pCi/g						
Europium-152	U	0.0415	+/-0.111	0.160	0.100	pCi/g						
Europium-154	U	-0.068	+/-0.133	0.222	0.500	pCi/g						
Lead-214		0.356	+/-0.162	0.122	0.100	pCi/g						
Manganese-54	U	0.0228	+/-0.0518	0.0911	0.100	pCi/g						
Niobium-94	U	0.00018	+/-0.0385	0.0646	1.00	pCi/g						
Potassium-40		4.66	+/-1.24	0.712	0.500	pCi/g						
Promethium-147	U	27500	+/-48700	77500	50000	pCi/g						
Ruthenium-106	U	0.0519	+/-0.371	0.639	0.500	pCi/g						

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #123
Sample ID: 35574004

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Silver-108m	U	-0.00532	+/-0.0328	0.0543	0.050	pCi/g						
Silver-110m	U	-0.108	+/-0.0559	0.0753	0.050	pCi/g						
Uranium-235	U	-0.0808	+/-0.201	0.303	0.500	pCi/g						
Zinc-65	U	-0.0391	+/-0.118	0.174	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	-0.585	+/-1.36	4.19	4.00	pCi/g		JEN	01/03/01	1957	59156	8
Beta		5.82	+/-2.59	4.85	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.0807	+/-0.142	0.304	1.00	pCi/g		LOM1	01/09/01	1636	58459	9
Liquid Scint												
LSC, Tritium Dist, solid												
Tritium		9.47	+/-2.88	4.32	6.00	pCi/g		SGL1	12/22/00	1726	58329	10
Liquid Scint C14, solid												
Carbon-14	U	-0.229	+/-0.630	1.08	1.00	pCi/g		CAF1	12/28/00	0633	58334	11
Liquid Scint Fe55, solid												
Iron-55		8.70	+/-3.33	6.65	2.00	pCi/g		RDD	01/05/01	1329	58554	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.393	+/-0.465	1.12	2.00	pCi/g		RDD	12/29/00	1935	58555	13
Liquid Scint Tc99, solid												
Technetium-99	U	-6.29	+/-3.31	9.06	5.00	pCi/g		CAF1	12/27/00	1007	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
7	DOE EML HASL 300

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #123
Sample ID: 35574004

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#128	Project:	ROCK2000
Sample ID:	37029007	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	10-OCT-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Fe55, solid												
Iron-55	U	0.00	+/-6.95	12.4	2.00	pCi/g		AEA	02/09/01	0914	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1118	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#128	Project:	ROCK2000
Sample ID:	35574007	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	10-OCT-00		
Receive Date:	19-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0379	+/-0.0537	0.0568	1.00	pCi/g		TOH2	01/02/01	2210	58610	1
Curium-242	U	-0.00979	+/-0.0196	0.157	1.00	pCi/g						
Curium-243/244	U	0.00	+/-2.00	0.0573	1.00	pCi/g						
Curium-245/246	U	0.022	+/-0.044	0.0659	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.128	+/-0.276	0.613	1.00	pCi/g		TOH2	01/02/01	1720	58611	2
Plutonium-239/240	U	0.0119	+/-0.0921	0.295	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.311	+/-0.199	0.252	1.00	pCi/g		TOH2	01/02/01	1700	58612	3
Uranium-235/236	U	0.0376	+/-0.0721	0.154	1.00	pCi/g						
Uranium-238		0.309	+/-0.183	0.153	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	6.93	+/-8.55	14.4	15.0	pCi/g		SWM	01/10/01	0214	58550	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.198	+/-0.318	0.451	1.00	pCi/g		SRB	01/08/01	2107	58092	5
Gamma Ni59, solid												
Nickel-59	U	4.37	+/-4.87	55.7	15.0	pCi/g		RDD	01/02/01	1455	58575	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.105	+/-0.335	0.506	0.500	pCi/g		SRB	01/01/01	1819	58296	7
Actinium-228	U	0.00	+/-0.237	0.287	0.500	pCi/g						
Americium-241	U	0.181	+/-0.180	0.217	0.200	pCi/g						
Antimony-125	U	0.0642	+/-0.0931	0.136	0.100	pCi/g						
Cadmium-109	U	0.590	+/-1.01	0.864	1.00	pCi/g						
Cerium-144	U	0.163	+/-0.180	0.285	0.500	pCi/g						
Cesium-134	U	-0.152	+/-0.0402	0.0512	0.050	pCi/g						
Cesium-135	U	0.0324	+/-0.138	0.192	0.200	pCi/g						
Cesium-137		0.166	+/-0.0619	0.0548	0.050	pCi/g						
Cobalt-60	U	0.0763	+/-0.050	0.0979	0.050	pCi/g						
Europium-152	U	-0.0215	+/-0.121	0.127	0.100	pCi/g						
Europium-154	U	0.0562	+/-0.128	0.233	0.500	pCi/g						
Lead-214		0.292	+/-0.117	0.0913	0.100	pCi/g						
Manganese-54	U	0.0111	+/-0.0728	0.068	0.100	pCi/g						
Niobium-94	U	0.0205	+/-0.0327	0.0562	1.00	pCi/g						
Potassium-40		7.52	+/-1.18	0.656	0.500	pCi/g						
Promethium-147	U	-1070	+/-40800	62300	50000	pCi/g						
Ruthenium-106	U	-0.132	+/-0.327	0.527	0.500	pCi/g						

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #128
Sample ID: 35574007

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Silver-108m	U	-0.00455	+/-0.0282	0.043	0.050	pCi/g						
Silver-110m	U	0.0284	+/-0.0433	0.0672	0.050	pCi/g						
Uranium-235	U	0.112	+/-0.157	0.247	0.500	pCi/g						
Zinc-65	U	-0.00936	+/-0.120	0.172	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		2.75	+/-0.863	1.01	4.00	pCi/g		JEN	01/04/01	0646	59156	8
Beta		4.46	+/-1.31	2.02	10.0	pCi/g						
GFPC, Sr90, solid												
[illegible]rontium-90	U	0.112	+/-0.142	0.297	1.00	pCi/g		LOM1	01/09/01	1636	58459	9
[illegible] Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	2.91	+/-2.93	4.89	6.00	pCi/g		SGL1	12/22/00	1901	58329	10
Liquid Scint C14, solid												
Carbon-14	U	0.519	+/-0.663	1.11	1.00	pCi/g		CAF1	12/28/00	1044	58334	11
Liquid Scint Fe55, solid												
Iron-55		7.69	+/-3.25	6.53	2.00	pCi/g		RDD	01/05/01	1503	58554	12
Liquid Scint Ni63, solid												
Nickel-63	U	-2.49	+/-0.657	1.58	2.00	pCi/g		RDD	12/30/00	0753	58555	13
Liquid Scint Tc99, solid												
Technetium-99	U	-1.48	+/-3.06	7.72	5.00	pCi/g		CAF1	12/27/00	1143	58168	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300
2	DOE EML HASL 300
3	DOE EML HASL 300
4	DOE EML HASL 300
5	LANL EM-9
6	DOE RESL Ni-1
[illegible]	DOE EML HASL 300

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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #128
Sample ID: 35574007

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
The Qualifiers in this report are defined as follows :

Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

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Lee M Heath
Reviewed by

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: February 9, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#7	Project:	ROCK2000
Sample ID:	37029008	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	07-JUL-00		
Receive Date:	31-JAN-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Rad Liquid Scint											
Liquid Scint Fe55, solid											
Iron-55	U	-0.357	+/-1.64	2.96	2.00	pCi/g		AEA 02/09/01	0945	63178	1

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	01/31/01	1148	63041
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	01/31/01	1118	63024

The following Analytical Methods were performed

Method	Description
1	DOE RESL Ni-1

Notes:
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> Actual result is greater than amount reported
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008
Matrix: Misc Solid
Collect Date: 07-JUL-00
Receive Date: 19-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Electrode Analysis											
SW9045C pH											
pH at Temp 20.1C		11.3		0.010	0.100	SU	1	TCC1 12/21/00	2243	58255	1
Hazardous Waste											
SW1010 Closedcup Flash Pt 200											
Flashpoint-200		>200		200	200	Fahrenheit	1	JBH 01/12/01	1200	60517	2
Mercury Analysis											
TCLP Hg in Solid											
Mercury	U	-0.00135		0.0006	0.002	mg/L	1	AW2 01/02/01	1147	59107	3
Metals Analysis-ICP											
TCLP ICP Metals for Solid											
Arsenic	U	0.00663		0.0257	0.500	mg/L	10	TLW 12/30/00	0405	59076	4
Barium	J	0.200		0.00748	10.0	mg/L	10				
Cadmium	U	-0.000853		0.00631	0.100	mg/L	10				
Chromium	J	0.112		0.0106	0.500	mg/L	10				
Lead	U	0.0126		0.0183	0.500	mg/L	10				
Selenium	U	0.00715		0.0236	0.100	mg/L	10				
Silver	U	-0.000844		0.00529	0.500	mg/L	10				
Rad Alpha Spec											
Alphaspec Am241, Cm, solid											
Americium-241	U	0.0238	+/-0.0854	0.201	1.00	pCi/g		TOH2 01/02/01	2210	58610	5
Curium-242	U	-0.0132	+/-0.0264	0.212	1.00	pCi/g					
Curium-243/244	U	0.0221	+/-0.0521	0.120	1.00	pCi/g					
Curium-245/246	U	0.0308	+/-0.0741	0.169	1.00	pCi/g					
Alphaspec Pu, solid											
Plutonium-238	U	-0.103	+/-0.221	0.635	1.00	pCi/g		TOH2 01/02/01	1720	58611	6
Plutonium-239/240	U	0.0187	+/-0.076	0.224	1.00	pCi/g					
Alphaspec U, solid											
Uranium-233/234		0.486	+/-0.251	0.254	1.00	pCi/g		TOH2 01/02/01	1700	58612	7
Uranium-235/236	U	-0.0237	+/-0.0885	0.294	1.00	pCi/g					
Uranium-238		0.349	+/-0.199	0.0806	1.00	pCi/g					
Liquid Scint Pu241, solid											
Plutonium-241	U	6.14	+/-8.08	13.6	15.0	pCi/g		SWM 01/10/01	0316	58550	8
Rad Gamma Spec											
Gamma I129, solid											
Iodine-129	U	0.129	+/-0.310	0.350	1.00	pCi/g		SRB 01/08/01	2159	58092	9
Gamma Ni59, solid											

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Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gamma Ni59, solid												
Nickel-59	U	-0.97	+/-5.39	5.41	15.0	pCi/g		RDD	01/02/01	1302	58575	10
Gammaspec, Gamma, solid												
Actinium-227	U	-0.144	+/-0.420	0.554	0.500	pCi/g		SRB	01/01/01	1820	58296	11
Actinium-228	U	0.314	+/-0.285	0.335	0.500	pCi/g						
Americium-241	U	0.189	+/-0.185	0.264	0.200	pCi/g						
Antimony-125	U	-0.00513	+/-0.0936	0.154	0.100	pCi/g						
Cadmium-109	U	0.00	+/-0.956	1.23	1.00	pCi/g						
Cerium-144	U	-0.229	+/-0.250	0.360	0.500	pCi/g						
Cesium-134	U	0.0258	+/-0.0452	0.0766	0.050	pCi/g						
Cesium-135	U	-0.0521	+/-0.151	0.225	0.200	pCi/g						
Cesium-137	U	-0.0226	+/-0.0387	0.0609	0.050	pCi/g						
Cobalt-60	U	-0.0115	+/-0.0429	0.0746	0.050	pCi/g						
Europium-152	U	-0.0531	+/-0.106	0.156	0.100	pCi/g						
Europium-154	U	0.101	+/-0.130	0.251	0.500	pCi/g						
Lead-214		0.275	+/-0.146	0.111	0.100	pCi/g						
Manganese-54	U	-0.0326	+/-0.0656	0.0889	0.100	pCi/g						
Niobium-94	U	-0.014	+/-0.0379	0.0607	1.00	pCi/g						
Potassium-40		6.14	+/-1.35	0.735	0.500	pCi/g						
Promethium-147	U	1420	+/-46200	69800	50000	pCi/g						
Ruthenium-106	U	0.0197	+/-0.462	0.766	0.500	pCi/g						
Silver-108m	U	0.0122	+/-0.0319	0.0538	0.050	pCi/g						
Silver-110m	U	-0.00147	+/-0.0554	0.0917	0.050	pCi/g						
Uranium-235	U	0.200	+/-0.179	0.283	0.500	pCi/g						
Zinc-65	U	0.0707	+/-0.160	0.261	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		1.66	+/-0.789	1.10	4.00	pCi/g		JEN	01/04/01	0646	59156	12
Beta		4.81	+/-1.41	2.18	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.0177	+/-0.126	0.278	1.00	pCi/g		LOM1	01/09/01	1643	58459	13
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	-0.979	+/-2.45	4.35	6.00	pCi/g		SGL1	12/22/00	1933	58329	14
Liquid Scint C14, solid												
Carbon-14	U	-0.0595	+/-0.493	0.844	1.00	pCi/g		CAF1	12/28/00	1249	58334	15
Liquid Scint Fe55, solid												
Iron-55		12.0	+/-3.51	7.14	2.00	pCi/g		RDD	01/05/01	1534	58554	16
Liquid Scint Ni63, solid												
Nickel-63	U	-2.61	+/-0.471	1.13	2.00	pCi/g		RDD	12/30/00	1159	58555	17

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
Liquid Scint Tc99, solid												
Technetium-99	U	-4.56	+/-2.33	6.39	5.00	pCi/g		CAF1	12/27/00	1215	58168	18
Rapid Flow Analysis (Alpkem)												
SW 7.3.3 Reactivity, Releasabl												
Reactive Releasable Cyanide	U	7.70		13.8	250000	ug/kg	1	ADF	01/04/01	1114	59309	19
Semi-Volatiles-GC/MS												
TCLP BNA SOLID 8270C 3510C												
1,4-Dichlorobenzene	U	0.00		0.0009	0.750	mg/L	1	KGB1	12/28/00	2154	58871	20
2,4,5-Trichlorophenol	U	0.00		0.00365	40.0	mg/L	1					
2,4,6-Trichlorophenol	U	0.00		0.0008	0.200	mg/L	1					
2,4-Dinitrotoluene	U	0.00		0.00075	0.130	mg/L	1					
Hexachlorobenzene	U	0.00		0.0007	0.130	mg/L	1					
Hexachlorobutadiene	U	0.00		0.001	0.100	mg/L	1					
Hexachloroethane	U	0.00		0.00065	0.300	mg/L	1					
Nitrobenzene	U	0.00		0.00165	0.200	mg/L	1					
Pentachlorophenol	U	0.00		0.0173	10.0	mg/L	1					
Pyridine	U	0.00		0.0007	0.500	mg/L	1					
m,p-Cresols	U	0.00		0.00085	20.0	mg/L	1					
o-Cresol	U	0.00		0.00115	20.0	mg/L	1					
Semi-Volatiles-HERB												
8151A TCLP HERB Soil												
2,4,5-TP	U	0.00		0.0188	0.100	mg/L	20	CAK	12/29/00	1608	58976	21
2,4-D	U	0.00		0.018	1.00	mg/L	20					
Semi-Volatiles-PEST												
8081A/3510C TCLP PEST Solid												
Chlordane (tech.)	U	0.00		0.00174	0.003	mg/L	1	MM	01/02/01	2241	58942	23
Endrin	U	0.00		0.000117	0.002	mg/L	1					
Heptachlor	U	0.00		0.00004	0.008	mg/L	1					
Heptachlor epoxide	U	0.00		0.000025	0.008	mg/L	1					
Methoxychlor	U	0.00		0.000291	1.00	mg/L	1					
Toxaphene	U	0.00		0.00312	0.050	mg/L	1					
gamma-BHC (Lindane)	U	0.00		0.000024	0.040	mg/L	1					
Spectrometric Analysis												
SW846-7.3.4 Sulfide, Reactive												
Reactive Releasable Sulfide	U	0.025		0.090	500	mg/kg	1	MOJ1	12/27/00	1145	58663	24
Volatile Organics												
TCLP Volatiles in Solid												
1,1-Dichloroethylene	U	0.00		0.00262	0.070	mg/L	10	JEB	12/24/00	1547	58637	25
1,2-Dichloroethane	U	0.00		0.0017	0.050	mg/L	10					
1,4-Dichlorobenzene	U	0.00		0.00223	0.750	mg/L	10					

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Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Volatile Organics										
TCLP Volatiles in Solid										
2-Butanone	U	0.0162	0.0176	20.0	mg/L	10				
Benzene	U	0.00	0.00276	0.050	mg/L	10				
Carbon tetrachloride	U	0.00	0.00144	0.050	mg/L	10				
Chlorobenzene	U	0.00	0.00206	10.0	mg/L	10				
Chloroform	U	0.00	0.00204	0.600	mg/L	10				
Tetrachloroethylene	U	0.00	0.00582	0.070	mg/L	10				
Trichloroethylene	U	0.00	0.0072	0.050	mg/L	10				
Vinyl chloride	U	0.00	0.00255	0.020	mg/L	10				
Wet Chemistry General										
SW9095 Paint Filter Test										
Paint Filter		PASS					MOJ1 12/27/00	0830	58662	26

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	12/20/00	1527	58280
Dry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	COB1	12/20/00	1459	58095
SW846 1311	SW846 1311 TCLP Leaching	JL	12/21/00	1945	58343
SW846 1311	SW846 1311 TCLP Leaching	JL	12/21/00	1945	58344
SW846 1311	SW846 1311 TCLP Volatiles Prep	JL	12/21/00	2120	58346
SW846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	12/28/00	1430	58744
SW846 3510C	3510C BNA TCLP Prep-8270C Analysis	AEJ	12/28/00	0730	58773
SW846 3510C	3510C PEST TCLP Liquid Prep	AW1	12/28/00	1300	58775
SW846 7.3.3 Pr	SW 7.3.3 Reactivity, Releasable Cyanide	MOJ1	12/27/00	0815	59147
SW846 7.3.4 Mod	SW846-7.3.4 Sulfide, Reactive-Releasabl	MOJ1	12/27/00	0815	58171
SW846 7470A	EPA 7470 Mercury Prep TCLP Liquid	AJM	12/29/00	1545	58749
SW846 8151A Pr	8151A HERB TCLP Prep in Liquid	HDB	12/28/00	0730	58826

The following Analytical Methods were performed

Method	Description
1	SW846 9045C
2	SW846 1010
3	SW846 7470A
4	SW846 3010/6010B
5	DOE EML HASL 300
6	DOE EML HASL 300
	DOE EML HASL 300

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Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
8	DOE EML HASL 300									
9	LANL EM-9									
10	DOE RESL Ni-1									
11	DOE EML HASL 300									
12	EPA 900.0									
13	EPA 905.0									
14	EPA 906.0									
15	EPA EERF C-01									
16	DOE RESL Ni-1									
17	DOE RESL Ni-1									
	DOE EML HASL 300									
19	SW846 7.3.3									
20	SW846 8270C									
21	SW846 8151A									
22	SW846 8151A									
23	SW846 8081A									
24	SW846 7.3.4 Modified									
25	SW846 8260B									
26	SW846 9095									

Surrogate recovery	Test	Recovery %	Acceptable Limits
2,4,6-Tribromophenol	TCLP BNA SOLID 8270C 3510C	95%	(30%-116%)
2-Fluorobiphenyl	TCLP BNA SOLID 8270C 3510C	81%	(29%-106%)
2-Fluorophenol	TCLP BNA SOLID 8270C 3510C	48%	(23%-71%)
Nitrobenzene-d5	TCLP BNA SOLID 8270C 3510C	89%	(25%-105%)
Phenol-d5	TCLP BNA SOLID 8270C 3510C	32%	(10%-50%)
p-Terphenyl-d14	TCLP BNA SOLID 8270C 3510C	103%	(18%-125%)
2,4-Dichlorophenylacetic acid	8151A TCLP HERB Soil	86%	(44%-145%)
4cmx	8081A/3510C TCLP PEST Solid	69%	(46%-125%)
Decachlorobiphenyl	8081A/3510C TCLP PEST Solid	65%	(42%-143%)
Bromofluorobenzene	TCLP Volatiles in Solid	76%	(59%-129%)
Dibromofluoromethane	TCLP Volatiles in Solid	80%	(66%-130%)
Toluene-d8	TCLP Volatiles in Solid	74%	(64%-130%)

Notes:
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Charlevoix, MI 49720

Report Date: January 26, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #7
Sample ID: 35574008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: #90
Sample ID: 35670014
Matrix: Misc Solid
Collect Date: 16-AUG-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Meth
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0371	+/-0.255	0.668	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	-0.0014	+/-0.344	1.07	1.00	pCi/g						
Curium-243/244	U	0.0768	+/-0.246	0.595	1.00	pCi/g						
Curium-245/246	U	0.0888	+/-0.178	0.266	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0487	+/-0.098	1.07	1.00	pCi/g		JLE	01/05/01	0823	59216	2
Plutonium-239/240	U	0.00	+/-2.01	0.607	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.351	+/-0.269	0.150	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	U	0.0261	+/-0.106	0.313	1.00	pCi/g						
Uranium-238	J	0.301	+/-0.248	0.150	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-1.95	+/-12.4	28.4	15.0	pCi/g		SWM	01/14/01	2341	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.0299	+/-0.343	0.323	1.00	pCi/g		SRB	01/05/01	2241	58962	5
Gamma Ni59, solid												
Nickel-59	U	2.53	+/-5.13	5.67	15.0	pCi/g		RDD	01/08/01	1214	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.341	+/-0.553	0.871	0.500	pCi/g		SRB	01/05/01	0852	59285	7
Actinium-228	U	0.471	+/-0.520	0.542	0.500	pCi/g						
Americium-241	U	0.00776	+/-0.0662	0.0858	0.200	pCi/g						
Antimony-125	U	0.00689	+/-0.153	0.250	0.100	pCi/g						
Cadmium-109	U	0.00	+/-0.787	1.04	1.00	pCi/g						
Cerium-144	U	0.0553	+/-0.303	0.472	0.500	pCi/g						
Cesium-134	U	0.0156	+/-0.0714	0.103	0.050	pCi/g						
Cesium-135	U	-0.242	+/-0.212	0.303	0.200	pCi/g						
Cesium-137	J	0.241	+/-0.125	0.0969	0.050	pCi/g						
Cobalt-60	J	0.245	+/-0.141	0.129	0.050	pCi/g						
Europium-152	U	0.0345	+/-0.144	0.222	0.100	pCi/g						
Europium-154	U	0.121	+/-0.220	0.390	0.500	pCi/g						
Lead-214	J	0.291	+/-0.215	0.152	0.100	pCi/g						
Manganese-54	U	0.0181	+/-0.087	0.149	0.100	pCi/g						

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #90
Sample ID: 35670014

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.0509	+/-0.059	0.101	1.00	pCi/g						
Potassium-40	J	3.08	+/-1.74	1.02	0.500	pCi/g						
Promethium-147	U	74100	+/-63600	1.030E+05	50000	pCi/g						
Ruthenium-106	U	0.0544	+/-0.734	1.19	0.500	pCi/g						
Silver-108m	U	-0.0321	+/-0.0497	0.0779	0.050	pCi/g						
Silver-110m	U	-0.00256	+/-0.0942	0.133	0.050	pCi/g						
Uranium-235	U	0.276	+/-0.450	0.416	0.500	pCi/g						
Zinc-65	U	0.0599	+/-0.219	0.378	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.63	+/-2.14	4.43	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	U	2.57	+/-2.44	5.13	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.281	+/-0.252	0.522	1.00	pCi/g		LOM1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	1.03	+/-4.21	7.28	6.00	pCi/g		SGL1	01/03/01	0201	58557	10
Liquid Scint C14, solid												
Carbon-14	U	0.863	+/-2.01	3.44	1.00	pCi/g		HOB1	01/10/01	0524	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-6.81	+/-3.21	8.40	2.00	pCi/g		AEA	02/07/01	0652	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.689	+/-2.47	6.08	2.00	pCi/g		RDD	01/09/01	0416	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	-0.91	+/-5.29	13.2	5.00	pCi/g		CAF1	01/18/01	2321	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #90
Sample ID: 35670014

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
The Qualifiers in this report are defined as follows :

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< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result is less than the MDA + 2 * Uncertainty.
U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy L. Griffin at 843-556-8171 Ext. 4264.

Stacy L Griffin
Reviewed by

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#149	Project:	ROCK2000
Sample ID:	35670015	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	23-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0393	+/-0.0787	0.118	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	0.00	+/-2.00	0.161	1.00	pCi/g						
Curium-243/244	U	-0.0208	+/-0.143	0.411	1.00	pCi/g						
Curium-245/246	J	0.182	+/-0.183	0.137	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.00	+/-2.00	0.251	1.00	pCi/g		JLE	01/05/01	0823	59216	2
Plutonium-239/240	U	0.0836	+/-0.168	0.251	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.387	+/-0.278	0.282	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	U	-0.0109	+/-0.0219	0.240	1.00	pCi/g						
Uranium-238	J	0.296	+/-0.245	0.282	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-9.68	+/-15.9	37.1	15.0	pCi/g		SWM	01/15/01	0013	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.129	+/-0.267	0.308	1.00	pCi/g		SRB	01/08/01	1021	58962	5
Gamma Ni59, solid												
Nickel-59	U	4.60	+/-5.53	6.33	15.0	pCi/g		RDD	01/08/01	1056	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.043	+/-0.321	0.480	0.500	pCi/g		SRB	01/07/01	1713	59285	7
Actinium-228	U	0.253	+/-0.212	0.293	0.500	pCi/g						
Americium-241	U	-0.00114	+/-0.0984	0.135	0.200	pCi/g						
Antimony-125	U	-0.0483	+/-0.093	0.125	0.100	pCi/g						
Cadmium-109	U	0.690	+/-0.816	0.978	1.00	pCi/g						
Cerium-144	U	0.0384	+/-0.197	0.301	0.500	pCi/g						
Cesium-134	U	0.00958	+/-0.0424	0.0598	0.050	pCi/g						
Cesium-135	U	-0.0187	+/-0.134	0.199	0.200	pCi/g						
Cesium-137	J	0.152	+/-0.0569	0.0572	0.050	pCi/g						
Cobalt-60		0.458	+/-0.114	0.0625	0.050	pCi/g						
Europium-152	U	0.0542	+/-0.0805	0.135	0.100	pCi/g						
Europium-154	U	-0.0592	+/-0.105	0.174	0.500	pCi/g						
Lead-214	J	0.311	+/-0.138	0.0939	0.100	pCi/g						
Manganese-54	U	0.0166	+/-0.0492	0.0638	0.100	pCi/g						

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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #149
Sample ID: 35670015

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.00334	+/-0.0323	0.0546	1.00	pCi/g						
Potassium-40		5.66	+/-1.12	0.684	0.500	pCi/g						
Promethium-147	U	31400	+/-47500	73900	50000	pCi/g						
Ruthenium-106	U	0.0597	+/-0.338	0.547	0.500	pCi/g						
Silver-108m	U	-0.00144	+/-0.0311	0.044	0.050	pCi/g						
Silver-110m	U	0.0395	+/-0.0345	0.0607	0.050	pCi/g						
Uranium-235	J	0.384	+/-0.449	0.291	0.500	pCi/g						
Zinc-65	U	0.0502	+/-0.113	0.172	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	J	3.52	+/-2.18	2.85	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	7.02	+/-2.58	4.60	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.0181	+/-0.232	0.536	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	2.56	+/-2.73	4.56	6.00	pCi/g		SGL1	01/03/01	0233	58557	10
Liquid Scint C14, solid												
Carbon-14	U	2.67	+/-2.42	4.02	1.00	pCi/g		HOB1	01/10/01	0556	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-1.21	+/-2.91	7.18	2.00	pCi/g		AEA	02/07/01	0723	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	1.43	+/-2.32	5.69	2.00	pCi/g		RDD	01/09/01	0448	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	-0.568	+/-3.90	9.72	5.00	pCi/g		CAF1	01/18/01	2353	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #149
Sample ID: 35670015

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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> Actual result is greater than amount reported
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	#117	Project:	ROCK2000
Sample ID:	35670016	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	12-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.103	+/-0.147	0.264	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	-0.000494	+/-0.121	0.379	1.00	pCi/g						
Curium-243/244	U	-0.0361	+/-0.156	0.428	1.00	pCi/g						
Curium-245/246	J	0.120	+/-0.139	0.120	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.00	+/-2.00	0.244	1.00	pCi/g		JLE	01/05/01	0823	59216	2
Plutonium-239/240	U	0.00	+/-2.00	0.244	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.512	+/-0.379	0.471	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	U	0.0304	+/-0.123	0.363	1.00	pCi/g						
Uranium-238	U	0.263	+/-0.265	0.362	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-3.52	+/-6.99	16.3	15.0	pCi/g		SWM	01/15/01	0044	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.0818	+/-0.375	0.379	1.00	pCi/g		SRB	01/08/01	1112	58962	5
Gamma Ni59, solid												
Nickel-59	U	3.06	+/-4.67	5.24	15.0	pCi/g		RDD	01/07/01	2339	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.325	+/-0.690	1.07	0.500	pCi/g		SRB	01/07/01	1714	59285	7
Actinium-228	U	0.534	+/-0.627	0.672	0.500	pCi/g						
Americium-241	U	0.022	+/-0.0875	0.113	0.200	pCi/g						
Antimony-125	U	-0.0802	+/-0.191	0.302	0.100	pCi/g						
Cadmium-109	U	0.031	+/-0.967	1.33	1.00	pCi/g						
Cerium-144	U	-0.226	+/-0.343	0.510	0.500	pCi/g						
Cesium-134	U	0.0279	+/-0.0952	0.137	0.050	pCi/g						
Cesium-135	U	0.017	+/-0.279	0.424	0.200	pCi/g						
Cesium-137	J	0.292	+/-0.179	0.139	0.050	pCi/g						
Cobalt-60	J	0.697	+/-0.280	0.155	0.050	pCi/g						
Europium-152	U	0.168	+/-0.198	0.313	0.100	pCi/g						
Europium-154	U	-0.117	+/-0.288	0.465	0.500	pCi/g						
Lead-214	U	0.00	+/-0.259	0.273	0.100	pCi/g						
Manganese-54	U	-0.0926	+/-0.102	0.162	0.100	pCi/g						

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #117
Sample ID: 35670016

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.0494	+/-0.0816	0.136	1.00	pCi/g						
Potassium-40	J	3.93	+/-1.95	1.28	0.500	pCi/g						
Promethium-147	U	2020	+/-78900	1.210E+05	50000	pCi/g						
Ruthenium-106	U	0.161	+/-0.875	1.42	0.500	pCi/g						
Silver-108m	U	-0.0131	+/-0.065	0.104	0.050	pCi/g						
Silver-110m	U	-0.0177	+/-0.110	0.152	0.050	pCi/g						
Uranium-235	U	0.507	+/-0.657	0.564	0.500	pCi/g						
Zinc-65	U	-0.158	+/-0.275	0.439	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.61	+/-1.58	2.58	4.00	pCi/g		JEN	01/11/01	1529	59160	8
Beta	U	4.23	+/-2.55	5.05	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.183	+/-0.267	0.578	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	5.18	+/-2.22	3.48	6.00	pCi/g		SGL1	01/03/01	0305	58557	10
Liquid Scint C14, solid												
Carbon-14	U	2.45	+/-2.35	3.91	1.00	pCi/g		HOB1	01/10/01	0629	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	1.54	+/-2.83	6.74	2.00	pCi/g		AEA	02/07/01	0754	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	0.969	+/-2.31	5.68	2.00	pCi/g		RDD	01/09/01	0520	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	2.14	+/-3.40	7.79	5.00	pCi/g		CAF1	01/19/01	0025	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #117
Sample ID: 35670016

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #100
Sample ID: 35670017
Matrix: Misc Solid
Collect Date: 02-NOV-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.227	+/-0.187	0.113	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	-0.0751	+/-0.0871	0.432	1.00	pCi/g						
Curium-243/244	U	-0.0775	+/-0.153	0.469	1.00	pCi/g						
Curium-245/246	J	0.394	+/-0.266	0.131	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.00	+/-2.01	0.381	1.00	pCi/g		JLE	01/05/01	0823	59216	2
Plutonium-239/240	U	-0.0609	+/-0.0868	0.790	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.543	+/-0.342	0.334	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	J	0.145	+/-0.168	0.145	1.00	pCi/g						
Uranium-238	J	0.325	+/-0.259	0.254	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-8.39	+/-10.8	25.5	15.0	pCi/g		SWM	01/15/01	0116	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.0489	+/-0.242	0.383	1.00	pCi/g		SRB	01/07/01	2358	58962	5
Gamma Ni59, solid												
Nickel-59	U	4.65	+/-5.10	5.89	15.0	pCi/g		RDD	01/07/01	1933	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.26	+/-0.474	0.732	0.500	pCi/g		SRB	01/07/01	1715	59285	7
Actinium-228	U	0.247	+/-0.434	0.520	0.500	pCi/g						
Americium-241	U	-0.0551	+/-0.0672	0.0814	0.200	pCi/g						
Antimony-125	U	0.0161	+/-0.137	0.224	0.100	pCi/g						
Cadmium-109	U	-0.209	+/-0.818	1.03	1.00	pCi/g						
Cerium-144	U	-0.0788	+/-0.250	0.359	0.500	pCi/g						
Cesium-134	U	0.00895	+/-0.0688	0.0981	0.050	pCi/g						
Cesium-135	U	-0.0361	+/-0.186	0.294	0.200	pCi/g						
Cesium-137	J	0.177	+/-0.101	0.0913	0.050	pCi/g						
Cobalt-60	U	-0.0465	+/-0.0725	0.116	0.050	pCi/g						
Europium-152	U	0.00841	+/-0.131	0.211	0.100	pCi/g						
Europium-154	U	0.0498	+/-0.204	0.367	0.500	pCi/g						
Lead-214	J	0.328	+/-0.164	0.165	0.100	pCi/g						
Manganese-54	U	0.000103	+/-0.0617	0.107	0.100	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #100 Project: ROCK2000
Sample ID: 35670017 Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.000501	+/-0.0621	0.100	1.00	pCi/g						
Potassium-40		4.38	+/-1.25	0.936	0.500	pCi/g						
Promethium-147	U	-5780	+/-60300	87600	50000	pCi/g						
Ruthenium-106	U	0.631	+/-0.550	0.989	0.500	pCi/g						
Silver-108m	U	-0.00315	+/-0.0512	0.0821	0.050	pCi/g						
Silver-110m	U	-0.012	+/-0.0774	0.107	0.050	pCi/g						
Uranium-235	U	0.0428	+/-0.367	0.331	0.500	pCi/g						
Zinc-65	U	-0.0157	+/-0.191	0.284	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.80	+/-1.67	2.81	4.00	pCi/g		JEN	01/11/01	1529	59160	8
Beta	J	8.13	+/-2.66	4.54	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.124	+/-0.208	0.454	1.00	pCi/g		LOM 1	01/15/01	1934	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	0.393	+/-17.4	30.4	6.00	pCi/g		SGL1	01/03/01	0337	58557	10
Liquid Scint C14, solid												
Carbon-14	U	2.33	+/-2.23	3.72	1.00	pCi/g		HOB1	01/10/01	0701	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-6.0	+/-2.92	7.63	2.00	pCi/g		AEA	02/07/01	0825	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	2.89	+/-2.35	5.78	2.00	pCi/g		RDD	01/09/01	0552	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	7.49	+/-9.44	21.3	5.00	pCi/g		CAF1	01/18/01	0044	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: #100
Sample ID: 35670017

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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> Actual result is greater than amount reported
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	119A	Project:	ROCK2000
Sample ID:	35670010	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	12-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.275	+/-0.227	0.137	1.00	pCi/g		JLE	01/04/01	2107	59215	1
Curium-242	U	0.0658	+/-0.132	0.197	1.00	pCi/g						
Curium-243/244	U	-0.07	+/-0.0812	0.403	1.00	pCi/g						
Curium-245/246	U	0.106	+/-0.151	0.160	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.0661	+/-0.191	0.416	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	0.235	+/-0.198	0.258	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.592	+/-0.223	0.242	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0396	+/-0.0699	0.126	1.00	pCi/g						
Uranium-238	J	0.461	+/-0.170	0.126	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-4.91	+/-11.0	25.6	15.0	pCi/g		SWM	01/14/01	2206	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.344	+/-0.819	0.681	1.00	pCi/g		SRB	01/05/01	1503	58962	5
Gamma Ni59, solid												
Nickel-59	U	1.78	+/-4.32	4.81	15.0	pCi/g		RDD	01/08/01	1540	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.240	+/-1.02	1.50	0.500	pCi/g		SRB	01/02/01	1737	59285	7
Actinium-228	U	0.443	+/-0.761	1.11	0.500	pCi/g						
Americium-241	U	0.0376	+/-0.239	0.317	0.200	pCi/g						
Antimony-125	U	0.117	+/-0.281	0.440	0.100	pCi/g						
Cadmium-109	U	1.46	+/-1.40	2.10	1.00	pCi/g						
Cerium-144	U	0.0401	+/-0.484	0.712	0.500	pCi/g						
Cesium-134	U	0.0334	+/-0.143	0.193	0.050	pCi/g						
Cesium-135	U	-0.0801	+/-0.386	0.558	0.200	pCi/g						
Cesium-137		4.08	+/-0.814	0.204	0.050	pCi/g						
Cobalt-60		59.9	+/-5.83	0.197	0.050	pCi/g						
Europium-152	U	0.0527	+/-0.251	0.393	0.100	pCi/g						
Europium-154	U	-0.383	+/-0.319	0.497	0.500	pCi/g						
Lead-214	J	0.387	+/-0.222	0.277	0.100	pCi/g						
Manganese-54		6.49	+/-1.25	0.284	0.100	pCi/g						

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119A
Sample ID: 35670010

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.0664	+/-0.115	0.187	1.00	pCi/g						
Potassium-40	J	5.95	+/-2.71	1.74	0.500	pCi/g						
Promethium-147	U	-47000	+/-1.120E+05	1.630E+05	50000	pCi/g						
Ruthenium-106	U	0.367	+/-1.30	2.00	0.500	pCi/g						
Silver-108m	U	-0.0284	+/-0.0943	0.145	0.050	pCi/g						
Silver-110m	U	0.0583	+/-0.169	0.229	0.050	pCi/g						
Uranium-235	U	0.180	+/-0.501	0.636	0.500	pCi/g						
Zinc-65	U	0.249	+/-0.518	0.830	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.81	+/-1.66	2.84	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta		46.8	+/-4.67	4.57	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.071	+/-0.201	0.448	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	4.17	+/-3.59	5.93	6.00	pCi/g		SGL1	01/03/01	0026	58557	10
Liquid Scint C14, solid												
Carbon-14	U	1.94	+/-2.32	3.90	1.00	pCi/g		HOB1	01/10/01	0347	58570	11
Liquid Scint Fe55, solid												
Iron-55		241	+/-7.72	7.16	2.00	pCi/g		AEA	02/06/01	2327	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	0.696	+/-2.28	5.60	2.00	pCi/g		RDD	01/09/01	0240	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	1.84	+/-4.08	9.54	5.00	pCi/g		CAF1	01/18/01	2145	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119A
Sample ID: 35670010

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
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U Indicates the compound was analyzed for but not detected above the detection limit

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Company : Consumers Energy
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Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	119B	Project:	ROCK2000
Sample ID:	35670005	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	12-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.276	+/-0.211	0.118	1.00	pCi/g		JLE	01/04/01	2105	59215	1
Curium-242	U	-0.0286	+/-0.0573	0.357	1.00	pCi/g						
Curium-243/244	U	0.0398	+/-0.0796	0.119	1.00	pCi/g						
Curium-245/246	U	0.0915	+/-0.130	0.137	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.285	+/-0.279	0.472	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.0341	+/-0.0483	0.259	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.562	+/-0.227	0.267	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	-0.0918	+/-0.187	0.368	1.00	pCi/g						
Uranium-238	J	0.588	+/-0.215	0.222	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-2.36	+/-11.5	26.4	15.0	pCi/g		SWM	01/14/01	1929	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.0399	+/-0.321	0.426	1.00	pCi/g		SRB	01/05/01	0943	58962	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-6.98	3.71	15.0	pCi/g		RDD	01/09/01	1909	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.326	+/-0.573	0.936	0.500	pCi/g		SRB	01/02/01	1507	59285	7
Actinium-228	U	0.474	+/-0.472	0.678	0.500	pCi/g						
Americium-241	U	0.021	+/-0.0792	0.102	0.200	pCi/g						
Antimony-125	U	0.143	+/-0.174	0.294	0.100	pCi/g						
Cadmium-109	U	0.492	+/-0.960	1.26	1.00	pCi/g						
Cerium-144	U	0.0983	+/-0.325	0.480	0.500	pCi/g						
Cesium-134	U	-0.0236	+/-0.0872	0.118	0.050	pCi/g						
Cesium-135	U	0.122	+/-0.229	0.374	0.200	pCi/g						
Cesium-137	J	0.376	+/-0.150	0.116	0.050	pCi/g						
Cobalt-60		2.60	+/-0.308	0.164	0.050	pCi/g						
Europium-152	U	0.0399	+/-0.151	0.245	0.100	pCi/g						
Europium-154	U	-0.0591	+/-0.244	0.411	0.500	pCi/g						
Lead-214	J	0.351	+/-0.245	0.175	0.100	pCi/g						
Manganese-54	U	0.119	+/-0.0715	0.176	0.100	pCi/g						

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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119B
Sample ID: 35670005

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0992	+/-0.0759	0.108	1.00	pCi/g						
Potassium-40	J	4.75	+/-2.03	1.22	0.500	pCi/g						
Promethium-147	U	28800	+/-77000	1.020E+05	50000	pCi/g						
Ruthenium-106	U	0.412	+/-0.746	1.25	0.500	pCi/g						
Silver-108m	U	0.0221	+/-0.062	0.101	0.050	pCi/g						
Silver-110m	U	0.0236	+/-0.0911	0.133	0.050	pCi/g						
Uranium-235	U	0.176	+/-0.272	0.410	0.500	pCi/g						
Zinc-65	U	-0.00852	+/-0.285	0.419	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	3.64	+/-2.59	4.12	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	10.6	+/-3.02	5.02	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.0622	+/-0.184	0.437	1.00	pCi/g		LOM1	01/15/01	1825	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	20.3	+/-10.1	16.1	6.00	pCi/g		SGL1	01/02/01	2147	58557	10
Liquid Scint C14, solid												
Carbon-14	U	3.83	+/-2.51	4.09	1.00	pCi/g		HOB1	01/10/01	0106	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-2.47	+/-2.82	7.07	2.00	pCi/g		AEA	02/06/01	2052	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.824	+/-2.20	5.42	2.00	pCi/g		RDD	01/08/01	2359	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	0.778	+/-4.09	9.84	5.00	pCi/g		CAF1	01/18/01	1905	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119B
Sample ID: 35670005

Proiect: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119C
Sample ID: 35670007
Matrix: Misc Solid
Collect Date: 12-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.047	+/-0.151	0.365	1.00	pCi/g		JLE	01/04/01	2107	59215	1
Curium-242	U	0.00	+/-2.00	0.205	1.00	pCi/g						
Curium-243/244	U	-0.0247	+/-0.127	0.418	1.00	pCi/g						
Curium-245/246	J	0.221	+/-0.222	0.165	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.0544	+/-0.236	0.525	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	0.0934	+/-0.164	0.328	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.435	+/-0.217	0.285	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0397	+/-0.0878	0.163	1.00	pCi/g						
Uranium-238	J	0.409	+/-0.156	0.101	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-0.905	+/-8.89	20.3	15.0	pCi/g		SWM	01/14/01	2032	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.0375	+/-0.328	0.419	1.00	pCi/g		SRB	01/05/01	1159	58962	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-8.59	6.19	15.0	pCi/g		RDD	01/09/01	1514	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.0138	+/-0.480	0.719	0.500	pCi/g		SRB	01/02/01	2137	59285	7
Actinium-228	U	0.00	+/-0.487	0.492	0.500	pCi/g						
Americium-241	U	-0.0165	+/-0.0528	0.0715	0.200	pCi/g						
Antimony-125	U	-0.0855	+/-0.134	0.209	0.100	pCi/g						
Cadmium-109	U	0.00	+/-0.721	0.807	1.00	pCi/g						
Cerium-144	U	-0.0822	+/-0.238	0.356	0.500	pCi/g						
Cesium-134	U	0.0857	+/-0.0871	0.0913	0.050	pCi/g						
Cesium-135	U	0.151	+/-0.254	0.279	0.200	pCi/g						
Cesium-137	J	0.225	+/-0.109	0.0935	0.050	pCi/g						
Cobalt-60		2.95	+/-0.215	0.103	0.050	pCi/g						
Europium-152	U	0.0694	+/-0.135	0.205	0.100	pCi/g						
Europium-154	U	-0.153	+/-0.184	0.285	0.500	pCi/g						
Lead-214	J	0.260	+/-0.170	0.141	0.100	pCi/g						
Manganese-54	U	0.0928	+/-0.0959	0.126	0.100	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119C
Sample ID: 35670007

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.00373	+/-0.0555	0.0876	1.00	pCi/g						
Potassium-40	J	2.61	+/-1.27	1.04	0.500	pCi/g						
Promethium-147	U	-23700	+/-52100	77800	50000	pCi/g						
Ruthenium-106	U	-0.202	+/-0.592	0.921	0.500	pCi/g						
Silver-108m	U	-0.0351	+/-0.0534	0.0723	0.050	pCi/g						
Silver-110m	U	-0.000928	+/-0.0747	0.103	0.050	pCi/g						
Uranium-235	U	0.00	+/-0.226	0.361	0.500	pCi/g						
Zinc-65	U	0.094	+/-0.214	0.314	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.21	+/-1.91	4.11	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	U	2.86	+/-2.50	5.22	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.0724	+/-0.192	0.428	1.00	pCi/g		LOM1	01/15/01	1825	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	7.24	+/-5.24	8.57	6.00	pCi/g		SGL1	01/02/01	2251	58557	10
Liquid Scint C14, solid												
Carbon-14	U	-0.942	+/-2.12	3.76	1.00	pCi/g		HOB1	01/10/01	0210	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	2.83	+/-2.98	7.01	2.00	pCi/g		AEA	02/06/01	2154	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	0.0855	+/-2.34	5.76	2.00	pCi/g		RDD	01/09/01	0103	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	3.65	+/-4.57	10.3	5.00	pCi/g		CAF1	01/18/01	2009	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Company : Consumers Energy
Address : 12625 US 31 North
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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119C
Sample ID: 35670007

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
The Qualifiers in this report are defined as follows :

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< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result is less than the MDA + 2 * Uncertainty.
U Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Stacy L. Griffin at 843-556-8171 Ext. 4264.

Reviewed by Stacy L. Griffin

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119D
Sample ID: 35670004
Matrix: Misc Solid
Collect Date: 12-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.115	+/-0.133	0.115	1.00	pCi/g		JLE	01/04/01	2105	59215	1
Curium-242	U	-0.0556	+/-0.0788	0.422	1.00	pCi/g						
Curium-243/244	U	-0.0589	+/-0.117	0.402	1.00	pCi/g						
Curium-245/246	U	0.0445	+/-0.0891	0.133	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0927	+/-0.246	0.621	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	0.124	+/-0.172	0.311	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.353	+/-0.193	0.258	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0524	+/-0.0981	0.175	1.00	pCi/g						
Uranium-238	J	0.339	+/-0.142	0.0999	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-1.26	+/-10.0	22.9	15.0	pCi/g		SWM	01/14/01	1857	59214	4
ad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.0313	+/-0.298	0.394	1.00	pCi/g		SRB	01/05/01	0839	58962	5
Gamma Ni59, solid												
Nickel-59	U	1.27	+/-7.34	5.66	15.0	pCi/g		RDD	01/09/01	2110	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.0535	+/-0.562	0.872	0.500	pCi/g		SRB	01/02/01	1506	59285	7
Actinium-228	U	0.238	+/-0.422	0.632	0.500	pCi/g						
Americium-241	U	0.0223	+/-0.245	0.372	0.200	pCi/g						
Antimony-125	U	-0.046	+/-0.146	0.239	0.100	pCi/g						
Cadmium-109	U	-0.0356	+/-1.07	1.62	1.00	pCi/g						
Cerium-144	U	-0.00259	+/-0.293	0.447	0.500	pCi/g						
Cesium-134	U	0.0727	+/-0.045	0.098	0.050	pCi/g						
Cesium-135	U	0.128	+/-0.217	0.349	0.200	pCi/g						
Cesium-137	J	0.189	+/-0.130	0.111	0.050	pCi/g						
Cobalt-60		3.36	+/-0.317	0.162	0.050	pCi/g						
Europium-152	U	0.00937	+/-0.166	0.257	0.100	pCi/g						
Europium-154	U	-0.00289	+/-0.211	0.382	0.500	pCi/g						
Lead-214	J	0.184	+/-0.235	0.177	0.100	pCi/g						
Manganese-54	U	0.134	+/-0.103	0.143	0.100	pCi/g						

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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119D
Sample ID: 35670004

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0374	+/-0.0652	0.103	1.00	pCi/g						
Potassium-40		7.03	+/-1.97	1.50	0.500	pCi/g						
Promethium-147	U	48400	+/-66600	1.060E+05	50000	pCi/g						
Ruthenium-106	U	0.256	+/-0.679	1.17	0.500	pCi/g						
Silver-108m	U	-0.0189	+/-0.0529	0.0857	0.050	pCi/g						
Silver-110m	U	0.00169	+/-0.0833	0.123	0.050	pCi/g						
Uranium-235	U	0.137	+/-0.474	0.405	0.500	pCi/g						
Zinc-65	U	-0.0652	+/-0.234	0.400	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		4.12	+/-1.18	1.20	4.00	pCi/g		JEN	01/11/01	2000	59160	8
Beta		8.87	+/-1.54	2.27	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.0849	+/-0.215	0.479	1.00	pCi/g		LOM1	01/15/01	1825	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	5.13	+/-5.10	8.51	6.00	pCi/g		SGL1	01/02/01	2116	58557	10
Liquid Scint C14, solid												
Carbon-14	U	0.502	+/-2.36	4.07	1.00	pCi/g		HOB1	01/10/01	0034	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-0.71	+/-2.90	7.10	2.00	pCi/g		AEA	02/06/01	2021	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	0.580	+/-2.38	5.86	2.00	pCi/g		RDD	01/08/01	2327	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	-0.801	+/-7.34	18.2	5.00	pCi/g		CAF1	01/18/01	0012	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Company : Consumers Energy
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119D
Sample ID: 35670004

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
1	DOE EML HASL 300									
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	LANL EM-9									
5	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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> Actual result is greater than amount reported
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U Indicates the compound was analyzed for but not detected above the detection limit

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Reviewed by

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119E
Sample ID: 35670006
Matrix: Misc Solid
Collect Date: 12-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.121	+/-0.140	0.121	1.00	pCi/g		JLE	01/04/01	2105	59215	1
Curium-242	U	-0.000579	+/-0.142	0.444	1.00	pCi/g						
Curium-243/244	U	0.101	+/-0.178	0.355	1.00	pCi/g						
Curium-245/246	U	0.00	+/-2.00	0.140	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0571	+/-0.372	0.891	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.132	+/-0.119	0.543	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.418	+/-0.166	0.167	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.035	+/-0.070	0.129	1.00	pCi/g						
Uranium-238	J	0.290	+/-0.132	0.128	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-5.57	+/-11.6	27.1	15.0	pCi/g		SWM	01/14/01	2000	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-1.01	+/-0.327	0.401	1.00	pCi/g		SRB	01/05/01	1107	58962	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-12.5	4.24	15.0	pCi/g		RDD	01/09/01	1616	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.598	+/-1.32	2.00	0.500	pCi/g		SRB	01/02/01	1507	59285	7
Actinium-228	U	0.933	+/-0.601	1.15	0.500	pCi/g						
Americium-241	U	0.0984	+/-0.320	0.287	0.200	pCi/g						
Antimony-125	U	-0.0873	+/-0.334	0.523	0.100	pCi/g						
Cadmium-109	U	-4.1	+/-2.11	2.72	1.00	pCi/g						
Cerium-144	U	-0.187	+/-0.689	1.03	0.500	pCi/g						
Cesium-134	U	-0.0465	+/-0.150	0.233	0.050	pCi/g						
Cesium-135	U	-0.0667	+/-0.521	0.805	0.200	pCi/g						
Cesium-137	U	0.219	+/-0.280	0.240	0.050	pCi/g						
Cobalt-60		2.13	+/-0.397	0.263	0.050	pCi/g						
Europium-152	U	-0.0434	+/-0.345	0.538	0.100	pCi/g						
Europium-154	U	-0.18	+/-0.411	0.685	0.500	pCi/g						
Lead-214	U	0.337	+/-0.363	0.493	0.100	pCi/g						
Manganese-54	U	-0.0622	+/-0.180	0.296	0.100	pCi/g						

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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119E
Sample ID: 35670006

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.00482	+/-0.140	0.227	1.00	pCi/g						
Potassium-40	J	4.88	+/-3.84	2.40	0.500	pCi/g						
Promethium-147	U	43300	+/-1.460E+05	2.230E+05	50000	pCi/g						
Ruthenium-106	U	-1.24	+/-1.55	2.32	0.500	pCi/g						
Silver-108m	U	-0.0718	+/-0.114	0.173	0.050	pCi/g						
Silver-110m	U	0.0809	+/-0.196	0.287	0.050	pCi/g						
Uranium-235	U	0.141	+/-0.618	0.944	0.500	pCi/g						
Zinc-65	U	-0.211	+/-0.452	0.740	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	3.31	+/-2.41	3.97	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta		13.4	+/-3.18	4.96	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.0302	+/-0.176	0.400	1.00	pCi/g		LOM1	01/15/01	1825	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	13.5	+/-6.30	9.94	6.00	pCi/g		SGL1	01/02/01	2219	58557	10
Liquid Scint C14, solid												
Carbon-14	U	1.29	+/-2.44	4.15	1.00	pCi/g		HOB1	01/10/01	0138	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-1.5	+/-3.19	7.87	2.00	pCi/g		AEA	02/06/01	2123	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-1.4	+/-2.11	5.19	2.00	pCi/g		RDD	01/09/01	0031	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	5.60	+/-5.84	12.9	5.00	pCi/g		CAF1	01/18/01	1937	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119E
Sample ID: 35670006

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
The Qualifiers in this report are defined as follows :

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< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result is less than the MDA + 2 * Uncertainty.
U Indicates the compound was analyzed for but not detected above the detection limit

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Stacy L Griffin
Reviewed by

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Certificate of Analysis

Company: Consumers Energy
Address: 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119F
Sample ID: 35670009
Matrix: Misc Solid
Collect Date: 12-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	J	0.125	+/-0.145	0.125	1.00	pCi/g		JLE	01/04/01	2107	59215	1
Curium-242	U	0.00	+/-2.00	0.179	1.00	pCi/g						
Curium-243/244	U	0.00	+/-2.00	0.126	1.00	pCi/g						
Curium-245/246	U	0.0967	+/-0.137	0.145	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0705	+/-0.139	0.427	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.0174	+/-0.0349	0.217	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.405	+/-0.163	0.167	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0116	+/-0.0697	0.143	1.00	pCi/g						
Uranium-238	J	0.220	+/-0.122	0.142	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-4.77	+/-11.3	26.2	15.0	pCi/g		SWM	01/14/01	2135	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.0036	+/-0.272	0.359	1.00	pCi/g		SRB	01/05/01	1412	58962	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-6.49	4.50	15.0	pCi/g		RDD	01/10/01	1506	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.289	+/-0.622	0.923	0.500	pCi/g		SRB	01/04/01	1915	59285	7
Actinium-228	U	0.249	+/-0.554	0.603	0.500	pCi/g						
Americium-241	U	-0.0327	+/-0.0734	0.0913	0.200	pCi/g						
Antimony-125	U	-0.031	+/-0.173	0.278	0.100	pCi/g						
Cadmium-109	U	0.930	+/-0.921	1.21	1.00	pCi/g						
Cerium-144	U	0.0929	+/-0.303	0.471	0.500	pCi/g						
Cesium-134	U	-0.0423	+/-0.122	0.116	0.050	pCi/g						
Cesium-135	U	0.0767	+/-0.241	0.372	0.200	pCi/g						
Cesium-137	J	0.395	+/-0.146	0.125	0.050	pCi/g						
Cobalt-60		1.49	+/-0.263	0.144	0.050	pCi/g						
Europium-152	U	0.0289	+/-0.166	0.255	0.100	pCi/g						
Europium-154	U	-0.0738	+/-0.239	0.390	0.500	pCi/g						
Lead-214	J	0.378	+/-0.211	0.191	0.100	pCi/g						
Manganese-54	U	0.0337	+/-0.0955	0.164	0.100	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119F
Sample ID: 35670009

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.00768	+/-0.0725	0.117	1.00	pCi/g						
Potassium-40	J	3.56	+/-1.57	1.31	0.500	pCi/g						
Promethium-147	U	-2700	+/-70500	1.080E+05	50000	pCi/g						
Ruthenium-106	U	0.0799	+/-0.770	1.25	0.500	pCi/g						
Silver-108m	U	0.0259	+/-0.0602	0.0997	0.050	pCi/g						
Silver-110m	U	-0.0777	+/-0.109	0.143	0.050	pCi/g						
Uranium-235	U	0.211	+/-0.452	0.433	0.500	pCi/g						
Zinc-65	U	0.237	+/-0.256	0.452	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.60	+/-1.67	2.96	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	8.65	+/-2.70	4.54	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.350	+/-0.260	0.530	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	2.93	+/-5.70	9.73	6.00	pCi/g		SGL1	01/02/01	2354	58557	10
Liquid Scint C14, solid												
Carbon-14	U	3.24	+/-2.54	4.18	1.00	pCi/g		HOB1	01/10/01	0315	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-0.153	+/-3.14	7.64	2.00	pCi/g		AEA	02/06/01	2256	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	1.80	+/-2.29	5.62	2.00	pCi/g		RDD	01/09/01	0207	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	4.11	+/-4.08	8.98	5.00	pCi/g		CAF1	01/18/01	2113	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300P

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Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119F
Sample ID: 35670009

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119G
Sample ID: 35670008
Matrix: Misc Solid
Collect Date: 12-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0506	+/-0.101	0.152	1.00	pCi/g		JLE	01/04/01	2107	59215	1
Curium-242	U	-0.0367	+/-0.0735	0.458	1.00	pCi/g						
Curium-243/244	U	0.178	+/-0.211	0.322	1.00	pCi/g						
Curium-245/246	U	0.0587	+/-0.118	0.176	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.121	+/-0.191	0.537	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.0517	+/-0.102	0.352	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	U	0.188	+/-0.171	0.269	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0778	+/-0.0919	0.149	1.00	pCi/g						
Uranium-238	J	0.399	+/-0.148	0.122	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-6.06	+/-11.5	26.8	15.0	pCi/g		SWM	01/14/01	2103	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.111	+/-0.242	0.348	1.00	pCi/g		SRB	01/05/01	1316	58962	5
Gamma Ni59, solid												
Nickel-59	U	2.31	+/-3.83	5.09	15.0	pCi/g		RDD	01/09/01	1306	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.356	+/-0.398	0.559	0.500	pCi/g		SRB	01/04/01	1826	59285	7
Actinium-228	U	0.286	+/-0.181	0.318	0.500	pCi/g						
Americium-241	U	0.033	+/-0.102	0.155	0.200	pCi/g						
Antimony-125	U	0.0611	+/-0.091	0.152	0.100	pCi/g						
Cadmium-109	U	-0.168	+/-0.690	1.03	1.00	pCi/g						
Cerium-144	U	-0.000309	+/-0.215	0.325	0.500	pCi/g						
Cesium-134	U	-0.0272	+/-0.0479	0.0625	0.050	pCi/g						
Cesium-135	U	-0.0204	+/-0.154	0.229	0.200	pCi/g						
Cesium-137	J	0.222	+/-0.0835	0.0643	0.050	pCi/g						
Cobalt-60		2.30	+/-0.280	0.0706	0.050	pCi/g						
Europium-152	U	0.0297	+/-0.0967	0.157	0.100	pCi/g						
Europium-154	U	0.017	+/-0.119	0.212	0.500	pCi/g						
Lead-214	U	0.072	+/-0.135	0.112	0.100	pCi/g						
Manganese-54	U	0.0708	+/-0.0783	0.0802	0.100	pCi/g						

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 119G
Sample ID: 35670008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.00859	+/-0.0355	0.0604	1.00	pCi/g						
Potassium-40		4.19	+/-0.969	0.686	0.500	pCi/g						
Promethium-147	U	13000	+/-50700	77300	50000	pCi/g						
Ruthenium-106	U	-0.0178	+/-0.406	0.644	0.500	pCi/g						
Silver-108m	U	0.0174	+/-0.0299	0.0499	0.050	pCi/g						
Silver-110m	U	-0.0471	+/-0.057	0.071	0.050	pCi/g						
Uranium-235	U	0.290	+/-0.296	0.328	0.500	pCi/g						
Zinc-65	U	-0.0208	+/-0.129	0.210	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	2.02	+/-1.79	2.74	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	5.30	+/-2.54	4.83	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.166	+/-0.215	0.537	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	-0.368	+/-6.95	12.2	6.00	pCi/g		SGL1	01/02/01	2322	58557	10
Liquid Scint C14, solid												
Carbon-14	U	3.63	+/-2.54	4.16	1.00	pCi/g		HOB1	01/10/01	0243	58570	11
Liquid Scint Fe55, solid												
Iron-55	J	9.63	+/-3.32	7.26	2.00	pCi/g		AEA	02/06/01	2225	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	1.64	+/-2.08	5.12	2.00	pCi/g		RDD	01/09/01	0135	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	0.631	+/-3.81	9.17	5.00	pCi/g		CAF1	01/18/01	2041	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 119G
Sample ID: 35670008

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	153A	Project:	ROCK2000
Sample ID:	35670003	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	24-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0504	+/-0.101	0.212	1.00	pCi/g		JLE	01/04/01	2105	59215	1
Curium-242	U	0.0459	+/-0.092	0.138	1.00	pCi/g						
Curium-243/244	U	-0.0343	+/-0.0486	0.260	1.00	pCi/g						
Curium-245/246	U	0.137	+/-0.162	0.247	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.146	+/-0.204	0.580	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	0.0534	+/-0.107	0.225	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.665	+/-0.205	0.171	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0476	+/-0.101	0.182	1.00	pCi/g						
Uranium-238		0.380	+/-0.143	0.0908	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-6.84	+/-8.80	20.8	15.0	pCi/g		SWM	01/14/01	1826	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.241	+/-0.724	0.692	1.00	pCi/g		SRB	01/05/01	0730	58962	5
Gamma Ni59, solid												
Nickel-59	U	1.34	+/-4.41	4.82	15.0	pCi/g		RDD	01/10/01	0855	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.950	+/-1.20	1.84	0.500	pCi/g		SRB	01/02/01	1506	59285	7
Actinium-228	U	-0.684	+/-1.02	1.58	0.500	pCi/g						
Americium-241	U	0.372	+/-0.509	0.705	0.200	pCi/g						
Antimony-125	U	0.307	+/-0.378	0.581	0.100	pCi/g						
Cadmium-109	U	0.880	+/-1.78	2.70	1.00	pCi/g						
Cerium-144	U	0.0683	+/-0.530	0.804	0.500	pCi/g						
Cesium-134	U	-0.0745	+/-0.155	0.244	0.050	pCi/g						
Cesium-135	U	-0.108	+/-0.482	0.722	0.200	pCi/g						
Cesium-137		4.54	+/-0.331	0.296	0.050	pCi/g						
Cobalt-60		88.5	+/-1.38	0.258	0.050	pCi/g						
Europium-152	U	0.0811	+/-0.332	0.503	0.100	pCi/g						
Europium-154	U	0.576	+/-0.433	0.785	0.500	pCi/g						
Lead-214	U	0.193	+/-0.381	0.369	0.100	pCi/g						
Manganese-54	J	0.762	+/-0.444	0.407	0.100	pCi/g						

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Company : Consumers Energy
Address : 12625 US 31 North
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Contact: Bob Wills
Project: Routine Analytical

Report Date: May 2, 2001

Client Sample ID: 153A
Sample ID: 35670003

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0149	+/-0.164	0.261	1.00	pCi/g						
Potassium-40		7.67	+/-2.44	1.98	0.500	pCi/g						
Promethium-147	U	0.00	+/-2.300E+05	1.830E+05	50000	pCi/g						
Ruthenium-106	U	1.97	+/-1.79	2.60	0.500	pCi/g						
Silver-108m	U	0.0177	+/-0.131	0.197	0.050	pCi/g						
Silver-110m	U	0.287	+/-0.220	0.324	0.050	pCi/g						
Uranium-235	U	0.0148	+/-0.473	0.716	0.500	pCi/g						
Zinc-65	U	0.866	+/-0.860	1.03	0.100	pCi/g						
tad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.29	+/-1.17	2.03	4.00	pCi/g		JEN	01/11/01	2000	59160	8
Beta		47.6	+/-2.54	2.48	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.222	+/-0.276	0.589	1.00	pCi/g		LOM 1	01/15/01	1825	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	4.57	+/-11.6	20.0	6.00	pCi/g		SGL1	01/02/01	2044	58557	10
Liquid Scint C14, solid												
Carbon-14	U	2.67	+/-1.99	3.28	1.00	pCi/g		HOB1	01/10/01	0002	58570	11
Liquid Scint Fe55, solid												
Iron-55		398	+/-10.2	7.97	2.00	pCi/g		AEA	02/06/01	1950	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	2.67	+/-2.65	6.51	2.00	pCi/g		RDD	01/08/01	2255	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	3.81	+/-8.45	19.7	5.00	pCi/g		CAF1	01/17/01	2340	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153A
Sample ID: 35670003

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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< Actual result is less than amount reported
> Actual result is greater than amount reported
J Indicates an estimated value. The result is less than the MDA + 2 * Uncertainty.
U Indicates the compound was analyzed for but not detected above the detection limit

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Stacy Griffin
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Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	153B	Project:	ROCK2000
Sample ID:	35670002	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	24-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0816	+/-0.116	0.122	1.00	pCi/g		JLE	01/04/01	2105	59215	1
Curium-242	U	-0.0281	+/-0.0563	0.351	1.00	pCi/g						
Curium-243/244	U	-0.104	+/-0.0935	0.427	1.00	pCi/g						
Curium-245/246	U	0.0947	+/-0.134	0.142	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0753	+/-0.426	0.974	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.0239	+/-0.165	0.472	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.328	+/-0.145	0.126	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0132	+/-0.079	0.162	1.00	pCi/g						
Uranium-238	J	0.394	+/-0.153	0.100	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-3.22	+/-10.2	23.4	15.0	pCi/g		SWM	01/14/01	1754	59214	4
tad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.159	+/-0.230	0.344	1.00	pCi/g		SRB	01/04/01	1324	58962	5
Gamma Ni59, solid												
Nickel-59	U	0.00	+/-6.12	5.01	15.0	pCi/g		RDD	01/10/01	1002	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.164	+/-0.428	0.641	0.500	pCi/g		SRB	01/02/01	1505	59285	7
Actinium-228	U	0.455	+/-0.294	0.460	0.500	pCi/g						
Americium-241	U	0.000651	+/-0.145	0.200	0.200	pCi/g						
Antimony-125	U	-0.0106	+/-0.119	0.197	0.100	pCi/g						
Cadmium-109	U	-0.305	+/-0.772	1.15	1.00	pCi/g						
Cerium-144	U	-0.0843	+/-0.251	0.376	0.500	pCi/g						
Cesium-134	U	-0.0361	+/-0.0831	0.0783	0.050	pCi/g						
Cesium-135	U	0.024	+/-0.184	0.285	0.200	pCi/g						
Cesium-137		0.263	+/-0.0839	0.0706	0.050	pCi/g						
Cobalt-60		0.348	+/-0.120	0.0944	0.050	pCi/g						
Europium-152	U	0.0188	+/-0.117	0.184	0.100	pCi/g						
Europium-154	U	0.081	+/-0.160	0.309	0.500	pCi/g						
Lead-214	J	0.246	+/-0.138	0.138	0.100	pCi/g						
Manganese-54	U	8.160E-05	+/-0.0584	0.0975	0.100	pCi/g						

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153B
Sample ID: 35670002

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0197	+/-0.0432	0.0685	1.00	pCi/g						
Potassium-40		5.22	+/-1.80	0.852	0.500	pCi/g						
Promethium-147	U	6890	+/-55500	85400	50000	pCi/g						
Ruthenium-106	U	-0.367	+/-0.454	0.694	0.500	pCi/g						
Silver-108m	U	-0.0163	+/-0.0401	0.0645	0.050	pCi/g						
Silver-110m	U	-0.032	+/-0.0556	0.0742	0.050	pCi/g						
Uranium-235	U	-0.101	+/-0.239	0.356	0.500	pCi/g						
Zinc-65	U	-0.0925	+/-0.144	0.234	0.100	pCi/g						
:ad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	J	3.01	+/-1.10	1.34	4.00	pCi/g		JEN	01/11/01	2000	59160	8
Beta		9.55	+/-1.58	2.31	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.148	+/-0.256	0.558	1.00	pCi/g		LOM 1	01/15/01	1825	59265	9
tad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	U	6.14	+/-4.91	8.09	6.00	pCi/g		SGL1	01/02/01	2012	58557	10
Liquid Scint C14, solid												
Carbon-14	U	1.00	+/-2.15	3.66	1.00	pCi/g		HOB1	01/09/01	2329	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	3.23	+/-3.12	7.31	2.00	pCi/g		AEA	02/06/01	1919	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.223	+/-2.43	5.97	2.00	pCi/g		RDD	01/08/01	2223	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	4.33	+/-5.11	11.5	5.00	pCi/g		CAF1	01/18/01	1833	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153B
Sample ID: 35670002

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
	DOE EML HASL 300									
	DOE EML HASL 300									
	DOE EML HASL 300									
	LANL EM-9									
	DOE RESL Ni-1									
	DOE EML HASL 300									
	EPA 900.0									
	EPA 905.0									
)	EPA 906.0									
1	EPA EERF C-01									
2	DOE RESL Ni-1									
3	DOE RESL Ni-1									
4	DOE EML HASL 300									

Notes:
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Company : Consumers Energy
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	153C	Project:	ROCK2000
Sample ID:	35670018	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	24-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.587	+/-0.549	0.958	1.00	pCi/g		JLE	01/04/01	2112	59215	1
Curium-242	U	0.0301	+/-0.312	0.761	1.00	pCi/g						
Curium-243/244	U	0.0175	+/-0.437	0.964	1.00	pCi/g						
Curium-245/246	U	0.192	+/-0.266	0.481	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.0537	+/-0.0764	0.696	1.00	pCi/g		JLE	01/05/01	0826	59216	2
Plutonium-239/240	U	0.00	+/-2.01	0.335	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.265	+/-0.229	0.243	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	U	0.0351	+/-0.0951	0.244	1.00	pCi/g						
Uranium-238	J	0.300	+/-0.248	0.286	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	2.89	+/-15.6	35.1	15.0	pCi/g		SWM	01/15/01	0147	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.134	+/-0.303	0.420	1.00	pCi/g		SRB	01/08/01	1216	58962	5
Gamma Ni59, solid												
Nickel-59	U	-0.32	+/-5.13	5.24	15.0	pCi/g		RDD	01/07/01	1711	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	-0.293	+/-1.19	1.82	0.500	pCi/g		SRB	01/07/01	1715	59285	7
Actinium-228	U	0.397	+/-0.819	0.954	0.500	pCi/g						
Americium-241	U	-0.417	+/-0.214	0.273	0.200	pCi/g						
Antimony-125	U	-0.129	+/-0.313	0.484	0.100	pCi/g						
Cadmium-109	U	2.42	+/-1.42	2.46	1.00	pCi/g						
Cerium-144	U	-0.257	+/-0.569	0.848	0.500	pCi/g						
Cesium-134	U	0.0291	+/-0.164	0.230	0.050	pCi/g						
Cesium-135	U	0.0246	+/-0.460	0.719	0.200	pCi/g						
Cesium-137	U	0.176	+/-0.185	0.185	0.050	pCi/g						
Cobalt-60	J	0.292	+/-0.191	0.187	0.050	pCi/g						
Europium-152	U	-0.197	+/-0.324	0.491	0.100	pCi/g						
Europium-154	U	0.00151	+/-0.280	0.516	0.500	pCi/g						
Lead-214	U	0.00	+/-0.418	0.426	0.100	pCi/g						
Manganese-54	U	0.0333	+/-0.145	0.254	0.100	pCi/g						

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Company : Consumers Energy
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153C
Sample ID: 35670018

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	0.0999	+/-0.124	0.215	1.00	pCi/g						
Potassium-40	J	6.93	+/-2.94	2.15	0.500	pCi/g						
Promethium-147	U	-3640	+/-1.350E+05	2.040E+05	50000	pCi/g						
Ruthenium-106	U	-0.27	+/-1.17	1.86	0.500	pCi/g						
Silver-108m	U	0.0437	+/-0.110	0.181	0.050	pCi/g						
Silver-110m	U	0.0439	+/-0.149	0.219	0.050	pCi/g						
Uranium-235	U	0.467	+/-0.646	0.872	0.500	pCi/g						
Zinc-65	U	0.0885	+/-0.372	0.583	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	1.78	+/-1.81	3.25	4.00	pCi/g		JEN	01/11/01	1529	59160	8
Beta	J	9.00	+/-2.89	4.98	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.0796	+/-0.206	0.498	1.00	pCi/g		LOM 1	01/15/01	1934	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	11.2	+/-5.40	8.55	6.00	pCi/g		SGL1	01/03/01	0408	58557	10
Liquid Scint C14, solid												
Carbon-14	U	1.60	+/-2.35	3.98	1.00	pCi/g		HOB1	01/10/01	0733	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	-4.03	+/-2.86	7.29	2.00	pCi/g		AEA	02/07/01	0856	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.331	+/-2.24	5.52	2.00	pCi/g		RDD	01/09/01	0624	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	0.409	+/-3.77	9.15	5.00	pCi/g		CAF1	01/19/01	0057	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153C
Sample ID: 35670018

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
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> Actual result is greater than amount reported
J Indicates an estimated value. The result is less than the MDA + 2 * Uncertainty.
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Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID:	153D	Project:	ROCK2000
Sample ID:	35670012	Client ID:	ROCK001
Matrix:	Misc Solid		
Collect Date:	24-OCT-00		
Receive Date:	21-DEC-00		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.110	+/-0.159	0.278	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	0.0297	+/-0.135	0.379	1.00	pCi/g						
Curium-243/244	U	-0.0228	+/-0.118	0.387	1.00	pCi/g						
Curium-245/246	U	0.0511	+/-0.102	0.153	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	0.00	+/-2.01	0.302	1.00	pCi/g		JLE	01/05/01	0823	59216	2
Plutonium-239/240	U	0.101	+/-0.202	0.302	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.426	+/-0.306	0.311	1.00	pCi/g		JLE	01/11/01	1430	59221	3
Uranium-235/236	U	0.00	+/-2.00	0.150	1.00	pCi/g						
Uranium-238	J	0.250	+/-0.226	0.150	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	11.0	+/-9.34	20.0	15.0	pCi/g		SWM	01/14/01	2309	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	0.117	+/-0.301	0.427	1.00	pCi/g		SRB	01/05/01	1648	58962	5
Gamma Ni59, solid												
Nickel-59	U	2.14	+/-3.20	4.95	15.0	pCi/g		RDD	01/08/01	1317	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.329	+/-0.478	0.758	0.500	pCi/g		SRB	01/05/01	0444	59285	7
Actinium-228	U	0.297	+/-0.230	0.418	0.500	pCi/g						
Americium-241	U	-0.0137	+/-0.0585	0.0751	0.200	pCi/g						
Antimony-125	U	0.0329	+/-0.121	0.201	0.100	pCi/g						
Cadmium-109	U	0.612	+/-0.611	0.920	1.00	pCi/g						
Cerium-144	U	-0.15	+/-0.226	0.342	0.500	pCi/g						
Cesium-134	U	-0.0811	+/-0.0583	0.0863	0.050	pCi/g						
Cesium-135	U	-0.0956	+/-0.191	0.285	0.200	pCi/g						
Cesium-137	J	0.218	+/-0.105	0.0942	0.050	pCi/g						
Cobalt-60	J	0.169	+/-0.0762	0.119	0.050	pCi/g						
Europium-152	U	0.0123	+/-0.126	0.194	0.100	pCi/g						
Europium-154	U	0.0216	+/-0.169	0.291	0.500	pCi/g						
Lead-214	J	0.309	+/-0.160	0.135	0.100	pCi/g						
Manganese-54	U	-0.00375	+/-0.0625	0.106	0.100	pCi/g						

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Company : Consumers Energy
Address : 12625 US 31 North
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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153D
Sample ID: 35670012

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0241	+/-0.0499	0.0777	1.00	pCi/g						
Potassium-40		5.63	+/-1.77	1.05	0.500	pCi/g						
Promethium-147	U	34200	+/-50900	81200	50000	pCi/g						
Ruthenium-106	U	-0.504	+/-0.565	0.861	0.500	pCi/g						
Silver-108m	U	-0.00734	+/-0.0418	0.0678	0.050	pCi/g						
Silver-110m	U	0.0131	+/-0.0712	0.102	0.050	pCi/g						
Uranium-235	U	0.170	+/-0.423	0.364	0.500	pCi/g						
Zinc-65	U	0.0269	+/-0.160	0.240	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	J	4.71	+/-2.78	3.67	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	6.83	+/-2.71	4.92	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	-0.0728	+/-0.199	0.480	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	9.48	+/-5.68	9.17	6.00	pCi/g		SGL1	01/03/01	0129	58557	10
Liquid Scint C14, solid												
Carbon-14	U	2.43	+/-2.29	3.81	1.00	pCi/g		HOB1	01/10/01	0452	58570	11
Liquid Scint Fe55, solid												
Iron-55	J	8.21	+/-3.41	7.59	2.00	pCi/g		AEA	02/07/01	0622	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	-0.927	+/-2.30	5.67	2.00	pCi/g		RDD	01/09/01	0344	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	1.50	+/-4.30	10.2	5.00	pCi/g		CAF1	01/18/01	2249	58564	14

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	01/02/01	1001	59055
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	COB1	12/29/00	1614	58390

The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300

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GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company : Consumers Energy
Address : 12625 US 31 North
Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153D
Sample ID: 35670012

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

Notes:
The Qualifiers in this report are defined as follows :

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< Actual result is less than amount reported
> Actual result is greater than amount reported
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U Indicates the compound was analyzed for but not detected above the detection limit

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Reviewed by

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Charlevoix, MI 49720

Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153E
Sample ID: 35670011
Matrix: Misc Solid
Collect Date: 24-OCT-00
Receive Date: 21-DEC-00
Collector: Client

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	0.0409	+/-0.0819	0.123	1.00	pCi/g		JLE	01/04/01	2109	59215	1
Curium-242	U	0.00	+/-2.00	0.167	1.00	pCi/g						
Curium-243/244	U	-0.042	+/-0.117	0.395	1.00	pCi/g						
Curium-245/246	J	0.285	+/-0.234	0.142	1.00	pCi/g						
Alphaspec Pu, solid												
Plutonium-238	U	-0.22	+/-0.360	1.12	1.00	pCi/g		JLE	01/04/01	2050	59216	2
Plutonium-239/240	U	-0.0873	+/-0.124	0.663	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234	J	0.314	+/-0.159	0.195	1.00	pCi/g		JLE	01/11/01	1426	59221	3
Uranium-235/236	U	0.0485	+/-0.0688	0.116	1.00	pCi/g						
Uranium-238	J	0.302	+/-0.133	0.116	1.00	pCi/g						
Liquid Scint Pu241, solid												
Plutonium-241	U	-0.447	+/-9.54	21.7	15.0	pCi/g		SWM	01/14/01	2238	59214	4
Rad Gamma Spec												
Gamma I129, solid												
Iodine-129	U	-0.08	+/-0.276	0.350	1.00	pCi/g		SRB	01/05/01	1600	58962	5
Gamma Ni59, solid												
Nickel-59	U	4.60	+/-5.29	6.13	15.0	pCi/g		RDD	01/08/01	1436	59351	6
Gammaspec, Gamma, solid												
Actinium-227	U	0.265	+/-0.556	0.506	0.500	pCi/g		SRB	01/05/01	0443	59285	7
Actinium-228	U	0.160	+/-0.211	0.279	0.500	pCi/g						
Americium-241	U	-0.0626	+/-0.0835	0.122	0.200	pCi/g						
Antimony-125	U	0.0191	+/-0.0787	0.129	0.100	pCi/g						
Cadmium-109	U	0.594	+/-0.704	0.849	1.00	pCi/g						
Cerium-144	U	0.0793	+/-0.188	0.290	0.500	pCi/g						
Cesium-134	U	-0.058	+/-0.0396	0.0551	0.050	pCi/g						
Cesium-135	U	-0.0247	+/-0.127	0.189	0.200	pCi/g						
Cesium-137		0.301	+/-0.0962	0.053	0.050	pCi/g						
Cobalt-60		0.236	+/-0.0726	0.0707	0.050	pCi/g						
Europium-152	U	0.0888	+/-0.0803	0.130	0.100	pCi/g						
Europium-154	U	-0.0298	+/-0.123	0.181	0.500	pCi/g						
Lead-214		0.498	+/-0.127	0.0856	0.100	pCi/g						
Manganese-54	U	0.0165	+/-0.0382	0.0667	0.100	pCi/g						

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153E
Sample ID: 35670011

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Niobium-94	U	-0.0168	+/-0.0294	0.0473	1.00	pCi/g						
Potassium-40		4.28	+/-1.06	0.581	0.500	pCi/g						
Promethium-147	U	65000	+/-56300	67200	50000	pCi/g						
Ruthenium-106	U	0.169	+/-0.316	0.525	0.500	pCi/g						
Silver-108m	U	-0.0153	+/-0.0271	0.0421	0.050	pCi/g						
Silver-110m	U	-0.0106	+/-0.0399	0.054	0.050	pCi/g						
Uranium-235	U	0.0625	+/-0.290	0.284	0.500	pCi/g						
Zinc-65	U	0.0433	+/-0.0973	0.150	0.100	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha	U	2.01	+/-2.04	3.86	4.00	pCi/g		JEN	01/11/01	1354	59160	8
Beta	J	6.73	+/-2.65	4.83	10.0	pCi/g						
GFPC, Sr90, solid												
Strontium-90	U	0.217	+/-0.211	0.438	1.00	pCi/g		LOM 1	01/15/01	1832	59265	9
Rad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium	J	9.65	+/-4.20	6.58	6.00	pCi/g		SGL1	01/03/01	0058	58557	10
Liquid Scint C14, solid												
Carbon-14	U	0.0461	+/-2.36	4.11	1.00	pCi/g		HOB1	01/10/01	0419	58570	11
Liquid Scint Fe55, solid												
Iron-55	U	2.23	+/-3.26	7.72	2.00	pCi/g		AEA	02/06/01	2358	59349	12
Liquid Scint Ni63, solid												
Nickel-63	U	0.774	+/-2.53	6.23	2.00	pCi/g		RDD	01/09/01	0312	59350	13
Liquid Scint Tc99, solid												
Technetium-99	U	4.11	+/-5.16	11.6	5.00	pCi/g		CAF1	01/18/01	2217	58564	14

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Method	Description	Analyst	Date	Time	Prep Batch
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The following Analytical Methods were performed

Method	Description
1	DOE EML HASL 300P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407

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Report Date: May 2, 2001

Contact: Bob Wills
Project: Routine Analytical

Client Sample ID: 153E
Sample ID: 35670011

Project: ROCK2000
Client ID: ROCK001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
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3	DOE EML HASL 300									
4	DOE EML HASL 300									
5	LANL EM-9									
6	DOE RESL Ni-1									
7	DOE EML HASL 300									
8	EPA 900.0									
9	EPA 905.0									
10	EPA 906.0									
11	EPA EERF C-01									
12	DOE RESL Ni-1									
13	DOE RESL Ni-1									
14	DOE EML HASL 300									

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NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES
UNDER 10 CFR 20.2002 PROVISIONS

ENCLOSURE 3

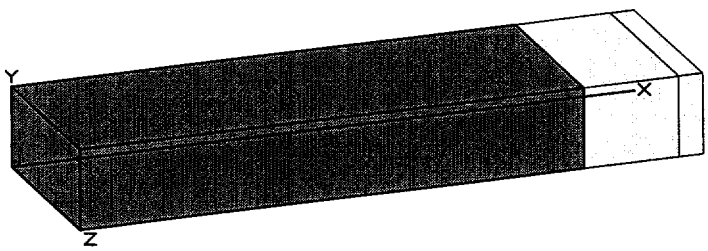
MicroShield Assessment of Transportation Worker Dose

MicroShield v5.03 (5.03-00060)
Consumers Energy

Page : 1
DOS File : ROLLOFF.MS5
Run Date: April 24, 2001
Run Time: 4:28:50 PM
Duration : 00:00:09

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

Case Title: Truck Driver Dose
Description: Roll-Off Container Transport System - Table 4 Source Term
Geometry: 13 - Rectangular Volume



Source Dimensions

Length	655.32 cm	21 ft 6.0 in
Width	243.84 cm	8 ft
Height	106.68 cm	3 ft 6.0 in

Dose Points

	X	Y	Z
# 1	808.6725 cm	53.34 cm	121.92 cm
	26 ft 6.4 in	1 ft 9.0 in	4 ft

Shields

Shield Name	Dimension	Material	Density
Source	602.0 ft³	Concrete	2.4
Shield 1	.021 ft	Iron	7.86
Shield 2	4.0 ft	Air	0.00122
Shield 3	.01 ft	Iron	7.86
Shield 4	1.0 ft	Air	0.00122
Air Gap		Air	0.00122

Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Ba-137m	4.2960e-005	1.5895e+006	2.5201e-006	9.3245e-002
Co-60	1.5915e-004	5.8885e+006	9.3360e-006	3.4543e-001
Cs-137	4.5413e-005	1.6803e+006	2.6640e-006	9.8568e-002
Fe-55	8.8779e-004	3.2848e+007	5.2080e-005	1.9270e+000
H-3	2.1769e-003	8.0544e+007	1.2770e-004	4.7249e+000

Buildup
The material reference is : Source

Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0318	3.291e+04	2.653e-36	1.175e-29	2.210e-38	9.791e-32
0.0322	6.072e+04	4.905e-35	2.254e-29	3.948e-37	1.814e-31
0.0364	2.209e+04	7.916e-27	2.499e-26	4.498e-29	1.420e-28
0.6616	1.430e+06	7.727e-03	3.320e-02	1.498e-05	6.435e-05
0.6938	9.605e+02	5.720e-06	2.368e-05	1.104e-08	4.573e-08
1.1732	5.888e+06	9.926e-02	2.850e-01	1.774e-04	5.093e-04
1.3325	5.888e+06	1.263e-01	3.364e-01	2.192e-04	5.836e-04
TOTALS:	1.332e+07	2.333e-01	6.546e-01	4.115e-04	1.157e-03

NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES
UNDER 10 CFR 20.2002 PROVISIONS

ENCLOSURE 4

RESRAD Assessment of Landfill Worker Dose

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Soil Concentration Per Nuclide 18

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Co-60	2.190E-04	2.190E-04	DCF2(1)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(2)
B-1	Fe-55	2.690E-06	2.690E-06	DCF2(3)
B-1	H-3	6.400E-08	6.400E-08	DCF2(4)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Co-60	2.690E-05	2.690E-05	DCF3(1)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(2)
D-1	Fe-55	6.070E-07	6.070E-07	DCF3(3)
D-1	H-3	6.400E-08	6.400E-08	DCF3(4)
D-34	Food transfer factors:			
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(1,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(1,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(2,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(2,3)
D-34				
D-34	Fe-55 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Fe-55 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
D-34	Fe-55 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(4,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(4,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(4,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(2,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Fe-55 , fish	2.000E+02	2.000E+02	BIOFAC(3,1)
D-5	Fe-55 , crustacea and mollusks	3.200E+03	3.200E+03	BIOFAC(3,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(4,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(4,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	3.965E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+00	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)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Co-60	3.890E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.110E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Fe-55	2.170E+01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): H-3	5.320E+01	0.000E+00	---	S1(4)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Fe-55	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(4)
R013	Cover depth (m)	1.500E-01	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
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)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	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 Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Fe-55				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	0.000E+00	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	0.000E+00	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.790E-01	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.800E-02	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
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
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	
Area:	3965.00 square meters
Thickness:	2.00 meters
Cover Depth:	0.15 meters

Initial Soil Concentrations, pCi/g	
Co-60	3.890E+00
Cs-137	1.110E+00
Fe-55	2.170E+01
H-3	5.320E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.756E-01	2.456E-01	1.954E-01	9.009E-02	1.604E-02	4.687E-03	8.897E-05	7.492E-12
M(t):	2.756E-01	2.456E-01	1.954E-01	9.009E-02	1.604E-02	4.687E-03	8.897E-05	7.492E-12

Maximum TDOSE(t): 2.756E-01 mrem/yr at t = 0.000E+00 years

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	2.639E-01	0.9574	9.421E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.155E-02	0.0419	4.207E-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
Fe-55	0.000E+00	0.0000	5.946E-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
H-3	0.000E+00	0.0000	2.023E-04	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
Total	2.754E-01	0.9993	2.023E-04	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

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.639E-01	0.9574
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.155E-02	0.0419
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.946E-10	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.023E-04	0.0007
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.756E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	2.341E-01	0.9532	2.515E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.144E-02	0.0466	1.236E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	1.421E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	5.953E-05	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
Total	2.455E-01	0.9998	5.956E-05	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

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.341E-01	0.9532
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.144E-02	0.0466
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.421E-09	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.953E-05	0.0002
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.456E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.841E-01	0.9424	4.528E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.124E-02	0.0575	2.756E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	2.000E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	5.073E-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
Total	1.954E-01	1.0000	5.123E-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

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.841E-01	0.9424
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.124E-02	0.0575
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.000E-09	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.073E-06	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.954E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	7.954E-02	0.8829	5.416E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	1.055E-02	0.1171	7.027E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	9.975E-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
H-3	0.000E+00	0.0000	7.772E-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
Total	9.009E-02	1.0000	6.296E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.954E-02	0.8829
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.055E-02	0.1171
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.975E-10	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.772E-10	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.009E-02	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	7.227E-03	0.4506	1.131E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.810E-03	0.5494	1.282E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	1.703E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	2.383E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.604E-02	1.0000	2.414E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.227E-03	0.4506
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.810E-03	0.5494
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.703E-11	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.383E-21	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.604E-02	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.634E-06	0.0003	3.703E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	4.685E-03	0.9996	8.283E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	8.706E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.687E-03	1.0000	8.287E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.634E-06	0.0003
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.685E-03	0.9997
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.706E-19	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.687E-03	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.066E-17	0.0000	2.023E-23	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	8.897E-05	1.0000	1.177E-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
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.897E-05	1.0000	1.177E-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

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.066E-17	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.897E-05	1.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.897E-05	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	7.492E-12	1.0000	9.911E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.492E-12	1.0000	9.911E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.492E-12	1.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.492E-12	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	6.783E-02	6.017E-02	4.734E-02	2.045E-02	1.858E-03	4.200E-07	2.739E-18	0.000E+00
Cs-137	Cs-137	1.000E+00	1.040E-02	1.031E-02	1.013E-02	9.506E-03	7.937E-03	4.221E-03	8.016E-05	6.749E-12
Fe-55	Fe-55	1.000E+00	2.740E-11	6.548E-11	9.215E-11	4.597E-11	7.850E-13	4.012E-20	2.913E-42	0.000E+00
H-3	H-3	1.000E+00	3.803E-06	1.119E-06	9.536E-08	1.461E-11	4.480E-23	0.000E+00	0.000E+00	0.000E+00

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	1.474E+01	1.662E+01	2.113E+01	4.891E+01	5.383E+02	2.381E+06	*1.131E+15	*1.131E+15
Cs-137	9.612E+01	9.699E+01	9.875E+01	1.052E+02	1.260E+02	2.369E+02	1.248E+04	1.482E+11
Fe-55	3.649E+10	1.527E+10	1.085E+10	2.175E+10	1.274E+12	*2.409E+15	*2.409E+15	*2.409E+15
H-3	2.630E+05	8.937E+05	1.049E+07	6.845E+10	*9.594E+15	*9.594E+15	*9.594E+15	*9.594E+15

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Co-60	3.890E+00	0.000E+00	6.783E-02	1.474E+01	6.783E-02	1.474E+01
Cs-137	1.110E+00	0.000E+00	1.040E-02	9.612E+01	1.040E-02	9.612E+01
Fe-55	2.170E+01	3.412 ± 0.007	9.272E-11	1.079E+10	2.740E-11	3.649E+10
H-3	5.320E+01	0.000E+00	3.803E-06	2.630E+05	3.803E-06	2.630E+05

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	2.639E-01	2.341E-01	1.841E-01	7.954E-02	7.227E-03	1.634E-06	1.066E-17	0.000E+00
Cs-137	Cs-137	1.000E+00	1.155E-02	1.144E-02	1.124E-02	1.055E-02	8.810E-03	4.685E-03	8.897E-05	7.492E-12
Fe-55	Fe-55	1.000E+00	5.946E-10	1.421E-09	2.000E-09	9.975E-10	1.703E-11	8.706E-19	0.000E+00	0.000E+00
H-3	H-3	1.000E+00	2.023E-04	5.953E-05	5.073E-06	7.772E-10	2.383E-21	0.000E+00	0.000E+00	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	3.890E+00	3.410E+00	2.621E+00	1.043E+00	7.490E-02	7.441E-06	2.723E-17	0.000E+00
Cs-137	Cs-137	1.000E+00	1.110E+00	1.084E+00	1.035E+00	8.795E-01	5.522E-01	1.083E-01	1.031E-03	8.682E-11
Fe-55	Fe-55	1.000E+00	2.170E+01	1.678E+01	1.004E+01	1.663E+00	9.761E-03	1.513E-10	7.362E-33	0.000E+00
H-3	H-3	1.000E+00	5.320E+01	1.558E+01	1.316E+00	1.956E-04	5.557E-16	0.000E+00	0.000E+00	0.000E+00

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

RESMAIN5.EXE execution time = 5.50 seconds

NUCLEAR REGULATORY COMMISSION
BIG ROCK POINT PLANT
REQUEST FOR APPROVAL OF PROPOSED DISPOSAL PROCEDURES
UNDER 10 CFR 20.2002 PROVISIONS

ENCLOSURE 5

RESRAD Assessment of Public Resident / Farmer Dose

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Co-60	2.190E-04	2.190E-04	DCF2(1)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(2)
B-1	Fe-55	2.690E-06	2.690E-06	DCF2(3)
B-1	H-3	6.400E-08	6.400E-08	DCF2(4)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Co-60	2.690E-05	2.690E-05	DCF3(1)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(2)
D-1	Fe-55	6.070E-07	6.070E-07	DCF3(3)
D-1	H-3	6.400E-08	6.400E-08	DCF3(4)
D-34	Food transfer factors:			
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(1,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(1,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(2,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(2,3)
D-34				
D-34	Fe-55 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Fe-55 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(3,2)
D-34	Fe-55 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(4,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(4,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(4,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(2,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Fe-55 , fish	2.000E+02	2.000E+02	BIOFAC(3,1)
D-5	Fe-55 , crustacea and mollusks	3.200E+03	3.200E+03	BIOFAC(3,2)
D-5				
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(4,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(4,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	3.965E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+00	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)	3.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	5.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Co-60	3.890E+00	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Cs-137	1.110E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Fe-55	2.170E+01	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): H-3	5.320E+01	0.000E+00	---	S1(4)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Fe-55	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(4)
R013	Cover depth (m)	1.220E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	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	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Water table drop rate (m/yr)	1.000E-03	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)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Fe-55				
R016	Contaminated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+03	1.000E+03	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.666E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.790E-01	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.198E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.198E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	1.400E+00	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	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	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	2.500E-01	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	2.500E-01	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	9.800E-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):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
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
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Contaminated Zone Dimensions	
Area:	3965.00 square meters
Thickness:	2.00 meters
Cover Depth:	1.22 meters

Initial Soil Concentrations, pCi/g	
Co-60	3.890E+00
Cs-137	1.110E+00
Fe-55	2.170E+01
H-3	5.320E+01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1 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	3.000E+01	5.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.515E-01	6.152E-01	2.088E+00	2.218E-02	1.378E-02	5.169E-03	8.430E-05	2.458E-11
M(t):	2.515E-01	6.152E-01	2.088E+00	2.218E-02	1.378E-02	5.169E-03	8.430E-05	2.458E-11

Maximum TDOSE(t): 2.195E+00 mrem/yr at t = 4.183 ± 0.008 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.183E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.193E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.188E-02	0.0236	1.012E-02	0.0046	1.196E-03	0.0005	0.000E+00	0.0000
Cs-137	5.691E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.284E-02	0.0104	6.685E-03	0.0030	2.106E-03	0.0010	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.550E-05	0.0000	8.877E-06	0.0000	1.573E-07	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.090E-03	0.0014	1.934E-04	0.0001	1.648E-04	0.0001	0.000E+00	0.0000
Total	1.199E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.786E-02	0.0355	1.701E-02	0.0077	3.467E-03	0.0016	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.183E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.321E-02	0.0288
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.163E-02	0.0144
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.454E-05	0.0000
H-3	1.857E+00	0.8458	4.542E-05	0.0000	0.000E+00	0.0000	1.728E-01	0.0787	1.752E-02	0.0080	4.982E-02	0.0227	2.100E+00	0.9568
Total	1.857E+00	0.8458	4.542E-05	0.0000	0.000E+00	0.0000	1.728E-01	0.0787	1.752E-02	0.0080	4.982E-02	0.0227	2.195E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.970E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	8.796E-02	0.3497	1.716E-02	0.0682	2.028E-03	0.0081	0.000E+00	0.0000
Cs-137	5.910E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.461E-02	0.0979	7.203E-03	0.0286	2.269E-03	0.0090	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.303E-04	0.0005	2.542E-05	0.0001	4.504E-07	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.884E-02	0.3930	6.057E-03	0.0241	5.199E-03	0.0207	0.000E+00	0.0000
Total	1.976E-05	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	2.115E-01	0.8411	3.045E-02	0.1211	9.496E-03	0.0378	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.072E-01	0.4261
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.408E-02	0.1355
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.561E-04	0.0006
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.101E-01	0.4377
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.515E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.748E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.753E-02	0.1260	1.513E-02	0.0246	1.787E-03	0.0029	0.000E+00	0.0000
Cs-137	5.857E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.418E-02	0.0393	7.075E-03	0.0115	2.229E-03	0.0036	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.013E-04	0.0002	1.976E-05	0.0000	3.503E-07	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.335E-02	0.0705	2.713E-03	0.0044	2.311E-03	0.0038	0.000E+00	0.0000
Total	1.754E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.452E-01	0.2360	2.493E-02	0.0405	6.328E-03	0.0103	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.446E-02	0.1536
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.348E-02	0.0544
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.214E-04	0.0002
H-3	3.922E-01	0.6375	9.203E-06	0.0000	0.000E+00	0.0000	3.340E-02	0.0543	2.943E-03	0.0048	1.020E-02	0.0166	4.871E-01	0.7918
Total	3.922E-01	0.6375	9.203E-06	0.0000	0.000E+00	0.0000	3.340E-02	0.0543	2.943E-03	0.0048	1.020E-02	0.0166	6.152E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.375E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.024E-02	0.0289	1.175E-02	0.0056	1.389E-03	0.0007	0.000E+00	0.0000
Cs-137	5.752E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.333E-02	0.0112	6.828E-03	0.0033	2.151E-03	0.0010	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.127E-05	0.0000	1.195E-05	0.0000	2.118E-07	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.249E-03	0.0040	5.161E-04	0.0002	4.397E-04	0.0002	0.000E+00	0.0000
Total	1.381E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.188E-02	0.0440	1.911E-02	0.0092	3.980E-03	0.0019	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.339E-02	0.0352
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.231E-02	0.0155
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.344E-05	0.0000
H-3	1.747E+00	0.8370	4.267E-05	0.0000	0.000E+00	0.0000	1.620E-01	0.0776	1.632E-02	0.0078	4.682E-02	0.0224	1.982E+00	0.9493
Total	1.747E+00	0.8370	4.267E-05	0.0000	0.000E+00	0.0000	1.620E-01	0.0776	1.632E-02	0.0078	4.682E-02	0.0224	2.088E+00	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	5.396E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.975E-03	0.0890	3.854E-04	0.0174	4.553E-05	0.0021	0.000E+00	0.0000
Cs-137	4.509E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.428E-02	0.6437	4.179E-03	0.1884	1.317E-03	0.0594	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.833E-08	0.0000	1.333E-08	0.0000	2.363E-10	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.525E-12	0.0000	9.543E-14	0.0000	8.130E-14	0.0000	0.000E+00	0.0000
Total	5.847E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.625E-02	0.7328	4.564E-03	0.2058	1.362E-03	0.0614	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.406E-03	0.1085
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.977E-02	0.8915
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.190E-08	0.0000
H-3	1.373E-09	0.0000	3.406E-14	0.0000	0.000E+00	0.0000	1.316E-10	0.0000	1.396E-11	0.0000	3.726E-11	0.0000	1.558E-09	0.0000
Total	1.373E-09	0.0000	3.406E-14	0.0000	0.000E+00	0.0000	1.316E-10	0.0000	1.396E-11	0.0000	3.726E-11	0.0000	2.218E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	4.903E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.554E-04	0.0113	3.032E-05	0.0022	3.581E-06	0.0003	0.000E+00	0.0000
Cs-137	3.765E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.817E-03	0.7122	2.873E-03	0.2084	9.052E-04	0.0657	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.393E-10	0.0000	8.572E-11	0.0000	1.519E-12	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.307E-20	0.0000	5.824E-21	0.0000	4.962E-21	0.0000	0.000E+00	0.0000
Total	8.667E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.972E-03	0.7234	2.904E-03	0.2106	9.088E-04	0.0659	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.893E-04	0.0137
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.360E-02	0.9863
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.266E-10	0.0000
H-3	7.685E-17	0.0000	1.906E-21	0.0000	0.000E+00	0.0000	7.364E-18	0.0000	7.811E-19	0.0000	2.085E-18	0.0000	8.718E-17	0.0000
Total	7.685E-17	0.0000	1.906E-21	0.0000	0.000E+00	0.0000	7.364E-18	0.0000	7.811E-19	0.0000	2.085E-18	0.0000	1.378E-02	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	1.220E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.615E-07	0.0001	5.103E-08	0.0000	6.029E-09	0.0000	0.000E+00	0.0000
Cs-137	2.398E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.732E-03	0.7220	1.092E-03	0.2113	3.441E-04	0.0666	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.412E-15	0.0000	2.755E-16	0.0000	4.882E-18	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.410E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.732E-03	0.7221	1.092E-03	0.2114	3.441E-04	0.0666	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.187E-07	0.0001
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.168E-03	0.9999
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.692E-15	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.169E-03	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	4.676E-21	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.639E-18	0.0000	3.200E-19	0.0000	3.780E-20	0.0000	0.000E+00	0.0000
Cs-137	3.946E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.086E-05	0.7220	1.782E-05	0.2114	5.613E-06	0.0666	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	3.946E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.086E-05	0.7220	1.782E-05	0.2114	5.613E-06	0.0666	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.002E-18	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.430E-05	1.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.430E-05	1.0000

*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	7.138E-12	0.2904	0.000E+00	0.0000	0.000E+00	0.0000	1.259E-11	0.5123	3.687E-12	0.1500	1.161E-12	0.0473	0.000E+00	0.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	7.138E-12	0.2904	0.000E+00	0.0000	0.000E+00	0.0000	1.259E-11	0.5123	3.687E-12	0.1500	1.161E-12	0.0473	0.000E+00	0.0000

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

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Co-60	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Cs-137	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.458E-11	1.0000
Fe-55	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.458E-11	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	3.000E+01	5.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	2.755E-02	2.428E-02	1.887E-02	6.186E-04	4.867E-05	8.192E-08	5.146E-19	0.000E+00
Cs-137	Cs-137	1.000E+00	3.070E-02	3.016E-02	2.911E-02	1.781E-02	1.225E-02	4.656E-03	7.595E-05	2.214E-11
Fe-55	Fe-55	1.000E+00	7.195E-06	5.595E-06	3.384E-06	3.774E-09	2.427E-11	7.799E-17	6.499E-39	0.000E+00
H-3	H-3	1.000E+00	2.069E-03	9.156E-03	3.725E-02	2.928E-11	1.639E-18	1.215E-36	0.000E+00	0.000E+00

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ≤ 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	3.000E+01	5.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	3.630E+01	4.118E+01	5.300E+01	1.616E+03	2.055E+04	1.221E+07	*1.131E+15	*1.131E+15
Cs-137	3.257E+01	3.315E+01	3.436E+01	5.614E+01	8.165E+01	2.148E+02	1.317E+04	4.516E+10
Fe-55	1.390E+05	1.787E+05	2.955E+05	2.649E+08	4.121E+10	*2.409E+15	*2.409E+15	*2.409E+15
H-3	4.832E+02	1.092E+02	2.684E+01	3.415E+10	*9.594E+15	*9.594E+15	*9.594E+15	*9.594E+15

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 4.183 ± 0.008 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Co-60	3.890E+00	0.000E+00	2.755E-02	3.630E+01	1.625E-02	6.154E+01
Cs-137	1.110E+00	0.000E+00	3.070E-02	3.257E+01	2.850E-02	3.509E+01
Fe-55	2.170E+01	0.000E+00	7.195E-06	1.390E+05	2.513E-06	3.979E+05
H-3	5.320E+01	4.267 ± 0.009	3.948E-02	2.533E+01	3.948E-02	2.533E+01

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	3.000E+01	5.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	1.072E-01	9.446E-02	7.339E-02	2.406E-03	1.893E-04	3.187E-07	2.002E-18	0.000E+00
Cs-137	Cs-137	1.000E+00	3.408E-02	3.348E-02	3.231E-02	1.977E-02	1.360E-02	5.168E-03	8.430E-05	2.458E-11
Fe-55	Fe-55	1.000E+00	1.561E-04	1.214E-04	7.344E-05	8.190E-08	5.266E-10	1.692E-15	0.000E+00	0.000E+00
H-3	H-3	1.000E+00	1.101E-01	4.871E-01	1.982E+00	1.558E-09	8.718E-17	0.000E+00	0.000E+00	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	3.000E+01	5.000E+01	1.000E+02	3.000E+02	1.000E+03
Co-60	Co-60	1.000E+00	3.890E+00	3.410E+00	2.621E+00	7.490E-02	5.380E-03	7.441E-06	2.723E-17	0.000E+00
Cs-137	Cs-137	1.000E+00	1.110E+00	1.084E+00	1.035E+00	5.522E-01	3.467E-01	1.083E-01	1.031E-03	8.682E-11
Fe-55	Fe-55	1.000E+00	2.170E+01	1.678E+01	1.004E+01	9.761E-03	5.731E-05	1.513E-10	7.362E-33	0.000E+00
H-3	H-3	1.000E+00	5.320E+01	2.308E+01	4.343E+00	6.999E-10	3.901E-17	2.860E-35	0.000E+00	0.000E+00

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

RESMAIN5.EXE execution time = 9.32 seconds