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MCC
Materials Characterization Center

Characterization of Spent Fuel Approved Testing Material—ATM-106

October 1988

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
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CHARACTERIZATION OF SPENT FUEL APPROVED TESTING MATERIAL--ATM-106

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ABSTRACT

The characterization data obtained to date are described for Approved Testing Material (ATM)-106 spent fuel from Assembly BT03 of pressurized-water reactor Calvert Cliffs No. 1. This report is one in a series being prepared by the Materials Characterization Center at Pacific Northwest Laboratory on spent fuel ATMs. The ATMs are receiving extensive examinations to provide a source of well-characterized spent fuel for testing in the U.S. Department of Energy Office of Civilian Radioactive Waste Management (OCWRM) program. ATM-106 consists of 20 full-length irradiated fuel rods with rod-average burnups of about 3700 GJ/kgM (43 MWd/kgM) and expected fission gas release of ~10%. Characterization data include 1) as-fabricated fuel design, irradiation history, and subsequent storage and handling; 2) isotopic gamma scans; 3) fission gas analyses; 4) ceramography of the fuel and metallography of the cladding; 5) calculated nuclide inventories and radioactivities in the fuel and cladding; and 6) radiochemical analyses of the fuel and cladding. Additional analyses of the fuel rod are being conducted and will be included in planned revisions of this report.

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1.0 INTRODUCTION

The Materials Characterization Center (MCC) at Pacific Northwest Laboratory[(a)] (PNL) has the responsibility to provide spent fuel test material (samples) for laboratory investigations of nuclear waste forms by the U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCWRM) program. This MCC reference report describes the characterization of Approved Testing Material (ATM)-106, one of five spent fuel ATMs that are being characterized. The first two reports in the series are on ATM-101 (Barner 1985) and ATM-103 (Guenther et al. 1988). General descriptions of the five spent fuel ATMs presently being characterized by the MCC are provided in Table 1.1. Additional ATMs, such as fuel rods with burnable poisons, rods from newer high-burnup designs, and rods with stainless steel cladding, are being considered as future ATMs.

Fuel rods from ATM-106 have a high burnup of about 3700 GJ/kgM (43 MWd/kgM) and were expected to have fission gas release from the UO_2 fuel during irradiation of about 10%. The fuel rods were fabricated by Combustion Engineering (C-E) and irradiated in the Calvert Cliffs No. 1 (CC-1) pressurized-water reactor (PWR), which is operated by Baltimore Gas and Electric (BG&E) in Maryland.

Twenty full-length fuel rods from Assembly BT03 constitute ATM-106--the remaining fuel rods were removed for other purposes by BG&E. ATM-106 fuel was selected for characterization because it had high burnup and expected high fission gas release based on information provided by BG&E. It was also manufactured by the same vendor and irradiated in the same reactor as ATM-103 fuel (moderate burnup, low fission gas release) and ATM-104 fuel (high burnup, low fission gas release). The expected differences in burnup and fission gas release among the various ATMs provide useful comparisons of as-irradiated characteristics of PWR fuel. ATM-105 will provide characterization data for boiling-water reactor (BWR) spent fuel and will be useful in comparing differences between irradiated PWR and BWR fuel rods. These spent fuel ATMs were selected to represent the typical end-of-life (EOL) fuel

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TABLE 1.1. Summary of Spent Fuel ATMs Being Characterized by the MCC

ATM	Fuel Type	Reactor	Expected Burnup Level	Expected Fission Gas Release, %	No. of Rods
101	PWR	H. B. Robinson, No. 1	Moderate, 2600 GJ/kgM (~30 MWd/kgM)	<1	9 as 27 1.2-m (4-ft) segments
103	PWR	CC-1	Moderate, 2600 GJ/kgM (~30 MWd/kgM)	<1	176 full length
104	PWR	CC-1	High, 3700 GJ/kgM (~43 MWd/kgM)	<1	128 full length
105	BWR	Cooper	Moderate, 2400 GJ/kgM (~28 MWd/kgM)	<1	98 full length
106	PWR	CC-1	High, 3700 GJ/kgM (~43 MWd/kgM)	~10	20 full length

conditions, potential extremes in EOL spent fuel conditions, or differences between PWR and BWR spent fuel from U.S. commercial nuclear reactors. The high burnup and expected high fission gas release of ATM-106 is representative of one type of spent fuel bounding condition for PWR reactors operating in the United States. Portions of the characterized fuel rods have been made available to the Nevada Nuclear Waste Storage Investigation (NNWSI) project for spent fuel testing. Additional quantities of ATM-106 will also be available for further distribution to experimenters.

The characterizations of ATM-106 spent fuel are based on a general characterization plan described by Barner (1984) and the specific characterization plan described in Section 3.0. All of the characterizations completed to date have been conducted at DOE's Hanford Site near Richland, Washington. The present report describes the characterizations completed to date for Rod NBD107 of ATM-106. Additional characterization data for Rod NBD107 and other ATM-106 fuel rods will be included in subsequent revisions of this report.

2.0 CONCLUSIONS

Analyses completed to date on four ATM-106 fuel rods, including detailed analyses of Rod NBD107, indicate that this fuel achieved a typical peak burnup of about 3900 GJ/kgM (46 MWd/kgM) and rod-average fission gas release from the fuel up to 11.2%.

Detailed characterization of two other fuel rods from ATM-106 will be conducted to further establish the characteristics of the ATM-106 fuel rods that are considered representative of one class of spent fuel that might be deposited in a repository. However, even the limited data obtained to date for ATM-106 indicates that differences in fission gas release correspond with significant differences in the fuel microstructure (such as grain growth) and the distribution of fission products. In addition, the high- burnup fuel with or without high fission gas release has a thin porous rim near the fuel edge. These results affirm the need to adequately characterize test materials because of potential variations in fission product distributions and their possible effects on subsequent test results. The results of the characterization of ATM-106 fuel rods are summarized below.

Fission Gas Release and Gamma Scans

Based on analyses of gas samples, the rod-average fission gas releases in Rods NBD040, NBD095, and NBD107 were 1.4%, 7.4%, and 11.2%, respectively. Gamma scans of the full-length rods indicated local variations in cesium beyond those expected from burnup alone and were consistent with the differences in the fission gas releases. As the rod-average fission gas release increased, the gamma scan data indicated greater portions of the fuel rods had cesium release or movement. The local variations in cesium release along the length of Rod NBD107 corresponded to measured changes in fuel grain growth and deposits of cesium and iodine on the interior surfaces of the cladding. Such information may provide a means of estimating the release of cesium and iodine for rods that do not receive destructive examination.

Fuel Radiochemistry

Radiochemical analyses of 11 fuel samples from different locations in Rod NBD107 indicated that the ORIGEN2 computer code provides reasonable predictions of the inventory and radioactivity of the nuclides examined. Measured values for ^{135}Cs, ^{137}Cs, ^{243}Cm and ^{244}Cm, ^{129}I, ^{90}Sr, ^{236}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu agreed within about $\pm 15\%$ of the values predicted by ORIGEN2. The amount of ^{241}Am measured in the fuel averaged about 6% above the predicted values, but was 32% higher than that predicted by ORIGEN2 for one of the samples. The ^{14}C in the fuel varied substantially from sample to sample, probably because of different amounts of initial nitrogen impurities, but averaged about 9% below the predicted ^{14}C levels. The measured amounts of ^{235}U were about 20% lower than those predicted by ORIGEN2. The measured amounts of ^{234}U were scattered over a wide range, averaging abut 11% higher than the predicted value, probably a result of analytical uncertainties for these small quantities. Both ^{237}Np and ^{99}Tc were measured at about 30% below their predicted values. The measured values for ^{79}Se and ^{126}Sn were consistently lower than the predicted values by about 87% and 81%, respectively. Similar differences between the measured and predicted values for ^{79}Se and ^{126}Sn have been obtained for other ATMs characterized by the MCC and suggests that modifications may be required in the ORIGEN2 code for predicting amounts of ^{79}Se and ^{126}Sn. Results of the fuel radiochemistry are being provided to Oak Ridge National Laboratory for their use in validating ORIGEN2. These differences will be further investigated when analytical results become available from spark source mass spectrometry of the fuel.

Fuel burnups for three samples from Rod NBD107 were determined based on the measured ^{148}Nd content. A correlation between measured burnup and ^{137}Cs activity obtained from gamma scanning was developed and used to estimate the burnup in samples from other locations in Rod NBD107. This correlation appears reasonable for estimating burnup in samples from Rod NBD107 even though there was high fission gas release and apparent local cesium migration in this rod.

Cladding Radiochemistry

Analyses of the Zircaloy-4 cladding were conducted to determine the amount of ^{135}Cs and ^{137}Cs on the exterior and interior surfaces, ^{129}I on the interior surface, and ^{14}C in the cladding. The deposits of ^{135}Cs and ^{137}Cs did not show any particular trend along the exterior surface of the cladding.

The levels of cesium on the interior cladding surface followed the power/ burnup profile of the rod and were 10 to 1000 times higher than for an ATM-103 fuel rod with low fission gas release. The ^{129}I level on the interior surface also approximated the power profile of the fuel, and was up to several orders of magnitude higher than for comparable samples from ATM-103. The variations of the ^{135}Cs, ^{137}Cs, and ^{129}I on the interior cladding surface are probably a result of different combinations of local fuel temperature and fission gas release that occurred at different regions of the fuel because the variations in the measured deposits on the cladding correlate with the variations in cesium release indicated by the gamma scans of the full-length rods and with the measured grain growth in the fuel. For Rod NBD107 with a rod-average fission gas release of 11.2%, it was estimated that 2% of the ^{137}Cs and 8% of the ^{129}I inventories were deposited rather firmly on the interior cladding surface.

The measured ^{14}C levels in the cladding averaged about 20% higher than the amounts predicted by ORIGEN2 and were about twice as high as those measured in cladding from ATM-103. Based on the range in as-fabricated nitrogen contents in the ATM-103 and ATM-106 cladding, such a difference is possible. The variations in ^{14}C in the cladding of a given rod or between rods of different ATMs may be primarily a result of differences in the as-fabricated nitrogen contents rather than analytical uncertainties.

Fuel Ceramography and Autoradiography

Ceramography conducted on fuel samples from Rod NBD107 indicated that the fuel grain size increased by 6 to 116%; the apparent as-fabricated grain size averaged about 7 μm. The grain growth at the fuel center at different axial locations in Rod NBD107 followed the same trend observed in the gamma scanning and radiochemical analyses. Fuel grain growth was lowest at the upper end of the fuel rod where there was no apparent cesium release according to the gamma scan and very low amounts of cesium deposited on the cladding. In the peak-power region, the fuel experienced a range of grain growth, with the highest grain growth corresponding to regions of apparently higher cesium release as indicated by the gamma scanning and radiochemistry of the cladding surfaces. More indications of fission-product metal ingots and fission gas bubbles at the grain boundaries were observed in the peak-power fuel samples of ATM-106 than in ATM-103. These results are indicative of higher fuel operating temperatures and are consistent with the ~50 times higher fission gas release in the ATM-106 fuel than in the ATM-103 fuel rod with only moderate burnup and low fission gas release.

Examination of the porosity distribution in the fuel also indicated a thin (~100- to 200-μm) porous rim near the fuel edge that is related to the high fission rate in this region. For fuel with burnups of about 40 MWd/kgM or higher, this effect can be important to the fuel structure and fission gas release, even if the central fuel temperatures are too low for significant fission gas release. Preliminary results for electron probe microanalyses of both ATM-104 and ATM-106 fuel indicate depletion of xenon in this rim region; the depletion may contribute a substantial portion of the fission gas release in high-burnup fuels with low fission gas release.

The beta/gamma autoradiography of ceramographic samples from the peak-power region of Rod NBD107 indicated movement of fission products from the central fuel region towards the outer edge, occasionally causing localized concentrations of fission products near the fuel/cladding interface. Regions of the fuel rod that had higher deposition of cesium and iodine on the interior cladding surface and greater fuel grain growth corresponded with a higher incidence of localized deposits of beta/gamma emitters in the autoradiographs. The beta/gamma autoradiography and measurement of fuel grain growth from ceramographic fuel samples provides additional information needed to understand differences in the as-irradiated fuel condition.

Cladding Metallography

Metallography of the Zircaloy-4 cladding from Rod NBD107 was conducted to evaluate the deposits on the exterior and interior cladding surfaces and the hydriding within the cladding. Cladding samples were examined at five locations along the fuel rod that represented different combinations of fuel and cladding operating temperatures. The oxide layer on the exterior cladding surface near the middle of the rod ranged from 11 to 15 μm thick which was about 2 to 3 times thicker than the deposits at the lower end of the rod. There was some layering on the exterior surface at the middle of the rod with an apparently loose outermost layer; the bottom of the rod had a solid monolayer. There were no apparent deposits of crud on the cladding. The interior surface of the Zircaloy-4 cladding had a relatively solid deposit about 5 μm thick that appears to be an oxide.

The amount and orientation of hydrides in the cladding are important to the strength of the irradiated cladding. Hydrides are a brittle phase formed from zirconium and hydrogen in the as-fabricated rod and/or hydrogen from the corrosion process at the exterior cladding surface. There was an obvious increase in hydride content from the bottom to the upper half of the rod where oxide layers on the cladding exterior surface were correspondingly higher. The orientations of the hydrides were primarily in the circumferential/longitudinal plane, which is the desired orientation to minimize the effect of hydrides on the cladding strength and ductility.

3.0 CHARACTERIZATION PLAN FOR ATM-106

The characterization plan for ATM-106 was prepared by the MCC and approved by the repository project. The plan describes standard examinations that are performed on all rods and detailed examinations that are performed on three representative rods. Information is provided below on the types of analyses conducted on rods receiving standard or detailed examinations as well as the criteria for selecting rods for detailed characterization.

3.1 STANDARD EXAMINATIONS

As can be seen in Figure 3.1, the first step in the MCC's characterization of spent fuel ATMs is to perform a full-length gamma scan on each of the intact fuel rods. A correlation between cesium activity and burnup will be developed for each spent fuel ATM, which will make it possible to define the burnup of samples from any portion of a rod from a given ATM after the rod has been gamma scanned. The gamma scan data also provide valuable information on fission product movement in the rod (such as cesium migration) and on densification or shifts, if any, in the fuel column.

After gamma scanning, each rod (except for the rod used as a gamma scan reference) is punctured and a gas sample is taken. Analysis of the gas provides an estimate of the fission gas released from the fuel during irradiation. The magnitude of the fission gas release is an indication of the extent of the microstructural changes that have occurred in the fuel. These microstructural changes may be important to the dissolution of fuel in a repository. The magnitude of fission gas release is also indicative of the fraction of volatile fission products, such as cesium and iodine, which have migrated to the grain boundaries and the gap between the fuel and cladding. Quantifying the inventory of fission products in the gap and at the grain boundaries is important because fission product release in a repository after the waste package barriers are breached will occur from these locations first and will be independent of the dissolution rate of the matrix.

It is planned to gamma scan and fission gas sample a number of ATM-106 rods to 1) have a backlog ATM-106 material that can be made available immediately upon request, 2) document the homogeneity of or differences in the

ATM-106 rods, and 3) provide a means of correlating measured data for fully characterized fuel rods with the gamma scan and fission gas release data that will be obtained from other ATM-106 fuel rods.

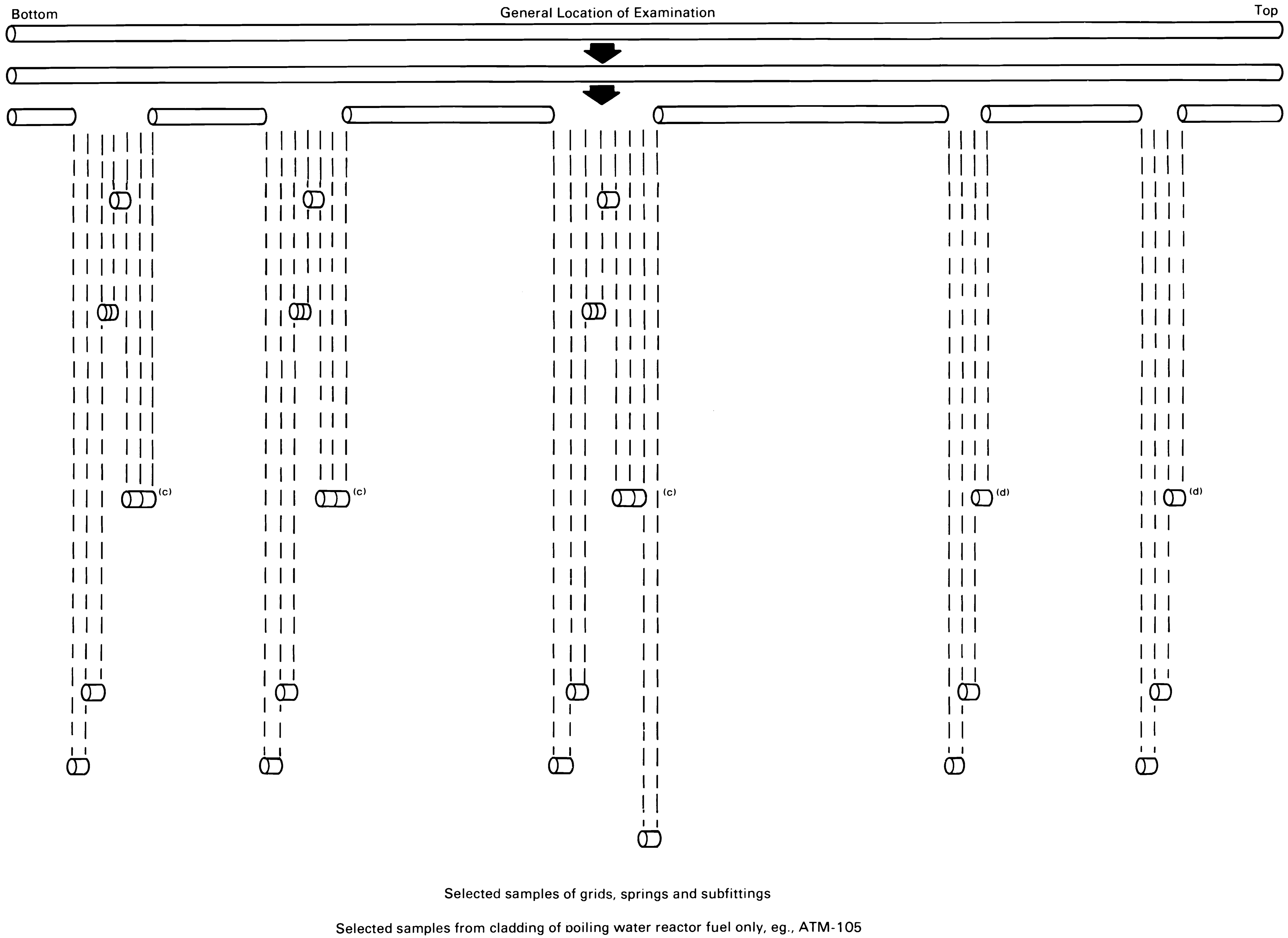
3.2 DETAILED EXAMINATIONS

As shown in Figure 3.1, samples are taken from several locations along the length of a rod receiving detailed characterization. Three rods from each ATM are scheduled to receive detailed characterization. Samples are scheduled to be taken for radiochemical analysis of the fuel and cladding, metallography of the cladding, ceramography of the fuel, analysis of the assembly hardware, and special examinations involving spark-source mass spectrometry (SSMS), electron probe microanalyses (EPMA), and analytical transmission electron microscopy (AEM).

A principle purpose of sampling the fuel rod at different locations is to determine the bulk inventory of long-lived radionuclides in fuel with different burnups. The fission products, actinides, and activation products of interest in assessments of geologic disposal are analyzed. Samples are taken from the peak-power region of the rod that corresponds with the region of maximum gamma activity, and from additional locations of lower power near the rod ends. Generally, the radionuclide concentrations are obtained from radiometric measurements of dissolved, or in the case of ^{14}C, thermally decomposed samples. In addition to the radiometric measurements, thermal ionization and SSMS are being used to obtain the bulk concentration of selected isotopes to supplement the data obtained from radiochemical methods or as overchecks on the determined values.

The bulk concentrations of the radionuclides of interest to geologic disposal are measured and compared with the predictions made with the ORIGEN2 computer code. These calculations are based on measured and estimated burnups for samples from the rods and the power history for the fuel rod. Comparison of the measured and predicted values serves to validate the ORIGEN2 code for use in predicting the radionuclide inventory in samples from other locations or other rods from the spent fuel ATMs at any decay time of interest.

Report Sections	Type of Characterization	Description
Sec. 4.3 & Append. B&D	Gamma Scan[a]	Selected isotopes, e.g., Cs-137, Cs-134, etc.
Sec. 4.4 & Append C	Fission Gas[a]	H_2, Ar, Kr, Xe, N_2, O_2, CO_2 (C-14), etc.
Sec. 4.7	Burnup	Nd-148 method, isotopes of U and Pu
Sec. 4.7	Specific Radionuclides	Se-79, Sr-90, Tc-99, Sn-126, Cs-135, Cs-137, Np-237, Am-241 and Cm-244
	Spark Source Mass Spectroscopy (ORNL)	Radial distribution (six points on radius) of most fission products and actinides, plus bulk concentration of same radionuclides (adjacent sample)
Sec. 4.5 & Append. E	Fuel Ceramography	Amount and type of cracking, grain size and structure, porosity and noble metal fission product particles
Sec. 4.5 & Append. E	Cladding Metallography	Hydride orientation, inner and outer surface oxidation, crud on outer surface, if present
	Microprobe	Radial distribution of selected elements
Sec. 4.5 & Append. E	Autoradiography	Alpha and beta-gamma intensity maps
Sec. 4.7	I-129 Distribution	Bulk concentration in fuel and chemically stripped from inner cladding surface
Sec. 4.7	Cs-135 and Cs-137 on Cladding	Chemically stripped from inner and outer cladding surfaces
Sec. 4.7	C-14 Distribution	Bulk concentration in fuel and cladding
	Transmission Electron Microscopy	Fission product distribution within grains and at grain boundaries
	Activation Products in Assembly Hardware	C-14, Ni-59, Ni-63 and Nb-94
	Crud Analyses[b]	C-14 and selected radionuclides



[a]Conducted on all rods
[b]Conducted on one rod per ATM
[c]Transverse and longitudinal examinations
[d]Transverse section examinations only

FIGURE 3.1. Characterization of Spent Fuel ATMs

In addition to determining the bulk concentrations of radionuclides in the fuel and cladding, characterization is also directed towards obtaining information on the radionuclide distribution in the fuel. Information on the nonuniform distribution of radionuclides will assist in providing an understanding of the preferential release of certain radionuclides that is observed in leach testing of spent fuel (Oversby and Wilson 1985). Special emphasis is being placed on determining the ^{14}C distribution in the fuel, cladding, crud, and assembly hardware because less is known about the actual concentrations of this radionuclide than most of the other radionuclides. Several mutually supportive techniques are being used to evaluate nonuniform distribution, including autoradiography, EPMA, AEM, SSMS of small radial samples from fuel pellets, and radiochemical analyses of material chemically stripped from the interior cladding surfaces.

The second major type of examination involves metallography and ceramography of samples from the peak-power and other lower-power regions of the fuel rod. Because cladding corrosion varies along the entire length of the rod, metallographic samples from the lower-power regions of the bottom and the top of the rod are examined. An understanding of cladding characteristics is needed because the cladding may serve as an important barrier during geologic disposal. Cladding corrosion on both the water side and fuel side is evaluated, along with hydriding and any crud deposition. Ceramography of the fuel is conducted to evaluate 1) the amount and location of fuel grain growth, 2) fission gas bubble formation and distribution, 3) the amount and distribution of fuel pellet cracking, 4) as-fabricated porosity and changes caused during irradiation, and 5) the formation of noble metal fission product agglomerates. Ceramography is important to interpreting differences in the behavior of fuel in leach tests and oxidation tests. Ceramography is also very important in establishing the characteristics of the individual spent fuel ATMs for comparison with the overall spent fuel population.

As indicated in Figure 3.1, selected samples from the spent fuel ATM assembly hardware will also be analyzed for specific activation products. To interpret this information, it will also be necessary to analyze for the precursor isotopes. The inventory of activation products in hardware is an important part of the evaluation of repository performance.

Special examinations consisting of SSMS, EPMA, and AEM are planned for selected samples from the rods that are receiving detailed characterization. As previously noted, SSMS is used to confirm the bulk measurements made by radiochemistry as well as to provide measurements of nuclides for which radiochemistry is not conducted. EPMA is used to determine the distribution of elements across the fuel radius and may prove useful in identifying secondary phases in the fuel and on the cladding. AEM provides a method for examining the fuel on a scale approaching the atomic level and can identify phases and structures that are not discernible in normal ceramography but are important to the understanding of the distribution of fission products in the fuel.

3.3 SELECTION OF RODS FOR DETAILED EXAMINATION

ATM-106 was selected for characterization because it contained fuel rods with high burnup and expected fission gas releases from the fuel of about 10%. This combination of high burnup with high fission gas release is one type of spent fuel that is expected to be emplaced in a geologic repository.

Because all of the ATM-106 rods had similar high burnups according to data provided by the vendor, it was desired to perform detailed examination on an ATM-106 rod with 10% or greater fission gas release. Gamma scanning and fission gas sampling were used to select the rod that received detailed characterization.

Seven ATM-106 rods from representative locations around the central water hole in the fuel assembly were selected for the initial gamma scanning and fission gas sampling. Results of the gamma scanning and fission gas sampling indicated a range of fission gas release for the first four ATM-106 fuel rods examined. Rod NBD107 was selected for detailed characterization because it had distinct indications of cesium release and possible movement in the gamma scan as well as a measured fission gas release greater than 10%. Because they had fission gas releases less than 10%, Rods NBD040 and NBD095 were gamma scanned and fission gas sampled only. Rod NBD066 was only gamma scanned because it was preselected to be the reference rod for gamma scanning examinations. Additional ATM-106 fuel rods will be gamma scanned and fission gas sampled to establish the rod-to-rod variability among the ATM-106 fuel rods and to select the next rods to receive detailed characterization. The results of the detailed examinations of Rod NBD107 and the limited examinations conducted on Rods NBD040, NBD066, and NBD095 are discussed in Section 4.

4.0 CHARACTERIZATION OF ATM-106

The following characterization of ATM-106 spent fuel consists of a description of the fuel rods and assembly design, the irradiation history, postirradiation handling and transportation, and a variety of destructive and nondestructive examinations conducted on four ATM-106 fuel rods. Of these rods, only Rod NBD107 received detailed examination. Sections 4.1 and 4.2 include information on the as-fabricated fuel design, irradiation histories, and subsequent storage and handling of the 20 spent fuel rods that comprise ATM-106. The remaining sections deal with the examinations conducted to date on ATM-106 fuel rods. This information includes 1) gamma scans of full-length fuel rods (Section 4.3), 2) fission gas analyses (Section 4.4), 3) ceramography and metallography of the fuel and cladding (Section 4.5), 4) calculated nuclide inventories and radioactivities in the fuel and cladding (Section 4.6), and 5) radiochemical analyses of the fuel and cladding as well as a comparison with predicted values (Section 4.7).

4.1 ASSEMBLY AND FUEL ROD DESCRIPTIONS

ATM-106 consists of 20 rods from one fuel assembly (BT03) that was fabricated by C-E and irradiated for four cycles in the CC-1 PWR, which is operated by BG&E and located outside Lusby, Maryland. The fuel assembly was discharged on October 18, 1980. The 20 ATM-106 fuel rods were transported from the reactor cooling basin to PNL in September 1985. Information in this section and Section 4.2 was provided to the MCC by C-E.

Assembly BT03 is a standard C-E 14 x 14 fuel assembly. The fuel assembly is constructed with five guide tubes that comprise the main structure of the assembly. The upper and lower end fittings, together with eight spacer grids and the five guide tubes, form a structural cage to support the fuel rods (Figure 4.1). All structural components except the lower Inconel grid and the stainless steel upper and lower end fittings are fabricated from Zircaloy-4.

A standard 14 x 14 fuel assembly contains 176 fuel rods. The fuel rods rest on the flow plate, which is part of the lower end fitting. Zircaloy-4 grid strips with integral springs align the rods with each other and provide

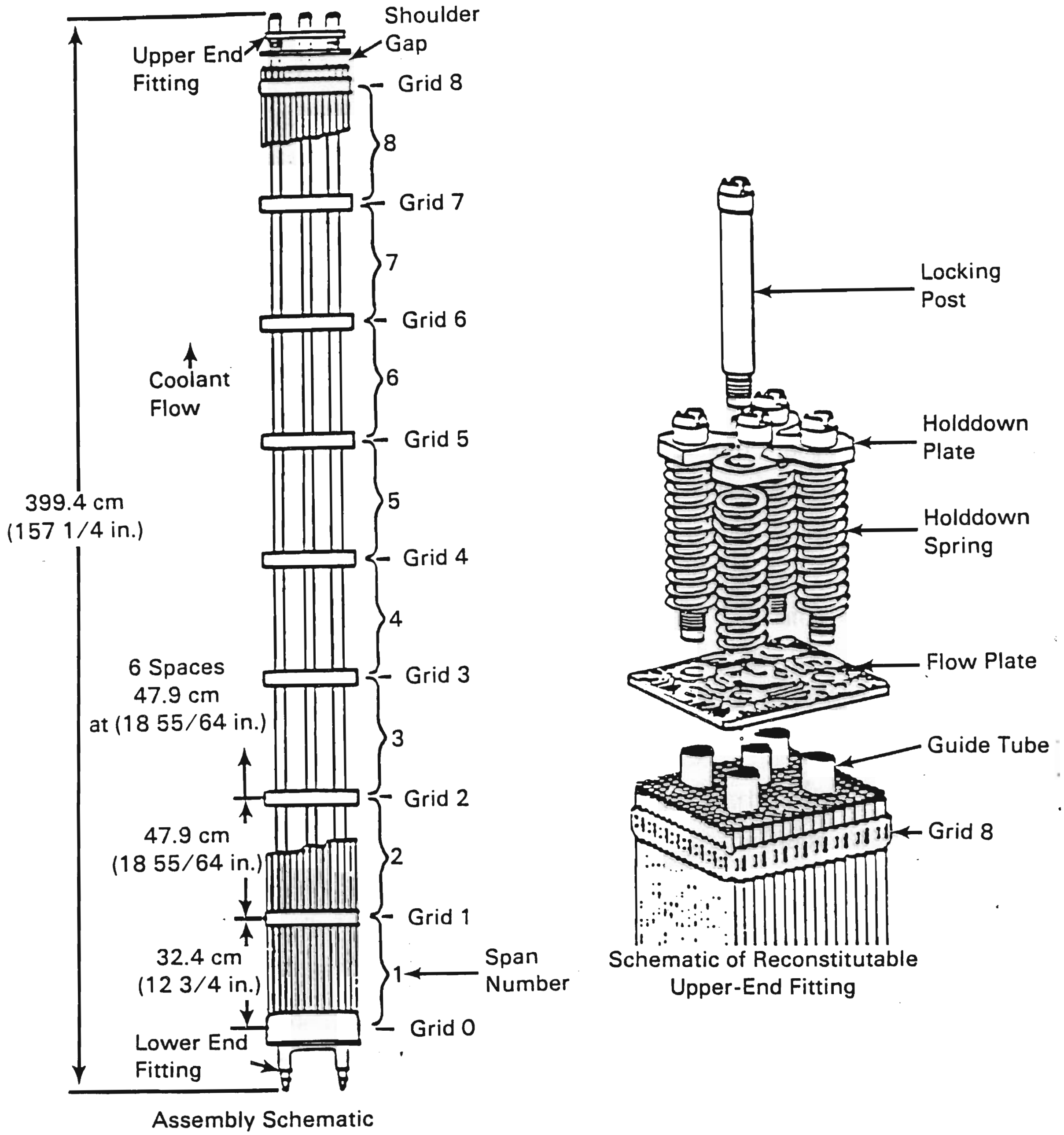


FIGURE 4.1. Combustion Engineering 14 x 14 Fuel Assembly Schematic

axial, lateral, and rotational restraint against fuel rod motion during operation. Combustion Engineering's standard fuel assembly is reconstitutable. Any or all fuel rods can be easily removed and replaced using the proper remote handling tools.

The ATM-106 fuel rod and pellet dimensions are shown in Figure 4.2. The pellets are approximately 1.5 times longer than the ATM-103 fuel pellets, and the void volumes of the two dished ends in the pellets are ~38% smaller than in the ATM-103 fuel pellet design. The fuel pellet certification data for Assembly BT03 are shown in Table 4.1. All ATM-106 fuel rods are clad with Zircaloy-4 tubing fabricated by Sandvik Special Metals, Lot Numbers 54028 and 54027. Cladding certification data are listed in Table 4.2.

In fabricating the fuel rods, the pellet stacks were laid out on a V-trough. The stacks were weighed and the stack lengths measured. The pellet stacks were then dried in a vacuum furnace and cooled in a flowing helium atmosphere. An Al_2O_3 spacer was added to each stack at the top and bottom, and the stacks were loaded into the Zircaloy-4 tubes with bottom end caps already welded on. The tubes were then closed with temporary caps to minimize exposure to the environment prior to welding the upper end caps. The plenum springs and permanent upper end caps were inserted, the rods were pressurized with 95% helium-5% argon to 3.1 MPa (450 psi), and the end caps were welded. The end cap welds were made using a magnetic force welding machine, which provides for pressurizing the rods to the required level.

Only 20 rods from Assembly BT03 were obtained by the MCC. The locations of the 20 rods during irradiation in Assembly BT03 are shown in Figure 4.3. To facilitate their shipment to PNL, the 20 rods were transferred into 20 vacant locations in Assembly D047 (ATM-104) in July of 1985. Rod NBD107, the first ATM-106 rod to receive detailed characterization, was located at position F7 adjacent to the center guide tube of the assembly.

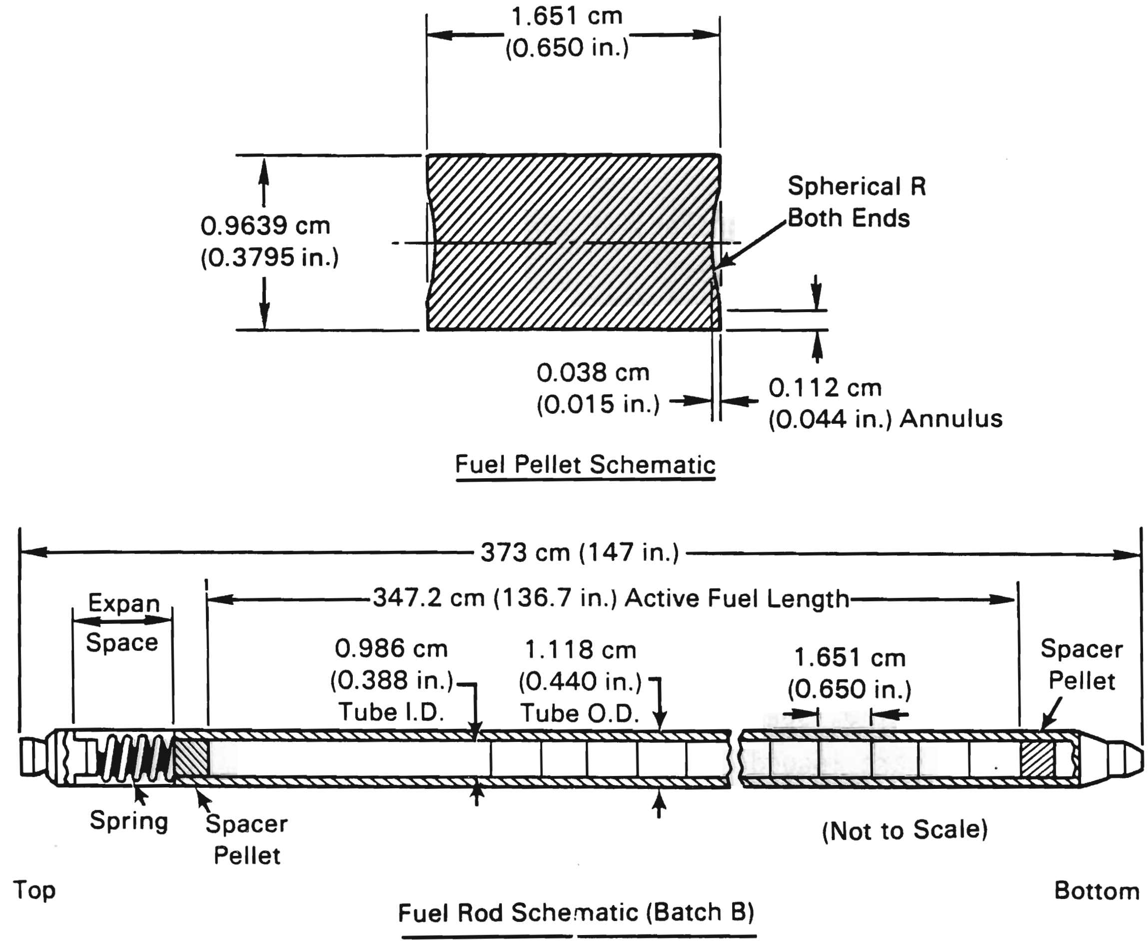


FIGURE 4.2. ATM-106 Pellet and Fuel Rod Dimensions

TABLE 4.1. ATM-106 Fuel Pellet Certification Data

Chemical Attribute	Fuel Lot B-25-BB Analysis Results				
Total uranium wt%	88.158	88.136	88.136	88.142	88.142
Carbon, ppm	17	23	33	9	15
Nitrogen, ppm	39	41	47	45	48
Fluorine, ppm	<10	<10	<10	<10	<10
Total halides, ppm	<20	<20	<20	<20	<20
Iron, ppm	<45	<45	<45	<45	<45
Silver, ppm	<1	<1	<1	<1	<1
Calcium, ppm					
Aluminum, ppm	<115	<115	<115	<117	<132
Silicon, ppm					
O:U ratio	2.00	2.00	2.00	2.00	2.00
Mass spec. analysis	2.453% U-235				
Density	10.05-10.30 g/cm^3				
Grain size	$\geq$5 μm				

TABLE 4.2. ATM-106 Fuel Rod Cladding Certification Data

Fuel Assembly: BT03	ROD LOT: NBC CLADDING LOT: 54028			ROD LOT: NBC/NBD CLADDING LOT: 54027		
Tensile Properties						
Room UTS, psi	98500	97900		89000	97300	
0.2% YS, psi	74300	73900		64500	69700	
Elong. 2 in., %	23.2	24.4		27.9	24.8	
750°F UTS, psi	52200	50000		48200	52700	
0.2% YS, psi	36600	32600		32000	36500	
Elong. 2 in., %	29.8	34.4		31.8	29.2	
Burst Test (closed end with mandrel at room temperature)						
Pressure, psi	16300	16000		15100	15900	
Circ. elong., %	20.1	34.7		45.3	22	
Hydride Orientation						
Fn OD	0.06	0.07		0.05	0.08	
Fn Mid	0.04	0.06		0.02	0.01	
Fn ID	0.02	0.02		0.03	0.02	
Corrosion Test (3 day, 750°F steam)						
Sample wt/dm^2	17.2	16.7		15.3	17.6	
Color	Slightly Gray			Slightly Gray		
Std. wt/dm^2	12.5	13.5	13.8	12.5	13.5	13.8
Std. No.	41	46	55	41	46	57
Chemical Analysis, ppm						
Hydrogen	12	13		12	10	
Nitrogen	38	45		41	45	
Oxygen	1260	1230		1280	1220	
Carbon	151	160		141	133	
Grain Size						
Long. ASTM	11.5	11.0		11.5	11.5	
Trans. ASTM	12.0	12.0		12.0	12.0	
Recrystallization Data	1100°F, 45 min			1100°F, 45 min		
Surface Roughness						
OD, RMS, microinch	12	10		14	12	
ID, RMS, microinch	12	20		16	16	

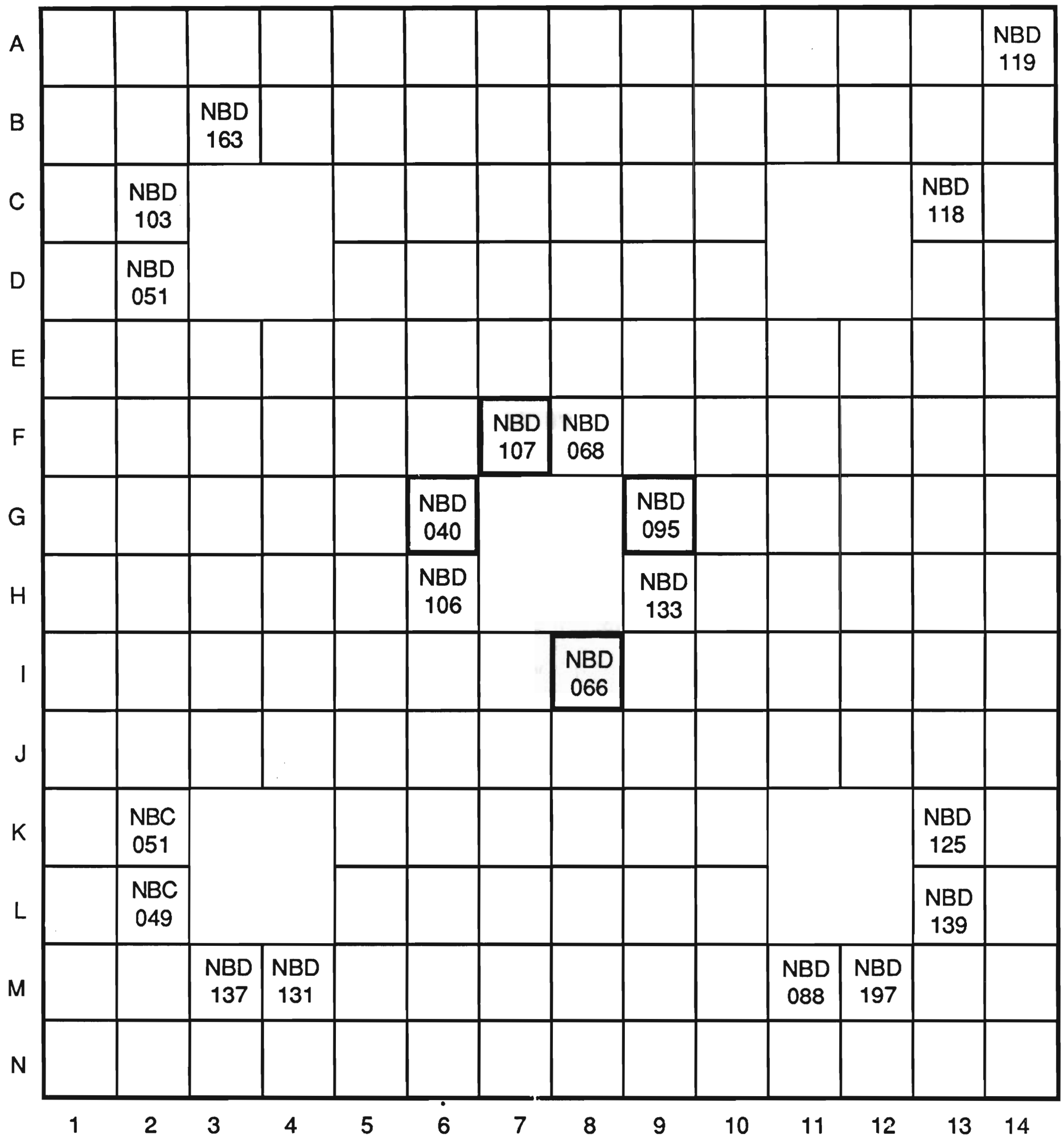


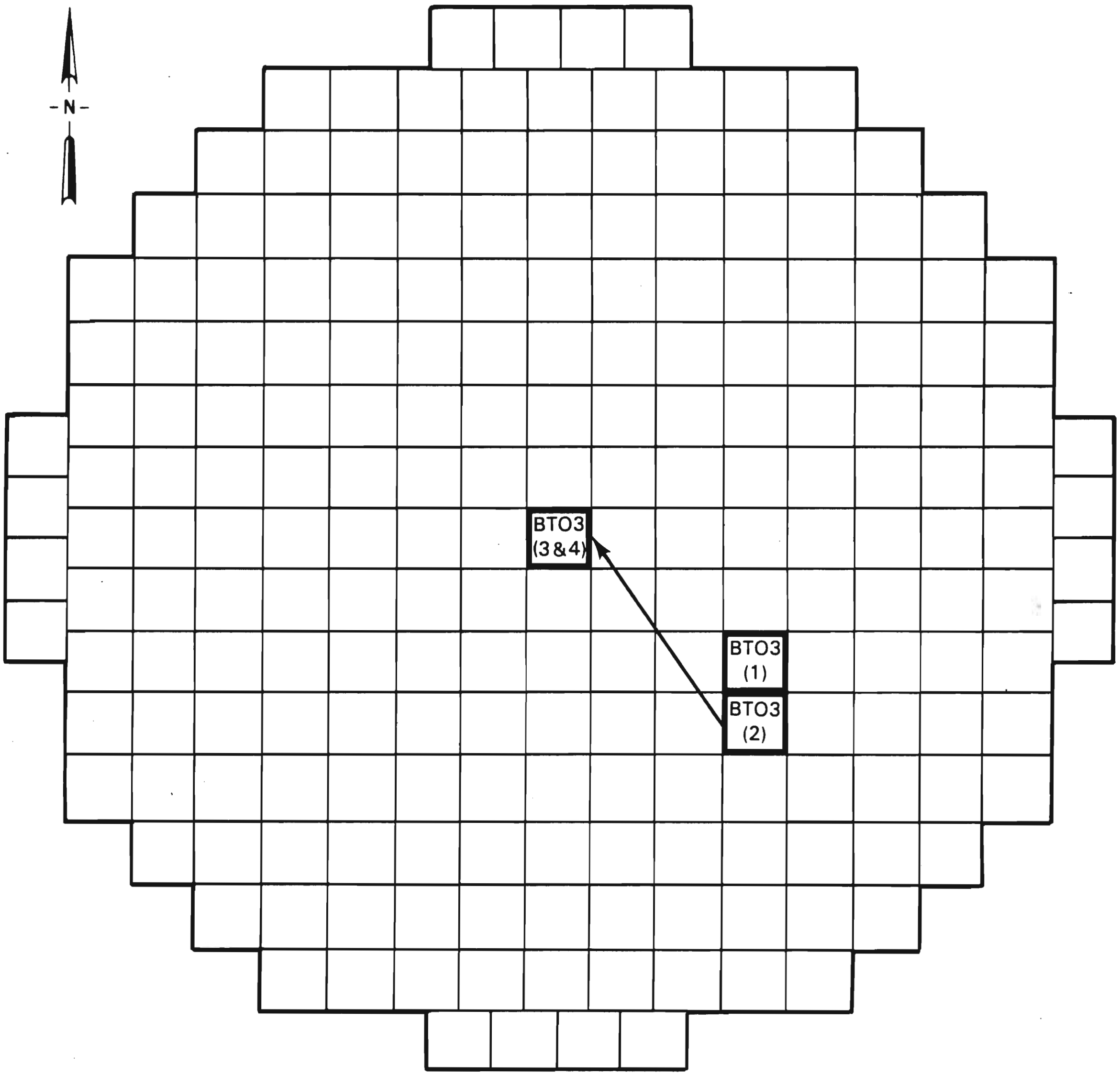
FIGURE 4.3. Locations of Twenty Rods in Assembly BT03 (characterized rods denoted in highlighted boxes)

4.2 IRRADIATION AND HANDLING HISTORY

The position of Assembly BT03 in the core during each cycle of irradiation is shown in Figure 4.4. Assembly BT03 was irradiated in Cycles 1, 2, 3, and 4 of operation of CC-1 between October 7, 1974, and October 18, 1980 (see Figure 4.5). The core thermal power rating at CC-1 was 2560 MWt from beginning-of-life (BOL) until midway through Cycle 2 (September 9, 1977) when a new license was issued to increase the power rating to 2700 MWt. Except for a period of about 5 months at reduced power during Cycle 4, the reactor operated at essentially full power during Cycles 1, 2, 3, and 4.

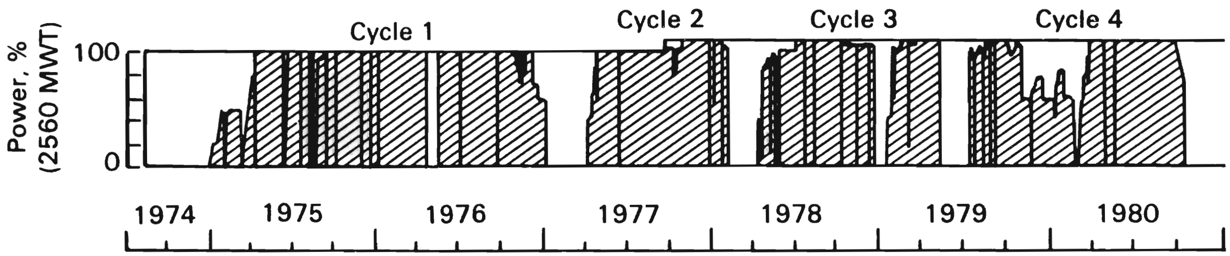
The CC-1 contains a total of 217 fuel assemblies. The linear heat generation rates (LHGRs) given in Figure 4.5 are averages for the entire core. The LHGRs for specific fuel rods vary significantly from average LHGRs. This is a typical effect of loading fresh fuel at the beginning of each cycle and moving the fuel assemblies to different core locations to optimally utilize the fissile fuel and maintain the required power distribution across the reactor core. As an example, the core-average LHGR was relatively constant at about 20 kW/m (6.1 kW/ft) during Cycles 1, 2, 3, and 4, but the average LHGR in Rod NBD107 ranged from a high of about 24 kW/m (7.3 kW/ft) at the beginning of Cycle 1 to a low of about 16 kW/m (4.8 kW/ft) at the end of Cycle 4. The power history specific to Rod NBD107 in Assembly BT03 is shown in Figure 4.6 and is approximated in tabular form in Appendix A.

Following discharge, Assembly BT03 was stored in the fuel storage basin at CC-1. In July of 1985, 20 rods were transferred to vacant positions in Assembly D047, which was loaded into a National Assurance Corporation NLI-1/2 cask in September 1985 and shipped dry to PNL. Since that time, Assembly D047 has been stored in air in B-cell of the 324 Building. There have been no unusual incidents associated with these fuel rods. Seven rods (see Table 4.3) were removed from the assembly in August 1986 and transferred to D-cell, 324 Building, where the intact fuel rods were stored in air at an ambient cell temperature of ~25°C. These rods are being characterized by the MCC (see Sections 4.3 through 4.8) and are available for use in the repository testing program (see Section 5.0).



*Bracketed Numbers Indicate the Cycle of Operation at the Indicated Location

FIGURE 4.4. Core Map Showing the Location of Assembly BT03 (ATM-106) in Calvert Cliffs No. 1 for Cycles 1, 2, 3, and 4



Dates	Cycle 1	Cycle 2	Cycle3	Cycle 4
Beginning of Cycle	10-7-74	3-22-77	4-3-78	7-10-79
End of Cycle	12-31-76	1-22-78	4-20-79	10-18-80
Burnups and Powers				
Cycle average Burnup at Shutdown, GJ/kgM (MWd/kgM)	1469 (17.0)	717 (8.3)	821 (9.5)	1011 (11.7)
Accumlative BT03 Assembly Average Burnup, GJ/kgM (MWd/kgM)	1680 (19.4)	2340 (27.1)	2950 (34.1)	3650 (42.7)
Cycle Average Linear Heat Generation Rate, kW/m (kW/ft)	19.99 (6.093)	19.97 (6.086) 21.06 (6.419*)	20.37 (6.209)	20.37 (6.209)

*After Increase to Stretch Power

FIGURE 4.5. Calvert Cliffs No. 1 Operating History

Cycle No.	1	2	3	4
Start/End of Cycle	10-7-74/12-31-76	3-22-77/ 1-22-78	4-3-78/ 4-20-79	7-10-79/ 10-18-80
Cycle Duration	~24 months	~10 months	~12.5 months	~15 months
Cycle Burnup MWd/kgM	19.67	7.70	6.72	8.23
Cumulative Burnup MWd/kgM	19.67	27.37	34.09	42.32

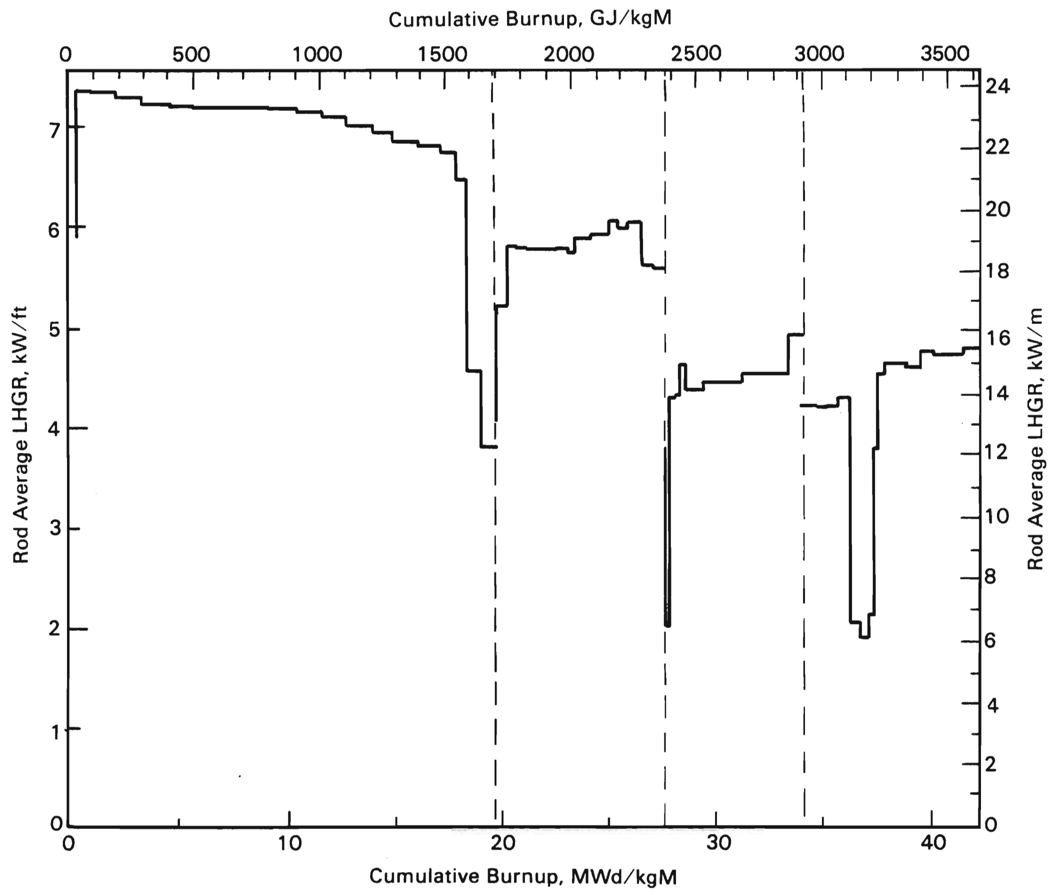


FIGURE 4.6. Power History for Rod NBD107 from Assembly BT03

TABLE 4.3. Initial ATM-106 Fuel Rods to be Characterized and and Used in Repository Project Testing Program

Rod Number	Rod Location[a]	Comments
NDB040	G6	Gamma scanned and fission gas sampled only. Described in this report.
NBD066	I8	Gamma scan reference rod.
NBD095 NBD106	G7 H6	One of these rods may receive in-depth characterization (pending results of gamma scans/fission gas sampling. NBD095 gamma scan and fission gas data reported.
NBD107	F7	Detailed characterization of this rod described in this report.
NBD131	M4	Detailed characterization in progress for this rod.
NBD133	H9	To be gamma scanned and fission gas sampled only.

(a) Locations refer to Figure 4.3.

4.3 GAMMA SCANNING RESULTS

Each fuel rod was gamma scanned axially using a germanium-lithium gamma ray detector. Details on the gamma scanning equipment and procedure are provided in Appendix B. The same counting geometry, counting equipment, analyzing equipment, and data storage equipment were used for each measurement. This system is the same system used to measure the gamma activity in the ATM-103 fuel rods (Guenther et al. 1988). As in the gamma scans for other MCC spent fuel rods, the gamma scans for standard rods in ATM-106 are preceded and followed by gamma scans of short portions of a reference rod. The reference rod for ATM-106 is Rod NBD066.

Initial spectral counting of the high-activity regions of the reference Rod NBD066 showed significant gamma ray peaks at 605 KeV (^{134}Cs), 662 KeV (^{137}Cs), and 796 KeV (^{134}Cs). The activity was sufficient to provide adequate counting statistics. A ^{60}Co signal was also detected during gamma scanning because a sample of this material is placed in the detection system as a reference point. The detailed results of the gamma scanning are provided in Appendix B for Rods NBD040, NBD066, NBD095, and NBD107.

The gamma scanning procedure requires the measurement of the as-irradiated fuel rod length from one end cap to the other. The as-measured fuel rod lengths are summarized in Table 4.4 for the four ATM-106 rods that have been gamma scanned. These rod lengths compare very well with the fuel rods in ATM-103 and may be compared with the nominal design length of 3.73 m (147 in.).

The ^{137}Cs gamma activity along the fuel rod length is shown in Figures 4.7 and 4.8 for Rods NBD040 and NBD107, respectively. These two rods were irradiated next to each other on adjacent sides of the central guide tube of Assembly BT03 (see Figure 4.3). The ^{137}Cs gamma scan for Rod NBD040 is similar to those seen for ATM-103, even though the ATM-106 fuel was expected to have had high fission gas release, i.e., greater than 10%, with an EOL burnup of about 43 MWd/kgM. The dips in cesium activity in Figure 4.7 indicate pellet/pellet interfaces that are on a spacing equivalent to the pellet length of 16.5 mm (0.65 in.). The location of the grid spacers along the fuel rod are also obvious from the approximately 5% decrease in activity at regular intervals along the fuel rod. The slight increase in activity near the ends of the fuel rods is a common result of neutron streaming at the fuel rods ends where the neutron flux peaks near the region containing a larger percentage of moderator, i.e., water. A small portion of the data near the middle of the rod was affected by an electronic shift and has been omitted from the plot in Figure 4.7. Except for differences in the peak average ^{137}Cs activity, the gamma scan for Rod NBD040 is very similar to those for the ATM-103 fuel rods.

In stark comparison, definite cesium movement occurred in Rod NBD107, as indicated by the major spikes and dips in the activity along the fuel rod near both the upper and lower ends of the fuel rod. The gamma scan of the central region of the rod is more regular, indicating slight decreases in activity on intervals equal to the pellet length. The ceramographic examination of fuel from this region of normal cesium activity does indicate that

TABLE 4.4. Fuel Rod Lengths Measured During Gamma Scanning

Fuel Rod Number	As-Irradiated Fuel Rod Length, m (in.)
NBD040	3.757 ±0.003 (147.9 ±0.2)
NBD066	3.759 ±0.003 (148.0 ±0.2)
NBD095	3.757 ±0.003 (147.9 ±0.2)
NBD107	3.754 ±0.003 (147.8 ±0.2)

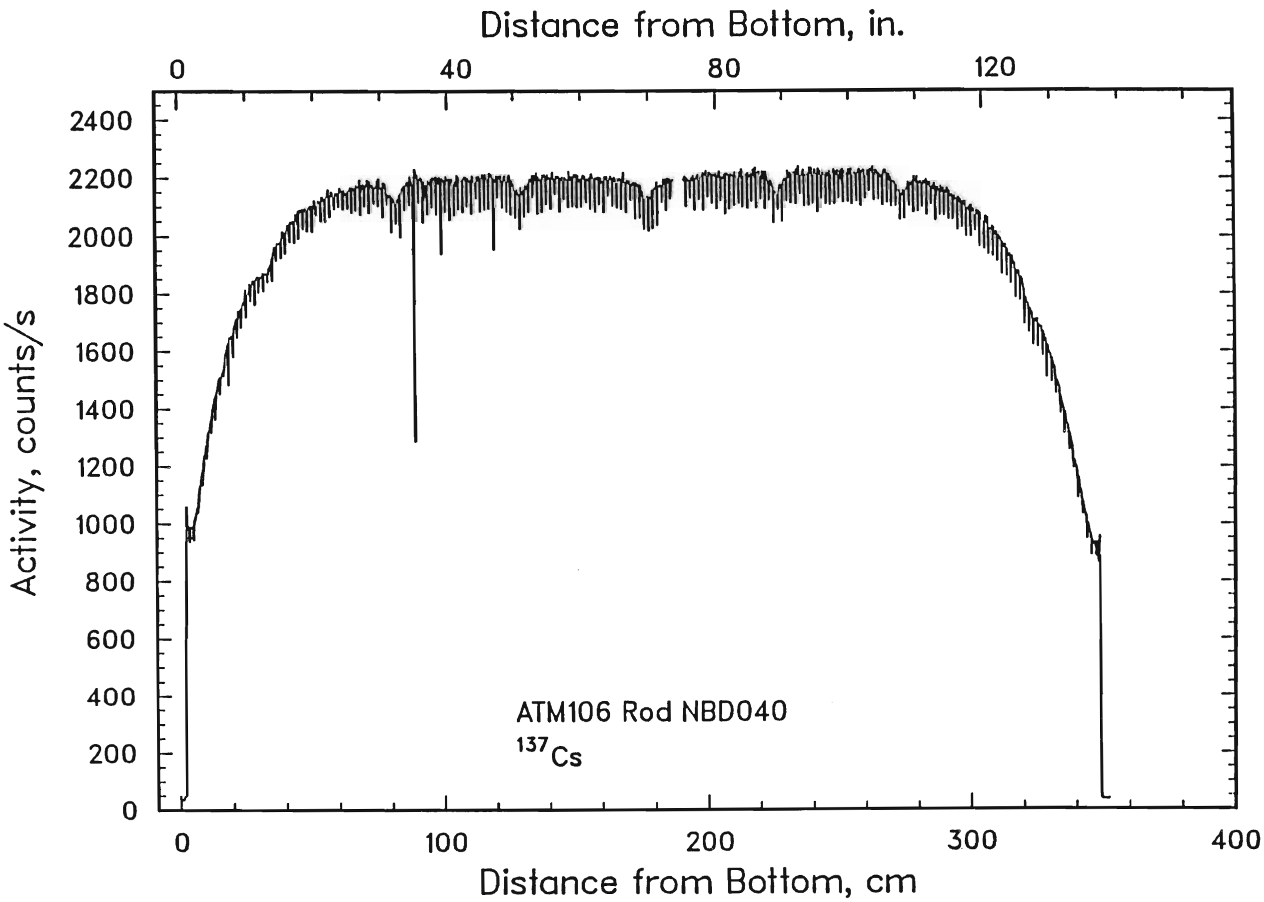


FIGURE 4.7. Spectral Gamma Scan for ^{137}Cs - Rod NBD040

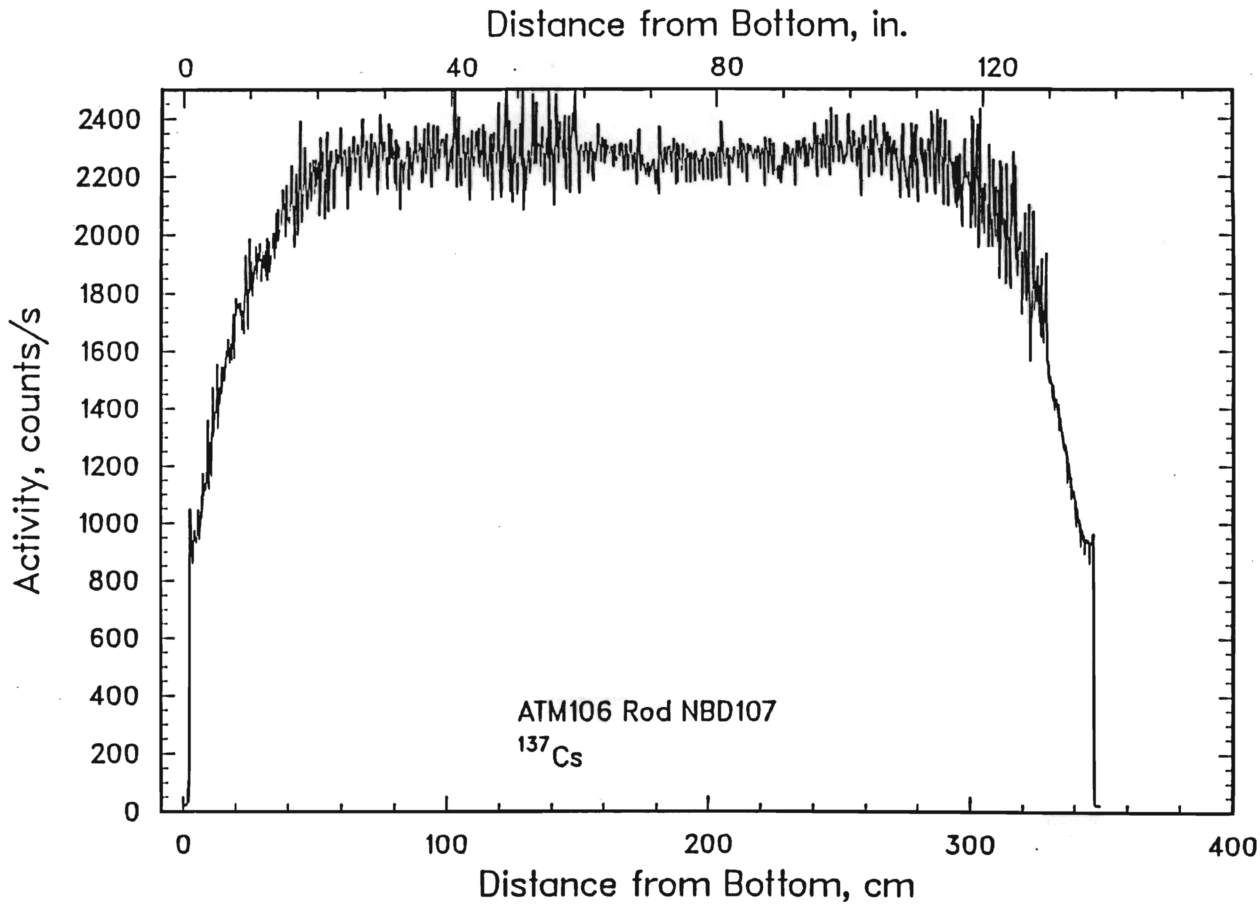


FIGURE 4.8. Spectral Gamma Scan for ^{137}Cs - Rod NBD107

the fuel experienced significant grain growth and fission gas agglomeration along the grain boundaries (see Section 4.5).

An expanded view of the ^{137}Cs activity in a selected portion of Rod NBD107 is shown in Figure 4.9 to highlight the differences in cesium behavior. One portion of fuel rod appears to have had little cesium movement, while only 40 cm (16 in.) away another portion of the fuel rod exhibits as much as 10% higher ^{137}Cs activity. The increase in cesium at the midplane of a fuel pellet requires that there be a depletion of cesium at the pellet/pellet interfaces, at a mid-pellet transverse crack, or at another part of the fuel rod, i.e., the cesium could move from the generally hotter central region of the fuel rod to the cooler ends of the fuel rod. The increase in cesium activity appears to occur at pellet/pellet interfaces and near the middle of the pellets. The release of cesium and its subsequent movement are

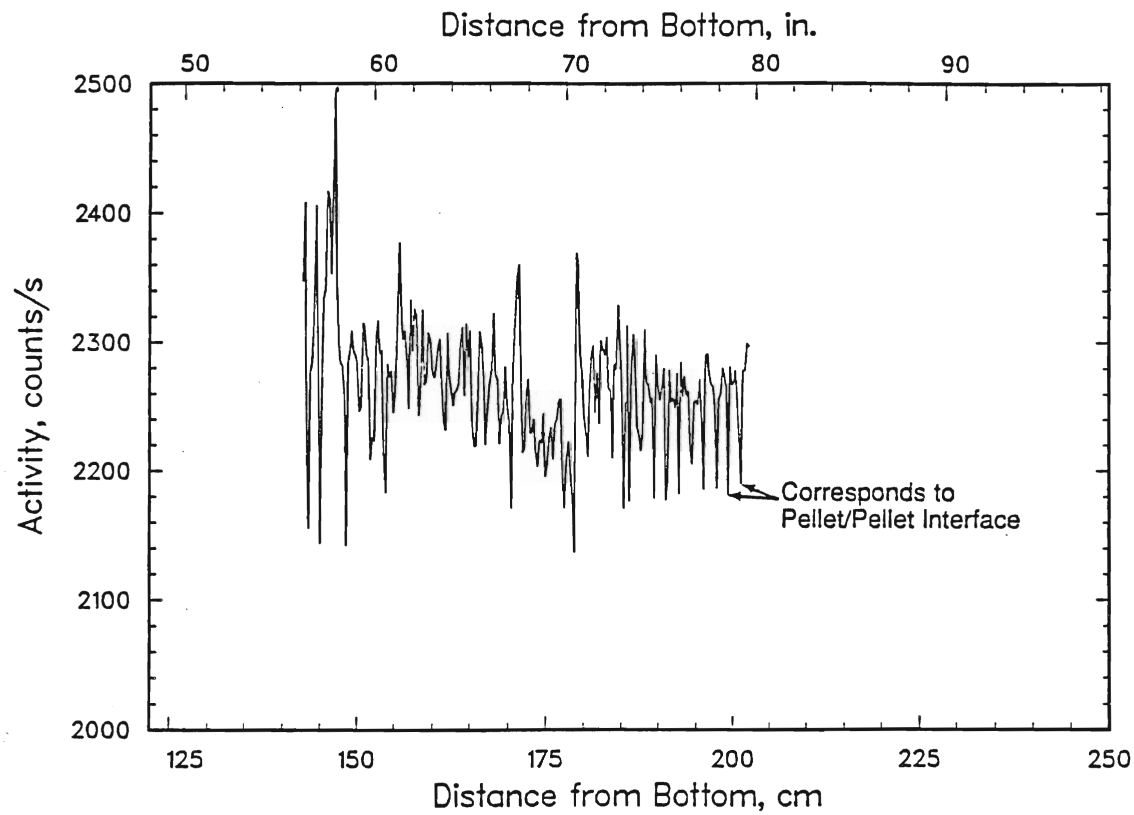


FIGURE 4.9. Expanded View of ^{137}Cs Gamma Scan for Central Portion of Rod NBD107

typical indications of a thermal feedback mechanism in which the escaping fission gas degrades the thermal conductivity of the gas in the fuel/cladding gap. This behavior causes the fuel temperature to increase, followed by a further increase in fission gas release, etc. Thermal feedback requires a minimum combination of fuel temperature, fission gas production, and fission gas release before it becomes significant. The observed differences in apparent cesium release at the bottom and top of the rod may be partly due to differences in mixing of the released fission gas with the gas in the fuel/cladding gap at the bottom of the rod and the large reservoir of gas in the plenum at the upper end of the rod.

4.4 FISSION GAS ANALYSES

The amount of fission gas release and the subsequent composition of the gas in the fuel rod void space can appreciably affect the fuel temperatures during reactor operations. This in turn can have an effect on the final characteristics of the spent fuel by increasing grain size, promoting additional fission gas release, and changing the distribution of some fission products within the fuel. The extent of this effect depends on the initial gas composition, initial fuel characteristics, power history, and final burnup. Fission gas analyses were made on the gas from Rods NBD040, NBD095, and NBD107 to determine the release of fission gas from within the fuel. The fission gas release was expected to be 10% or greater based on data provided by C-E. The procedures for gas sampling, void volume measurement, and determination of the gas volume are described in Appendix C. Results are provided below for the elemental and isotopic gas analyses, measurement of the ^{14}C in the gas, and calculated fission gas releases.

4.4.1 Elemental and Isotopic Gas Analyses

Analyses were conducted on gas samples from three ATM-106 rods to determine the components of the gas in the rods, the amounts of the xenon and krypton isotopes, and the amount of ^{14}C in the gas.

Elemental Gas Analyses

The results of the elemental gas analyses for the ATM-106 rods are listed in Table 4.5. These data were obtained using a mass spectrometer. The primary components of the gas samples were helium and argon, the gases used to pressurize the rods during fabrication, and the fission gases xenon and krypton (see Table 4.5). The gas in the ATM-106 rods has substantially greater percentages of xenon and krypton than in either the ATM-101 (Barner 1985) or ATM-103 rods (Guenther et al. 1988). There were no significant indications of air in the ATM-106 fuel rods. Based on the gamma scan for rods that were sampled for fission gas, the lowest release was expected in Rod NBD040 and the highest release in Rod NBD107.

TABLE 4.5. Gas Composition for ATM-106 Fuel Rods, Vol%

Rod No.	He	Xe	Kr	Ar	H_2	CO_2	CO	N_2	O_2	Organics	Xe-Kr Ratio
NBD040	90.6	4.18	0.47	4.64	<0.01	<0.01	<0.05	0.05	0.02	<0.01	8.9
NBD095	76.8	17.97	1.84	3.38	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9.8
NBD107	72.1	22.64	2.58	2.70	<0.01	<0.01	<0.02	0.02	<0.01	<0.01	8.8

The average xenon/krypton ratio of about 9.2 for the three ATM-106 rods compares reasonably well with the average value of 9.0 for the ATM-101 rods and 9.0 for the single ATM-103 rod. Assuming a 40 MWd/kgM average burnup and a 6.5-year discharge time, ORIGEN2 calculations described in Section 4.6 result in a xenon/krypton ratio of 10.5. The ratio of xenon and krypton measured in the gas sampled from the ATM-106 rods is about 12% lower than the predicted value.

Xenon and Krypton Isotopes in the Gas

The amounts of xenon and krypton gas recovered from each rod were evaluated in two ways. First, the volume percentages of the total rod gas were determined for xenon isotopes and krypton isotopes; the total rod gas includes the original fill gases plus any gases released to the rod void as shown in Table 4.5. Second, the relative amounts of the various isotopes that make up the total xenon or krypton gas were determined and compared with the calculated values.

The isotopic gas analyses for xenon and krypton as a percentage of the total rod gas are given in Tables 4.6 and 4.7, respectively. As indicated in Tables 4.6 and 4.7, the volume percentage of both xenon and krypton increased as expected based on the gamma scanning results.

TABLE 4.6. Percentages of Xenon Isotopes in Total Rod Gas

	Volume Percentage					
Rod No.	^{128}Xe	^{130}Xe	^{131}Xe	^{132}Xe	^{134}Xe	^{136}Xe
NBD040	<0.01	0.01	0.24	0.96	1.19	1.78
NBD095	0.01	0.07	0.86	4.26	5.03	7.74
NBD107	0.02	0.08	1.17	5.28	6.35	9.74

TABLE 4.7. Percentages of Krypton Isotopes in Total Rod Gas

	Volume Percentage				
Rod No.	^{82}Kr	^{83}Kr	^{84}Kr	^{85}Kr	^{86}Kr
NBD040	<0.01	0.04	0.17	0.02	0.24
NBD095	<0.01	0.16	0.65	0.07	0.96
NBD107	0.01	0.25	0.88	0.10	1.34

The relative amounts of the isotopes of the xenon or krypton measured in the rod gas are given in Tables 4.8 and 4.9, repectively. The relative amounts of the different isotopes of xenon and krypton estimated by using the ORIGEN2 code (see Section 4.6) assuming a discharge time of 6.5 years and 40 MWd/kgM burnup are also listed in Tables 4.8 and 4.9. The relative amounts predicted using ORIGEN2 are very close to the measured values.

TABLE 4.8. Relative Amounts of Xenon Isotopes in Xenon Gas

	Relative Volume Percentage					
Rod No.	^{128}Xe	^{130}Xe	^{131}Xe	^{132}Xe	^{134}Xe	^{136}Xe
NBD040	(a)	0.2	5.7	23.0	28.5	42.6
NBD095	0.1	0.4	4.8	23.7	28.0	43.1
NBD107	0.1	0.4	5.2	23.3	28.0	43.0
Predicted(b)	0.1	0.4	7.2	22.0	27.4	43.0

(a) Assumed to be essentially zero for calculating relative percentages of xenon (See Table 4.6).
(b) Relative amounts of xenon isotopes predicted by ORIGEN2 (See Section 4.6) assuming a burnup of 40 MWd/kgM and 6.5-y-discharge.

TABLE 4.9. Relative Amounts of Krypton Isotopes in Krypton Gas

	Relative Volume Percentage				
Rod No.	^{82}Kr	^{83}Kr	^{84}Kr	^{85}Kr	^{86}Kr
NBD040	(a)	8.5	36.2	4.3	51.1
NBD095	(a)	8.7	35.3	3.8	52.2
NBD107	0.4	9.7	34.1	3.9	51.9
Predicted(b)	0.4	10.4	33.3	3.8	52.0

(a) Assumed to be essentially zero for calculating relative percentages of krypton (See Table 4.7).
(b) Relative amounts of krypton isotopes predicted by ORIGEN2 (See Section 4.6) assuming a burnup of 40 MWd/kgM and 6.5-y-discharge.

Carbon-14 in the Gas

The ^{14}C content in the gas removed from the three ATM-106 rods was determined by collecting the gas containing carbon, converting it to CO_2, trapping the CO_2 in a caustic solution, and measuring it by beta-scintillation analysis. The amounts of ^{14}C in the gas from the ATM-106 fuel rods are listed below.

Rod Number	^{14}C, nCi/cm^3 at STP
NBD040	<0.0007
NBD095	0.0038
NBD107	<0.011

The measured ^{14}C content in the gas sample from Rod NBD095 was the only one for ATM-106 that was above the detection level; the detection level varies from rod to rod depending primarily on the volume of the gas sample and the measurement system background level. If the highest ^{14}C level is assumed to be 0.011 nCi/cm^3 for ATM-106, then the ^{14}C level is comparable to the value measured for one ATM-103 rod (Guenther et al. 1988) and only about 1% of the average measurements for the nine ATM-101 fuel rods (Barner 1985). The ATM-101 fuel rods were believed to contain a small amount of residual nitrogen in the fill gas that activated to ^{14}C.

4.4.2 Fission Gas Release

Fission gas release in the three ATM-106 rods ranged between 1.4% and 11.2%. These values were obtained assuming 1) 31.0 cm^3 of fission gas was generated for each MWd of burnup at standard temperature (0°C) and pressure (0.1 MPa, 1 Atm.) (SSA 1982), 2) data in Table 4.10, and 3) the rod-average burnup of 3664 GJ/kgM (42.32 MWd/kgM) provided by C-E. The measured rod void volumes varied between 19.9 and 25.4 cm^3 based on the sampling described in Appendix C. The as-fabricated void volume was estimated to be 27 cm^3. Any errors in the measured EOL void volume contribute very little error in estimating fission gas release because the fuel rod void volume is only a small fraction of the total measuring system gas volume at standard temperature and pressure. Based on these calculations, the fission gas releases for the ATM-106 fuel rods are all higher than for the rods from ATMs 101 and 103.

TABLE 4.10. Fission Gas Release Information for ATM-106 Fuel Rods[a]

Rod Number	Total Recovered Gas at STP, cm^3	Xe + Kr, %	Volume of Xe + Kr at STP, cm^3	Rod-Average Burnup, MWd/kgM	Estimated Fission Gas Produced, cm^3	Fission Gas Released, %
NBD040	874	4.65	40.6	42.32	2941	1.4
NBD095	1098	19.81	217.5	42.32	2941	7.4
NBD107	1300	25.22	327.9	42.32	2941	11.2

(a) Fuel weight in each rod was 2.242 kgM.

The measured fission gas releases are consistent with the different levels of apparent cesium movement noted in Section 4.3 for the four ATM-106 fuel rods. Although the actual fuel operating conditions that caused these different cesium releases are not known, the fission gas analyses for three of the ATM-106 fuel rods can be used to obtain a rough visual correlation between cesium movement and fission gas release. Figure 4.10 is a composite of four ^{137}Cs gamma scans for Rods NBD040, NBD066, NBD095, and NBD107. The fission gas release calculated for three of these rods (the reference Rod NBD066 was not punctured) are indicated on their respective figures. For Rod NBD040, which did not exhibit any cesium movement, the fission gas release is ~1.4%. For Rod NBD095, with cesium movement apparent in only the lower half of the fuel rod, the fission gas release is ~7.4%. Finally, Rod NBD107 evidenced significant cesium movement over major portions near both ends of the rod. The calculated release was about 11.2%. Based on these results, the fission gas release in Rod NBD066 is probably about 4%. If a correlation such as inferred in Figure 4.10 can also be tied to actual chemical analyses of fuel and cladding samples, then a method of estimating the gap inventory of volatile nuclides may be possible for similar fuel rods that have gamma scan and fission gas release data.

4.5 CERAMOGRAPHIC/METALLOGRAPHIC EXAMINATIONS

Selected fuel samples were sectioned from Rod NBD107 for ceramographic examination of the irradiated fuel, metallographic examination of the irradiated cladding at the same location, and alpha and beta-gamma autoradiography

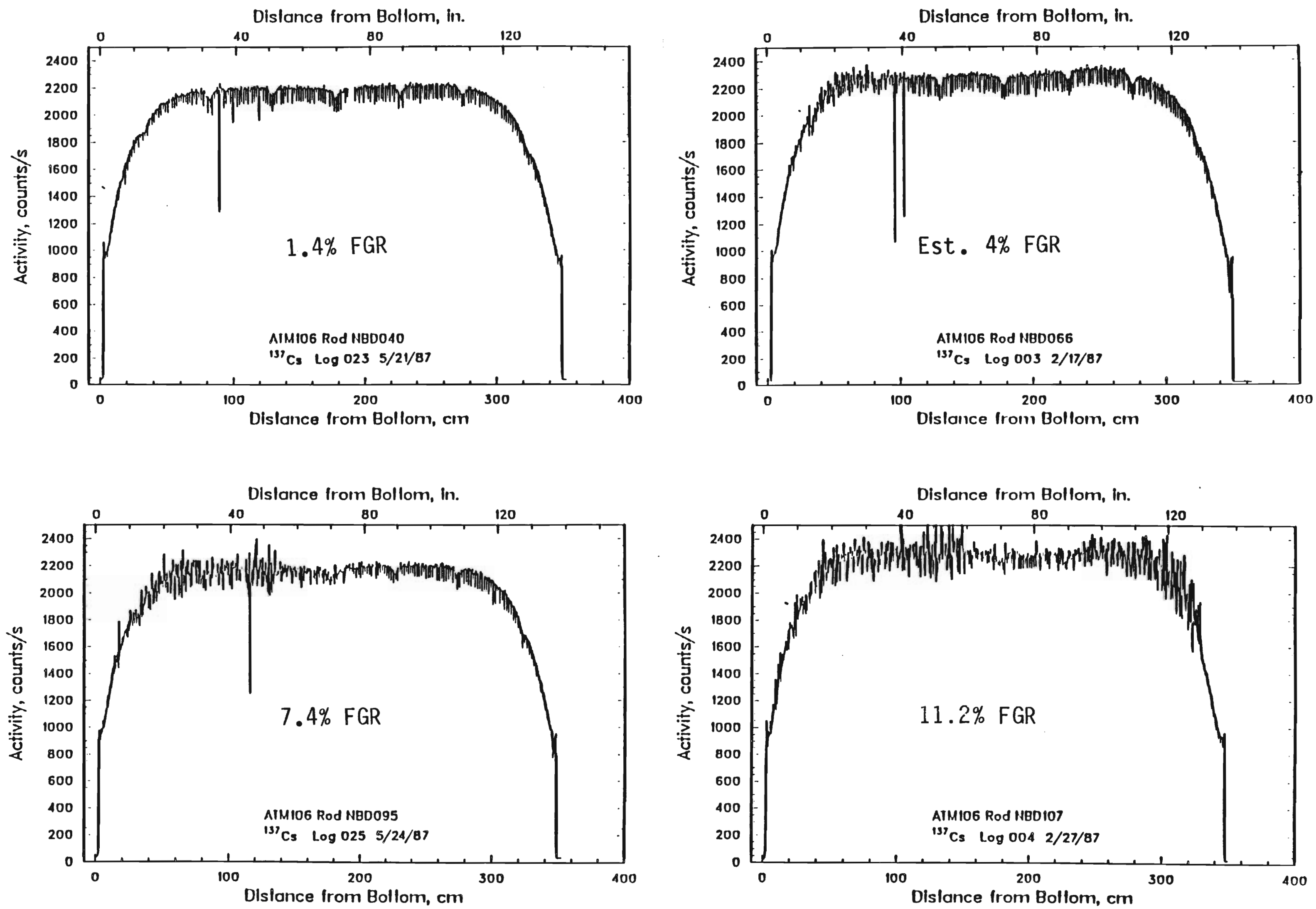


FIGURE 4.10. Comparison of ^{137}Cs Gamma Scan Data of Four ATM-106 Fuel Rods with Different Fission Gas Releases (FGR)

of each sample. These fuel samples were taken in coordination with several other samples for radiochemistry, transmission electron microscopy, distribution to experimenters, and archiving. The sectioning was based on the results of the ^{137}Cs gamma scan and the desired number and types of examinations for this fuel (Figure 3.1).

4.5.1 Fuel Rod Sectioning and Sample Selection

After gamma scanning and fission gas sampling, a sectioning diagram was prepared for Rod NBD107. The sectioning was based on the characterization plan and the results of a ^{137}Cs gamma scan of the entire length of Rod NBD107. The sectioning diagram was provided to representatives of the repository project for review prior to sectioning.

The sections used for radiochemical, ceramographic, and metallographic analyses were 0.6 to 2.5 cm (0.25 to 1.0 in.) in length. Each sample was designated with an alpha-numeric symbol in the order of sectioning from the top of the fuel rod. Detailed descriptions of the fuel sections, their lengths, and locations in the fuel rod are given in Appendix D. Additional details on the sectioning process are also given in Appendix D.

Five transverse and three longitudinal fuel sections were taken from Rod NBD107 as indicated in Figure 4.11 to provide detailed ceramographic/metallographic characterization across the fuel radius and at fuel axial locations with a variety of cladding temperatures and fuel burnups. The fuel sections taken from the low-power regions of the fuel rod also provide information on as-fabricated fuel data such as grain size and porosity. Representative results obtained to date of the fuel ceramography (Section 4.5.2) and cladding metallography (Section 4.5.3) conducted on Rod NBD107 of ATM-106 are discussed below. Photographic details of all samples are provided in Appendix E.

4.5.2 Ceramography of ATM-106 Fuel

The fuel sections obtained from Rod NBD107 were used to characterize porosity and microstructural variations as a function of radial position and axial location. The general cracking pattern, porosity in the fuel, wedging of small fuel particles between fuel fragments and in the gap, and as-irradiated gap width are of interest and can be observed in the

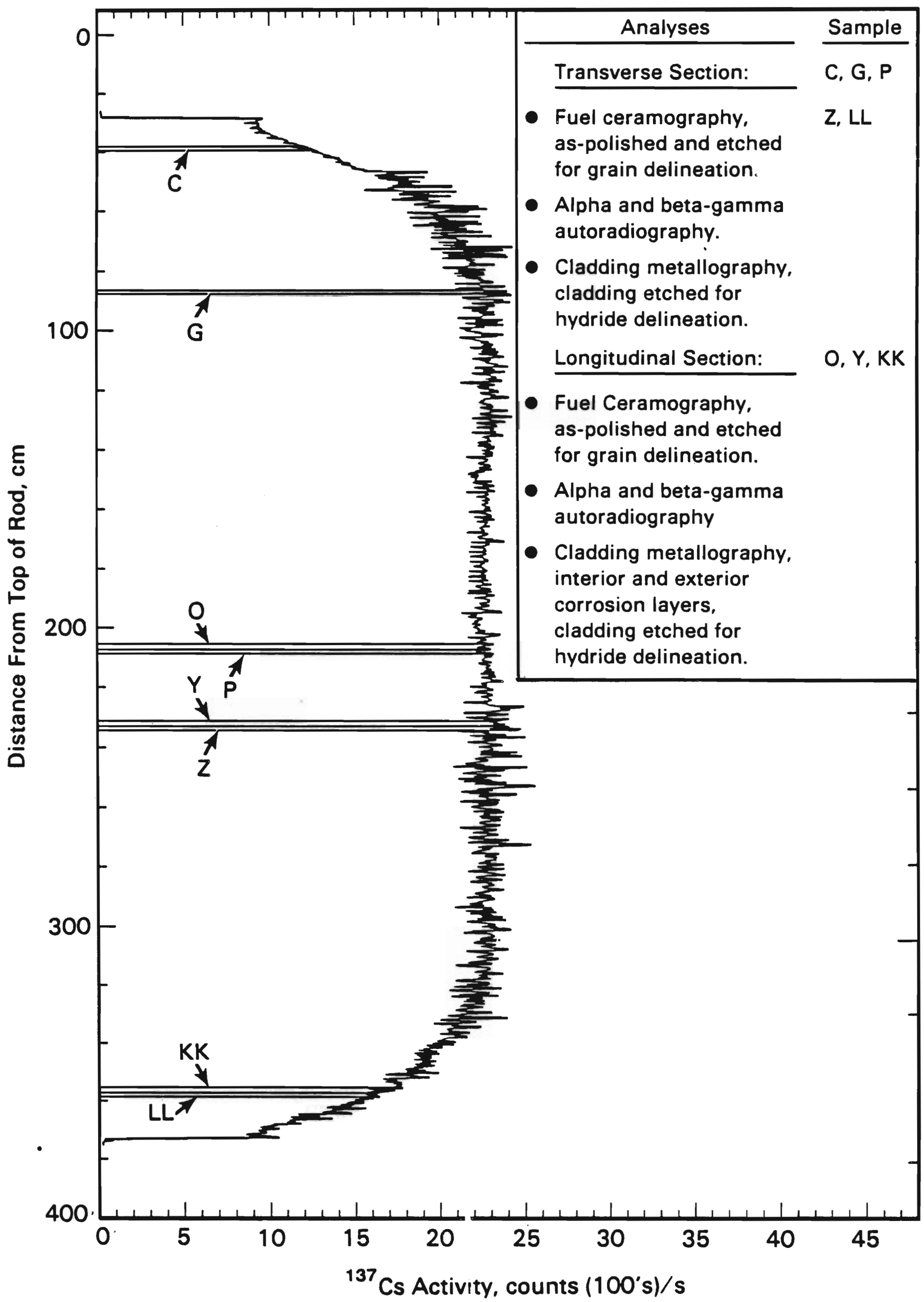


FIGURE 4.11. Locations of Ceramographic/Metallographic Samples from Rod NBD107

as-polished transverse and longitudinal samples. The cracking pattern and gap width are of interest in calculating in-reactor temperatures. The number of fuel fragments/pieces and their sizes can be used to estimate the surface area of the fuel. Fission gas bubble size and distribution, metallic ingots, and grain size variations are also of interest. The grain size variations are particularly observable after etching the fuel samples. The number and size of fission gas bubbles is best observed in the as-polished condition; however, etching is useful in determining the location of the fission gas bubbles. The formation of fission gas bubbles and grain growth correlate with higher fuel temperatures and migration of fission products. The metallic ingots (also called five-metal particles) are typically seen only near the fuel center, if at all, in fuel with moderate to high operating temperatures. Details are given below for the macrophotography and microphotography of the fuel in the as-polished and as-etched conditions.

Both the transverse and longitudinal fuel samples were prepared for examination by placing them in mounts followed by vacuum impregnation with polyester resin. The mounts included a reference notch so that high-magnification photographs of the as-polished and etched samples could be taken along approximately the same radial line. After grinding the mounted fuel with up to a 600 grit in a water-base lubricant, the samples were polished with a 1-μm diamond paste using kerosene. A final polish was then made in a 0.3-μm Al_2O_3 aqueous suspension.

<u>As-Polished Fuel Condition</u>

Several features of interest were investigated using the as-polished fuel samples: 1) crack patterns, 2) variations in porosity of the fuel, and 3) metallic ingot formation. These features are discussed below.

<u>Crack Patterns</u>. The as-polished transverse and longitudinal samples of fuel sectioned from the peak-power region of Rod NBD107 are shown in Figures 4.12 and 4.13, respectively. Sample 106-NBD107-P (a transverse sample) is highly fragmented. There are four to five relatively wide-gapped cracks approximately the length of the fuel radius intersecting at various locations in the fuel. Randomly-oriented shorter cracks intersect the longer cracks at various angles. In addition, nonintersecting shorter cracks approximately

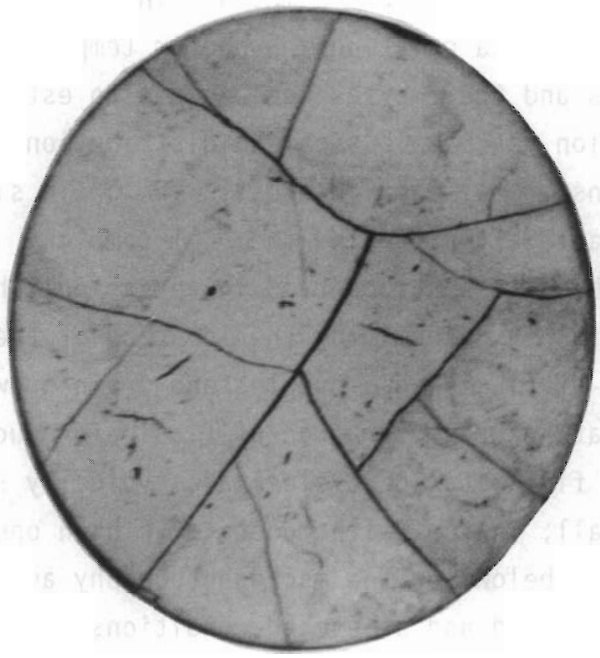


FIGURE 4.12. Photomacrograph of As-Polished Transverse Sample 106-NBD107-P from the Peak-Power Region (~10x) (Neg. No. 8704675-20) (Note: Photo taken at an oblique angle to fuel surface)

0.6 to 0.8 mm (0.02 to 0.03 in.) in length are present. The majority of cracks intersecting the outer fuel edge are approximately normal to this edge.

As-polished longitudinal Sample 106-NBD107-0 (also taken at the peak-power region adjacent to the previously described transverse section) has several cracks intersecting along the fuel center axis of the longitudinal sample. Multiple transverse cracks, extending from the central axial cracks to the outer pellet edge, intersect the outer edge of the fuel at random angles. Although the fuel is highly fragmented, negligible numbers of fuel particles relocated into the dish region or the fuel/cladding gap. The ATM-106 fuel sample from Rod NBD107 at the peak-power region is similar to samples taken from the peak-power regions of ATM-101 (Barner 1985) and ATM-103 (Guenther et al. 1988).

Porosity Variation. Porosity in the fuel consists of macropores that are generally greater than 50 μm in size and micropores of less than 4 μm in diameter. The macroporosity is observable under low magnification and is

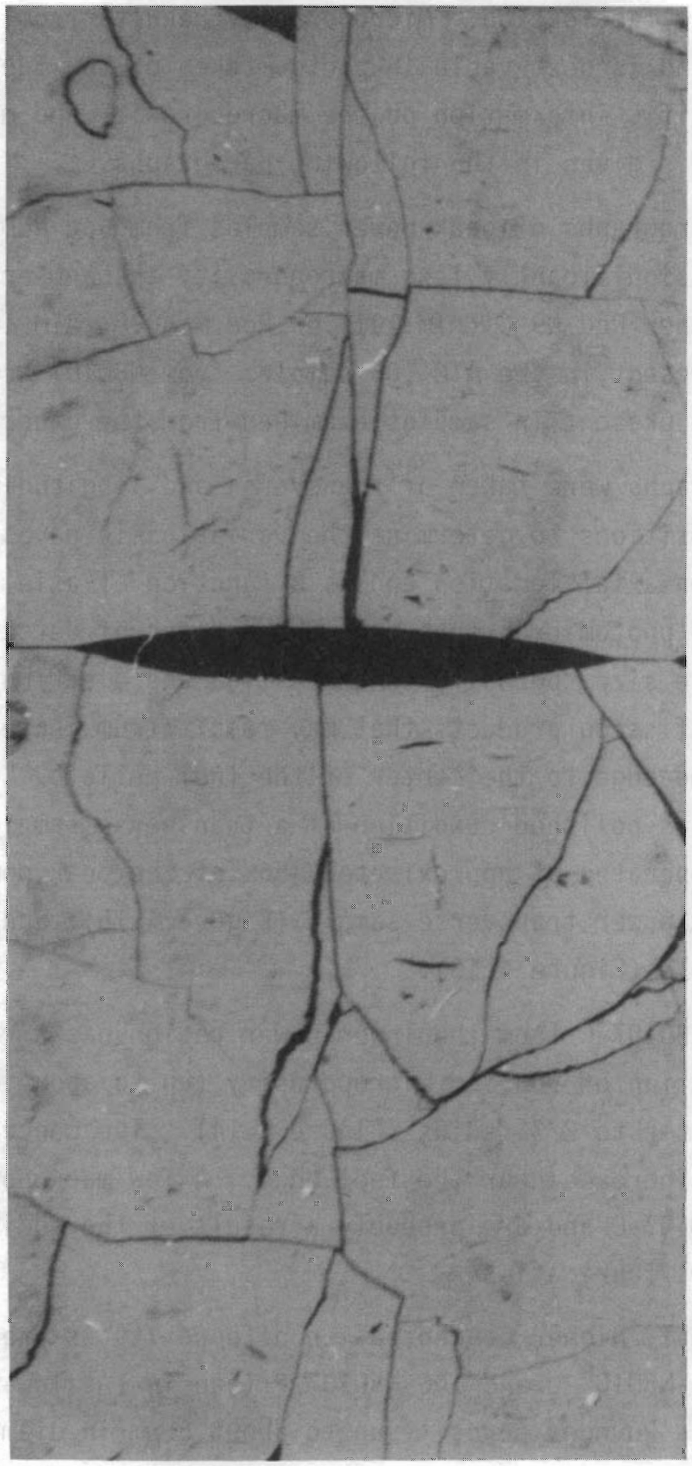


FIGURE 4.13. Photomacrograph of As-Polished Longitudinal Sample 106-NBD107-O from the Peak-Power Region (~10x) (Neg. No. 8704675-15) (Note: Photo taken at an oblique angle to fuel surface)

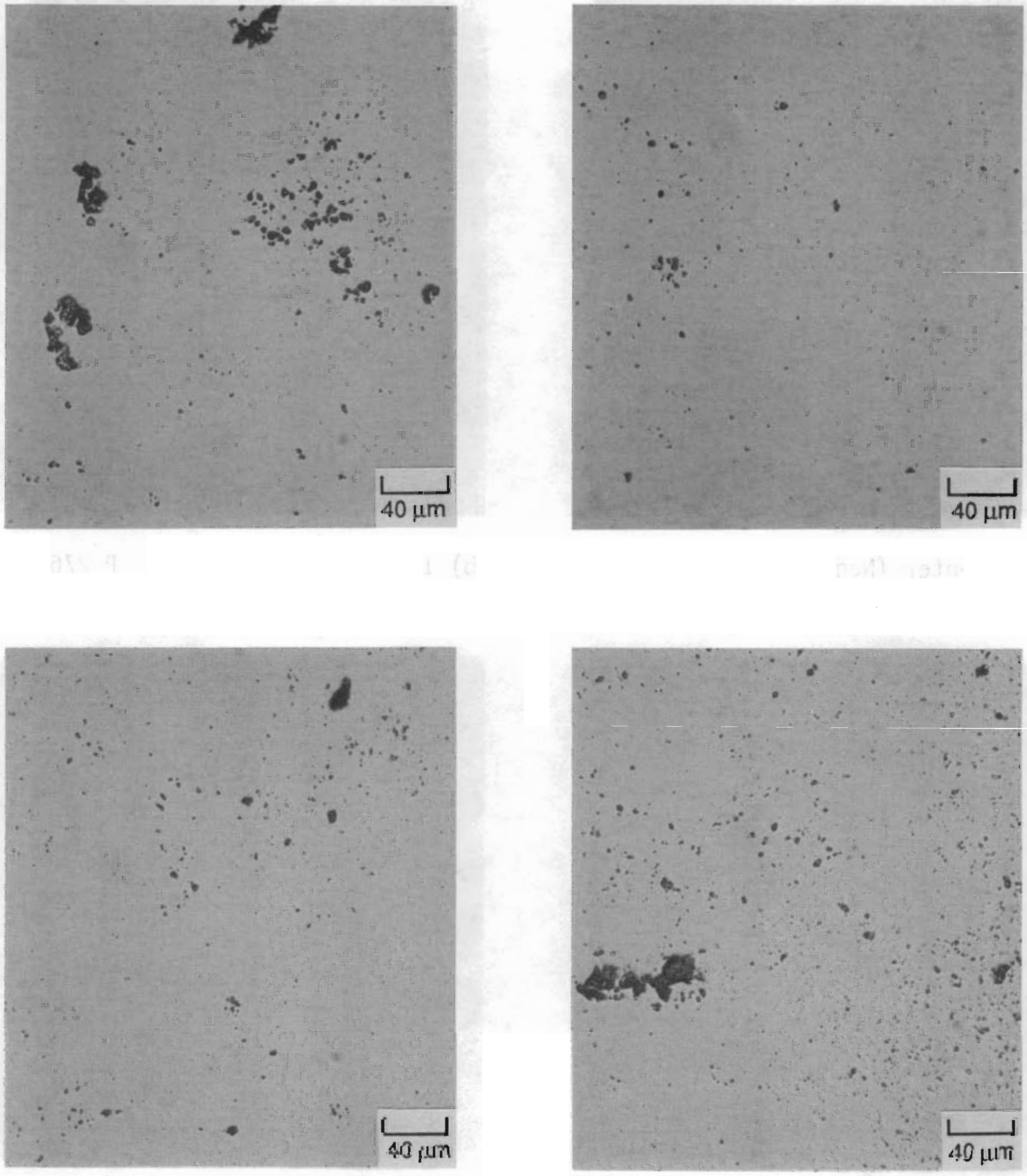
formed during fuel fabrication. Microporosity results from fuel fabrication and irradiation and is observable in photos taken of the fuel under high magnification. Specific information on the macroporosity and microporosity for the ATM-106 fuel is given in the following paragraphs.

The photomacrographs of peak-power samples from Rod NBD107 (Figures 4.12 and 4.13) reveal significantly less macroporosity than observed for samples examined from either Rod N9-C (ATM-101) or Rod MLA098 (ATM-103). The macropores that are present in the ATM-106 samples from NBD107 are significantly larger than those present in samples examined from the other ATMs.

Photomicrographs were taken of transverse and longitudinal fuel samples at four radial positions to determine the variation in porosity from center to edge at a given axial location and as a function of axial position. Comparison of radial photomicrographs provides a means of detecting changes in fission gas bubble size, porosity concentration and distribution, and the agglomeration of fission products that may result from increasing fuel temperatures from the edge to the center of the fuel pellet. Comparisons are made between the as-polished condition of a transverse sample from a region of the rod that operated at approximately 56% of the peak power (Figure 4.14), a peak-power transverse sample (Figure 4.15), and a peak-power longitudinal sample (Figure 4.16).

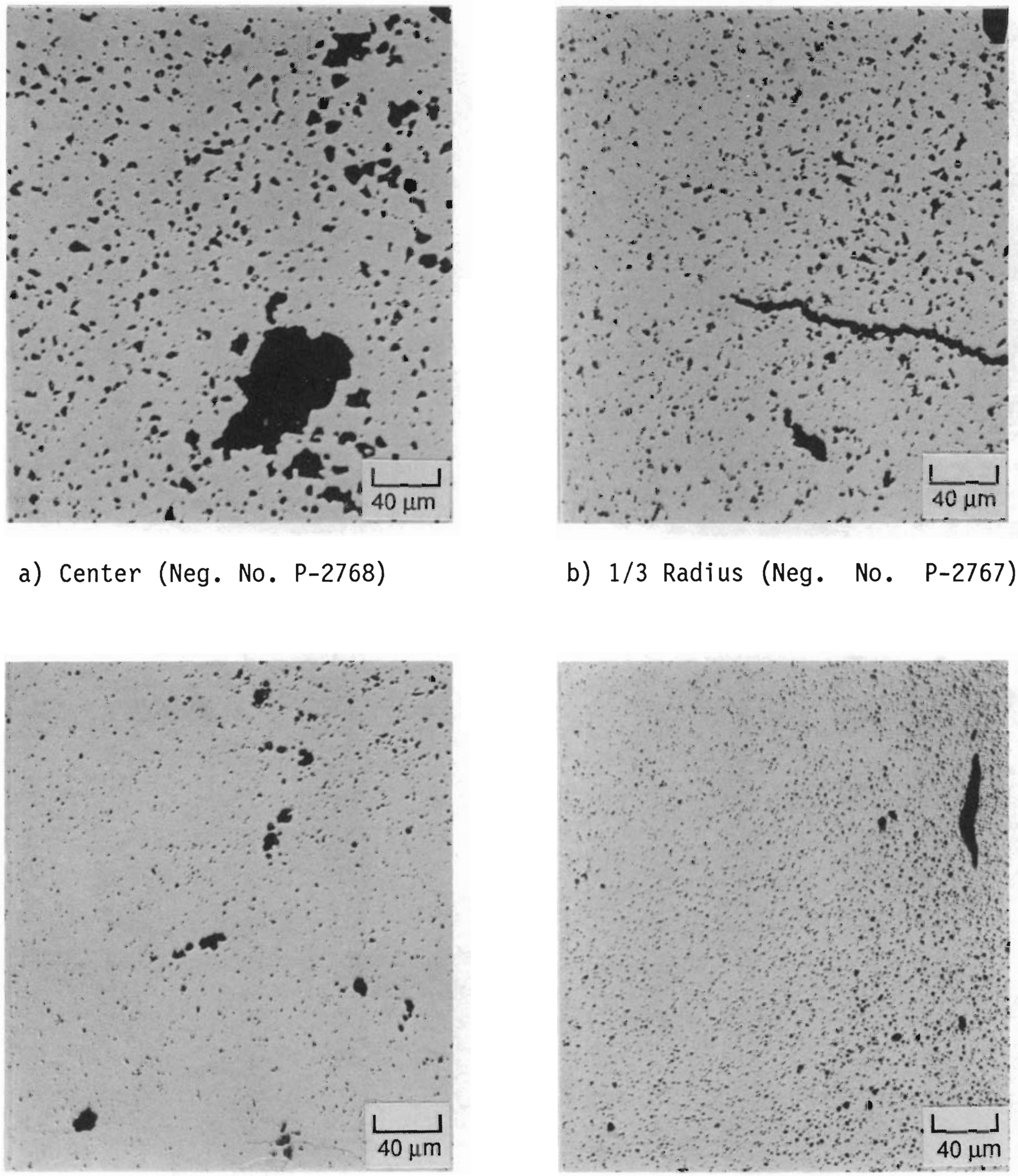
Sample 106-NBD107-C from the lower-power region has a relatively uniform and low concentration of rounded microporosity (up to about 4 μm in diameter) from the fuel center to 2/3 radius (Figure 4.14). The concentration of small pores appears to increase near the fuel edge. A few macropores are observed in Sample 106-NBD107-C and are probably a result of the addition of a pore former during fuel fabrication.

A significantly higher concentration of porosity is present in peak-power Samples 106-NBD107-O and 106-NBD107-P than in the low-power Sample 106-NBD107-C. Rounded porosity up to about 5 μm in diameter is present from the centerline to 1/3-radius positions in Samples 106-NBD107-O and 106-NBD107-P. The amount of porosity with diameters above 2 μm substantially decreases as the distance from the center increases; the majority of porosity beyond 1/3-radius is ≤ 2 μm in diameter. A substantial amount of elongated porosity is present in both samples and is concentrated at the fuel



c) 2/3 Radius (Neg. No. P-3054) d) Edge (Neg. No. P-3053)

FIGURE 4.14. Photomicrographs of As-Polished Transverse Sample 106-NBD107-C from a Region at Approximately 56% of Peak Power



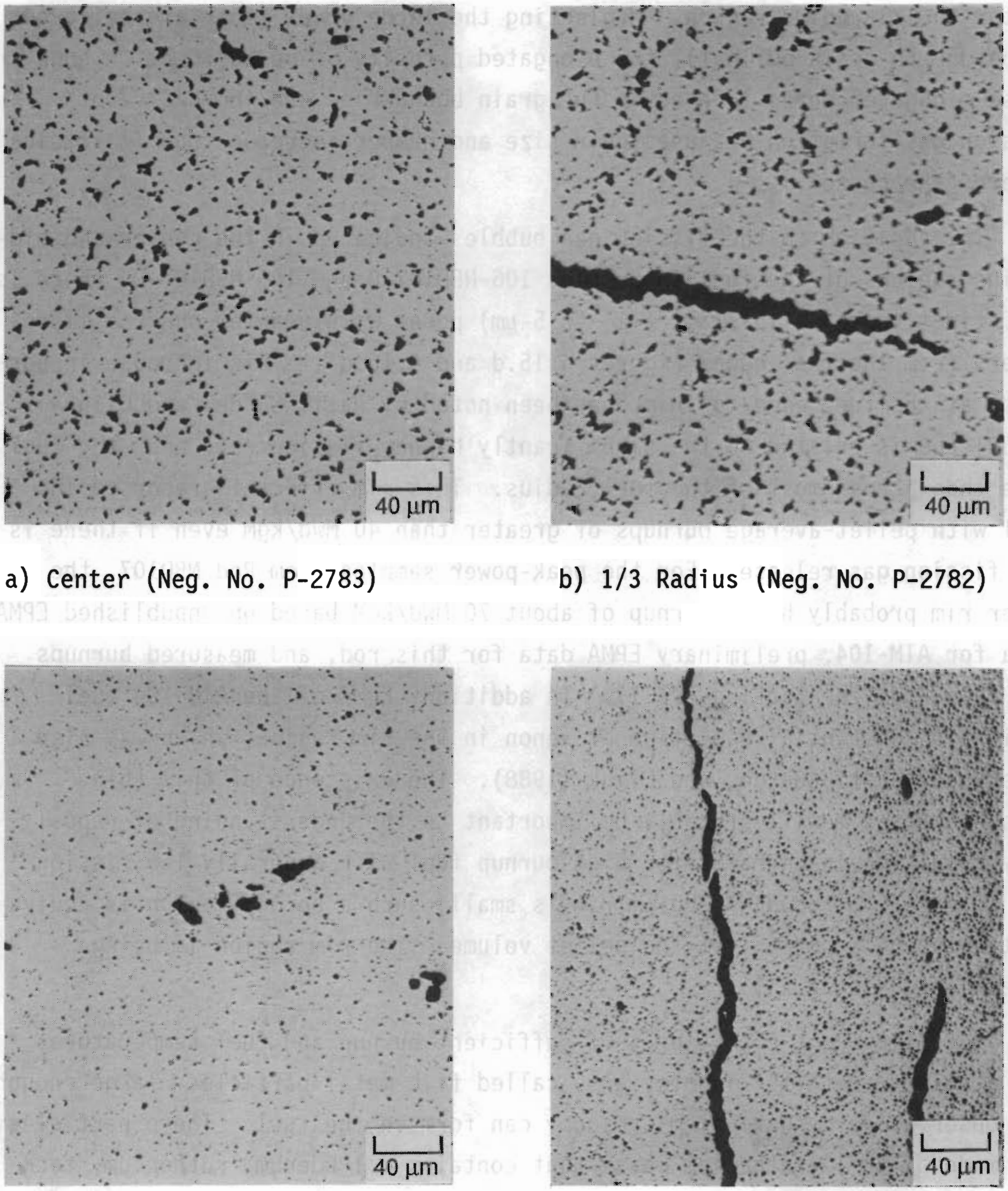
a) Center (Neg. No. P-2768)

b) 1/3 Radius (Neg. No. P-2767)

c) 2/3 Radius (Neg. No. P-2766)

d) Edge (Neg. No. P-2765)

FIGURE 4.15. Photomicrographs of As-Polished Transverse Sample 106-NBD107-P from the Peak-Power Region



a) Center (Neg. No. P-2783)　　b) 1/3 Radius (Neg. No. P-2782)

c) 2/3 Radius (Neg. No. P-2781)　　d) Edge (Neg. No. P-2780)

FIGURE 4.16. Photomicrographs of As-Polished Longitudinal Sample 106-NBD107-0 from the Peak-Power Region

center to 1/3-radius region. Neglecting the large voids (that are believed to be due to grain pullout), the elongated porosity is up to 10 μm on edge. These elongated pores located at the grain boundaries are indicative of fission gas formation because their size and number increase from 1/3-radius towards the center.

In addition to the fission gas bubbles indicated in the center and mid-radius regions of the fuel in Samples 106-NBD107-O and 106-NBD107-P, there is a distinct increase in small (~1- to 5-μm) pores within a few hundred micrometers from the fuel edge (Figures 4.15.d and 4.16.d). This increase in porosity at the fuel edge, or rim, has been noted by Pati, Garde, and Clink (1988) and is related to the significantly higher fission rate near the fuel edge than across most of the fuel radius. This rim effect is reported in fuel with pellet-average burnups of greater than 40 MWd/kgM even if there is low fission gas release. For the peak-power samples from Rod NBD107, the outer rim probably has a burnup of about 70 MWd/kgM based on unpublished EPMA data for ATM-104, preliminary EPMA data for this rod, and measured burnups for this rod (see Section 4.7.1). In addition, EPMA of the ATM-104 fuel indicates substantial depletion of xenon in the rim region, which was also observed by Pati, Garde, and Clink (1988). The existence of this thin, porous outer rim will probably be important to the understanding of repository condition leach rates for high-burnup fuel with generally low fission gas release. Although a 200-μm rim is small, such a porous region is equivalent to about 8 percent of the pellet volume. The rim region is being investigated in detail.

Metallic Ingot Formation. If sufficient burnup and fuel temperatures are attained, metallic ingots, also called five-metal particles, large enough for observation by optical microscopy can form in the fuel. These particles are made of the -ruthenium phase that contains molybdenum, ruthenium, technetium, palladium, and rhodium. When seen, the ingots appear as bright white spots as shown in Figure 4.17 for the central fuel region of peak-power Sample 106-NBD107-Z. The concentration of the metal ingots is much higher than in the ATM-103 fuel with low fission gas release, particularly for high-power samples in Rod NBD107 where substantial cesium movement occurred as

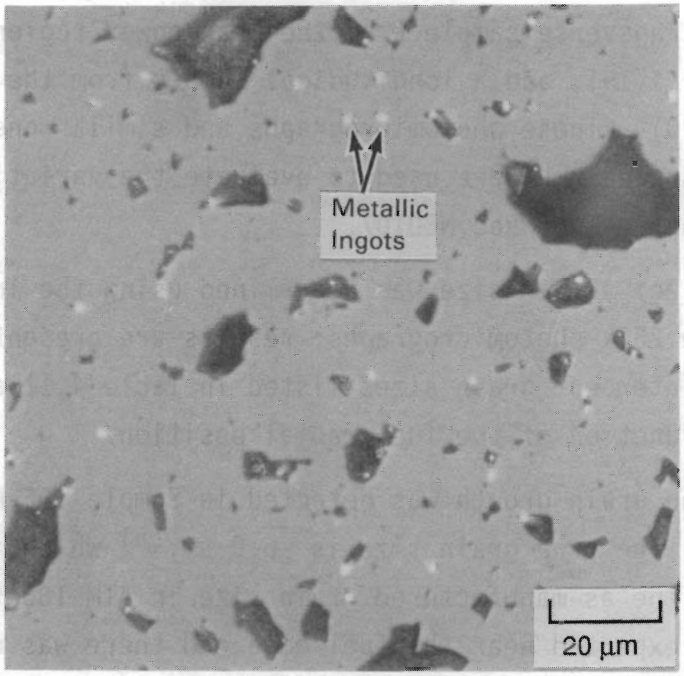


FIGURE 4.17. Example of Metallic Ingots Near Center of As-Polished Transverse Sample 106-NBD107-Z (Neg. No. P-3041)

indicated for Samples 106-NBD107-G, 106-NBD107-Y, and 106-NBD107-Z in Figure 4.11. The number of visible metallic ingots decreases with increasing distance from the center of a sample and drops significantly at positions beyond 2/3 radius.

The metallic ingots are significantly more visible in the peak-power fuel samples from Rod NBD107 than they were in PWR Rod MLA098 (ATM-103). Because higher fission gas release indicates higher operating fuel temperatures, the formation of secondary phases in the ATM-106 fuel is consistent with the considerably higher fission gas release of ~11% determined for Rod NBD107 compared with ~0.25% for Rod MLA098.

As Etched Fuel Condition

ATM-106 peak-power fuel samples were etched using argon ions in a cathode vacuum etcher to determine any grain size variation with radial position and determine if porosity was preferentially located at selected sites, e.g., at grain boundaries, in the grain interior. Examples of the as-etched fuel are provided for a transverse sample from a region at about 56% of peak power

(Figure 4.18), a transverse sample from the peak-power region near the middle of the rod (Figure 4.19), and a longitudinal sample from the peak-power region (Figure 4.20). These photomicrographs and similar ones for other fuel samples shown in Appendix E were used to evaluate the variation in grain size and porosity in the fuel of Rod NBD107.

Fuel Grain Size. Grain size was determined using the intercept method (ASTM 1980) on the 250x photomicrographs; results are presented in Table 4.11. The intercept grain sizes listed in Table 4.11 are plotted in Figure 4.21 as a function of the fuel radial position.

Essentially no grain growth was detected in Sample 106-NBD107-C from the low-power region. The true grain size is ~6.9 μm,[(a)] which is believed to be representative of the as-manufactured grain size in ATM-106 fuel because negligible growth is expected near the fuel edge and there was no grain growth across the fuel at this location. The fuel design specified grains ≥5 μm. A significant increase in grain size is apparent near the fuel center and 1/3 radius positions of high-power samples from Rod 106-NBD107. True grain size near the fuel center ranged from 6 to 16 μm, compared with the outer pellet edge grain sizes of 6 to 9 μm, indicating grain growth as high as 116% (See Table 4.11).

Sample 106-NBD107-Z had greater grain growth at the 1/3-radius and 2/3-radius locations than at the fuel center. However, the gamma scan data suggest more cesium release in the region of Sample 106-NBD107-Z (See Figure 4.11) than in other peak-power locations, and beta-gamma autoradiography of this sample (See Section 4.5.4) suggests an asymmetric fission product distribution that is consistent with slightly lower grain growth at the fuel center than at the 1/3-radius locations. The photomicrographs used to obtain the grain growth in this sample were taken on a radial line from the fuel edge across a large crack perpendicular to the fuel radius (See Appendix E). This crack could have created a heat transfer barrier that caused the

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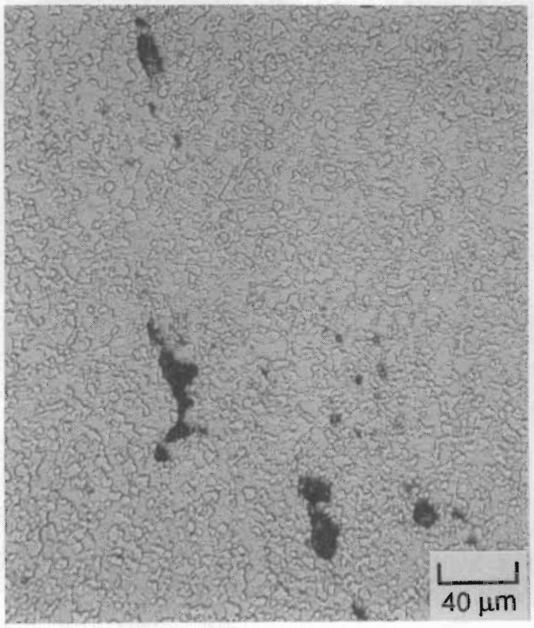
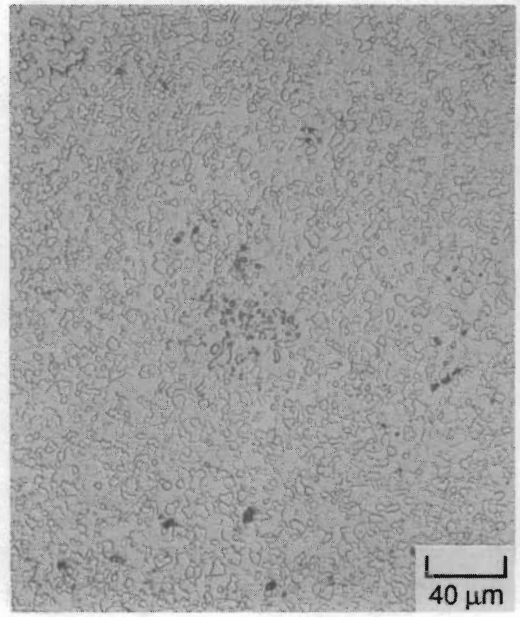
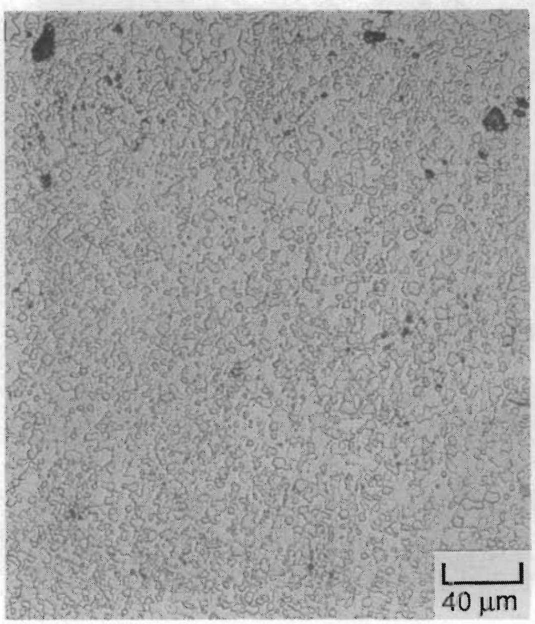
(a) True grain size is determined by multiplying the grain size obtained using the intercept method by 1.57 (ASTM 1980). This corrects for the grains that appear smaller in the ceramographic section than they really are because sectioning does not show the true grain size of all grains.



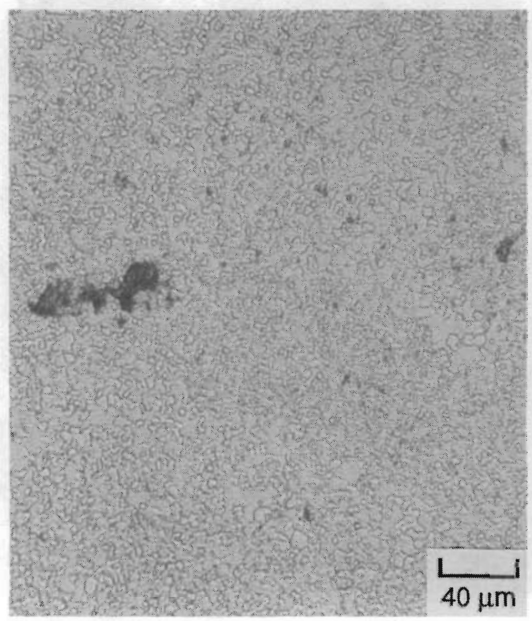
a) Center (Neg. No. P-3192)



b) 1/3 Radius (Neg. No. P-3191)

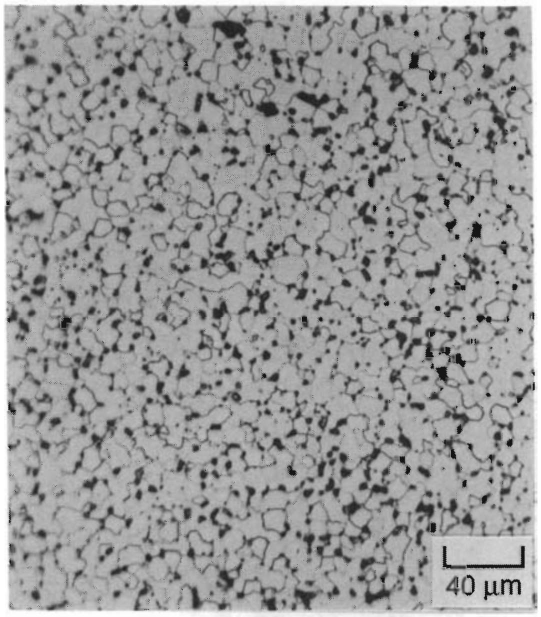


c) 2/3 Radius (Neg. No. P-3190)

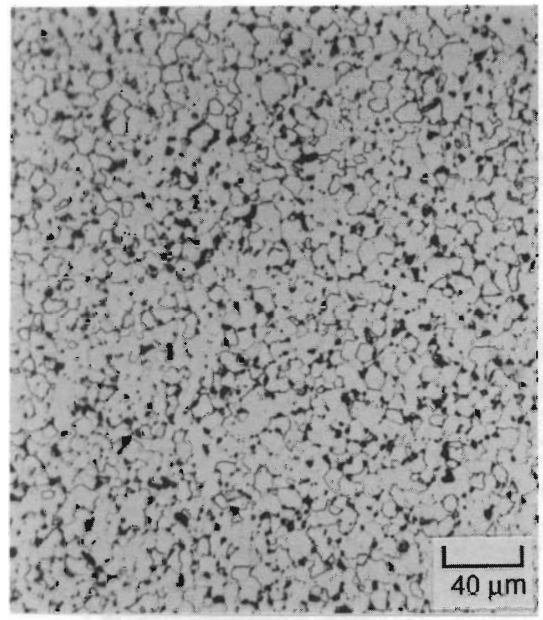


d) Edge (Neg. No. P-3189)

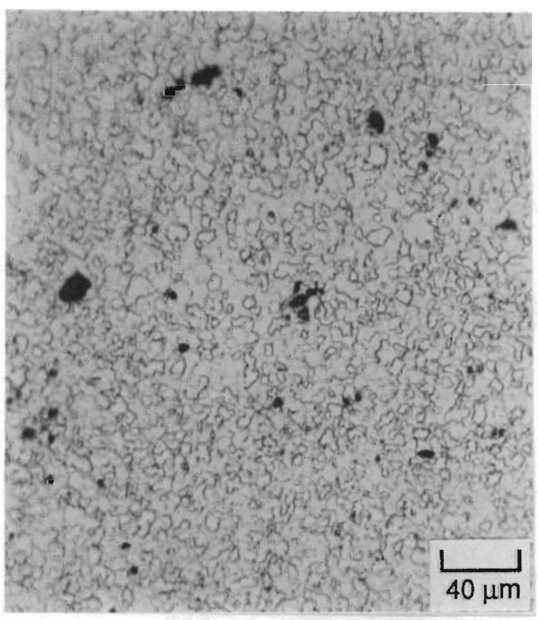
FIGURE 4.18. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-C from a Region at Approximately 56% of Peak Power



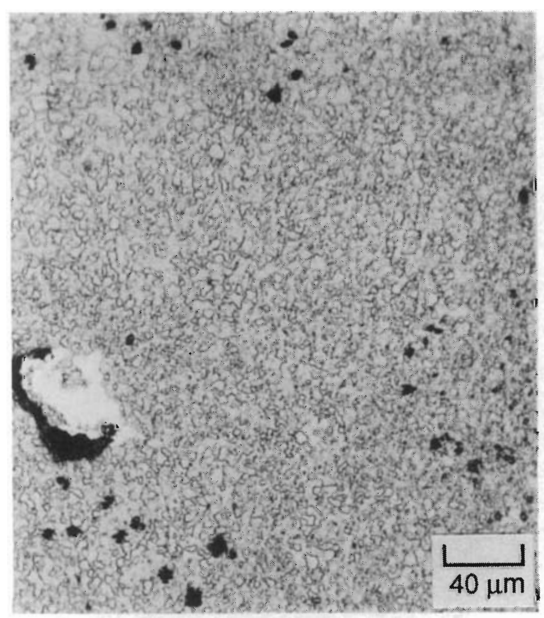
a) Center (Neg. No. P-2940)



b) 1/3 Radius (Neg. No. P-2939)

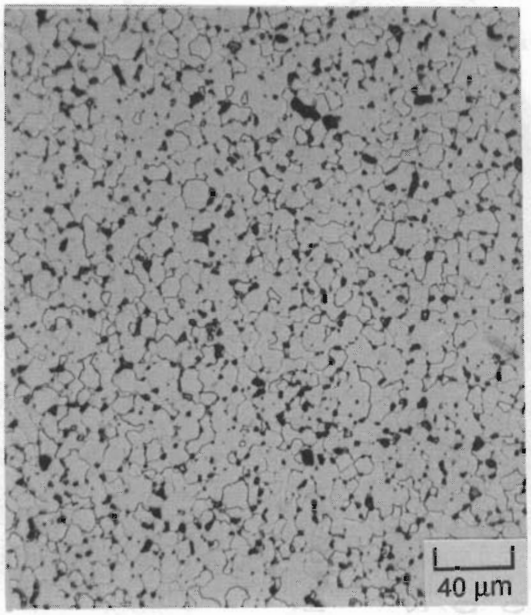


c) 2/3 Radius (Neg. No. P-2938)

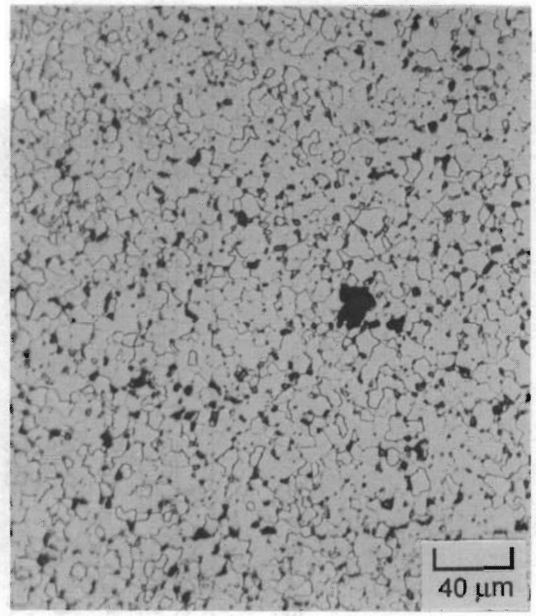


d) Edge (Neg. No. P-2937)

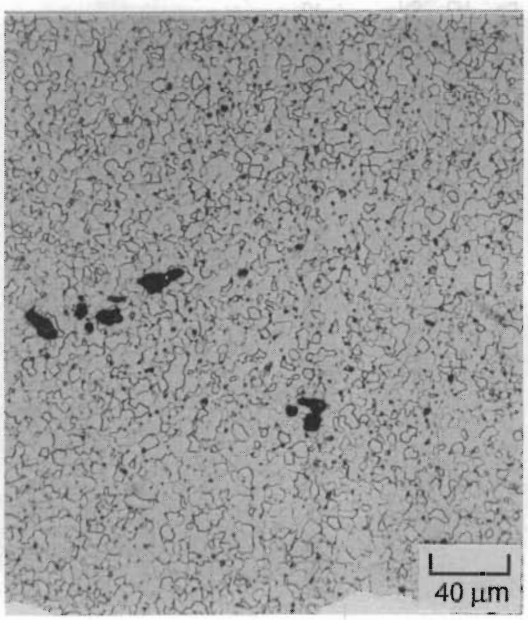
FIGURE 4.19. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-P from the Peak-Power Region



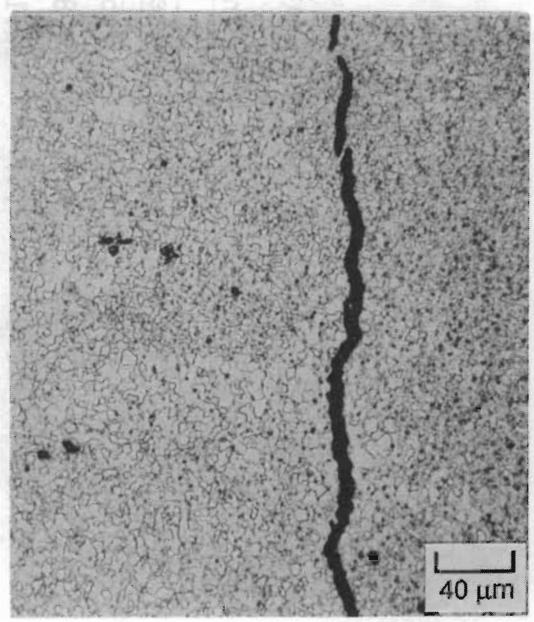
a) Center (Neg. No. P-2936)



b) 1/3 Radius (Neg. No. P-2935)



c) 2/3 Radius (Neg. No. P-2934)



d) Edge (Neg. No. P-2933)

FIGURE 4.20. Photomicrographs of Argon Ion-Etched Longitudinal Sample 106-NBD107-O from the Peak-Power Region

TABLE 4.11. Results of Fuel Grain Size Measurements[a]

Sample ID	Grain Size, μm: Center		1/3 Radius		2/3 Radius		Edge	
	Intercept	True	Intercept	True	Intercept	True	Intercept	True
106-NBD107-C	4.3	6.8	4.8	7.5	4.4	6.9	4.1	6.4
106-NBD107-G	8.6	13.5	6.9	10.8	5.6	8.8	4.2	6.6
106-NBD107-O	7.6	11.9	7.7	12.1	5.4	8.5	4.4	6.9
106-NBD107-P	8.7	13.7	7.6	11.9	5.5	8.6	4.9	7.7
106-NBD107-Y	10.3	16.2	7.9	12.4	5.9	9.3	4.8	7.5
106-NBD107-Z	9.1	14.3	10.0	15.7	9.0	14.1	4.7	7.4
106-NBD107-KK	9.6	15.1	7.3	11.5	6.0	9.4	5.8	9.1
106-NBD107-LL	9.2	14.4	7.1	11.2	5.2	8.2	5.6	8.8

(a) The true grain size equals the intercept grain size multiplied by 1.57.

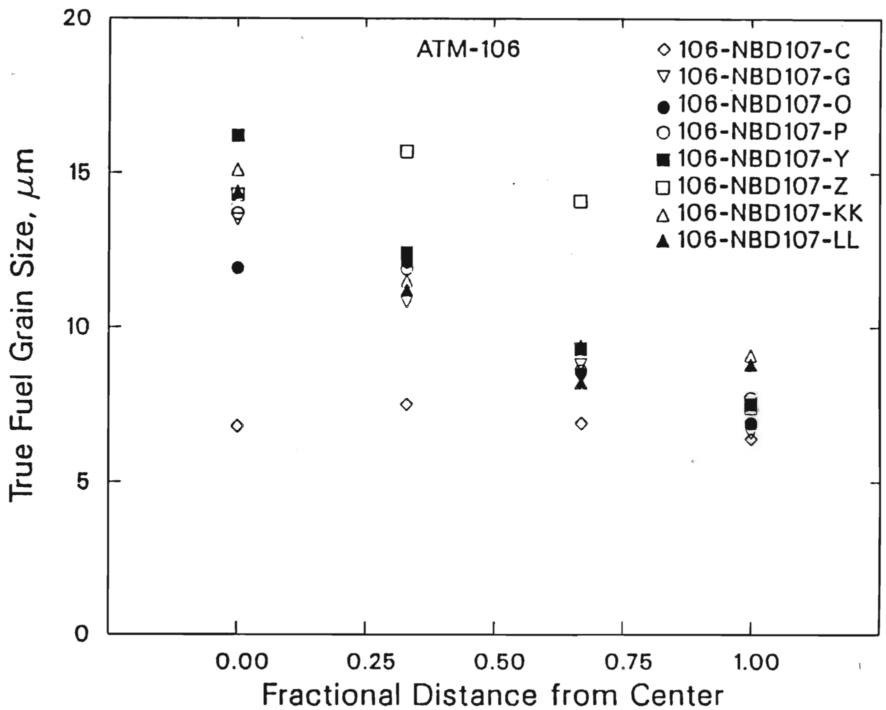


FIGURE 4.21. Comparison of Radial Variation in True Grain Size of Fuel Samples from Rod NBD107 of ATM-106

apparently asymmetric radial temperture profile in Sample 106-NBD107-Z indicated by the shape of the grain growth curve in Figure 4.21.

In contrast to Rod NBD107, the samples from Rod MLA098 of ATM-103 indicated negligible grain growth at peak-power locations (Guenther et al. 1988) as expected because of the lower discharge burnup and fission gas release than in the ATM-106 rods. The significant grain growth observed in the peak-power region of Rod NBD107 indicates high fuel operating temperatures and is consistent with the high fission gas release of approximately 11%.

Fuel Porosity. The ~2- to 5-μm diameter pores previously noted for the as-polished fuel samples from Rod NBD107 are present almost exclusively at grain boundaries and grain boundary intersections. Elongated porosity, concentrated primarily near the fuel center is located predominantly at grain boundary intersections. The rounded and elongated pores at the fuel centers are consistent with the formation of fission gas bubbles in this fuel with a rod-averaged fission gas release of ~11%, although some of the elongated porosity is probably due to grain pullout during the sample preparation steps. Variations in the amount of grain boundary porosity in the fuel samples from Rod NBD107 are consistent with the cesium release indicated by the gamma scan data and by the grain growth measured for these samples. Greater cesium release and fuel grain growth are indicative of higher fuel temperatures. Sample 106-NBD107-C from the upper end of Rod NBD107, where the power was low (about 56% of peak burnup), had essentially no grain growth (Table 4.11), no indication of cesium release (Figure 4.11), and no indication of fission gas bubbles at the grain boundaries near the fuel center (Figure 4.18.a). In contrast, Sample 106-NBD107-KK from the other end of the rod at about 73% of the peak power had about 66% grain growth at the fuel center, indications of cesium release, and grain boundary porosity similar to that in the peak-power Sample 106-NBD107-O, which had about 72% grain growth. Such variations in the distribution of fission products and grain growth are expected to be important to the selection of fuel samples for repository testing.

4.5.3 Metallography of ATM-106 Cladding

Oxide thickness on the interior and exterior cladding surfaces and hydride orientation within the cladding were determined during the cladding examinations conducted on the same mounted samples used for the fuel examinations. Information on the exterior oxide/crud layers is useful in determining the potential for airborne contamination during handling operations and potential interactions with the exterior environment during disposal. The interior oxide layer is of interest for correlating fission product deposits with structural observations in the fuel as possible clues to fission product distributions. Hydride orientations are important to the failure sensitivity of the cladding because of the brittle nature of zirconium hydrides. Selected data obtained on cladding oxide and hydride examinations from Rod NBD107 are provided below. Photographic details of all samples examined are provided in Appendix E.

Cladding Oxide Examinations

Oxide thickness measurements made on as-polished cladding samples are listed in Table 4.12. The interior cladding surfaces of low-power Sample 106-NBD107-KK and peak-power Sample 106-NBD107-O have relatively uniform

TABLE 4.12. Oxide Layer Thicknesses on Cladding of ATM-106 Samples

		Oxide Thickness,[a] μm (mil)					
		Exterior Layer			Interior Layer		
Sample	Axial Location, cm (in.) From Top of Fuel Rod	Average Measured Thickness	Standard Denitration	Observations	Average Measured Thickness	Standard Denitration	Observations
106-NBD107-G	87.0 (34.3)			No examination.	5.4 (0.21)	±2.3 (0.09)	Nonuniform thickness, solid. Fuel adhered to oxide. Oxide partly separated from cladding surface.
106-NBD107-O	206.4 (81.3)	11.1 (0.44)	±2.6 (0.10)	Uniform thickness, layered. Outermost layer spalling.	9.3 (0.37)[b]	±4.4 (0.17)	Uniform thickness, solid, some bare cladding.
106-NBD107-Y	232.3 (91.4)	15.4 (0.61)	±1.2 (0.04)	Uniform thickness, layered.	3.5 (0.14)	±1.6 (0.06)	Uniform thickness, solid.
106-NBD107-KK	356.3 (140.3)	4.4 (0.17)	±1.6 (0.06)	Uniform thickness, solid. Notched on outer surface.	3.8 (0.15)	±1.6 (0.06)	Uniform thickness, solid. Fuel adhered to oxide.
106-NBD107-LL	358.0 (140.9)	5.5 (0.22)	±1.4 (0.05)	Uniform thickness, solid. Notched on outer surface.	5.3 (0.21)	±1.4 (0.05)	Uniform thickness, solid. Fuel adhered to oxide.

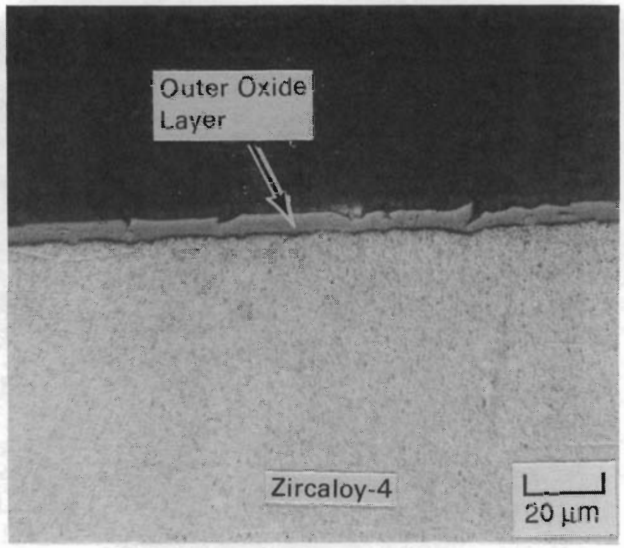
(a) Oxide thickness determined from Figures 4.22 and 4.23 and the figures in Appendix E with a minimum of 30 measurements over the length of the photographed region of the sample. Reported range is two standard deviations.
(b) Typical where present.

oxide/reaction product deposits as shown in Figures 4.22 and 4.23, respectively. The typical oxide layer thickness on the interior cladding surface varies from 4 to 9 μm. The uniform deposits on the ATM-106 cladding surface contrast with cladding oxides measured for ATM-103, which had localized reaction products on the relatively bare interior cladding surfaces of peak-power samples and negligible deposits on the low-power samples of Rod MLA098 (Guenther et al. 1988). These high-magnification photos also clearly show the difference in rim porosity near the edges of high-burnup (~46 MWd/kgM) and moderate-burnup (~34 MWd/kgM) fuel.

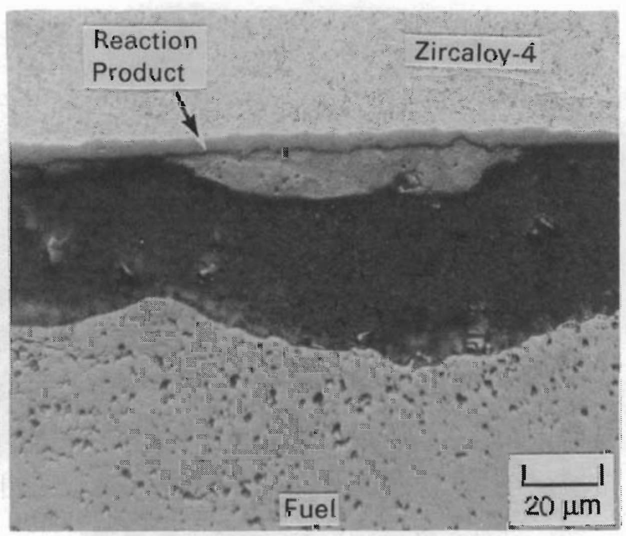
The oxide thickness on the exterior cladding surface of Rod NBD107 was thicker at the center than at the bottom of the fuel rod. No exterior cladding surfaces have been examined at the top of the rod. Samples examined from near the center of the fuel rod had a multi-layered exterior oxide ranging from approximately 11 to 15 μm thick (Table 4.12). The outermost oxide layer has separated from the remaining inner layers of Sample 106-NBD107-0, indicating that the deposits are loosely held (Figure 4.23a). The oxide on the cladding exterior surface near the bottom end of the rod formed a single solid layer (Figure 4.22a). The observations of deposits on the exterior cladding surfaces of Rod NBD107 (ATM-106) are similar to samples examined from Rod MLA098 of ATM-103, neither of which had indications of crud deposits.

Cladding Hydride Examinations

The Zircaloy-4 cladding was etched with a 45% HNO_3, 45% glycerin, 10% HF solution to reveal the cladding grain structure. This step was followed by etching with a 45% HNO_3, 45% H_2O_2, 10% HF solution to reveal the hydrides. Hydrides in the cladding near the center of the fuel rod are present primarily in the circumferential/longitudinal planes as shown in Figures 4.24 and 4.25. A significantly greater amount of hydriding is observed in cladding samples from the upper half of Rod NBD107 (Figures 4.26 and 4.27). This increase in hydriding is consistent with the higher cladding oxide thicknesses indicated in Table 4.12. The hydriding level is known to increase with increasing corrosion but also depends on neutron fluence, cladding prefilms, and other factors (Lanning et al. 1984; Johnson and Lanning 1985).

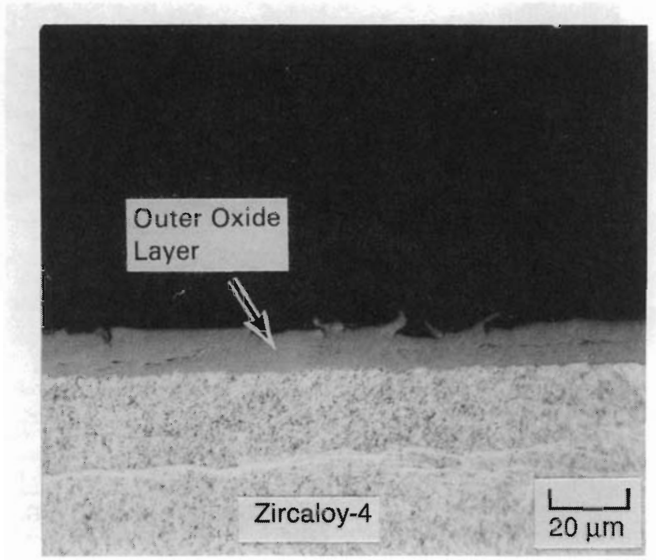


a) Exterior Surface (Neg. No. P-3006)

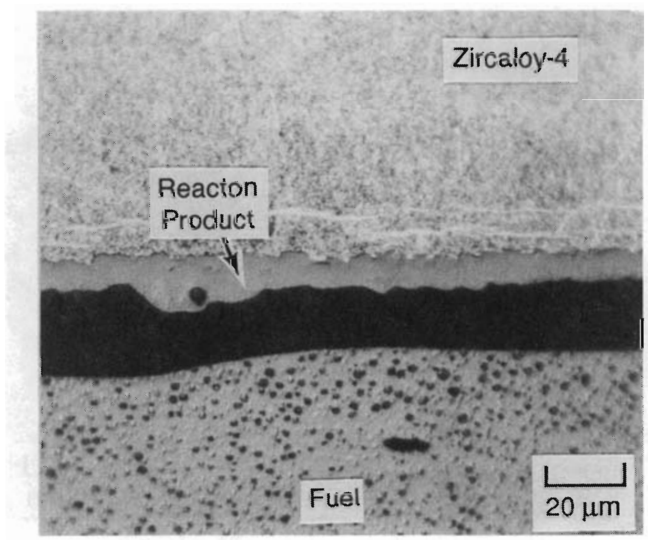


b) Interior Surface (Neg. No. P-3007)

FIGURE 4.22. Exterior and Interior Cladding Surface of As-Polished Sample 106-NBD107-KK Taken from a Region at about 73% of the Peak Power



a) Exterior Surface (Neg. No. P-2784)



b) Interior Surface (Neg. No. P-2785)

FIGURE 4.23. Exterior and Interior Cladding Surface of As-Polished Sample 106-NBD107-0 from the Peak-Power Region

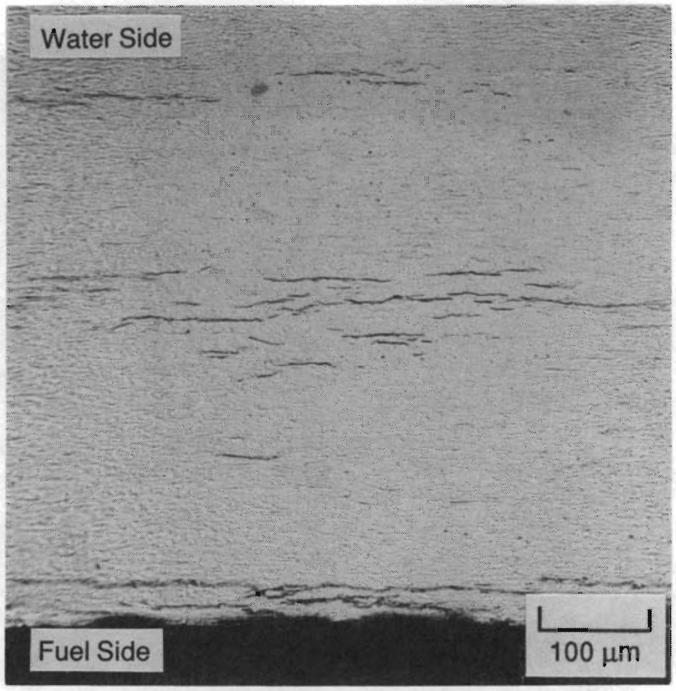


FIGURE 4.24. Etched Cladding of Longitudinal Sample 106-NBD107-O from the Peak-Power Region (Neg. No. P-3273)

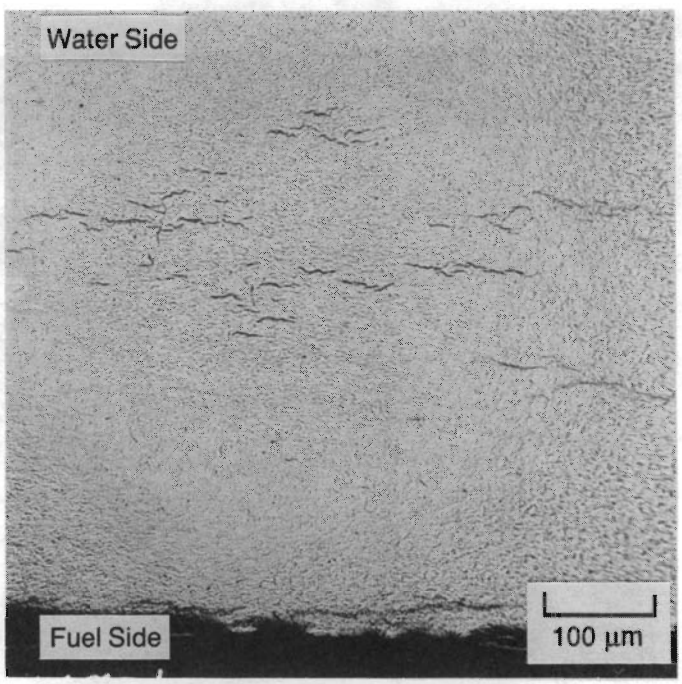


FIGURE 4.25. Etched Cladding of Transverse Sample 106-NBD107-P from the Peak-Power Region (Neg. No. P-3247)

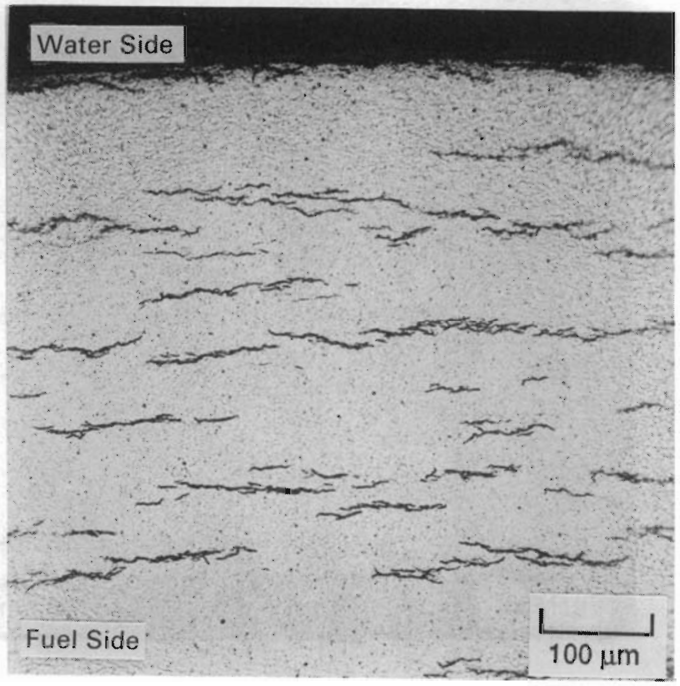


FIGURE 4.26. Etched Cladding of Transverse Sample 106-NBD107-C from Approximately 56% of Peak-Power (Neg. No. P-3310)

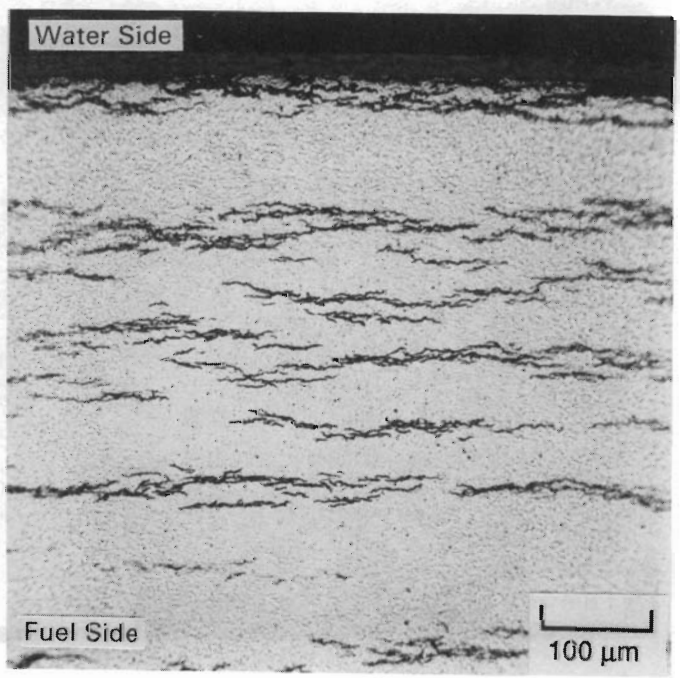


FIGURE 4.27. Etched Cladding of Transverse Sample 106-NBD107-G from the Peak-Power Region (Neg. No. P-3315)

4.5.4 Autoradiography of ATM-106 Samples

Alpha and beta-gamma autoradiographs of the ion-etched fuel are given in Figures 4.28 through 4.31 for samples from Rod NBD107. The autoradiographs are used to determine the relative distributions of alpha-emitting isotopes and fission products. Kodak LR115 (Type II) film and Kodak SO-343 film were used for the alpha and beta-gamma autoradiographs, respectively.

The alpha autoradiographs for longitudinal Sample 106-NBD107-O and transverse Sample 106-NBD107-P are shown in Figures 4.28 and 4.30. The darker regions of the photographs indicate higher relative activity. The high activity in the alpha autoradiographs at the pellet outer edges indicates the preferential generation of alpha-emitting isotopes such as plutonium, americium, and curium. The neutron flux peaks at the outer edge of the fuel during irradiation, thus producing a relatively higher amount of alpha-emitting isotopes. Comparisons of ATM-106 samples with the peak-power ATM-103 samples, which have a lower burnup than in the ATM-106 rod, show similar relative radial distributions of alpha-emitting isotopes.

The beta-gamma autoradiograph of Sample 106-NBD107-O from the peak-power region indicates fission product migration. This sample was removed from a location in the peak-power region of the fuel rod as indicated in Figure 4.11. The fission product migration is primarily from center to edge as indicated by the lower activity in the central core of the fuel sample, i.e., the lighter regions indicated in Figure 4.29. This region extends from the fuel center to approximately the mid-radius of the fuel, suggesting that the operating temperature at the fuel center was sufficiently high to cause fission product migration towards the cooler outer radial location of the fuel. Preferential migration of fission products along cracks to the fuel pellet edge may also have occurred as indicated by the localized dark regions along some cracks near the outer edges of the fuel. Regions with more beta-gamma emitting material are evident on the outer surfaces of longitudinal Sample 106-NBD107-O. These sites may be at or adjacent to crack openings in the fuel outer surface that are hidden in Figure 4.29 because of the curvature of the fuel pellet. The observed fission product migration correlates with the 11.2% fission gas release from Rod NBD107 and the 75% grain growth in peak-power Samples 106-NBD107-O and 106-NBD107-P. In contrast, negligible fission

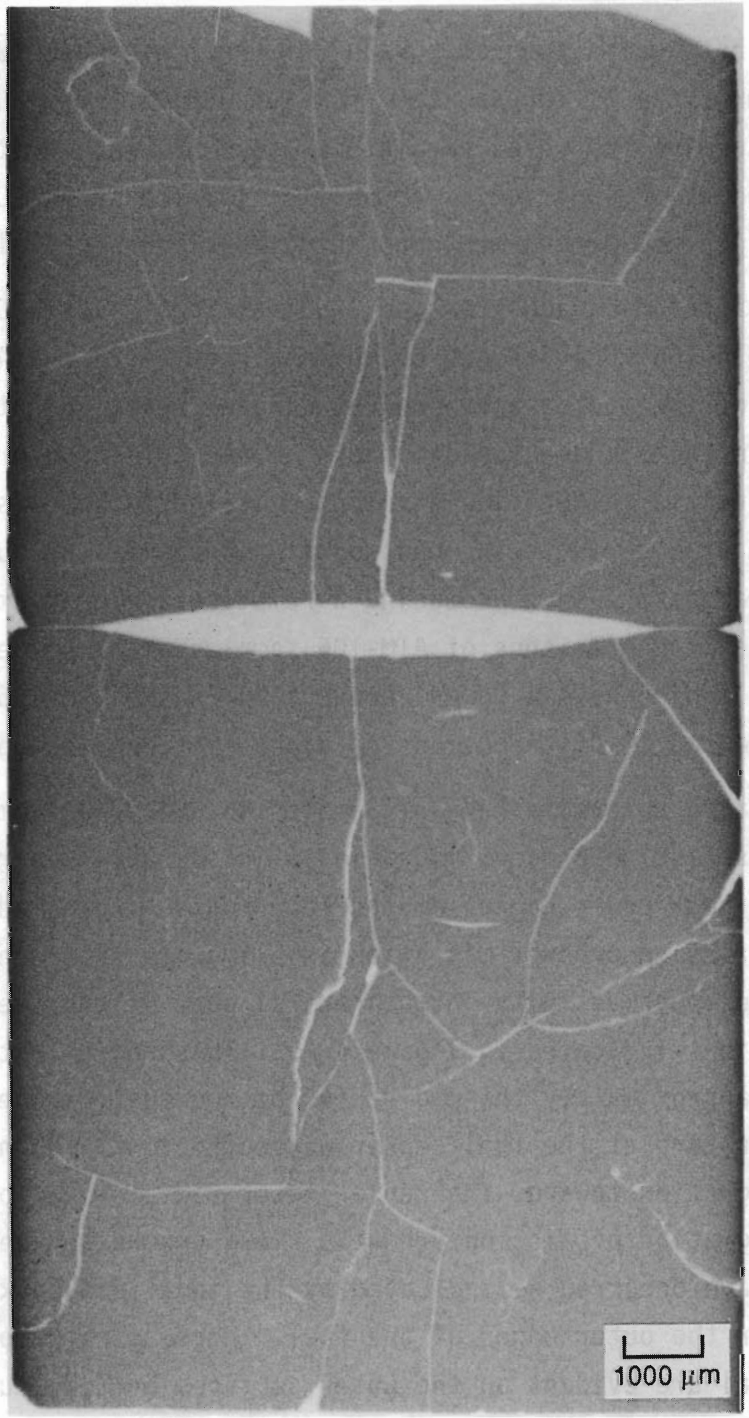


FIGURE 4.28. Alpha Autoradiograph of Longitudinal Sample 106-NBD107-O from the Peak-Power Region (Neg. No. 5430)

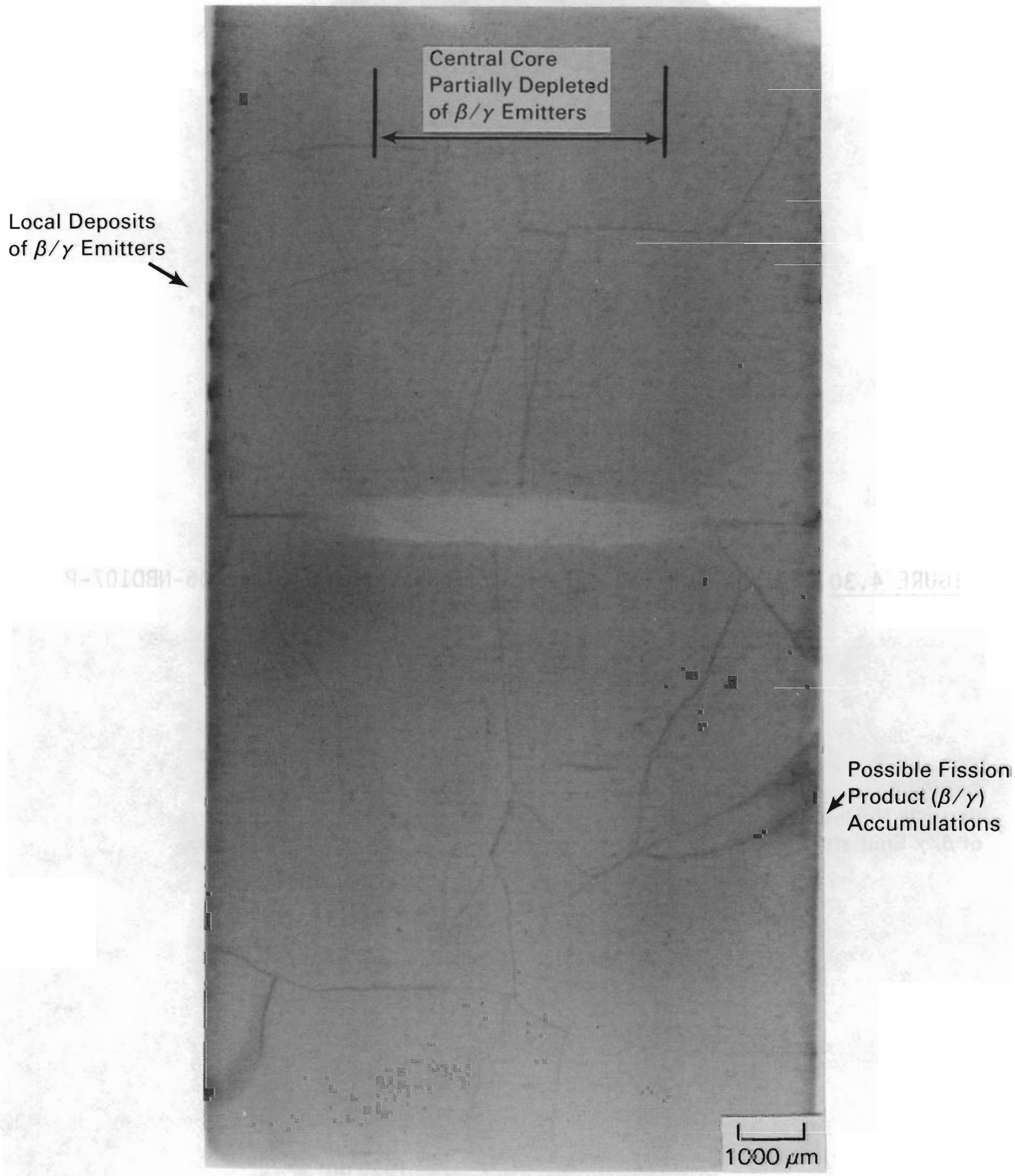


FIGURE 4.29. Beta-Gamma Autoradiograph of Longitudinal Sample 106-NBD107-O from the Peak-Power Region (Neg. No. 5431)

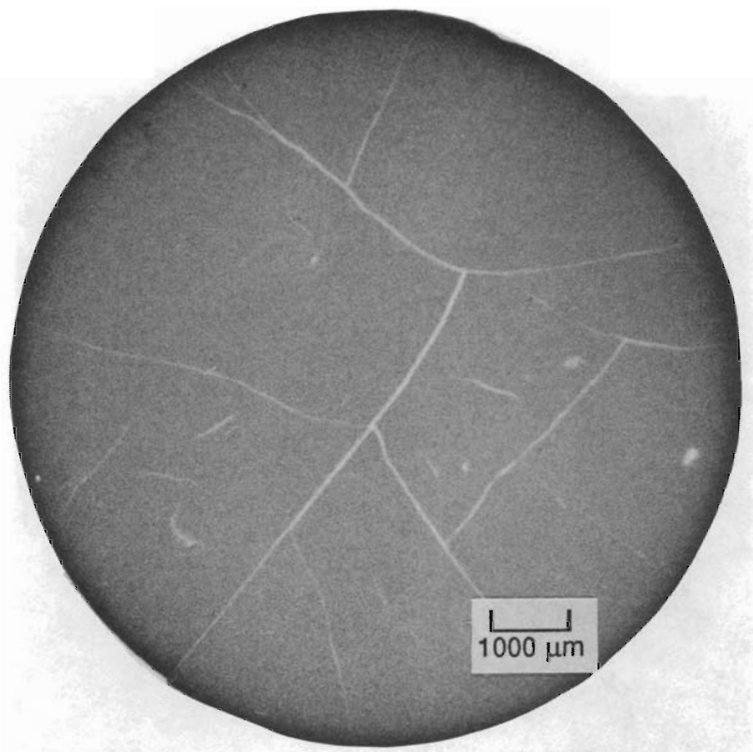


FIGURE 4.30. Alpha Autoradiograph of Transverse Sample 106-NBD107-P from the Peak-Power Region (Neg. No. 5432)

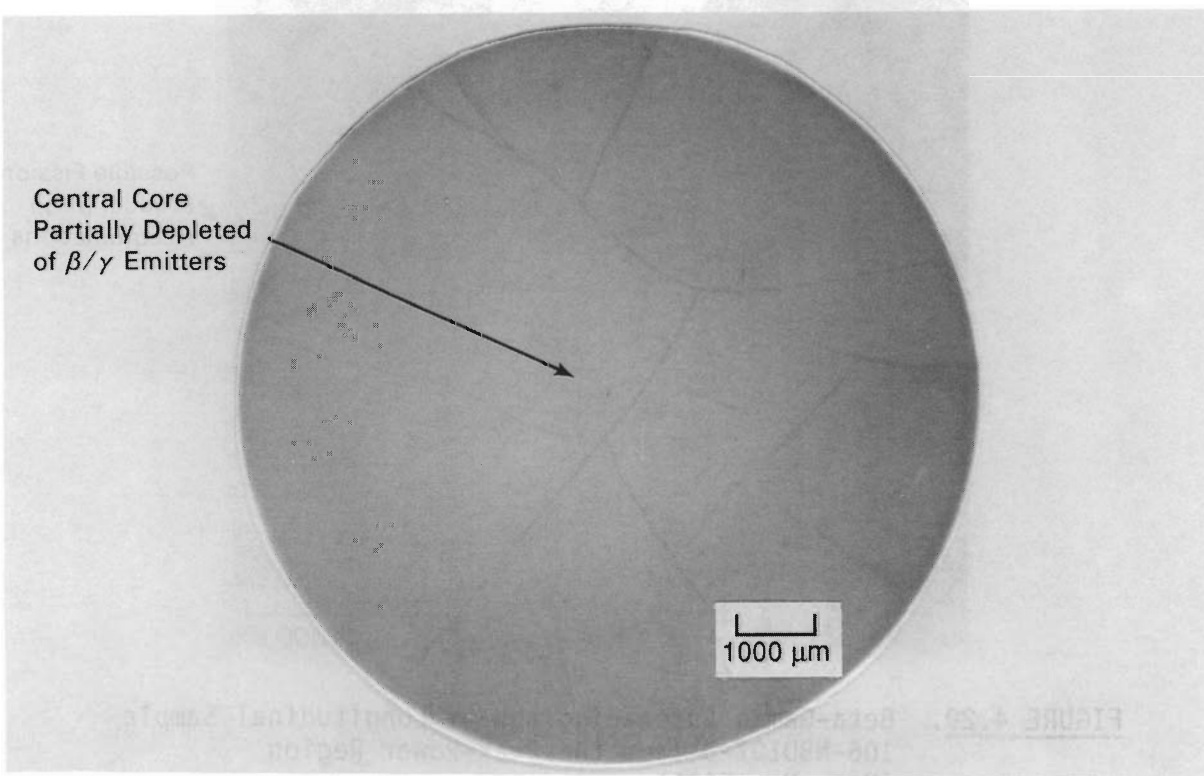


FIGURE 4.31. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-P from the Peak-Power Region (Neg. No. 5433)

product migration was observed in fuel samples removed from the peak-power region of ATM-103 Rod MLA089, which had only 0.25% release (Guenther et al. 1988). Some of the dark regions at the cracks and surfaces near the fuel edge may result from cesium moving into these regions during sample preparation. This possibility is being evaluated, but no definitive results are available.

Beta/gamma autoradiography of other samples from Rod NBD107 indicates apparently greater fission product release than in Samples 106-NBD-107-O and 106-NBD107-P even though the samples had similar burnup. These results are consistent with the variability in cesium levels indicated in Figure 4.11 and grain growth indicated in Table 4.11. Comparison of beta-gamma autoradiographs of Samples 106-NBD107-O and 106-NBD107-P (low ^{137}Cs gamma variability) in Figures 4.29 and 4.31 with Samples 106-NBD107-Y and 106-NBD107-Z (high ^{137}Cs gamma variability) in Figures 4.32 and 4.33 shows these differences. In Samples 106-NBD107-Y and 106-NBD107-Z, the central cores of the fuel appear more depleted of beta/gamma emitting fission products (as indicated by the more distinct boundaries in Figures 4.32 and 4.33) than in Samples 106-NBD107-O and 106-NBD107-P. A continuous thin region of high beta/gamma activity at the pellet periphery is also evident on Samples 106-NBD107-Y and 106-NBD107-Z. Samples 106-NBD107-O and 106-NBD107-P appear to have less depletion at the central fuel core and localized areas of high activity at the fuel outer radius. Apparently the operating temperatures of peak-power Samples 106-NBD107-Y and 106-NBD107-Z were higher than in peak-power Samples 106-NBD107-O and 106-NBD107-P. This observation correlates with the average 105% grain growth (from the center to edge) of Samples 106-NBD107-Y and 106-NBD107-Z compared with the average 75% grain growth for Samples 106-NBD107-O and 106-NBD107-P. The apparent asymmetric radial temperature profile suggested previously in Section 4.5.2 in Sample 106-NBD107-Z is more clearly indicated by comparing the plot of grain growth in Figure 4.33.b with a beta/gamma autoradiograph for this sample in Figure 4.33a. These apparent differences in radial distributions of fission products will be further examined by EPMA.

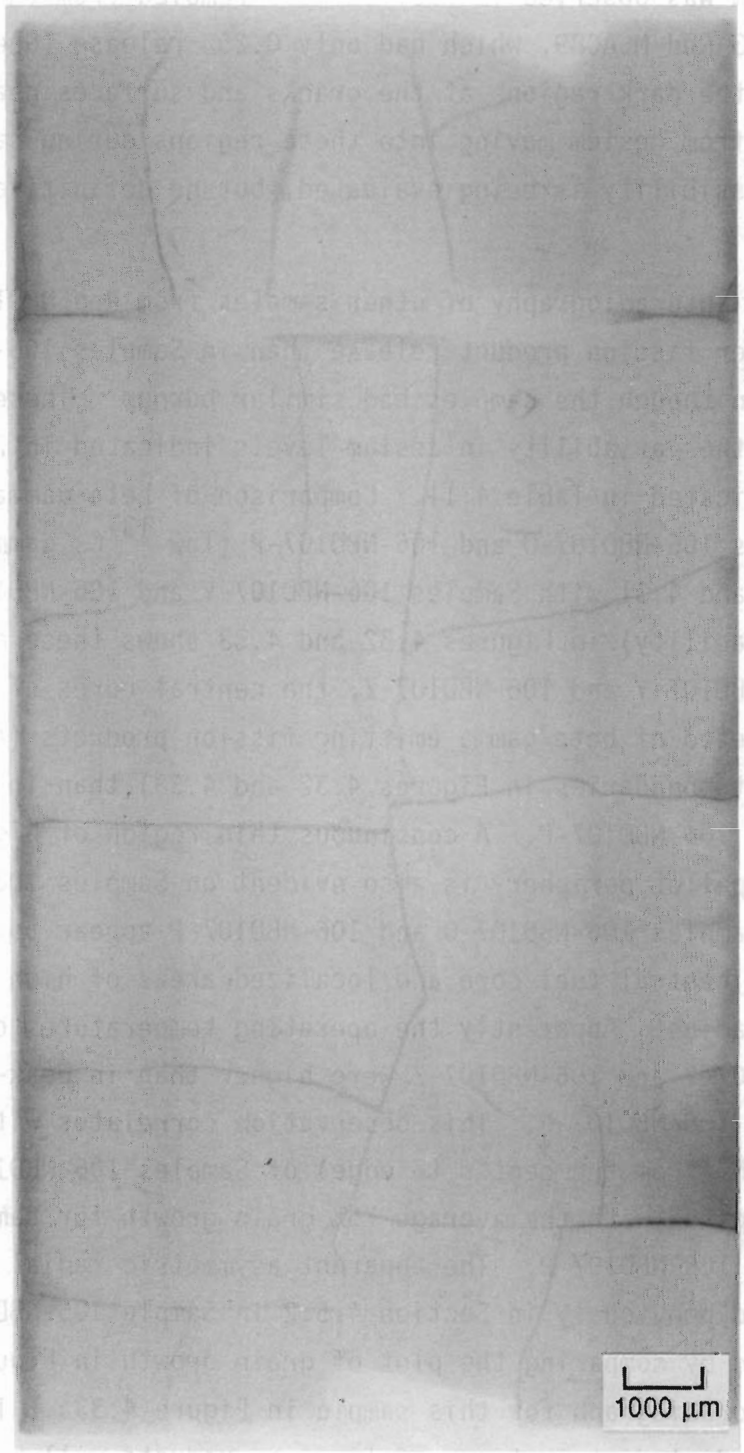
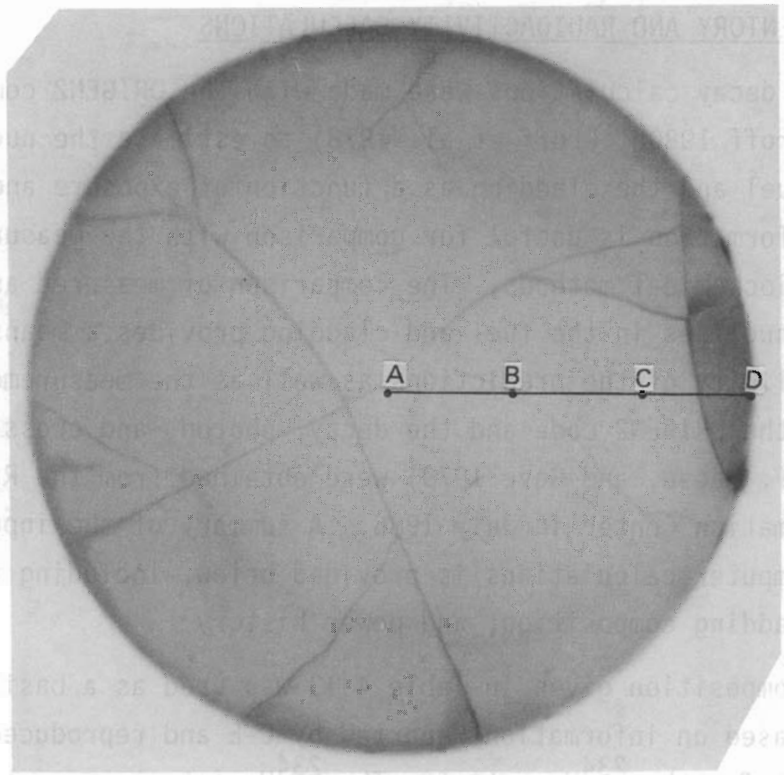
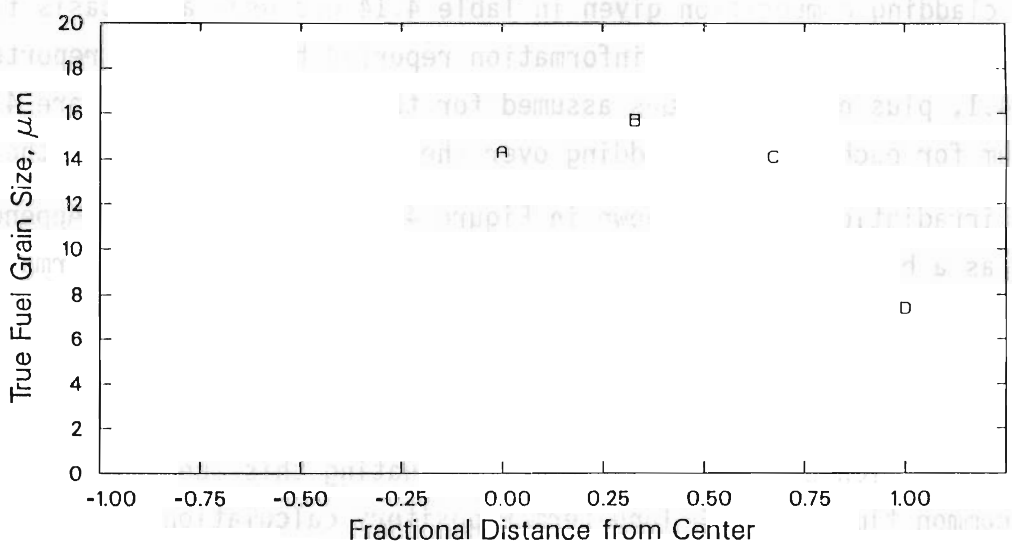


FIGURE 4.32. Beta-Gamma Autoradiograph of Longitudinal Sample 106-NBD107-Y from the Peak-Power Region (Neg. No. 5437)



a) Distribution of β/γ Emitters (Neg. No. 5443)



b) Fuel Grain Growth

FIGURE 4.33. Comparison of Beta-Gamma Autoradiography and Fuel Grain Growth of Transverse Sample 106-NBD107-Z from the Peak-Power Region

4.6 NUCLIDE INVENTORY AND RADIOACTIVITY CALCULATIONS

Burnup and decay calculations were made with the ORIGEN2 computer code (Croff 1980a, Croff 1980b, Croff et al. 1978) to estimate the nuclide inventories in the fuel and the cladding as a function of exposure and decay times. This information is useful for comparison with the measured values obtained by radiochemical methods. The comparison of measured and predicted values of radionuclides in the fuel and cladding provides a means of cross checking the validity of the predictions as well as the measurements. The VAX version of the ORIGEN2 code and the decay, photon, and cross-section libraries (Croff, Haese, and Gove 1979) were obtained from the Radiation Shielding Information Center in July 1986. A summary of the input data for making these computer calculations is provided below, including fuel composition, cladding composition, and power history.

The fuel composition given in Table 4.13 was used as a basis for ORIGEN2 input. It is based on information reported by C-E and reproduced in Section 4.1, except for the ^{234}U content. The ^{234}U content was estimated by interpolating between published values for fuels of various ^{235}U enrichments.

The cladding composition given in Table 4.14 was used as a basis for ORIGEN2 input. It is based on information reported by C-E, also reported in Section 4.1, plus nominal values assumed for the cladding. There are 4.573 g of uranium for each gram of cladding over the UO_2-bearing length of the rod.

The irradiation history shown in Figure 4.6 and tabulated in Appendix A was used as a basis for ORIGEN2 input. The power densities were normalized to give burnup exposures of 20, 25, 30, 35, 40, 45, and 50 MWd/kgM.

Nuclide inventories were calculated for decay times of 6, 8, 10, 12, 15, 20, and 1000 years after discharge from the reactor. These times bracket the period during which experimenters may be evaluating this fuel and approximates a common time at which long-term repository calculations are made. Sample inputs for fuel irradiation/decay and cladding irradiation/decay calculations are provided in Appendix F. Appendix F also contains tables of ORIGEN2 output for fuel and cladding.

TABLE 4.13. Fuel Composition of ATM-106 Assumed for ORIGEN2 Calculations

Parameter	Value[a]
Enrichment, wt%	2.453
^{234}U, ppm	199[b]
Total Uranium, wt%	88.143
Oxygen, wt%	11.857
Carbon, ppm	19
Nitrogen, ppm	44
Fluorine, ppm	10
Chlorine, ppm	10
Iron, ppm	45
Silver, ppm	1
Calcium, ppm	40
Aluminum, ppm	40
Silicon, ppm	40
Nickel, ppm	25

(a) Based on measured values (see Table 4.1)
(b) Based on other fuel enrichments.

TABLE 4.14. Cladding Composition of ATM-106 Assumed for ORIGEN2 Calculations

Parameter	Value
Zirconium, wt%	98.0
Tin, wt%	1.5[a]
Iron, wt%	0.2[a]
Chromium, wt%	0.1[a]
Aluminum, ppm	40[a]
Hafnium, ppm	55[a]
Silicon, ppm	80[a]
Oxygen, ppm	1248[b]
Carbon, ppm	146[b]
Nitrogen, ppm	42[a]
Hydrogen, ppm	12[a]

(a) Nominal values.
(b) Average of measured values (see Table 4.2).

4.7 RADIOCHEMISTRY ANALYSES

This section provides the results from radiochemical analyses of the fuel and cladding from Rod NBD107 of ATM-106. The analyses were conducted primarily to verify or identify deficiencies in the results of the ORIGEN2 calculations. Secondary reasons for radiochemical analyses were to 1) characterize radionuclide migration (which ORIGEN2 cannot predict), and 2) characterize inventories of radionuclides for which input information is unknown or uncertain, such as ^{14}C or various activation products. Thus, analytical samples were taken at various burnups and fuel and cladding operating temperature levels. Figure 4.34 provides a general view of the locations of the fuel samples used for radiochemical analyses of the ATM-106 fuel rod. Two pairs of fuel samples were taken from the upper half and three sets of three fuel samples were taken from the lower half of Rod NBD107. The analyses performed on the fuel and cladding samples are indicated in Figure 4.34. In the lower three sets of fuel samples an additional fuel sample is included to measure the fuel burnup, the isotopes of uranium and plutonium, and specific nuclides: ^{79}Se, ^{90}Sr, ^{99}Tc, ^{126}Sn, ^{135}Cs, ^{137}Cs, ^{237}Np, ^{241}Am, and ^{243}Cm plus ^{244}Cm. Additional details of these fuel sections, as they relate to other samples cut from Rod NBD107, are provided in Appendix D. The procedures used in performing the radiochemistry analyses are described in Table 4.15. An estimate of the uncertainty, expressed as the relative standard deviation, is included for each analysis. Results from the fuel burnup analyses are given in Section 4.7.1. Radiochemistry of the fuel and cladding are discussed in Sections 4.7.2 and 4.7.3, respectively.

4.7.1 Fuel Burnup Measurements

Burnup analyses were completed on three fuel samples from the lower half of Rod NBD107 at positions representative of three burnups as indicated by the level of ^{137}Cs activity. The measured burnup for these samples have been correlated to the ^{137}Cs gamma scan results in order to estimate the burnup and radionuclide content of any particular sample from ATM-106 that might be provided to a repository experimenter.

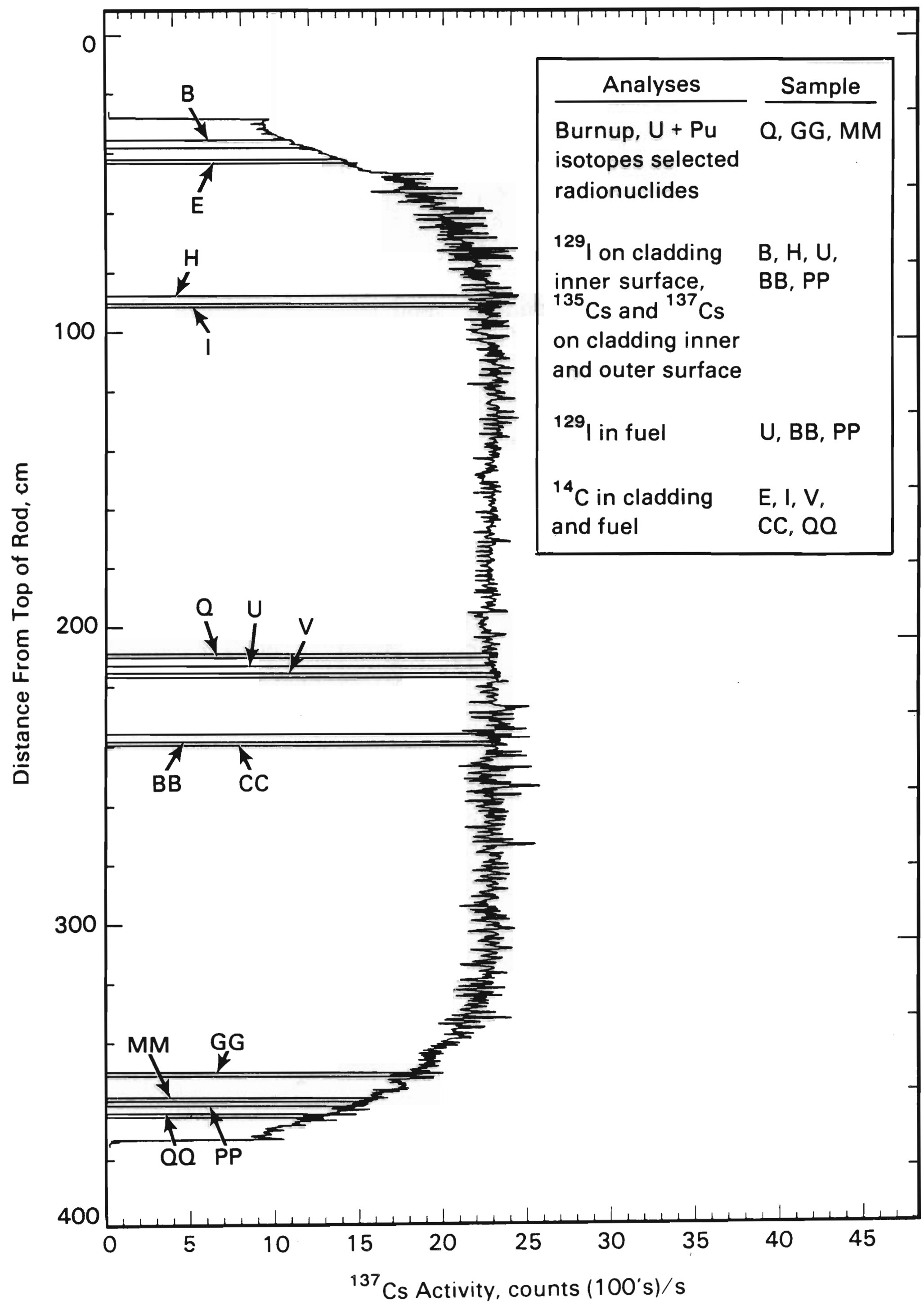


FIGURE 4.34. General Locations of Samples Used for Radiochemical Analyses of Rod NBD107

TABLE 4.15. Description of Radiochemical Analysis Procedures

Analysis	Description
Fuel	
Burnup Sample Preparation	Weighed sample is dissolved in heated 12N HNO_3 (+trace HF). Solution is separated from cladding and made up to 100 mL. Aliquots are taken for subsequent analyses. Uncertainty: ±1.0%.
Burnup (including U and Pu isotopes)	Fission product neodymium is chemically separated from irradiated fuel and determined by isotopic dilution mass spectrometry. Enriched ^{150}Nd is used as the Nd isotope diluent, and mass 142 is used to determine natural Nd contamination. Uranium and plutonium are also determined by mass spectrometry. The method uses a calibrated triple spike of ^{150}Nd, ^{233}U, and ^{242}Pu per ANSI/ASTM Standard Test Method E321-79. Uncertainty: Atom % burnup, ±2.5%; Pu, ±1.6%; U, ±1.6%.
^{14}C	The carbon in a specially-crushed sample of the fuel is evolved by combustion in pure oxygen. The CO_2 is collected and ^{14}C is measured by liquid scintillation counting. Uncertainty: ±5.6%.
^{79}Se	Selenium-79 is separated from other radioactive species by passing the chemically-adjusted solution through a cation plus anion exchange resin column. The selenium in the column effluent is distilled from hydrobromic acid and precipitated as metal by reducing it with hydroxylamine hydrochloride. The reduced metal is dissolved in nitric acid, and the ^{79}Se is measured using liquid scintillation counting. Uncertainty: ±4.9%.
^{90}Sr	The ^{90}Sr is separated from other radioactive species by selective elution from a cation exchange resin using 2-methyllactic acid. Following separation, the growth of ^{90}Y is measured by beta counting. The ^{90}Sr is then calculated, based on the growth of the ^{90}Y daughter over a measured period of time. Uncertainty: ±5.7%.
^{99}Tc	Technetium is separated from other radioactive species by a process that absorbs most of the other species onto a cation exchange resin. The technetium is extracted from the effluent into hexone as tetraphenylarsonium pertechnetate. The technetium activity is then measured by beta counting. Uncertainty: ±3.5%.

TABLE 4.15. (contd)

Analysis	Description
Fuel (contd)	
^{129}I	Iodine is separated by distillation and precipitation as AgI. Iodine-129 is determined in a GeLi well detector. Uncertainty: ±2.2%.
^{126}Sn	Tin is separated by a combination of cation and anion exchange resins. Tin is finally eluted with dilute nitric acid and measured using a GeLi gamma spectrometer. Uncertainty: ±10.2%.
135Cs	Cesium is separated from other elements by chromatographic elution from a cation exchange column. Isotopic abundance of the cesium isotope is determined by mass spectrometry. Uncertainty: ±14%.
^{137}Cs	The cesium is determined by gamma ray spectrometry on an aliquot of the aqueous solution. Uncertainty: ±3.5%.
^{237}Np	Neptunium-237 is separated from other radionuclides species by extraction into a mixture of tri-iso-octylamine (TiOA) in xylene, stripped from the TiOA phase with HCl and re-extraction into a mixture of thenoyltrifluoracetone (TTA) in xylene for additional separation. Neptunium-237 is measured by alpha counting. A ^{239}Np tracer is added to the sample and gamma-counted to determine a recovery factor. Uncertainty: ±1.9%.
^{241}Am, ^{243}Cm plus ^{244}Cm	Americium and curium are separated using cation and anion exchange and determined by alpha spectrometry. Uncertainty: ^{241}Am, ±4.9%; ^{243}Cm plus ^{244}Cm, ±4.1%.
Cladding	
^{14}C	The carbon in the cladding is evolved by total combustion in pure oxygen, the CO_2 collected, and the ^{14}C measured by liquid scintillation counting. Uncertainty: ±5.6%.
^{135}Cs Interior and Exterior Surfaces	The cesium is leached from (interior or exterior) surface and separated from other elements by chromatographic elution from a cation exchange column. Isotope abundance of cesium isotopes is determined by mass spectrometry. Uncertainty: ±14%.

TABLE 4.15. (contd)

Analysis	Description
Fuel (contd)	
^{137}Cs Interior and Exterior Surfaces	The cesium is leached from interior or exterior surface and determined by gamma ray spectrometry on an aliquot of the leachate. Uncertainty: ±3.7%.
^{129}I Interior Surface	The cladding interior surface is leached in nitric acid. The iodine is separated from the nitric acid leachate by distillation and precipitation as AgI. Iodine-129 is determined in a GeLi well detector. Uncertainty: ±2.8%.

The results of the burnup analyses are listed in Table 4.16. Values are presented for burnups based on the measured amounts of ^{148}Nd as well as burnups derived from the ^{137}Cs contents. The gamma activity for ^{137}Cs obtained during the full-length scan of Rod NBD107 is also presented in Table 4.16. These two methods of obtaining measured burnup values provide a check on each other if there is no substantial ^{137}Cs movement in the fuel rod. The agreement between the burnups based on ^{148}Nd and ^{137}Cs for the fuel samples is not as close for the ATM-106 fuel as it was for the ATM-103 fuel (Guenther et al. 1988).

The measured burnup values, in units of MWd/kgM for ease of interpolating in the tables of Appendix F, are plotted in Figure 4.35 against the ^{137}Cs activity measured during gamma scanning of the full-length rod. The location of the fuel samples and detailed gamma scanning data are provided in Appendices D and B, respectively. Because the ^{137}Cs activity and the measured burnup form a linear relationship in the burnup range measured, an equation can be derived for estimating the burnup in other fuel samples from Rod NBD107. Using the measured ^{137}Cs activity and burnup values shown in Table 4.16, the relationship between burnup and ^{137}Cs activity for Rod NBD107 is:

$$BU = 0.01980\ \bar{A} + 0.815$$

where BU = the burnup of the Rod NBD107 fuel sample in question, MWd/kgM

$\bar{A}$ = the average activity measured over the length of the desired fuel sample (see the as-cut sectioning diagram in Appendix D), counts/s.

TABLE 4.16. Burnup Results for ATM-106 Fuel Samples[a]

Sample No.	Burnup (^{148}Nd Basis) At.%	Burnup (^{148}Nd Basis) GJ/kgM (MWd/kgM)	Measured Gamma Activity, Counts/s	Burnup (^{137}Cs Basis), GJ/kgM (MWd/kgM)[b]	Sample Location
106-NBD107-Q	4.859	4014 (46.46)	2310	4294 (49.70)	Typical peak burnup in center portion of Rod NBD107.
106-NBD107-GG	3.901	3220 (37.27)	1828	3255 (37.67)	Representative of approximately 80% of peak Cs activity in bottom portion of Rod NBD107.
106-NBD107-MM	3.289	2713 (31.40)	1553	2863 (33.14)	Representative of approximately 67% of peak Cs activity in bottom portion of Rod NBD107.

(a) See sectioning diagrams in Appendix D for sample locations with respect to gamma activity.
(b) Calculation based on Cs half-life of 30.174 years and effective fission yield of 6.31% for Sample 106-NBD107-Q, 6.31% for Sample 106-NBD107-GG, and 6.29% for Sample 106-NBD107-MM. The calculation procedure used was ASTM Standard E-219 "Standard Test Method for Atom Percent Fission in Uranium Fuel" (Radiochemical Method).

This equation is valid for determining the burnup in fuel samples from Rod NBD107 as long as the ^{137}Cs activities given for Rod NBD107 in Appendix D are used. As more fuel rods from ATM-106 are gamma scanned and analyzed for fuel burnup, it will become more apparent how well this relationship will estimate the burnup in other ATM-106 rods based solely on the gamma scan data.

When ATM-106 fuel rods are gamma scanned in the future, a correction for the decay of ^{137}Cs will be incorporated in comparisons of gamma scan data. The correction is especially important in determining the relationship between burnup and ^{137}Cs activity. The rate of decrease in ^{137}Cs activity is indicated by the plot of calculated ^{137}Cs activity shown in Figure 4.36. At

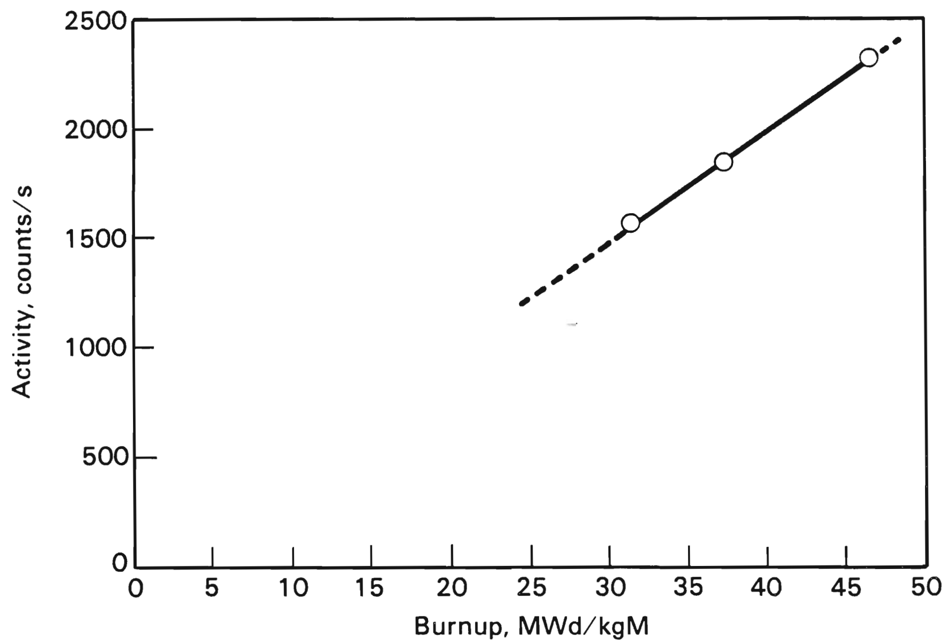


FIGURE 4.35. Correlation Between ^{137}Cs Gamma Counting and ^{148}Nd Burnup Analyses

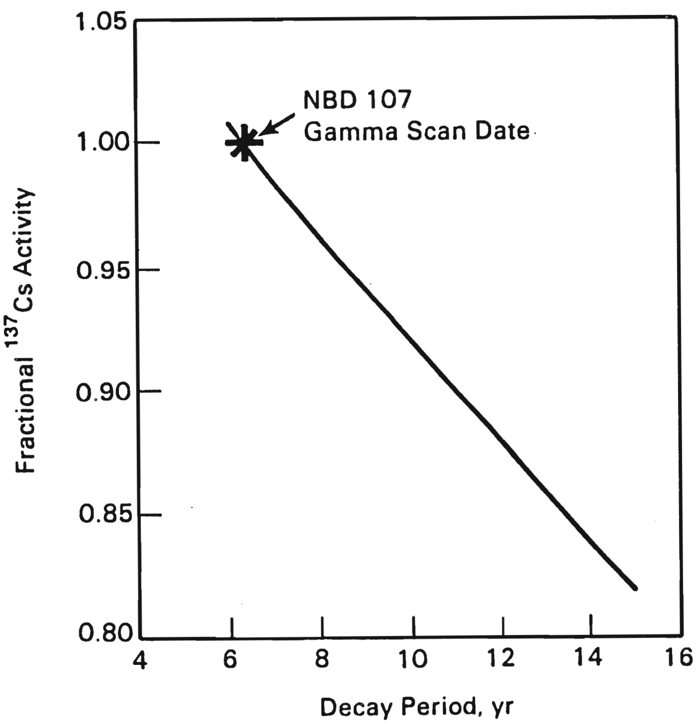


FIGURE 4.36. Fractional ^{137}Cs Activity as a Function of Decay Period

the time of gamma scanning (February 1987), Rod NBD107 had been discharged from the reactor for 6.42 years. At the time of the burnup analyses (June 1987), Rod NBD107 had been discharged 6.7 years.

The correlation between ^{137}Cs activity and burnup values can be used in conjunction with the inventory calculations in Appendix F and the gamma scan in Appendix D to determine the radioisotope inventory for a particular sample that might be used by an experimenter.

4.7.2 <u>Fuel Radiochemistry Analyses and Comparisons with ORIGEN2 Predictions</u>

A total of 11 samples were analyzed for fuel radiochemistry as indicated in Figure 4.34 and Appendix D. For the fuel samples being analyzed for ^{14}C and ^{129}I, the burnup was estimated using the gamma scan sectioning diagram in Appendix D and the equation relating ^{137}Cs activity and fuel burnup in Section 4.7.1. Measured burnup values were used for the remaining samples. The results of the radiochemical analyses for the fuel are provided in Table 4.17 and are compared with the ORIGEN2 predictions.

Most of the radiochemical results agreed with ORIGEN2 predictions within ±15%. The agreement between measured and predicted values was less consistent in ATM-106 than it was in ATM-101 (Barner 1985) and ATM-103 (Guenther et al. 1988). The most significant differences occurred in Sample 106-NBD107-Q taken from the peak-burnup region. In that sample, the concentrations of ^{235}U, ^{239}Pu, ^{241}Pu and ^{241}Am varied considerably more than in previous ATMs. The measured contents of these same radionuclides were closer to predictions in the lower-burnup Samples 106-NBD107-GG and 106-NBD107-MM.

The amount of ^{234}U measured in the fuel was low for all of the samples; however, the analysis of the standard for ^{234}U after the fuel measurements were taken was about 68% of the preanalysis value. Thus, the values reported in Table 4.17 for ^{234}U contents were obtained by correcting for this drift in the measured standard value. The measurement of the ^{234}U is inherently less accurate than those for other uranium isotopes because the ^{234}U value is obtained as a ratio from mass spectrometry analysis and there is considerably less ^{234}U than ^{238}U in the fuel. A different technique will be used for future samples to improve the accuracy of these measurements.

TABLE 4.17. Fuel Radiochemical Analyses Results and Comparisons with ORIGEN2-Calculated Radionuclide Inventory

Sample ID and Radionuclide	Burnup,[a] MWd/kgM	Analytical Value	ORIGEN2 Value[b]	Ratio, Analytical to ORIGEN2
106-NBD107-E				
C-14	28.89	1.038×10^{-6} Ci/g fuel[c]	0.970×10^{-6} Ci/g fuel	1.07
106-NBD107-I				
C-14	46.36	1.38×10^{-6} Ci/g fuel[c]	1.658×10^{-6} Ci/g fuel	0.83
106-NBD107-Q				
U-234[d]	46.46	7.49×10^{-5} g/g fuel	9.669×10^{-5} g/g fuel	0.77
U-235		1.406×10^{-3} "	1.930×10^{-3} "	0.73
U-236		3.04×10^{-3} "	2.919×10^{-3} "	1.04
U-238		8.272×10^{-1} "	8.236×10^{-1} "	1.00
Pu-238		2.842×10^{-4} "	3.133×10^{-4} "	0.91
Pu-239		3.766×10^{-3} "	4.519×10^{-3} "	0.83
Pu-240		2.599×10^{-3} "	2.543×10^{-3} "	1.02
Pu-241		8.862×10^{-4} "	1.086×10^{-3} "	0.82
Pu-242		1.169×10^{-3} "	0.971×10^{-3} "	1.20
Np-237		2.66×10^{-7} Ci/g fuel	3.750×10^{-7} Ci/g fuel	0.71
Am-241		2.18×10^{-3} "	1.657×10^{-3} "	1.32
Cm-243 & 244		9.86×10^{-3} "	1.007×10^{-2} "	0.98
Se-79		5.99×10^{-8} "	4.819×10^{-7} "	0.12
Sr-90		6.04×10^{-2} "	6.028×10^{-2} "	1.00
Tc-99		1.09×10^{-5} "	1.486×10^{-5} "	0.73
Sn-126		2.10×10^{-7} "	1.122×10^{-6} "	0.19
Cs-135		4.79×10^{-7} "	5.137×10^{-7} "	0.93
Cs-137		1.12×10^{-1} "	1.059×10^{-1} "	1.06
106-NBD107-U				
I-129	46.51	3.83×10^{-8} Ci/g fuel	4.140×10^{-8} Ci/g fuel	0.93
106-NBD107-V				
C-14	46.83	1.76×10^{-6} Ci/g fuel[c]	1.677×10^{-6} Ci/g fuel	1.05
106-NBD107-BB				
I-129	47.05	4.34×10^{-8} Ci/g fuel	4.187×10^{-8} Ci/g fuel	1.04
106-NBD107-CC				
C-14	46.63	1.62×10^{-6} Ci/g fuel[c]	1.670×10^{-6} Ci/g fuel	0.97
106-NBD107-GG				
U-234[d]	37.27	1.27×10^{-4} g/g fuel	1.061×10^{-4} g/g fuel	1.20
U-235		2.71×10^{-3} "	3.334×10^{-3} "	0.81
U-236		3.03×10^{-3} "	2.874×10^{-3} "	1.05
U-238		8.438×10^{-1} "	8.316×10^{-1} "	1.01
Pu-238		1.947×10^{-4} "	2.179×10^{-4} "	0.89
Pu-239		3.835×10^{-3} "	4.509×10^{-3} "	0.85
Pu-240		2.321×10^{-3} "	2.346×10^{-3} "	0.99
Pu-241		8.130×10^{-4} "	9.449×10^{-4} "	0.86
Pu-242		7.753×10^{-4} "	6.731×10^{-4} "	1.15
Np-237		2.26×10^{-7} Ci/g fuel	3.044×10^{-7} Ci/g fuel	0.74
Am-241		1.46×10^{-3} "	1.487×10^{-3} "	0.98
Cm-243 & 244		4.11×10^{-3} "	4.170×10^{-3} "	0.99
Se-79		5.63×10^{-8} "	3.950×10^{-7} "	0.14
Sr-90		5.18×10^{-2} "	5.169×10^{-2} "	1.00
Tc-99		8.96×10^{-6} "	1.246×10^{-5} "	0.72
Sn-126		1.60×10^{-7} "	8.701×10^{-7} "	0.18
Cs-135		4.15×10^{-7} "	4.650×10^{-7} "	0.89
Cs-137		8.56×10^{-2} "	8.482×10^{-2} "	1.01

TABLE 4.17. (contd)

Sample ID and Radionuclide	Burnup,[a] MWd/kgM	Analytical Value	ORIGEN2 Value[b]	Ratio, Analytical to ORIGEN2
106-NBD107-MM				
U-234[d]	31.40	1.53×10^{-4} g/g fuel	1.134×10^{-4} g/g fuel	1.35
U-235		3.86×10^{-3} "	4.660×10^{-3} "	0.83
U-236		2.86×10^{-3} "	2.756×10^{-3} "	1.04
U-238		8.446×10^{-1} "	8.366×10^{-1} "	1.01
Pu-238		1.426×10^{-4} "	1.589×10^{-4} "	0.90
Pu-239		3.814×10^{-3} "	4.462×10^{-3} "	0.85
Pu-240		2.067×10^{-3} "	2.120×10^{-3} "	0.98
Pu-241		7.260×10^{-4} "	8.212×10^{-4} "	0.88
Pu-242		5.463×10^{-4} "	4.888×10^{-4} "	1.12
Np-237		1.84×10^{-7} Ci/g fuel	2.514×10^{-7} Ci/g fuel	0.73
Am-241		1.18×10^{-3} "	1.326×10^{-3} "	0.89
Cm-243 & 244		1.87×10^{-3} "	2.018×10^{-3} "	0.93
Se-79		4.18×10^{-8} "	3.378×10^{-7} "	0.12
Sr-90		4.64×10^{-2} "	4.561×10^{-2} "	1.02
Tc-99		7.70×10^{-6} "	1.083×10^{-5} "	0.71
Sn-126		1.41×10^{-7} "	7.138×10^{-7} "	0.20
Cs-135		4.04×10^{-7} "	4.347×10^{-7} "	0.93
Cs-137		7.47×10^{-2} "	7.141×10^{-2} "	1.05
106-NBD107-PP				
I-129	29.49	2.19×10^{-8} Ci/g fuel	2.602×10^{-8} Ci/g fuel	0.84
106-NBD107-QQ				
C-14	26.75	5.40×10^{-7} Ci/g fuel[c]	8.908×10^{-7} Ci/g fuel	0.61

(a) Burnup values were measured for Samples 106-NBD107-Q, 106-NBD107-GG, and 106-NBD107-MM. All other burnups are estimated using the equation in Section 4.7.1 and ^{137}Cs activity in Appendix D for specific samples. Estimated burnups are probably accurate to about ±0.5 MWd/kgM.

(b) ORIGEN2 values obtained from Appendix F using burnup derived with equation in Section 4.7.1 and ^{137}Cs activity in Appendix D, except for Samples 106-NBD107-Q, 106-NBD107-GG, and 106-NBD107-MM, for which these values were directly calculated using ORIGEN2 and the measured sample burnup. Values in Apendix F were converted from g/gU to g/g UO_2. 1 g of unirradiated UO_2 is equivalent to 1 g of as-irradiated fuel with all fission products.

(c) Average of two measurements that varied within less than 10%.

(d) Measured values for ^{234}U were corrected for an apparent drift in measurement systems based on comparisons with standard samples before and after analyses. A new approach is being used for subsequent samples.

The amount of ^{99}Tc measured in the fuel was also low for all of the fuel samples. In the moderate burnup fuel from ATM-103, the measured values were nearly identical to the predicted values. A possible explanation for some of the discrepancy between the measured and predicted ^{99}Tc values may be that some of the technetium was not removed from the solution used for this analysis. Unlike previous radiochemical analysis, the solutions made from dissolving this fuel had a residual material that was not completly dissolved. Analysis of the residue indicated that it contains primarily material found in metallic ingots, which includes technetium. The preparation procedure has been revised to completely dissolve the residue and may decrease the discrepancy between the measured and predicted amounts of technetium in this high-burnup, high fission gas release fuel.

As in ATM-103 (Guenther et al. 1988), the most significant differences between measured and predicted values occurred for ^{79}Se and ^{126}Sn, for which the measured values were about 13% and 19% of their respective ORIGEN2 predictions.

4.7.3 Cladding Radiochemistry Analyses

A total of 10 cladding samples were taken from Rod NBD107 and analyzed by radiochemistry. These analyses included determination of the amount of ^{135}Cs and ^{137}Cs on both the interior and exterior cladding surfaces, the ^{129}I on the interior cladding surface, and the ^{14}C in the cladding. The analyses of these isotopes on the interior cladding surface can provide useful information on the relationship between fission product release, possible migration and their relationship to fuel and/or cladding temperatures. The levels of ^{135}Cs and ^{137}Cs on the exterior cladding surface are of interest to handling operations where large quantities of dispersible radioactivity could be an issue. The ^{14}C in the cladding, which results primarily from the activation of ^{14}N, is of interest because ^{14}C has a relatively long half life (>5000 yr). The ^{14}C in the cladding contributes about 10% of the total ^{14}C in the fuel rod.

Radiochemical analyses for cesium and iodine were obtained from 2.5-cm (1.0-in.) cladding sections taken from locations along the length of the rod as indicated in Figure 4.34. The fuel was removed from the cladding with a specially constructed punch, and the interior cladding surface was wiped four to five times with fresh, dry Q-tips to remove loose particles. The first Q-tip swabs were black-streaked; thus it may be inferred that some "loose" cesium and iodine may have been removed by the swabs. After stoppering the open ends, the cladding was immersed in 8N HNO_3, and the resulting solution was analyzed for ^{137}Cs and ^{135}Cs to obtain the exterior surface values for cesium and iodine. Then the stoppers were removed before another 8N HNO_3 treatment was made to obtain the interior surface values for cesium and iodine.

The results of the cladding radiochemical analyses for cesium and iodine are provided in Table 4.18. The ^{137}Cs concentration on the interior cladding surface ranged from 19.6 $\mu Ci/cm^2$ to 5,811 $\mu Ci/cm^2$. The level of ^{135}Cs on the cladding interior surface followed the trend in ^{137}Cs but at a much lower level that was roughly equal to the expected $^{137}Cs/^{135}Cs$ ratio of about 10^5. The amounts of these isotopes are somewhat similar in terms of grams, but the shorter half life for ^{137}Cs results in a much greater activity. As indicated by the data of Table 4.18, the general trend of cesium activity along the interior cladding surface correlates more with the power/burnup of the adjacent fuel, which is highest in the middle of the rod and low at both ends, than with the interior cladding temperature, which increases from the bottom to the top of the fuel rod during irradiation.

The trend in cesium on the interior cladding surface along the fuel rod generally follows the power/burnup profile but also appears to follow the detailed changes in ^{137}Cs activity measured in the gamma scan. The correspondence between gamma scan data, measured deposits of cesium and iodine on

TABLE 4.18. Cladding Radiochemistry Analyses Results

Sample No.	Exterior Surface Activity, $\mu Ci/cm^2$ ^{137}Cs	Exterior Surface Activity, $\mu Ci/cm^2$ ^{135}Cs	Interior Surface Activity, $\mu Ci/cm^2$ ^{137}Cs	Interior Surface Activity, $\mu Ci/cm^2$ ^{135}Cs	Interior Surface Activity, $\mu Ci/cm^2$ ^{129}I
106-NBD107-B	6.2	3.74×10^{-5}	19.6	1.12×10^{-4}	1.26×10^{-5}
106-NBD107-H	4.9	2.30×10^{-5}	3973	180×10^{-4}	950×10^{-5}
106-NBD107-U	9.6	4.32×10^{-5}	1414	64×10^{-4}	269×10^{-5}
106-NBD107-BB	16.5	7.39×10^{-5}	5811	261×10^{-4}	802×10^{-5}
106-NBD107-PP	14.4	8.29×10^{-5}	2707	169×10^{-4}	284×10^{-5}

the cladding interior surface, and the movement of beta/gamma emitting fission products is shown in Figure 4.37. There is little apparent cesium release in the gamma scan at the very top (Sample 106-NBD107-C) or near the middle of the fuel column (Sample 106-NBD107-P), but the ^{137}Cs activity increases from 2 to 10% above the nominal cesium level in parts of the rod that experienced peak burnup/power (Samples 106-NBD107-G and 106-NBD107-Z). Possible cesium release is even indicated at the lower end of the fuel rod (Sample 106-NBD107-LL).

Sample 106-NBD107-B was taken from the upper region of Rod NBD107, where there was apparently no significant cesium release according to the gamma scan, and had only 19.6 Ci/cm^2 of ^{137}Cs on the interior cladding surface. Fission product release was not indicated in the β/γ autoradiograph of adjacent Sample 106-NBD107-C. In contrast, Samples 106-NBD107-H and 106-NBD107-BB taken from peak-power regions had orders of magnitude more cesium on the cladding than measured on the sample from the upper end of the fuel rod. The increase in deposits on the cladding is further evidence of higher fuel temperatures that were indicated by a depleted core and local concentrations of β/γ emitters in the adjacent fuel examined by β/γ autoradiography (Samples 106-NBD107-G and 106-NBD107-Z).

The cesium deposit measured for Sample 106-NBD107-U appears low compared with the other peak-power samples, but examination of the cesium gamma scan data in Figure 4.37 indicates that the deposits of cesium on the interior cladding surface at this location is consistent with the trend in cesium release indicated during gamma scanning and changes in the distribution of β/γ emitters observed in autoradiography. Sample 106-NBD107-PP from the bottom of the rod had more cesium on the cladding than Sample 106-NBD107-U at the peak-power region, but there was as much or more variability in the cesim level at the bottom of the rod (106-NBD107-PP) than at Sample 106-NBD107-U even though the grain growths were somewhat comparable. This suggests that the bottom of the fuel rod was probably hotter than fuel with a comparable burnup in the upper end of the rod. Results of these three types of examinations (axial gamma scanning, interior cladding deposit radiochemistry, and

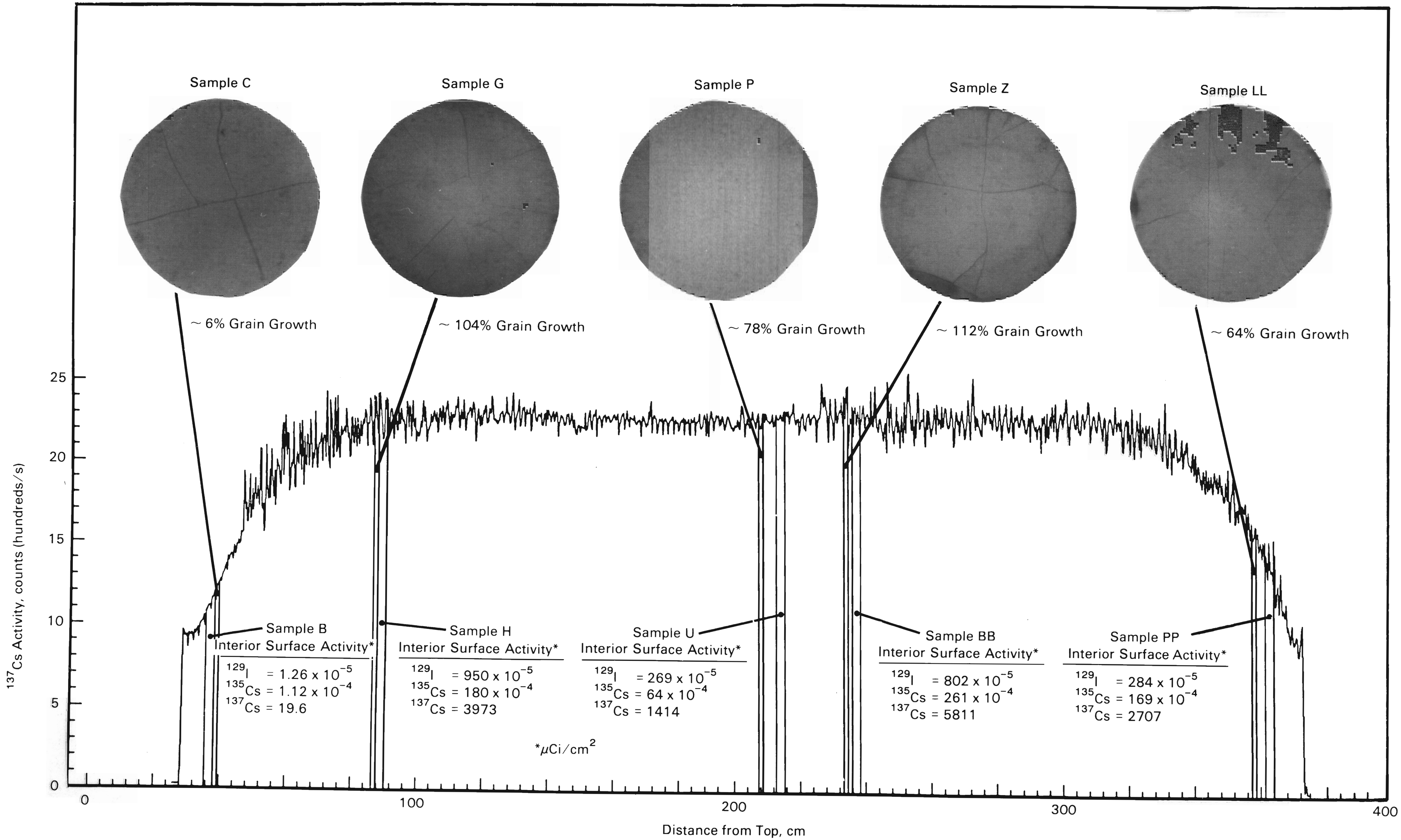


FIGURE 4.37. Comparison of Fission Product Movement in Rod NBD107 Using Gamma Scanning, Cladding Rdiochemistry, and β/γ Autoradiography Data

β/γ autoradiography), along with fuel grain growth measurements listed in Table 4.11, are consistent with local variations in fuel temperature and fission gas release.

The values for ^{129}I on the interior cladding surface indicated a trend that also approximates the variation of the power/burnup in the fuel. Because cesium and iodine form a very stable CsI compound, it is not unexpected that the iodine concentrations follow a pattern similar to the cesium. In Rod NBD107, the ^{135}Cs, ^{137}Cs, and ^{129}I interior surface activities were much higher than in ATM-103 (Guenther et al. 1988). In ATM-103, the ^{129}I activity was reduced at the lower and upper ends of the rods, but Rod NBD107 had a similar decrease in activity only at the upper end. As indicated in Figure 4.37, Samples 106-NBD107-H and 106-NBD107-BB had peak activities which corresponded to the peak level of activity in the gamma scans. Using data from Tables 4.17 and 4.18, it can be calculated that an average of 8% and 2%, respectively, of ^{129}I and ^{137}Cs have been firmly deposited on the inner surface of Rod NBD107.

The ^{135}Cs concentration on the exterior surface ranged between about 0.1% and 33% of the ^{135}Cs concentration on the interior surface for the same sample. The ratios between the ^{135}Cs and ^{137}Cs on the outer surfaces roughly approximate the expected difference in these isotopes. However, the amount of cesium deposited on the exterior surface of the cladding did not follow any particular profile although it was highest at the lower end. This distribution may result from random amounts of ^{135}Cs and ^{137}Cs that can be picked up on the exterior surface during handling operations in the hot cell or deposited during irradiation in the exterior cladding oxide layer.

Analyses of ^{14}C were also performed on cladding sections taken from five locations along the length of the rod. The fuel was removed from these 1.3-cm (0.50-in) samples, and the cladding was broken into two portions that were analyzed separately. The analytical results are compared with ORIGEN2 predictions in Table 4.19. The analyzed concentrations averaged 120% of the predicted concentrations, but there is wide scatter in the as-analyzed values, possibly as a result of measurement uncertainties for these small quantities or variations in the nitrogen impurity levels assumed to be in the cladding.

TABLE 4.19. Radiochemical Analyses of ^{14}C in Cladding and Comparison with ORIGEN2 Predictions

Sample No.	Analyzed Activities, μCi/g Cladding[(a)]	Average of Analyzed Activities, μCi/g Cladding	Interpolated ORIGEN2 Activity, μCi/g Cladding[(b)]	Ratio, Average Analytical Activity to ORIGEN2
106-NBD107-E	1.04, 1.15	1.10	0.8365	1.32
106-NBD107-I	0.966, 0.959	0.962	1.431	0.67
106-NBD107-V	2.55, 2.08	2.32	1.448	1.60
106-NBD107-CC	1.95, 1.74	1.85	1.440	1.28
106-NBD107-QQ	0.990, 0.750	0.870	0.7688	1.13

(a) Each cladding sample was separated for duplicate analyses.
(b) Interpolated ORIGEN2 values obtained from Appendix F using estimated burnup from equation in Section 4.7 and ^{137}Cs activity in Appendix D.

5.0 DISTRIBUTION OF ATM-106 SPENT FUEL

A number of ATM-106 spent fuel samples have been sectioned from Rod NBD107. When Rod NBD107 was sectioned, the Basalt Waste Isolation Project (BWIP) and the Office of Nuclear Waste Isolation (ONWI) projects were actively investigating basalt and salt formations, respectively, as sites for a geologic repository. Therefore, samples of Rod NBD107 were reserved for these projects as shown in Table 5.1 and in Appendix D. After the rod was sectioned, the number of respository sites being investigated was narrowed to the Nevada Nuclear Waste Storage Investigation (NNWSI). In the future, the NNWSI will be the major user of spent fuel ATMs prepared by the MCC. Samples have also been taken for characterization or experimentation by the MCC and Oak Ridge National Laboratory (ORNL). Samples designated in Table 5.1 for ONWI and BWIP were not delivered and are available for redesignation to other experimenters. The small samples are stored in glass vials. Long sections of fuel are stored in argon-filled storage tubes with Swagelok end caps.

TABLE 5.1. Initially Planned Distributions of ATM-106 Spent Fuel Rod NBD107

Section	Planned Recipient	Approximate Fuel Length, cm (in.)
D	ONWI	2.54 (1)
J	ONWI	2.54 (1)
L	NNWSI	13 (5)
M	NNWSI	13 (5)
R	ORNL	0.6 (0.25)
S	ORNL	0.6 (0.25)
W	ONWI	2.54 (1)
EE	BWIP	38 (15)
HH	ORNL	0.6 (0.25)
II	ORNL	0.6 (0.25)
JJ	ONWI	2.54 (1)
NN	ORNL	0.6 (0.25)
OO	ORNL	0.6 (0.25)

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APPENDIX A

POWER HISTORY FOR ASSEMBLY BT03

APPENDIX A

POWER HISTORY FOR ASSEMBLY BT03

The 20 ATM-106 fuel rods were obtained from Assembly BT03, which was irradiated in the Calvert Cliffs No. 1 reactor during Cycles 1, 2, 3, and 4. The detailed power history for Rod NBD107 (Figure 4.6 and Table A.1) was used as the basis for generating the irradiation times and power densities for the ORIGEN2 Code. Cycle 1 started on October 7, 1974, and Cycle 4 ended on October 18, 1980. Because the power is very low during initial startup of a reactor, the power history used for the ATM-106 fuel rods assumes that startup actually occurred on January 1, 1975. During Cycle 1, the reactor was down for ~33 days, starting on April 10, 1976. During Cycle 3, the reactor was down for approximately 25 days, starting on December 28, 1978. The average burnup for Rod NBD107 is 3660 GJ/kgM (42.3 MWd/kgM) as compared with the assembly average burnup of 3690 GJ/kgM (42.7 MWd/kgM). Both of these burnups were calculated by Combustion Engineering (C-E).

The irradiation history was extracted from data reported by C-E. The detailed data given in Table A.1 have been averaged over periods when the power did not change by more than 30%. The results are given in Table A.1. The power densities given in Table A.2 were then normalized to give burnups of 20, 25, 30, 35, 40, 45, and 50 MWd/kgM at discharge. Normalization is required because some portions of the fuel (such as at the ends of the rod) do not achieve the peak or rod-average burnups. Results of the ORIGEN2 calculations are provided in Appendix F.

TABLE A.1. Detailed Power History for Rod NBD107

Cycle 1		Cycle 2		Cycle 3[a]		Cycle 4	
Time Interval, Days	LHGR, kW/m (kW/ft)	Time Interval, Days	LHGR, kW/m (kW/ft)	Time Interval, Days	LHGR, kW/m (kW/ft)	Time Interval, Days	LHGR, kW/m (kW/ft)
24.2	19.2 (5.84)	7.2	13.3 (4.06)	10.9	12.6 (3.84)	45.0	13.8 (4.21)
19.6	24.1 (7.36)	31.0	17.1 (5.20)	14.1	12.4 (3.78)	24.1	13.8 (4.20)
39.7	24.1 (7.34)	16.4	19.0 (5.80)	25.3	6.7 (2.03)	22.4	13.9 (4.23)
39.7	23.9 (7.27)	11.4	18.9 (5.77)	12.2	14.0 (4.27)	25.2	14.1 (4.29)
39.4	23.7 (7.22)	12.6	18.9 (5.76)	16.3	14.2 (4.33)	31.0	6.7 (2.05)
39.3	23.6 (7.18)	23.2	18.9 (5.76)	15.1	15.2 (4.63)	44.8	6.3 (1.91)
39.1	23.5 (7.17)	22.7	18.9 (5.76)	38.1	14.3 (4.37)	48.1	7.0 (2.13)
38.9	23.6 (7.18)	23.0	18.9 (5.76)	30.9	14.6 (4.44)	10.9	12.4 (3.78)
39.0	23.6 (7.18)	8.2	18.8 (5.74)	31.4	14.6 (4.45)	10.6	14.9 (4.54)
39.1	23.5 (7.16)	31.0	19.3 (5.88)	31.5	14.6 (4.44)	45.3	15.2 (4.63)
39.1	23.3 (7.11)	33.8	19.4 (5.90)	43.2	14.8 (4.52)	28.7	15.1 (4.59)
39.4	23.1 (7.05)	16.5	19.8 (6.03)	60.0	14.9 (4.53)	27.9	15.6 (4.75)
39.3	22.9 (6.97)	19.1	19.6 (5.97)	28.0	16.1 (4.92)	65.9	15.5 (4.71)
39.3	22.6 (6.90)	12.8	19.8 (6.02)			36.1	15.7 (4.79)
39.3	22.4 (6.82)	35.2	18.4 (5.62)				
39.3	22.2 (6.76)	1.9	18.3 (5.57)				
19.6	22.0 (6.72)						
20.4	21.1 (6.44)						
30.8	14.9 (4.54)						
32.8	12.3 (3.76)						

(a) Reactor was shut down for 25 days starting with day 270 of Cycle 3.

TABLE A.2. ATM-106 Power History Based on Rod NBD107

Cycle No.	Time Interval, days	Power Density, W/g
1	465.0	29.66
1	33.0	0
1	168.7	28.33
1	63.3	17.28
down	81.0	0
2	306.0	25.18
down	71.0	0
3	25.0	16.72
3	25.3	8.93
3	218.7	19.32
3	25.0	0
3	88.0	20.98
down	81.0	0
4	116.7	19.44
4	123.9	9.33
4	225.4	21.34

APPENDIX B

GAMMA SCANNING OF ATM-106

APPENDIX B

GAMMA SCANNING OF ATM-106

The Materials Characterization Center (MCC) gamma scanning system consists of three major components: 1) the Data Acquisition (DA) System, 2) the in-cell hardware, and 3) an IBM host computer that supervises and controls the gamma scan process and logs all pertinent data. The DA system and the IBM host system are illustrated in the schematic representation shown in Figure B.1. The in-cell hardware is shown in Figure B.2. The fuel rod is drawn by a motor-driven chuck past the germanium-lithium gamma ray detector, which is located at a wall plug in the front face of the hot cell. The wall plug contains a collimater and normally a 0.254-cm (0.1-in.) slit, although a 0.0254-cm (0.01-in.) slit may be installed. A stepping motor controls the position of the fuel rod relative to the detector and controls the rate at which the fuel rod is stepped past the detector. The available hot cell space was insufficient for gamma scanning full-length PWR and BWR fuel rods from top to bottom. Thus, this system is designed to scan from the center of the fuel rod to one end. The rod is then rotated 180° and the process is repeated to scan the other half. The stepping motors determine the center of the fuel rod from an overall fuel rod length measurement made before scanning started.

The software used to complete gamma scanning operations was written to use a variable counting time at each position. The counting time is set to maintain a fixed statistical uncertainty (set at 1%) until the counting time reaches a maximum preset value. Typically, the counting time is 40 to 60 s in the center of the fuel rod (area of maximum activity) and gradually increases to 5 min (preset maximum value) as the activity decreases near the end of the fuel rod. With this approach, gamma scan results have been obtained for the following isotopes: ^{134}Cs (0.6 MeV), ^{137}Cs, and ^{134}Cs (0.8 MeV). These are the only isotopes present that meet the predetermined statistical requirements. Other isotopes can be selected and counted, but

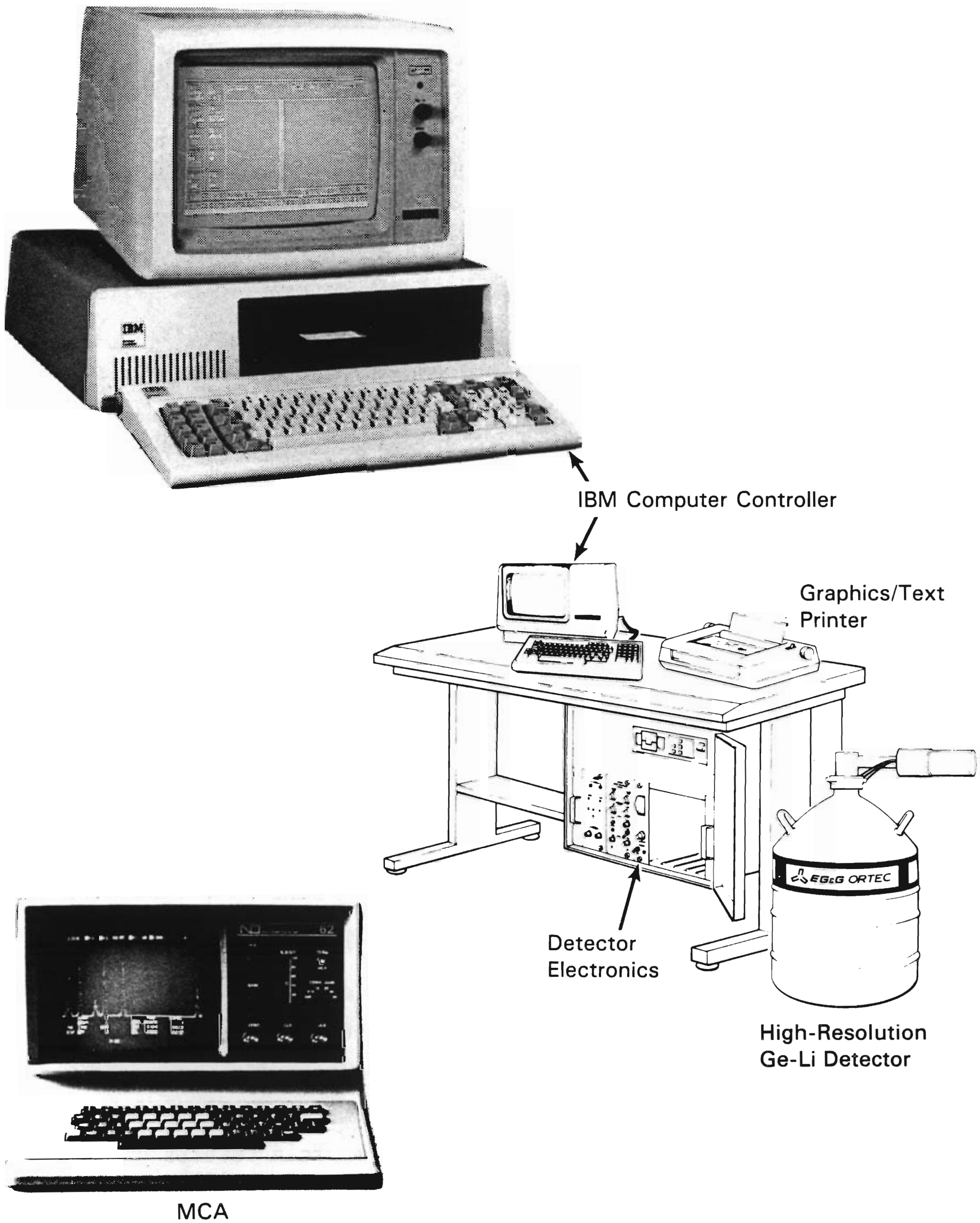


FIGURE B.1. Data Acquisition System and IBM Host System for Gamma Scanning Spent Fuel Rods

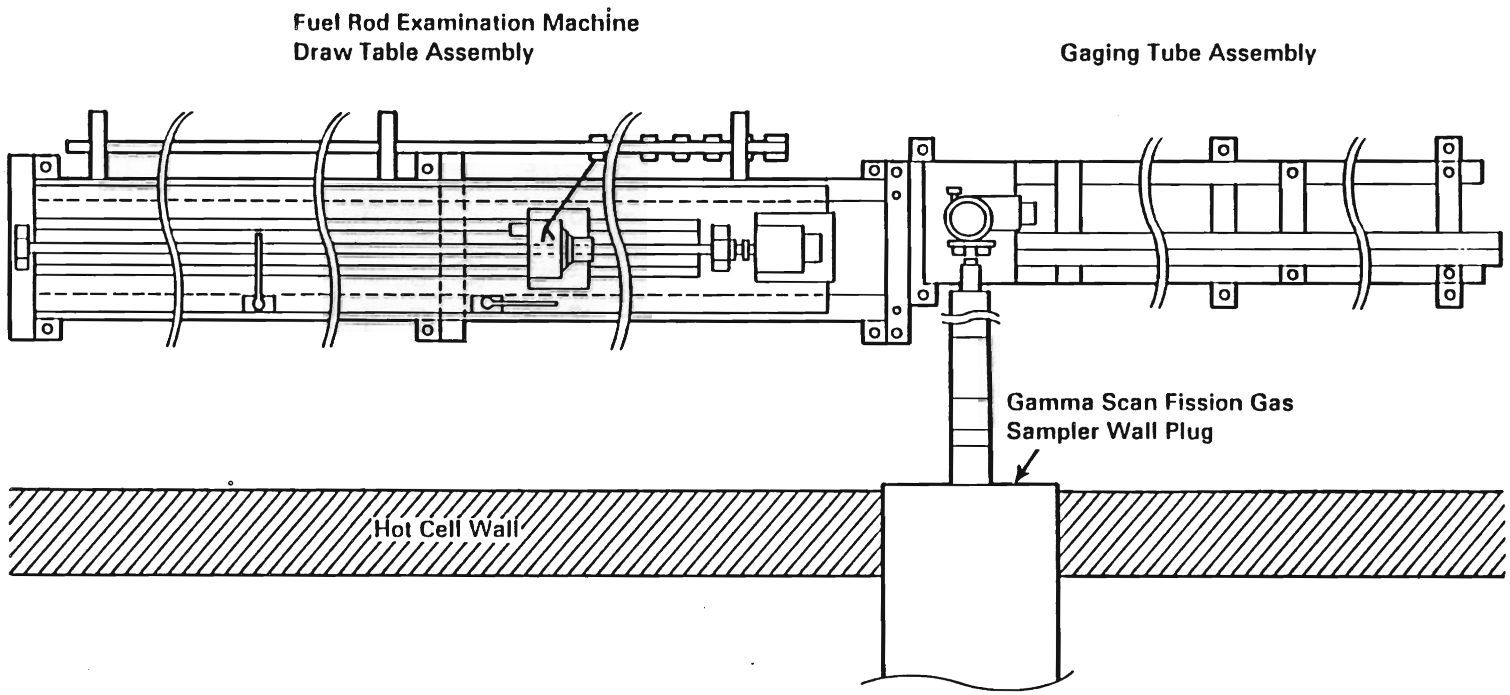


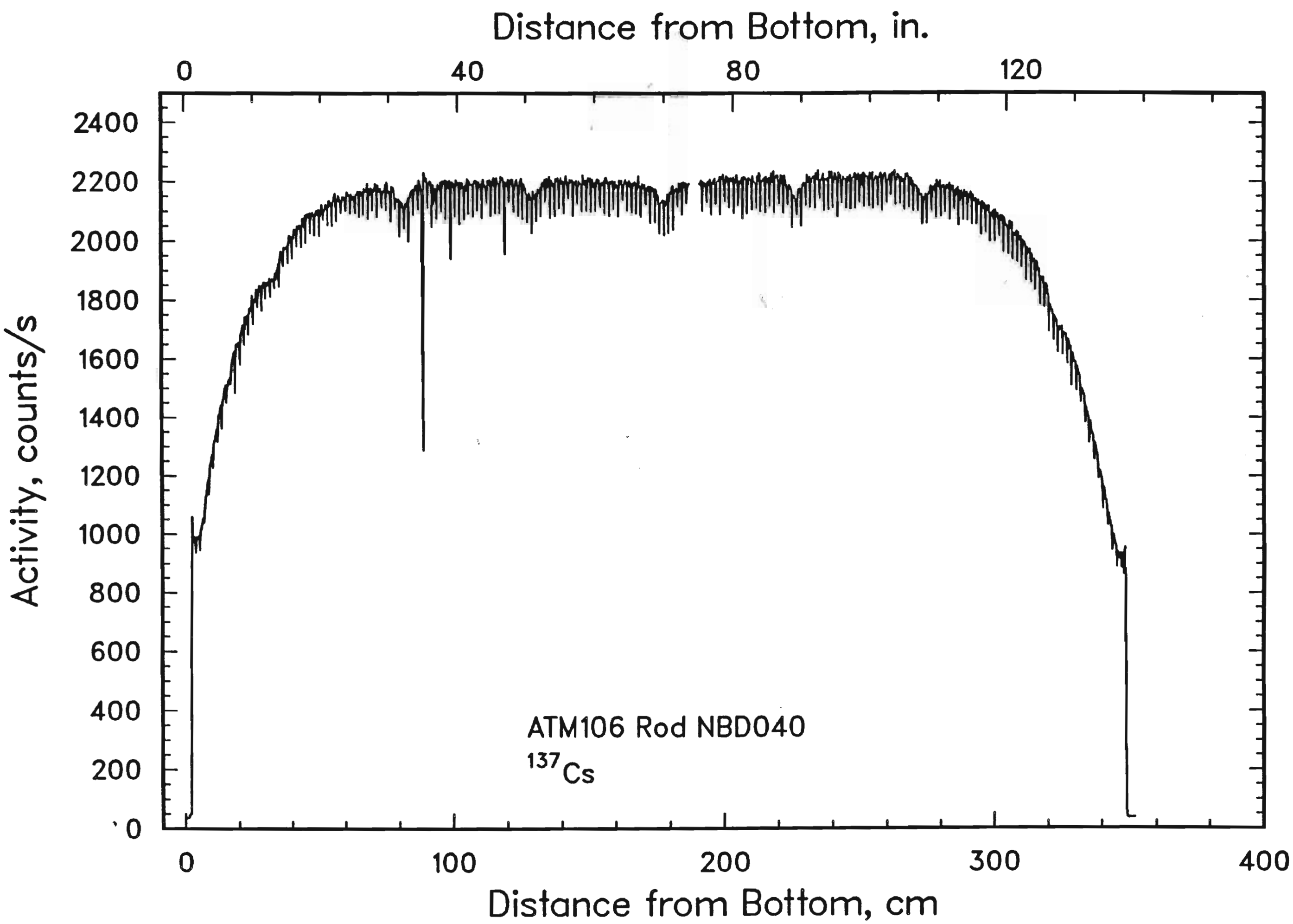
FIGURE B.2. Plan View of In-Cell Hardware for Gamma Scanning of MCC Spent Fuel Rods the error associated with the resulting values will force the use of maximum counting times. A ^{60}Co external source is also tracked to identify whether the multichannel analyzer is functioning correctly.

The following procedure is used for each ATM. One rod is designated the reference rod for that ATM (NBD066 for ATM-106). A full-length gamma scan is completed. The data is plotted and the scan accepted or rejected on the basis of the "reasonableness" of the data plot. For example, there should be no sudden shifts in activity; and the activity is normally highest near the middle, decreasing rapidly toward the ends. Subsequent scans of fuel rods are accepted or rejected on the basis of a 5.08 cm (2-in.) scan of the reference rod taken at a preselected location before and after the full-length gamma scan of the subject rod. The variability in the average activity for those 5.08 cm (2-in) scans must be less than 5% for ^{137}Cs for the rod being scanned to be accepted.

Spectral gamma scan results are presented in this appendix in alphanumeric order for the four rods of ATM-106 that have been examined to date. A summary of the figures for Rods NBD040, NBD066 (reference rod), NBD095, and NBD107 is provided below:

^{137}Cs spectral gamma scans - Figures B.3 to B.6
^{134}Cs spectral gamma scans for 0.6 MeV gamma rays - Figures B.7 to B.10
^{134}Cs spectral gamma scans for 0.8 Mev gamma rays - Figures B.11 to B.14.

A portion of the gamma scan data for Rod NBD040 was affected by an electronic shift over a very short length of the fuel rod. For this reason, the gamma activity data over the fuel rod length from 1.878 to 1.853 m (73.950 to 72.950 in.) from the top of Rod NBD040 are omitted in Figures B.3 and B.7.



<u>FIGURE B.3</u>. Spectral Gamma Scan for ^{137}Cs - Rod NBD040

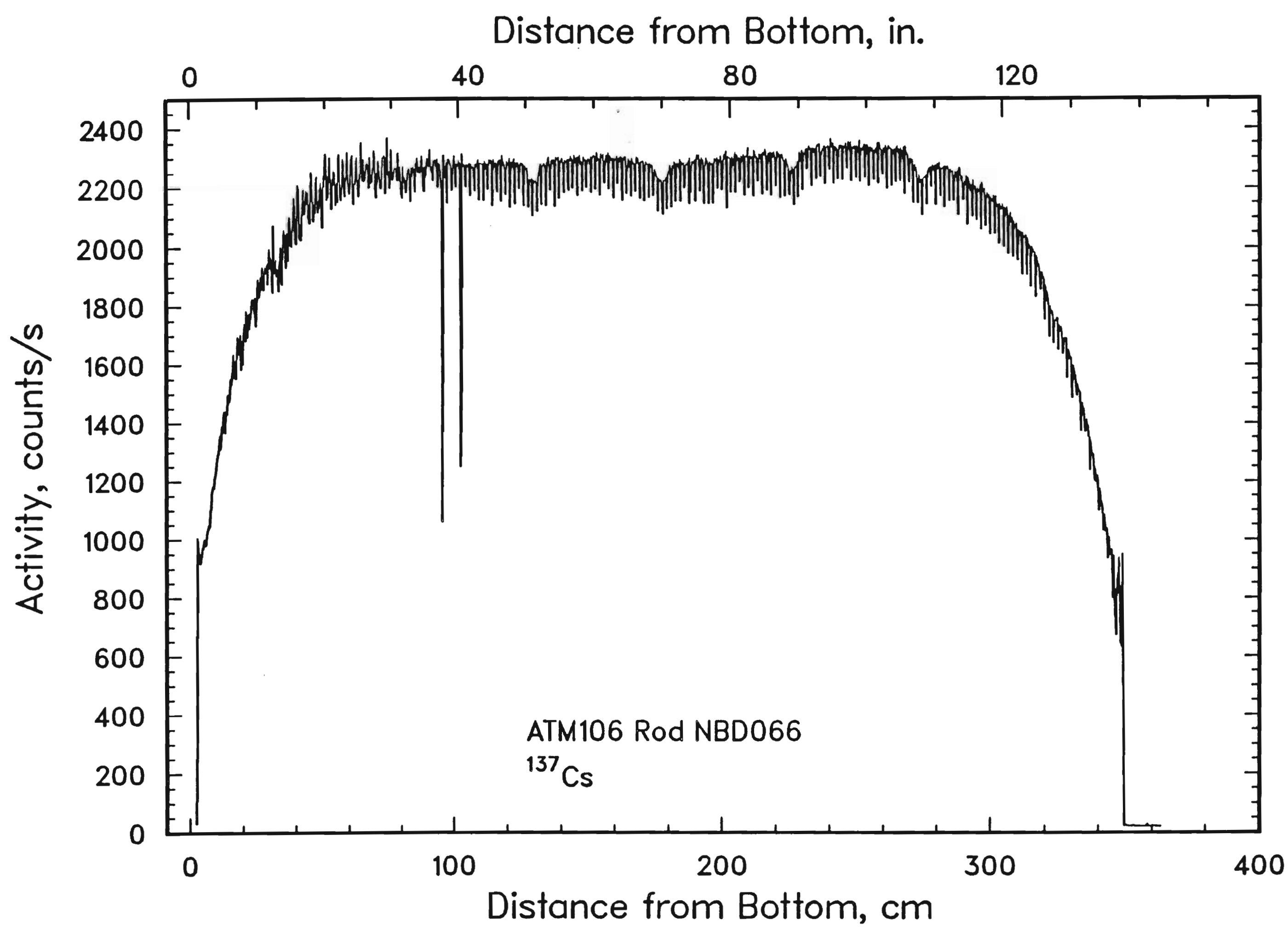


FIGURE B.4. Spectral Gamma Scan for ^{137}Cs - Rod NBD066

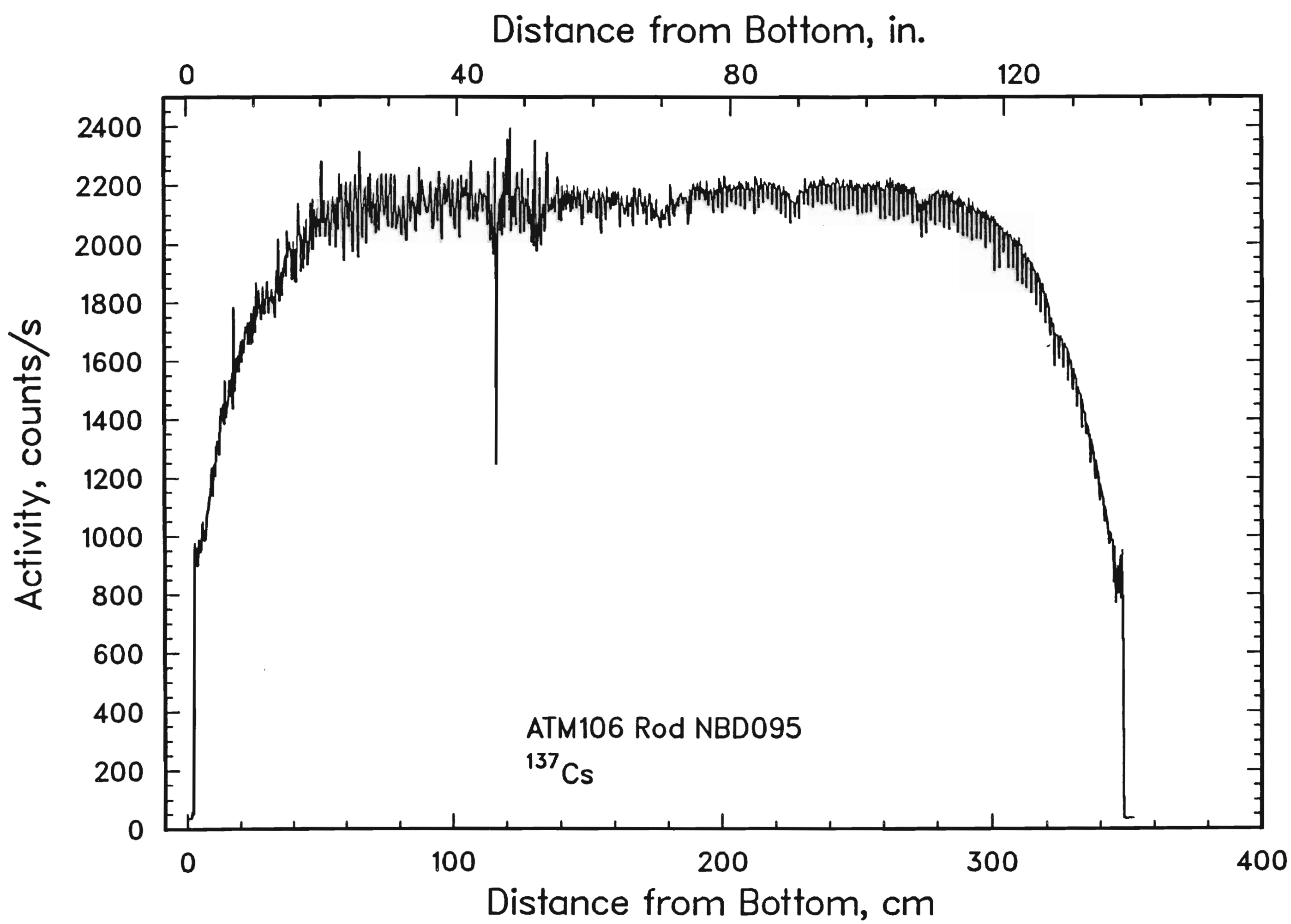


FIGURE B.5. Spectral Gamma Scan for ^{137}Cs - Rod NBD095

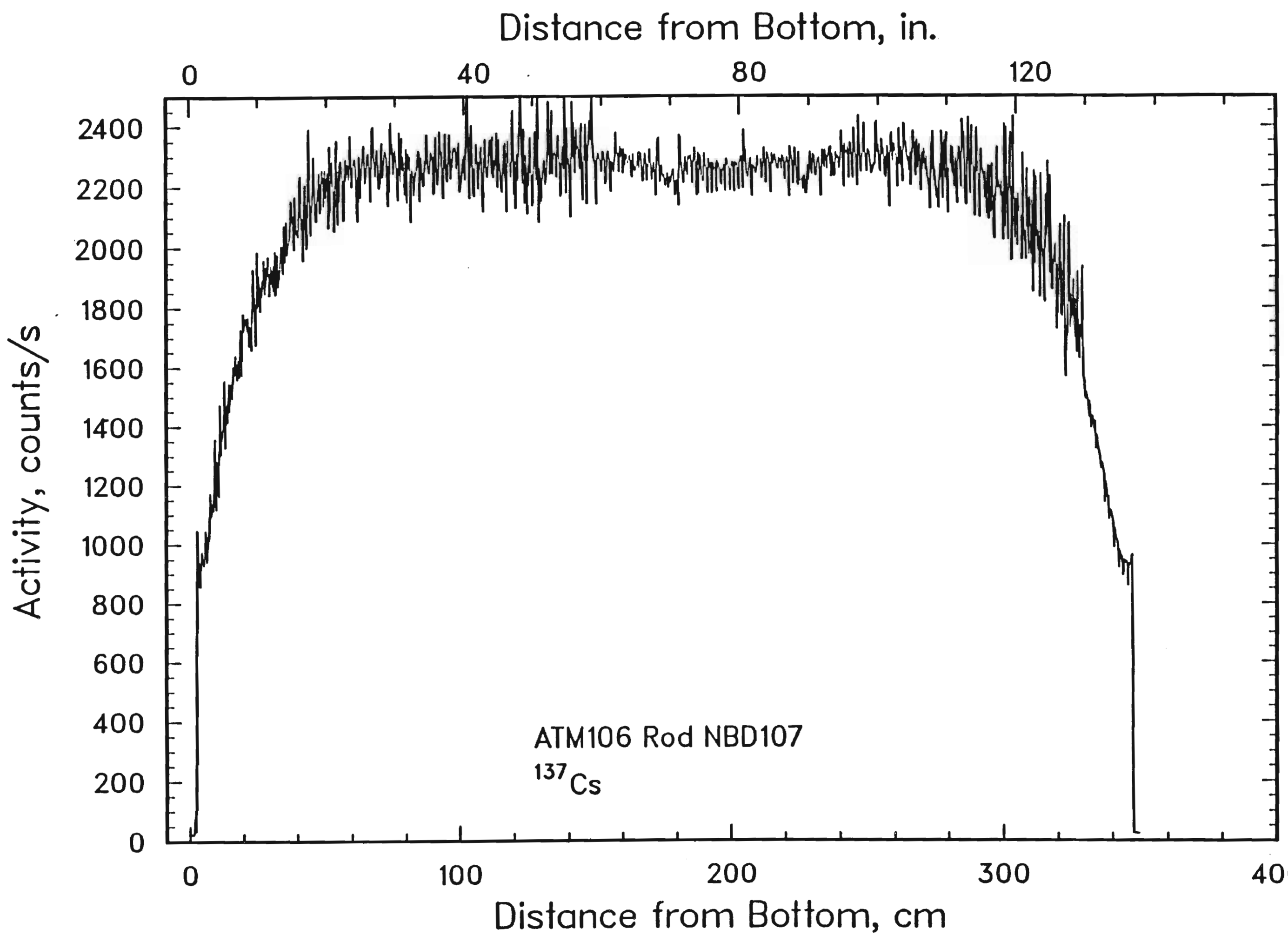


FIGURE B.6. Spectral Gamma Scan for ^{137}Cs - Rod NBD107

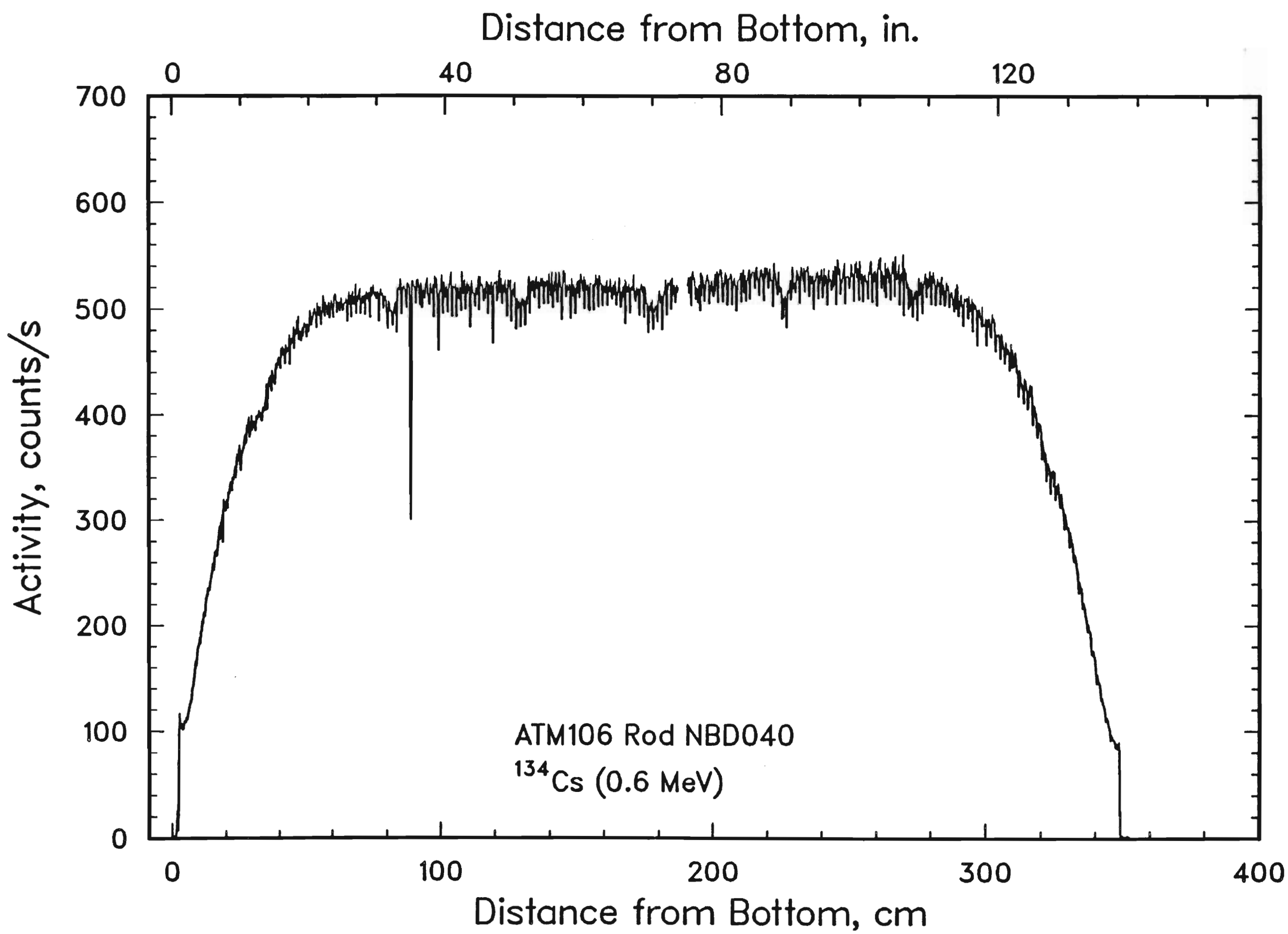


FIGURE B.7. Spectral Gamma Scan for ^{134}Cs (0.6 MeV) - Rod NBD040

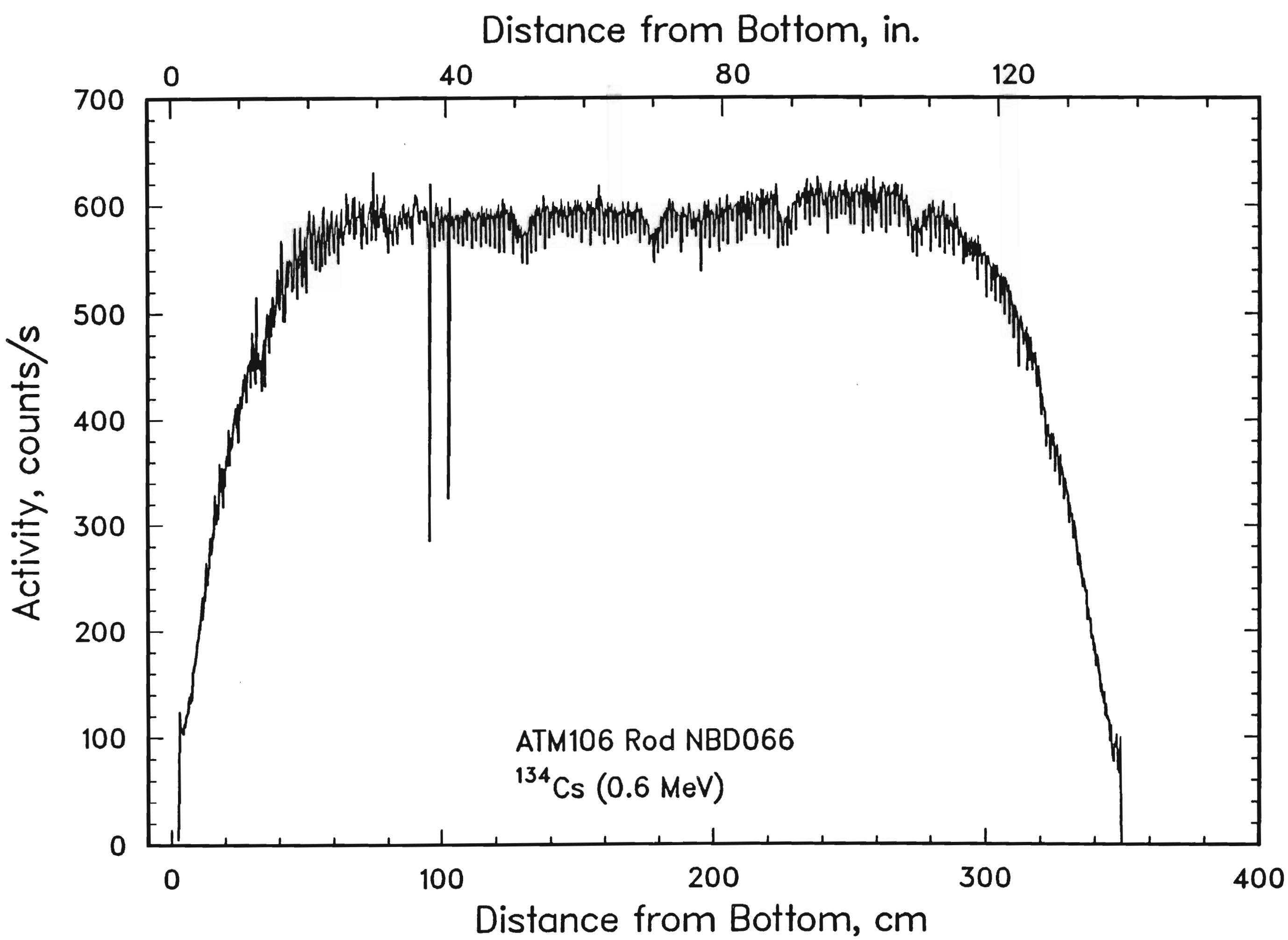


FIGURE B.8. Spectral Gamma Scan for ^{134}Cs (0.6 MeV) - Rod NBD066

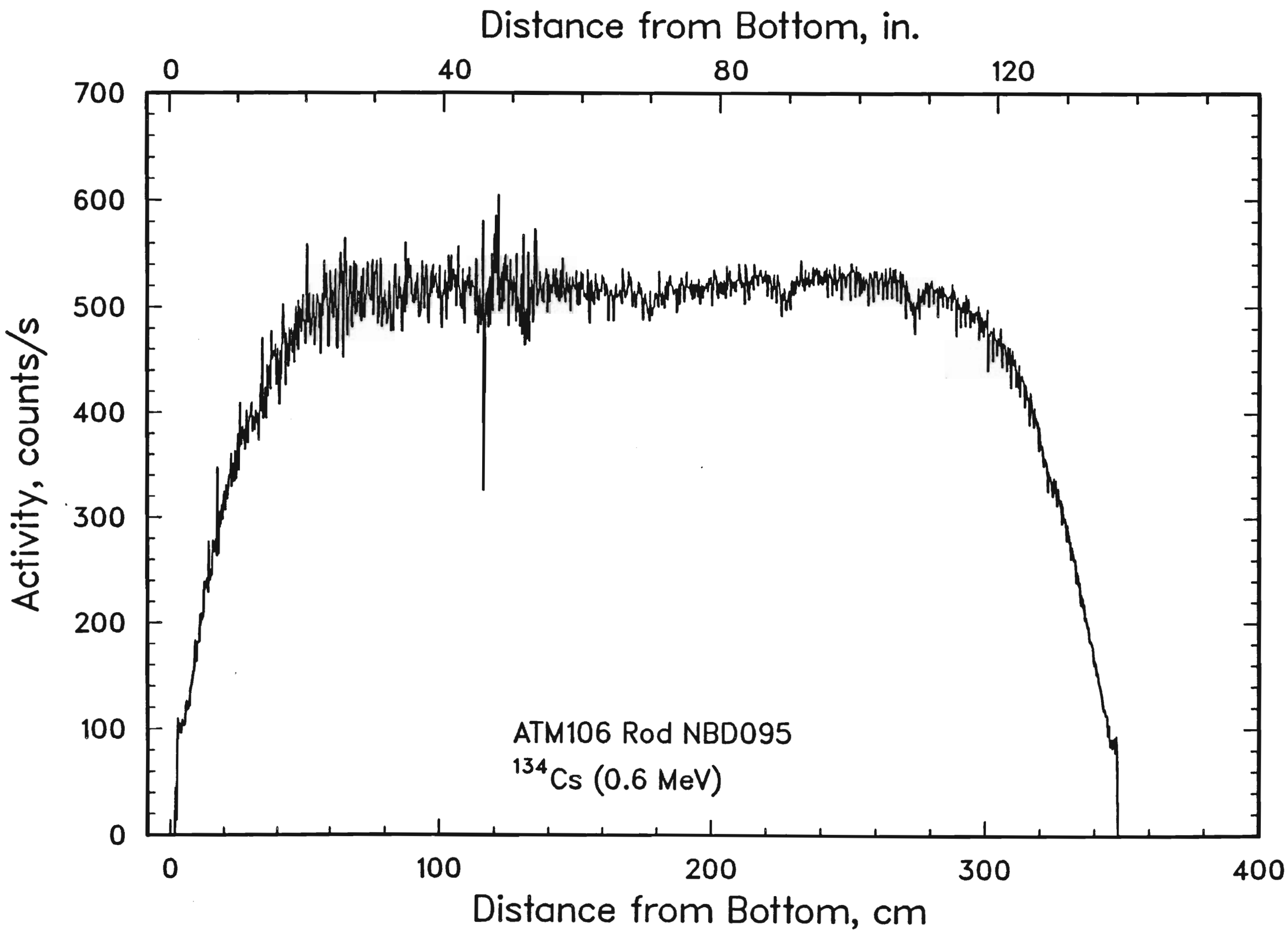


FIGURE B.9. Spectral Gamma Scan for ^{134}Cs (0.6 MeV) - Rod NBD095

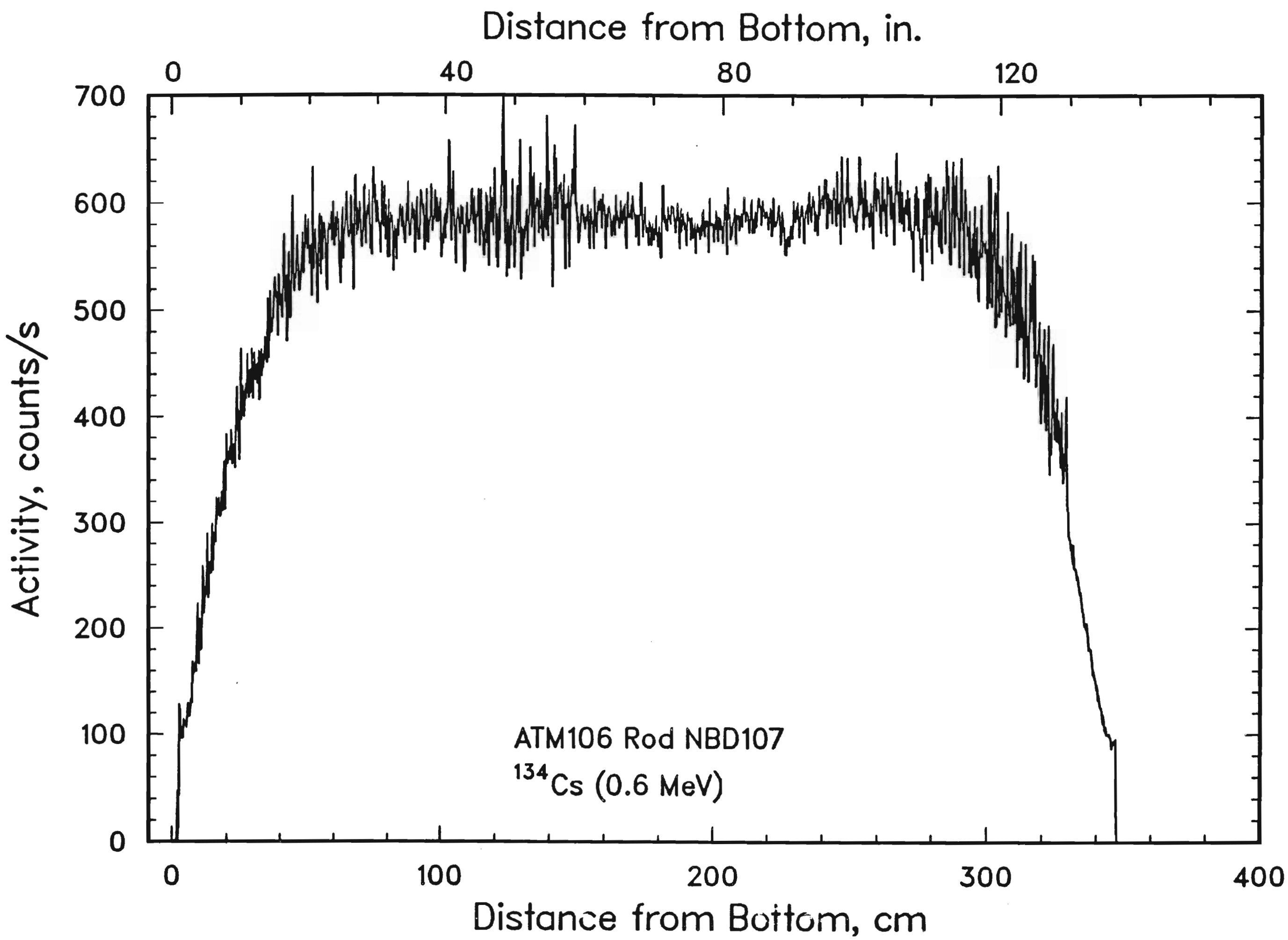


FIGURE B.10. Spectral Gamma Scan for ^{137}Cs (0.6 MeV) - Rod NBD107

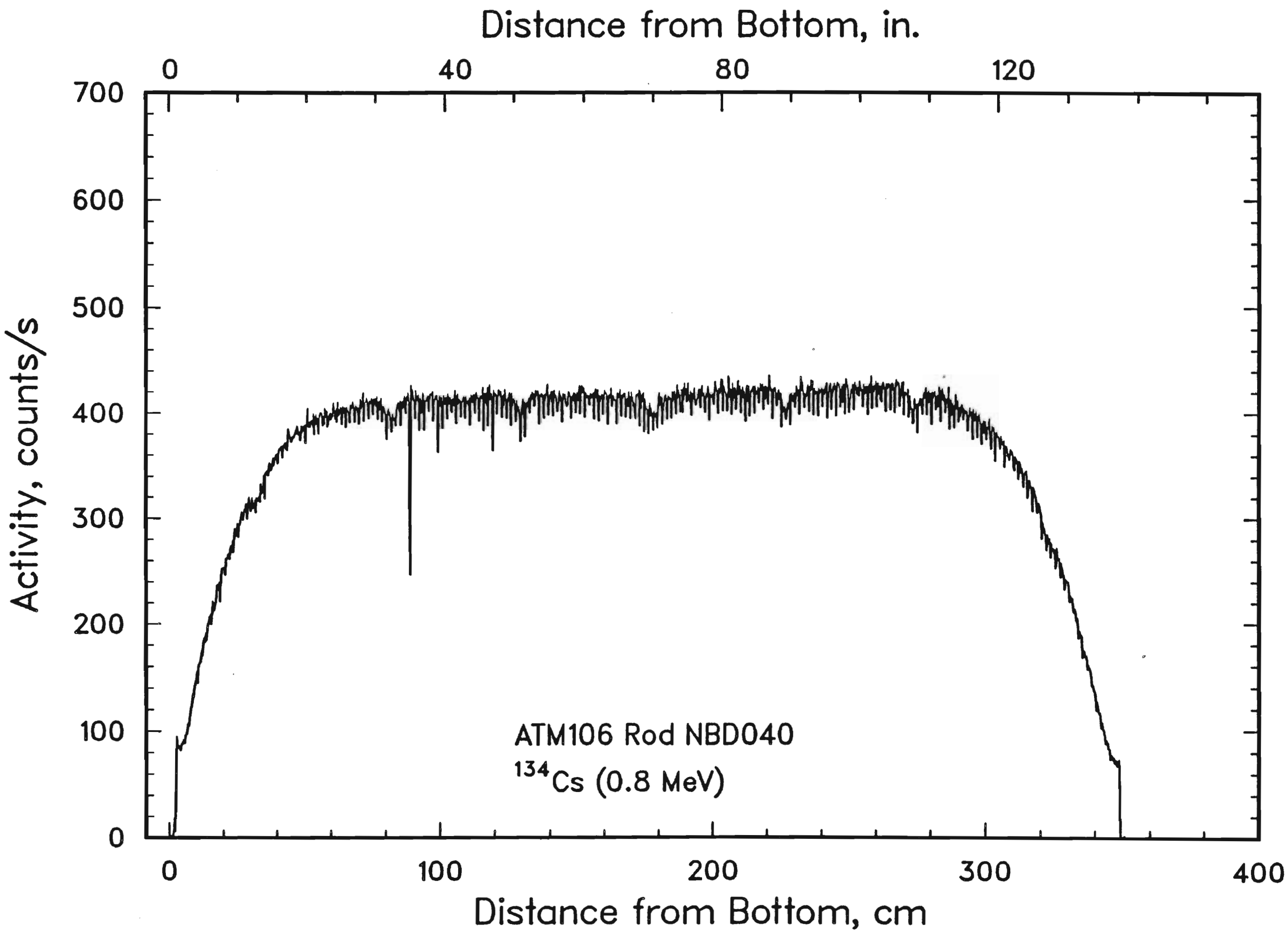


FIGURE B.11. Spectral Gamma Scan for ^{134}Cs (0.8 MeV) - Rod NBD040

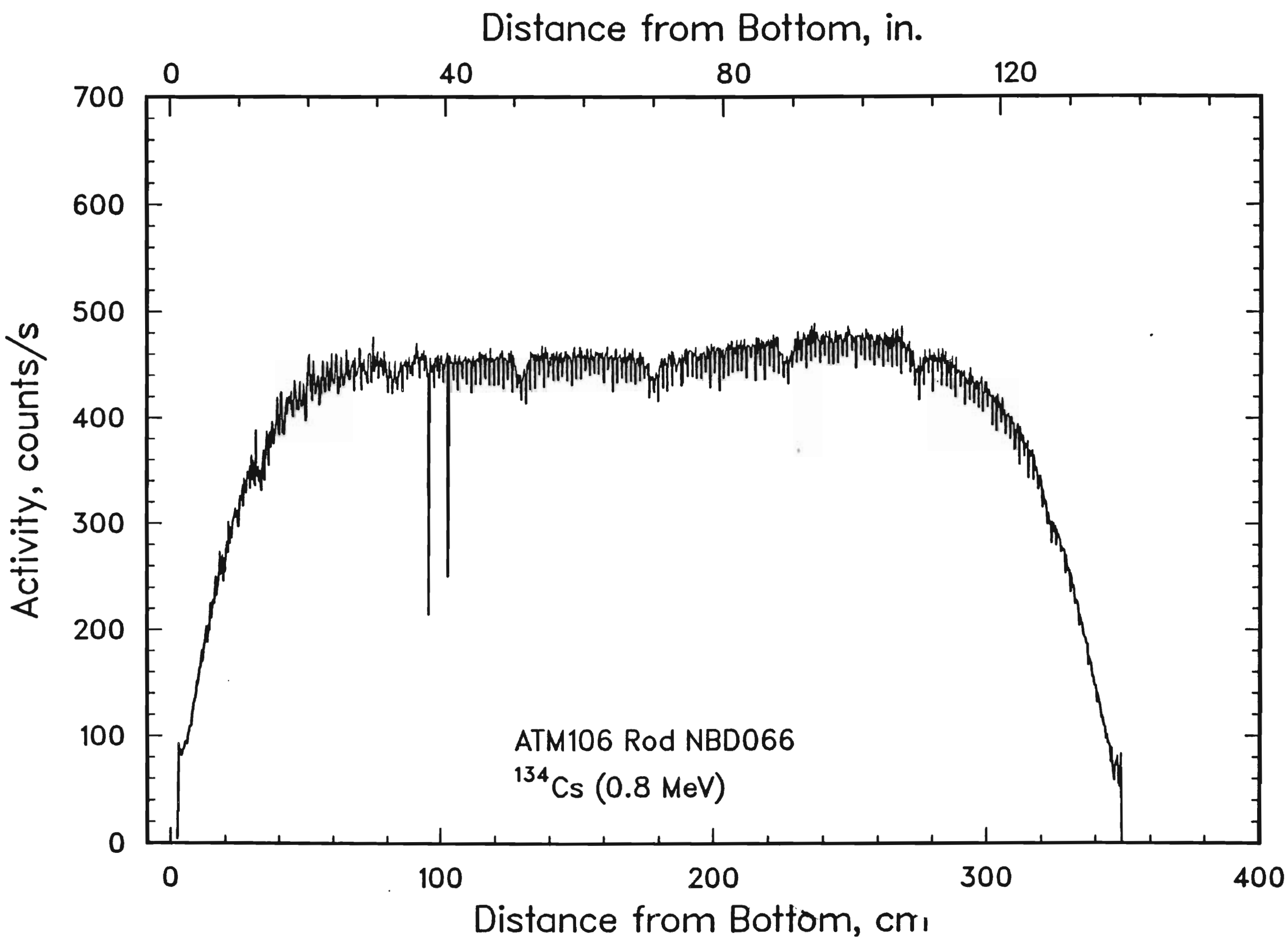


FIGURE B.12. Spectral Gamma Scan for ^{134}Cs (0.8 MeV) - Rod NBD066

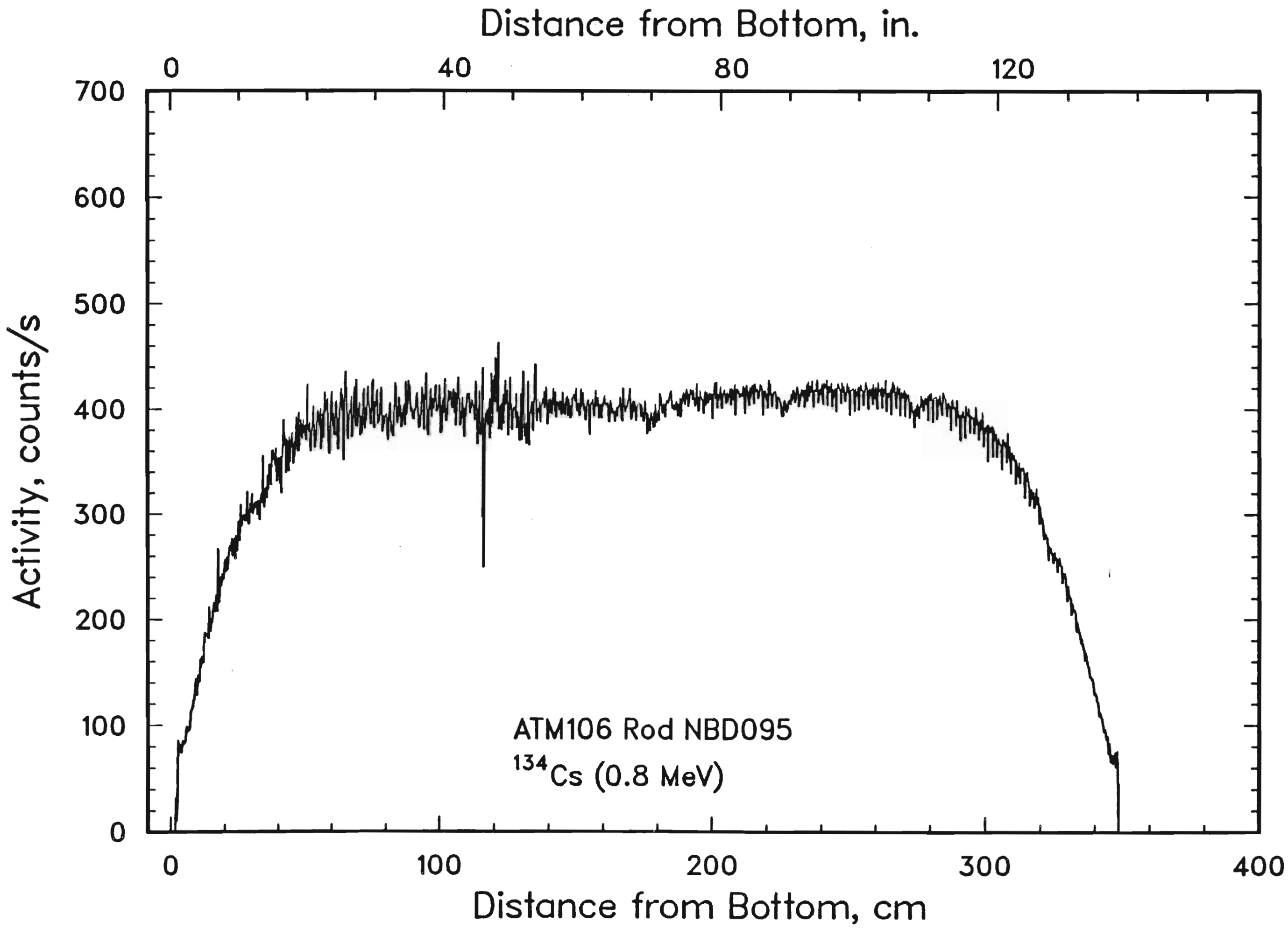


FIGURE B.13. Spectral Gamma Scan for ^{134}Cs (0.8 MeV) - Rod NBD095

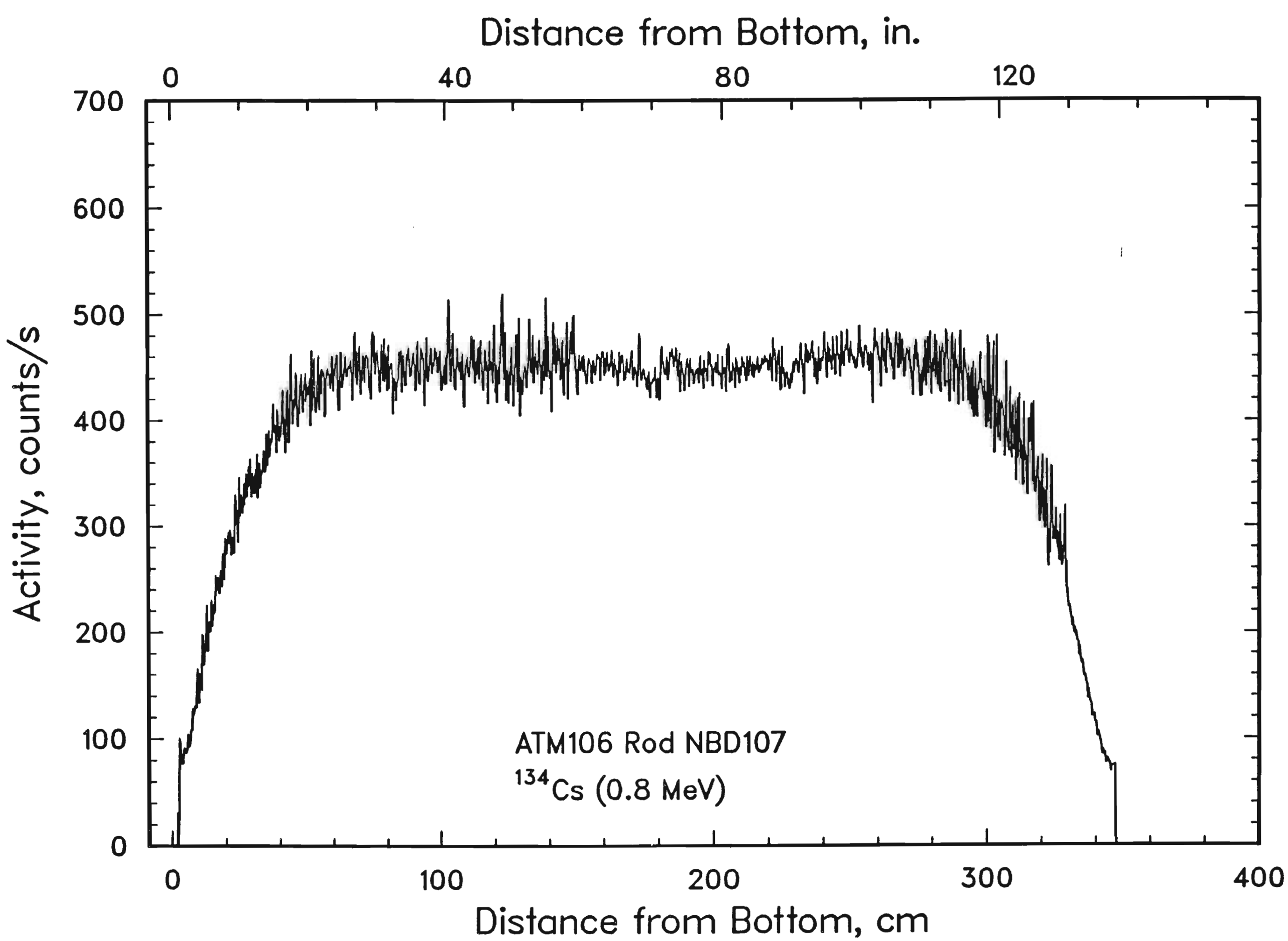


FIGURE B.14. Spectral Gamma Scan for ^{134}Cs (0.8 MeV) - Rod NBD107

APPENDIX C

FISSION GAS SAMPLING

APPENDIX C

FISSION GAS SAMPLING

OPERATING PROCEDURE

There are three objectives for fission gas sampling operations. The first objective is to collect the fission gas from the fuel rods for analysis without contaminating the sample. The other two objectives are to determine the volume of fission gas present in the fuel rod and to determine the fuel rod void volume. To accomplish these objectives a system of leak-tight piping, valves, and calibrated flasks connected to vacuum pumps was fabricated. This system (referred to as the fission gas sample cart) is located in the operating gallery or the "cold" side of the hot cell facility. Piping runs from this cart to a wall plug that extends through the wall of the hot cell. All operations of the system are carried out with a partial vacuum using the current procedure. The top of the fuel rod is inserted into the machined "head" with a flange which, when clamped to the other end of the wall plug, makes a leak-tight connection between the fuel rod and the fission gas sample cart (Figure C.1).

The entire system is evacuated by vacuum pumps to the lowest pressure obtainable, as indicated by a Baratron® gauge. This pressure is usually less than 10^{-1} mm Hg. The system is purged with argon and re-evacuated to remove residual air or other contaminants. The valve to the vacuum pumps is closed, and the readout on the pressure gauge is observed for at least 1 min to determine whether there are any leaks in the system. If no leaks are indicated, the valves to all of the calibrated flasks are closed and fission gas sampling can be conducted. A laser is used to make a small hole in the fuel rod by focusing the laser to a pinhole-sized beam to breach the cladding. The fission gas flows into the evacuated sample cart system. Valves to the calibrated flasks are opened until the Baratron gauge is on scale. This pressure, referred to as the system pressure P_S, is recorded. Valves are then opened to the evacuated analytical sample flasks (to obtain the samples for analysis). Two samples are taken in case the fission gas analysis needs

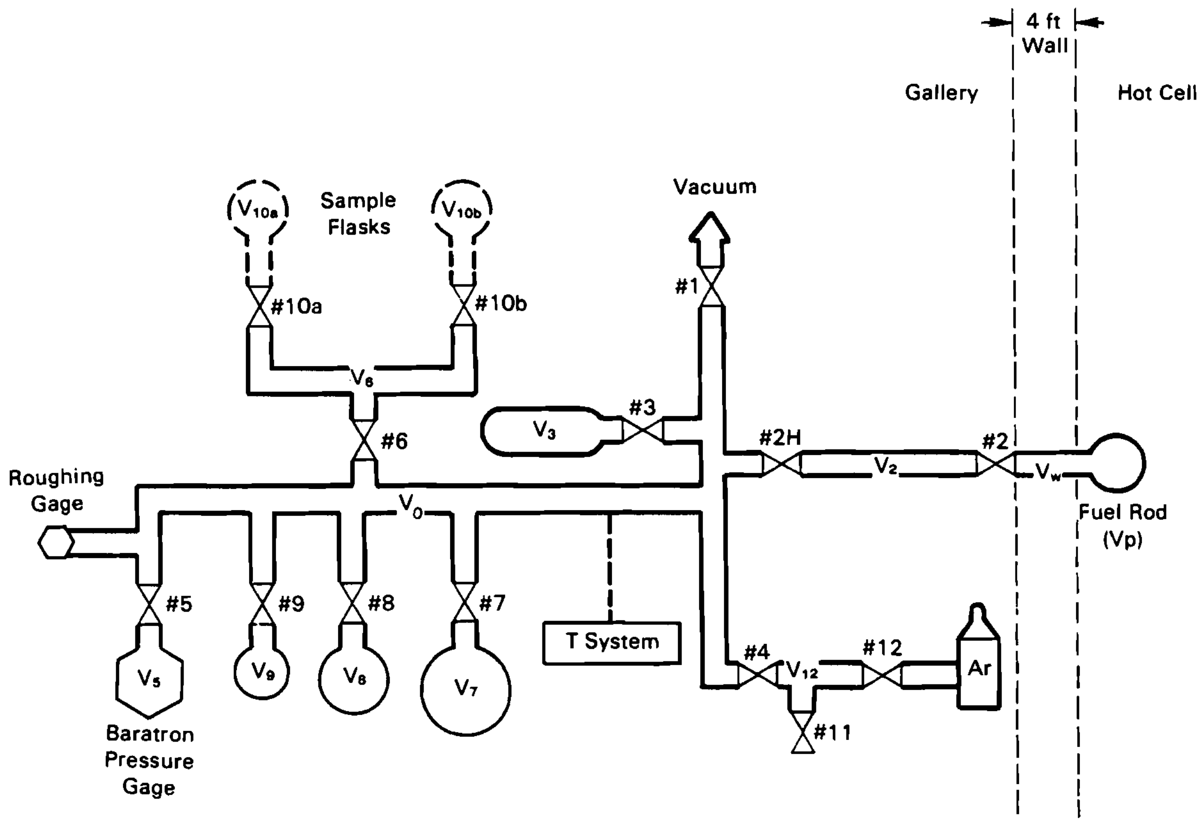


FIGURE C.1. Schematic of Fission Gas Sampling System

to be repeated. The valves to these flasks are closed and the entire system is again evacuated to remove residual fission gas in the rod. The sample flasks are removed from the cart and transferred to the analytical lab.

FUEL ROD VOID VOLUME

After the fuel rod gas is collected, the fuel rod void volume is determined. The entire piping system is evacuated. Then, the valves to the evacuated calibrated flasks are closed, and the fission gas system piping and the fuel rod are pressurized with argon. The argon is permitted to flow into the fuel rod until equilibrium is reached (as indicated by no change in pressure on the Baratron gauge). This pressure is recorded, and the valve to one of the calibrated flasks is opened. When a second equilibrium is reached, the void volume calculation can be completed. The fuel rod void volume is calculated from Boyles' law

$$Vp = \frac{(P_2)\ (V_s) + P_2\ (V_x) - P_1\ (V_s)}{P_1 - P_2}$$

where: P_1 = first pressure reading, mm Hg
P_2 = second pressure reading, mm Hg
V_s = volume of fission gas system piping, cm^3
V_x = volume of selected calibrated flask, cm^3
v_p = fuel rod void volume, cm^3.

QUANTITY OF GAS COLLECTED

Once V_p has been determined, the number of moles of gas collected from the fuel rod can be determined according to the ideal gas law.

$$n = \frac{(P_s)\ (\Sigma V\ )_i}{(62360)\ (273 + T)}$$

where: P_s = system pressure recorded after fuel rod puncture, mm Hg
T = system temperature, °C
ΣV_i = volume of system piping (V_s plus V_p plus volume of all calibrated flasks opened to obtain P_s)
n = moles of gas.

Because V_p is a very small value compared with the other volumes used to determine ΣV_i, normal errors in V_p have only a minor effect on the values reported for n.

APPENDIX D

SECTIONING DIAGRAM

APPENDIX D

SECTIONING DIAGRAM

The as-cut sectioning diagram for Rod NBD107 is shown in a continuous four-part graph of the ^{137}Cs gamma scan (Figure D.1). Each letter along the top of the graph identifies a specific section of the rod and is keyed to the detailed section assignment and location description (Table D.1) that follows the graph. It should be noted that the graphs are referenced to the top end of the rod. Also, note that dashed lines represent cuts that have not been made at the time of preparing this report.

Sections were cut from the rod using a circular saw with an aluminum oxide blade; the saw is operated without coolant. Each cut required less than 1 min. After cutting, the small fuel samples were placed in glass vials for transfer to the analytical facilities. The remaining longer segments (for repository testing or MCC spare material) were marked at the top end for orientation purposes and were placed in individual stainless steel storage tubes that were filled with argon before being capped with a Swagelok® fitting. Two operators were used during sectioning operations to verify that the sections were cut correctly and placed in the proper prelabeled transfer or storage containers. As the sections longer than 2.5 cm (1.0 in.) were cut, as-cut measurements were made. These as-cut measurements were used to prepare an as-cut sectioning diagram as shown in this appendix.

®Swagelok fittings are manufactured by the Crawford Fitting Company, Solon, Ohio.

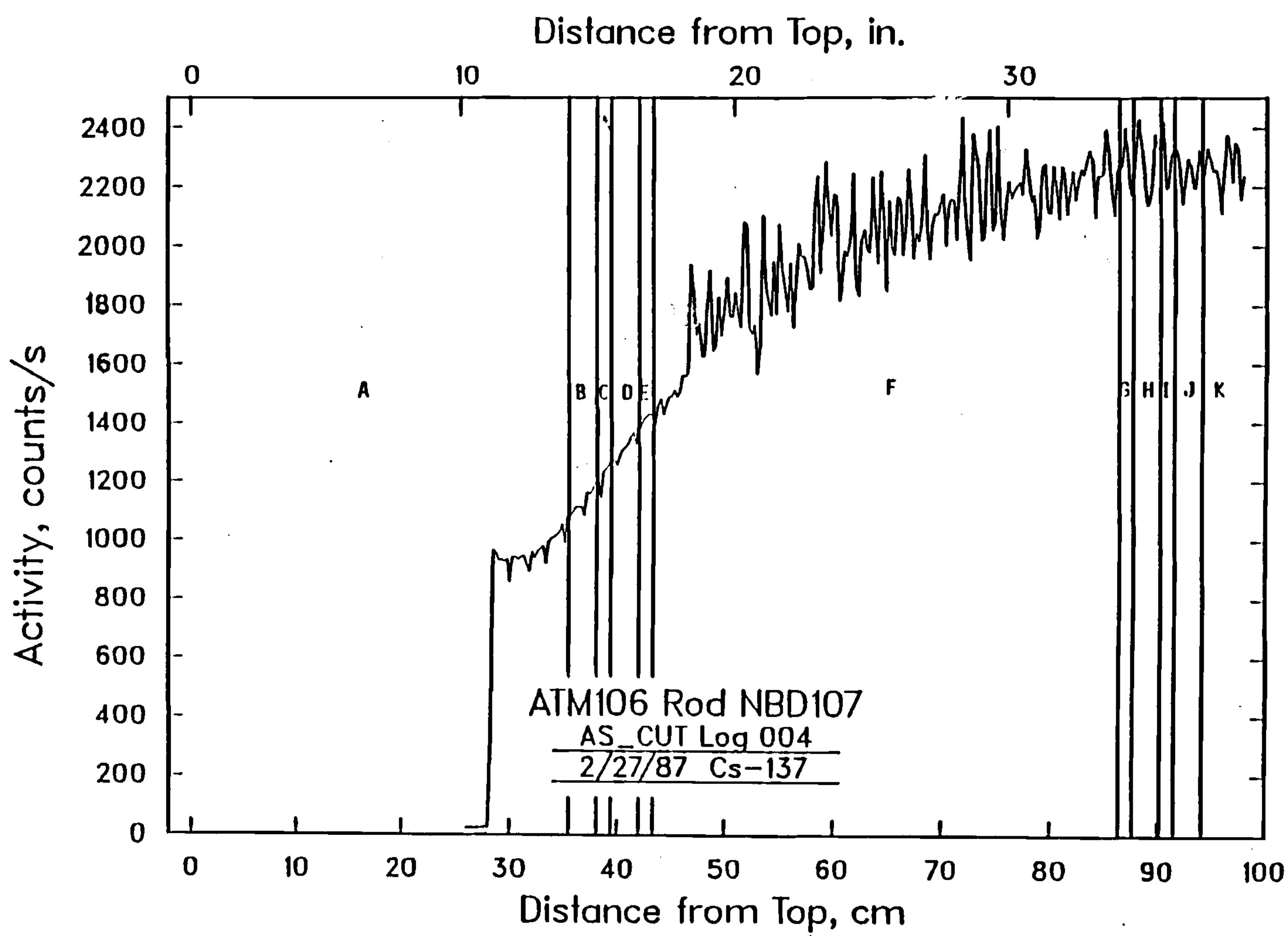


FIGURE D.1. As-Cut Sectioning Diagram for Rod NBD107

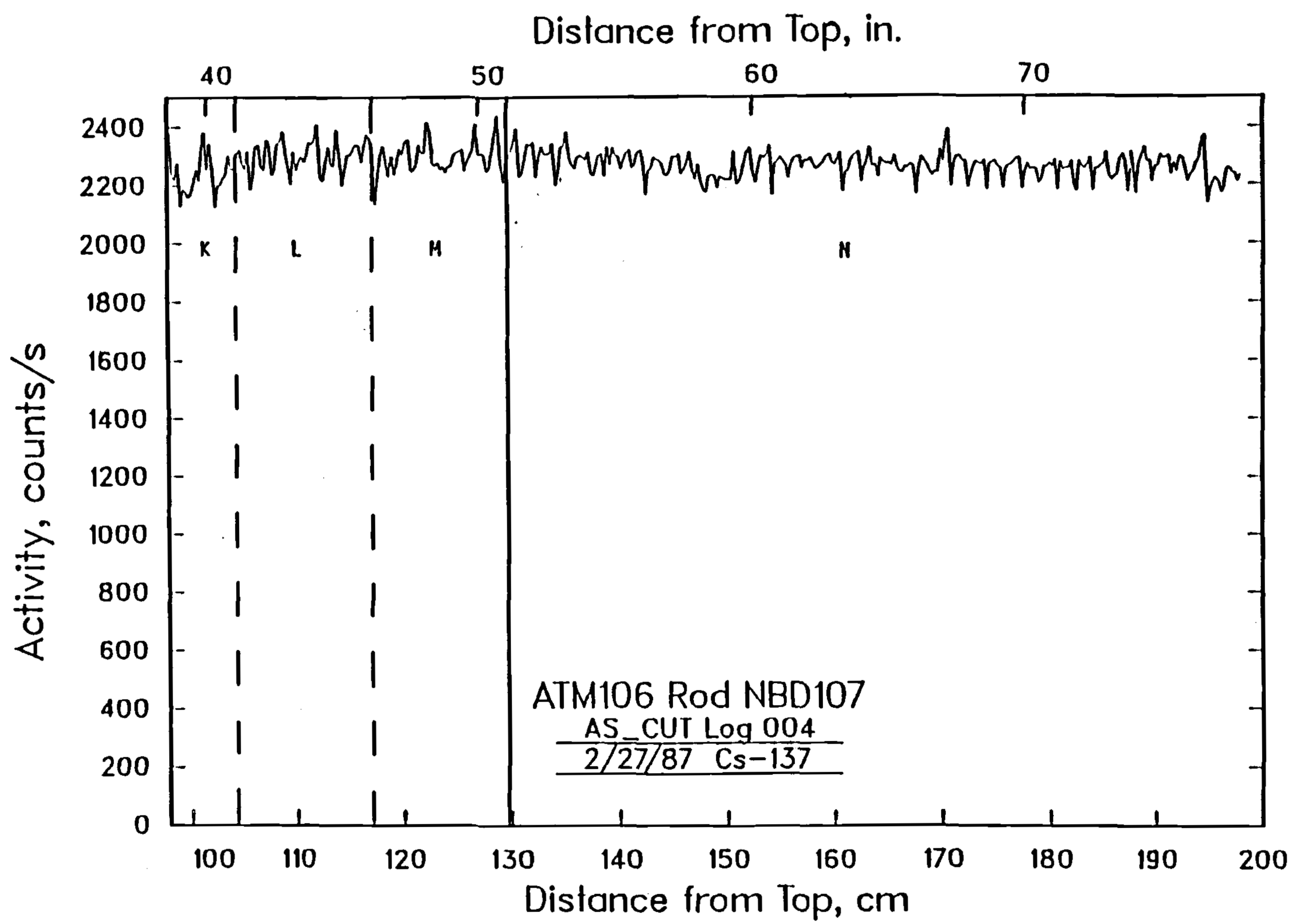


FIGURE D.1. As-Cut Sectioning Diagram for Rod NBD107

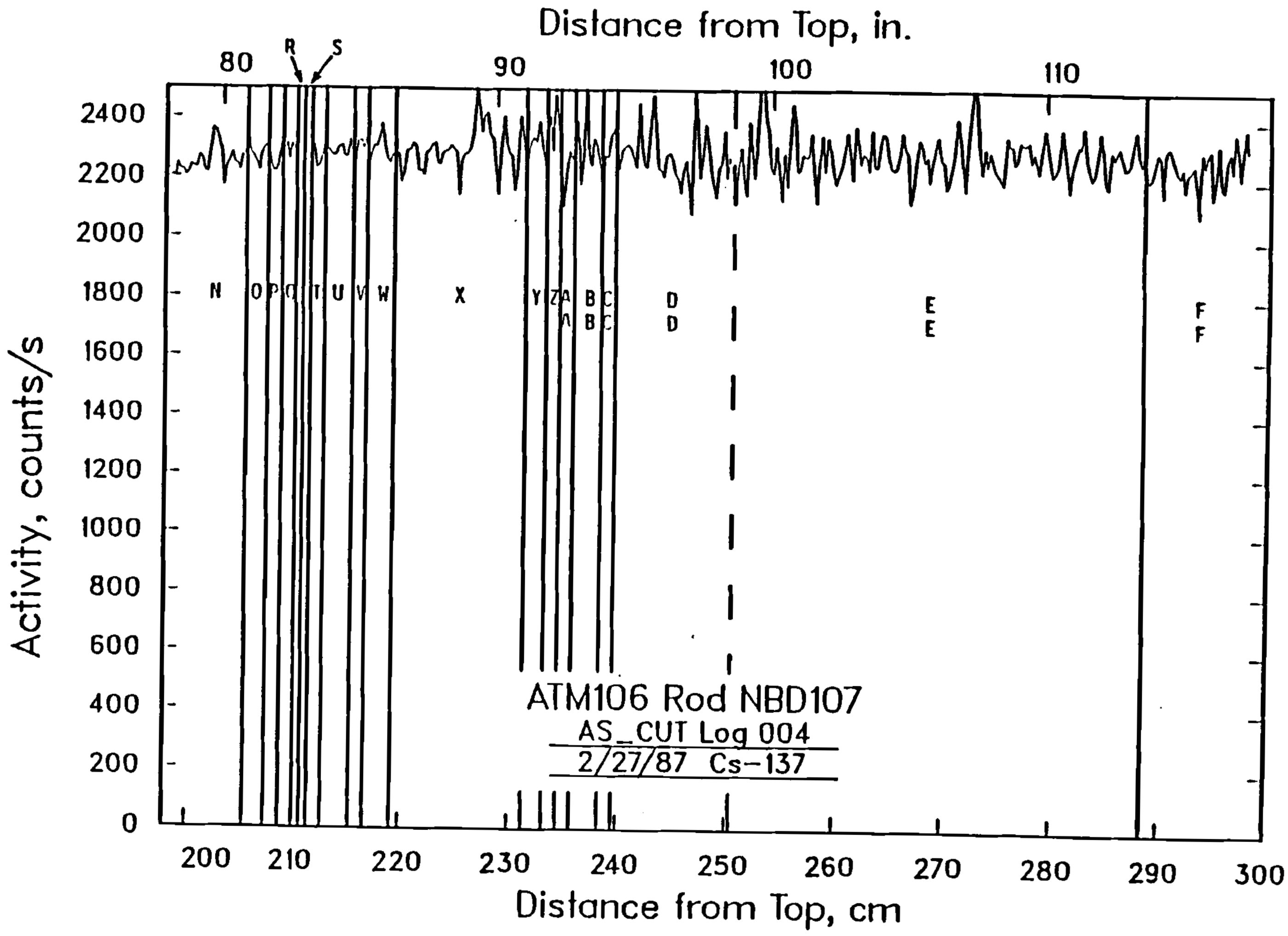


FIGURE D.1. As-Cut Sectioning Diagram for Rod NBD107

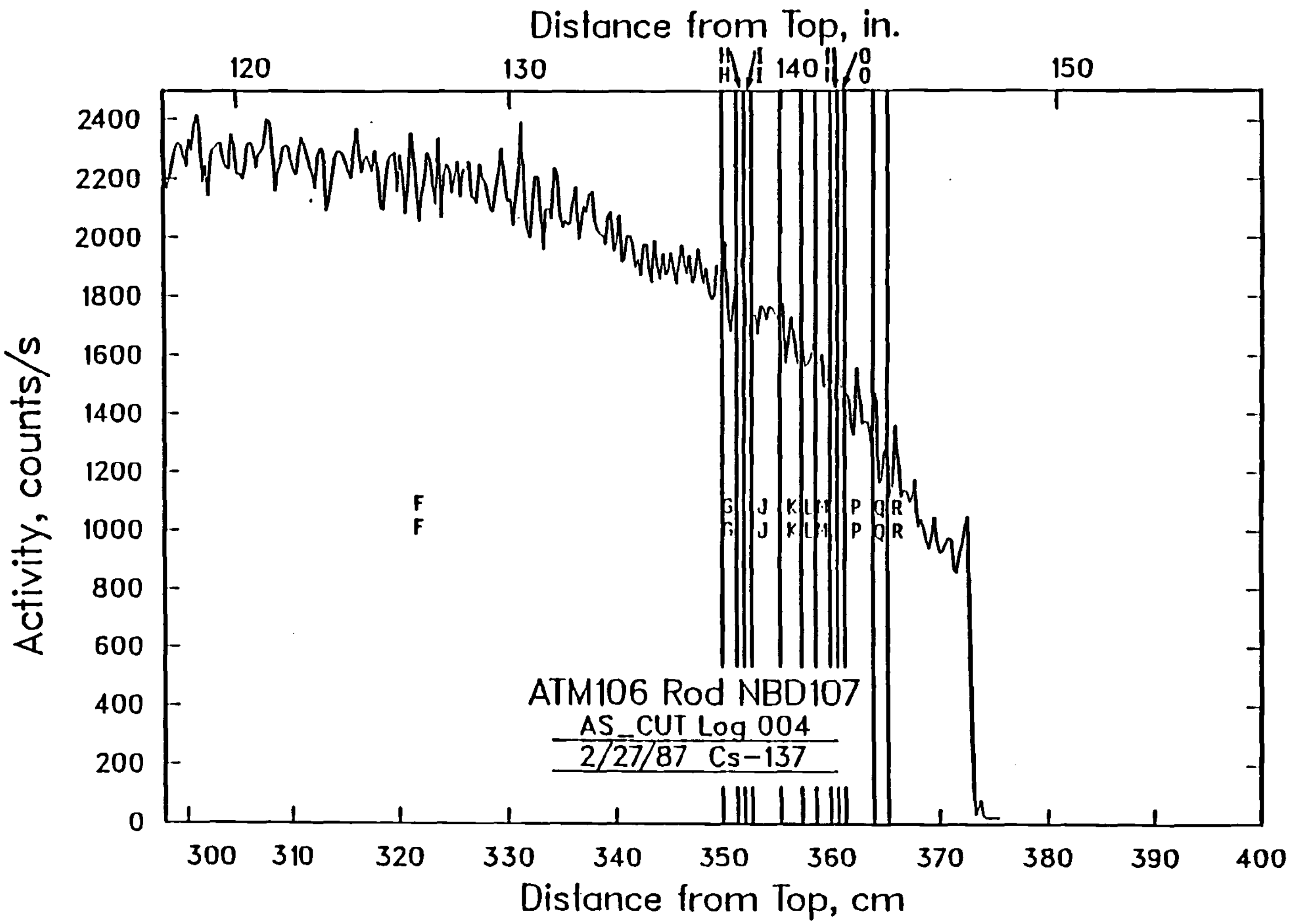


FIGURE D.1. As-Cut Sectioning Diagram for Rod NBD107

TABLE D.1. Description of As-Cut Sections of ATM-106, Rod NBD-107 (Keyed to Figure D.1)

Section Identification	Section Assignment	Distance[a] from Top, cm (in.)	Length,[b] cm (in.)	Notes
A.	MCC Spare Material	0-35.433 (0-13.950)	35.43 (13.95)	c
B.	MCC I-129 on Cladding ID; MCC Cs-135 and Cs-137 on Cladding ID and OD	35.497-38.037 (13.975-14.975)	2.54 (1.00)	d
C.	MCC Transverse Metallography-Ceramography	38.100-39.370 (15.000-15.500)	1.27 (0.50)	
D.	ONWI Material	39.434-41.974 (15.525-16.525)	2.54 (1.00)	d
E.	MCC C-14 in Fuel and Cladding	42.037-43.307 (16.550- 17.050)	1.27 (0.50)	
F.	MCC Spare and Archive Material	43.371-86.360 (17.075-34.000)	42.99 (16.93)	c,e
G.	MCC Transverse Metallography-Ceramography	86.424-87.655 (34.025-34.510)	1.23 (0.49)	e
H.	MCC I-129 on Cladding ID; MCC Cs-135 and Cs-137 on Cladding ID and OD	87.719-90.221 (34.535- 35.520)	2.50 (0.99)	e
I.	MCC C-14 in Fuel and Cladding	90.284-91.516 (35.545-36.030)	1.23 (0.49)	e
J.	ONWI Material	91.580-94.082 (36.055-37.040)	2.50 (0.99)	e
K.	MCC Spare Material	94.145-104.305* (37.065-41.065*)	10.16 (4.0)	e,f
L.	NNWSI Material	104.369*-117.069* (41.090*-46.090*)	12.70 (5.0)	e,f
M.	NNWSI Material	117.132*-129.667 (46.115*-51.050)	12.53 (4.94)	e,f
N.	MCC Spare Material	129.731-205.433 (51.075-80.879)	75.70 29.80	c,g
O.	MCC Longitudinal Metallography-Ceramography	205.496-207.386 (80.904-81.648)	1.89 (0.74)	g
P.	MCC Transverse Metallography-Ceramography	207.449-208.704 (81.673- 82.167)	1.25 (0.49)	g
Q.	MCC Burnup, Isotopes, and Radionuclides	208.768-210.022 (82.192-82.686)	1.25 (0.49)	g
R.	ORNL Spark Source	210.086-210.706 (82.711-82.955)	0.62 (0.24)	g

TABLE D.1. (contd)

Section Identification	Section Assignment	Distance From Top,[a] cm (in.)	Length,[b] cm (in.)	Notes
S.	ORNL Spark Source	210.769-211.389 (82.980-83.224)	0.62 (0.24)	g
T.	MCC Transmission Electron Microscopy	211.452-212.707 (83.249-83.743)	0.494 (0.49)	g
U.	MCC I-129 in Fuel and on Cladding ID; MCC Cs-135 and Cs-137 on Cladding ID and OD	212.771-215.295 (83.768-84.762)	2.52 (0.99)	g
V.	MCC C-14 in Fuel and Cladding	215.359-216.614 (84.787-85.281)	1.25 (0.49)	g
W.	ONWI Material	216.677-219.202 (85.306-86.300)	2.53 (0.99)	g
X.	MCC Spare and Archive Material	219.266-231.267 (86.325-91.050)	12.00 (4.73)	c,h
Y.	MCC Longitudinal Metallography-Ceramography	231.331-233.172 (91.075-91.800)	1.841 (0.73)	h
Z.	MCC Transverse Metallography-Ceramography	233.236-234.442 (91.825-92.300)	1.21 (0.48)	h
AA.	MCC Transmission Electron Microscopy	234.506-235.712 (92.325-92.800)	1.21 (0.48)	h
BB.	MCC I-129 in Fuel and on Cladding ID; MCC Cs-135 and Cs-137 on Cladding ID and OD	235.776-238.252 (92.825-93.800)	2.48 (0.98)	h
CC.	MCC C-14 in Fuel and Cladding	238.316-239.522 (93.825-94.300)	1.21 (0.48)	h
DD.	MCC Spare Material	239.586-250.381*	10.80	c,h
EE.	BWIP Material	250.444*-288.417 (98.600*-113.550)	37.97 (14.95)	c,h
FF.	MCC Spare and Archive Material	288.481-349.987 (113.575-137.790)	61.51 (24.22)	c
GG.	MCC Burnup, Isotopes, and Radionuclides	350.050-351.320 (137.815-138.315)	1.27 (0.50)	
HH.	ORNL Spark Source	351.384-352.019 (138.340-138.590)	0.64 (0.25)	
II.	ORNL Spark Source	352.082-352.717 (138.615-138.865)	0.25 (0.25)	
JJ.	ONWI Material	352.781-355.321 (138.890-139.890)	2.54 (1.00)	

TABLE D.1. (contd)

Section Identification	Section Assignment	Distance From Top,[a] cm (in.)	Length,[b] cm (in.)	Notes
KK.	MCC Longitudinal Metallography-Ceramography	355.384-357.289 (139.915-140.665)	1.91 (0.75)	
LL.	MCC Transverse Metallography-Ceramography	357.353-358.623 (140.690-141.190)	1.27 (0.50)	
MM.	MCC Burnup, Isotopes, and Radionuclides	358.686-359.956 (141.215-141.715)	1.27 (0.50)	
NN.	ORNL Spark Source	360.020-360.655 (141.740-141.990)	0.64 (0.25)	
OO.	ORNL Spark Source	360.718-361.353 (142.015-142.265)	0.64 (0.25)	
PP.	MCC I-129 in Fuel and on Cladding ID; MCC Cs-135 and Cs-137 on Cladding ID and OD	361.417-363.957 (142.290-143.290)	2.54 (1.00)	
QQ.	MCC C-14 in Fuel and Cladding	364.020-365.290 (143.315-143.815)	1.27 (0.50)	
RR.	MCC Spare Material	365.354-375.51 (143.840-147.84)	10.16 (4.00)	

(a) Distance from top reported to three decimal places to keep account of saw loss between sections only.
(b) Section lengths reported to two decimal places. Length does not include 0.064 cm (0.025 in.) saw loss. This is accounted for between sections. Measured lengths are within 0.16 cm (1/16 in.).
(c) Within 0.16 cm (1/16 in.) of as-measured length.
(d) Section assignments for B and D exchanged because of a nonrecovered fuel loss from section B during cutting. Section B, originally specified as ONWI material, is designated as ^{129}I, ^{135}Cs, ^{137}Cs analysis on cladding. Section D, originally specified as ^{129}I, ^{135}Cs, ^{137}Cs analysis on cladding, is designated as ONWI material.
(e) Subtracted 0.038 cm (0.015 in.) from each of the six sections (F-K/L/M) to compensate for 0.223 cm (0.088 in.) difference between as-cut length measurements and "theoretical" summation of sections G through K/L/M after accounting for saw loss. Note that K/L/M is currently one section.
(f) Sections are one section of fuel. Asterisk (*) indicates a theoretical distance from top of the rod that gives a length specified in the pre-cut plan.
(g) Length decreased by 0.015 cm (0.006 in.) for each of 10 sections (N-W) to compensate for 0.160 cm (0.063 in.) difference between as-cut length measurements and "theoretical" summation of sections O through W after accounting for saw loss.
(h) Length decreased by 0.063 cm (0.025 in.) from each of seven sections (X-DD/EE) to compensate for 0.445 cm (0.175 in.) difference between as-cut length measurements and "theoretical" summation of sections Y through DD/EE after accounting for saw loss. Note that DD/EE is currently one section.

APPENDIX E

DETAILS OF CERAMOGRAPHY/METALLOGRAPHY

APPENDIX E

DETAILS OF CERAMOGRAPHY/METALLOGRAPHY

This appendix includes the results of all ceramographic and metallographic examinations conducted to date on ATM-106 fuel. Photographs will be added (pending completion of exams) in subsequent updates of this report. Table E.1 gives a summary of specimen locations. Refer to Figure 4.11 and Appendix D (Sectioning Diagrams) for further details.

The organization of the Figures in Appendix E is given below:

Figure E.1.a - E.1.e	Photomacrographs of As-Polished Transverse Samples
Figure E.1.f - E.1.h	Photomacrographs of As-Polished Longitudinal Samples
Figure E.2.a - E.2.e	Photomicrographs of As-Polished Transverse Samples
Figure E.2.f - E.2.h	Photomicrographs of As-Polished Longitudinal Samples
Figure E.3.a - E.3.e	Photomicrographs of Argon Ion-Etched Transverse Samples
Figure E.3.f - E.3.h	Photomicrographs of Argon Ion-Etched Longitudinal Samples
Figure E.4.a - E.4.f	Exterior/Interior Cladding Surfaces of As-Polished Samples
Figure E.5.a - E.5.e	Etched Cladding of Transverse Samples
Figure E.5.f - E.5.h	Etched Cladding of Longitidinal Samples
Figure E.6.a - E.6.j	Alpha and Beta-Gamma Autoradiographs of Transverse Samples
Figure E.6.k - E.6.p	Alpha and Beta-Gamma Autoradiographs of Longitudinal Samples.

TABLE E.1. Summary of Ceramographic/Metallographic Sections

Specimen ID	Distance from Top,[a] cm (in.)	Type
106-NBD107-C	38.10-39.37 (15.00-15.50)	Transverse Fuel Sample
106-NBD107-G	86.42-87.66 (34.03-34.51)	Transverse Fuel Sample
106-NBD107-O	205.50-207.39 (80.90-81.65)	Longitudinal Fuel Sample
106-NBD107-P	207.45-208.70 (81.67-82.17)	Transverse Fuel Sample
106-NBD107-Y	231.33-233.17 (91.08-91.80)	Longitudinal Fuel Sample
106-NBD107-Z	233.24-234.44 (91.83-92.30)	Transverse Fuel Sample
106-NBD107-KK	355.38-357.29 (139.92-140.67)	Longitudinal Fuel Sample
106-NBD107-LL	357.35-358.62 (140.69-141.19)	Transverse Fuel Sample

(a) Rod distance referenced from top end of rod.

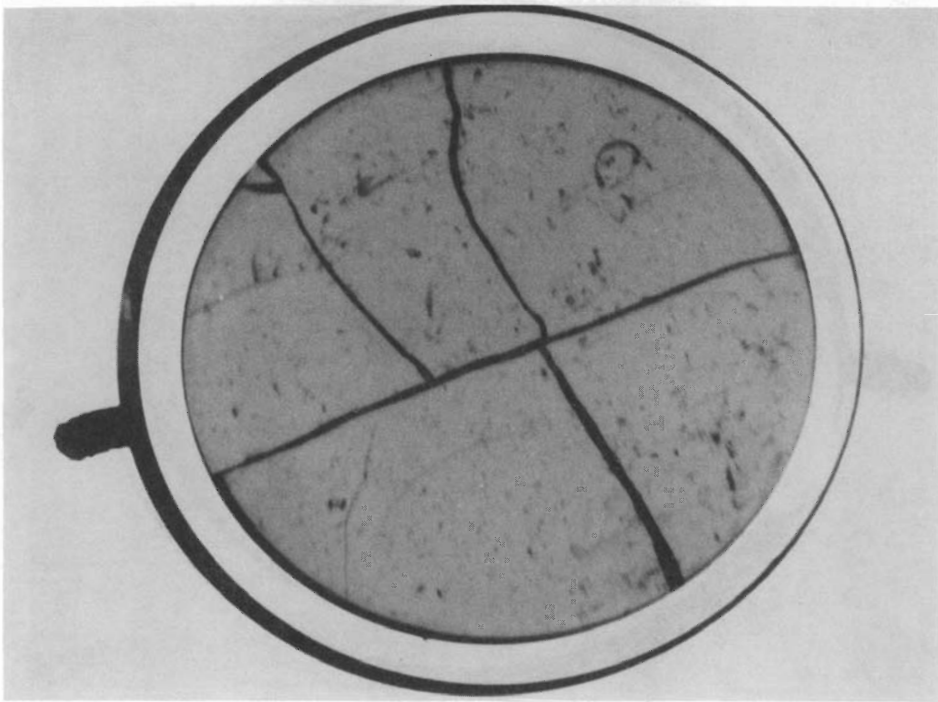


FIGURE E.1.a. Photomacrograph of As-Polished Transverse Sample 106-NBD107-C (~10x) (Neg. No. 8704675-26)

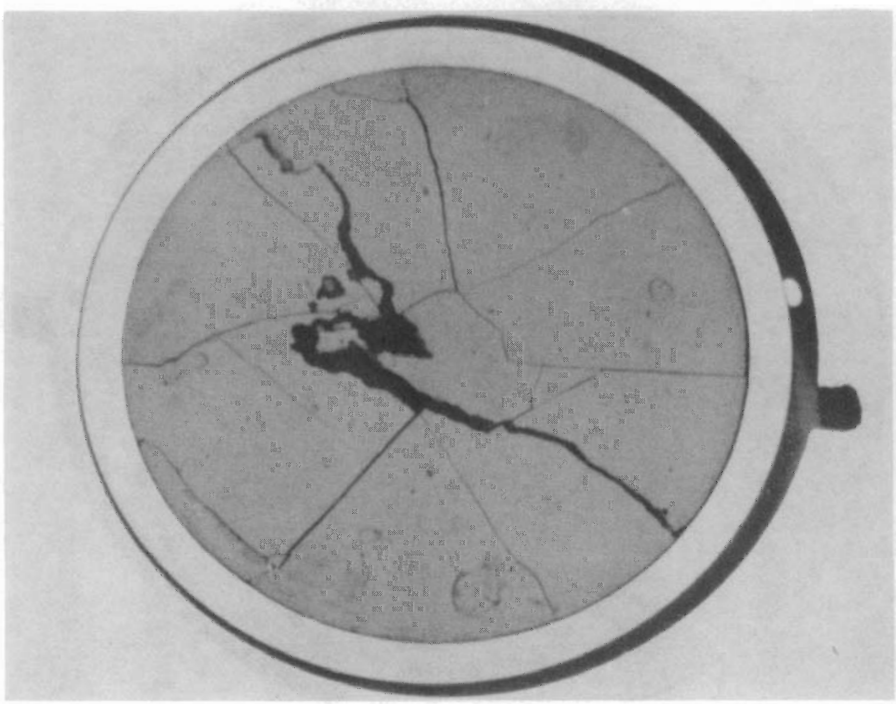


FIGURE E.1.b. Photomacrograph of As-Polished Transverse Sample 106-NBD107-G (~10x) (Neg. No. 8704675-7)

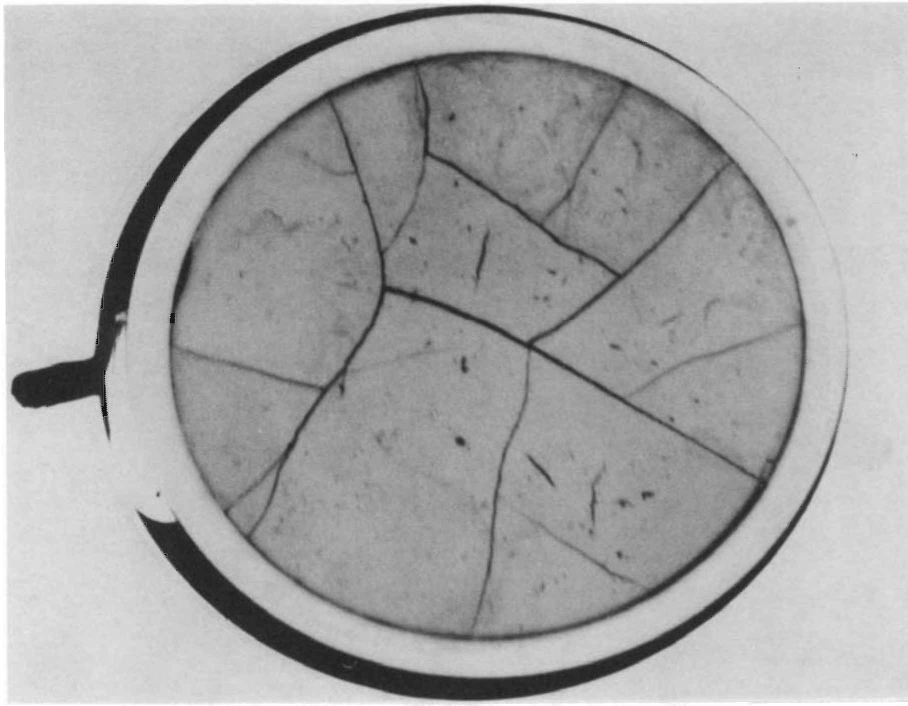


FIGURE E.1.c. Photomacrograph of As-Polished Transverse Sample 106-NBD107-P (~10x) (Neg. No. 8704675-20)

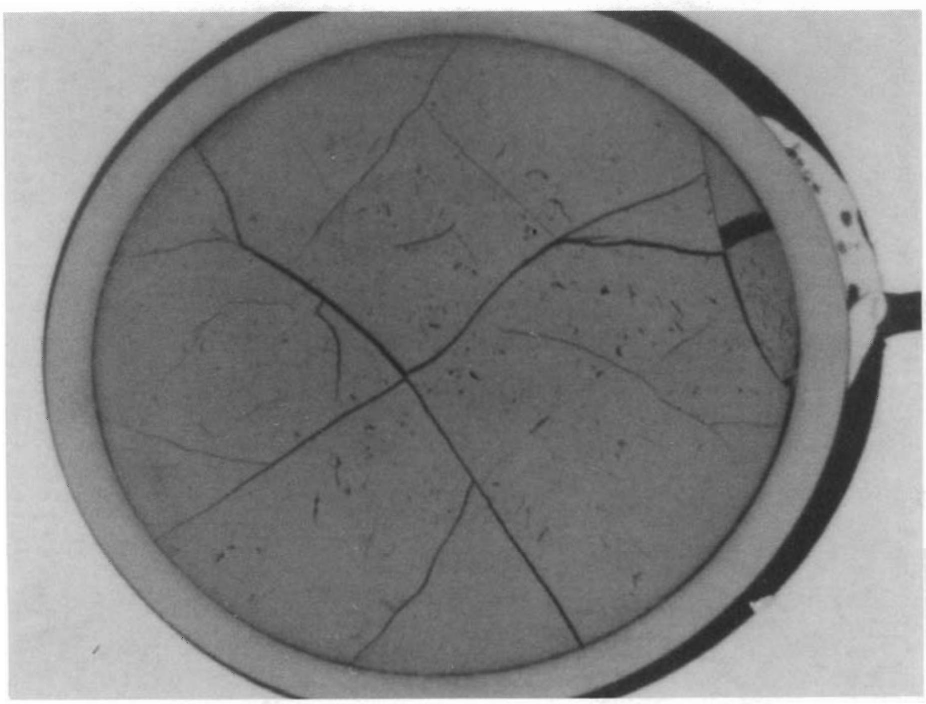


FIGURE E.1.d. Photomacrograph of As-Polished Transverse Sample 106-NBD107-Z (~10x) (Neg. No. 8704494-16)

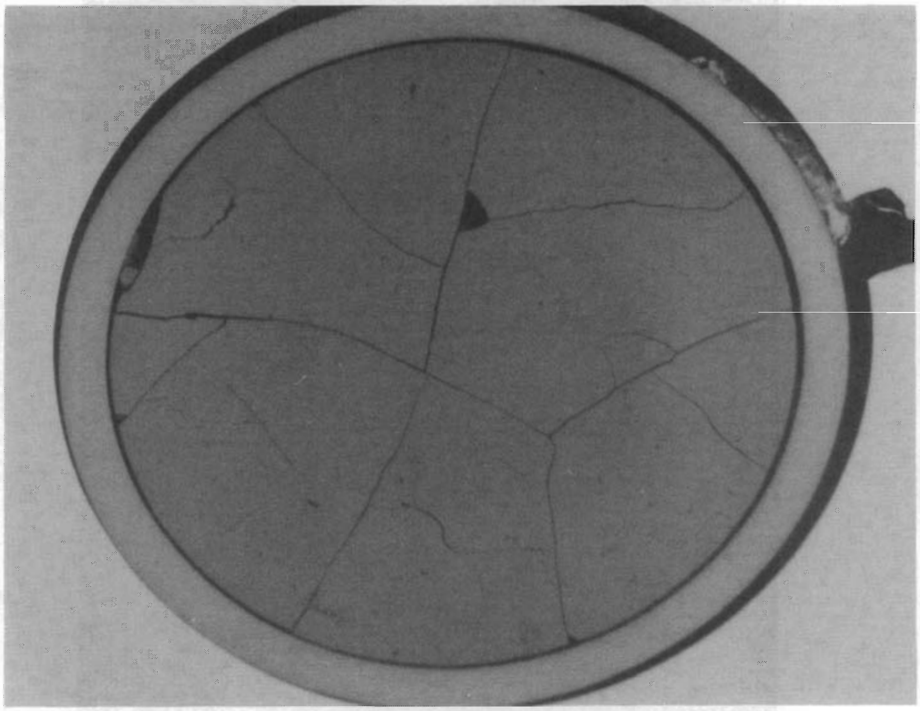


FIGURE E.1.e. Photomacrograph of As-Polished Transverse Sample 106-NBD107-LL (~10x) (Neg. No. 8704494-20)

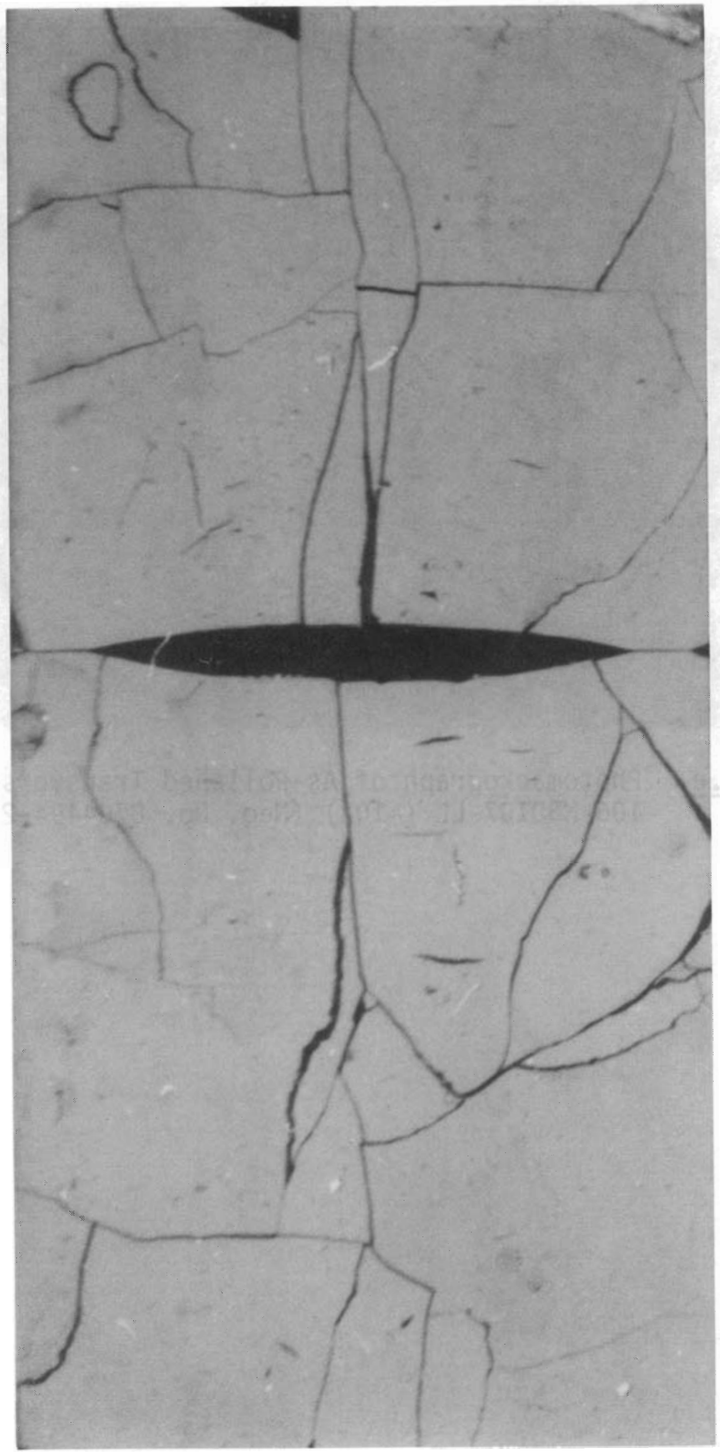


FIGURE E.1.f. Photomacrograph of As-Polished Longitudinal Sample 106-NBD107-0 (~10x) (Neg. No. 8704675-15)

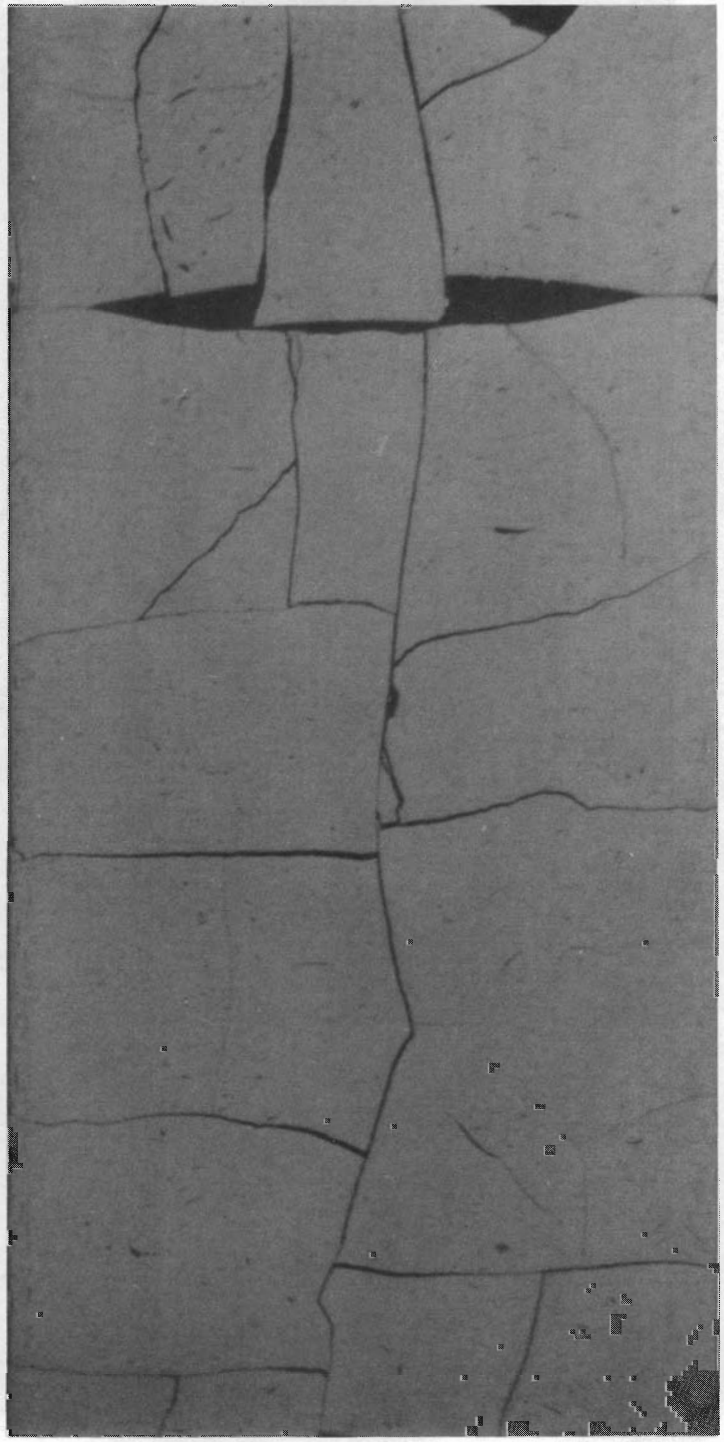


FIGURE E.1.g. Photomacrograph of As-Polished Longitudinal Sample 106-NBD107-Y (~10x) (Neg. No. 8704494-2)

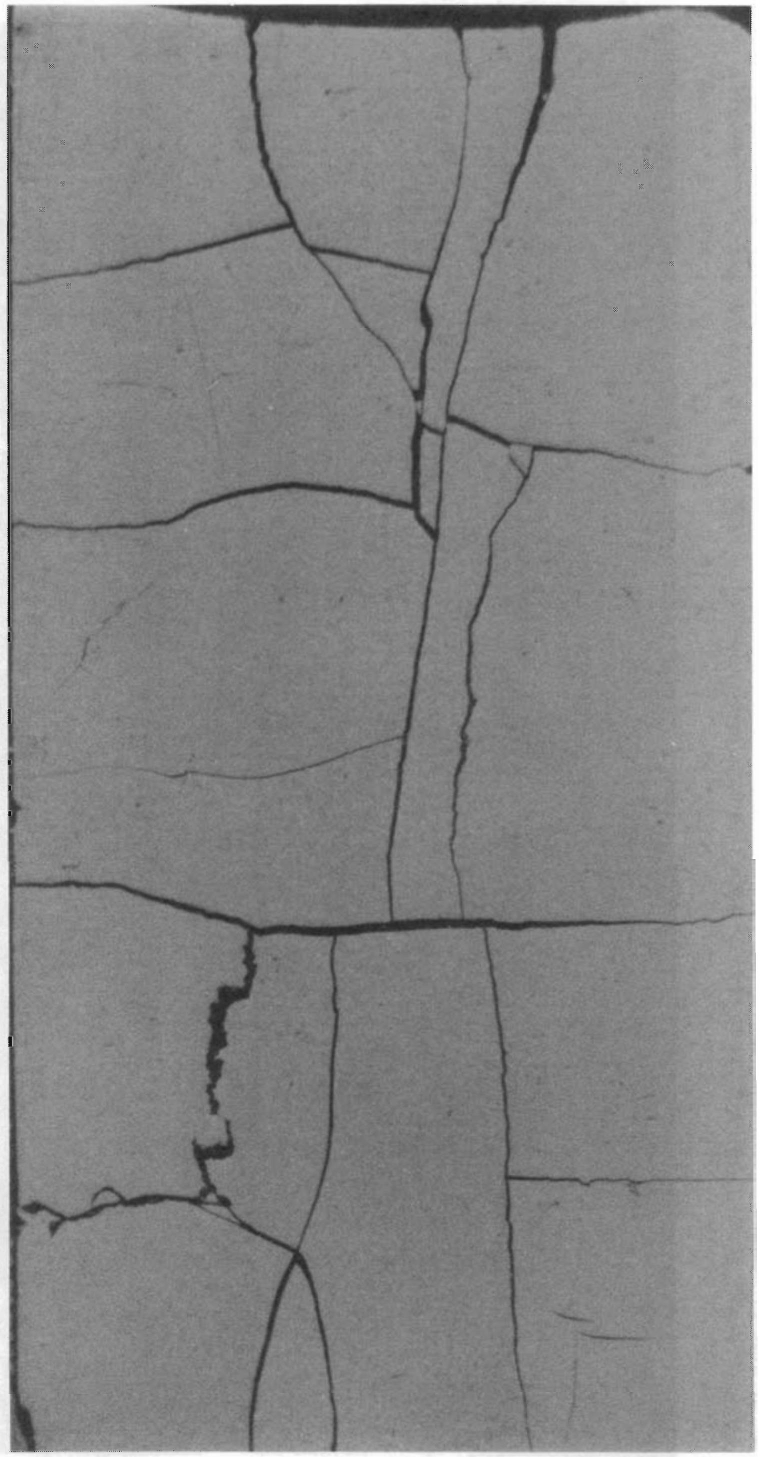
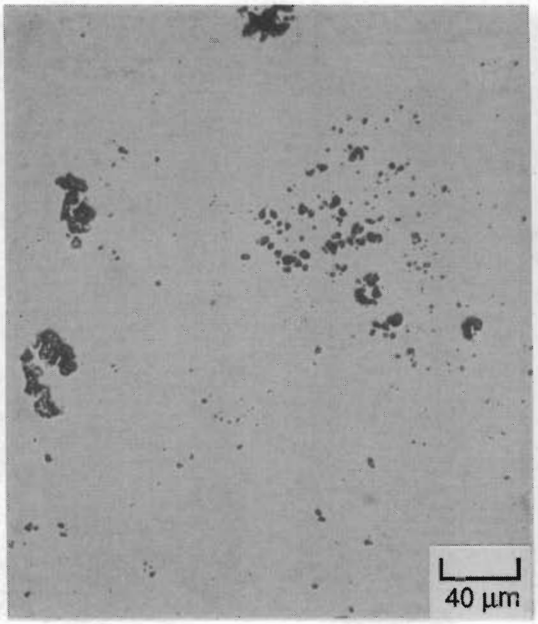
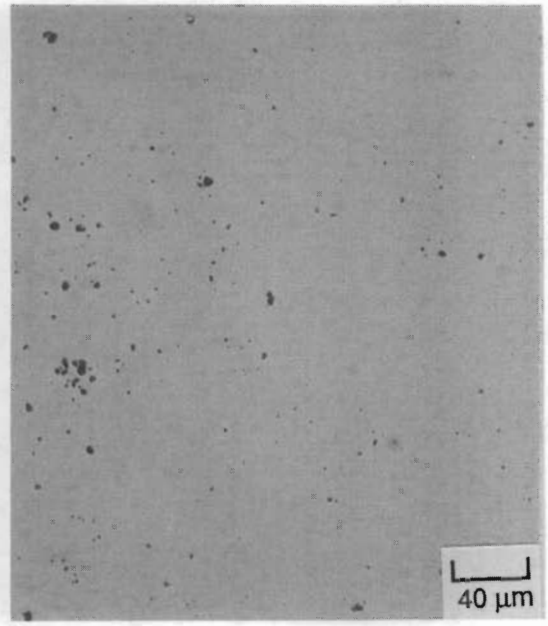


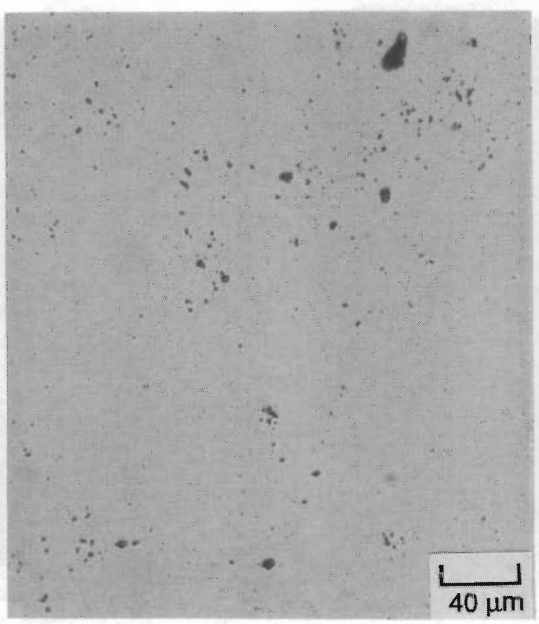
FIGURE E.1.h. Photomacrograph of As-Polished Longitudinal Sample 106-NBD107-KK (~10x) (Neg. No. 8704494-8)



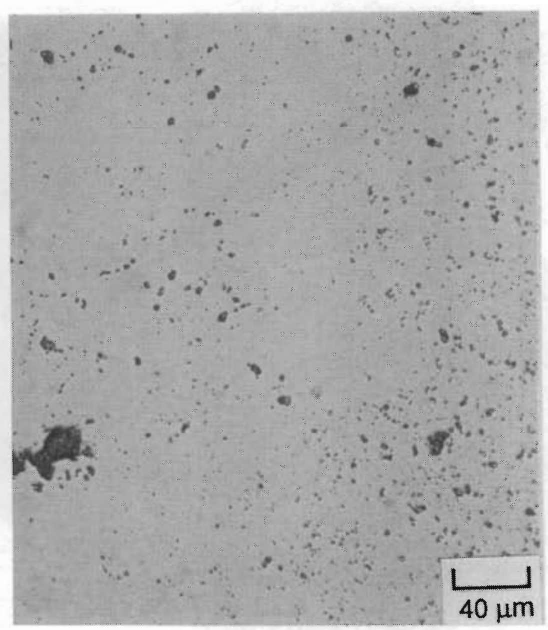
a) Center (Neg. No. P-3056)



b) 1/3 Radius (Neg. No. P-3055)

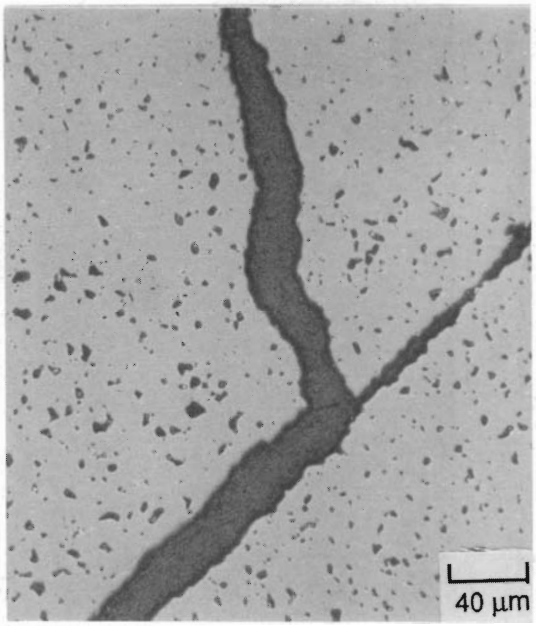


c) 2/3 Radius (Neg. No. P-3054)

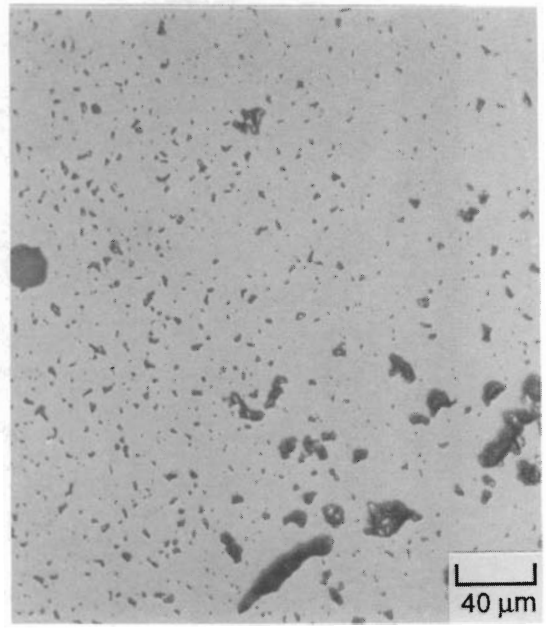


d) Edge (Neg. No. P-3053)

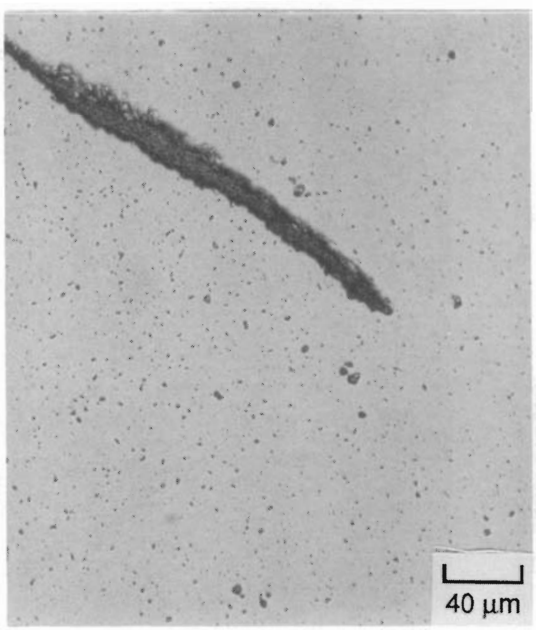
FIGURE E.2.a. Photomicrographs of As-Polished Transverse Sample 106-NBD107-C



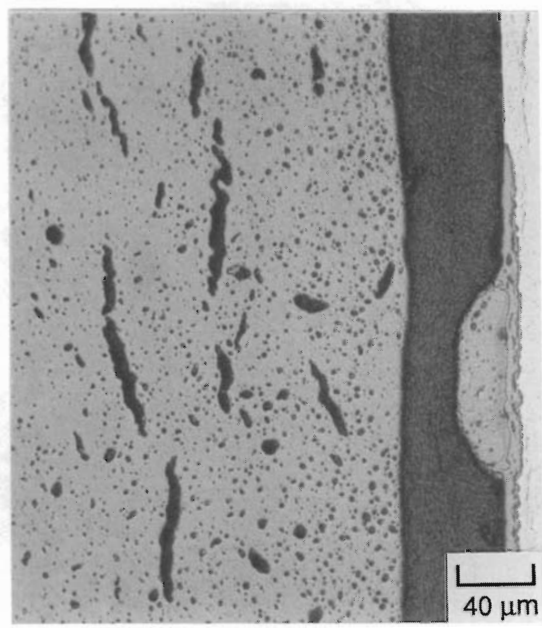
a) Center (Neg. No. P-3050)



b) 1/3 Radius (Neg. No. P-3049)

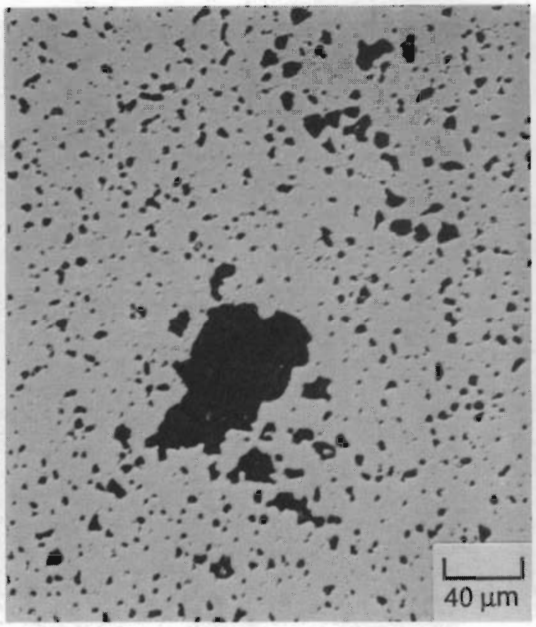


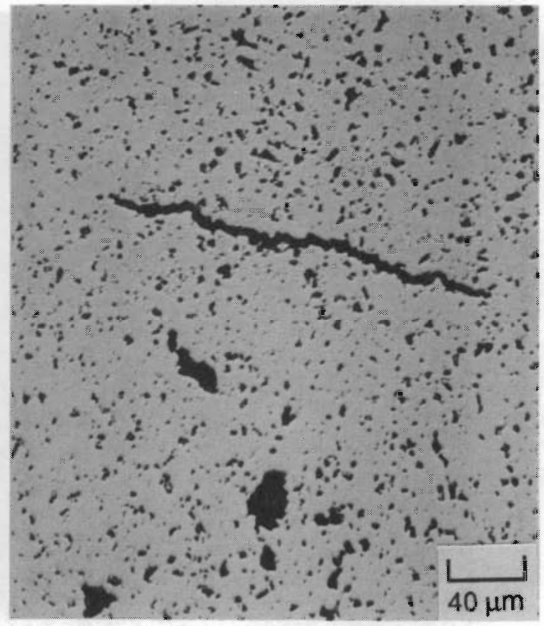
c) 2/3 Radius (Neg. No. P-3048)



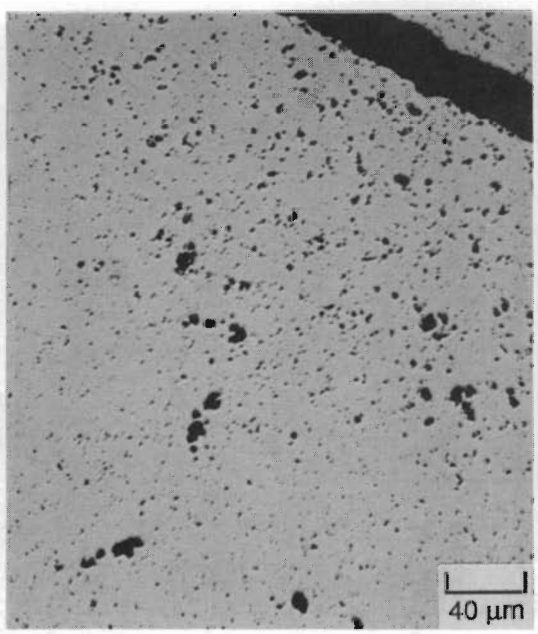
d) Edge (Neg. No. P-3047)

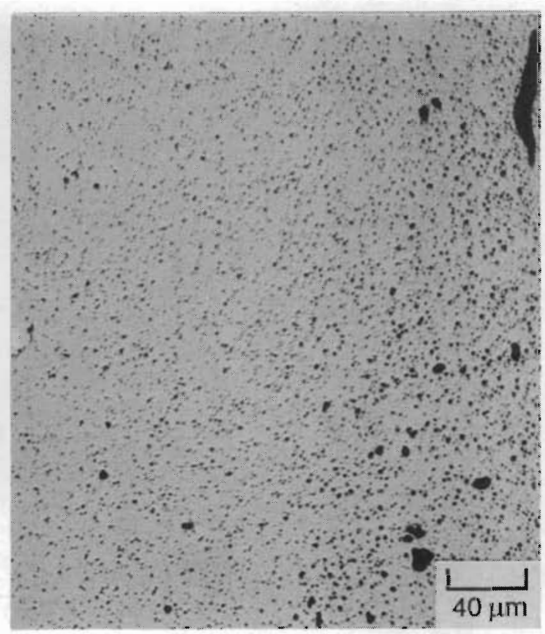
FIGURE E.2.b. Photomicrographs of As-Polished Transverse Sample 106-NBD107-G





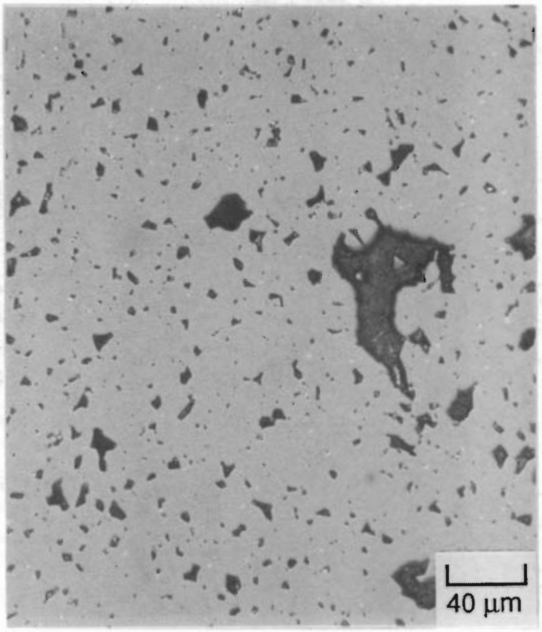
a) Center (Neg. No. P-2768)   b) 1/3 Radius (Neg. No. P-2767)



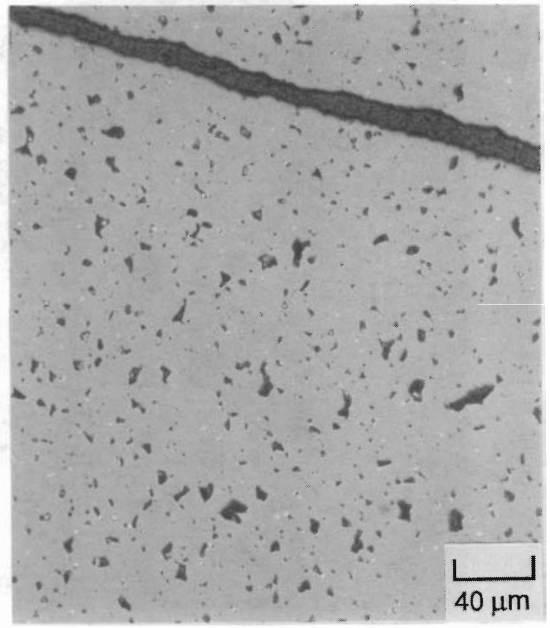


c) 2/3 Radius (Neg. No. P-2766)   d) Edge (Neg. No. P-2765)

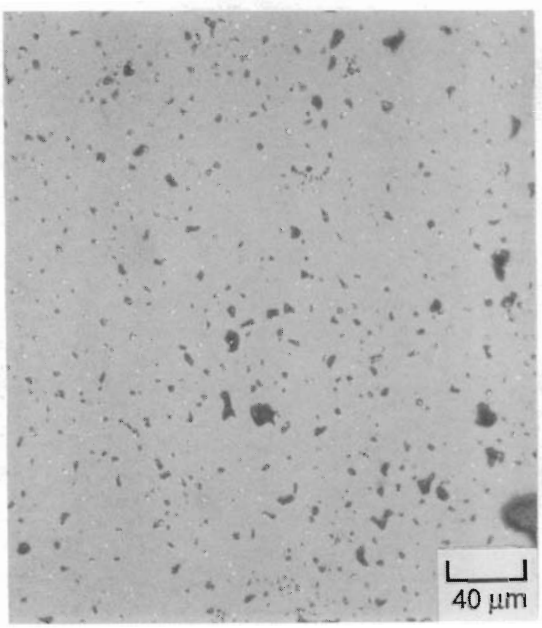
FIGURE E.2.c. Photomicrographs of As-Polished Transverse Sample 106-NBD107-P



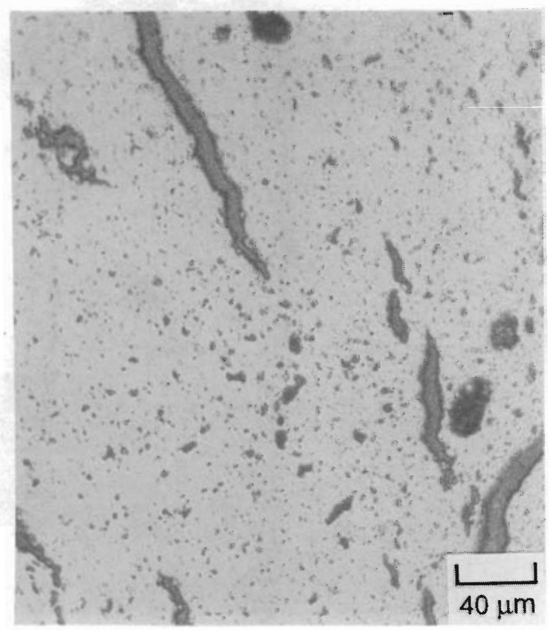
a) Center (Neg. No. P-3040)



b) 1/3 Radius (Neg. No. P-3039)

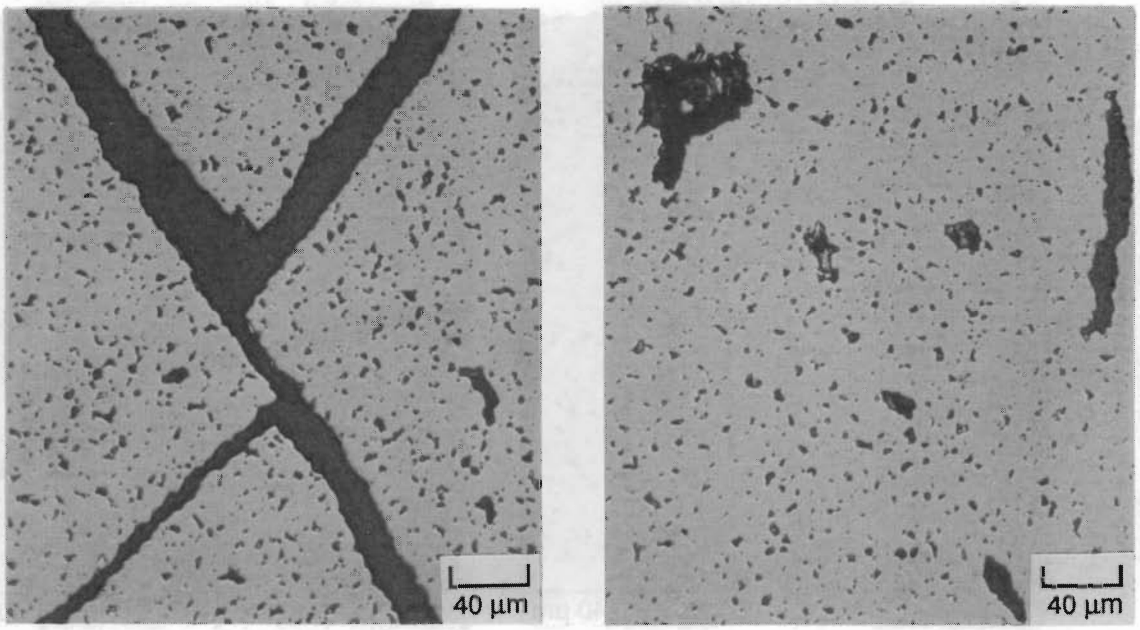


c) 2/3 Radius (Neg. No. P-3038)

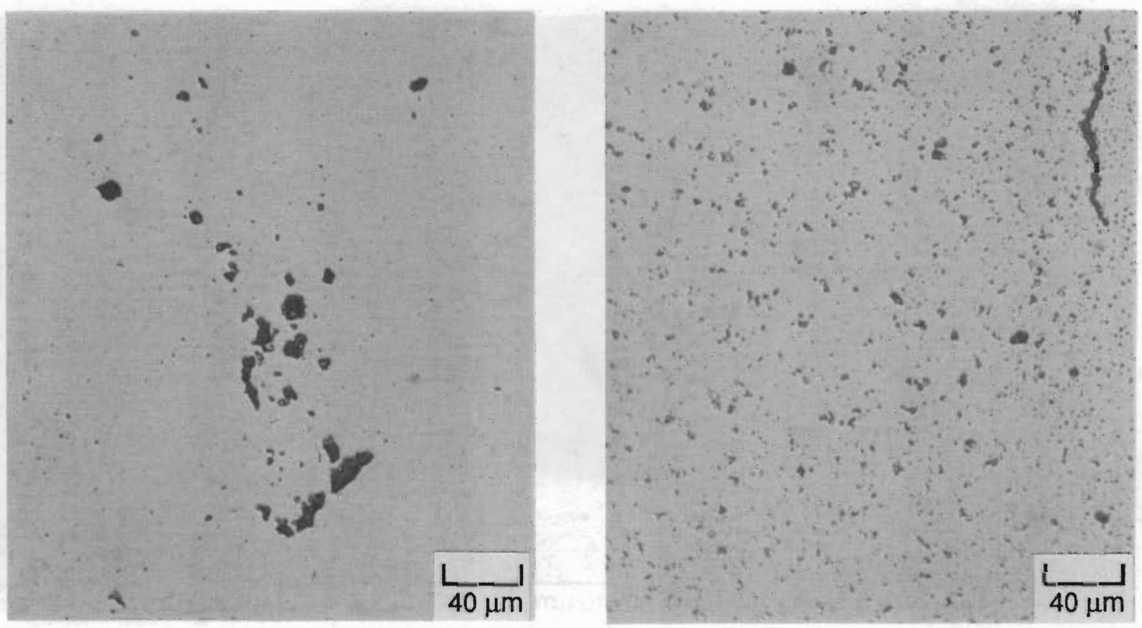


d) Edge (Neg. No. P-3037)

FIGURE E.2.d. Photomicrographs of As-Polished Transverse Sample 106-NBD107-Z

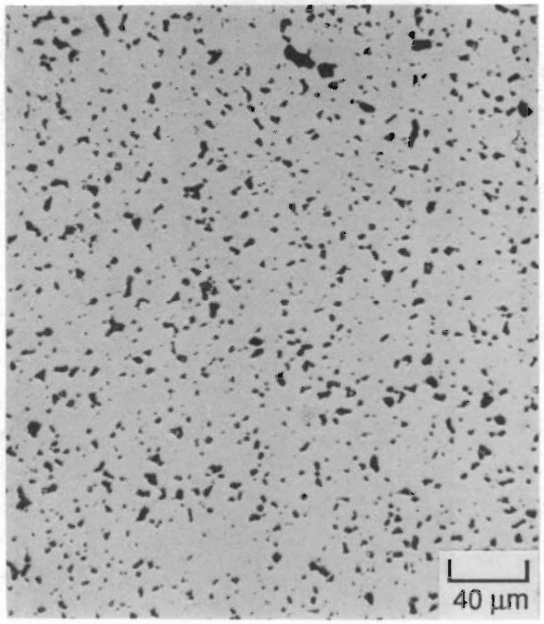


a) Center (Neg. No. P-3017) b) 1/3 Radius (Neg. No. P-3016)

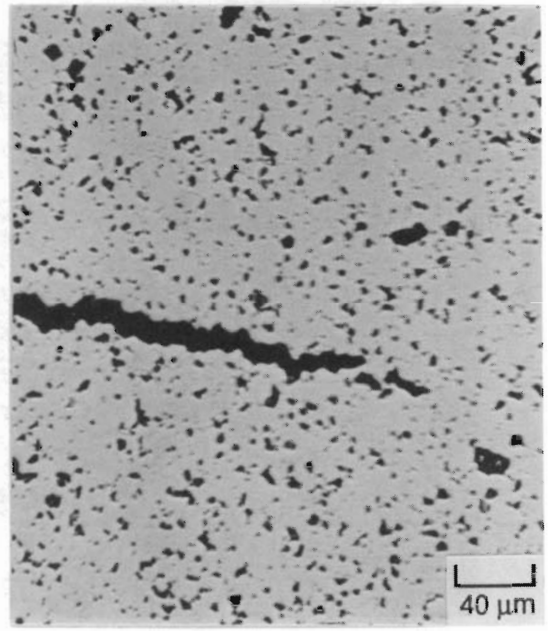


c) 2/3 Radius (Neg. No. P-3015) d) Edge (Neg. No. P-3014)

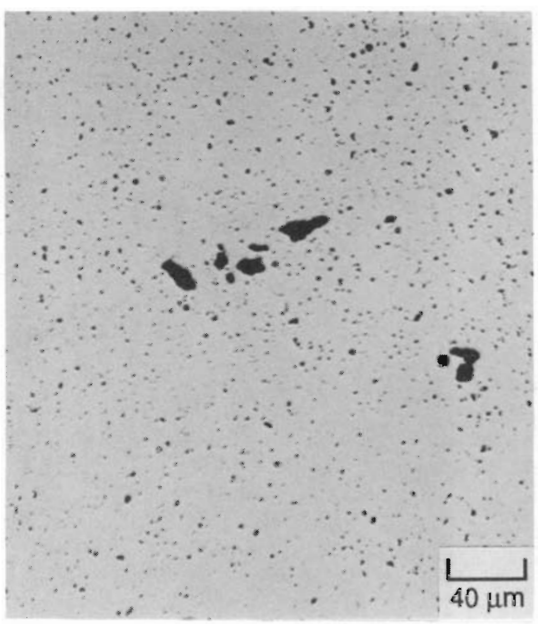
FIGURE E.2.e. Photomicrographs of As-Polished Transverse Sample 106-NBD107-LL



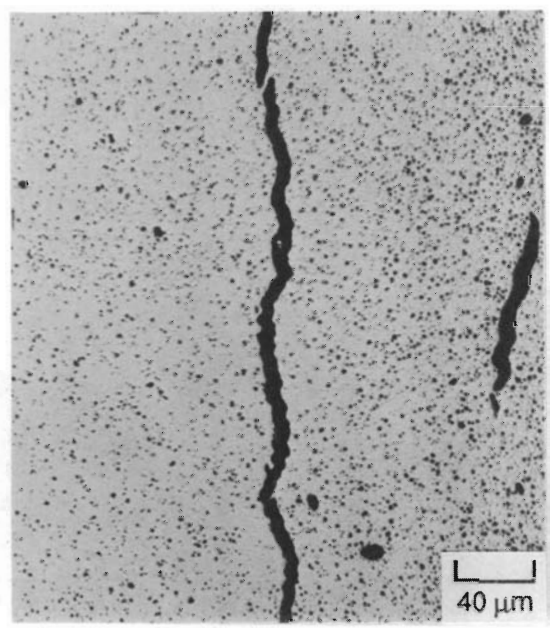
a) Center (Neg. No. P-2783)



b) 1/3 Radius (Neg. No. P-2782)

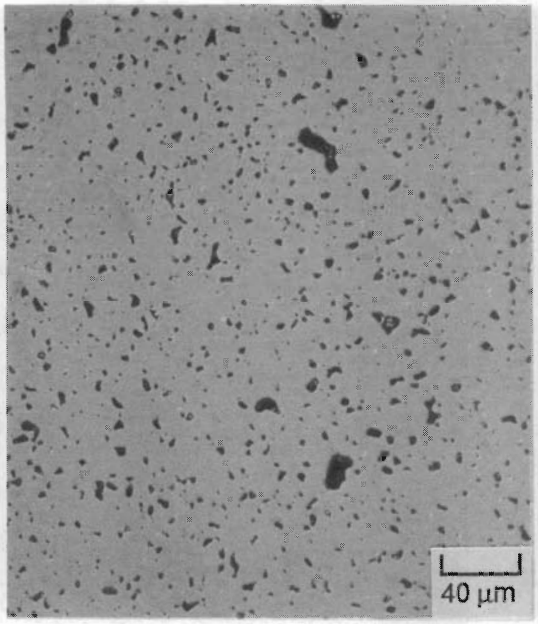


c) 2/3 Radius (Neg. No. P-2781)

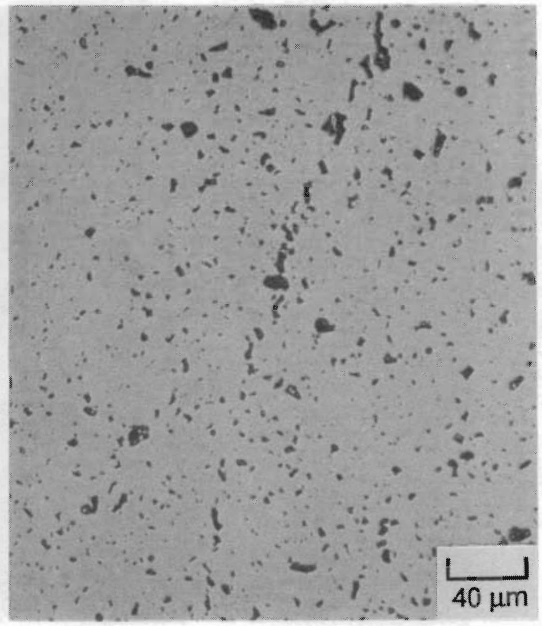


d) Edge (Neg. No. P-2780)

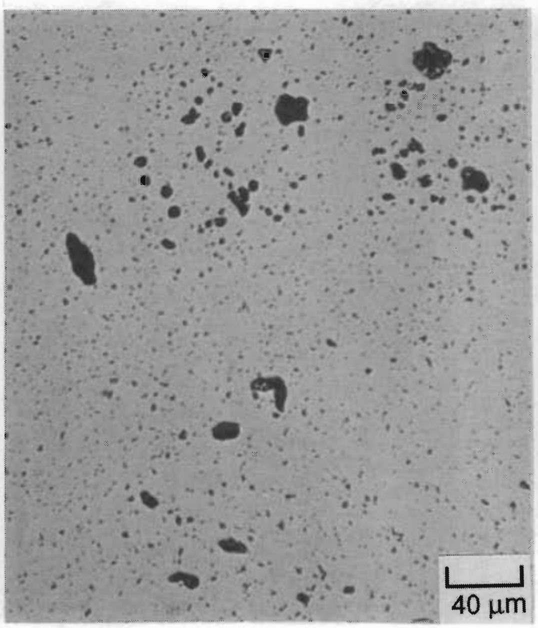
FIGURE E.2.f. Photomicrographs of As-Polished Longitudinal Sample 106-NBD107-O



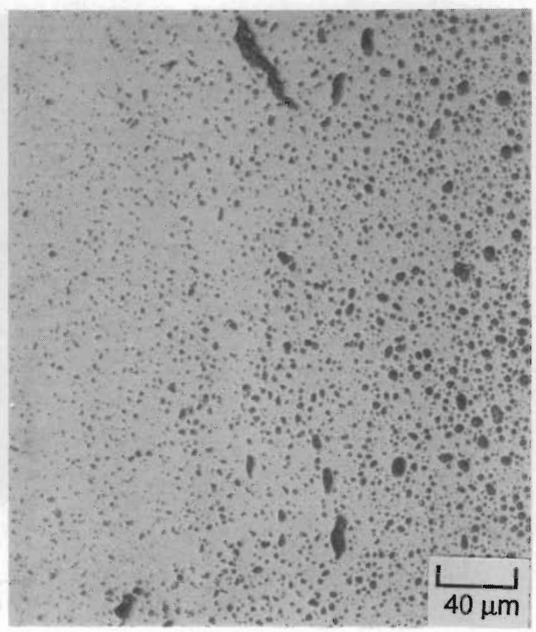
a) Center (Neg. No. P-3000)



b) 1/3 Radius (Neg. No. P-2999)

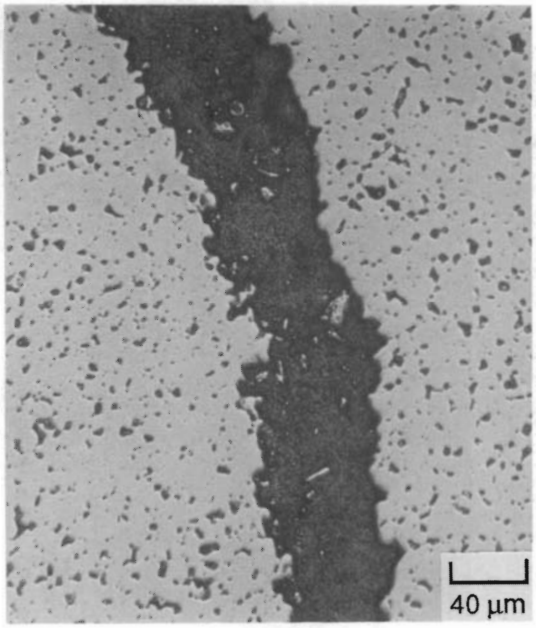


c) 2/3 Radius (Neg. No. P-2998)

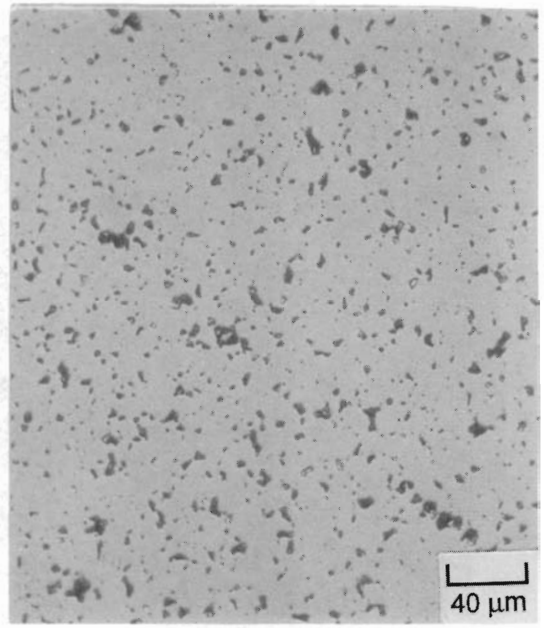


d) Edge (Neg. No. P-2997)

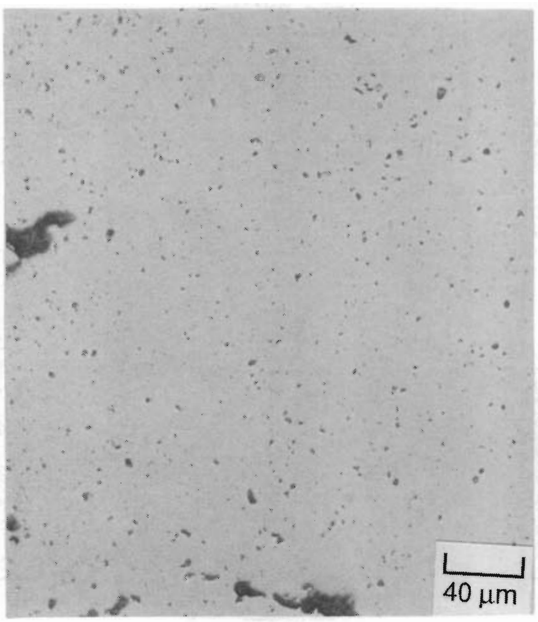
FIGURE E.2.g. Photomicrographs of As-Polished Longitudinal Sample 106-NBD107-Y



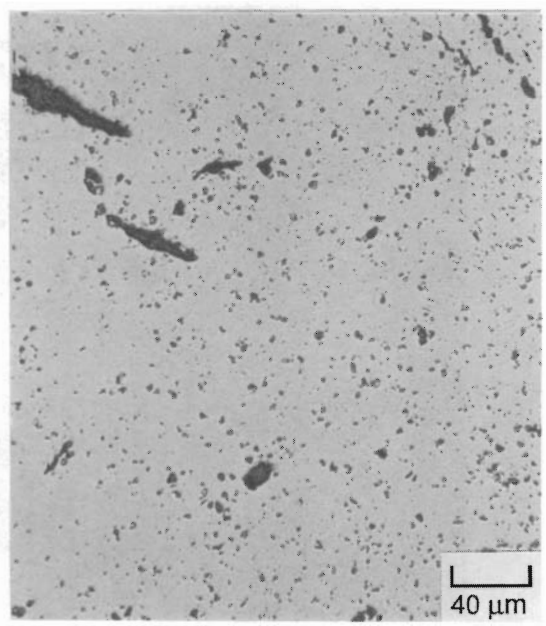
a) Center (Neg. No. P-3005)



b) 1/3 Radius (Neg. No. P-3004)

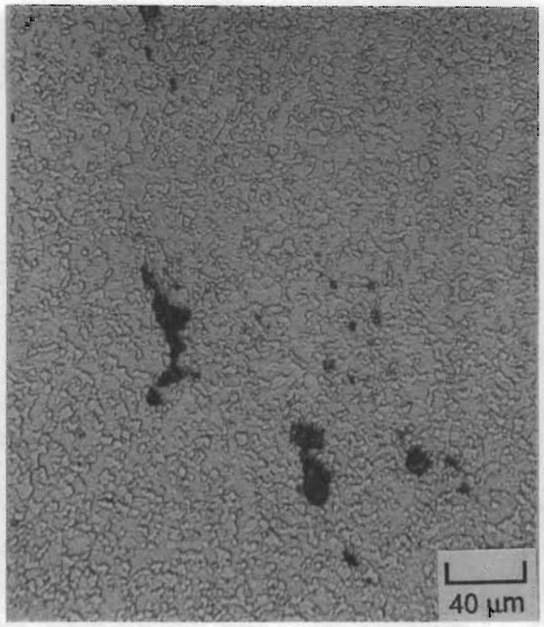


c) 2/3 Radius (Neg. No. P-3003)

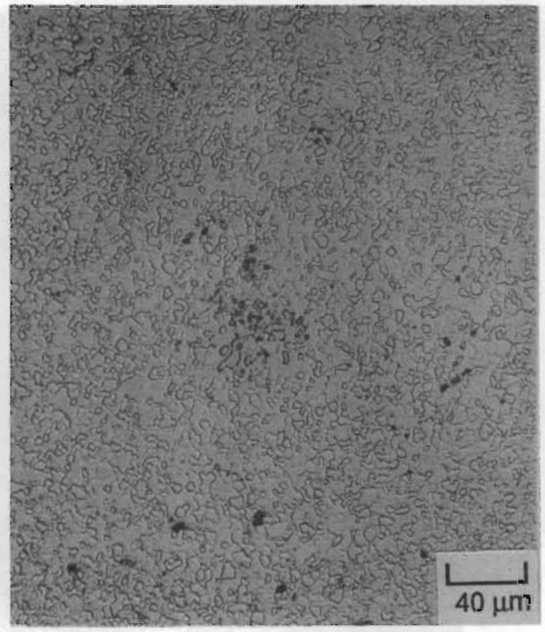


d) Edge (Neg. No. P-3002)

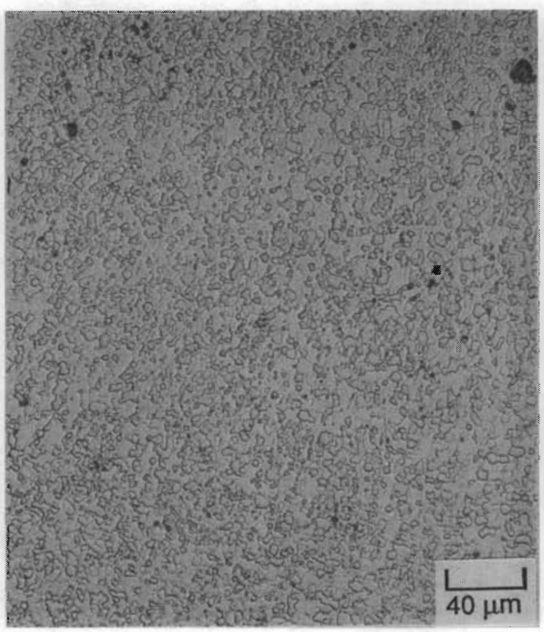
FIGURE E.2.h. Photomicrographs of As-Polished Longitudinal Sample 106-NBD107-KK



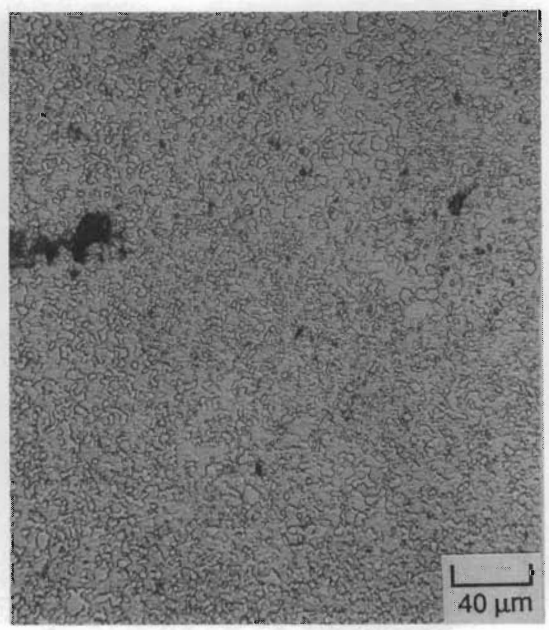
a) Center (Neg. No. P-3192)



b) 1/3 Radius (Neg. No. P-3191)

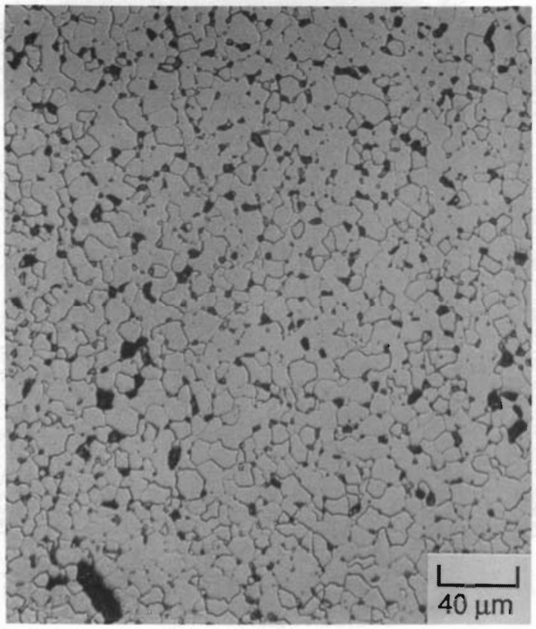


c) 2/3 Radius (Neg. No. P-3190)

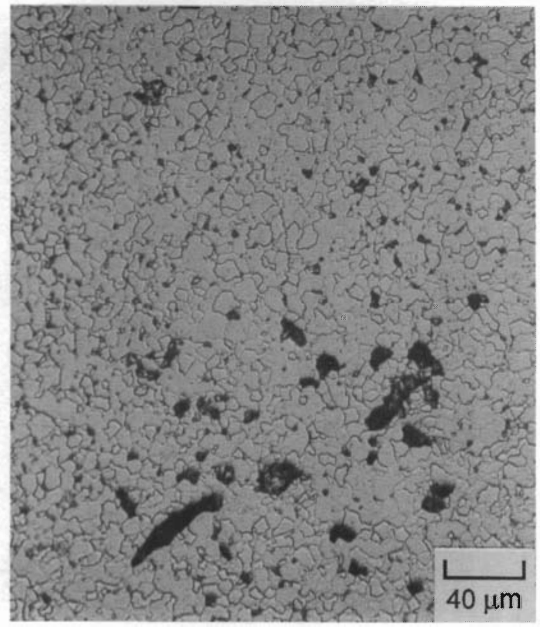


d) Edge (Neg. No. P-3189)

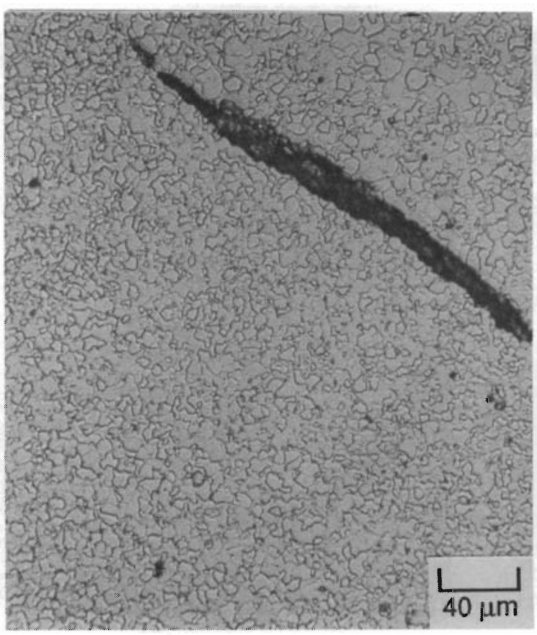
FIGURE E.3.a. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-C



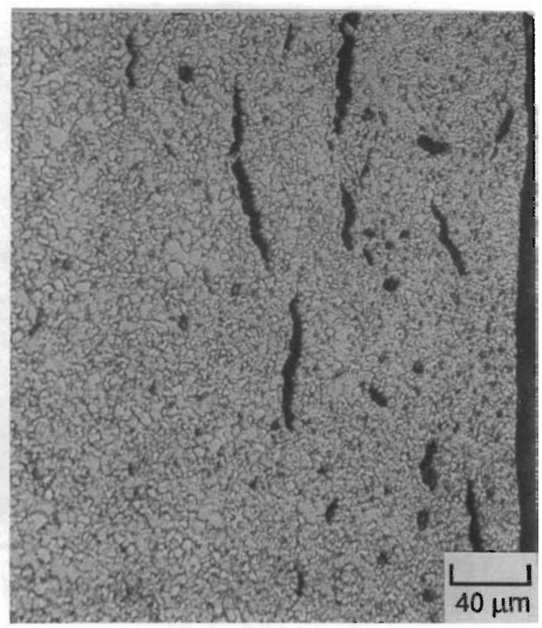
a) Center (Neg. No. P-3188)



b) 1/3 Radius (Neg. No. P-3187)

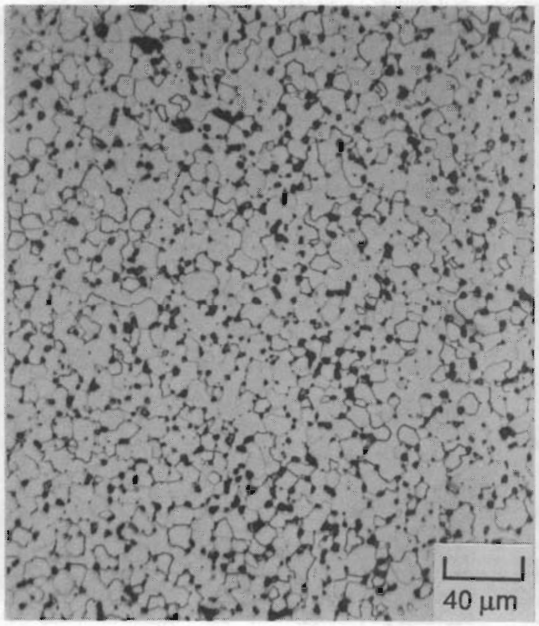


c) 2/3 Radius (Neg. No. P-3186)

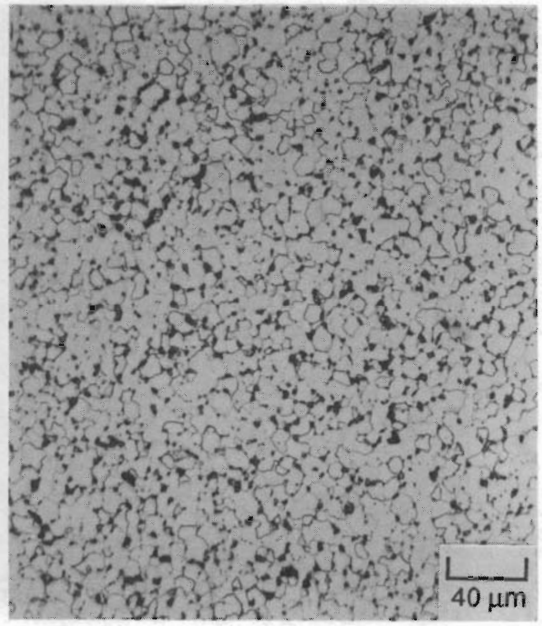


d) Edge (Neg. No. P-3185)

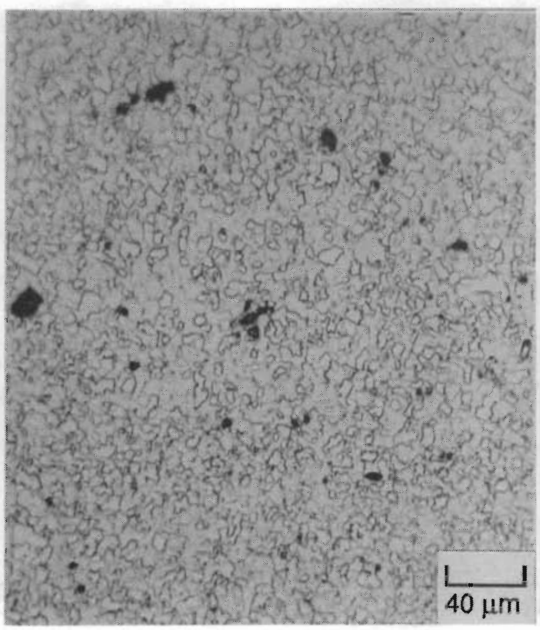
FIGURE E.3.b. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-G



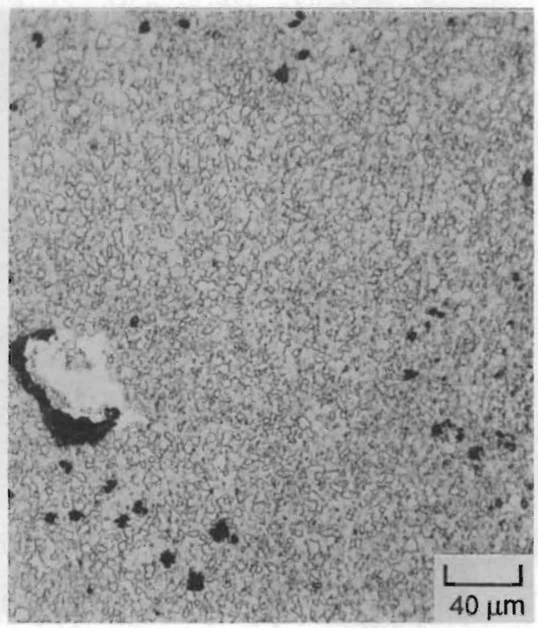
a) Center (Neg. No. P-2940)



b) 1/3 Radius (Neg. No. P-2939)

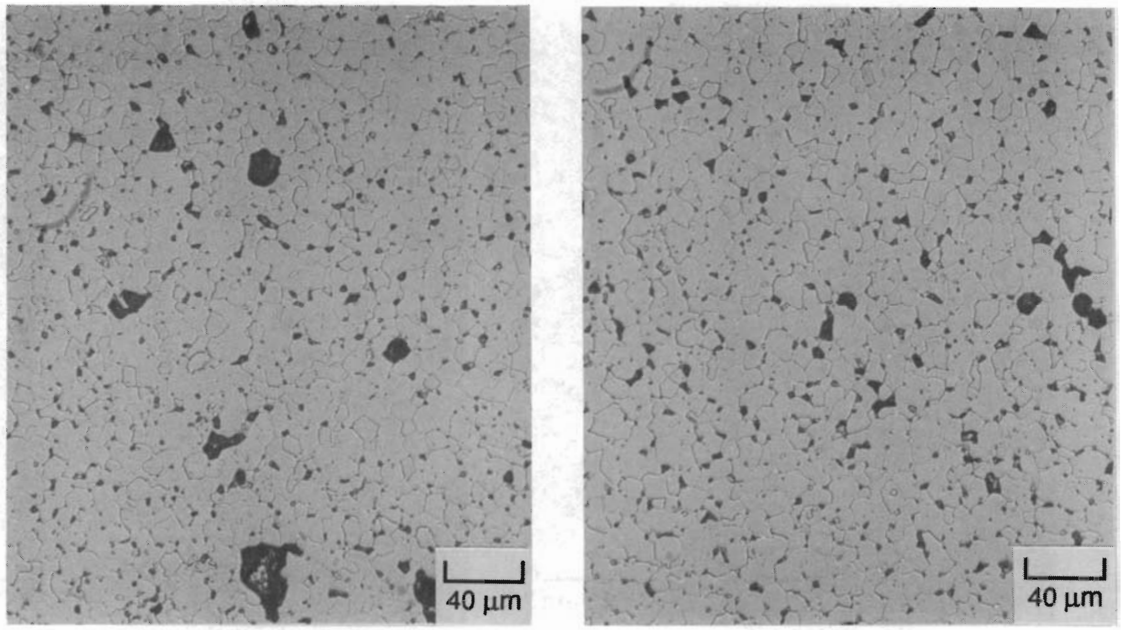


c) 2/3 Radius (Neg. No. P-2938)

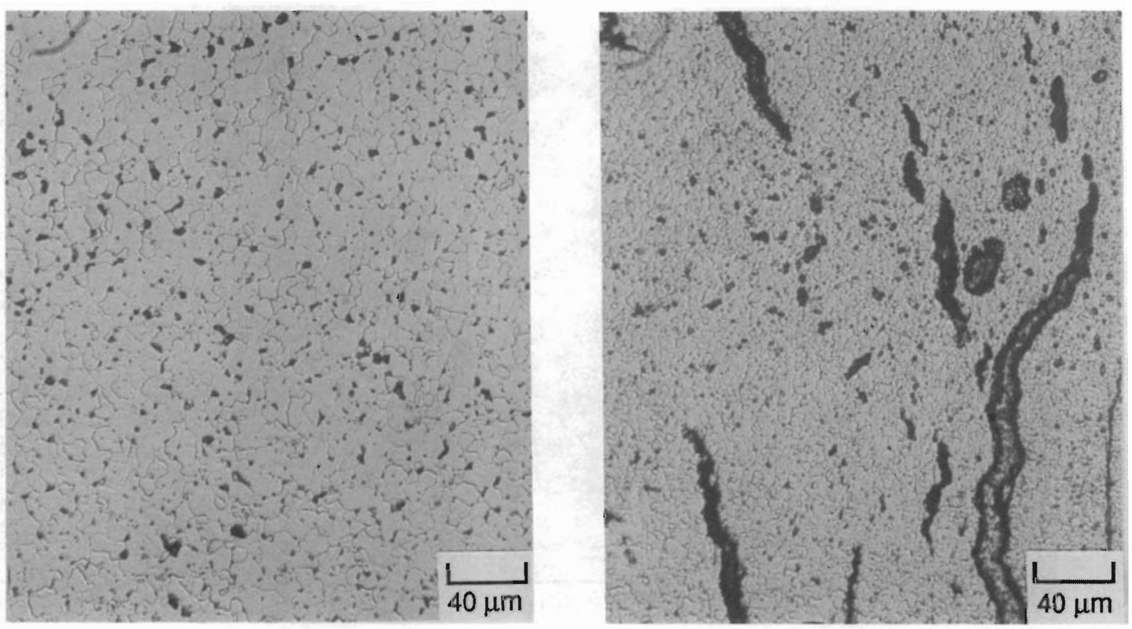


d) Edge (Neg. No. P-2937)

FIGURE E.3.c. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-P

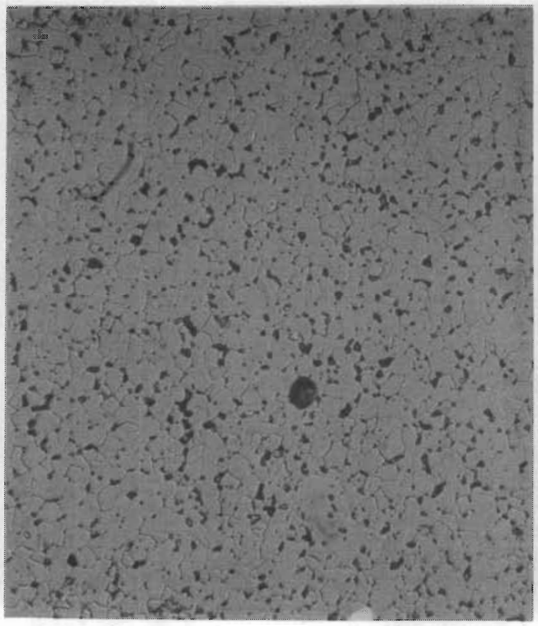


a) Center (Neg. No. P-3067) b) 1/3 Radius (Neg. No. P-3066)

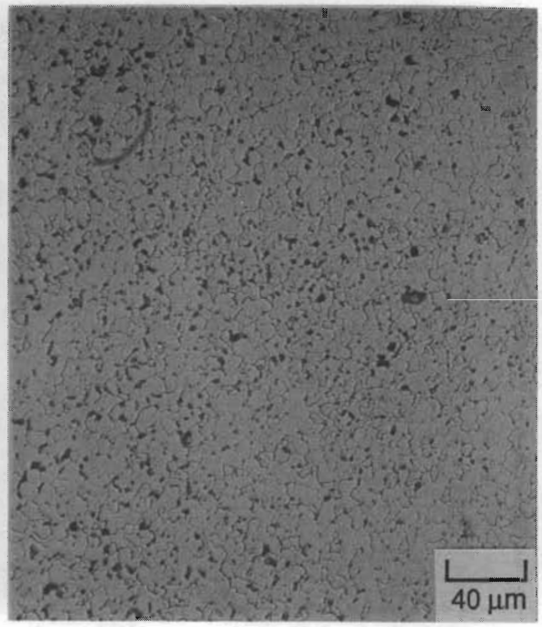


c) 2/3 Radius (Neg. No. P-3065) d) Edge (Neg. No. P-3064)

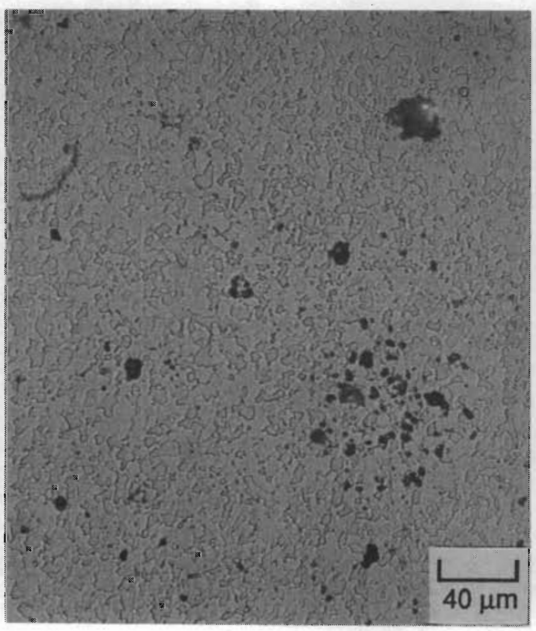
FIGURE E.3.d. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-Z



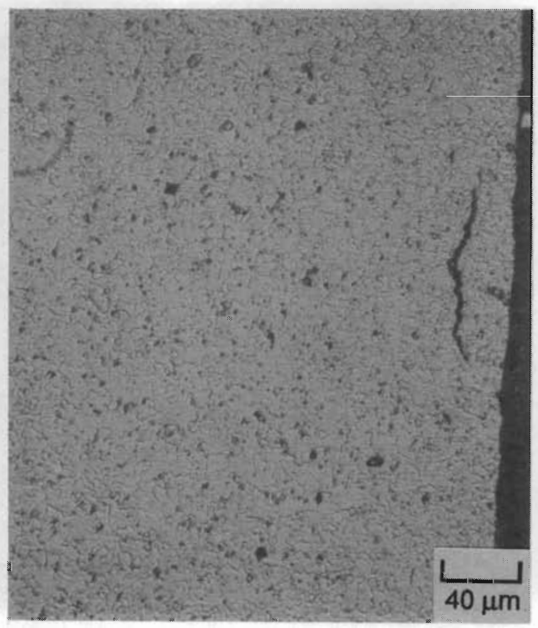
a) Center (Neg. No. P-3091)



b) 1/3 Radius (Neg. No. P-3090)

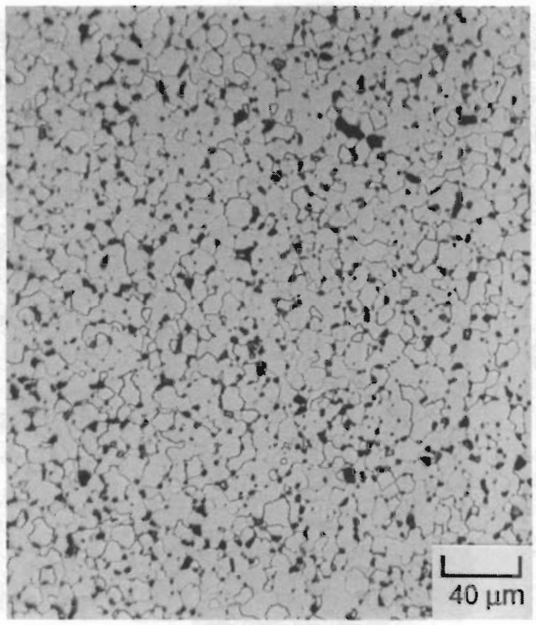


c) 2/3 Radius (Neg. No. P-3089)

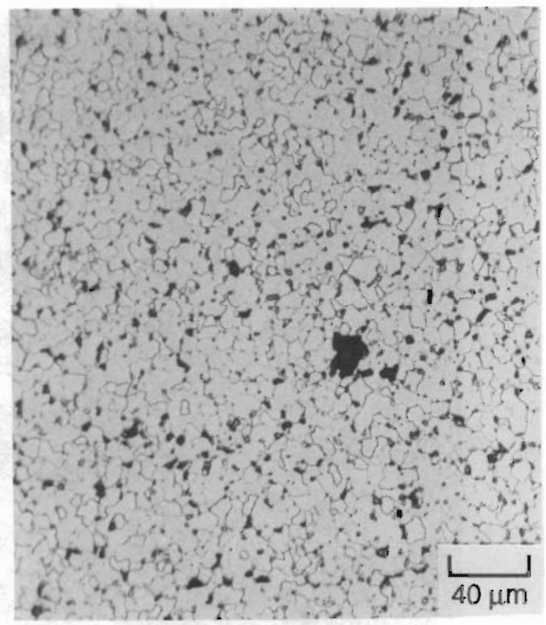


d) Edge (Neg. No. P-3088)

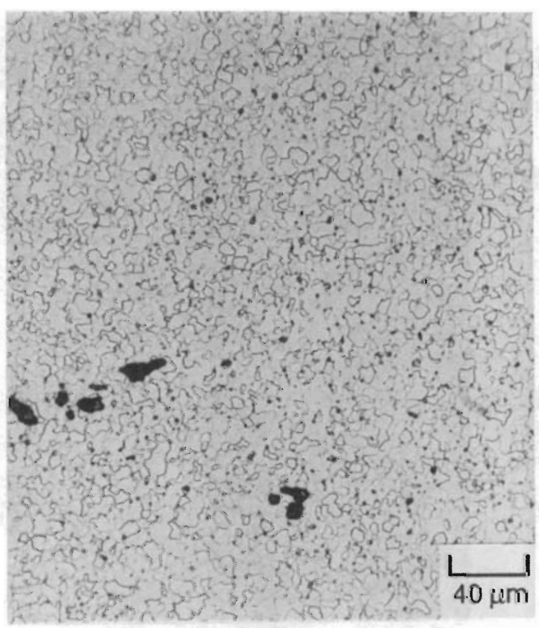
FIGURE E.3.e. Photomicrographs of Argon Ion-Etched Transverse Sample 106-NBD107-LL



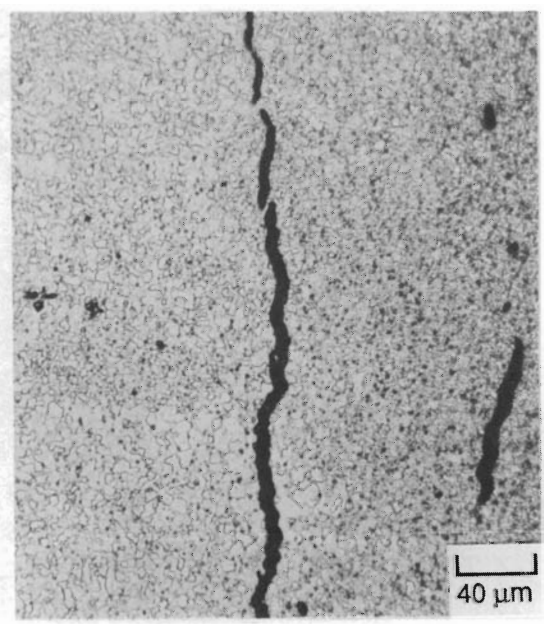
a) Center (Neg. No. P-2936)



b) 1/3 Radius (Neg. No. P-2935)

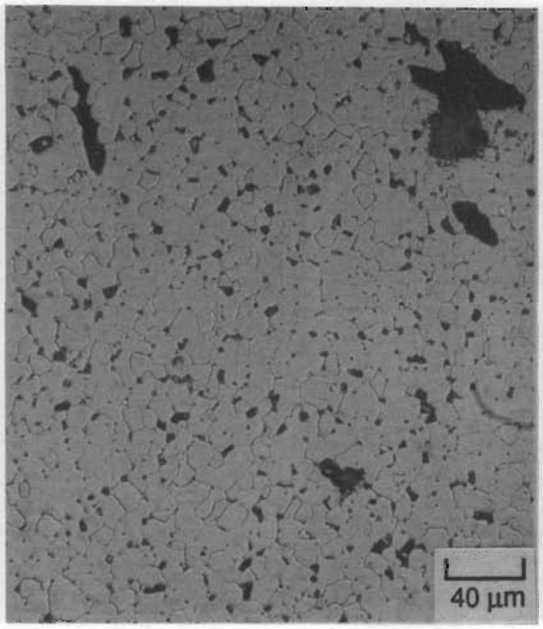


c) 2/3 Radius (Neg. No. P-2934)

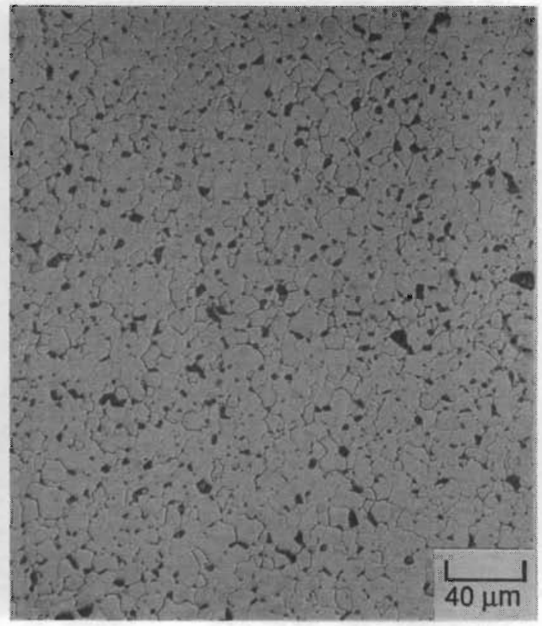


d) Edge (Neg. No. P-2933)

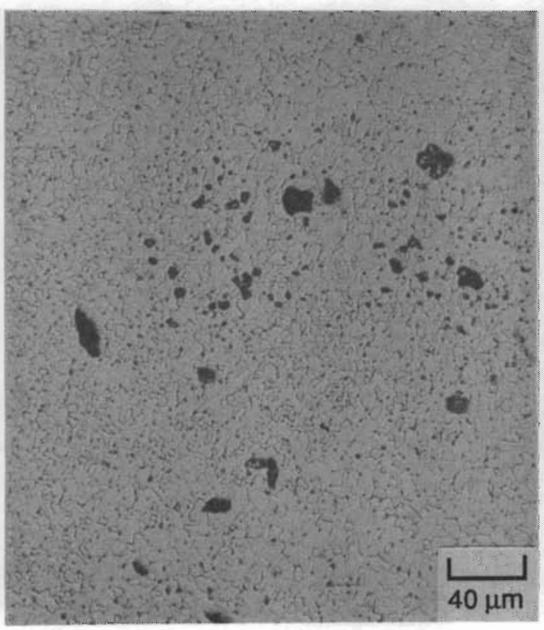
FIGURE E.3.f. Photomicrographs of Argon Ion-Etched Longitudinal Sample 106-NBD107-0



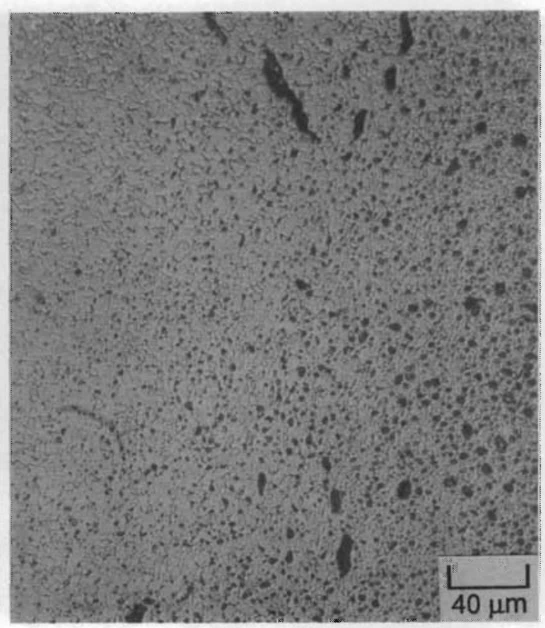
a) Center (Neg. No. P-3071)



b) 1/3 Radius (Neg. No. P-3070)

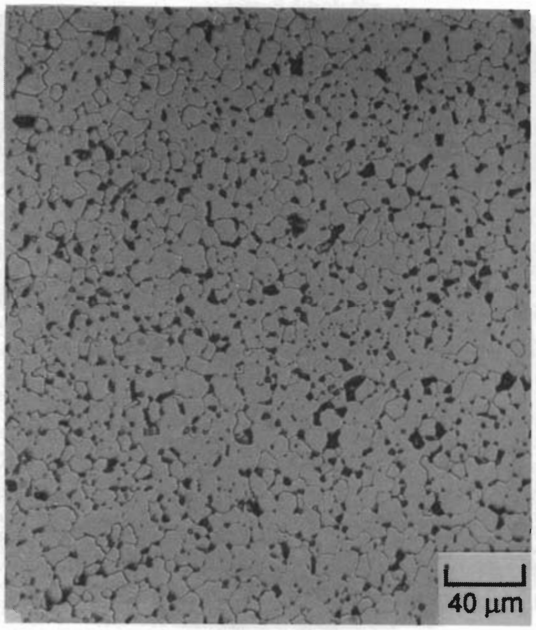


c) 2/3 Radius (Neg. No. P-3069)

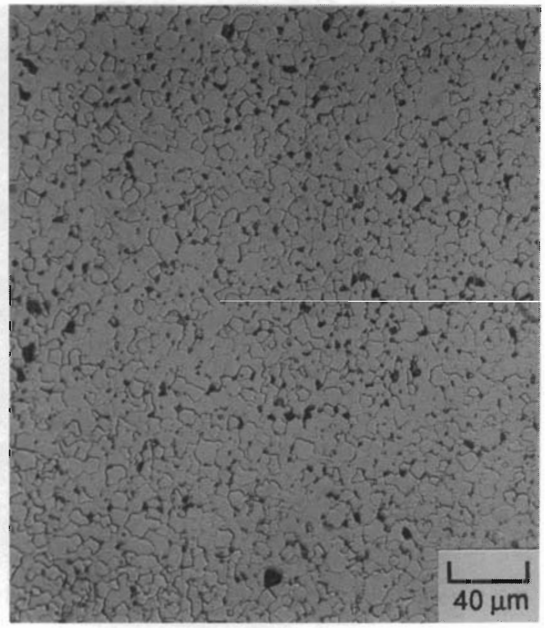


d) Edge (Neg. No. P-3068)

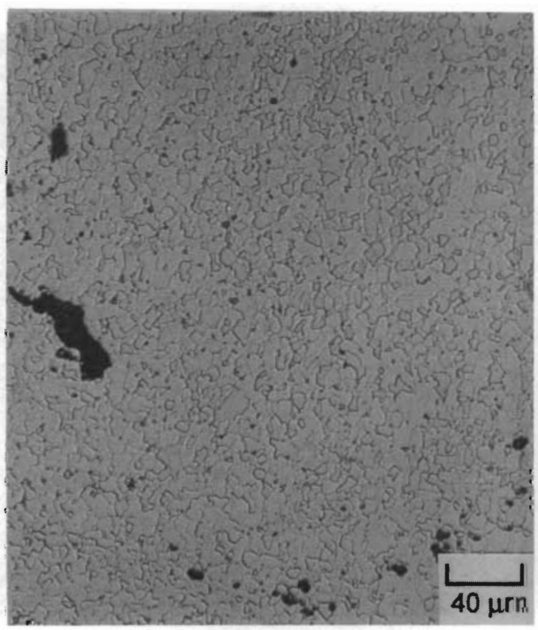
FIGURE E.3.g. Photomicrographs of Argon Ion-Etched Longitudinal Sample 106-NBD107-Y



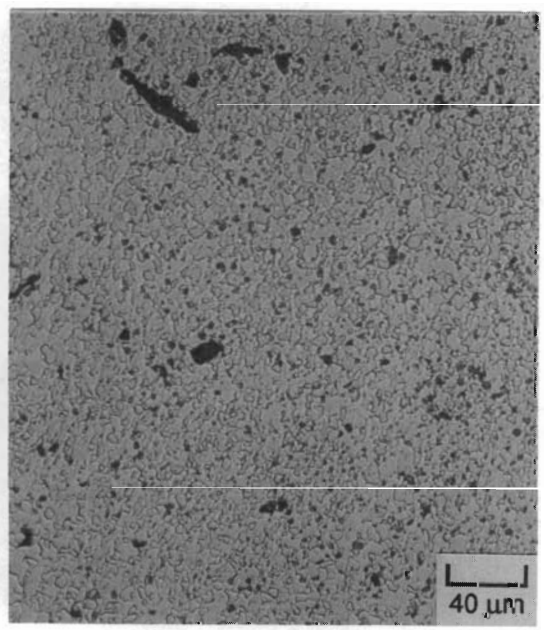
a) Center (Neg. No. P-3075)



b) 1/3 Radius (Neg. No. P-3074)



c) 2/3 Radius (Neg. No. P-3073)

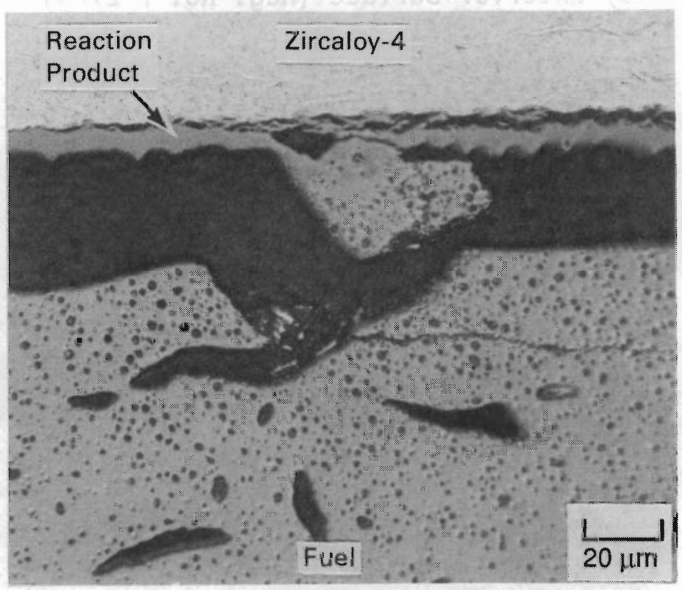


d) Edge (Neg. No. P-3072)

FIGURE E.3.h. Photomicrographs of Argon Ion-Etched Longitudinal Sample 106-NBD107-KK

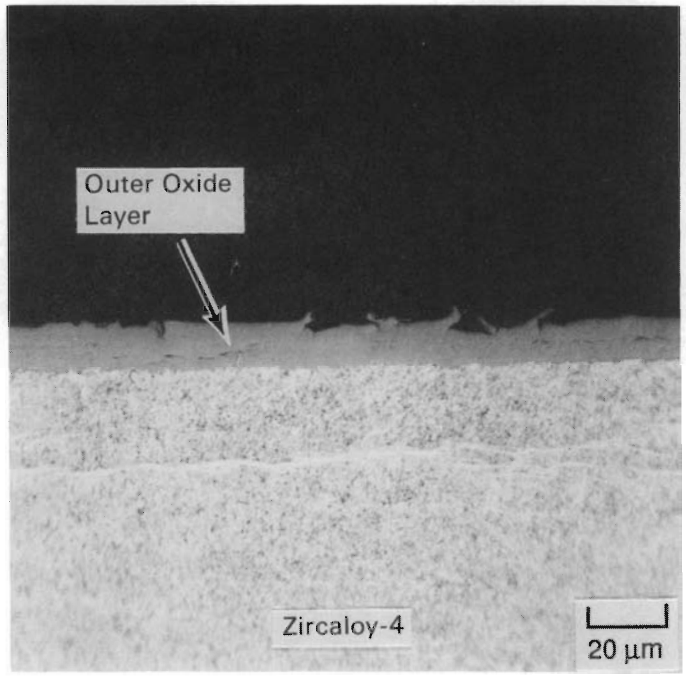
(No Examination)

a) Exterior Surface

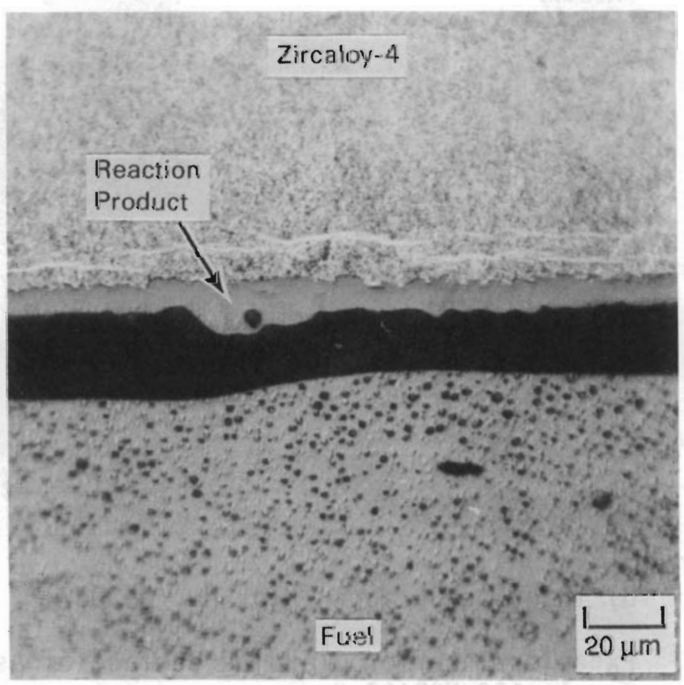


b) Interior Surface (Neg. No. P-3052)

FIGURE E.4.a. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-G

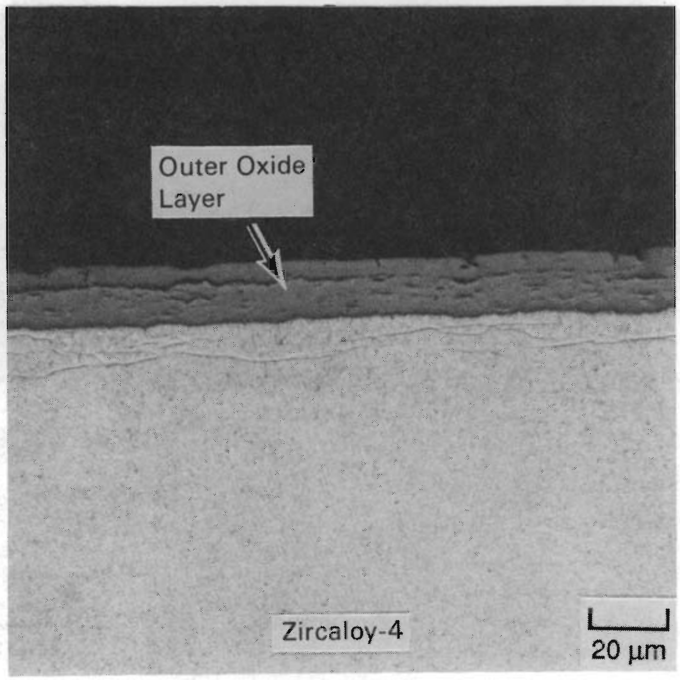


a) Exterior Surface (Neg. No. P-2784)

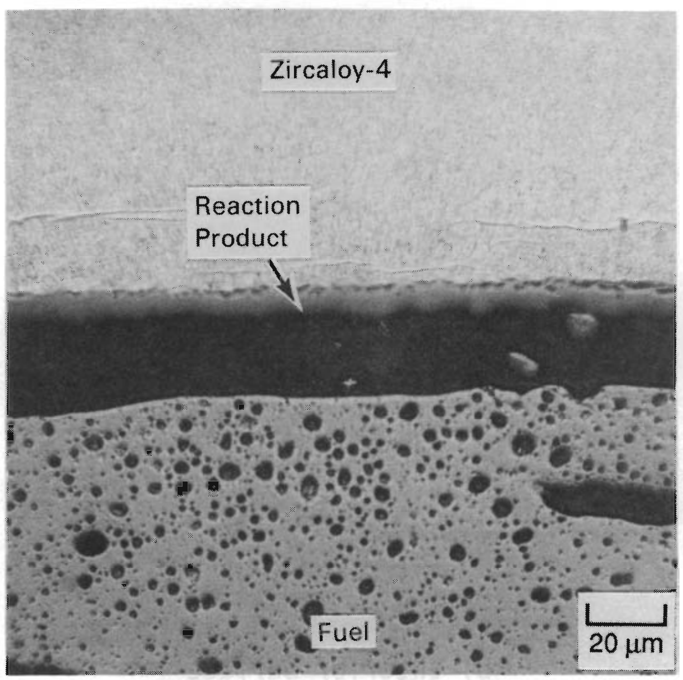


b) Interior Surface (Neg. No. P-2785)

FIGURE E.4.b. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-0

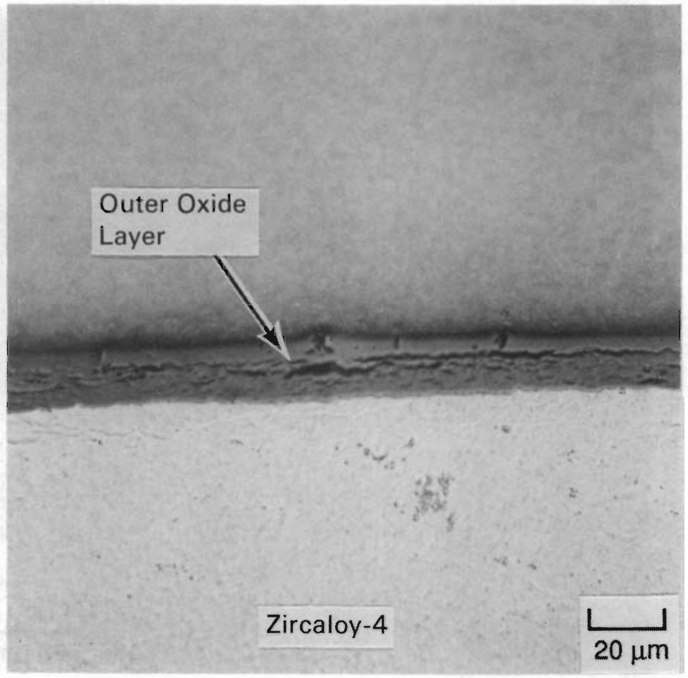


a) Exterior Surface (Neg. No. P-2995)



b) Interior Surface (Neg. No. P-2996)

FIGURE E.4.c. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-Y

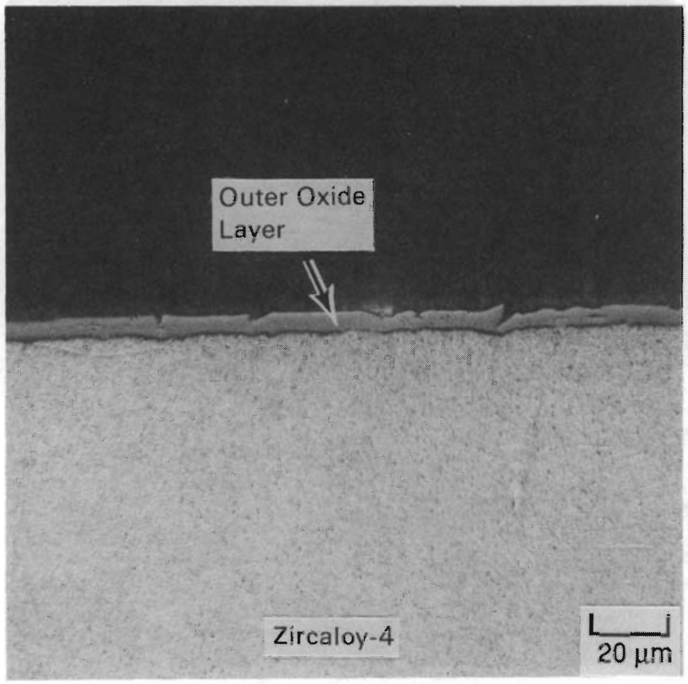


a) Exterior Surface (Neg. No. P-3036)

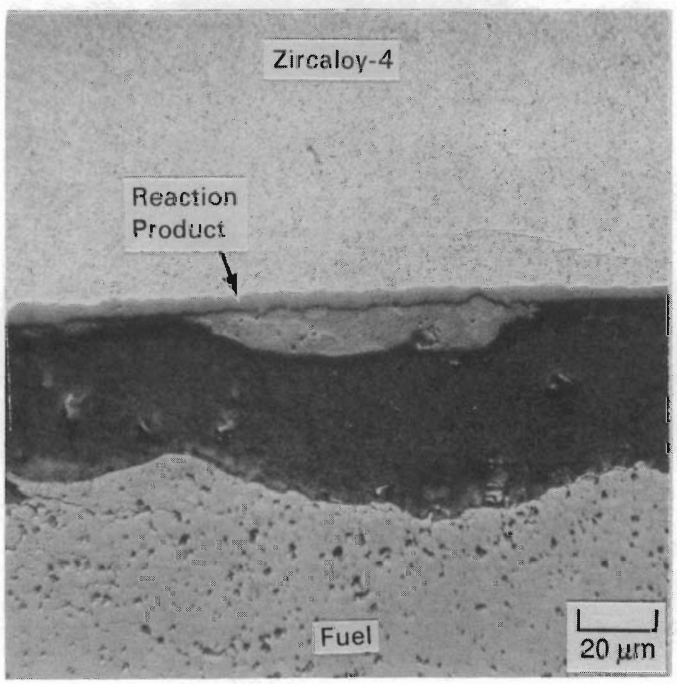
(No Examination)

b) Interior Surface

FIGURE E.4.d. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-Z

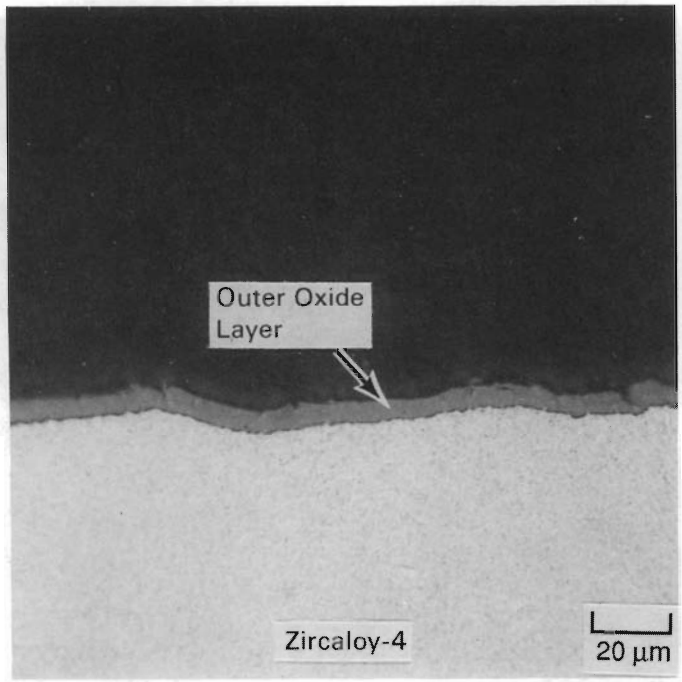


a) Exterior Surface (Neg. No. P-3006)

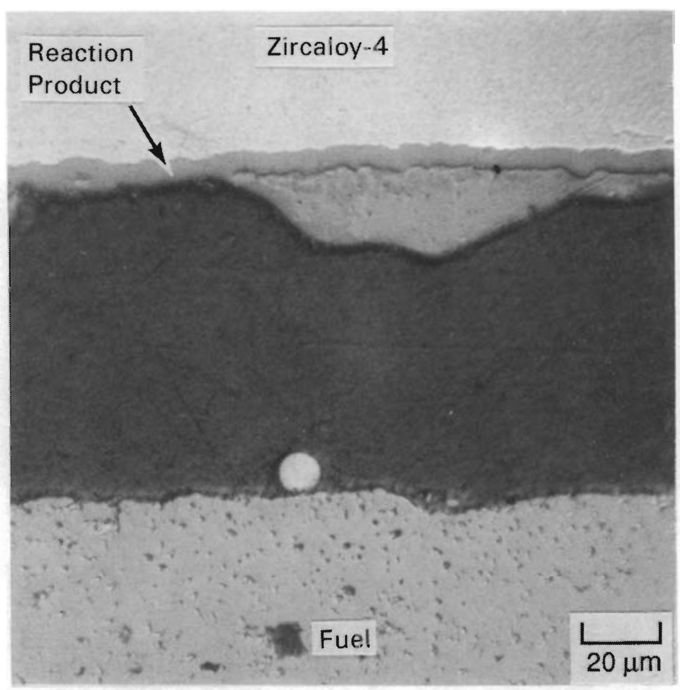


b) Interior Surface (Neg. No. P-3007)

FIGURE E.4.e. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-KK



a) Exterior Surface (Neg. No. P-3008)



b) Interior Surface (Neg. No. P-3013)

FIGURE E.4.f. Exterior/Interior Cladding Surface of As-Polished Sample 106-NBD107-LL

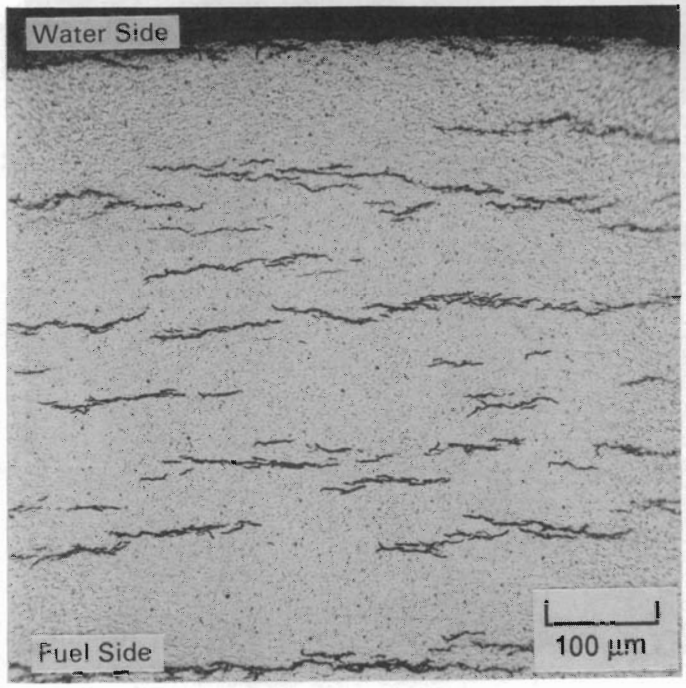


FIGURE E.5.a. Etched Cladding of Transverse Sample 106-NBD107-C (Neg. No. P-3310)

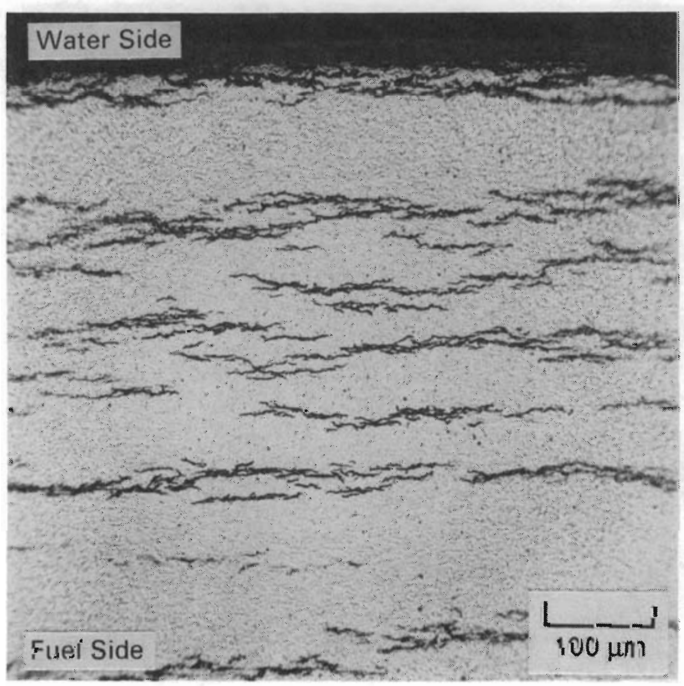


FIGURE E.5.b. Etched Cladding of Transverse Sample 106-NBD107-G (Neg. No. P-3315)

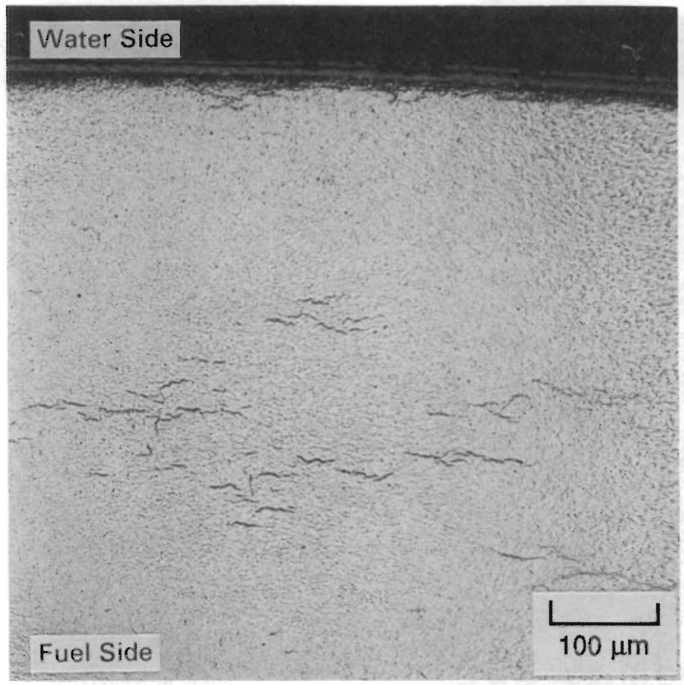


FIGURE E.5.c. Etched Cladding of Transverse Sample 106-NBD107-P (Neg. No. P-3247)

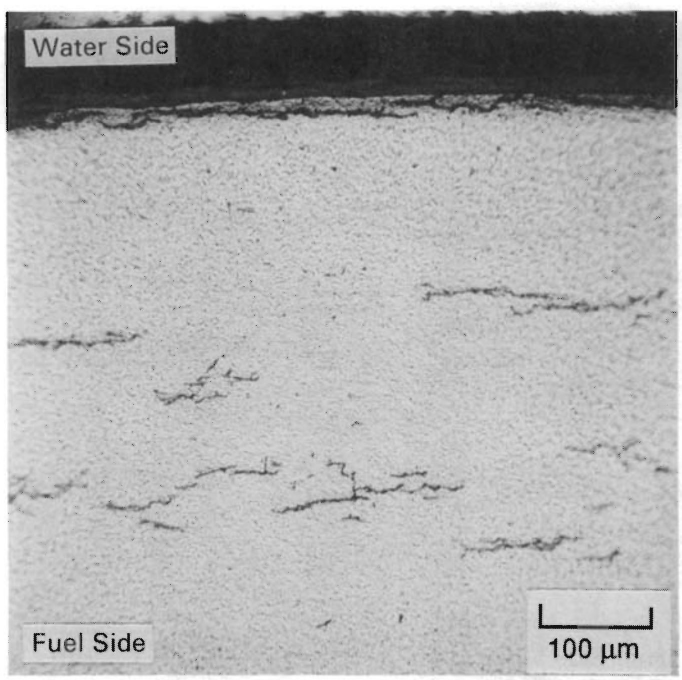


FIGURE E.5.d. Etched Cladding of Transverse Sample 106-NBD107-Z (Neg. No. P-3312)

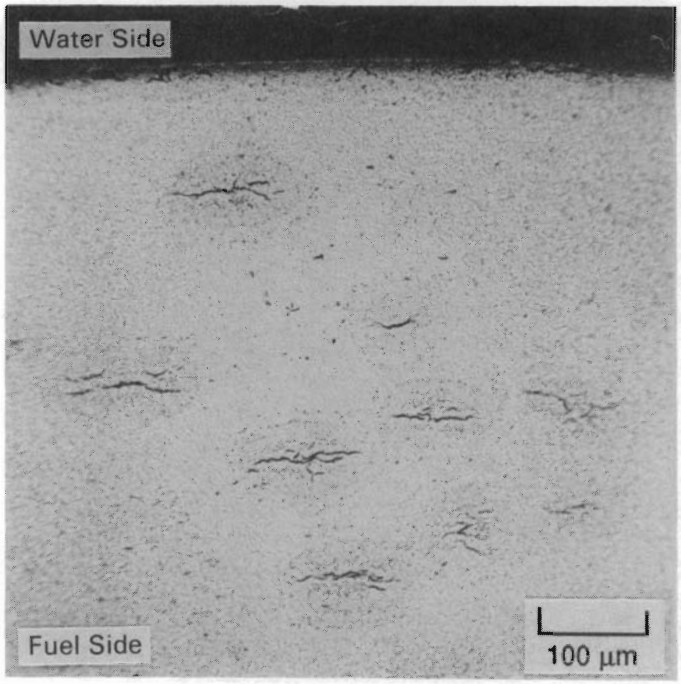


FIGURE E.5.e. Etched Cladding of Transverse Sample 106-NBD107-LL (Neg. No. P-3309)

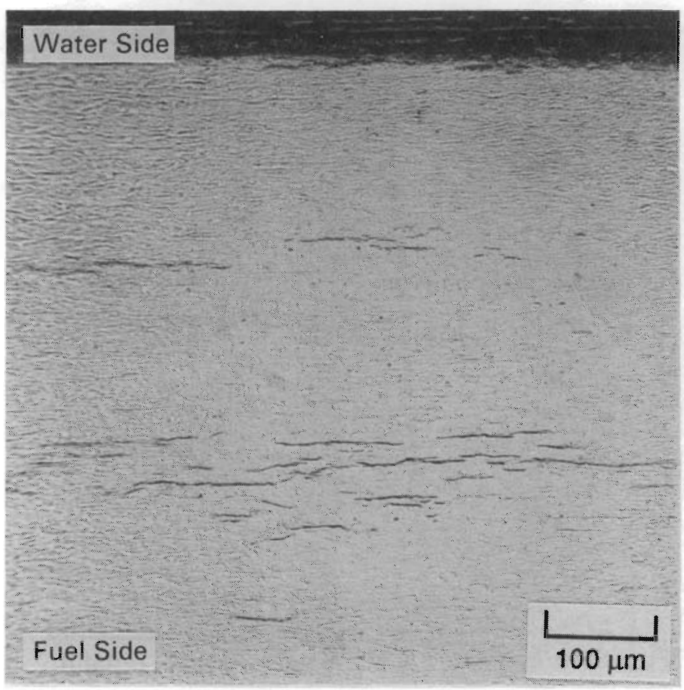


FIGURE E.5.f. Etched Cladding of Longitudinal Sample 106-NBD107-O (Neg. No. P-3273)

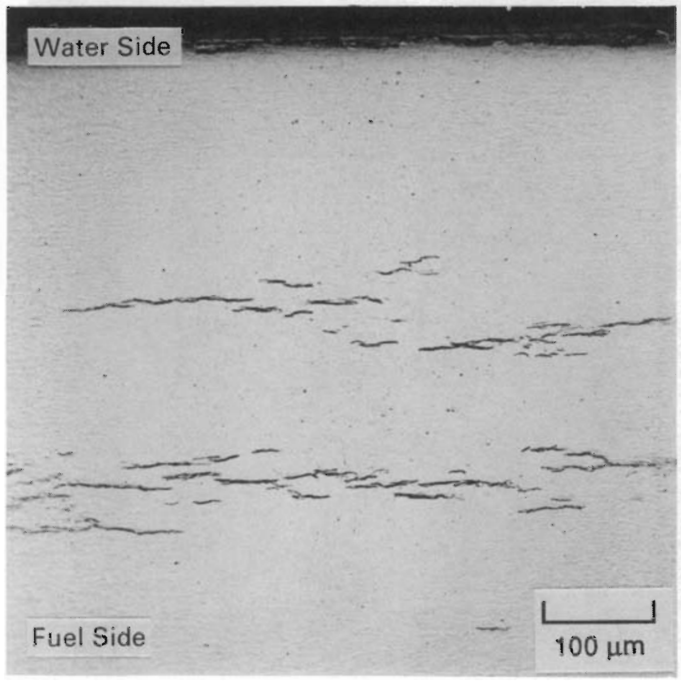


FIGURE E.5.g. Etched Cladding of Longitudinal Sample 106-NBD107-Y (Neg. No. P-3311)

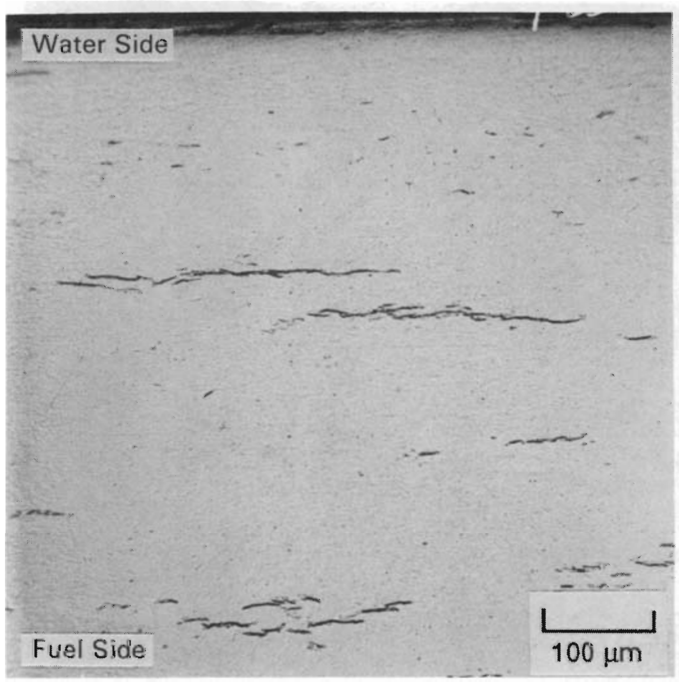


FIGURE E.5.h. Etched Cladding of Longitudinal Sample 106-NBD107-KK (Neg. No. P-3318)

(Intentionally left blank to facilitate comparison of alpha and beta-gamma autoradiographs.)

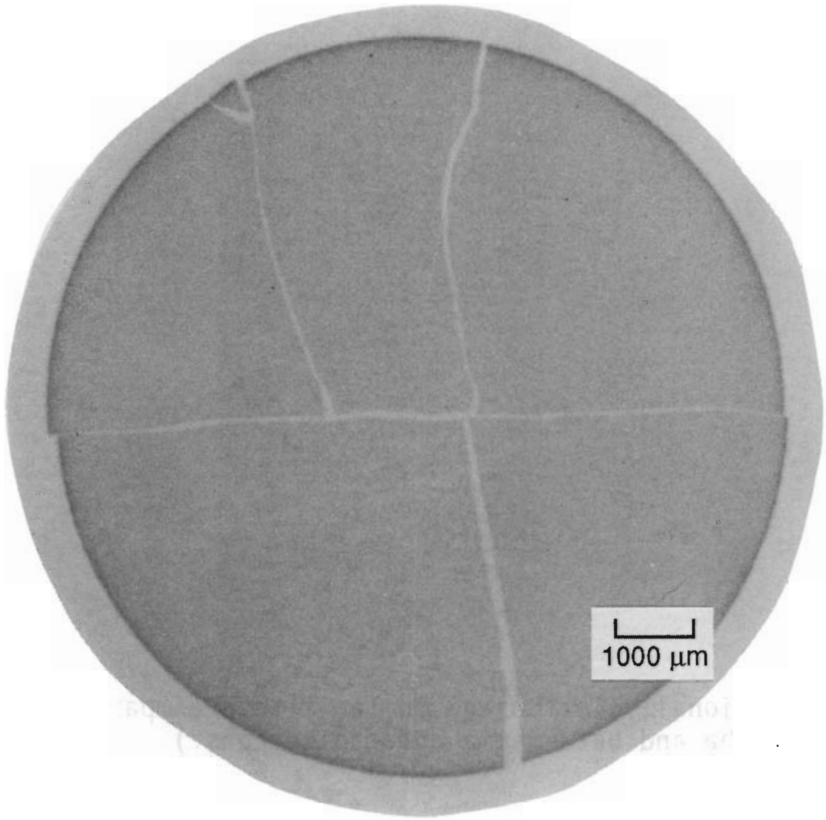


FIGURE E.6.a. Alpha Autoradiograph of Transverse Sample 106-NBD107-C (Neg. No. 5460)

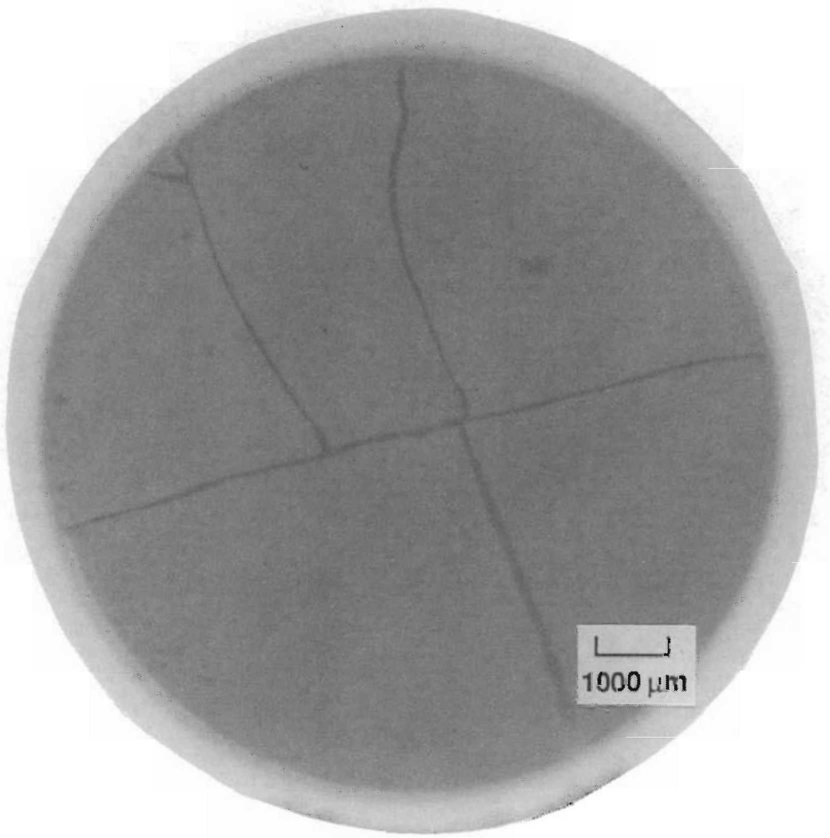


FIGURE E.6.b. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-C (Neg. No. 5461)

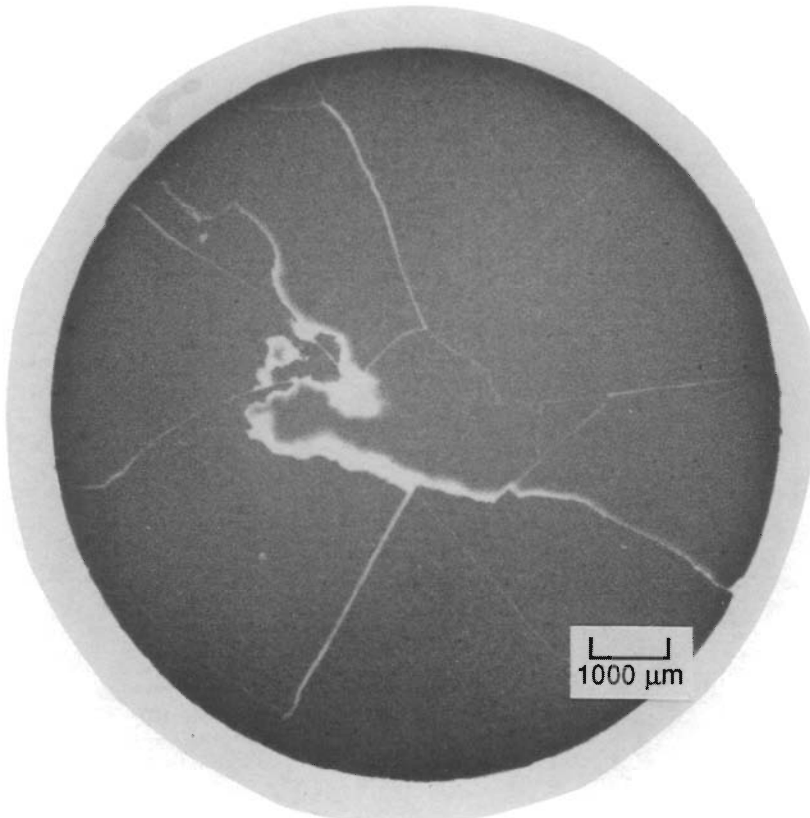


FIGURE E.6.c. Alpha Autoradiograph of Transverse Sample 106-NBD107-G (Neg. No. 5434)

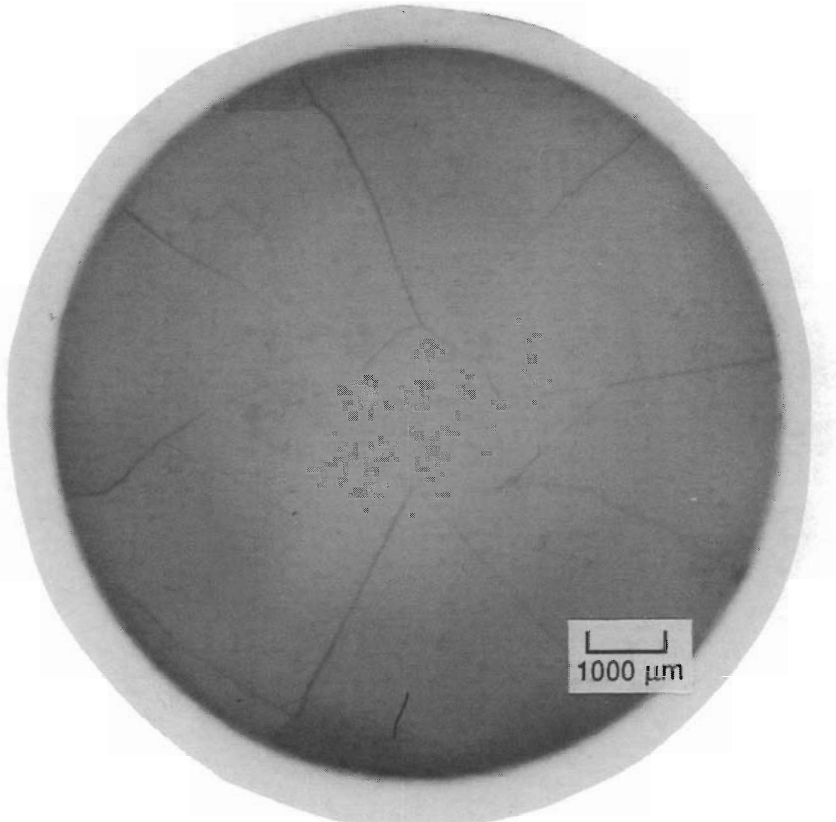


FIGURE E.6.d. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-G (Neg. No. 5435)

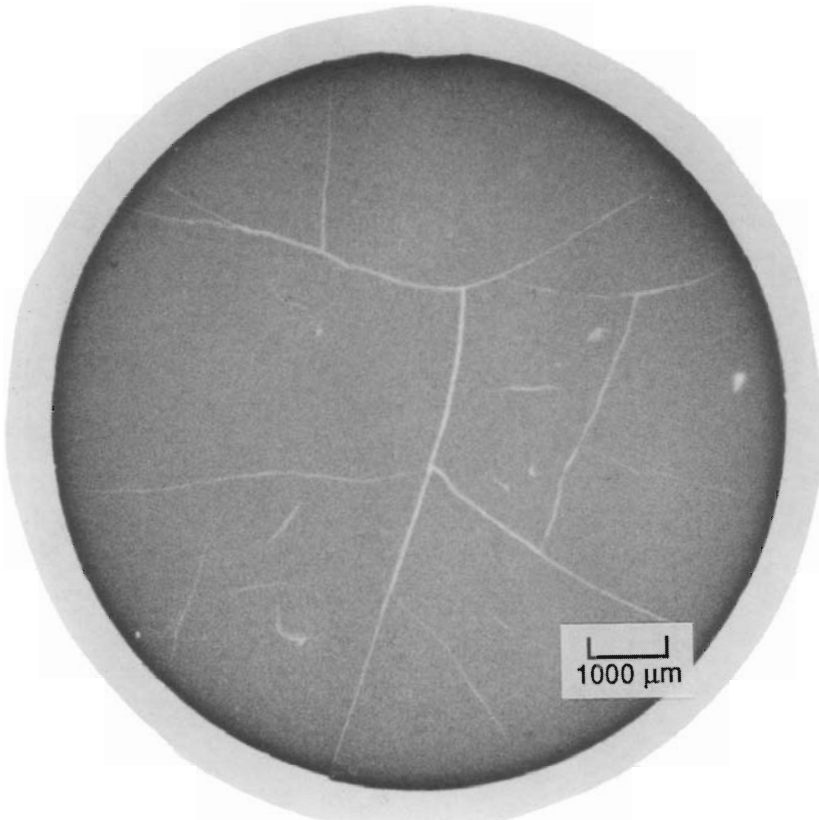


FIGURE E.6.e. Alpha Autoradiograph of Transverse Sample 106-NBD107-P (Neg. No. 5432)

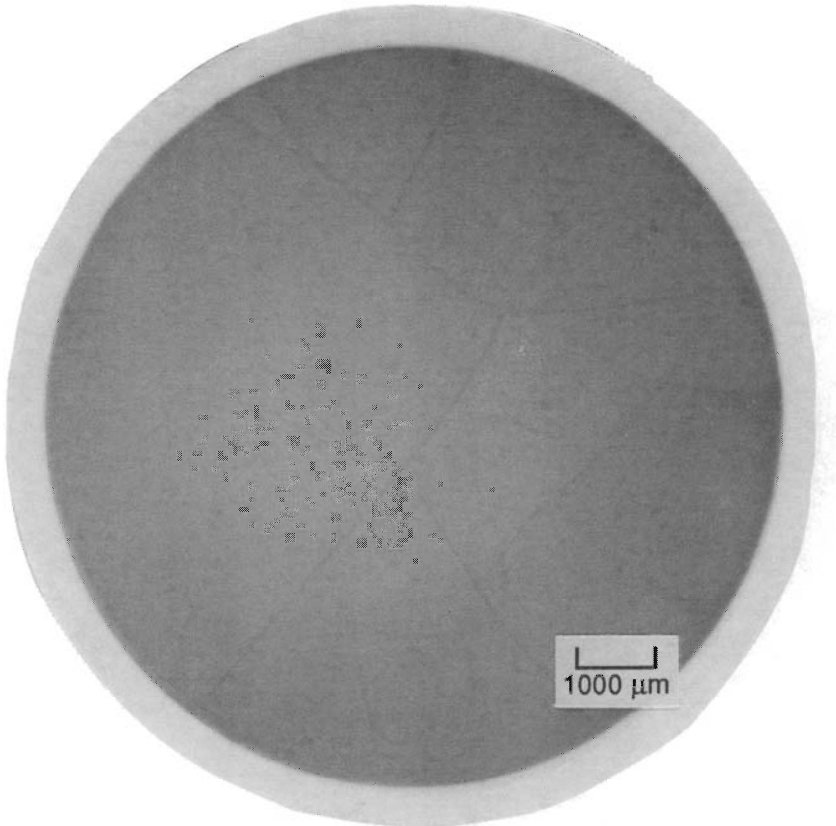


FIGURE E.6.f. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-P (Neg. No. 5433)

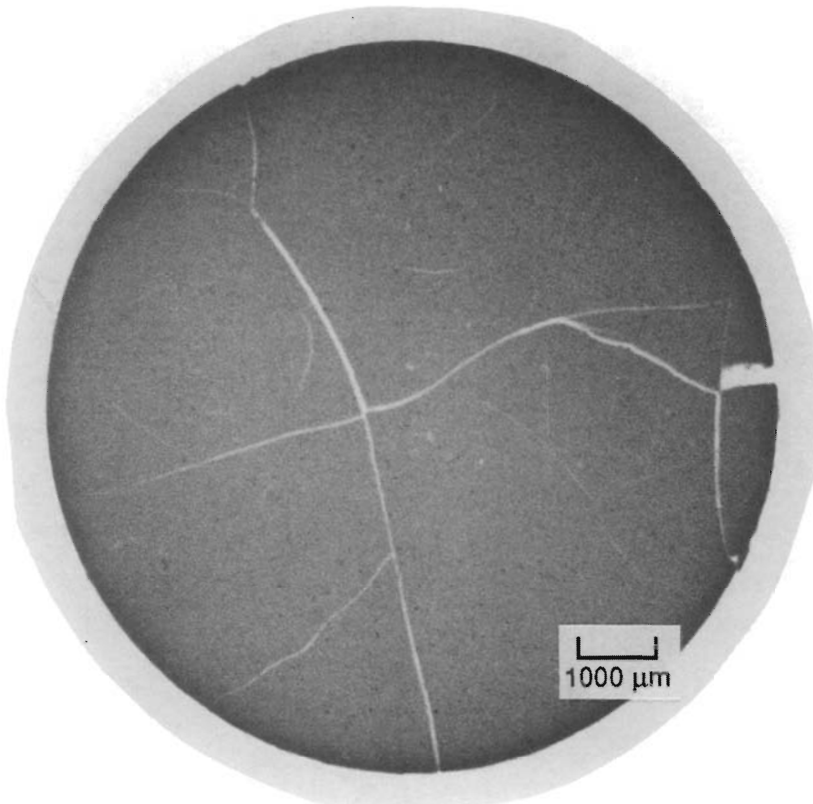


FIGURE E.6.g. Alpha Autoradiograph of Transverse Sample 106-NBD107-Z (Neg. No. 5442)

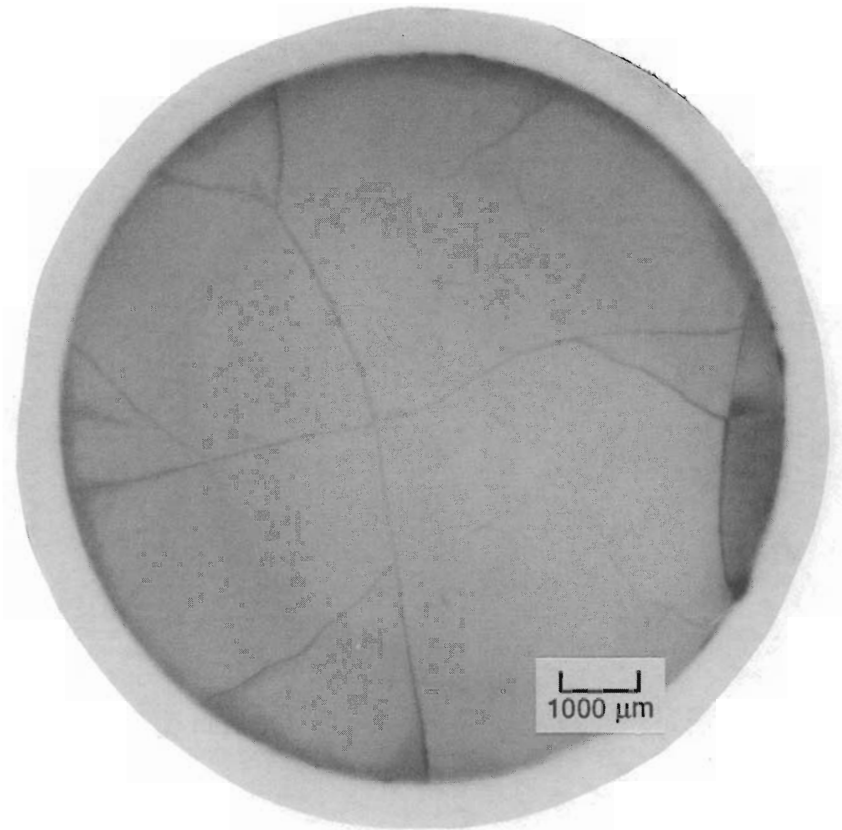


FIGURE E.6.h. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-Z (Neg. No. 5443)

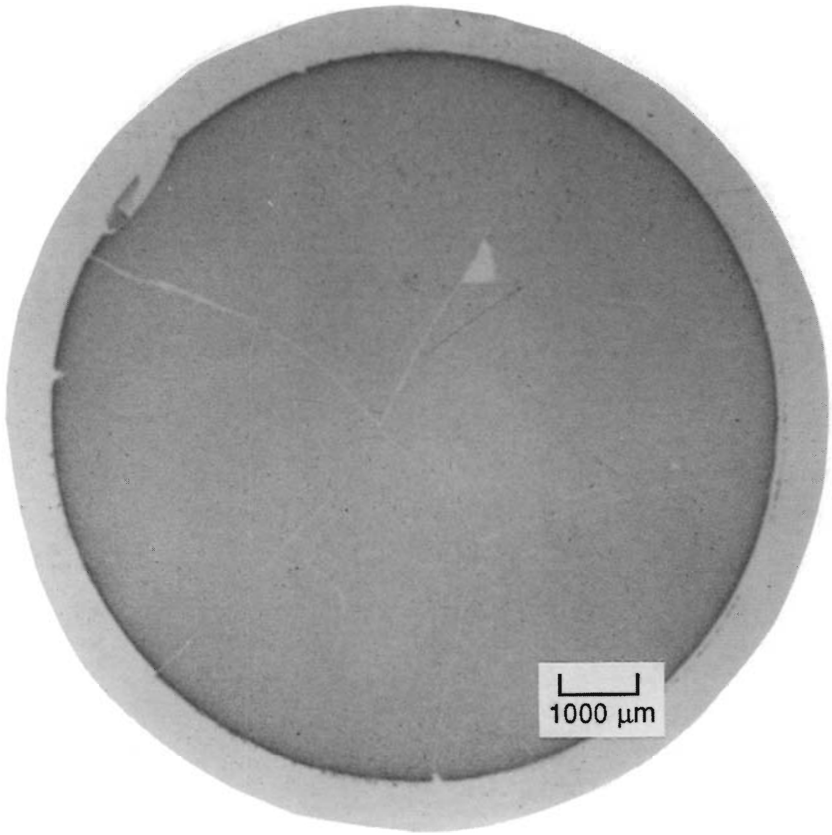


FIGURE E.6.i. Alpha Autoradiograph of Transverse Sample 106-NBD107-LL (Neg. No. 5440)

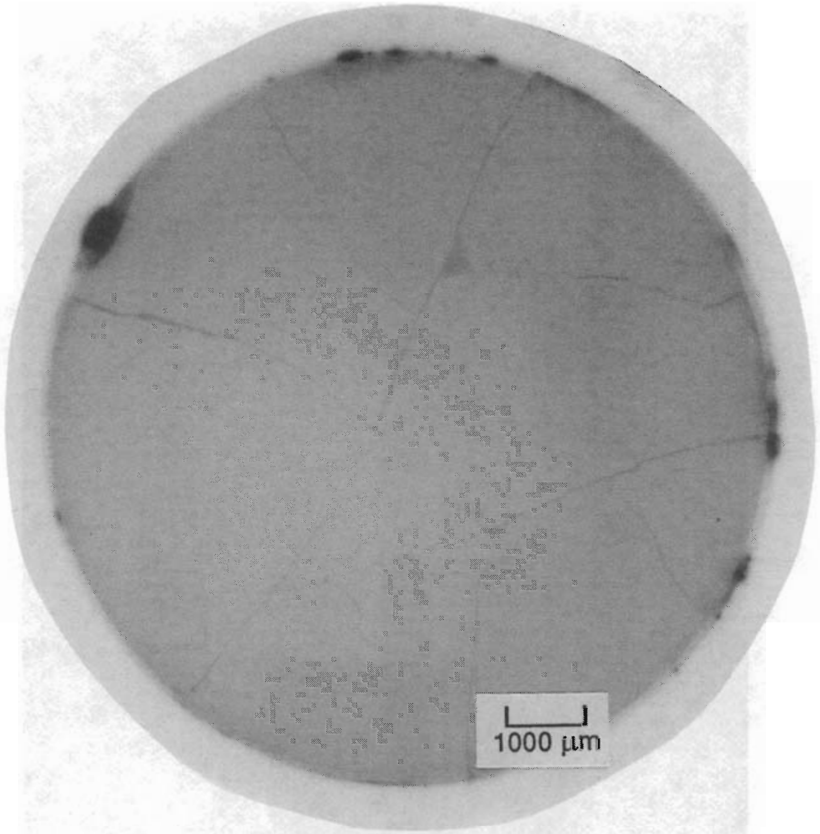


FIGURE E.6.j. Beta-Gamma Autoradiograph of Transverse Sample 106-NBD107-LL (Neg. No. 5441)

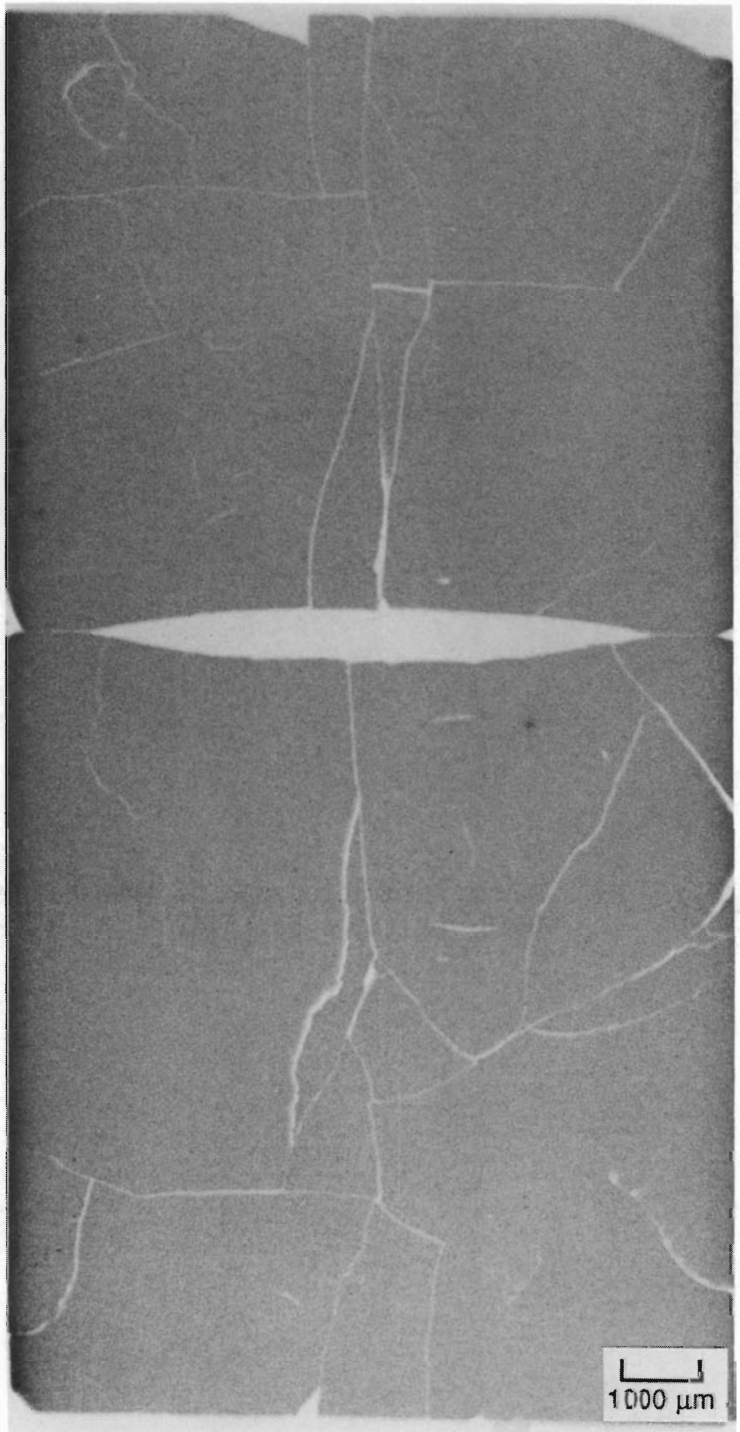


FIGURE E.6.k. Alpha Autoradiograph of Longitudinal Sample 106-NBD107-0 (Neg.No. 5430)

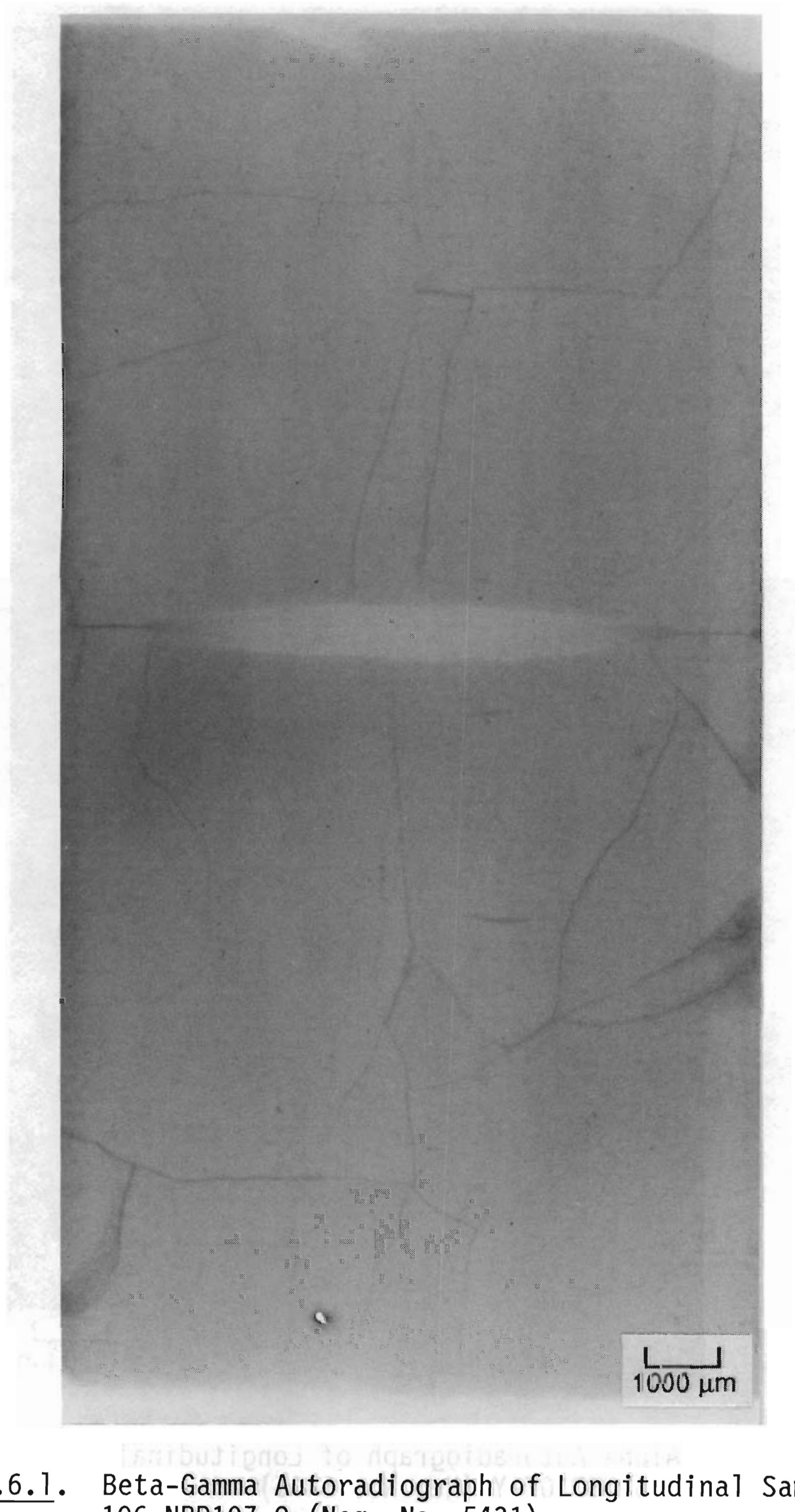


FIGURE E.6.1. Beta-Gamma Autoradiograph of Longitudinal Sample 106-NBD107-0 (Neg. No. 5431)

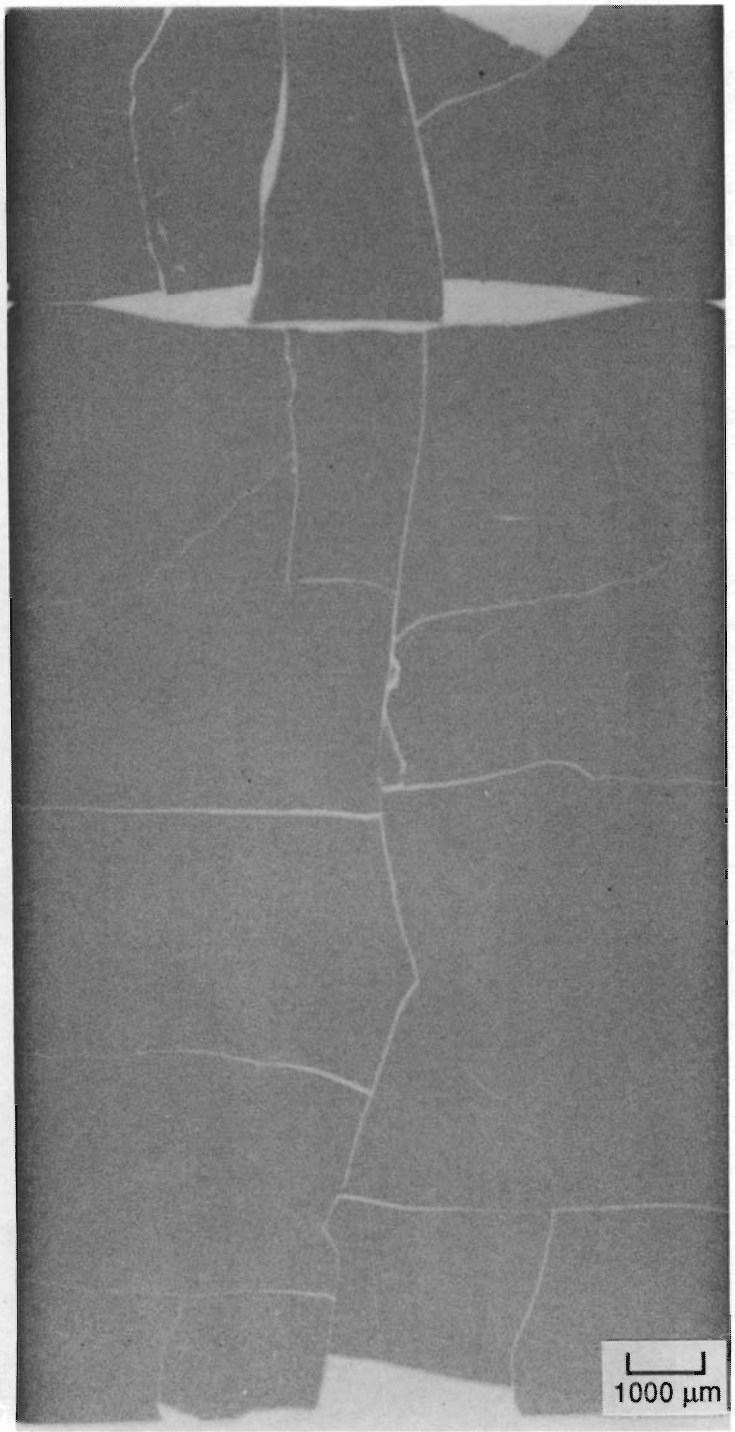


FIGURE E.6.m. Alpha Autoradiograph of Longitudinal Sample 106-NBD107-Y (Neg.No. 5436)

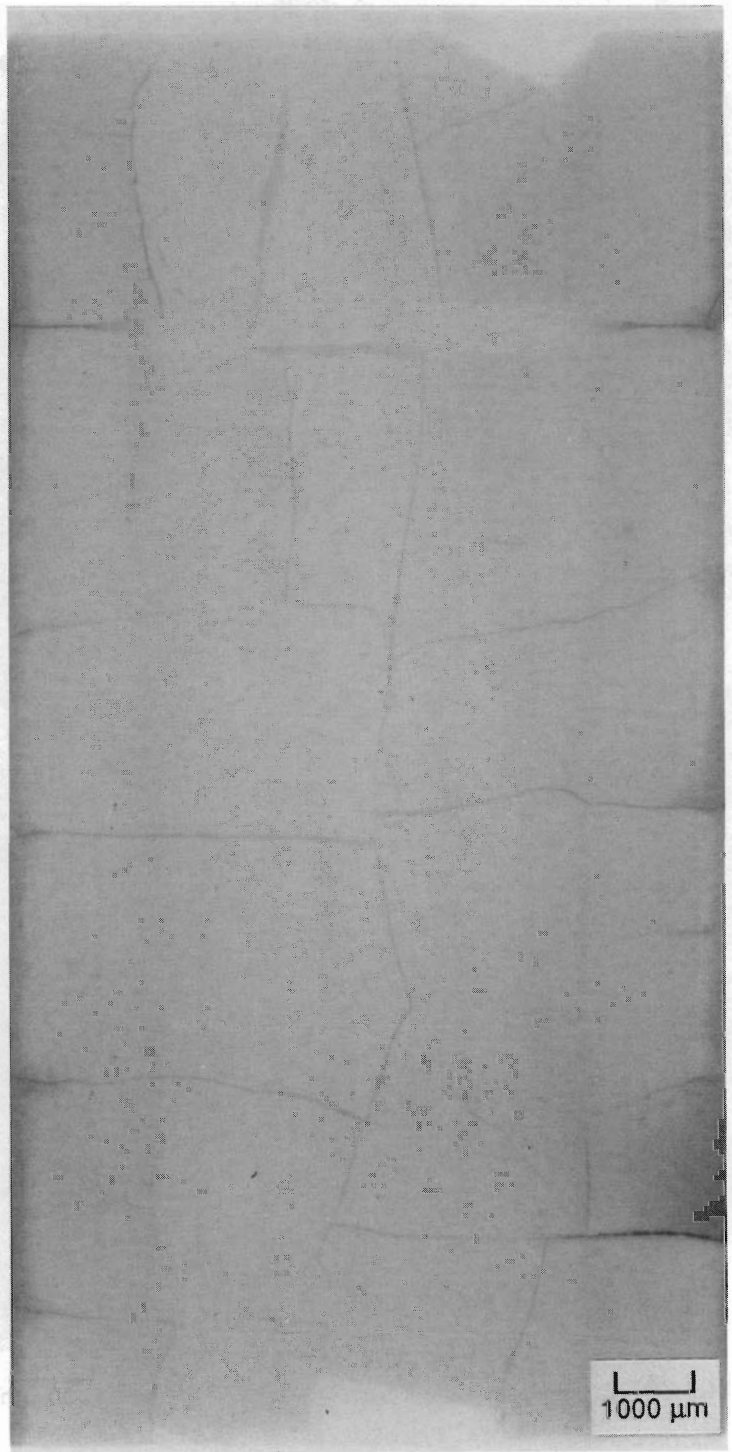


FIGURE E.6.n. Beta-Gamma Autoradiograph of Longitudinal Sample 106-NBD107-Y (Neg. No. 5437)

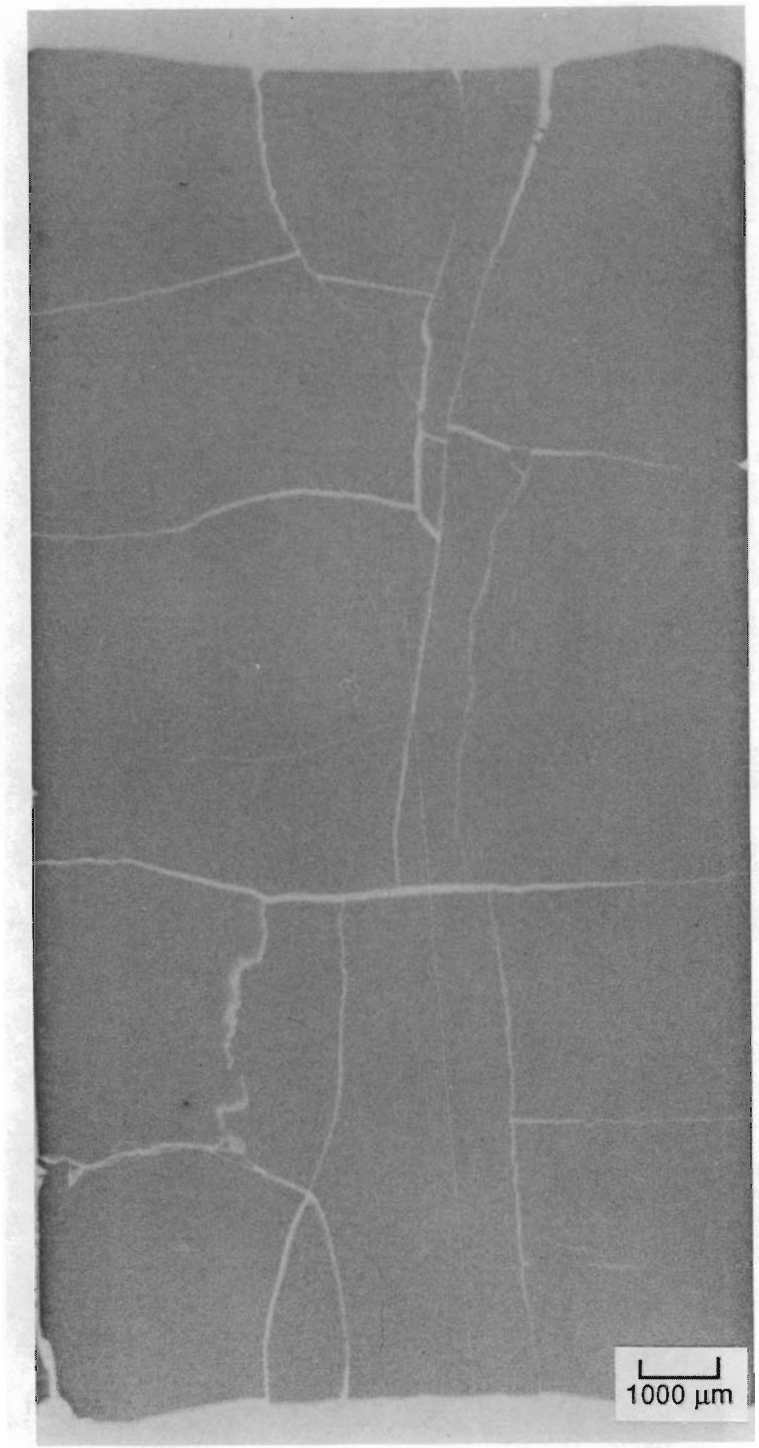


FIGURE E.6.o. Alpha Autoradiograph of Longitudinal Sample 106-NBD107-KK (Neg. No. 5444)

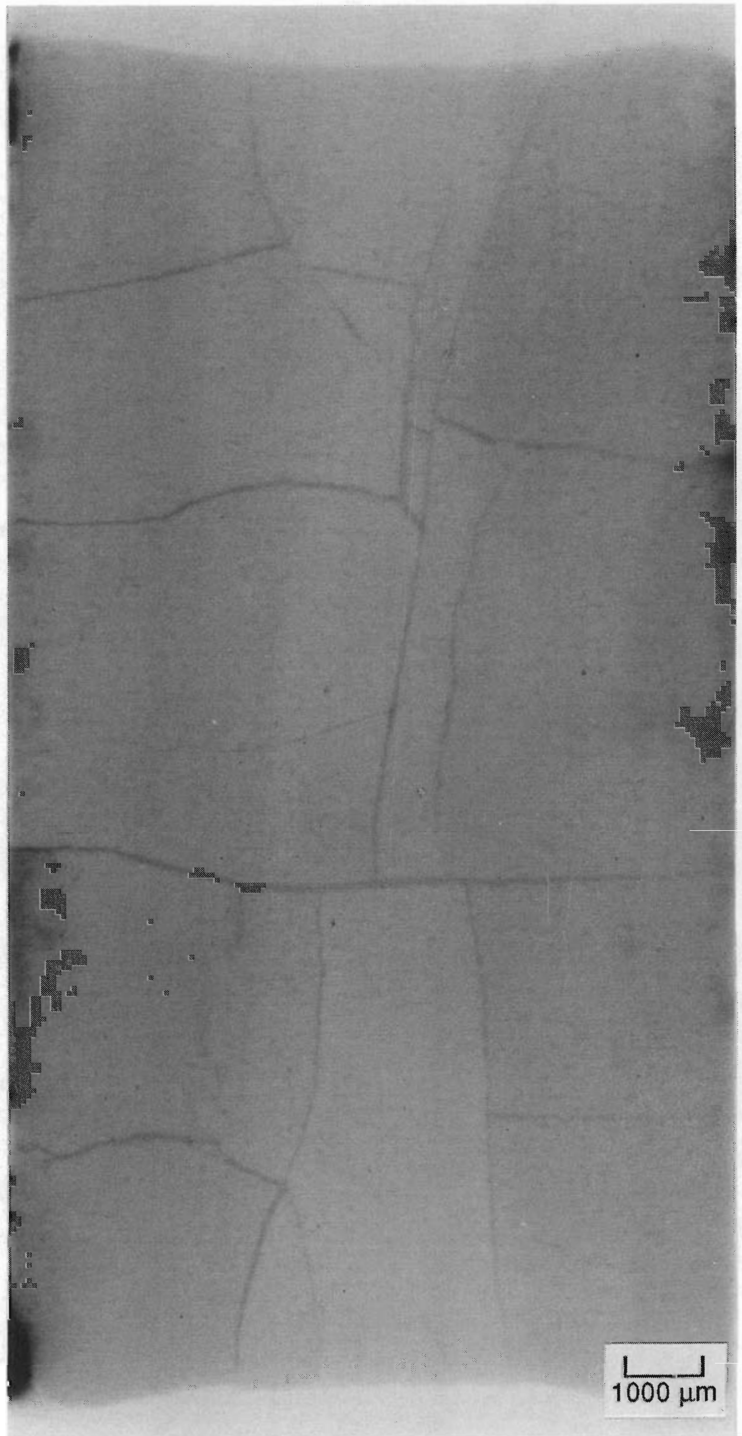


FIGURE E.6.p. Beta-Gamma Autoradiograph of Longitudinal Sample 106-NBD107-KK (Neg. No. 5445)

APPENDIX F

RESULTS OF ORIGEN2 RADIONUCLIDE INVENTORY CALCULATIONS

APPENDIX F

RESULTS OF ORIGEN2 RADIONUCLIDE INVENTORY CALCULATIONS

Appendix F contains input and output from the ORIGEN2 calculations for ATM-106 spent fuel based on data described in Section 4.6 and Appendix A. An example of the ORIGEN2 input for fuel irradiation/decay is shown in Figure F.1. An example of the ORIGEN2 input for cladding irradiation/decay is shown in Figure F.2. The power densities given in Appendix A were normalized to give burnup exposures of 20, 25, 30, 35, 40, 45, and 50 MWd/kgM. Eight tables of output at each of these exposures are given in Appendix F. Their contents are as follows:

Table F.1.a - F.1.g	Fission Product Radioactivity by Isotope, Ci/gU
Table F.2.a - F.2.g	Actinide Radioactivity by Isotope, Ci/gU
Table F.3.a - F.3.g	Fission Product Inventory by Isotope, g/gU
Table F.4.a - F.4.g	Actinide Inventory by Isotope, g/gU
Table F.5.a - F.5.g	Fission Product Inventory by Element, g/gU
Table F.6.a - F.6.g	Actinide Inventory by Element, g/gU
Table F.7.a - F.7.g	Fuel Activation Product Inventory by Isotope, g/gU
Table F.8.a - F.8.g	Cladding Activation Product Inventory by Isotope, g/gZr.

Each table contains values for out-of-reactor decay times of 6, 8, 10, 12, 15, 20, and 1000 years.

```
-1
-1
-1
TIT     ATM-106 FUEL PWR  E=2.453  20.0 GWD/MTU
BAS     GRAM
LIB     0 1 2 3 204 205 206 9 3 0 1 1
PHO     101 102 103 10
LIP     0 0 0
INP     1 1 -1 -1 1 1
RDA     BURNUP TO 20,000 MWD/MTU
BUP
IRP     116.    14.0169-6  1 2 4 2
IRP     232.    14.0169-6  2 3 4 0
IRP     348.    14.0169-6  3 4 4 0
IRP     465.    14.0169-6  4 5 4 0
DEC     498.               5 6 4 0
IRP     588.    13.3884-6  6 7 4 0
IRP     666.7   13.3884-6  7 8 4 0
IRP     730.     8.1663-6  8 9 4 0
DEC     811.               9 1 4 0
IRP     911.    11.8997-6  1 2 4 0
IRP     1011.   11.8997-6  2 3 4 0
IRP     1117.   11.8997-6  3 4 4 0
DEC     1188.              4 5 4 0
IRP     1213.    7.9016-6  5 6 4 0
IRP     1238.3   4.2202-6  6 7 4 0
IRP     1348.3   9.1304-6  7 8 4 0
IRP     1457.    9.1304-6  8 9 4 0
DEC     1482.              9 1 4 0
IRP     1570.    9.9148-6  1 2 4 0
DEC     1651.              2 3 4 0
IRP     1767.7   9.1871-6  3 4 4 0
IRP     1891.6   4.4092-6  4 5 4 0
IRP     2001.6 10.0850-6   5 6 4 0
IRP     2117.   10.0850-6  6 7 4 0
DEC     1.      7  8 5 2
DEC     6.      8  1 5 0
DEC     8.      1  2 5 0
DEC     10.     2  3 5 0
DEC     12.     3  4 5 0
DEC     15.     4  5 5 0
DEC     20.     5  6 5 0
DEC     50.     6  7 5 0
```

FIGURE F.1. Sample ORIGEN2 Input for ATM-106 Fuel

```
DEC     100.    7  8 5 0
DEC     200.    8  9 5 0
DEC     500.    9 10 5 0
DEC     1000. 10  7 5 0
BUP
HED     1 ' 6 YEARS
HED     2 ' 8 YEARS
HED     3 10 YEARS
HED     4 12 YEARS
HED     5 15 YEARS
HED     6 20 YEARS
HED     7 1000 YEARS
OPTA    8 8 8 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTL    8 8 8 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.0-15  7 1.0-15  -1
OUT     7 1  0  1
STP     4
2  922340 .000199 922350 .02453 922380 .97527 0 0.0
4  80000 .13452 60000 21.6-6  70000 49.9-6  90000 11.3-6
4  170000 11.3-6 26000 51.1-6  470000 1.1-6  200000 45.4-6
4  130000 45.4-6  140000 45.4-6  280000 28.4-6  0 0.0
0
END
```

FIGURE F.1. (contd)

```
-1
-1
-1
TIT     ATM-106 CLAD PWR  E=2.453  20.0 GWD/MTU
BAS     GRAM
LIB     0 1 2 3 204 205 206 9 3 0 1 1
PHO     101 102 103 10
LIP     0 0 0
INP     1 1 -1 -1 1 1
RDA     BURNUP TO 20,000 MWD/MTU
BUP
IRP     116.    64.0985-6  1 2 4 2
IRP     232.    64.0985-6  2 3 4 0
IRP     348.    64.0985-6  3 4 4 0
IRP     465.    64.0985-6  4 5 4 0
DEC     498.               5 6 4 0
IRP     588.    61.2242-6  6 7 4 0
IRP     666.7   61.2242-6  7 8 4 0
IRP     730.    37.3439-6  8 9 4 0
DEC     811.               9 1 4 0
IRP     911.    54.4167-6  1 2 4 0
IRP     1011.   54.4167-6  2 3 4 0
IRP     1117.   54.4167-6  3 4 4 0
DEC     1188.              4 5 4 0
IRP     1213.   36.1337-6  5 6 4 0
IRP     1238.3  19.2987-6  6 7 4 0
IRP     1348.3  41.7526-6  7 8 4 0
IRP     1457.   41.7526-6  8 9 4 0
DEC     1482.              9 1 4 0
IRP     1570.   45.3400-6  1 2 4 0
DEC     1651.              2 3 4 0
IRP     1767.7  42.0119-6  3 4 4 0
IRP     1891.6  20.1631-6  4 5 4 0
IRP     2001.6  46.1180-6  5 6 4 0
IRP     2117.   46.1180-6  6 7 4 0
DEC     1.      7  8 5 2
DEC     6.      8  1 5 0
DEC     8.      1  2 5 0
DEC     10.     2  3 5 0
DEC     12.     3  4 5 0
DEC     15.     4  5 5 0
DEC     20.     5  6 5 0
DEC     50.     6  7 5 0
```

FIGURE F.2. Sample ORIGEN2 Input for ATM-106 Cladding

```
DEC     100.    7  8 5 0
DEC     200.    8  9 5 0
DEC     500.    9 10 5 0
DEC     1000. 10  7 5 0
BUP
HED     1 ' 6 YEARS
HED     2 ' 8 YEARS
HED     3 10 YEARS
HED     4 12 YEARS
HED     5 15 YEARS
HED     6 20 YEARS
HED     7 1000 YEARS
OPTA    8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTL    8 8 8 8 7 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
OPTF    8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8
CUT     5 1.0-15  7 1.0-15  -1
OUT     7 1  0  1
STP     4
2  922340 .000910 922350 .11217 922380 4.4598 0 0.0
4  400000 .9804  500000 .015  260000 .002  240000 .000
4  130000 40.0-6  720000 55.0-6  140000 80.0-6  80000 1248.0-6
4  60000 146.0-6  70000 42.0-6 10000 12.0-6  0 0.0
0
END
```

FIGURE F.2. (contd)

TABLE F.1.a. Fission Product Radioactivity by Isotope at 20 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	2.146E-04	1.918E-04	1.715E-04	1.532E-04	1.295E-04	9.781E-05	0.00
Be-10	1.760E-12	1.760E-12	1.760E-12	1.760E-12	1.760E-12	1.760E-12	1.759E-12
C-14	7.092E-11	7.090E-11	7.088E-11	7.086E-11	7.084E-11	7.080E-11	6.288E-11
Se-79	2.518E-07	2.518E-07	2.518E-07	2.518E-07	2.518E-07	2.518E-07	2.492E-07
Kr-81	2.336E-13	2.336E-13	2.336E-13	2.336E-13	2.336E-13	2.336E-13	2.328E-13
Kr-85	3.439E-03	3.021E-03	2.655E-03	2.333E-03	1.922E-03	1.391E-03	0.00
Rb-87	1.310E-11	1.310E-11	1.310E-11	1.310E-11	1.310E-11	1.310E-11	1.310E-11
Sr-89	2.078E-14	9.184E-19	4.058E-23	0.00	0.00	0.00	0.00
Sr-90	3.701E-02	3.529E-02	3.365E-02	3.208E-02	2.987E-02	2.652E-02	1.964E-12
Y-90	3.702E-02	3.529E-02	3.365E-02	3.209E-02	2.988E-02	2.653E-02	1.965E-12
Y-91	1.649E-12	2.875E-16	5.013E-20	8.740E-24	0.00	0.00	0.00
Zr-93	1.109E-06	1.109E-06	1.109E-06	1.109E-06	1.109E-06	1.109E-06	1.108E-06
Nb-93m	3.997E-07	4.630E-07	5.202E-07	5.719E-07	6.402E-07	7.331E-07	1.053E-06
Nb-94	8.543E-11	8.543E-11	8.542E-11	8.541E-11	8.541E-11	8.539E-11	8.258E-11
Zr-95	2.107E-11	7.705E-15	2.817E-18	1.030E-21	0.00	0.00	0.00
Nb-95	4.679E-11	1.711E-14	6.254E-18	2.287E-21	0.00	0.00	0.00
Nb-95m	1.563E-13	5.716E-17	2.090E-20	7.641E-24	0.00	0.00	0.00
Tc-98	2.204E-12	2.204E-12	2.204E-12	2.204E-12	2.204E-12	2.204E-12	2.204E-12
Tc-99	8.209E-06	8.209E-06	8.209E-06	8.209E-06	8.209E-06	8.208E-06	8.182E-06
Rh-102	1.019E-07	6.317E-08	3.916E-08	2.428E-08	1.185E-08	3.588E-09	0.00
Ru-106	2.641E-03	6.675E-04	1.687E-04	4.264E-05	5.419E-06	1.741E-07	0.00
Rh-106	2.641E-03	6.675E-04	1.687E-04	4.264E-05	5.419E-06	1.741E-07	0.00
Pd-107	6.470E-08	6.470E-08	6.470E-08	6.470E-08	6.470E-08	6.470E-08	6.469E-08
Ag-108	1.526E-12	1.510E-12	1.493E-12	1.477E-12	1.453E-12	1.414E-12	6.724E-15
Ag-108m	1.715E-11	1.696E-11	1.678E-11	1.660E-11	1.633E-11	1.589E-11	7.555E-14
Ag-109m	9.469E-12	3.180E-12	1.068E-12	3.586E-13	6.977E-14	4.559E-15	0.00
Cd-109	9.469E-12	3.180E-12	1.068E-12	3.586E-13	6.977E-14	4.559E-15	0.00
Ag-110	2.940E-08	3.875E-09	5.108E-10	6.733E-11	3.223E-12	2.033E-14	0.00
Ag-110m	2.210E-06	2.913E-07	3.841E-08	5.063E-09	2.423E-10	1.529E-12	0.00
Cd-113m	2.222E-05	2.020E-05	1.837E-05	1.671E-05	1.449E-05	1.142E-05	6.868E-26
Sn-119m	1.260E-07	1.595E-08	2.020E-09	2.558E-10	1.152E-11	6.577E-14	0.00
Sn-121m	1.113E-07	1.083E-07	1.053E-07	1.024E-07	9.824E-08	9.166E-08	1.145E-13
Sn-123	7.604E-09	1.509E-10	2.993E-12	5.938E-14	1.662E-16	9.212E-21	0.00
Te-123m	6.541E-12	9.509E-14	1.382E-15	2.007E-17	0.00	0.00	0.00
Sb-124	3.015E-15	6.703E-19	1.490E-22	0.00	0.00	0.00	0.00
Sb-125	1.388E-03	8.417E-04	5.103E-04	3.093E-04	1.460E-04	4.178E-05	0.00
Te-125m	3.388E-04	2.054E-04	1.245E-04	7.550E-05	3.563E-05	1.019E-05	0.00
Sn-126	4.833E-07	4.833E-07	4.833E-07	4.833E-07	4.833E-07	4.832E-07	4.800E-07
Sb-126	6.766E-08	6.766E-08	6.766E-08	6.766E-08	6.766E-08	6.765E-08	6.720E-08
Sb-126m	4.833E-07	4.833E-07	4.833E-07	4.833E-07	4.833E-07	4.832E-07	4.800E-07
Te-127	3.421E-09	3.287E-11	3.158E-13	3.034E-15	2.857E-18	2.586E-23	0.00
Te-127m	3.493E-09	3.356E-11	3.224E-13	3.098E-15	2.917E-18	2.640E-23	0.00
I-129	1.958E-08	1.958E-08	1.958E-08	1.958E-08	1.958E-08	1.958E-08	1.958E-08
Cs-134	6.210E-03	3.170E-03	1.619E-03	8.263E-04	3.014E-04	5.613E-05	0.00
Cs-135	4.095E-07	4.095E-07	4.095E-07	4.095E-07	4.095E-07	4.095E-07	4.094E-07
Cs-137	5.235E-02	4.998E-02	4.773E-02	4.557E-02	4.252E-02	3.788E-02	5.552E-12

TABLE F.1.a. Fission Product Radioactivity by Isotope at 20 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	4.952E-02	4.729E-02	4.515E-02	4.311E-02	4.022E-02	3.584E-02	5.253E-12
Ce-142	1.637E-11	1.637E-11	1.637E-11	1.637E-11	1.637E-11	1.637E-11	1.637E-11
Ce-144	1.451E-03	2.444E-04	4.116E-05	6.933E-06	4.792E-07	5.578E-09	0.00
Pr-144	1.451E-03	2.444E-04	4.117E-05	6.933E-06	4.792E-07	5.579E-09	0.00
Pr-144m	1.741E-05	2.933E-06	4.940E-07	8.320E-08	5.751E-09	6.694E-11	0.00
Nd-144	8.785E-16	8.790E-16	8.791E-16	8.791E-16	8.791E-16	8.791E-16	8.791E-16
Pm-146	4.890E-07	3.800E-07	2.954E-07	2.296E-07	1.573E-07	8.376E-08	0.00
Sm-146	1.739E-13	1.771E-13	1.795E-13	1.814E-13	1.835E-13	1.857E-13	1.881E-13
Pm-147	1.565E-02	9.226E-03	5.439E-03	3.207E-03	1.451E-03	3.873E-04	0.00
Sm-147	3.551E-12	3.709E-12	3.801E-12	3.856E-12	3.899E-12	3.925E-12	3.935E-12
Eu-150	1.998E-11	1.923E-11	1.850E-11	1.780E-11	1.680E-11	1.526E-11	9.756E-20
Sm-151	2.418E-04	2.381E-04	2.345E-04	2.309E-04	2.256E-04	2.171E-04	1.144E-07
Eu-152	1.125E-05	1.016E-05	9.178E-06	8.288E-06	7.113E-06	5.513E-06	0.00
Gd-153	7.573E-08	9.346E-09	1.153E-09	1.423E-10	6.171E-12	3.302E-14	0.00
Eu-154	2.678E-03	2.280E-03	1.940E-03	1.651E-03	1.297E-03	8.666E-04	0.00
Eu-155	1.210E-03	9.146E-04	6.916E-04	5.229E-04	3.438E-04	1.709E-04	0.00
Tb-160	1.442E-13	1.311E-16	1.192E-19	1.083E-22	0.00	0.00	0.00
Ho-166m	8.303E-10	8.293E-10	8.284E-10	8.274E-10	8.260E-10	8.236E-10	4.676E-10
Tm-170	4.990E-14	9.729E-16	1.899E-17	3.331E-19	6.973E-20	3.699E-24	0.00
Tm-171	6.329E-12	3.074E-12	1.493E-12	7.254E-13	2.456E-13	4.039E-14	0.00
Total	2.155E-01	1.898E-01	1.740E-01	1.623E-01	1.484E-01	1.300E-01	1.223E-05

TABLE F.1.b. Fission Product Radioactivity by Isotope at 25 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	2.739E-04	2.448E-04	2.188E-04	1.956E-04	1.653E-04	1.248E-04	0.00
Be-10	2.195E-12	2.195E-12	2.195E-12	2.195E-12	2.195E-12	2.195E-12	2.194E-12
C-14	8.846E-11	8.844E-11	8.842E-11	8.840E-11	8.836E-11	8.831E-11	7.844E-11
Se-79	3.103E-07	3.103E-07	3.103E-07	3.103E-07	3.103E-07	3.103E-07	3.070E-07
Kr-81	3.526E-13	3.526E-13	3.526E-13	3.526E-13	3.526E-13	3.526E-13	3.515E-13
Kr-85	4.137E-03	3.636E-03	3.195E-03	2.807E-03	2.312E-03	1.673E-03	0.00
Rb-87	1.569E-11	1.569E-11	1.569E-11	1.569E-11	1.569E-11	1.569E-11	1.569E-11
Sr-89	2.399E-14	1.060E-18	4.684E-23	0.00	0.00	0.00	0.00
Sr-90	4.420E-02	4.214E-02	4.019E-02	3.832E-02	3.568E-02	3.167E-02	2.346E-12
Y-90	4.421E-02	4.216E-02	4.020E-02	3.833E-02	3.569E-02	3.168E-02	2.347E-12
Y-91	1.927E-12	3.359E-16	5.857E-20	1.021E-23	0.00	0.00	0.00
Zr-93	1.347E-06	1.347E-06	1.347E-06	1.347E-06	1.347E-06	1.347E-06	1.346E-06
Nb-93m	4.865E-07	5.633E-07	6.327E-07	6.953E-07	7.781E-07	8.908E-07	1.279E-06
Nb-94	1.155E-10	1.155E-10	1.155E-10	1.155E-10	1.154E-10	1.154E-10	1.116E-10
Zr-95	2.563E-11	9.372E-15	3.427E-18	1.253E-21	0.00	0.00	0.00
Nb-95	5.691E-11	2.081E-14	7.607E-18	2.781E-21	0.00	0.00	0.00
Nb-95m	1.902E-13	6.952E-17	2.542E-20	9.294E-24	0.00	0.00	0.00
Tc-98	3.480E-12	3.480E-12	3.480E-12	3.480E-12	3.480E-12	3.480E-12	3.480E-12
Tc-99	1.004E-05	1.004E-05	1.004E-05	1.004E-05	1.004E-05	1.004E-05	1.001E-05
Rh-102	1.600E-07	9.917E-08	6.149E-08	3.812E-08	1.861E-08	5.633E-09	0.00
Ru-106	3.668E-03	9.272E-04	2.344E-04	5.924E-05	7.528E-06	2.418E-07	0.00
Rh-106	3.668E-03	9.272E-04	2.344E-04	5.924E-05	7.528E-06	2.418E-07	0.00
Pd-107	9.040E-08	9.040E-08	9.040E-08	9.040E-08	9.040E-08	9.040E-08	9.039E-08
Ag-108	2.187E-12	2.164E-12	2.140E-12	2.117E-12	2.082E-12	2.026E-12	9.636E-15
Ag-108m	2.458E-11	2.431E-11	2.405E-11	2.378E-11	2.340E-11	2.277E-11	1.083E-13
Ag-109m	2.065E-11	6.935E-12	2.329E-12	7.820E-13	1.522E-13	9.942E-15	0.00
Cd-109	2.065E-11	6.935E-12	2.329E-12	7.820E-13	1.522E-13	9.942E-15	0.00
Ag-110	5.095E-08	6.717E-09	8.854E-10	1.167E-10	5.586E-12	3.524E-14	0.00
Ag-110m	3.831E-06	5.050E-07	6.657E-08	8.776E-09	4.200E-10	2.650E-12	0.00
Cd-113m	3.075E-05	2.797E-05	2.543E-05	2.313E-05	2.005E-05	1.581E-05	9.505E-26
Sn-119m	1.694E-07	2.146E-08	2.717E-09	3.440E-10	1.550E-11	8.845E-14	0.00
Sn-121m	1.474E-07	1.434E-07	1.395E-07	1.357E-07	1.301E-07	1.214E-07	1.516E-13
Sn-123	9.748E-09	1.934E-10	3.837E-12	7.613E-14	2.127E-16	1.179E-20	0.00
Te-123m	1.353E-11	1.967E-13	2.859E-15	4.150E-17	1.177E-19	3.000E-24	0.00
Sb-124	4.897E-15	1.089E-18	2.420E-22	5.379E-26	0.00	0.00	0.00
Sb-125	1.798E-03	1.090E-03	6.608E-04	4.006E-04	1.891E-04	5.411E-05	0.00
Te-125m	4.387E-04	2.660E-04	1.613E-04	9.777E-05	4.614E-05	1.320E-05	0.00
Sn-126	6.233E-07	6.233E-07	6.233E-07	6.233E-07	6.232E-07	6.232E-07	6.190E-07
Sb-126	8.726E-08	8.726E-08	8.726E-08	8.726E-08	8.725E-08	8.725E-08	8.666E-08
Sb-126m	6.233E-07	6.233E-07	6.233E-07	6.233E-07	6.232E-07	6.232E-07	6.190E-07
Te-127	4.455E-09	4.280E-11	4.113E-13	3.951E-15	3.721E-18	3.367E-23	0.00
Te-127m	4.548E-09	4.370E-11	4.198E-13	4.034E-15	3.799E-18	3.437E-23	0.00
I-129	2.482E-08	2.482E-08	2.482E-08	2.482E-08	2.482E-08	2.482E-08	2.482E-08
Cs-134	9.553E-03	4.877E-03	2.490E-03	1.271E-03	4.637E-04	8.634E-05	0.00
Cs-135	4.509E-07	4.509E-07	4.509E-07	4.509E-07	4.509E-07	4.509E-07	4.508E-07
Cs-137	6.550E-02	6.254E-02	5.972E-02	5.702E-02	5.320E-02	4.740E-02	6.947E-12

TABLE F.1.b. Fission Product Radioactivity by Isotope at 25 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	6.196E-02	5.916E-02	5.649E-02	5.394E-02	5.033E-02	4.484E-02	6.572E-12
Ce-142	2.025E-11	2.025E-11	2.025E-11	2.025E-11	2.025E-11	2.025E-11	2.025E-11
Ce-144	1.770E-03	2.982E-04	5.022E-05	8.458E-06	5.846E-07	6.806E-09	0.00
Pr-144	1.770E-03	2.982E-04	5.022E-05	8.458E-06	5.846E-07	6.806E-09	0.00
Pr-144m	2.124E-05	3.578E-06	6.026E-07	1.015E-07	7.015E-09	8.167E-11	0.00
Nd-144	1.127E-15	1.128E-15	1.128E-15	1.128E-15	1.128E-15	1.128E-15	1.128E-15
Pm-146	7.135E-07	5.545E-07	4.310E-07	3.350E-07	2.295E-07	1.222E-07	0.00
Sm-146	2.526E-13	2.573E-13	2.609E-13	2.636E-13	2.667E-13	2.698E-13	2.734E-13
Pm-147	1.736E-02	1.023E-02	6.032E-03	3.556E-03	1.610E-03	4.295E-04	0.00
Pm-147	3.908E-12	4.082E-12	4.185E-12	4.246E-12	4.294E-12	4.323E-12	4.333E-12
Eu-150	2.204E-11	2.121E-11	2.041E-11	1.964E-11	1.854E-11	1.683E-11	1.076E-19
Sm-151	2.637E-04	2.597E-04	2.557E-04	2.518E-04	2.461E-04	2.368E-04	1.248E-07
Eu-152	1.020E-05	9.215E-06	8.322E-06	7.516E-06	6.450E-06	4.999E-06	0.00
Gd-153	9.174E-08	1.132E-08	1.397E-09	1.724E-10	7.477E-12	4.000E-14	0.00
Eu-154	4.168E-03	3.548E-03	3.019E-03	2.570E-03	2.018E-03	1.349E-03	0.00
Eu-155	1.798E-03	1.360E-03	1.028E-03	7.774E-04	5.111E-04	2.541E-04	0.00
Tb-160	2.566E-13	2.333E-16	2.121E-19	1.928E-22	0.00	0.00	0.00
Ho-166m	1.639E-09	1.637E-09	1.635E-09	1.633E-09	1.631E-09	1.626E-09	9.231E-10
Tm-170	1.207E-13	2.352E-15	4.592E-17	9.189E-19	0.00	0.00	0.00
Tm-171	1.974E-11	9.589E-12	4.658E-12	2.263E-12	7.661E-13	1.260E-13	0.00
Total	2.666E-01	2.340E-01	2.143E-01	1.997E-01	1.825E-01	1.598E-01	1.496E-05

TABLE F.1.c. Fission Product Radioactivity by Isotope at 30 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	3.347E-04	2.992E-04	2.674E-04	2.390E-04	2.020E-04	1.525E-04	0.00
Be-10	2.630E-12	2.630E-12	2.630E-12	2.630E-12	2.630E-12	2.630E-12	2.628E-12
C-14	1.060E-10	1.059E-10	1.059E-10	1.059E-10	1.058E-10	1.058E-10	9.395E-11
Se-79	3.674E-07	3.674E-07	3.674E-07	3.674E-07	3.674E-07	3.674E-07	3.635E-07
Kr-81	4.985E-13	4.985E-13	4.984E-13	4.984E-13	4.984E-13	4.984E-13	4.968E-13
Kr-85	4.795E-03	4.213E-03	3.702E-03	3.253E-03	2.680E-03	1.939E-03	0.00
Rb-87	1.810E-11	1.810E-11	1.810E-11	1.810E-11	1.810E-11	1.810E-11	1.810E-11
Sr-89	2.666E-14	1.178E-18	5.205E-23	0.00	0.00	0.00	0.00
Sr-90	5.085E-02	4.849E-02	4.623E-02	4.408E-02	4.104E-02	3.644E-02	2.699E-12
Y-90	5.086E-02	4.850E-02	4.624E-02	4.409E-02	4.106E-02	3.645E-02	2.700E-12
Y-91	2.169E-12	3.782E-16	6.595E-20	1.150E-23	0.00	0.00	0.00
Zr-93	1.573E-06	1.573E-06	1.573E-06	1.573E-06	1.573E-06	1.573E-06	1.572E-06
Nb-93m	5.696E-07	6.592E-07	7.401E-07	8.132E-07	9.098E-07	1.041E-06	1.494E-06
Nb-94	1.469E-10	1.468E-10	1.468E-10	1.468E-10	1.468E-10	1.468E-10	1.420E-10
Zr-95	3.003E-11	1.098E-14	4.014E-18	1.468E-21	0.00	0.00	0.00
Nb-95	6.666E-11	2.437E-14	8.911E-18	3.258E-21	0.00	0.00	0.00
Nb-95m	2.227E-13	8.144E-17	2.978E-20	1.089E-23	0.00	0.00	0.00
Tc-98	5.078E-12	5.078E-12	5.078E-12	5.078E-12	5.078E-12	5.078E-12	5.077E-12
Tc-99	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.174E-05
Rh-102	2.311E-07	1.433E-07	8.885E-08	5.509E-08	2.689E-08	8.140E-09	0.00
Ru-106	4.781E-03	1.208E-03	3.054E-04	7.720E-05	9.811E-06	3.151E-07	0.00
Rh-106	4.781E-03	1.208E-03	3.054E-04	7.720E-05	9.811E-06	3.151E-07	0.00
Pd-107	1.185E-07	1.185E-07	1.185E-07	1.185E-07	1.185E-07	1.185E-07	1.185E-07
Ag-108	2.942E-12	2.910E-12	2.878E-12	2.847E-12	2.801E-12	2.725E-12	1.296E-14
Ag-108m	3.305E-11	3.270E-11	3.234E-11	3.199E-11	3.147E-11	3.062E-11	1.456E-13
Ag-109m	3.932E-11	1.321E-11	4.434E-12	1.489E-12	2.897E-13	1.893E-14	0.00
Cd-109	3.932E-11	1.321E-11	4.434E-12	1.489E-12	2.897E-13	1.893E-14	0.00
Ag-110	8.035E-08	1.059E-08	1.396E-09	1.840E-10	8.808E-12	5.557E-14	0.00
Ag-110m	6.041E-06	7.963E-07	1.050E-07	1.384E-08	6.622E-10	4.179E-12	0.00
Cd-113m	4.069E-05	3.700E-05	3.365E-05	3.060E-05	2.653E-05	2.092E-05	1.258E-25
Sn-119m	2.193E-07	2.777E-08	3.517E-09	4.453E-10	2.007E-11	1.145E-13	0.00
Sn-121m	1.853E-07	1.802E-07	1.753E-07	1.705E-07	1.636E-07	1.526E-07	1.906E-13
Sn-123	1.206E-08	2.392E-10	4.746E-12	9.416E-14	2.633E-16	1.460E-20	0.00
Te-123m	2.523E-11	3.668E-13	5.333E-15	7.756E-17	2.198E-19	5.601E-24	0.00
Sb-124	7.507E-15	1.669E-18	3.710E-22	8.247E-26	0.00	0.00	0.00
Sb-125	2.226E-03	1.349E-03	8.180E-04	4.959E-04	2.341E-04	6.698E-05	0.00
Te-125m	5.431E-04	3.293E-04	1.996E-04	1.210E-04	5.711E-05	1.634E-05	0.00
Sn-126	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.631E-07
Sb-126	1.076E-07	1.076E-07	1.076E-07	1.076E-07	1.076E-07	1.076E-07	1.068E-07
Sb-126m	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.683E-07	7.631E-07
Te-127	5.559E-09	5.341E-11	5.132E-13	4.931E-15	4.644E-18	4.202E-23	0.00
Te-127m	5.675E-09	5.453E-11	5.239E-13	5.034E-15	4.741E-18	4.290E-23	0.00
I-129	3.005E-08	3.005E-08	3.005E-08	3.005E-08	3.005E-08	3.005E-08	3.005E-08
Cs-134	1.358E-02	6.935E-03	3.541E-03	1.808E-03	6.593E-04	1.228E-04	0.00
Cs-135	4.846E-07	4.846E-07	4.846E-07	4.846E-07	4.846E-07	4.846E-07	4.845E-07
Cs-137	7.866E-02	7.510E-02	7.171E-02	6.847E-02	6.389E-02	5.692E-02	8.343E-12

TABLE F.1.c. FissION Product Radioactivity by Isotope at 30 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	7.441E-02	7.105E-02	6.784E-02	6.478E-02	6.044E-02	5.384E-02	7.892E-12
Ce-142	2.407E-11	2.407E-11	2.407E-11	2.407E-11	2.407E-11	2.407E-11	2.407E-11
Ce-144	2.079E-03	3.501E-04	5.897E-05	9.932E-06	6.865E-07	7.992E-09	0.00
Pr-144	2.079E-03	3.501E-04	5.897E-05	9.932E-06	6.865E-07	7.992E-09	0.00
Pr-144m	2.495E-05	4.202E-06	7.076E-07	1.192E-07	8.238E-09	9.591E-11	0.00
Nd-144	1.387E-15	1.388E-15	1.388E-15	1.388E-15	1.388E-15	1.388E-15	1.388E-15
Pm-146	9.645E-07	7.496E-07	5.826E-07	4.528E-07	3.102E-07	1.652E-07	0.00
Sm-146	3.395E-13	3.458E-13	3.506E-13	3.544E-13	3.585E-13	3.628E-13	3.676E-13
Pm-147	1.851E-02	1.091E-02	6.434E-03	3.793E-03	1.717E-03	4.582E-04	0.00
Sm-147	4.130E-12	4.316E-12	4.426E-12	4.490E-12	4.541E-12	4.572E-12	4.583E-12
Eu-150	2.388E-11	2.298E-11	2.211E-11	2.128E-11	2.008E-11	1.824E-11	1.165E-19
Sm-151	2.812E-04	2.769E-04	2.726E-04	2.685E-04	2.623E-04	2.524E-04	1.331E-07
Eu-152	9.180E-06	8.290E-06	7.487E-06	6.761E-06	5.803E-06	4.498E-06	0.00
Gd-153	1.068E-07	1.318E-08	1.627E-09	2.007E-10	8.703E-12	4.659E-14	0.00
Eu-154	5.864E-03	4.991E-03	4.248E-03	3.616E-03	2.839E-03	1.897E-03	0.00
Eu-155	2.489E-03	1.882E-03	1.423E-03	1.076E-03	7.074E-04	3.517E-04	0.00
Tb-160	4.211E-13	3.828E-16	3.480E-19	3.164E-22	0.00	0.00	0.00
Ho-166m	2.949E-09	2.946E-09	2.942E-09	2.939E-09	2.934E-09	2.925E-09	1.661E-09
Tm-170	2.551E-13	4.972E-15	9.687E-17	1.939E-18	5.829E-20	3.092E-24	0.00
Tm-171	5.113E-11	2.484E-11	1.206E-11	5.861E-12	1.984E-12	3.263E-13	0.00
Total	3.172E-01	2.775E-01	2.537E-01	2.363E-01	2.159E-01	1.890E-01	1.757E-05

TABLE F.1.d. Fission Product Radioactivity by Isotope at 35 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	3.969E-04	3.548E-04	3.171E-04	2.834E-04	2.395E-04	1.809E-04	0.00
Be-10	3.063E-12	3.063E-12	3.063E-12	3.063E-12	3.063E-12	3.063E-12	3.061E-12
C-14	1.234E-10	1.234E-10	1.233E-10	1.233E-10	1.233E-10	1.232E-10	1.094E-10
Se-79	4.232E-07	4.232E-07	4.232E-07	4.232E-07	4.232E-07	4.232E-07	4.188E-07
Kr-81	6.734E-13	6.734E-13	6.734E-13	6.734E-13	6.734E-13	6.734E-13	6.712E-13
Kr-85	5.413E-03	4.757E-03	4.180E-03	3.673E-03	3.025E-03	2.189E-03	0.00
Rb-87	2.033E-11	2.033E-11	2.033E-11	2.033E-11	2.033E-11	2.033E-11	2.033E-11
Sr-89	2.885E-14	1.275E-18	5.633E-23	0.00	0.00	0.00	0.00
Sr-90	5.699E-02	5.434E-02	5.181E-02	4.940E-02	4.600E-02	4.084E-02	3.025E-12
Y-90	5.700E-02	5.435E-02	5.182E-02	4.941E-02	4.601E-02	4.085E-02	3.026E-12
Y-91	2.379E-12	4.147E-16	7.231E-20	1.261E-23	0.00	0.00	0.00
Zr-93	1.789E-06	1.789E-06	1.789E-06	1.789E-06	1.789E-06	1.789E-06	1.788E-06
Nb-93m	6.491E-07	7.509E-07	8.428E-07	9.259E-07	1.036E-06	1.185E-06	1.699E-06
Nb-94	1.792E-10	1.792E-10	1.792E-10	1.792E-10	1.792E-10	1.791E-10	1.732E-10
Zr-95	3.423E-11	1.252E-14	4.576E-18	1.673E-21	0.00	0.00	0.00
Nb-95	7.599E-11	2.779E-14	1.016E-17	3.714E-21	0.00	0.00	0.00
Nb-95m	2.539E-13	9.284E-17	3.395E-20	1.241E-23	0.00	0.00	0.00
Tc-98	7.004E-12	7.004E-12	7.004E-12	7.004E-12	7.004E-12	7.004E-12	7.003E-12
Tc-99	1.343E-05	1.343E-05	1.343E-05	1.343E-05	1.343E-05	1.343E-05	1.338E-05
Rh-102	3.142E-07	1.948E-07	1.208E-07	7.489E-08	3.656E-08	1.107E-08	0.00
Ru-106	5.988E-03	1.514E-03	3.826E-04	9.670E-05	1.229E-05	3.947E-07	0.00
Rh-106	5.988E-03	1.514E-03	3.826E-04	9.670E-05	1.229E-05	3.947E-07	0.00
Pd-107	1.489E-07	1.489E-07	1.489E-07	1.489E-07	1.489E-07	1.489E-07	1.489E-07
Ag-108	3.793E-12	3.752E-12	3.711E-12	3.671E-12	3.611E-12	3.514E-12	1.671E-14
Ag-108m	4.261E-11	4.215E-11	4.169E-11	4.124E-11	4.057E-11	3.948E-11	1.877E-13
Ag-109m	6.764E-11	2.271E-11	7.627E-12	2.561E-12	4.984E-13	3.256E-14	0.00
Cd-109	6.764E-11	2.271E-11	7.627E-12	2.561E-12	4.984E-13	3.256E-14	0.00
Ag-110	1.172E-07	1.545E-08	2.037E-09	2.685E-10	1.285E-11	8.108E-14	0.00
Ag-110m	8.814E-06	1.162E-06	1.532E-07	2.019E-08	9.663E-10	6.095E-12	0.00
Cd-113m	5.219E-05	4.745E-05	4.315E-05	3.924E-05	3.403E-05	2.683E-05	1.613E-25
Sn-119m	2.752E-07	3.485E-08	4.413E-09	5.588E-10	2.518E-11	1.437E-13	0.00
Sn-121m	2.247E-07	2.186E-07	2.126E-07	2.068E-07	1.983E-07	1.850E-07	2.311E-13
Sn-123	1.442E-08	2.861E-10	5.676E-12	1.126E-13	3.146E-16	1.744E-20	0.00
Te-123m	4.284E-11	6.228E-13	9.055E-15	1.317E-16	1.891E-19	4.819E-24	0.00
Sb-124	1.071E-14	2.380E-18	5.292E-22	1.176E-25	0.00	0.00	0.00
Sb-125	2.670E-03	1.618E-03	9.811E-04	5.948E-04	2.807E-04	8.034E-05	0.00
Te-125m	6.513E-04	3.950E-04	2.394E-04	1.452E-04	6.850E-05	1.960E-05	0.00
Sn-126	9.181E-07	9.180E-07	9.180E-07	9.180E-07	9.180E-07	9.180E-07	9.117E-07
Sb-126	1.285E-07	1.285E-07	1.285E-07	1.285E-07	1.285E-07	1.285E-07	1.276E-07
Sb-126m	9.181E-07	9.180E-07	9.180E-07	9.180E-07	9.180E-07	9.180E-07	9.117E-07
Te-127	6.696E-09	6.434E-11	6.181E-13	5.939E-15	5.593E-18	5.061E-23	0.00
Te-127m	6.836E-09	6.568E-11	6.311E-13	6.063E-15	5.710E-18	5.167E-23	0.00
I-129	3.526E-08	3.526E-08	3.526E-08	3.526E-08	3.526E-08	3.526E-08	3.526E-08
Cs-134	1.821E-02	9.297E-03	4.746E-03	2.423E-03	8.839E-04	1.646E-04	0.00
Cs-135	5.144E-07	5.144E-07	5.144E-07	5.144E-07	5.144E-07	5.144E-07	5.142E-07
Cs-137	9.182E-02	8.768E-02	8.372E-02	7.994E-02	7.458E-02	6.645E-02	9.740E-12

TABLE F.1.d. Fission Product Radioactivity by Isotope at 35 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	8.687E-02	8.294E-02	7.920E-02	7.562E-02	7.056E-02	6.286E-02	9.214E-12
Ce-142	2.784E-11	2.784E-11	2.784E-11	2.784E-11	2.784E-11	2.784E-11	2.784E-11
Ce-144	2.376E-03	4.002E-04	6.741E-05	1.135E-05	7.847E-07	9.135E-09	0.00
Pr-144	2.377E-03	4.002E-04	6.741E-05	1.135E-05	7.848E-07	9.136E-09	0.00
Pr-144m	2.852E-05	4.803E-06	8.089E-07	1.362E-07	9.417E-09	1.096E-10	0.00
Nd-144	1.657E-15	1.657E-15	1.658E-15	1.658E-15	1.658E-15	1.658E-15	1.658E-15
Pm-146	1.235E-06	9.600E-07	7.461E-07	5.799E-07	3.973E-07	2.116E-07	0.00
Sm-146	4.316E-13	4.396E-13	4.458E-13	4.506E-13	4.559E-13	4.613E-13	4.675E-13
Pm-147	1.928E-02	1.137E-02	6.702E-03	3.951E-03	1.788E-03	4.773E-04	0.00
Sm-147	4.249E-12	4.443E-12	4.557E-12	4.625E-12	4.678E-12	4.710E-12	4.722E-12
Eu-150	2.551E-11	2.454E-11	2.362E-11	2.272E-11	2.145E-11	1.948E-11	1.245E-19
Sm-151	2.996E-04	2.950E-04	2.905E-04	2.860E-04	2.795E-04	2.689E-04	1.418E-07
Eu-152	8.200E-06	7.405E-06	6.688E-06	6.040E-06	5.183E-06	4.017E-06	0.00
Gd-153	1.192E-07	1.472E-08	1.816E-09	2.242E-10	9.718E-12	5.200E-14	0.00
Eu-154	7.665E-03	6.524E-03	5.552E-03	4.726E-03	3.711E-03	2.480E-03	0.00
Eu-155	3.252E-03	2.459E-03	1.859E-03	1.406E-03	9.244E-04	4.596E-04	0.00
Tb-160	6.353E-13	5.776E-16	5.251E-19	4.773E-22	0.00	0.00	0.00
Ho-166m	4.966E-09	4.960E-09	4.955E-09	4.949E-09	4.940E-09	4.926E-09	2.797E-09
Tm-170	4.842E-13	9.438E-15	1.839E-16	3.561E-18	0.00	0.00	0.00
Tm-171	1.161E-10	5.641E-11	2.740E-11	1.331E-11	4.506E-12	7.411E-13	0.00
Total	3.674E-01	3.203E-01	2.924E-01	2.721E-01	2.484E-01	2.174E-01	2.008E-05

TABLE F.1.e. Fission Product Radioactivity by Isotope at 40 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	4.603E-04	4.114E-04	3.677E-04	3.287E-04	2.777E-04	2.098E-04	0.00
Be-10	3.495E-12	3.495E-12	3.495E-12	3.495E-12	3.495E-12	3.495E-12	3.493E-12
C-14	1.408E-10	1.408E-10	1.407E-10	1.407E-10	1.406E-10	1.406E-10	1.248E-10
Se-79	4.778E-07	4.778E-07	4.777E-07	4.777E-07	4.777E-07	4.777E-07	4.727E-07
Kr-81	8.782E-13	8.782E-13	8.782E-13	8.782E-13	8.782E-13	8.781E-13	8.753E-13
Kr-85	5.999E-03	5.271E-03	4.631E-03	4.070E-03	3.352E-03	2.426E-03	0.00
Rb-87	2.243E-11	2.243E-11	2.243E-11	2.243E-11	2.243E-11	2.243E-11	2.243E-11
Sr-89	3.079E-14	1.360E-18	6.011E-23	0.00	0.00	0.00	0.00
Sr-90	6.269E-02	5.977E-02	5.699E-02	5.434E-02	5.060E-02	4.492E-02	3.327E-12
Y-90	6.270E-02	5.979E-02	5.701E-02	5.436E-02	5.061E-02	4.493E-02	3.328E-12
Y-91	2.571E-12	4.483E-16	7.816E-20	1.363E-23	0.00	0.00	0.00
Zr-93	1.996E-06	1.996E-06	1.996E-06	1.996E-06	1.996E-06	1.996E-06	1.995E-06
Nb-93m	7.255E-07	8.389E-07	9.414E-07	1.034E-06	1.156E-06	1.323E-06	1.895E-06
Nb-94	2.120E-10	2.120E-10	2.120E-10	2.120E-10	2.120E-10	2.119E-10	2.050E-10
Zr-95	3.833E-11	1.401E-14	5.124E-18	1.873E-21	0.00	0.00	0.00
Nb-95	8.510E-11	3.111E-14	1.138E-17	4.159E-21	0.00	0.00	0.00
Nb-95m	2.843E-13	1.040E-16	3.801E-20	1.390E-23	0.00	0.00	0.00
Tc-98	9.247E-12	9.247E-12	9.247E-12	9.247E-12	9.247E-12	9.247E-12	9.245E-12
Tc-99	1.498E-05	1.498E-05	1.498E-05	1.498E-05	1.498E-05	1.498E-05	1.493E-05
Rh-102	4.072E-07	2.524E-07	1.565E-07	9.704E-08	4.737E-08	1.434E-08	0.00
Ru-106	7.262E-03	1.836E-03	4.640E-04	1.173E-04	1.490E-05	4.787E-07	0.00
Rh-106	7.262E-03	1.836E-03	4.640E-04	1.173E-04	1.490E-05	4.787E-07	0.00
Pd-107	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07
Ag-108	4.734E-12	4.683E-12	4.632E-12	4.582E-12	4.507E-12	4.386E-12	2.086E-14
Ag-108m	5.319E-11	5.262E-11	5.204E-11	5.148E-11	5.064E-11	4.928E-11	2.344E-13
Ag-109m	1.073E-10	3.604E-11	1.210E-11	4.064E-12	7.908E-13	5.167E-14	0.00
Cd-109	1.073E-10	3.604E-11	1.210E-11	4.064E-12	7.908E-13	5.167E-14	0.00
Ag-110	1.612E-07	2.124E-08	2.800E-09	3.691E-10	1.767E-11	1.115E-13	0.00
Ag-110m	1.212E-05	1.597E-06	2.105E-07	2.775E-08	1.328E-09	8.381E-12	0.00
Cd-113m	6.530E-05	5.938E-05	5.400E-05	4.910E-05	4.258E-05	3.358E-05	2.018E-25
Sn-119m	3.361E-07	4.256E-08	5.390E-09	6.825E-10	3.075E-11	1.755E-13	0.00
Sn-121m	2.652E-07	2.580E-07	2.509E-07	2.440E-07	2.341E-07	2.184E-07	2.728E-13
Sn-123	1.680E-08	3.333E-10	6.613E-12	1.312E-13	3.666E-16	2.033E-20	0.00
Te-123m	6.772E-11	9.844E-13	1.431E-14	2.082E-16	2.986E-19	7.611E-24	0.00
Sb-124	1.454E-14	3.231E-18	7.183E-22	1.597E-25	0.00	0.00	0.00
Sb-125	3.124E-03	1.894E-03	1.148E-03	6.960E-04	3.285E-04	9.400E-05	0.00
Te-125m	7.621E-04	4.622E-04	2.802E-04	1.698E-04	8.015E-05	2.294E-05	0.00
Sn-126	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.064E-06
Sb-126	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.489E-07
Sb-126m	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.071E-06	1.064E-06
Te-127	7.844E-09	7.537E-11	7.241E-13	6.957E-15	6.552E-18	5.929E-23	0.00
Te-127m	8.009E-09	7.694E-11	7.392E-13	7.103E-15	6.689E-18	6.053E-23	0.00
I-129	4.041E-08	4.041E-08	4.041E-08	4.041E-08	4.041E-08	4.041E-08	4.041E-08
Cs-134	2.329E-02	1.189E-02	6.071E-03	3.100E-03	1.131E-03	2.105E-04	0.00
Cs-135	5.433E-07	5.433E-07	5.433E-07	5.433E-07	5.433E-07	5.433E-07	5.431E-07
Cs-137	1.050E-01	1.003E-01	9.573E-02	9.140E-02	8.528E-02	7.598E-02	1.114E-11

TABLE F.1.e. Fission Product Radioactivity by Isotope at 40 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	9.933E-02	9.484E-02	9.056E-02	8.647E-02	8.068E-02	7.188E-02	1.054E-11
Ce-142	3.156E-11	3.156E-11	3.156E-11	3.156E-11	3.156E-11	3.156E-11	3.156E-11
Ce-144	2.667E-03	4.492E-04	7.566E-05	1.274E-05	8.808E-07	1.025E-08	0.00
Pr-144	2.667E-03	4.492E-04	7.566E-05	1.274E-05	8.808E-07	1.025E-08	0.00
Pr-144m	3.201E-05	5.391E-06	9.079E-07	1.529E-07	1.057E-08	1.230E-10	0.00
Nd-144	1.934E-15	1.935E-15	1.935E-15	1.935E-15	1.935E-15	1.935E-15	1.935E-15
Pm-146	1.519E-06	1.181E-06	9.177E-07	7.132E-07	4.887E-07	2.602E-07	0.00
Sm-146	5.253E-13	5.351E-13	5.428E-13	5.487E-13	5.553E-13	5.619E-13	5.695E-13
Pm-147	1.982E-02	1.169E-02	6.890E-03	4.062E-03	1.839E-03	4.906E-04	0.00
Sm-147	4.298E-12	4.497E-12	4.615E-12	4.684E-12	4.739E-12	4.772E-12	4.784E-12
Eu-150	2.703E-11	2.601E-11	2.503E-11	2.408E-11	2.273E-11	2.064E-11	1.319E-19
Sm-151	3.178E-04	3.130E-04	3.082E-04	3.035E-04	2.965E-04	2.853E-04	1.504E-07
Eu-152	7.399E-06	6.682E-06	6.034E-06	5.450E-06	4.677E-06	3.625E-06	0.00
Gd-153	1.295E-07	1.599E-08	1.973E-09	2.435E-10	1.056E-11	5.649E-14	0.00
Eu-154	9.469E-03	8.059E-03	6.859E-03	5.838E-03	4.584E-03	3.064E-03	0.00
Eu-155	4.040E-03	3.055E-03	2.310E-03	1.747E-03	1.148E-03	5.710E-04	0.00
Tb-160	9.052E-13	8.229E-16	7.481E-19	6.801E-22	0.00	0.00	0.00
Ho-166m	7.918E-09	7.909E-09	7.900E-09	7.891E-09	7.877E-09	7.855E-09	4.460E-09
Tm-170	8.508E-13	1.658E-14	3.233E-16	6.260E-18	0.00	0.00	0.00
Tm-171	2.377E-10	1.155E-10	5.610E-11	2.725E-11	9.225E-12	1.517E-12	0.00
Total	4.170E-01	3.624E-01	3.303E-01	3.072E-01	2.803E-01	2.451E-01	2.249E-05

TABLE F.1.f. Fission Product Radioactivity by Isotope at 45 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	5.246E-04	4.689E-04	4.191E-04	3.746E-04	3.165E-04	2.391E-04	0.00
Be-10	3.926E-12	3.926E-12	3.926E-12	3.926E-12	3.926E-12	3.926E-12	3.924E-12
C-14	1.582E-10	1.581E-10	1.581E-10	1.581E-10	1.580E-10	1.579E-10	1.402E-10
Se-79	5.313E-07	5.312E-07	5.312E-07	5.312E-07	5.312E-07	5.312E-07	5.257E-07
Kr-81	1.114E-12	1.114E-12	1.114E-12	1.114E-12	1.114E-12	1.114E-12	1.110E-12
Kr-85	6.558E-03	5.762E-03	5.063E-03	4.449E-03	3.665E-03	2.652E-03	0.00
Rb-87	2.440E-11	2.440E-11	2.440E-11	2.440E-11	2.440E-11	2.440E-11	2.440E-11
Sr-89	3.264E-14	1.442E-18	6.372E-23	0.00	0.00	0.00	0.00
Sr-90	6.803E-02	6.487E-02	6.185E-02	5.898E-02	5.491E-02	4.875E-02	3.611E-12
Y-90	6.805E-02	6.489E-02	6.187E-02	5.899E-02	5.493E-02	4.877E-02	3.612E-12
Y-91	2.758E-12	4.808E-16	8.383E-20	1.462E-23	0.00	0.00	0.00
Zr-93	2.195E-06	2.195E-06	2.195E-06	2.195E-06	2.195E-06	2.195E-06	2.194E-06
Nb-93m	7.992E-07	9.238E-07	1.036E-06	1.138E-06	1.272E-06	1.455E-06	2.084E-06
Nb-94	2.450E-10	2.450E-10	2.450E-10	2.450E-10	2.449E-10	2.449E-10	2.368E-10
Zr-95	4.240E-11	1.550E-14	5.668E-18	2.072E-21	0.00	0.00	0.00
Nb-95	9.413E-11	3.441E-14	1.258E-17	4.600E-21	0.00	0.00	0.00
Nb-95m	3.145E-13	1.150E-16	4.204E-20	1.537E-23	0.00	0.00	0.00
Tc-98	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11
Tc-99	1.644E-05	1.644E-05	1.644E-05	1.644E-05	1.644E-05	1.644E-05	1.639E-05
Rh-102	5.084E-07	3.152E-07	1.954E-07	1.212E-07	5.915E-08	1.790E-08	0.00
Ru-106	8.580E-03	2.169E-03	5.482E-04	1.386E-04	1.761E-05	5.656E-07	0.00
Rh-106	8.580E-03	2.169E-03	5.482E-04	1.386E-04	1.761E-05	5.656E-07	0.00
Pd-107	2.149E-07	2.149E-07	2.149E-07	2.149E-07	2.149E-07	2.149E-07	2.149E-07
Ag-108	5.764E-12	5.701E-12	5.640E-12	5.578E-12	5.488E-12	5.340E-12	2.539E-14
Ag-108m	6.476E-11	6.406E-11	6.337E-11	6.268E-11	6.166E-11	6.000E-11	2.853E-13
Ag-109m	1.600E-10	5.373E-11	1.804E-11	6.058E-12	1.179E-12	7.703E-14	0.00
Cd-109	1.600E-10	5.373E-11	1.804E-11	6.058E-12	1.179E-12	7.703E-14	0.00
Ag-110	2.117E-07	2.790E-08	3.678E-09	4.848E-10	2.320E-11	1.464E-13	0.00
Ag-110m	1.591E-05	2.098E-06	2.765E-07	3.645E-08	1.745E-09	1.101E-11	0.00
Cd-113m	8.010E-05	7.284E-05	6.623E-05	6.023E-05	5.223E-05	4.119E-05	2.475E-25
Sn-119m	4.021E-07	5.091E-08	6.447E-09	8.164E-10	3.679E-11	2.100E-13	0.00
Sn-121m	3.066E-07	2.982E-07	2.901E-07	2.821E-07	2.706E-07	2.525E-07	3.153E-13
Sn-123	1.920E-08	3.809E-10	7.557E-12	1.499E-13	4.193E-16	2.325E-20	0.00
Te-123m	1.013E-10	1.472E-12	2.141E-14	3.112E-16	5.716E-19	1.457E-23	0.00
Sb-124	1.899E-14	4.222E-18	9.386E-22	2.087E-25	0.00	0.00	0.00
Sb-125	3.585E-03	2.173E-03	1.318E-03	7.987E-04	3.770E-04	1.079E-04	0.00
Te-125m	8.747E-04	5.304E-04	3.216E-04	1.949E-04	9.199E-05	2.632E-05	0.00
Sn-126	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.219E-06
Sb-126	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.706E-07
Sb-126m	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.227E-06	1.219E-06
Te-127	8.999E-09	8.647E-11	8.308E-13	7.982E-15	7.518E-18	6.802E-23	0.00
Te-127m	9.188E-09	8.827E-11	8.482E-13	8.149E-15	7.675E-18	6.945E-23	0.00
I-129	4.547E-08	4.547E-08	4.547E-08	4.547E-08	4.547E-08	4.547E-08	4.547E-08
Cs-134	2.874E-02	1.467E-02	7.490E-03	3.824E-03	1.395E-03	2.598E-04	0.00
Cs-135	5.735E-07	5.735E-07	5.735E-07	5.735E-07	5.735E-07	5.735E-07	5.733E-07
Cs-137	1.182E-01	1.128E-01	1.077E-01	1.029E-01	9.599E-02	8.551E-02	1.253E-11

TABLE F.1.f. Fission Product Radioactivity by Isotope at 45 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	1.118E-01	1.067E-01	1.019E-01	9.732E-02	9.080E-02	8.090E-02	1.186E-11
Ce-142	3.525E-11	3.525E-11	3.525E-11	3.525E-11	3.525E-11	3.525E-11	3.525E-11
Ce-144	2.954E-03	4.975E-04	8.379E-05	1.411E-05	9.754E-07	1.136E-08	0.00
Pr-144	2.954E-03	4.975E-04	8.379E-05	1.411E-05	9.755E-07	1.136E-08	0.00
Pr-144m	3.545E-05	5.970E-06	1.005E-06	1.693E-07	1.171E-08	1.363E-10	0.00
Nd-144	2.219E-15	2.220E-15	2.220E-15	2.220E-15	2.220E-15	2.220E-15	2.220E-15
Pm-146	1.813E-06	1.409E-06	1.095E-06	8.509E-07	5.830E-07	3.105E-07	0.00
Sm-146	6.185E-13	6.303E-13	6.394E-13	6.465E-13	6.543E-13	6.622E-13	6.712E-13
Pm-147	2.022E-02	1.192E-02	7.028E-03	4.143E-03	1.875E-03	5.004E-04	0.00
Sm-147	4.299E-12	4.503E-12	4.623E-12	4.693E-12	4.749E-12	4.783E-12	4.795E-12
Eu-150	2.845E-11	2.737E-11	2.634E-11	2.535E-11	2.392E-11	2.173E-11	1.389E-19
Sm-151	3.353E-04	3.302E-04	3.251E-04	3.202E-04	3.129E-04	3.010E-04	1.587E-07
Eu-152	6.735E-06	6.082E-06	5.493E-06	4.960E-06	4.257E-06	3.300E-06	0.00
Gd-153	1.385E-07	1.710E-08	2.110E-09	2.604E-10	1.129E-11	6.044E-14	0.00
Eu-154	1.120E-02	9.534E-03	8.115E-03	6.907E-03	5.423E-03	3.625E-03	0.00
Eu-155	4.815E-03	3.641E-03	2.753E-03	2.082E-03	1.369E-03	6.804E-04	0.00
Tb-160	1.235E-12	1.123E-15	1.021E-18	9.281E-22	0.00	0.00	0.00
Ho-166m	1.207E-08	1.206E-08	1.204E-08	1.203E-08	1.201E-08	1.197E-08	6.798E-09
Tm-170	1.416E-12	2.760E-14	5.380E-16	1.042E-17	5.812E-20	3.083E-24	0.00
Tm-171	4.505E-10	2.189E-10	1.063E-10	5.164E-11	1.748E-11	2.875E-12	0.00
Total	4.661E-01	4.038E-01	3.676E-01	3.417E-01	3.116E-01	2.724E-01	2.480E-05

TABLE F.1.g. Fission Product Radioactivity by Isotope at 50 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	5.896E-04	5.270E-04	4.710E-04	4.210E-04	3.557E-04	2.687E-04	0.00
Be-10	4.356E-12	4.356E-12	4.356E-12	4.356E-12	4.356E-12	4.356E-12	4.354E-12
C-14	1.755E-10	1.755E-10	1.754E-10	1.754E-10	1.753E-10	1.752E-10	1.556E-10
Se-79	5.839E-07	5.839E-07	5.839E-07	5.839E-07	5.838E-07	5.838E-07	5.777E-07
Kr-81	1.380E-12	1.380E-12	1.380E-12	1.380E-12	1.380E-12	1.380E-12	1.376E-12
Kr-85	7.098E-03	6.237E-03	5.480E-03	4.815E-03	3.966E-03	2.871E-03	0.00
Rb-87	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11
Sr-89	3.447E-14	1.523E-18	6.730E-23	0.00	0.00	0.00	0.00
Sr-90	7.310E-02	6.970E-02	6.646E-02	6.337E-02	5.901E-02	5.238E-02	3.880E-12
Y-90	7.312E-02	6.972E-02	6.648E-02	6.339E-02	5.902E-02	5.240E-02	3.881E-12
Y-91	2.943E-12	5.132E-16	8.947E-20	1.560E-23	0.00	0.00	0.00
Zr-93	2.387E-06	2.387E-06	2.387E-06	2.387E-06	2.387E-06	2.387E-06	2.386E-06
Nb-93m	8.707E-07	1.006E-06	1.128E-06	1.239E-06	1.385E-06	1.583E-06	2.267E-06
Nb-94	2.779E-10	2.778E-10	2.778E-10	2.778E-10	2.778E-10	2.777E-10	2.686E-10
Zr-95	4.644E-11	1.698E-14	6.208E-18	2.270E-21	0.00	0.00	0.00
Nb-95	1.031E-10	3.770E-14	1.378E-17	5.039E-21	0.00	0.00	0.00
Nb-95m	3.445E-13	1.260E-16	4.605E-20	1.684E-23	0.00	0.00	0.00
Tc-98	1.465E-11	1.465E-11	1.465E-11	1.465E-11	1.465E-11	1.465E-11	1.464E-11
Tc-99	1.783E-05	1.783E-05	1.783E-05	1.783E-05	1.783E-05	1.783E-05	1.777E-05
Rh-102	6.163E-07	3.821E-07	2.369E-07	1.469E-07	7.171E-08	2.171E-08	0.00
Ru-106	9.921E-03	2.508E-03	6.339E-04	1.602E-04	2.036E-05	6.540E-07	0.00
Rh-106	9.921E-03	2.508E-03	6.339E-04	1.602E-04	2.036E-05	6.540E-07	0.00
Pd-107	2.496E-07	2.496E-07	2.496E-07	2.496E-07	2.496E-07	2.496E-07	2.496E-07
Ag-108	6.880E-12	6.805E-12	6.731E-12	6.658E-12	6.550E-12	6.374E-12	3.031E-14
Ag-108m	7.730E-11	7.646E-11	7.563E-11	7.481E-11	7.360E-11	7.162E-11	3.406E-13
Ag-109m	2.269E-10	7.619E-11	2.558E-11	8.591E-12	1.672E-12	1.092E-13	0.00
Cd-109	2.269E-10	7.619E-11	2.558E-11	8.591E-12	1.672E-12	1.092E-13	0.00
Ag-110	2.681E-07	3.534E-08	4.658E-09	6.141E-10	2.939E-11	1.854E-13	0.00
Ag-110m	2.016E-05	2.657E-06	3.502E-07	4.617E-08	2.210E-09	1.394E-11	0.00
Cd-113m	9.664E-05	8.788E-05	7.991E-05	7.267E-05	6.302E-05	4.969E-05	2.987E-25
Sn-119m	4.730E-07	5.989E-08	7.584E-09	9.603E-10	4.327E-11	2.469E-13	0.00
Sn-121m	3.487E-07	3.392E-07	3.299E-07	3.209E-07	3.078E-07	2.872E-07	3.587E-13
Sn-123	2.160E-08	4.285E-10	8.502E-12	1.687E-13	4.710E-16	2.611E-20	0.00
Te-123m	1.449E-10	2.106E-12	3.062E-14	4.452E-16	8.190E-19	2.087E-23	0.00
Sb-124	2.407E-14	5.351E-18	1.189E-21	2.644E-25	0.00	0.00	0.00
Sb-125	4.051E-03	2.456E-03	1.489E-03	9.027E-04	4.261E-04	1.219E-04	0.00
Te-125m	9.885E-04	5.994E-04	3.634E-04	2.203E-04	1.040E-04	2.975E-05	0.00
Sn-126	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.376E-06
Sb-126	1.939E-07	1.939E-07	1.939E-07	1.939E-07	1.939E-07	1.939E-07	1.926E-07
Sb-126m	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.385E-06	1.376E-06
Te-127	1.015E-08	9.754E-11	9.371E-13	9.003E-15	8.478E-18	7.672E-23	0.00
Te-127m	1.036E-08	9.957E-11	9.566E-13	9.191E-15	8.656E-18	7.832E-23	0.00
I-129	5.043E-08	5.043E-08	5.043E-08	5.043E-08	5.043E-08	5.043E-08	5.042E-08
Cs-134	3.445E-02	1.759E-02	8.979E-03	4.584E-03	1.672E-03	3.114E-04	0.00
Cs-135	6.064E-07	6.064E-07	6.064E-07	6.064E-07	6.064E-07	6.064E-07	6.062E-07
Cs-137	1.314E-01	1.254E-01	1.198E-01	1.143E-01	1.067E-01	9.505E-02	1.393E-11

TABLE F.1.g. Fission Product Radioactivity by Isotope at 50 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ba-137m	1.243E-01	1.186E-01	1.133E-01	1.082E-01	1.009E-01	8.992E-02	1.318E-11
Ce-142	3.890E-11	3.890E-11	3.890E-11	3.890E-11	3.890E-11	3.890E-11	3.890E-11
Ce-144	3.238E-03	5.454E-04	9.186E-05	1.547E-05	1.069E-06	1.245E-08	0.00
Pr-144	3.238E-03	5.454E-04	9.186E-05	1.547E-05	1.069E-06	1.245E-08	0.00
Pr-144m	3.886E-05	6.545E-06	1.102E-06	1.857E-07	1.283E-08	1.494E-10	0.00
Nd-144	2.508E-15	2.509E-15	2.509E-15	2.509E-15	2.509E-15	2.509E-15	2.509E-15
Pm-146	2.112E-06	1.642E-06	1.276E-06	9.916E-07	6.794E-07	3.618E-07	0.00
Sm-146	7.097E-13	7.233E-13	7.340E-13	7.422E-13	7.513E-13	7.606E-13	7.711E-13
Pm-147	2.053E-02	1.210E-02	7.135E-03	4.207E-03	1.904E-03	5.081E-04	0.00
Sm-147	4.270E-12	4.477E-12	4.598E-12	4.670E-12	4.727E-12	4.761E-12	4.773E-12
Eu-150	2.985E-11	2.872E-11	2.764E-11	2.659E-11	2.510E-11	2.280E-11	1.456E-19
Sm-151	3.525E-04	3.471E-04	3.418E-04	3.365E-04	3.289E-04	3.164E-04	1.668E-07
Eu-152	6.197E-06	5.596E-06	5.054E-06	4.564E-06	3.917E-06	3.036E-06	0.00
Gd-153	1.468E-07	1.812E-08	2.236E-09	2.760E-10	1.196E-11	6.404E-14	0.00
Eu-154	1.283E-02	1.092E-02	9.295E-03	7.911E-03	6.212E-03	4.152E-03	0.00
Eu-155	5.553E-03	4.199E-03	3.175E-03	2.401E-03	1.578E-03	7.847E-04	0.00
Tb-160	1.630E-12	1.482E-15	1.347E-18	1.225E-21	0.00	0.00	0.00
Ho-166m	1.771E-08	1.769E-08	1.767E-08	1.765E-08	1.762E-08	1.757E-08	9.975E-09
Tm-170	2.263E-12	4.412E-14	8.600E-16	1.679E-17	9.377E-20	4.975E-24	0.00
Tm-171	8.050E-10	3.910E-10	1.900E-10	9.227E-11	3.124E-11	5.138E-12	0.00
Total	5.148E-01	4.447E-01	4.043E-01	3.755E-01	3.423E-01	2.992E-01	2.703E-05

TABLE F.2.a. Actinide Radioactivity by Isotope at 20 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	4.132E-12	5.137E-12	6.130E-12	7.118E-12	8.585E-12	1.100E-11	4.568E-10
Tl-208	3.634E-09	4.058E-09	4.310E-09	4.444E-09	4.502E-09	4.416E-09	4.393E-13
Tl-209	2.659E-15	2.720E-15	2.786E-15	2.859E-15	2.979E-15	3.210E-15	1.688E-12
Pb-209	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Pb-210	2.848E-14	4.406E-14	6.451E-14	9.041E-14	1.407E-13	2.592E-13	2.155E-09
Pb-211	4.144E-12	5.151E-12	6.148E-12	7.138E-12	8.609E-12	1.103E-11	4.581E-10
Pb-212	1.011E-08	1.130E-08	1.199E-08	1.237E-08	1.253E-08	1.229E-08	1.223E-12
Pb-214	2.435E-13	3.327E-13	4.364E-13	5.546E-13	7.594E-13	1.175E-12	2.156E-09
Bi-210	2.848E-14	4.407E-14	6.453E-14	9.045E-14	1.407E-13	2.592E-13	2.155E-09
Bi-210	4.144E-12	5.151E-12	6.148E-12	7.138E-12	8.609E-12	1.103E-11	4.581E-10
Bi-212	1.011E-08	1.130E-08	1.199E-08	1.237E-08	1.253E-08	1.229E-08	1.223E-12
Bi-213	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Bi-214	2.435E-13	3.327E-13	4.364E-13	5.546E-13	7.594E-13	1.175E-12	2.156E-09
Po-210	2.848E-14	3.928E-14	5.812E-14	8.229E-14	1.299E-13	2.592E-13	2.155E-09
Po-211	1.160E-14	1.442E-14	1.721E-14	1.998E-14	2.411E-14	3.089E-14	1.283E-12
Po-212	6.480E-09	7.237E-09	7.685E-09	7.924E-09	8.028E-09	7.874E-09	7.833E-13
Po-213	1.205E-13	1.232E-13	1.262E-13	1.295E-13	1.349E-13	1.454E-13	7.648E-11
Po-214	2.434E-13	3.326E-13	4.363E-13	5.545E-13	7.593E-13	1.174E-12	2.155E-09
Po-215	4.144E-12	5.151E-12	6.148E-12	7.138E-12	8.609E-12	1.103E-11	4.581E-10
Po-216	1.011E-08	1.130E-08	1.199E-08	1.237E-08	1.253E-08	1.229E-08	1.223E-12
Po-218	2.435E-13	3.328E-13	4.365E-13	5.548E-13	7.596E-13	1.175E-12	2.156E-09
At-217	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Rn-219	4.144E-12	5.151E-12	6.148E-12	7.138E-12	8.609E-12	1.103E-11	4.581E-10
Rn-220	1.011E-08	1.130E-08	1.199E-08	1.237E-08	1.253E-08	1.229E-08	1.223E-12
Rn-222	2.435E-13	3.328E-13	4.365E-13	5.548E-13	7.596E-13	1.175E-12	2.156E-09
Fr-221	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Fr-223	5.714E-14	7.096E-14	8.468E-14	9.831E-14	1.186E-13	1.520E-13	6.322E-12
Ra-223	4.144E-12	5.151E-12	6.148E-12	7.138E-12	8.609E-12	1.103E-11	4.581E-10
Ra-224	1.011E-08	1.130E-08	1.199E-08	1.237E-08	1.253E-08	1.229E-08	1.223E-12
Ra-225	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Ra-226	2.435E-13	3.328E-13	4.365E-13	5.548E-13	7.596E-13	1.175E-12	2.156E-09
Ac-225	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Ac-227	4.141E-12	5.142E-12	6.136E-12	7.124E-12	8.594E-12	1.102E-11	4.581E-10
Th-227	4.087E-12	5.080E-12	6.063E-12	7.039E-12	8.490E-12	1.088E-11	4.518E-10
Th-228	1.011E-08	1.127E-08	1.197E-08	1.234E-08	1.251E-08	1.228E-08	1.223E-12
Th-229	1.231E-13	1.259E-13	1.290E-13	1.324E-13	1.379E-13	1.486E-13	7.816E-11
Th-230	9.497E-11	1.117E-10	1.285E-10	1.455E-10	1.711E-10	2.144E-10	1.174E-08
Th-231	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.121E-08
Th-232	7.907E-17	9.537E-17	1.117E-16	1.280E-16	1.524E-16	1.932E-16	8.437E-15
Th-234	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07
Pa-231	1.993E-11	2.081E-11	2.170E-11	2.259E-11	2.391E-11	2.613E-11	4.580E-10
Pa-233	1.617E-07	1.623E-07	1.631E-07	1.640E-07	1.656E-07	1.686E-07	6.596E-07
Pa-234m	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07
Pa-234	4.194E-10	4.194E-10	4.194E-10	4.194E-10	4.194E-10	4.194E-10	4.194E-10
U-232	1.210E-08	1.252E-08	1.267E-08	1.268E-08	1.252E-08	1.206E-08	1.188E-12
U-233	1.415E-11	1.565E-11	1.715E-11	1.865E-11	2.089E-11	2.454E-11	2.049E-09

TABLE F.2.a. Actinide Radioactivity by Isotope at 20 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-234	9.249E-07	9.317E-07	9.384E-07	9.449E-07	9.546E-07	9.703E-07	1.363E-06
U-235	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.093E-08	2.121E-08
U-236	1.651E-07	1.652E-07	1.652E-07	1.652E-07	1.652E-07	1.653E-07	1.755E-07
U-237	1.592E-06	1.446E-06	1.313E-06	1.192E-06	1.032E-06	8.113E-07	4.706E-13
U-238	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07	3.226E-07
U-240	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14
Np-235	4.004E-11	1.115E-11	3.105E-12	8.646E-13	1.271E-13	5.199E-15	0.00
Np-236	2.474E-12	2.474E-12	2.474E-12	2.474E-12	2.473E-12	2.473E-12	2.459E-12
Np-237	1.617E-07	1.623E-07	1.631E-07	1.640E-07	1.656E-07	1.686E-07	6.596E-07
Np-238	6.702E-08	6.641E-08	6.581E-08	6.521E-08	6.433E-08	6.288E-08	7.207E-10
Np-239	5.314E-06	5.313E-06	5.312E-06	5.311E-06	5.310E-06	5.307E-06	4.840E-06
Np-240m	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14
Pu-236	4.290E-08	2.638E-08	1.622E-08	9.976E-09	4.811E-09	1.427E-09	2.213E-13
Pu-238	1.209E-03	1.190E-03	1.172E-03	1.154E-03	1.127E-03	1.084E-03	7.423E-07
Pu-239	2.941E-04	2.941E-04	2.941E-04	2.941E-04	2.941E-04	2.940E-04	2.860E-04
Pu-240	3.722E-04	3.721E-04	3.721E-04	3.721E-04	3.720E-04	3.719E-04	3.357E-04
Pu-241	6.489E-02	5.893E-02	5.352E-02	4.861E-02	4.207E-02	3.307E-02	1.921E-08
Pu-242	7.898E-07	7.898E-07	7.898E-07	7.898E-07	7.898E-07	7.898E-07	7.892E-07
Pu-243	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.855E-15
Pu-244	5.276E-14	5.276E-14	5.276E-14	5.276E-14	5.276E-14	5.276E-14	5.276E-14
Am-241	9.515E-04	1.147E-03	1.323E-03	1.482E-03	1.692E-03	1.977E-03	6.474E-04
Am-242m	1.340E-05	1.328E-05	1.316E-05	1.304E-05	1.287E-05	1.258E-05	1.441E-07
Am-242	1.334E-05	1.322E-05	1.310E-05	1.298E-05	1.280E-05	1.251E-05	1.434E-07
Am-243	5.314E-06	5.313E-06	5.312E-06	5.311E-06	5.310E-06	5.307E-06	4.840E-06
Cm-242	1.393E-05	1.108E-05	1.086E-05	1.075E-05	1.061E-05	1.035E-05	1.186E-07
Cm-243	6.972E-06	6.641E-06	6.325E-06	6.025E-06	5.601E-06	4.960E-06	2.210E-16
Cm-244	2.922E-04	2.706E-04	2.507E-04	2.322E-04	2.070E-04	1.710E-04	8.767E-21
Cm-245	2.080E-08	2.079E-08	2.079E-08	2.079E-08	2.078E-08	2.077E-08	1.918E-08
Cm-246	2.749E-09	2.749E-09	2.748E-09	2.747E-09	2.746E-09	2.744E-09	2.377E-09
Cm-247	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.856E-15	4.855E-15
Cm-248	6.921E-15	6.921E-15	6.921E-15	6.921E-15	6.921E-15	6.921E-15	6.907E-15
Bk-249	1.354E-13	2.782E-14	5.718E-15	1.175E-15	1.095E-16	2.082E-18	0.00
Cf-249	5.075E-14	5.081E-14	5.067E-14	5.048E-14	5.018E-14	4.969E-14	7.153E-15
Cf-250	1.357E-13	1.221E-13	1.098E-13	9.876E-14	8.424E-14	6.463E-14	1.439E-23
Cf-251	8.394E-16	8.381E-16	8.368E-16	8.355E-16	8.336E-16	8.304E-16	3.897E-16
Cf-252	1.937E-14	1.145E-14	6.771E-15	4.003E-15	1.820E-15	4.893E-16	0.00
Total	6.807E-02	6.227E-02	5.699E-02	5.220E-02	4.582E-02	3.703E-02	1.285E-03

TABLE F.2.b. Actinide Radioactivity by Isotope at 25 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	4.258E-12	5.271E-12	6.260E-12	7.230E-12	8.651E-12	1.094E-11	3.594E-10
Tl-208	5.577E-09	6.277E-09	6.698E-09	6.927E-09	7.036E-09	6.914E-09	6.786E-13
Tl-209	4.285E-15	4.355E-15	4.434E-15	4.520E-15	4.666E-15	4.947E-15	2.178E-12
Pb-209	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Pb-210	2.704E-14	4.130E-14	6.005E-14	8.386E-14	1.302E-13	2.399E-13	2.412E-09
Pb-211	4.270E-12	5.286E-12	6.277E-12	7.250E-12	8.675E-12	1.097E-11	3.604E-10
Pb-212	1.552E-08	1.747E-08	1.864E-08	1.928E-08	1.958E-08	1.924E-08	1.889E-12
Pb-214	2.236E-13	3.058E-13	4.015E-13	5.110E-13	7.014E-13	1.090E-12	2.413E-09
Bi-210	2.704E-14	4.131E-14	6.008E-14	8.390E-14	1.303E-13	2.400E-13	2.412E-09
Bi-210	4.270E-12	5.286E-12	6.277E-12	7.250E-12	8.675E-12	1.097E-11	3.604E-10
Bi-212	1.552E-08	1.747E-08	1.864E-08	1.928E-08	1.958E-08	1.924E-08	1.889E-12
Bi-213	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Bi-214	2.236E-13	3.058E-13	4.015E-13	5.110E-13	7.014E-13	1.090E-12	2.413E-09
Po-210	2.704E-14	3.692E-14	5.418E-14	7.639E-14	1.203E-13	2.400E-13	2.412E-09
Po-211	1.196E-14	1.480E-14	1.758E-14	2.030E-14	2.429E-14	3.072E-14	1.009E-12
Po-212	9.944E-09	1.119E-08	1.194E-08	1.235E-08	1.255E-08	1.233E-08	1.210E-12
Po-213	1.941E-13	1.973E-13	2.008E-13	2.048E-13	2.113E-13	2.241E-13	9.867E-11
Po-214	2.236E-13	3.057E-13	4.014E-13	5.109E-13	7.013E-13	1.089E-12	2.412E-09
Po-215	4.270E-12	5.286E-12	6.277E-12	7.250E-12	8.675E-12	1.097E-11	3.604E-10
Po-216	1.552E-08	1.747E-08	1.864E-08	1.928E-08	1.958E-08	1.924E-08	1.889E-12
Po-218	2.236E-13	3.058E-13	4.016E-13	5.111E-13	7.015E-13	1.090E-12	2.413E-09
At-217	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Rn-219	4.270E-12	5.286E-12	6.277E-12	7.250E-12	8.675E-12	1.097E-11	3.604E-10
Rn-220	1.552E-08	1.747E-08	1.864E-08	1.928E-08	1.958E-08	1.924E-08	1.889E-12
Rn-222	2.236E-13	3.058E-13	4.016E-13	5.111E-13	7.015E-13	1.090E-12	2.413E-09
Fr-221	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Fr-223	5.889E-14	7.281E-14	8.647E-14	9.986E-14	1.195E-13	1.512E-13	4.973E-12
Ra-223	4.270E-12	5.286E-12	6.277E-12	7.250E-12	8.675E-12	1.097E-11	3.604E-10
Ra-224	1.552E-08	1.747E-08	1.864E-08	1.928E-08	1.958E-08	1.924E-08	1.889E-12
Ra-225	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Ra-226	2.236E-13	3.058E-13	4.016E-13	5.111E-13	7.015E-13	1.090E-12	2.413E-09
Ac-225	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Ac-227	4.267E-12	5.276E-12	6.266E-12	7.236E-12	8.660E-12	1.095E-11	3.604E-10
Th-227	4.212E-12	5.213E-12	6.191E-12	7.150E-12	8.555E-12	1.082E-11	3.554E-10
Th-228	1.551E-08	1.743E-08	1.860E-08	1.923E-08	1.955E-08	1.923E-08	1.889E-12
Th-229	1.984E-13	2.016E-13	2.053E-13	2.093E-13	2.160E-13	2.290E-13	1.008E-10
Th-230	8.728E-11	1.030E-10	1.188E-10	1.349E-10	1.594E-10	2.011E-10	1.332E-08
Th-231	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.650E-08
Th-232	8.959E-17	1.079E-16	1.261E-16	1.444E-16	1.718E-16	2.175E-16	9.485E-15
Th-234	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07
Pa-231	2.028E-11	2.097E-11	2.165E-11	2.234E-11	2.337E-11	2.508E-11	3.602E-10
Pa-233	2.158E-07	2.167E-07	2.177E-07	2.188E-07	2.208E-07	2.245E-07	8.438E-07
Pa-234m	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07
Pa-234	4.175E-10	4.175E-10	4.175E-10	4.175E-10	4.175E-10	4.175E-10	4.175E-10
U-232	1.878E-08	1.950E-08	1.979E-08	1.983E-08	1.960E-08	1.889E-08	1.838E-12
U-233	1.638E-11	1.838E-11	2.038E-11	2.239E-11	2.537E-11	3.024E-11	2.634E-09

TABLE F.2.b. Actinide Radioactivity by Isotope at 25 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-234	8.656E-07	8.766E-07	8.875E-07	8.982E-07	9.140E-07	9.394E-07	1.576E-06
U-235	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.621E-08	1.650E-08
U-236	1.851E-07	1.851E-07	1.852E-07	1.852E-07	1.852E-07	1.853E-07	1.979E-07
U-237	2.017E-06	1.832E-06	1.664E-06	1.511E-06	1.308E-06	1.028E-06	1.611E-12
U-238	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07
U-240	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13
Np-235	6.379E-11	1.776E-11	4.947E-12	1.377E-12	2.024E-13	8.284E-15	0.00
Np-236	3.612E-12	3.612E-12	3.612E-12	3.612E-12	3.612E-12	3.612E-12	3.591E-12
Np-237	2.158E-07	2.167E-07	2.177E-07	2.188E-07	2.208E-07	2.245E-07	8.438E-07
Np-238	8.512E-08	8.435E-08	8.358E-08	8.282E-08	8.170E-08	7.985E-08	9.153E-10
Np-239	1.133E-05	1.133E-05	1.133E-05	1.133E-05	1.132E-05	1.132E-05	1.032E-05
Np-240m	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13	1.526E-13
Pu-236	7.160E-08	4.403E-08	2.708E-08	1.665E-08	8.029E-09	2.381E-09	3.232E-13
Pu-238	1.965E-03	1.935E-03	1.904E-03	1.875E-03	1.831E-03	1.761E-03	1.110E-06
Pu-239	3.058E-04	3.058E-04	3.058E-04	3.058E-04	3.058E-04	3.057E-04	2.975E-04
Pu-240	4.542E-04	4.543E-04	4.544E-04	4.544E-04	4.545E-04	4.545E-04	4.109E-04
Pu-241	8.221E-02	7.467E-02	6.781E-02	6.159E-02	5.331E-02	4.190E-02	6.575E-08
Pu-242	1.328E-06	1.328E-06	1.328E-06	1.328E-06	1.328E-06	1.328E-06	1.327E-06
Pu-243	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14
Pu-244	1.528E-13	1.528E-13	1.528E-13	1.528E-13	1.528E-13	1.528E-13	1.528E-13
Am-241	1.188E-03	1.435E-03	1.658E-03	1.860E-03	2.126E-03	2.488E-03	8.167E-04
Am-242m	1.702E-05	1.687E-05	1.672E-05	1.656E-05	1.634E-05	1.597E-05	1.830E-07
Am-242	1.694E-05	1.678E-05	1.663E-05	1.648E-05	1.626E-05	1.589E-05	1.821E-07
Am-243	1.133E-05	1.133E-05	1.133E-05	1.133E-05	1.132E-05	1.132E-05	1.032E-05
Cm-242	1.854E-05	1.411E-05	1.379E-05	1.365E-05	1.347E-05	1.315E-05	1.506E-07
Cm-243	1.391E-05	1.325E-05	1.262E-05	1.202E-05	1.118E-05	9.896E-06	4.409E-16
Cm-244	8.337E-04	7.723E-04	7.153E-04	6.626E-04	5.907E-04	4.879E-04	2.501E-20
Cm-245	7.118E-08	7.117E-08	7.116E-08	7.114E-08	7.113E-08	7.110E-08	6.564E-08
Cm-246	1.263E-08	1.263E-08	1.262E-08	1.262E-08	1.261E-08	1.260E-08	1.092E-08
Cm-247	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14	2.901E-14
Cm-248	5.446E-14	5.447E-14	5.447E-14	5.447E-14	5.447E-14	5.447E-14	5.436E-14
Bk-249	1.301E-12	2.674E-13	5.496E-14	1.130E-14	1.052E-15	2.014E-17	0.00
Cf-249	4.812E-13	4.819E-13	4.806E-13	4.788E-13	4.760E-13	4.713E-13	6.785E-14
Cf-250	1.469E-12	1.321E-12	1.188E-12	1.069E-12	9.118E-13	6.995E-13	2.045E-22
Cf-251	1.022E-14	1.020E-14	1.019E-14	1.017E-14	1.015E-14	1.011E-14	4.745E-15
Cf-252	3.087E-13	1.825E-13	1.079E-13	6.380E-14	2.901E-14	7.798E-15	0.00
Total	8.706E-02	7.966E-02	7.294E-02	6.683E-02	5.870E-02	4.748E-02	1.553E-03

TABLE F.2.c. Actinide Radioactivity by Isotope at 30 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	4.284E-12	5.289E-12	6.260E-12	7.204E-12	8.569E-12	1.073E-11	2.795E-10
Tl-208	7.902E-09	8.950E-09	9.587E-09	9.939E-09	1.012E-08	9.954E-09	9.640E-13
Tl-209	6.466E-15	6.544E-15	6.633E-15	6.732E-15	6.899E-15	7.228E-15	2.601E-12
Pb-209	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Pb-210	2.604E-14	3.903E-14	5.617E-14	7.800E-14	1.206E-13	2.222E-13	2.737E-09
Pb-211	4.297E-12	5.304E-12	6.278E-12	7.224E-12	8.593E-12	1.076E-11	2.803E-10
Pb-212	2.199E-08	2.491E-08	2.668E-08	2.766E-08	2.815E-08	2.770E-08	2.683E-12
Pb-214	2.048E-13	2.803E-13	3.687E-13	4.702E-13	6.474E-13	1.011E-12	2.737E-09
Bi-210	2.604E-14	3.904E-14	5.619E-14	7.803E-14	1.207E-13	2.222E-13	2.737E-09
Bi-210	4.297E-12	5.304E-12	6.278E-12	7.224E-12	8.593E-12	1.076E-11	2.803E-10
Bi-212	2.199E-08	2.491E-08	2.668E-08	2.766E-08	2.815E-08	2.770E-08	2.683E-12
Bi-213	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Bi-214	2.048E-13	2.803E-13	3.687E-13	4.702E-13	6.474E-13	1.011E-12	2.737E-09
Po-210	2.604E-14	3.502E-14	5.079E-14	7.113E-14	1.115E-13	2.223E-13	2.737E-09
Po-211	1.203E-14	1.485E-14	1.758E-14	2.023E-14	2.406E-14	3.013E-14	7.849E-13
Po-212	1.409E-08	1.596E-08	1.710E-08	1.772E-08	1.804E-08	1.775E-08	1.719E-12
Po-213	2.929E-13	2.964E-13	3.005E-13	3.049E-13	3.125E-13	3.274E-13	1.178E-10
Po-214	2.048E-13	2.803E-13	3.686E-13	4.701E-13	6.473E-13	1.011E-12	2.737E-09
Po-215	4.297E-12	5.304E-12	6.278E-12	7.224E-12	8.593E-12	1.076E-11	2.803E-10
Po-216	2.199E-08	2.491E-08	2.668E-08	2.766E-08	2.815E-08	2.770E-08	2.683E-12
Po-218	2.048E-13	2.804E-13	3.688E-13	4.703E-13	6.475E-13	1.012E-12	2.738E-09
At-217	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Rn-219	4.297E-12	5.304E-12	6.278E-12	7.224E-12	8.593E-12	1.076E-11	2.803E-10
Rn-220	2.199E-08	2.491E-08	2.668E-08	2.766E-08	2.815E-08	2.770E-08	2.683E-12
Rn-222	2.048E-13	2.804E-13	3.688E-13	4.703E-13	6.475E-13	1.012E-12	2.738E-09
Fr-221	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Fr-223	5.925E-14	7.306E-14	8.647E-14	9.950E-14	1.184E-13	1.482E-13	3.868E-12
Ra-223	4.297E-12	5.304E-12	6.278E-12	7.224E-12	8.593E-12	1.076E-11	2.803E-10
Ra-224	2.199E-08	2.491E-08	2.668E-08	2.766E-08	2.815E-08	2.770E-08	2.683E-12
Ra-225	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Ra-226	2.048E-13	2.804E-13	3.688E-13	4.703E-13	6.475E-13	1.012E-12	2.738E-09
Ac-225	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Ac-227	4.293E-12	5.294E-12	6.266E-12	7.210E-12	8.578E-12	1.074E-11	2.803E-10
Th-227	4.237E-12	5.231E-12	6.191E-12	7.124E-12	8.475E-12	1.061E-11	2.764E-10
Th-228	2.199E-08	2.485E-08	2.662E-08	2.759E-08	2.811E-08	2.768E-08	2.683E-12
Th-229	2.993E-13	3.030E-13	3.071E-13	3.117E-13	3.194E-13	3.346E-13	1.204E-10
Th-230	8.008E-11	9.484E-11	1.099E-10	1.252E-10	1.487E-10	1.893E-10	1.529E-08
Th-231	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.266E-08
Th-234	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07
Pa-231	2.026E-11	2.078E-11	2.131E-11	2.183E-11	2.261E-11	2.392E-11	2.802E-10
Pa-233	2.699E-07	2.709E-07	2.720E-07	2.733E-07	2.755E-07	2.799E-07	9.940E-07
Pa-234m	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07
Pa-234	4.155E-10	4.155E-10	4.155E-10	4.155E-10	4.155E-10	4.155E-10	4.155E-10
U-232	2.686E-08	2.797E-08	2.844E-08	2.852E-08	2.821E-08	2.721E-08	2.613E-12
U-233	1.824E-11	2.073E-11	2.323E-11	2.574E-11	2.947E-11	3.554E-11	3.128E-09
U-234	8.122E-07	8.282E-07	8.440E-07	8.595E-07	8.823E-07	9.191E-07	1.838E-06

TABLE F.2.c. Actinide Radioactivity by Isotope at 30 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-235	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.236E-08	1.266E-08
U-236	1.994E-07	1.994E-07	1.994E-07	1.995E-07	1.995E-07	1.996E-07	2.143E-07
U-237	2.339E-06	2.125E-06	1.930E-06	1.753E-06	1.517E-06	1.192E-06	4.238E-12
U-238	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07	3.196E-07
U-240	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13
Np-235	9.203E-11	2.563E-11	7.137E-12	1.987E-12	2.920E-13	1.195E-14	0.00
Np-236	4.815E-12	4.815E-12	4.815E-12	4.815E-12	4.815E-12	4.814E-12	4.786E-12
Np-237	2.699E-07	2.709E-07	2.720E-07	2.733E-07	2.755E-07	2.799E-07	9.940E-07
Np-238	9.466E-08	9.380E-08	9.294E-08	9.210E-08	9.085E-08	8.880E-08	1.018E-09
Np-239	2.025E-05	2.025E-05	2.025E-05	2.024E-05	2.024E-05	2.023E-05	1.845E-05
Np-240m	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13
Pu-236	1.080E-07	6.642E-08	4.084E-08	2.512E-08	1.211E-08	3.592E-09	4.308E-13
Pu-238	2.844E-03	2.800E-03	2.756E-03	2.713E-03	2.650E-03	2.548E-03	1.490E-06
Pu-239	3.134E-04	3.133E-04	3.133E-04	3.133E-04	3.133E-04	3.132E-04	3.051E-04
Pu-240	5.307E-04	5.310E-04	5.313E-04	5.315E-04	5.318E-04	5.321E-04	4.824E-04
Pu-241	9.537E-02	8.661E-02	7.866E-02	7.144E-02	6.184E-02	4.861E-02	1.730E-07
Pu-242	1.937E-06	1.937E-06	1.937E-06	1.937E-06	1.937E-06	1.937E-06	1.935E-06
Pu-243	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13
Pu-244	3.560E-13	3.560E-13	3.560E-13	3.560E-13	3.560E-13	3.560E-13	3.560E-13
Am-241	1.351E-03	1.638E-03	1.897E-03	2.131E-03	2.440E-03	2.859E-03	9.420E-04
Am-242m	1.893E-05	1.876E-05	1.859E-05	1.842E-05	1.817E-05	1.776E-05	2.036E-07
Am-242	1.884E-05	1.866E-05	1.850E-05	1.833E-05	1.808E-05	1.767E-05	2.025E-07
Am-243	2.025E-05	2.025E-05	2.025E-05	2.024E-05	2.024E-05	2.023E-05	1.845E-05
Am-245	1.176E-16	2.417E-17	4.967E-18	1.021E-18	9.511E-20	1.821E-21	0.00
Cm-242	2.177E-05	1.574E-05	1.534E-05	1.518E-05	1.498E-05	1.462E-05	1.675E-07
Cm-243	2.325E-05	2.215E-05	2.110E-05	2.010E-05	1.868E-05	1.654E-05	7.371E-16
Cm-244	1.904E-03	1.763E-03	1.633E-03	1.513E-03	1.349E-03	1.114E-03	5.711E-20
Cm-245	1.873E-07	1.872E-07	1.872E-07	1.872E-07	1.871E-07	1.870E-07	1.727E-07
Cm-246	4.260E-08	4.259E-08	4.258E-08	4.256E-08	4.255E-08	4.251E-08	3.683E-08
Cm-247	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13	1.214E-13
Cm-248	2.881E-13	2.881E-13	2.881E-13	2.881E-13	2.881E-13	2.881E-13	2.875E-13
Bk-249	8.107E-12	1.666E-12	3.424E-13	7.038E-14	6.557E-15	1.256E-16	0.00
Cf-249	2.946E-12	2.951E-12	2.942E-12	2.931E-12	2.914E-12	2.885E-12	4.154E-13
Cf-250	9.968E-12	8.966E-12	8.064E-12	7.253E-12	6.187E-12	4.747E-12	1.748E-21
Cf-251	7.562E-14	7.550E-14	7.539E-14	7.527E-14	7.509E-14	7.481E-14	3.511E-14
Cf-252	2.884E-12	1.705E-12	1.008E-12	5.962E-13	2.710E-13	7.286E-14	0.00
Total	1.024E-01	9.378E-02	8.591E-02	7.876E-02	6.924E-02	5.609E-02	1.776E-03

TABLE F.2.d. Actinide Radioactivity by Isotope at 35 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	4.224E-12	5.206E-12	6.149E-12	7.057E-12	8.360E-12	1.039E-11	2.162E-10
Tl-208	1.055E-08	1.201E-08	1.290E-08	1.340E-08	1.366E-08	1.346E-08	1.287E-12
Tl-209	9.206E-15	9.291E-15	9.388E-15	9.498E-15	9.685E-15	1.006E-14	3.016E-12
Pb-209	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Pb-210	2.554E-14	3.730E-14	5.291E-14	7.287E-14	1.120E-13	2.060E-13	3.108E-09
Pb-211	4.236E-12	5.221E-12	6.166E-12	7.077E-12	8.383E-12	1.042E-11	2.168E-10
Pb-212	2.935E-08	3.342E-08	3.590E-08	3.729E-08	3.802E-08	3.745E-08	3.583E-12
Pb-214	1.871E-13	2.565E-13	3.380E-13	4.321E-13	5.973E-13	9.396E-13	3.109E-09
Bi-210	2.554E-14	3.732E-14	5.293E-14	7.290E-14	1.121E-13	2.061E-13	3.108E-09
Bi-210	4.236E-12	5.221E-12	6.166E-12	7.077E-12	8.383E-12	1.042E-11	2.168E-10
Bi-212	2.935E-08	3.342E-08	3.590E-08	3.729E-08	3.802E-08	3.745E-08	3.583E-12
Bi-213	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Bi-214	1.871E-13	2.565E-13	3.380E-13	4.321E-13	5.973E-13	9.396E-13	3.109E-09
Po-210	2.554E-14	3.366E-14	4.799E-14	6.657E-14	1.036E-13	2.061E-13	3.108E-09
Po-211	1.186E-14	1.462E-14	1.726E-14	1.982E-14	2.347E-14	2.917E-14	6.071E-13
Po-212	1.881E-08	2.141E-08	2.300E-08	2.389E-08	2.436E-08	2.399E-08	2.296E-12
Po-213	4.170E-13	4.208E-13	4.253E-13	4.302E-13	4.387E-13	4.555E-13	1.366E-10
Po-214	1.871E-13	2.564E-13	3.380E-13	4.320E-13	5.972E-13	9.394E-13	3.108E-09
Po-215	4.236E-12	5.221E-12	6.166E-12	7.077E-12	8.383E-12	1.042E-11	2.168E-10
Po-216	2.935E-08	3.342E-08	3.590E-08	3.729E-08	3.802E-08	3.745E-08	3.583E-12
Po-218	1.871E-13	2.565E-13	3.381E-13	4.322E-13	5.974E-13	9.398E-13	3.109E-09
At-217	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Rn-219	4.236E-12	5.221E-12	6.166E-12	7.077E-12	8.383E-12	1.042E-11	2.168E-10
Rn-220	2.935E-08	3.342E-08	3.590E-08	3.729E-08	3.802E-08	3.745E-08	3.583E-12
Rn-222	1.871E-13	2.565E-13	3.381E-13	4.322E-13	5.974E-13	9.398E-13	3.109E-09
Fr-221	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Fr-223	5.842E-14	7.192E-14	8.493E-14	9.748E-14	1.155E-13	1.435E-13	2.992E-12
Ra-223	4.236E-12	5.221E-12	6.166E-12	7.077E-12	8.383E-12	1.042E-11	2.168E-10
Ra-224	2.935E-08	3.342E-08	3.590E-08	3.729E-08	3.802E-08	3.745E-08	3.583E-12
Ra-225	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Ra-226	1.871E-13	2.565E-13	3.381E-13	4.322E-13	5.974E-13	9.397E-13	3.109E-09
Ac-225	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Ac-227	4.233E-12	5.212E-12	6.155E-12	7.064E-12	8.368E-12	1.040E-11	2.168E-10
Th-227	4.178E-12	5.149E-12	6.081E-12	6.980E-12	8.268E-12	1.027E-11	2.138E-10
Th-228	2.934E-08	3.334E-08	3.582E-08	3.720E-08	3.795E-08	3.742E-08	3.583E-12
Th-229	4.262E-13	4.301E-13	4.346E-13	4.397E-13	4.484E-13	4.656E-13	1.396E-10
Th-230	7.336E-11	8.731E-11	1.016E-10	1.164E-10	1.391E-10	1.788E-10	1.754E-08
Th-231	9.324E-09	9.325E-09	9.325E-09	9.326E-09	9.327E-09	9.329E-09	9.631E-09
Th-234	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07
Pa-231	1.990E-11	2.030E-11	2.069E-11	2.108E-11	2.168E-11	2.266E-11	2.167E-10
Pa-233	3.224E-07	3.235E-07	3.248E-07	3.263E-07	3.288E-07	3.336E-07	1.142E-06
Pa-234m	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07
Pa-234	4.135E-10	4.135E-10	4.135E-10	4.135E-10	4.135E-10	4.135E-10	4.135E-10
U-232	3.611E-08	3.770E-08	3.839E-08	3.852E-08	3.813E-08	3.680E-08	3.491E-12
U-233	1.978E-11	2.276E-11	2.574E-11	2.874E-11	3.319E-11	4.043E-11	3.612E-09
U-234	7.643E-07	7.857E-07	8.067E-07	8.275E-07	8.580E-07	9.072E-07	2.134E-06

TABLE F.2.d. Actinide Radioactivity by Isotope at 35 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-235	9.324E-09	9.325E-09	9.325E-09	9.326E-09	9.327E-09	9.329E-09	9.631E-09
U-236	2.084E-07	2.084E-07	2.085E-07	2.085E-07	2.086E-07	2.087E-07	2.251E-07
U-237	2.667E-06	2.422E-06	2.200E-06	1.998E-06	1.729E-06	1.359E-06	9.216E-12
U-238	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07	3.181E-07
U-240	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13
Np-235	1.231E-10	3.429E-11	9.550E-12	2.659E-12	3.908E-13	1.599E-14	0.00
Np-236	6.027E-12	6.027E-12	6.027E-12	6.027E-12	6.026E-12	6.026E-12	5.991E-12
Np-237	3.224E-07	3.235E-07	3.248E-07	3.263E-07	3.288E-07	3.336E-07	1.142E-06
Np-238	9.806E-08	9.717E-08	9.629E-08	9.542E-08	9.412E-08	9.200E-08	1.054E-09
Np-239	3.227E-05	3.226E-05	3.226E-05	3.225E-05	3.224E-05	3.223E-05	2.939E-05
Np-240m	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13	7.107E-13
Pu-236	1.513E-07	9.303E-08	5.721E-08	3.518E-08	1.696E-08	5.031E-09	5.392E-13
Pu-238	3.804E-03	3.745E-03	3.686E-03	3.629E-03	3.544E-03	3.408E-03	1.877E-06
Pu-239	3.173E-04	3.172E-04	3.172E-04	3.172E-04	3.172E-04	3.172E-04	3.092E-04
Pu-240	5.869E-04	5.875E-04	5.881E-04	5.886E-04	5.893E-04	5.903E-04	5.374E-04
Pu-241	1.087E-01	9.873E-02	8.966E-02	8.143E-02	7.048E-02	5.541E-02	3.761E-07
Pu-242	2.602E-06	2.602E-06	2.602E-06	2.602E-06	2.602E-06	2.602E-06	2.599E-06
Pu-243	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13
Pu-244	7.116E-13	7.116E-13	7.116E-13	7.116E-13	7.116E-13	7.116E-13	7.116E-13
Am-241	1.502E-03	1.829E-03	2.125E-03	2.392E-03	2.744E-03	3.222E-03	1.066E-03
Am-242m	1.961E-05	1.943E-05	1.926E-05	1.908E-05	1.882E-05	1.840E-05	2.109E-07
Am-242	1.951E-05	1.934E-05	1.916E-05	1.899E-05	1.873E-05	1.831E-05	2.098E-07
Am-243	3.227E-05	3.226E-05	3.226E-05	3.225E-05	3.224E-05	3.223E-05	2.939E-05
Am-245	5.381E-16	1.106E-16	2.273E-17	4.671E-18	4.352E-19	8.334E-21	0.00
Cm-242	2.385E-05	1.637E-05	1.589E-05	1.573E-05	1.552E-05	1.515E-05	1.735E-07
Cm-243	3.426E-05	3.263E-05	3.108E-05	2.961E-05	2.752E-05	2.437E-05	1.086E-15
Cm-244	3.705E-03	3.432E-03	3.179E-03	2.945E-03	2.625E-03	2.168E-03	1.112E-19
Cm-245	4.072E-07	4.072E-07	4.071E-07	4.070E-07	4.069E-07	4.068E-07	3.755E-07
Cm-246	1.157E-07	1.157E-07	1.156E-07	1.156E-07	1.156E-07	1.155E-07	1.000E-07
Cm-247	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13	3.972E-13
Cm-248	1.157E-12	1.157E-12	1.157E-12	1.157E-12	1.157E-12	1.157E-12	1.155E-12
Bk-249	3.710E-11	7.625E-12	1.567E-12	3.221E-13	3.001E-14	5.746E-16	0.00
Bk-250	1.871E-16	2.983E-17	4.777E-18	7.705E-19	7.324E-20	3.308E-20	1.063E-20
Cf-249	1.329E-11	1.331E-11	1.327E-11	1.322E-11	1.315E-11	1.302E-11	1.874E-12
Cf-250	4.867E-11	4.378E-11	3.938E-11	3.542E-11	3.021E-11	2.318E-11	1.063E-20
Cf-251	3.945E-13	3.939E-13	3.932E-13	3.926E-13	3.917E-13	3.902E-13	1.832E-13
Cf-252	1.847E-11	1.092E-11	6.458E-12	3.819E-12	1.736E-12	4.667E-13	0.00
Total	1.188E-01	1.088E-01	9.972E-02	9.146E-02	8.046E-02	6.526E-02	1.983E-03

TABLE F.2.e. Actinide Radioactivity by Isotope at 40 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	4.092E-12	5.039E-12	5.942E-12	6.808E-12	8.039E-12	9.934E-12	1.667E-10
Tl-208	1.340E-08	1.532E-08	1.650E-08	1.716E-08	1.752E-08	1.727E-08	1.634E-12
Tl-209	1.245E-14	1.254E-14	1.264E-14	1.276E-14	1.297E-14	1.338E-14	3.386E-12
Pb-209	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Pb-210	2.557E-14	3.618E-14	5.034E-14	6.854E-14	1.045E-13	1.916E-13	3.510E-09
Pb-211	4.104E-12	5.053E-12	5.959E-12	6.827E-12	8.062E-12	9.962E-12	1.672E-10
Pb-212	3.730E-08	4.263E-08	4.592E-08	4.777E-08	4.876E-08	4.808E-08	4.548E-12
Pb-214	1.706E-13	2.344E-13	3.097E-13	3.970E-13	5.515E-13	8.745E-13	3.510E-09
Bi-210	2.558E-14	3.620E-14	5.036E-14	6.857E-14	1.045E-13	1.916E-13	3.510E-09
Bi-210	4.104E-12	5.053E-12	5.959E-12	6.827E-12	8.062E-12	9.962E-12	1.672E-10
Bi-212	3.730E-08	4.263E-08	4.592E-08	4.777E-08	4.876E-08	4.808E-08	4.548E-12
Bi-213	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Bi-214	1.706E-13	2.344E-13	3.097E-13	3.970E-13	5.515E-13	8.745E-13	3.510E-09
Po-210	2.558E-14	3.287E-14	4.585E-14	6.277E-14	9.674E-14	1.916E-13	3.510E-09
Po-211	1.149E-14	1.415E-14	1.668E-14	1.911E-14	2.257E-14	2.789E-14	4.681E-13
Po-212	2.390E-08	2.732E-08	2.942E-08	3.060E-08	3.124E-08	3.080E-08	2.914E-12
Po-213	5.639E-13	5.680E-13	5.728E-13	5.781E-13	5.874E-13	6.059E-13	1.534E-10
Po-214	1.706E-13	2.343E-13	3.096E-13	3.970E-13	5.514E-13	8.743E-13	3.510E-09
Po-215	4.104E-12	5.053E-12	5.959E-12	6.827E-12	8.062E-12	9.962E-12	1.672E-10
Po-216	3.730E-08	4.263E-08	4.592E-08	4.777E-08	4.876E-08	4.808E-08	4.548E-12
Po-218	1.707E-13	2.344E-13	3.097E-13	3.971E-13	5.516E-13	8.747E-13	3.511E-09
At-217	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Rn-219	4.104E-12	5.053E-12	5.959E-12	6.827E-12	8.062E-12	9.962E-12	1.672E-10
Rn-220	3.730E-08	4.263E-08	4.592E-08	4.777E-08	4.876E-08	4.808E-08	4.548E-12
Rn-222	1.707E-13	2.344E-13	3.097E-13	3.971E-13	5.516E-13	8.747E-13	3.511E-09
Fr-221	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Fr-223	5.659E-14	6.961E-14	8.208E-14	9.403E-14	1.111E-13	1.373E-13	2.307E-12
Ra-223	4.104E-12	5.053E-12	5.959E-12	6.827E-12	8.062E-12	9.962E-12	1.672E-10
Ra-224	3.730E-08	4.263E-08	4.592E-08	4.777E-08	4.876E-08	4.808E-08	4.548E-12
Ra-225	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Ra-226	1.707E-13	2.344E-13	3.097E-13	3.971E-13	5.516E-13	8.747E-13	3.511E-09
Ac-225	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Ac-227	4.101E-12	5.044E-12	5.948E-12	6.814E-12	8.047E-12	9.946E-12	1.672E-10
Th-227	4.047E-12	4.984E-12	5.877E-12	6.733E-12	7.951E-12	9.825E-12	1.649E-10
Th-228	3.729E-08	4.254E-08	4.581E-08	4.765E-08	4.867E-08	4.803E-08	4.548E-12
Th-229	5.764E-13	5.806E-13	5.854E-13	5.909E-13	6.004E-13	6.193E-13	1.568E-10
Th-230	6.718E-11	8.041E-11	9.413E-11	1.083E-10	1.305E-10	1.697E-10	1.996E-08
Th-231	6.970E-09	6.971E-09	6.972E-09	6.972E-09	6.973E-09	6.975E-09	7.279E-09
Th-234	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07
Pa-231	1.925E-11	1.954E-11	1.984E-11	2.013E-11	2.057E-11	2.131E-11	1.671E-10
Pa-233	3.709E-07	3.720E-07	3.734E-07	3.750E-07	3.778E-07	3.831E-07	1.272E-06
Pa-234m	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07
Pa-234	4.113E-10	4.113E-10	4.113E-10	4.113E-10	4.113E-10	4.113E-10	4.114E-10
U-232	4.616E-08	4.829E-08	4.922E-08	4.942E-08	4.895E-08	4.725E-08	4.434E-12
U-233	2.103E-11	2.445E-11	2.789E-11	3.133E-11	3.644E-11	4.476E-11	4.041E-09
U-234	7.217E-07	7.487E-07	7.753E-07	8.016E-07	8.401E-07	9.024E-07	2.451E-06

TABLE F.2.e. Actinide Radioactivity by Isotope at 40 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-235	6.970E-09	6.971E-09	6.972E-09	6.972E-09	6.973E-09	6.975E-09	7.279E-09
U-236	2.132E-07	2.132E-07	2.132E-07	2.133E-07	2.133E-07	2.134E-07	2.311E-07
U-237	2.951E-06	2.680E-06	2.434E-06	2.211E-06	1.913E-06	1.504E-06	1.743E-11
U-238	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07	3.164E-07
U-240	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12
Np-235	1.552E-10	4.322E-11	1.203E-11	3.351E-12	4.925E-13	2.015E-14	0.00
Np-236	7.186E-12	7.186E-12	7.186E-12	7.186E-12	7.186E-12	7.186E-12	7.143E-12
Np-237	3.709E-07	3.720E-07	3.734E-07	3.750E-07	3.778E-07	3.831E-07	1.272E-06
Np-238	9.834E-08	9.745E-08	9.657E-08	9.569E-08	9.439E-08	9.226E-08	1.057E-09
Np-239	4.706E-05	4.705E-05	4.704E-05	4.703E-05	4.702E-05	4.699E-05	4.286E-05
Np-240m	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12	1.271E-12
Pu-236	1.996E-07	1.227E-07	7.547E-08	4.641E-08	2.238E-08	6.636E-09	6.429E-13
Pu-238	4.810E-03	4.734E-03	4.660E-03	4.588E-03	4.481E-03	4.308E-03	2.270E-06
Pu-239	3.186E-04	3.186E-04	3.186E-04	3.186E-04	3.186E-04	3.185E-04	3.110E-04
Pu-240	6.257E-04	6.269E-04	6.280E-04	6.290E-04	6.303E-04	6.322E-04	5.792E-04
Pu-241	1.203E-01	1.092E-01	9.922E-02	9.011E-02	7.799E-02	6.131E-02	7.113E-07
Pu-242	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.298E-06
Pu-243	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12
Pu-244	1.273E-12	1.273E-12	1.273E-12	1.273E-12	1.273E-12	1.273E-12	1.273E-12
Am-241	1.627E-03	1.989E-03	2.316E-03	2.611E-03	3.001E-03	3.531E-03	1.173E-03
Am-242m	1.967E-05	1.949E-05	1.931E-05	1.914E-05	1.888E-05	1.845E-05	2.115E-07
Am-242	1.957E-05	1.939E-05	1.922E-05	1.904E-05	1.878E-05	1.836E-05	2.104E-07
Am-243	4.706E-05	4.705E-05	4.704E-05	4.703E-05	4.702E-05	4.699E-05	4.286E-05
Am-245	1.945E-15	3.997E-16	8.214E-17	1.688E-17	1.573E-18	3.012E-20	0.00
Cm-242	2.531E-05	1.648E-05	1.594E-05	1.578E-05	1.557E-05	1.519E-05	1.740E-07
Cm-243	4.615E-05	4.395E-05	4.187E-05	3.988E-05	3.707E-05	3.283E-05	1.463E-15
Cm-244	6.450E-03	5.975E-03	5.534E-03	5.127E-03	4.570E-03	3.774E-03	1.935E-19
Cm-245	7.701E-07	7.699E-07	7.698E-07	7.697E-07	7.695E-07	7.692E-07	7.101E-07
Cm-246	2.665E-07	2.664E-07	2.663E-07	2.662E-07	2.661E-07	2.659E-07	2.304E-07
Cm-247	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12	1.075E-12
Cm-248	3.758E-12	3.758E-12	3.758E-12	3.758E-12	3.758E-12	3.758E-12	3.751E-12
Bk-249	1.341E-10	2.756E-11	5.663E-12	1.164E-12	1.084E-13	2.076E-15	0.00
Bk-250	1.163E-15	1.854E-16	2.959E-17	4.772E-18	3.522E-19	6.799E-20	4.993E-20
Cf-249	4.743E-11	4.751E-11	4.738E-11	4.720E-11	4.693E-11	4.646E-11	6.689E-12
Cf-250	1.848E-10	1.663E-10	1.495E-10	1.345E-10	1.147E-10	8.803E-11	4.993E-20
Cf-251	1.576E-12	1.574E-12	1.571E-12	1.569E-12	1.565E-12	1.559E-12	7.317E-13
Cf-252	8.850E-11	5.233E-11	3.094E-11	1.829E-11	8.317E-12	2.236E-12	0.00
Es-254	1.162E-15	1.852E-16	2.950E-17	4.718E-18	2.740E-19	1.608E-20	0.00
Total	1.343E-01	1.231E-01	1.129E-01	1.036E-01	9.119E-02	7.406E-02	2.163E-03

TABLE F.2.f. Actinide Radioactivity by Isotope at 45 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	3.906E-12	4.808E-12	5.664E-12	6.481E-12	7.637E-12	9.398E-12	1.285E-10
Tl-208	1.635E-08	1.876E-08	2.024E-08	2.108E-08	2.154E-08	2.125E-08	1.992E-12
Tl-209	1.612E-14	1.622E-14	1.633E-14	1.646E-14	1.667E-14	1.711E-14	3.695E-12
Pb-209	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Pb-210	2.617E-14	3.568E-14	4.847E-14	6.504E-14	9.804E-14	1.788E-13	3.926E-09
Pb-211	3.917E-12	4.821E-12	5.680E-12	6.499E-12	7.658E-12	9.424E-12	1.289E-10
Pb-212	4.552E-08	5.220E-08	5.633E-08	5.867E-08	5.995E-08	5.916E-08	5.543E-12
Pb-214	1.555E-13	2.140E-13	2.837E-13	3.650E-13	5.098E-13	8.160E-13	3.926E-09
Bi-210	2.618E-14	3.569E-14	4.849E-14	6.507E-14	9.807E-14	1.789E-13	3.926E-09
Bi-210	3.917E-12	4.821E-12	5.680E-12	6.499E-12	7.658E-12	9.424E-12	1.289E-10
Bi-212	4.552E-08	5.220E-08	5.633E-08	5.867E-08	5.995E-08	5.916E-08	5.543E-12
Bi-213	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Bi-214	1.555E-13	2.140E-13	2.837E-13	3.650E-13	5.098E-13	8.160E-13	3.926E-09
Po-210	2.618E-14	3.267E-14	4.438E-14	5.976E-14	9.088E-14	1.789E-13	3.926E-09
Po-211	1.097E-14	1.350E-14	1.590E-14	1.820E-14	2.144E-14	2.639E-14	3.609E-13
Po-212	2.916E-08	3.344E-08	3.609E-08	3.759E-08	3.841E-08	3.790E-08	3.552E-12
Po-213	7.303E-13	7.346E-13	7.396E-13	7.454E-13	7.552E-13	7.752E-13	1.674E-10
Po-214	1.554E-13	2.140E-13	2.837E-13	3.649E-13	5.097E-13	8.158E-13	3.926E-09
Po-215	3.917E-12	4.821E-12	5.680E-12	6.499E-12	7.658E-12	9.424E-12	1.289E-10
Po-216	4.552E-08	5.220E-08	5.633E-08	5.867E-08	5.995E-08	5.916E-08	5.543E-12
Po-218	1.555E-13	2.141E-13	2.838E-13	3.651E-13	5.099E-13	8.161E-13	3.927E-09
At-217	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Rn-219	3.917E-12	4.821E-12	5.680E-12	6.499E-12	7.658E-12	9.424E-12	1.289E-10
Rn-220	4.552E-08	5.220E-08	5.633E-08	5.867E-08	5.995E-08	5.916E-08	5.543E-12
Rn-222	1.555E-13	2.141E-13	2.838E-13	3.651E-13	5.099E-13	8.161E-13	3.927E-09
Fr-221	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Fr-223	5.402E-14	6.642E-14	7.824E-14	8.952E-14	1.055E-13	1.298E-13	1.779E-12
Ra-223	3.917E-12	4.821E-12	5.680E-12	6.499E-12	7.658E-12	9.424E-12	1.289E-10
Ra-224	4.552E-08	5.220E-08	5.633E-08	5.867E-08	5.995E-08	5.916E-08	5.543E-12
Ra-225	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Ra-226	1.555E-13	2.141E-13	2.838E-13	3.651E-13	5.099E-13	8.161E-13	3.927E-09
Ac-225	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Ac-227	3.914E-12	4.813E-12	5.670E-12	6.487E-12	7.644E-12	9.409E-12	1.289E-10
Th-227	3.863E-12	4.755E-12	5.602E-12	6.410E-12	7.553E-12	9.294E-12	1.271E-10
Th-228	4.550E-08	5.208E-08	5.620E-08	5.853E-08	5.985E-08	5.910E-08	5.543E-12
Th-229	7.465E-13	7.509E-13	7.560E-13	7.618E-13	7.719E-13	7.923E-13	1.711E-10
Th-230	6.154E-11	7.414E-11	8.734E-11	1.011E-10	1.228E-10	1.618E-10	2.245E-08
Th-231	5.172E-09	5.173E-09	5.173E-09	5.174E-09	5.175E-09	5.176E-09	5.481E-09
Th-234	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07
Pa-231	1.837E-11	1.859E-11	1.881E-11	1.903E-11	1.936E-11	1.990E-11	1.288E-10
Pa-233	4.137E-07	4.149E-07	4.164E-07	4.181E-07	4.210E-07	4.266E-07	1.377E-06
Pa-234m	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07
Pa-234	4.092E-10	4.092E-10	4.092E-10	4.092E-10	4.092E-10	4.092E-10	4.092E-10
U-232	5.660E-08	5.930E-08	6.050E-08	6.078E-08	6.023E-08	5.816E-08	5.405E-12
U-233	2.201E-11	2.583E-11	2.966E-11	3.350E-11	3.920E-11	4.846E-11	4.394E-09
U-234	6.840E-07	7.168E-07	7.491E-07	7.808E-07	8.275E-07	9.030E-07	2.778E-06

TABLE F.2.f. Actinide Radioactivity by Isotope at 45 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-235	5.172E-09	5.173E-09	5.173E-09	5.174E-09	5.175E-09	5.176E-09	5.481E-09
U-236	2.145E-07	2.145E-07	2.145E-07	2.146E-07	2.146E-07	2.147E-07	2.334E-07
U-237	3.171E-06	2.880E-06	2.616E-06	2.375E-06	2.056E-06	1.616E-06	2.974E-11
U-238	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07	3.148E-07
U-240	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12
Np-235	1.865E-10	5.195E-11	1.447E-11	4.028E-12	5.920E-13	2.422E-14	0.00
Np-236	8.245E-12	8.245E-12	8.245E-12	8.245E-12	8.245E-12	8.245E-12	8.196E-12
Np-237	4.137E-07	4.149E-07	4.164E-07	4.181E-07	4.210E-07	4.266E-07	1.377E-06
Np-238	9.640E-08	9.552E-08	9.466E-08	9.380E-08	9.252E-08	9.044E-08	1.037E-09
Np-239	6.415E-05	6.414E-05	6.413E-05	6.412E-05	6.410E-05	6.407E-05	5.843E-05
Np-240m	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12	2.090E-12
Pu-236	2.509E-07	1.543E-07	9.488E-08	5.835E-08	2.814E-08	8.343E-09	7.377E-13
Pu-238	5.828E-03	5.737E-03	5.647E-03	5.559E-03	5.429E-03	5.219E-03	2.658E-06
Pu-239	3.189E-04	3.188E-04	3.188E-04	3.188E-04	3.188E-04	3.188E-04	3.117E-04
Pu-240	6.511E-04	6.531E-04	6.549E-04	6.566E-04	6.588E-04	6.620E-04	6.118E-04
Pu-241	1.293E-01	1.174E-01	1.066E-01	9.683E-02	8.381E-02	6.588E-02	1.214E-06
Pu-242	4.008E-06	4.008E-06	4.008E-06	4.008E-06	4.008E-06	4.008E-06	4.003E-06
Pu-243	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12
Pu-244	2.093E-12	2.093E-12	2.093E-12	2.093E-12	2.093E-12	2.093E-12	2.093E-12
Am-241	1.717E-03	2.106E-03	2.458E-03	2.775E-03	3.195E-03	3.764E-03	1.254E-03
Am-242m	1.928E-05	1.910E-05	1.893E-05	1.876E-05	1.850E-05	1.809E-05	2.073E-07
Am-242	1.918E-05	1.901E-05	1.884E-05	1.867E-05	1.841E-05	1.800E-05	2.063E-07
Am-243	6.415E-05	6.414E-05	6.413E-05	6.412E-05	6.410E-05	6.407E-05	5.843E-05
Am-245	5.853E-15	1.203E-15	2.472E-16	5.081E-17	4.734E-18	9.065E-20	0.00
Cm-242	2.626E-05	1.621E-05	1.563E-05	1.547E-05	1.526E-05	1.489E-05	1.706E-07
Cm-243	5.845E-05	5.567E-05	5.303E-05	5.051E-05	4.696E-05	4.158E-05	1.853E-15
Cm-244	1.031E-02	9.552E-03	8.848E-03	8.196E-03	7.307E-03	6.034E-03	3.094E-19
Cm-245	1.314E-06	1.314E-06	1.314E-06	1.313E-06	1.313E-06	1.312E-06	1.212E-06
Cm-246	5.415E-07	5.414E-07	5.412E-07	5.411E-07	5.408E-07	5.404E-07	4.681E-07
Cm-247	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12	2.514E-12
Cm-248	1.035E-11	1.035E-11	1.035E-11	1.035E-11	1.035E-11	1.035E-11	1.033E-11
Bk-249	4.035E-10	8.293E-11	1.704E-11	3.503E-12	3.264E-13	6.250E-15	0.00
Bk-250	5.558E-15	8.859E-16	1.414E-16	2.269E-17	1.662E-18	2.145E-19	1.921E-19
Cf-249	1.412E-10	1.414E-10	1.410E-10	1.405E-10	1.397E-10	1.383E-10	1.991E-11
Cf-250	5.783E-10	5.201E-10	4.678E-10	4.208E-10	3.589E-10	2.754E-10	1.921E-19
Cf-251	5.131E-12	5.123E-12	5.115E-12	5.107E-12	5.095E-12	5.076E-12	2.382E-12
Cf-252	3.391E-10	2.005E-10	1.186E-10	7.010E-11	3.187E-11	8.566E-12	0.00
Es-254	5.555E-15	8.852E-16	1.411E-16	2.247E-17	1.461E-18	0.00	0.00
Total	1.483E-01	1.360E-01	1.248E-01	1.146E-01	1.010E-01	8.211E-02	2.312E-03

TABLE F.2.g. Actinide Radioactivity by Isotope at 50 MWd/kgM, Ci/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Tl-207	3.683E-12	4.533E-12	5.338E-12	6.102E-12	7.179E-12	8.807E-12	9.934E-11
Tl-208	1.929E-08	2.219E-08	2.398E-08	2.500E-08	2.557E-08	2.525E-08	2.346E-12
Tl-209	2.012E-14	2.022E-14	2.033E-14	2.047E-14	2.070E-14	2.116E-14	3.939E-12
Pb-209	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Pb-210	2.733E-14	3.578E-14	4.730E-14	6.234E-14	9.260E-14	1.676E-13	4.336E-09
Pb-211	3.693E-12	4.546E-12	5.353E-12	6.119E-12	7.199E-12	8.832E-12	9.962E-11
Pb-212	5.370E-08	6.175E-08	6.675E-08	6.959E-08	7.117E-08	7.027E-08	6.529E-12
Pb-214	1.415E-13	1.954E-13	2.600E-13	3.359E-13	4.720E-13	7.632E-13	4.336E-09
Bi-210	2.733E-14	3.580E-14	4.732E-14	6.237E-14	9.264E-14	1.677E-13	4.336E-09
Bi-210	3.693E-12	4.546E-12	5.353E-12	6.119E-12	7.199E-12	8.832E-12	9.962E-11
Bi-212	5.370E-08	6.175E-08	6.675E-08	6.959E-08	7.117E-08	7.027E-08	6.529E-12
Bi-213	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Bi-214	1.415E-13	1.954E-13	2.600E-13	3.359E-13	4.720E-13	7.632E-13	4.336E-09
Po-210	2.734E-14	3.307E-14	4.358E-14	5.752E-14	8.600E-14	1.677E-13	4.336E-09
Po-211	1.034E-14	1.273E-14	1.499E-14	1.713E-14	2.016E-14	2.473E-14	2.789E-13
Po-212	3.441E-08	3.956E-08	4.277E-08	4.459E-08	4.560E-08	4.502E-08	4.183E-12
Po-213	9.114E-13	9.159E-13	9.211E-13	9.270E-13	9.374E-13	9.585E-13	1.784E-10
Po-214	1.415E-13	1.954E-13	2.599E-13	3.358E-13	4.719E-13	7.631E-13	4.336E-09
Po-215	3.693E-12	4.546E-12	5.353E-12	6.119E-12	7.199E-12	8.832E-12	9.962E-11
Po-216	5.370E-08	6.175E-08	6.675E-08	6.959E-08	7.117E-08	7.027E-08	6.529E-12
Po-218	1.416E-13	1.955E-13	2.601E-13	3.359E-13	4.721E-13	7.634E-13	4.337E-09
At-217	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Rn-219	3.693E-12	4.546E-12	5.353E-12	6.119E-12	7.199E-12	8.832E-12	9.962E-11
Rn-220	5.370E-08	6.175E-08	6.675E-08	6.959E-08	7.117E-08	7.027E-08	6.529E-12
Rn-222	1.416E-13	1.955E-13	2.601E-13	3.359E-13	4.721E-13	7.634E-13	4.337E-09
Fr-221	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Fr-223	5.093E-14	6.262E-14	7.373E-14	8.429E-14	9.917E-14	1.217E-13	1.375E-12
Ra-223	3.693E-12	4.546E-12	5.353E-12	6.119E-12	7.199E-12	8.832E-12	9.962E-11
Ra-224	5.370E-08	6.175E-08	6.675E-08	6.959E-08	7.117E-08	7.027E-08	6.529E-12
Ra-225	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Ra-226	1.416E-13	1.955E-13	2.601E-13	3.359E-13	4.721E-13	7.634E-13	4.337E-09
Ac-225	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Ac-227	3.691E-12	4.538E-12	5.343E-12	6.108E-12	7.186E-12	8.818E-12	9.962E-11
Th-227	3.643E-12	4.483E-12	5.279E-12	6.035E-12	7.100E-12	8.710E-12	9.824E-11
Th-228	5.368E-08	6.162E-08	6.659E-08	6.942E-08	7.105E-08	7.020E-08	6.529E-12
Th-229	9.316E-13	9.361E-13	9.414E-13	9.475E-13	9.581E-13	9.797E-13	1.824E-10
Th-230	5.641E-11	6.847E-11	8.121E-11	9.462E-11	1.160E-10	1.548E-10	2.491E-08
Th-231	3.814E-09	3.815E-09	3.815E-09	3.816E-09	3.817E-09	3.818E-09	4.123E-09
Th-234	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07
Pa-231	1.734E-11	1.750E-11	1.766E-11	1.782E-11	1.807E-11	1.847E-11	9.958E-11
Pa-233	4.501E-07	4.513E-07	4.529E-07	4.546E-07	4.577E-07	4.636E-07	1.457E-06
Pa-234m	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07
Pa-234	4.070E-10	4.070E-10	4.070E-10	4.070E-10	4.070E-10	4.070E-10	4.070E-10
U-232	6.703E-08	7.033E-08	7.181E-08	7.217E-08	7.153E-08	6.909E-08	6.366E-12
U-233	2.275E-11	2.690E-11	3.106E-11	3.524E-11	4.144E-11	5.151E-11	4.669E-09
U-234	6.506E-07	6.889E-07	7.267E-07	7.638E-07	8.185E-07	9.068E-07	3.099E-06

TABLE F.2.g. Actinide Radioactivity by Isotope at 50 MWd/kgM, Ci/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
U-235	3.814E-09	3.815E-09	3.815E-09	3.816E-09	3.817E-09	3.818E-09	4.123E-09
U-236	2.132E-07	2.132E-07	2.132E-07	2.133E-07	2.133E-07	2.135E-07	2.330E-07
U-237	3.328E-06	3.022E-06	2.745E-06	2.493E-06	2.158E-06	1.696E-06	4.680E-11
U-238	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07	3.131E-07
U-240	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12
Np-235	2.159E-10	6.013E-11	1.674E-11	4.663E-12	6.852E-13	2.804E-14	0.00
Np-236	9.173E-12	9.173E-12	9.173E-12	9.173E-12	9.173E-12	9.173E-12	9.119E-12
Np-237	4.501E-07	4.513E-07	4.529E-07	4.546E-07	4.577E-07	4.636E-07	1.457E-06
Np-238	9.272E-08	9.188E-08	9.104E-08	9.022E-08	8.899E-08	8.698E-08	9.970E-10
Np-239	8.292E-05	8.290E-05	8.289E-05	8.287E-05	8.285E-05	8.281E-05	7.553E-05
Np-240m	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12	3.212E-12
Pu-236	3.032E-07	1.865E-07	1.147E-07	7.051E-08	3.400E-08	1.008E-08	8.207E-13
Pu-238	6.818E-03	6.712E-03	6.607E-03	6.504E-03	6.352E-03	6.106E-03	3.028E-06
Pu-239	3.186E-04	3.186E-04	3.186E-04	3.185E-04	3.185E-04	3.185E-04	3.119E-04
Pu-240	6.682E-04	6.712E-04	6.740E-04	6.765E-04	6.800E-04	6.849E-04	6.398E-04
Pu-241	1.356E-01	1.232E-01	1.119E-01	1.016E-01	8.795E-02	6.914E-02	1.910E-06
Pu-242	4.689E-06	4.689E-06	4.689E-06	4.689E-06	4.689E-06	4.689E-06	4.684E-06
Pu-243	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12
Pu-244	3.216E-12	3.216E-12	3.216E-12	3.216E-12	3.216E-12	3.216E-12	3.216E-12
Am-241	1.775E-03	2.183E-03	2.552E-03	2.886E-03	3.326E-03	3.924E-03	1.311E-03
Am-242m	1.854E-05	1.837E-05	1.821E-05	1.804E-05	1.780E-05	1.740E-05	1.994E-07
Am-242	1.845E-05	1.828E-05	1.812E-05	1.795E-05	1.771E-05	1.731E-05	1.984E-07
Am-243	8.292E-05	8.290E-05	8.289E-05	8.287E-05	8.285E-05	8.281E-05	7.553E-05
Am-245	1.526E-14	3.135E-15	6.444E-16	1.324E-16	1.234E-17	2.363E-19	0.00
Cm-242	2.673E-05	1.566E-05	1.503E-05	1.487E-05	1.468E-05	1.432E-05	1.641E-07
Cm-243	7.048E-05	6.713E-05	6.394E-05	6.091E-05	5.662E-05	5.014E-05	2.234E-15
Cm-244	1.539E-02	1.425E-02	1.320E-02	1.223E-02	1.090E-02	9.005E-03	4.618E-19
Cm-245	2.068E-06	2.068E-06	2.067E-06	2.067E-06	2.066E-06	2.066E-06	1.907E-06
Cm-246	9.984E-07	9.981E-07	9.978E-07	9.975E-07	9.971E-07	9.963E-07	8.631E-07
Cm-247	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12	5.243E-12
Cm-248	2.505E-11	2.505E-11	2.505E-11	2.505E-11	2.505E-11	2.505E-11	2.500E-11
Bk-249	1.052E-09	2.162E-10	4.443E-11	9.131E-12	8.507E-13	1.629E-14	0.00
Bk-250	2.161E-14	3.445E-15	5.495E-16	8.814E-17	6.222E-18	7.407E-19	6.316E-19
Cf-249	3.642E-10	3.648E-10	3.638E-10	3.625E-10	3.603E-10	3.568E-10	5.137E-11
Cf-250	1.554E-09	1.398E-09	1.257E-09	1.131E-09	9.647E-10	7.402E-10	6.316E-19
Cf-251	1.423E-11	1.421E-11	1.419E-11	1.417E-11	1.414E-11	1.408E-11	6.609E-12
Cf-252	1.091E-09	6.450E-10	3.814E-10	2.255E-10	1.025E-10	2.756E-11	0.00
Es-254	2.160E-14	3.443E-15	5.486E-16	8.744E-17	5.534E-18	8.396E-20	0.00
Total	1.609E-01	1.476E-01	1.355E-01	1.245E-01	1.098E-01	8.946E-02	2.434E-03

TABLE F.3.a. Fission Product Inventory by Isotope at 20 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	2.223E-08	1.987E-08	1.776E-08	1.587E-08	1.341E-08	1.013E-08	1.307E-32
Li-6	1.407E-10	1.407E-10	1.407E-10	1.407E-10	1.407E-10	1.407E-10	1.407E-10
Li-7	6.128E-12	6.128E-12	6.128E-12	6.128E-12	6.128E-12	6.128E-12	6.128E-12
Be-9	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11	1.180E-11
Be-10	7.874E-11	7.874E-11	7.874E-11	7.874E-11	7.873E-11	7.873E-11	7.870E-11
C-14	1.590E-11	1.590E-11	1.590E-11	1.589E-11	1.589E-11	1.588E-11	1.410E-11
Zn-66	2.248E-14	2.248E-14	2.248E-14	2.248E-14	2.248E-14	2.248E-14	2.248E-14
Zn-67	9.326E-16	9.326E-16	9.326E-16	9.326E-16	9.326E-16	9.326E-16	9.326E-16
Ga-71	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13
Ga-72	1.378E-08	1.378E-08	1.378E-08	1.378E-08	1.378E-08	1.378E-08	1.378E-08
Ge-73	2.871E-08	2.871E-08	2.871E-08	2.871E-08	2.871E-08	2.871E-08	2.871E-08
Ge-74	6.050E-08	6.050E-08	6.050E-08	6.050E-08	6.050E-08	6.050E-08	6.050E-08
As-75	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07
Ge-76	3.090E-07	3.090E-07	3.090E-07	3.090E-07	3.090E-07	3.090E-07	3.090E-07
Se-76	2.302E-09	2.302E-09	2.302E-09	2.302E-09	2.302E-09	2.302E-09	2.302E-09
Se-77	6.425E-07	6.425E-07	6.425E-07	6.425E-07	6.425E-07	6.425E-07	6.425E-07
Se-78	1.471E-06	1.471E-06	1.471E-06	1.471E-06	1.471E-06	1.471E-06	1.471E-06
Se-79	3.614E-06	3.614E-06	3.614E-06	3.613E-06	3.613E-06	3.613E-06	3.576E-06
Br-79	3.619E-10	4.390E-10	5.162E-10	5.933E-10	7.089E-10	9.017E-10	3.849E-08
Se-80	8.182E-06	8.182E-06	8.182E-06	8.182E-06	8.182E-06	8.182E-06	8.182E-06
Kr-80	1.379E-10	1.379E-10	1.379E-10	1.379E-10	1.379E-10	1.379E-10	1.379E-10
Br-81	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05
Kr-81	1.110E-11	1.110E-11	1.110E-11	1.110E-11	1.110E-11	1.110E-11	1.107E-11
Se-82	2.066E-05	2.066E-05	2.066E-05	2.066E-05	2.066E-05	2.066E-05	2.066E-05
Kr-82	4.281E-07	4.281E-07	4.281E-07	4.281E-07	4.281E-07	4.281E-07	4.281E-07
Kr-83	2.765E-05	2.765E-05	2.765E-05	2.765E-05	2.765E-05	2.765E-05	2.765E-05
Kr-84	6.705E-05	6.705E-05	6.705E-05	6.705E-05	6.705E-05	6.705E-05	6.705E-05
Kr-85	8.761E-06	7.698E-06	6.764E-06	5.944E-06	4.896E-06	3.543E-06	1.075E-33
Rb-85	6.578E-05	6.685E-05	6.778E-05	6.860E-05	6.965E-05	7.100E-05	7.454E-05
Kr-86	1.165E-04	1.165E-04	1.165E-04	1.165E-04	1.165E-04	1.165E-04	1.165E-04
Sr-86	1.680E-07	1.680E-07	1.680E-07	1.680E-07	1.680E-07	1.680E-07	1.680E-07
Rb-87	1.496E-04	1.496E-04	1.496E-04	1.496E-04	1.496E-04	1.496E-04	1.496E-04
Sr-87	1.346E-09	1.346E-09	1.346E-09	1.346E-09	1.346E-09	1.346E-09	1.349E-09
Sr-88	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04
Y-89	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04
Sr-90	2.712E-04	2.586E-04	2.466E-04	2.351E-04	2.189E-04	1.943E-04	1.439E-14
Y-90	6.801E-08	6.484E-08	6.183E-08	5.896E-08	5.489E-08	4.873E-08	3.610E-18
Zr-90	6.905E-05	8.166E-05	9.369E-05	1.052E-04	1.214E-04	1.459E-04	3.403E-04
Y-91	6.721E-17	1.172E-20	2.043E-24	3.562E-28	8.201E-34	0.00	0.00
Zr-91	3.622E-04	3.622E-04	3.622E-04	3.622E-04	3.622E-04	3.622E-04	3.622E-04
Zr-92	3.913E-04	3.913E-04	3.913E-04	3.913E-04	3.913E-04	3.913E-04	3.913E-04
Zr-93	4.411E-04	4.411E-04	4.411E-04	4.411E-04	4.411E-04	4.411E-04	4.409E-04
Nb-93	4.784E-10	6.541E-10	8.514E-10	1.068E-09	1.427E-09	2.097E-09	1.968E-07
Nb-93m	1.413E-09	1.637E-09	1.840E-09	2.023E-09	2.264E-09	2.593E-09	3.724E-09
Zr-94	4.496E-04	4.496E-04	4.496E-04	4.496E-04	4.496E-04	4.496E-04	4.496E-04
Nb-94	4.558E-10	4.558E-10	4.557E-10	4.557E-10	4.557E-10	4.556E-10	4.406E-10

TABLE F.3.a. Fission Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	9.806E-16	3.585E-19	1.311E-22	4.793E-26	3.351E-31	0.00	0.00
Nb-95	1.196E-15	4.373E-19	1.599E-22	5.846E-26	3.054E-33	0.00	0.00
Mo-95	4.665E-04	4.665E-04	4.665E-04	4.665E-04	4.665E-04	4.665E-04	4.665E-04
Zr-96	4.863E-04	4.863E-04	4.863E-04	4.863E-04	4.863E-04	4.863E-04	4.863E-04
Mo-96	1.535E-05	1.535E-05	1.535E-05	1.535E-05	1.535E-05	1.535E-05	1.535E-05
Mo-97	4.811E-04	4.811E-04	4.811E-04	4.811E-04	4.811E-04	4.811E-04	4.811E-04
Mo-98	4.993E-04	4.993E-04	4.993E-04	4.993E-04	4.993E-04	4.993E-04	4.993E-04
Tc-98	2.536E-09	2.536E-09	2.536E-09	2.536E-09	2.536E-09	2.536E-09	2.536E-09
Tc-99	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.824E-04
Ru-99	1.460E-08	1.775E-08	2.090E-08	2.405E-08	2.878E-08	3.665E-08	1.578E-06
Mo-100	5.629E-04	5.629E-04	5.629E-04	5.629E-04	5.629E-04	5.629E-04	5.629E-04
Ru-100	3.841E-05	3.841E-05	3.841E-05	3.841E-05	3.841E-05	3.841E-05	3.841E-05
Ru-101	4.721E-04	4.721E-04	4.721E-04	4.721E-04	4.721E-04	4.721E-04	4.721E-04
Ru-102	4.584E-04	4.584E-04	4.584E-04	4.584E-04	4.584E-04	4.584E-04	4.584E-04
Rh-102	8.427E-11	5.224E-11	3.239E-11	2.008E-11	9.804E-12	2.968E-12	0.00
Rh-103	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04
Ru-104	3.208E-04	3.208E-04	3.208E-04	3.208E-04	3.208E-04	3.208E-04	3.208E-04
Pd-104	1.002E-04	1.002E-04	1.002E-04	1.002E-04	1.002E-04	1.002E-04	1.002E-04
Pd-105	2.367E-04	2.367E-04	2.367E-04	2.367E-04	2.367E-04	2.367E-04	2.367E-04
Ru-106	7.889E-07	1.994E-07	5.040E-08	1.274E-08	1.619E-09	5.200E-11	0.00
Rh-106	7.415E-13	1.874E-13	4.738E-14	1.198E-14	1.522E-15	4.888E-17	0.00
Pd-106	1.923E-04	1.929E-04	1.931E-04	1.931E-04	1.931E-04	1.931E-04	1.931E-04
Pd-107	1.257E-04	1.257E-04	1.257E-04	1.257E-04	1.257E-04	1.257E-04	1.257E-04
Ag-107	1.157E-10	1.425E-10	1.694E-10	1.962E-10	2.364E-10	3.035E-10	1.345E-08
Pd-108	8.607E-05	8.607E-05	8.607E-05	8.607E-05	8.607E-05	8.607E-05	8.607E-05
Ag-108m	6.577E-13	6.505E-13	6.435E-13	6.365E-13	6.261E-13	6.093E-13	2.897E-15
Cd-108	1.588E-10	1.588E-10	1.588E-10	1.588E-10	1.588E-10	1.588E-10	1.589E-10
Ag-109	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.714E-05
Cd-109	3.666E-15	1.231E-15	4.134E-16	1.388E-16	2.701E-17	1.765E-18	0.00
Pd-110	2.827E-05	2.827E-05	2.827E-05	2.827E-05	2.827E-05	2.827E-05	2.827E-05
Ag-110m	4.651E-10	6.131E-11	8.081E-12	1.065E-12	5.098E-14	3.217E-16	0.00
Cd-110	1.351E-05	1.351E-05	1.351E-05	1.351E-05	1.351E-05	1.351E-05	1.351E-05
Cd-111	1.592E-05	1.592E-05	1.592E-05	1.592E-05	1.592E-05	1.592E-05	1.592E-05
Cd-112	9.755E-06	9.755E-06	9.755E-06	9.755E-06	9.755E-06	9.755E-06	9.755E-06
Cd-113	1.373E-07	1.373E-07	1.373E-07	1.373E-07	1.373E-07	1.373E-07	1.374E-07
Cd-113m	1.024E-07	9.313E-08	8.469E-08	7.701E-08	6.678E-08	5.266E-08	3.166E-28
In-113	5.207E-08	6.134E-08	6.978E-08	7.744E-08	8.767E-08	1.018E-07	1.544E-07
Cd-114	1.363E-05	1.363E-05	1.363E-05	1.363E-05	1.363E-05	1.363E-05	1.363E-05
Sn-114	1.083E-09	1.083E-09	1.083E-09	1.083E-09	1.083E-09	1.083E-09	1.083E-09
In-115	2.092E-06	2.092E-06	2.092E-06	2.092E-06	2.092E-06	2.092E-06	2.092E-06
Sn-115	2.032E-07	2.032E-07	2.032E-07	2.032E-07	2.032E-07	2.032E-07	2.032E-07
Cd-116	5.193E-06	5.193E-06	5.193E-06	5.193E-06	5.193E-06	5.193E-06	5.193E-06
Sn-116	3.976E-06	3.976E-06	3.976E-06	3.976E-06	3.976E-06	3.976E-06	3.976E-06
Sn-117	5.267E-06	5.267E-06	5.267E-06	5.267E-06	5.267E-06	5.267E-06	5.267E-06
Sn-118	5.304E-06	5.304E-06	5.304E-06	5.304E-06	5.304E-06	5.304E-06	5.304E-06
Sn-119	5.284E-06	5.284E-06	5.284E-06	5.284E-06	5.284E-06	5.284E-06	5.284E-06

TABLE F.3.a. Fission Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	2.812E-11	3.560E-12	4.509E-13	5.709E-14	2.572E-15	1.468E-17	0.00
Sn-120	5.390E-06	5.390E-06	5.390E-06	5.390E-06	5.390E-06	5.390E-06	5.390E-06
Sn-121m	1.882E-09	1.830E-09	1.780E-09	1.731E-09	1.661E-09	1.550E-09	1.935E-15
Sb-121	5.374E-06	5.374E-06	5.374E-06	5.374E-06	5.374E-06	5.374E-06	5.375E-06
Sn-122	5.942E-06	5.942E-06	5.942E-06	5.942E-06	5.942E-06	5.942E-06	5.942E-06
Te-122	2.360E-07	2.360E-07	2.360E-07	2.360E-07	2.360E-07	2.360E-07	2.360E-07
Sn-123	9.248E-13	1.835E-14	3.640E-16	7.222E-18	2.021E-20	1.120E-24	0.00
Sb-123	6.561E-06	6.561E-06	6.561E-06	6.561E-06	6.561E-06	6.561E-06	6.561E-06
Te-123	2.504E-09	2.504E-09	2.504E-09	2.504E-09	2.504E-09	2.504E-09	2.504E-09
Te-123m	7.370E-16	1.072E-17	1.558E-19	2.261E-21	0.00	0.00	0.00
Sn-124	8.020E-06	8.020E-06	8.020E-06	8.020E-06	8.020E-06	8.020E-06	8.020E-06
Te-124	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07	1.812E-07
Sb-125	1.344E-06	8.148E-07	4.940E-07	2.995E-07	1.414E-07	4.045E-08	0.00
Te-125	1.049E-05	1.103E-05	1.135E-05	1.155E-05	1.171E-05	1.181E-05	1.185E-05
Te-125m	1.880E-08	1.140E-08	6.911E-09	4.190E-09	1.977E-09	5.658E-10	0.00
Sn-126	1.703E-05	1.703E-05	1.703E-05	1.703E-05	1.703E-05	1.703E-05	1.691E-05
Sb-126	8.090E-13	8.090E-13	8.090E-13	8.090E-13	8.089E-13	8.089E-13	8.034E-13
Sb-126m	6.151E-15	6.151E-15	6.151E-15	6.150E-15	6.150E-15	6.150E-15	6.109E-15
Te-126	4.272E-07	4.274E-07	4.277E-07	4.279E-07	4.282E-07	4.288E-07	5.441E-07
Te-127	1.296E-15	1.245E-17	1.196E-19	1.149E-21	1.082E-24	9.793E-30	0.00
Te-127m	3.702E-13	3.557E-15	3.417E-17	3.283E-19	3.091E-22	2.797E-27	0.00
I-127	3.447E-05	3.447E-05	3.447E-05	3.447E-05	3.447E-05	3.447E-05	3.447E-05
Te-128	6.741E-05	6.741E-05	6.741E-05	6.741E-05	6.741E-05	6.741E-05	6.741E-05
Xe-128	1.223E-06	1.223E-06	1.223E-06	1.223E-06	1.223E-06	1.223E-06	1.223E-06
I-129	1.109E-04	1.109E-04	1.109E-04	1.109E-04	1.109E-04	1.109E-04	1.109E-04
Xe-129	4.573E-09	4.583E-09	4.593E-09	4.602E-09	4.617E-09	4.642E-09	9.440E-09
Te-130	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04	2.147E-04
Xe-130	4.963E-06	4.963E-06	4.963E-06	4.963E-06	4.963E-06	4.963E-06	4.963E-06
Xe-131	2.917E-04	2.917E-04	2.917E-04	2.917E-04	2.917E-04	2.917E-04	2.917E-04
Xe-132	6.183E-04	6.183E-04	6.183E-04	6.183E-04	6.183E-04	6.183E-04	6.183E-04
Ba-132	7.600E-10	7.600E-10	7.600E-10	7.600E-10	7.600E-10	7.600E-10	7.600E-10
Cs-133	7.166E-04	7.166E-04	7.166E-04	7.166E-04	7.166E-04	7.166E-04	7.166E-04
Xe-134	8.857E-04	8.857E-04	8.857E-04	8.857E-04	8.857E-04	8.857E-04	8.857E-04
Cs-134	4.798E-06	2.449E-06	1.250E-06	6.384E-07	2.329E-07	4.336E-08	0.00
Ba-134	6.342E-05	6.577E-05	6.697E-05	6.758E-05	6.798E-05	6.817E-05	6.822E-05
Cs-135	3.555E-04	3.555E-04	3.555E-04	3.555E-04	3.555E-04	3.555E-04	3.554E-04
Ba-135	1.354E-07	1.356E-07	1.358E-07	1.360E-07	1.363E-07	1.369E-07	2.419E-07
Xe-136	1.227E-03	1.227E-03	1.227E-03	1.227E-03	1.227E-03	1.227E-03	1.227E-03
Ba-136	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05
Cs-137	6.016E-04	5.744E-04	5.485E-04	5.237E-04	4.886E-04	4.353E-04	6.381E-14
Ba-137	1.429E-04	1.701E-04	1.960E-04	2.208E-04	2.559E-04	3.092E-04	7.445E-04
Ba-137m	9.203E-11	8.787E-11	8.391E-11	8.012E-11	7.475E-11	6.660E-11	9.761E-21
Ba-138	7.718E-04	7.718E-04	7.718E-04	7.718E-04	7.718E-04	7.718E-04	7.718E-04
La-138	3.873E-09	3.873E-09	3.873E-09	3.873E-09	3.873E-09	3.873E-09	3.873E-09
La-139	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04
Ce-140	7.466E-04	7.466E-04	7.466E-04	7.466E-04	7.466E-04	7.466E-04	7.466E-04

TABLE F.3.a. Fission Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Pr-141	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04
Ce-142	6.818E-04	6.818E-04	6.818E-04	6.818E-04	6.818E-04	6.818E-04	6.818E-04
Nd-142	1.069E-05	1.069E-05	1.069E-05	1.069E-05	1.069E-05	1.069E-05	1.069E-05
Nd-143	5.296E-04	5.296E-04	5.296E-04	5.296E-04	5.296E-04	5.296E-04	5.296E-04
Ce-144	4.547E-07	7.658E-08	1.290E-08	2.172E-09	1.502E-10	1.748E-12	0.00
Pr-144	1.920E-11	3.234E-12	5.446E-13	9.173E-14	6.340E-15	7.381E-17	0.00
Pr-144m	9.598E-14	1.617E-14	2.723E-15	4.586E-16	3.170E-17	3.690E-19	0.00
Nd-144	7.424E-04	7.428E-04	7.428E-04	7.428E-04	7.428E-04	7.428E-04	7.428E-04
Nd-145	4.251E-04	4.251E-04	4.251E-04	4.251E-04	4.251E-04	4.251E-04	4.251E-04
Nd-146	3.984E-04	3.984E-04	3.984E-04	3.984E-04	3.984E-04	3.984E-04	3.984E-04
Pm-146	1.098E-09	8.533E-10	6.632E-10	5.154E-10	3.531E-10	1.881E-10	0.00
Sm-146	4.969E-09	5.060E-09	5.130E-09	5.185E-09	5.245E-09	5.306E-09	5.375E-09
Pm-147	1.688E-05	9.949E-06	5.865E-06	3.458E-06	1.565E-06	4.177E-07	0.00
Sm-147	1.562E-04	1.631E-04	1.672E-04	1.696E-04	1.715E-04	1.726E-04	1.731E-04
Nd-148	2.230E-04	2.230E-04	2.230E-04	2.230E-04	2.230E-04	2.230E-04	2.230E-04
Sm-148	9.031E-05	9.031E-05	9.031E-05	9.031E-05	9.031E-05	9.031E-05	9.031E-05
Sm-149	1.609E-06	1.609E-06	1.609E-06	1.609E-06	1.609E-06	1.609E-06	1.609E-06
Nd-150	1.066E-04	1.066E-04	1.066E-04	1.066E-04	1.066E-04	1.066E-04	1.066E-04
Sm-150	1.445E-04	1.445E-04	1.445E-04	1.445E-04	1.445E-04	1.445E-04	1.445E-04
Eu-150	3.017E-13	2.903E-13	2.793E-13	2.688E-13	2.537E-13	2.304E-13	1.473E-21
Sm-151	9.188E-06	9.047E-06	8.909E-06	8.773E-06	8.572E-06	8.248E-06	4.348E-09
Eu-151	4.583E-07	5.987E-07	7.370E-07	8.732E-07	1.074E-06	1.397E-06	9.642E-06
Sm-152	8.592E-05	8.593E-05	8.593E-05	8.593E-05	8.594E-05	8.594E-05	8.597E-05
Eu-152	6.505E-08	5.874E-08	5.305E-08	4.791E-08	4.112E-08	3.187E-08	6.490E-30
Gd-152	3.877E-08	4.053E-08	4.211E-08	4.355E-08	4.544E-08	4.801E-08	5.689E-08
Eu-153	6.006E-05	6.006E-05	6.006E-05	6.006E-05	6.006E-05	6.006E-05	6.006E-05
Gd-153	2.147E-11	2.649E-12	3.269E-13	4.035E-14	1.749E-15	9.361E-18	0.00
Sm-154	2.153E-05	2.153E-05	2.153E-05	2.153E-05	2.153E-05	2.153E-05	2.153E-05
Eu-154	9.918E-06	8.442E-06	7.185E-06	6.115E-06	4.802E-06	3.209E-06	0.00
Gd-154	8.954E-06	1.043E-05	1.169E-05	1.276E-05	1.407E-05	1.566E-05	1.887E-05
Eu-155	2.600E-06	1.966E-06	1.486E-06	1.124E-06	7.389E-07	3.674E-07	0.00
Gd-155	3.518E-06	4.152E-06	4.631E-06	4.994E-06	5.378E-06	5.750E-06	6.117E-06
Gd-156	2.587E-05	2.587E-05	2.587E-05	2.587E-05	2.587E-05	2.587E-05	2.587E-05
Gd-157	5.132E-08	5.132E-08	5.132E-08	5.132E-08	5.132E-08	5.132E-08	5.132E-08
Gd-158	8.847E-06	8.847E-06	8.847E-06	8.847E-06	8.847E-06	8.847E-06	8.847E-06
Tb-159	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06
Gd-160	7.183E-07	7.183E-07	7.183E-07	7.183E-07	7.183E-07	7.183E-07	7.183E-07
Dy-160	1.177E-07	1.177E-07	1.177E-07	1.177E-07	1.177E-07	1.177E-07	1.177E-07
Dy-161	2.507E-07	2.507E-07	2.507E-07	2.507E-07	2.507E-07	2.507E-07	2.507E-07
Dy-162	2.126E-07	2.126E-07	2.126E-07	2.126E-07	2.126E-07	2.126E-07	2.126E-07
Dy-163	1.439E-07	1.439E-07	1.439E-07	1.439E-07	1.439E-07	1.439E-07	1.439E-07
Dy-164	2.327E-08	2.327E-08	2.327E-08	2.327E-08	2.327E-08	2.327E-08	2.327E-08
Ho-165	6.460E-08	6.460E-08	6.460E-08	6.460E-08	6.460E-08	6.460E-08	6.460E-08
Ho-166m	4.625E-10	4.619E-10	4.614E-10	4.609E-10	4.601E-10	4.587E-10	2.605E-10
Er-166	1.943E-08	1.943E-08	1.943E-08	1.943E-08	1.943E-08	1.943E-08	1.963E-08
Er-167	2.027E-09	2.027E-09	2.027E-09	2.027E-09	2.027E-09	2.027E-09	2.027E-09

TABLE F.3.a. Fission Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-168	3.877E-09	3.877E-09	3.877E-09	3.877E-09	3.877E-09	3.877E-09	3.877E-09
Tm-169	1.944E-11	1.944E-11	1.944E-11	1.944E-11	1.944E-11	1.944E-11	1.944E-11
Er-170	6.210E-15	6.210E-15	6.210E-15	6.210E-15	6.210E-15	6.210E-15	6.210E-15
Yb-170	4.172E-12	4.172E-12	4.172E-12	4.172E-12	4.172E-12	4.172E-12	4.172E-12
Tm-171	5.810E-15	2.822E-15	1.371E-15	6.659E-16	2.254E-16	3.708E-17	0.00
Yb-171	1.529E-13	1.559E-13	1.573E-13	1.581E-13	1.585E-13	1.587E-13	1.587E-13
Yb-172	4.291E-15	4.291E-15	4.291E-15	4.291E-15	4.291E-15	4.291E-15	4.291E-15
Total	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02

TABLE F.3.b. Fission Product Inventory by Isotope at 25 MWD/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	2.837E-08	2.536E-08	2.267E-08	2.026E-08	1.712E-08	1.293E-08	1.667E-32
Li-6	1.510E-10	1.510E-10	1.510E-10	1.510E-10	1.510E-10	1.510E-10	1.510E-10
Li-7	7.644E-12	7.644E-12	7.644E-12	7.644E-12	7.644E-12	7.644E-12	7.644E-12
Be-9	1.472E-11	1.472E-11	1.472E-11	1.472E-11	1.472E-11	1.472E-11	1.472E-11
Be-10	9.821E-11	9.821E-11	9.821E-11	9.821E-11	9.821E-11	9.821E-11	9.817E-11
C-14	1.984E-11	1.983E-11	1.983E-11	1.982E-11	1.982E-11	1.980E-11	1.759E-11
Zn-66	2.657E-14	2.657E-14	2.657E-14	2.657E-14	2.657E-14	2.657E-14	2.657E-14
Zn-67	1.096E-15	1.096E-15	1.096E-15	1.096E-15	1.096E-15	1.096E-15	1.096E-15
Ga-71	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13
Ge-72	1.764E-08	1.764E-08	1.764E-08	1.764E-08	1.764E-08	1.764E-08	1.764E-08
Ge-73	3.593E-08	3.593E-08	3.593E-08	3.593E-08	3.593E-08	3.593E-08	3.593E-08
Ge-74	7.585E-08	7.585E-08	7.585E-08	7.585E-08	7.585E-08	7.585E-08	7.585E-08
As-75	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07
Ge-76	3.793E-07	3.793E-07	3.793E-07	3.793E-07	3.793E-07	3.793E-07	3.793E-07
Se-76	3.588E-09	3.588E-09	3.588E-09	3.588E-09	3.588E-09	3.588E-09	3.588E-09
Se-77	7.797E-07	7.797E-07	7.797E-07	7.797E-07	7.797E-07	7.797E-07	7.797E-07
Se-78	1.832E-06	1.832E-06	1.832E-06	1.832E-06	1.832E-06	1.832E-06	1.832E-06
Se-79	4.453E-06	4.452E-06	4.452E-06	4.452E-06	4.452E-06	4.452E-06	4.406E-06
Br-79	4.460E-10	5.410E-10	6.360E-10	7.311E-10	8.736E-10	1.111E-09	4.742E-08
Se-80	1.006E-05	1.006E-05	1.006E-05	1.006E-05	1.006E-05	1.006E-05	1.006E-05
Kr-80	1.845E-10	1.845E-10	1.845E-10	1.845E-10	1.845E-10	1.845E-10	1.845E-10
Br-81	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.641E-05
Kr-81	1.676E-11	1.676E-11	1.676E-11	1.676E-11	1.676E-11	1.676E-11	1.671E-11
Se-82	2.513E-05	2.513E-05	2.513E-05	2.513E-05	2.513E-05	2.513E-05	2.513E-05
Kr-82	6.450E-07	6.450E-07	6.450E-07	6.450E-07	6.450E-07	6.450E-07	6.450E-07
Kr-83	3.192E-05	3.192E-05	3.192E-05	3.192E-05	3.192E-05	3.192E-05	3.192E-05
Kr-84	8.265E-05	8.265E-05	8.265E-05	8.265E-05	8.265E-05	8.265E-05	8.265E-05
Kr-85	1.054E-05	9.263E-06	8.139E-06	7.152E-06	5.891E-06	4.263E-06	1.289E-33
Rb-85	7.911E-05	8.039E-05	8.151E-05	8.250E-05	8.376E-05	8.539E-05	8.965E-05
Kr-86	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04
Sr-86	2.572E-07	2.572E-07	2.572E-07	2.572E-07	2.572E-07	2.572E-07	2.572E-07
Rb-87	1.792E-04	1.792E-04	1.792E-04	1.792E-04	1.792E-04	1.792E-04	1.792E-04
Sr-87	2.113E-09	2.113E-09	2.113E-09	2.113E-09	2.113E-09	2.113E-09	2.115E-09
Sr-88	2.570E-04	2.570E-04	2.570E-04	2.570E-04	2.570E-04	2.570E-04	2.570E-04
Y-89	3.350E-04	3.350E-04	3.350E-04	3.350E-04	3.350E-04	3.350E-04	3.350E-04
Sr-90	3.239E-04	3.088E-04	2.945E-04	2.808E-04	2.614E-04	2.321E-04	1.719E-14
Y-90	8.123E-08	7.745E-08	7.385E-08	7.042E-08	6.556E-08	5.821E-08	4.311E-18
Zr-90	8.293E-05	9.799E-05	1.124E-04	1.260E-04	1.454E-04	1.747E-04	4.069E-04
Y-91	7.853E-17	1.369E-20	2.387E-24	4.162E-28	9.582E-34	0.00	0.00
Zr-91	4.351E-04	4.351E-04	4.351E-04	4.351E-04	4.351E-04	4.351E-04	4.351E-04
Zr-92	4.733E-04	4.733E-04	4.733E-04	4.733E-04	4.733E-04	4.733E-04	4.733E-04
Zr-93	5.357E-04	5.357E-04	5.357E-04	5.357E-04	5.357E-04	5.357E-04	5.354E-04
Nb-93	5.845E-10	7.982E-10	1.038E-09	1.302E-09	1.737E-09	2.552E-09	2.390E-07
Nb-93m	1.720E-09	1.992E-09	2.237E-09	2.459E-09	2.752E-09	3.150E-09	4.522E-09
Zr-94	5.513E-04	5.513E-04	5.513E-04	5.513E-04	5.513E-04	5.513E-04	5.513E-04
Nb-94	6.161E-10	6.161E-10	6.161E-10	6.160E-10	6.159E-10	6.158E-10	5.956E-10

TABLE F.3.b. Fissio Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	1.193E-15	4.361E-19	1.594E-22	5.829E-26	4.075E-31	0.00	0.00
Nb-95	1.455E-15	5.319E-19	1.945E-22	7.110E-26	3.715E-33	0.00	0.00
Mo-95	5.683E-04	5.683E-04	5.683E-04	5.683E-04	5.683E-04	5.683E-04	5.683E-04
Zr-96	5.995E-04	5.995E-04	5.995E-04	5.995E-04	5.995E-04	5.995E-04	5.995E-04
Mo-96	2.411E-05	2.411E-05	2.411E-05	2.411E-05	2.411E-05	2.411E-05	2.411E-05
Mo-97	5.965E-04	5.965E-04	5.965E-04	5.965E-04	5.965E-04	5.965E-04	5.965E-04
Mo-98	6.225E-04	6.225E-04	6.225E-04	6.225E-04	6.225E-04	6.225E-04	6.225E-04
Tc-98	4.004E-09	4.004E-09	4.004E-09	4.004E-09	4.004E-09	4.004E-09	4.004E-09
Tc-99	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.902E-04
Ru-99	1.787E-08	2.172E-08	2.558E-08	2.943E-08	3.521E-08	4.484E-08	1.930E-06
Mo-100	7.039E-04	7.039E-04	7.039E-04	7.039E-04	7.039E-04	7.039E-04	7.039E-04
Ru-100	6.057E-05	6.057E-05	6.057E-05	6.057E-05	6.057E-05	6.057E-05	6.057E-05
Ru-101	5.900E-04	5.900E-04	5.900E-04	5.900E-04	5.900E-04	5.900E-04	5.900E-04
Ru-102	5.859E-04	5.859E-04	5.859E-04	5.859E-04	5.859E-04	5.859E-04	5.859E-04
Rh-102	1.323E-10	8.202E-11	5.085E-11	3.153E-11	1.539E-11	4.659E-12	0.00
Rh-103	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04
Ru-104	4.239E-04	4.239E-04	4.239E-04	4.239E-04	4.239E-04	4.239E-04	4.239E-04
Pd-104	1.574E-04	1.574E-04	1.574E-04	1.574E-04	1.574E-04	1.574E-04	1.574E-04
Pd-105	3.144E-04	3.144E-04	3.144E-04	3.144E-04	3.144E-04	3.144E-04	3.144E-04
Ru-106	1.096E-06	2.770E-07	7.002E-08	1.770E-08	2.249E-09	7.224E-11	0.00
Rh-106	1.030E-12	2.604E-13	6.581E-14	1.664E-14	2.114E-15	6.790E-17	0.00
Pd-106	2.701E-04	2.709E-04	2.711E-04	2.712E-04	2.712E-04	2.712E-04	2.712E-04
Pd-107	1.757E-04	1.757E-04	1.757E-04	1.757E-04	1.757E-04	1.757E-04	1.757E-04
Ag-107	1.611E-10	1.986E-10	2.361E-10	2.736E-10	3.299E-10	4.236E-10	1.879E-08
Pd-108	1.211E-04	1.211E-04	1.211E-04	1.211E-04	1.211E-04	1.211E-04	1.211E-04
Ag-108m	9.426E-13	9.323E-13	9.222E-13	9.122E-13	8.974E-13	8.732E-13	4.153E-15
Cd-108	2.779E-10	2.779E-10	2.779E-10	2.779E-10	2.779E-10	2.779E-10	2.780E-10
Ag-109	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.362E-05
Cd-109	7.996E-15	2.685E-15	9.016E-16	3.027E-16	5.891E-17	3.849E-18	0.00
Pd-110	3.963E-05	3.963E-05	3.963E-05	3.963E-05	3.963E-05	3.963E-05	3.963E-05
Ag-110m	8.062E-10	1.063E-10	1.401E-11	1.847E-12	8.838E-14	5.576E-16	0.00
Cd-110	2.358E-05	2.358E-05	2.358E-05	2.358E-05	2.358E-05	2.358E-05	2.358E-05
Cd-111	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.196E-05
Cd-112	1.324E-05	1.324E-05	1.324E-05	1.324E-05	1.324E-05	1.324E-05	1.324E-05
Cd-113	1.449E-07	1.449E-07	1.449E-07	1.449E-07	1.449E-07	1.449E-07	1.450E-07
Cd-113m	1.418E-07	1.289E-07	1.172E-07	1.066E-07	9.244E-08	7.289E-08	4.381E-28
In-113	7.103E-08	8.387E-08	9.554E-08	1.062E-07	1.203E-07	1.398E-07	2.126E-07
Cd-114	1.796E-05	1.796E-05	1.796E-05	1.796E-05	1.796E-05	1.796E-05	1.796E-05
Sn-114	1.835E-09	1.835E-09	1.835E-09	1.835E-09	1.835E-09	1.835E-09	1.835E-09
In-115	2.227E-06	2.227E-06	2.227E-06	2.227E-06	2.227E-06	2.227E-06	2.227E-06
Sn-115	2.608E-07	2.608E-07	2.608E-07	2.608E-07	2.608E-07	2.608E-07	2.608E-07
Cd-116	6.663E-06	6.663E-06	6.663E-06	6.663E-06	6.663E-06	6.663E-06	6.663E-06
Sn-116	5.632E-06	5.632E-06	5.632E-06	5.632E-06	5.632E-06	5.632E-06	5.632E-06
Sn-117	6.746E-06	6.746E-06	6.746E-06	6.746E-06	6.746E-06	6.746E-06	6.746E-06
Sn-118	6.791E-06	6.791E-06	6.791E-06	6.791E-06	6.791E-06	6.791E-06	6.791E-06
Sn-119	6.771E-06	6.771E-06	6.771E-06	6.771E-06	6.771E-06	6.771E-06	6.771E-06

TABLE F.3.b. Fission Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	3.782E-11	4.789E-12	6.064E-13	7.679E-14	3.460E-15	1.974E-17	0.00
Sn-120	6.901E-06	6.901E-06	6.901E-06	6.901E-06	6.901E-06	6.901E-06	6.901E-06
Sn-121m	2.493E-09	2.425E-09	2.358E-09	2.294E-09	2.200E-09	2.053E-09	2.564E-15
Sb-121	6.791E-06	6.791E-06	6.791E-06	6.791E-06	6.791E-06	6.792E-06	6.794E-06
Sn-122	7.594E-06	7.594E-06	7.594E-06	7.594E-06	7.594E-06	7.594E-06	7.594E-06
Te-122	3.795E-07	3.795E-07	3.795E-07	3.795E-07	3.795E-07	3.795E-07	3.795E-07
Sn-123	1.186E-12	2.352E-14	4.667E-16	9.258E-18	2.587E-20	1.435E-24	0.00
Sb-123	8.318E-06	8.318E-06	8.318E-06	8.318E-06	8.318E-06	8.318E-06	8.318E-06
Te-123	4.592E-09	4.592E-09	4.592E-09	4.592E-09	4.592E-09	4.592E-09	4.592E-09
Te-123m	1.524E-15	2.216E-17	3.222E-19	4.677E-21	1.327E-23	3.381E-28	0.00
Sn-124	1.022E-05	1.022E-05	1.022E-05	1.022E-05	1.022E-05	1.022E-05	1.022E-05
Te-124	2.933E-07	2.933E-07	2.933E-07	2.933E-07	2.933E-07	2.933E-07	2.933E-07
Sb-125	1.741E-06	1.055E-06	6.397E-07	3.878E-07	1.831E-07	5.238E-08	0.00
Te-125	1.354E-05	1.423E-05	1.465E-05	1.491E-05	1.511E-05	1.525E-05	1.530E-05
Te-125m	2.435E-08	1.476E-08	8.950E-09	5.426E-09	2.560E-09	7.327E-10	0.00
Sn-126	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.196E-05	2.181E-05
Sb-126	1.043E-12	1.043E-12	1.043E-12	1.043E-12	1.043E-12	1.043E-12	1.036E-12
Sb-126m	7.932E-15	7.932E-15	7.932E-15	7.932E-15	7.932E-15	7.932E-15	7.878E-15
Te-126	5.826E-07	5.829E-07	5.832E-07	5.835E-07	5.839E-07	5.847E-07	7.333E-07
Te-127	1.687E-15	1.621E-17	1.558E-19	1.497E-21	1.409E-24	1.275E-29	0.00
Te-127m	4.820E-13	4.631E-15	4.449E-17	4.275E-19	4.026E-22	3.643E-27	0.00
I-127	4.437E-05	4.437E-05	4.437E-05	4.437E-05	4.437E-05	4.437E-05	4.437E-05
Te-128	8.629E-05	8.629E-05	8.629E-05	8.629E-05	8.629E-05	8.629E-05	8.629E-05
Xe-128	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06
I-129	1.405E-04	1.405E-04	1.405E-04	1.405E-04	1.405E-04	1.405E-04	1.405E-04
Xe-129	9.424E-09	9.437E-09	9.449E-09	9.461E-09	9.480E-09	9.511E-09	1.559E-08
Te-130	2.728E-04	2.728E-04	2.728E-04	2.728E-04	2.728E-04	2.728E-04	2.728E-04
Xe-130	8.013E-06	8.013E-06	8.013E-06	8.013E-06	8.013E-06	8.013E-06	8.013E-06
Xe-131	3.454E-04	3.454E-04	3.454E-04	3.454E-04	3.454E-04	3.454E-04	3.454E-04
Xe-132	8.010E-04	8.010E-04	8.010E-04	8.010E-04	8.010E-04	8.010E-04	8.010E-04
Ba-132	1.195E-09	1.195E-09	1.195E-09	1.195E-09	1.195E-09	1.195E-09	1.195E-09
Cs-133	8.715E-04	8.715E-04	8.715E-04	8.715E-04	8.715E-04	8.715E-04	8.715E-04
Xe-134	1.104E-03	1.104E-03	1.104E-03	1.104E-03	1.104E-03	1.104E-03	1.104E-03
Cs-134	7.380E-06	3.768E-06	1.924E-06	9.820E-07	3.582E-07	6.671E-08	0.00
Ba-134	9.761E-05	1.012E-04	1.031E-04	1.040E-04	1.046E-04	1.049E-04	1.050E-04
Cs-135	3.915E-04	3.915E-04	3.915E-04	3.915E-04	3.915E-04	3.915E-04	3.914E-04
Ba-135	2.666E-07	2.668E-07	2.670E-07	2.673E-07	2.676E-07	2.682E-07	3.838E-07
Xe-136	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03
Ba-136	1.584E-05	1.584E-05	1.584E-05	1.584E-05	1.584E-05	1.584E-05	1.584E-05
Cs-137	7.527E-04	7.187E-04	6.862E-04	6.552E-04	6.113E-04	5.446E-04	7.983E-14
Ba-137	1.788E-04	2.128E-04	2.452E-04	2.762E-04	3.201E-04	3.868E-04	9.315E-04
Ba-137m	1.151E-10	1.099E-10	1.050E-10	1.002E-10	9.353E-11	8.332E-11	1.221E-20
Ba-138	9.568E-04	9.568E-04	9.568E-04	9.568E-04	9.568E-04	9.568E-04	9.568E-04
La-138	4.300E-09	4.300E-09	4.300E-09	4.300E-09	4.300E-09	4.300E-09	4.300E-09
La-139	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04
Ce-140	9.287E-04	9.287E-04	9.287E-04	9.287E-04	9.287E-04	9.287E-04	9.287E-04

TABLE F.3.b. Fission Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Pr-141	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04
Ce-142	8.435E-04	8.435E-04	8.435E-04	8.435E-04	8.435E-04	8.435E-04	8.435E-04
Nd-142	1.693E-05	1.693E-05	1.693E-05	1.693E-05	1.693E-05	1.693E-05	1.693E-05
Nd-143	6.124E-04	6.124E-04	6.124E-04	6.124E-04	6.124E-04	6.124E-04	6.124E-04
Ce-144	5.547E-07	9.343E-08	1.574E-08	2.650E-09	1.832E-10	2.133E-12	0.00
Pr-144	2.342E-11	3.945E-12	6.644E-13	1.119E-13	7.735E-15	9.005E-17	0.00
Pr-144m	1.171E-13	1.972E-14	3.321E-15	5.594E-16	3.867E-17	4.502E-19	0.00
Nd-144	9.523E-04	9.528E-04	9.529E-04	9.529E-04	9.529E-04	9.529E-04	9.529E-04
Nd-145	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04
Nd-146	5.050E-04	5.050E-04	5.050E-04	5.050E-04	5.050E-04	5.050E-04	5.050E-04
Pm-146	1.602E-09	1.245E-09	9.676E-10	7.520E-10	5.153E-10	2.744E-10	0.00
Sm-146	7.219E-09	7.352E-09	7.454E-09	7.534E-09	7.622E-09	7.711E-09	7.812E-09
Pm-147	1.871E-05	1.103E-05	6.504E-06	3.834E-06	1.736E-06	4.632E-07	0.00
Sm-147	1.719E-04	1.795E-04	1.841E-04	1.867E-04	1.888E-04	1.901E-04	1.906E-04
Nd-148	2.785E-04	2.785E-04	2.785E-04	2.785E-04	2.785E-04	2.785E-04	2.785E-04
Sm-148	1.270E-04	1.270E-04	1.270E-04	1.270E-04	1.270E-04	1.270E-04	1.270E-04
Sm-149	1.698E-06	1.698E-06	1.698E-06	1.698E-06	1.698E-06	1.698E-06	1.698E-06
Nd-150	1.359E-04	1.359E-04	1.359E-04	1.359E-04	1.359E-04	1.359E-04	1.359E-04
Sm-150	1.797E-04	1.797E-04	1.797E-04	1.797E-04	1.797E-04	1.797E-04	1.797E-04
Eu-150	3.328E-13	3.202E-13	3.081E-13	2.965E-13	2.799E-13	2.542E-13	1.625E-21
Sm-151	1.002E-05	9.868E-06	9.717E-06	9.569E-06	9.350E-06	8.997E-06	4.742E-09
Eu-151	4.934E-07	6.466E-07	7.974E-07	9.460E-07	1.165E-06	1.518E-06	1.051E-05
Sm-152	1.032E-04	1.032E-04	1.032E-04	1.032E-04	1.032E-04	1.032E-04	1.033E-04
Eu-152	5.898E-08	5.327E-08	4.811E-08	4.344E-08	3.728E-08	2.890E-08	5.886E-30
Gd-152	3.520E-08	3.680E-08	3.823E-08	3.953E-08	4.125E-08	4.359E-08	5.164E-08
Eu-153	8.062E-05	8.062E-05	8.062E-05	8.062E-05	8.062E-05	8.062E-05	8.062E-05
Gd-153	2.600E-11	3.209E-12	3.961E-13	4.888E-14	2.119E-15	1.134E-17	0.00
Sm-154	2.873E-05	2.873E-05	2.873E-05	2.873E-05	2.873E-05	2.873E-05	2.873E-05
Eu-154	1.543E-05	1.314E-05	1.118E-05	9.517E-06	7.473E-06	4.994E-06	0.00
Gd-154	1.395E-05	1.624E-05	1.820E-05	1.986E-05	2.191E-05	2.439E-05	2.938E-05
Eu-155	3.865E-06	2.922E-06	2.210E-06	1.671E-06	1.099E-06	5.462E-07	0.00
Gd-155	5.202E-06	6.144E-06	6.857E-06	7.396E-06	7.968E-06	8.521E-06	9.067E-06
Gd-156	4.200E-05	4.200E-05	4.200E-05	4.200E-05	4.200E-05	4.200E-05	4.200E-05
Gd-157	6.365E-08	6.365E-08	6.365E-08	6.365E-08	6.365E-08	6.365E-08	6.365E-08
Gd-158	1.283E-05	1.283E-05	1.283E-05	1.283E-05	1.283E-05	1.283E-05	1.283E-05
Tb-159	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06
Gd-160	1.010E-06	1.010E-06	1.010E-06	1.010E-06	1.010E-06	1.010E-06	1.010E-06
Dy-160	1.989E-07	1.989E-07	1.989E-07	1.989E-07	1.989E-07	1.989E-07	1.989E-07
Dy-161	3.353E-07	3.353E-07	3.353E-07	3.353E-07	3.353E-07	3.353E-07	3.353E-07
Dy-162	2.968E-07	2.968E-07	2.968E-07	2.968E-07	2.968E-07	2.968E-07	2.968E-07
Dy-163	2.199E-07	2.199E-07	2.199E-07	2.199E-07	2.199E-07	2.199E-07	2.199E-07
Dy-164	3.342E-08	3.342E-08	3.342E-08	3.342E-08	3.342E-08	3.342E-08	3.342E-08
Ho-165	1.038E-07	1.038E-07	1.038E-07	1.038E-07	1.038E-07	1.038E-07	1.038E-07
Ho-166m	9.129E-10	9.119E-10	9.108E-10	9.098E-10	9.082E-10	9.056E-10	5.141E-10
Er-166	3.201E-08	3.201E-08	3.201E-08	3.201E-08	3.201E-08	3.201E-08	3.240E-08
Er-167	2.557E-09	2.557E-09	2.557E-09	2.557E-09	2.557E-09	2.557E-09	2.557E-09

TABLE F.3.b. Fission Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-168	6.062E-09	6.062E-09	6.062E-09	6.062E-09	6.062E-09	6.062E-09	6.062E-09
Tm-169	3.674E-11	3.674E-11	3.674E-11	3.674E-11	3.674E-11	3.674E-11	3.674E-11
Er-170	1.502E-14	1.502E-14	1.502E-14	1.502E-14	1.502E-14	1.502E-14	1.502E-14
Yb-170	1.004E-11	1.004E-11	1.004E-11	1.004E-11	1.004E-11	1.004E-11	1.004E-11
Tm-171	1.812E-14	8.803E-15	4.276E-15	2.077E-15	7.032E-16	1.157E-16	0.00
Yb-171	4.704E-13	4.797E-13	4.842E-13	4.864E-13	4.878E-13	4.884E-13	4.885E-13
Yb-172	1.688E-14	1.688E-14	1.688E-14	1.688E-14	1.688E-14	1.688E-14	1.688E-14
Total	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02

TABLE F.3.c. Fission Product Inventory by Isotope at 30 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	3.467E-08	3.099E-08	2.770E-08	2.476E-08	2.092E-08	1.580E-08	2.038E-32
Li-6	1.557E-10	1.557E-10	1.557E-10	1.557E-10	1.557E-10	1.557E-10	1.557E-10
Li-7	9.157E-12	9.157E-12	9.157E-12	9.157E-12	9.157E-12	9.157E-12	9.157E-12
Be-9	1.762E-11	1.762E-11	1.762E-11	1.762E-11	1.762E-11	1.762E-11	1.762E-11
Be-10	1.176E-10	1.176E-10	1.176E-10	1.176E-10	1.176E-10	1.176E-10	1.176E-10
C-14	2.376E-11	2.376E-11	2.375E-11	2.374E-11	2.374E-11	2.372E-11	2.107E-11
Zn-66	3.026E-14	3.026E-14	3.026E-14	3.026E-14	3.026E-14	3.026E-14	3.026E-14
Zn-67	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15
Ga-71	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13
Ge-72	2.165E-08	2.165E-08	2.165E-08	2.165E-08	2.165E-08	2.165E-08	2.165E-08
Ge-73	4.316E-08	4.316E-08	4.316E-08	4.316E-08	4.316E-08	4.316E-08	4.316E-08
Ge-74	9.139E-08	9.139E-08	9.139E-08	9.139E-08	9.139E-08	9.139E-08	9.139E-08
As-75	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07
Ge-76	4.478E-07	4.478E-07	4.478E-07	4.478E-07	4.478E-07	4.478E-07	4.478E-07
Se-76	5.172E-09	5.172E-09	5.172E-09	5.172E-09	5.172E-09	5.172E-09	5.172E-09
Se-77	9.093E-07	9.093E-07	9.093E-07	9.093E-07	9.093E-07	9.093E-07	9.093E-07
Se-78	2.192E-06	2.192E-06	2.192E-06	2.192E-06	2.192E-06	2.192E-06	2.192E-06
Se-79	5.272E-06	5.272E-06	5.272E-06	5.272E-06	5.272E-06	5.271E-06	5.217E-06
Br-79	5.278E-10	6.403E-10	7.528E-10	8.653E-10	1.034E-09	1.315E-09	5.615E-08
Se-80	1.188E-05	1.188E-05	1.188E-05	1.188E-05	1.188E-05	1.188E-05	1.188E-05
Kr-80	2.331E-10	2.331E-10	2.331E-10	2.331E-10	2.331E-10	2.331E-10	2.331E-10
Br-81	1.916E-05	1.916E-05	1.916E-05	1.916E-05	1.916E-05	1.916E-05	1.916E-05
Kr-81	2.369E-11	2.369E-11	2.369E-11	2.369E-11	2.369E-11	2.369E-11	2.361E-11
Se-82	2.942E-05	2.942E-05	2.942E-05	2.942E-05	2.942E-05	2.942E-05	2.942E-05
Kr-82	9.024E-07	9.024E-07	9.024E-07	9.024E-07	9.024E-07	9.024E-07	9.024E-07
Kr-83	3.537E-05	3.537E-05	3.537E-05	3.537E-05	3.537E-05	3.537E-05	3.537E-05
Kr-84	9.807E-05	9.807E-05	9.807E-05	9.807E-05	9.807E-05	9.807E-05	9.807E-05
Kr-85	1.222E-05	1.073E-05	9.433E-06	8.288E-06	6.827E-06	4.941E-06	1.497E-33
Rb-85	9.161E-05	9.309E-05	9.439E-05	9.554E-05	9.700E-05	9.888E-05	1.038E-04
Kr-86	1.614E-04	1.614E-04	1.614E-04	1.614E-04	1.614E-04	1.614E-04	1.614E-04
Sr-86	3.658E-07	3.658E-07	3.658E-07	3.658E-07	3.658E-07	3.658E-07	3.658E-07
Rb-87	2.067E-04	2.067E-04	2.067E-04	2.067E-04	2.067E-04	2.067E-04	2.067E-04
Sr-87	3.149E-09	3.149E-09	3.149E-09	3.149E-09	3.149E-09	3.149E-09	3.152E-09
Sr-88	2.962E-04	2.962E-04	2.962E-04	2.962E-04	2.962E-04	2.962E-04	2.962E-04
Y-89	3.854E-04	3.854E-04	3.854E-04	3.854E-04	3.854E-04	3.854E-04	3.854E-04
Sr-90	3.726E-04	3.553E-04	3.388E-04	3.230E-04	3.008E-04	2.670E-04	1.978E-14
Y-90	9.345E-08	8.910E-08	8.496E-08	8.101E-08	7.543E-08	6.697E-08	4.960E-18
Zr-90	9.591E-05	1.132E-04	1.298E-04	1.455E-04	1.678E-04	2.015E-04	4.686E-04
Y-91	8.842E-17	1.542E-20	2.688E-24	4.686E-28	1.079E-33	0.00	0.00
Zr-91	5.032E-04	5.032E-04	5.032E-04	5.032E-04	5.032E-04	5.032E-04	5.032E-04
Zr-92	5.510E-04	5.510E-04	5.510E-04	5.510E-04	5.510E-04	5.510E-04	5.510E-04
Zr-93	6.258E-04	6.258E-04	6.258E-04	6.258E-04	6.258E-04	6.258E-04	6.255E-04
Nb-93	6.867E-10	9.368E-10	1.218E-09	1.526E-09	2.035E-09	2.988E-09	2.792E-07
Nb-93m	2.014E-09	2.331E-09	2.618E-09	2.876E-09	3.218E-09	3.683E-09	5.283E-09
Zr-94	6.503E-04	6.503E-04	6.503E-04	6.503E-04	6.503E-04	6.503E-04	6.503E-04
Nb-94	7.835E-10	7.835E-10	7.834E-10	7.834E-10	7.833E-10	7.832E-10	7.574E-10

TABLE F.3.c. Fission Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	1.397E-15	5.108E-19	1.868E-22	6.828E-26	4.774E-31	0.00	0.00
Nb-95	1.704E-15	6.230E-19	2.278E-22	8.329E-26	4.352E-33	0.00	0.00
Mo-95	6.651E-04	6.651E-04	6.651E-04	6.651E-04	6.651E-04	6.651E-04	6.651E-04
Zr-96	7.104E-04	7.104E-04	7.104E-04	7.104E-04	7.104E-04	7.104E-04	7.104E-04
Mo-96	3.504E-05	3.504E-05	3.504E-05	3.504E-05	3.504E-05	3.504E-05	3.504E-05
Mo-97	7.103E-04	7.103E-04	7.103E-04	7.103E-04	7.103E-04	7.103E-04	7.103E-04
Mo-98	7.453E-04	7.453E-04	7.453E-04	7.453E-04	7.453E-04	7.453E-04	7.453E-04
Tc-98	5.842E-09	5.842E-09	5.842E-09	5.842E-09	5.842E-09	5.842E-09	5.841E-09
Tc-99	6.947E-04	6.947E-04	6.947E-04	6.947E-04	6.946E-04	6.946E-04	6.924E-04
Ru-99	2.097E-08	2.549E-08	3.002E-08	3.454E-08	4.132E-08	5.262E-08	2.264E-06
Mo-100	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04
Ru-100	8.825E-05	8.825E-05	8.825E-05	8.825E-05	8.825E-05	8.825E-05	8.825E-05
Ru-101	7.071E-04	7.071E-04	7.071E-04	7.071E-04	7.071E-04	7.071E-04	7.071E-04
Ru-102	7.178E-04	7.178E-04	7.178E-04	7.178E-04	7.178E-04	7.178E-04	7.178E-04
Rh-102	1.912E-10	1.185E-10	7.348E-11	4.556E-11	2.224E-11	6.732E-12	0.00
Rh-103	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04
Ru-104	5.330E-04	5.330E-04	5.330E-04	5.330E-04	5.330E-04	5.330E-04	5.330E-04
Pd-104	2.273E-04	2.273E-04	2.273E-04	2.273E-04	2.273E-04	2.273E-04	2.273E-04
Pd-105	3.955E-04	3.955E-04	3.955E-04	3.955E-04	3.955E-04	3.955E-04	3.955E-04
Ru-106	1.428E-06	3.610E-07	9.125E-08	2.306E-08	2.931E-09	9.415E-11	0.00
Rh-106	1.342E-12	3.393E-13	8.577E-14	2.168E-14	2.755E-15	8.849E-17	0.00
Pd-106	3.575E-04	3.586E-04	3.588E-04	3.589E-04	3.589E-04	3.589E-04	3.589E-04
Pd-107	2.304E-04	2.304E-04	2.304E-04	2.304E-04	2.304E-04	2.304E-04	2.304E-04
Ag-107	2.108E-10	2.599E-10	3.091E-10	3.583E-10	4.320E-10	5.549E-10	2.464E-08
Pd-108	1.596E-04	1.596E-04	1.596E-04	1.596E-04	1.596E-04	1.596E-04	1.596E-04
Ag-108m	1.268E-12	1.254E-12	1.240E-12	1.227E-12	1.207E-12	1.174E-12	5.585E-15
Cd-108	4.399E-10	4.399E-10	4.399E-10	4.399E-10	4.399E-10	4.399E-10	4.400E-10
Ag-109	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.034E-05
Cd-109	1.523E-14	5.113E-15	1.717E-15	5.765E-16	1.122E-16	7.330E-18	0.00
Pd-110	5.222E-05	5.222E-05	5.222E-05	5.222E-05	5.222E-05	5.222E-05	5.222E-05
Ag-110m	1.271E-09	1.676E-10	2.209E-11	2.912E-12	1.393E-13	8.792E-16	0.00
Cd-110	3.722E-05	3.722E-05	3.722E-05	3.722E-05	3.722E-05	3.722E-05	3.722E-05
Cd-111	2.867E-05	2.867E-05	2.867E-05	2.867E-05	2.867E-05	2.867E-05	2.867E-05
Cd-112	1.710E-05	1.710E-05	1.710E-05	1.710E-05	1.710E-05	1.710E-05	1.710E-05
Cd-113	1.484E-07	1.484E-07	1.484E-07	1.485E-07	1.485E-07	1.485E-07	1.486E-07
Cd-113m	1.876E-07	1.706E-07	1.551E-07	1.410E-07	1.223E-07	9.645E-08	5.797E-28
In-113	9.268E-08	1.097E-07	1.251E-07	1.392E-07	1.579E-07	1.837E-07	2.801E-07
Cd-114	2.263E-05	2.263E-05	2.263E-05	2.263E-05	2.263E-05	2.263E-05	2.263E-05
Sn-114	2.871E-09	2.871E-09	2.871E-09	2.871E-09	2.871E-09	2.871E-09	2.871E-09
In-115	2.310E-06	2.310E-06	2.310E-06	2.310E-06	2.310E-06	2.310E-06	2.310E-06
Sn-115	3.206E-07	3.206E-07	3.206E-07	3.206E-07	3.206E-07	3.206E-07	3.206E-07
Cd-116	8.196E-06	8.196E-06	8.196E-06	8.196E-06	8.196E-06	8.196E-06	8.196E-06
Sn-116	7.444E-06	7.444E-06	7.444E-06	7.444E-06	7.444E-06	7.444E-06	7.444E-06
Sn-117	8.286E-06	8.286E-06	8.286E-06	8.286E-06	8.286E-06	8.286E-06	8.286E-06
Sn-118	8.339E-06	8.339E-06	8.339E-06	8.339E-06	8.339E-06	8.339E-06	8.339E-06
Sn-119	8.320E-06	8.320E-06	8.320E-06	8.320E-06	8.320E-06	8.320E-06	8.320E-06

TABLE F.3.c. Fission Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	4.895E-11	6.199E-12	7.849E-13	9.940E-14	4.479E-15	2.555E-17	0.00
Sn-120	8.473E-06	8.473E-06	8.473E-06	8.473E-06	8.473E-06	8.473E-06	8.473E-06
Sn-121m	3.133E-09	3.047E-09	2.964E-09	2.883E-09	2.765E-09	2.580E-09	3.222E-15
Sb-121	8.225E-06	8.225E-06	8.225E-06	8.225E-06	8.226E-06	8.226E-06	8.228E-06
Sn-122	9.306E-06	9.306E-06	9.306E-06	9.306E-06	9.306E-06	9.306E-06	9.306E-06
Te-122	5.635E-07	5.635E-07	5.635E-07	5.635E-07	5.635E-07	5.635E-07	5.635E-07
Sn-123	1.467E-12	2.909E-14	5.772E-16	1.145E-17	3.202E-20	1.775E-24	0.00
Sb-123	1.011E-05	1.011E-05	1.011E-05	1.011E-05	1.011E-05	1.011E-05	1.011E-05
Te-123	7.538E-09	7.538E-09	7.538E-09	7.538E-09	7.538E-09	7.538E-09	7.538E-09
Te-123m	2.843E-15	4.133E-17	6.009E-19	8.740E-21	2.477E-23	6.312E-28	0.00
Sn-124	1.249E-05	1.249E-05	1.249E-05	1.249E-05	1.249E-05	1.249E-05	1.249E-05
Te-124	4.391E-07	4.391E-07	4.391E-07	4.391E-07	4.391E-07	4.391E-07	4.391E-07
Sb-125	2.155E-06	1.306E-06	7.919E-07	4.801E-07	2.266E-07	6.484E-08	0.00
Te-125	1.670E-05	1.756E-05	1.808E-05	1.840E-05	1.865E-05	1.882E-05	1.888E-05
Te-125m	3.014E-08	1.828E-08	1.108E-08	6.717E-09	3.170E-09	9.070E-10	0.00
Sn-126	2.707E-05	2.707E-05	2.707E-05	2.707E-05	2.707E-05	2.707E-05	2.689E-05
Sb-126	1.286E-12	1.286E-12	1.286E-12	1.286E-12	1.286E-12	1.286E-12	1.277E-12
Sb-126m	9.779E-15	9.778E-15	9.778E-15	9.778E-15	9.778E-15	9.778E-15	9.711E-15
Te-126	7.570E-07	7.574E-07	7.578E-07	7.581E-07	7.587E-07	7.596E-07	9.429E-07
Te-127	2.105E-15	2.023E-17	1.944E-19	1.867E-21	1.759E-24	1.591E-29	0.00
Te-127m	6.014E-13	5.779E-15	5.552E-17	5.335E-19	5.024E-22	4.546E-27	0.00
I-127	5.446E-05	5.446E-05	5.446E-05	5.446E-05	5.446E-05	5.446E-05	5.446E-05
Te-128	1.056E-04	1.056E-04	1.056E-04	1.056E-04	1.056E-04	1.056E-04	1.056E-04
Xe-128	3.053E-06	3.053E-06	3.053E-06	3.053E-06	3.053E-06	3.053E-06	3.053E-06
I-129	1.702E-04	1.702E-04	1.702E-04	1.702E-04	1.702E-04	1.702E-04	1.702E-04
Xe-129	1.728E-08	1.730E-08	1.731E-08	1.733E-08	1.735E-08	1.739E-08	2.475E-08
Te-130	3.320E-04	3.320E-04	3.320E-04	3.320E-04	3.320E-04	3.320E-04	3.320E-04
Xe-130	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05
Xe-131	3.912E-04	3.912E-04	3.912E-04	3.912E-04	3.912E-04	3.912E-04	3.912E-04
Xe-132	9.939E-04	9.939E-04	9.939E-04	9.939E-04	9.939E-04	9.939E-04	9.939E-04
Ba-132	1.737E-09	1.737E-09	1.737E-09	1.737E-09	1.737E-09	1.737E-09	1.737E-09
Cs-133	1.016E-03	1.016E-03	1.016E-03	1.016E-03	1.016E-03	1.016E-03	1.016E-03
Xe-134	1.323E-03	1.323E-03	1.323E-03	1.323E-03	1.323E-03	1.323E-03	1.323E-03
Cs-134	1.049E-05	5.358E-06	2.735E-06	1.396E-06	5.094E-07	9.485E-08	0.00
Ba-134	1.386E-04	1.438E-04	1.464E-04	1.477E-04	1.486E-04	1.490E-04	1.491E-04
Cs-135	4.207E-04	4.207E-04	4.207E-04	4.207E-04	4.207E-04	4.207E-04	4.206E-04
Ba-135	4.679E-07	4.682E-07	4.684E-07	4.687E-07	4.690E-07	4.697E-07	5.939E-07
Xe-136	1.973E-03	1.973E-03	1.973E-03	1.973E-03	1.973E-03	1.973E-03	1.973E-03
Ba-136	2.068E-05	2.068E-05	2.068E-05	2.068E-05	2.068E-05	2.068E-05	2.068E-05
Cs-137	9.039E-04	8.631E-04	8.241E-04	7.869E-04	7.342E-04	6.541E-04	9.587E-14
Ba-137	2.147E-04	2.555E-04	2.945E-04	3.317E-04	3.844E-04	4.645E-04	1.119E-03
Ba-137m	1.383E-10	1.320E-10	1.261E-10	1.204E-10	1.123E-10	1.001E-10	1.467E-20
Ba-138	1.140E-03	1.140E-03	1.140E-03	1.140E-03	1.140E-03	1.140E-03	1.140E-03
La-138	4.577E-09	4.577E-09	4.577E-09	4.577E-09	4.577E-09	4.577E-09	4.577E-09
La-139	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03
Ce-140	1.110E-03	1.110E-03	1.110E-03	1.110E-03	1.110E-03	1.110E-03	1.110E-03

TABLE F.3.c. Fission Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Pr-141	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04
Ce-142	1.003E-03	1.003E-03	1.003E-03	1.003E-03	1.003E-03	1.003E-03	1.003E-03
Nd-142	2.478E-05	2.478E-05	2.478E-05	2.478E-05	2.478E-05	2.478E-05	2.478E-05
Nd-143	6.789E-04	6.789E-04	6.789E-04	6.789E-04	6.789E-04	6.789E-04	6.789E-04
Ce-144	6.514E-07	1.097E-07	1.848E-08	3.112E-09	2.151E-10	2.504E-12	0.00
Pr-144	2.751E-11	4.633E-12	7.802E-13	1.314E-13	9.083E-15	1.057E-16	0.00
Pr-144m	1.375E-13	2.316E-14	3.900E-15	6.569E-16	4.541E-17	5.286E-19	0.00
Nd-144	1.172E-03	1.172E-03	1.173E-03	1.173E-03	1.173E-03	1.173E-03	1.173E-03
Nd-145	5.972E-04	5.972E-04	5.972E-04	5.972E-04	5.972E-04	5.972E-04	5.972E-04
Nd-146	6.153E-04	6.153E-04	6.153E-04	6.153E-04	6.153E-04	6.153E-04	6.153E-04
Pm-146	2.165E-09	1.683E-09	1.308E-09	1.017E-09	6.966E-10	3.709E-10	0.00
Sm-146	9.702E-09	9.881E-09	1.002E-08	1.013E-08	1.025E-08	1.037E-08	1.050E-08
Pm-147	1.996E-05	1.177E-05	6.938E-06	4.090E-06	1.851E-06	4.940E-07	0.00
Sm-147	1.816E-04	1.898E-04	1.947E-04	1.975E-04	1.997E-04	2.011E-04	2.016E-04
Nd-148	3.339E-04	3.339E-04	3.339E-04	3.339E-04	3.339E-04	3.339E-04	3.339E-04
Sm-148	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04
Sm-149	1.766E-06	1.766E-06	1.766E-06	1.766E-06	1.766E-06	1.766E-06	1.766E-06
Nd-150	1.660E-04	1.660E-04	1.660E-04	1.660E-04	1.660E-04	1.660E-04	1.660E-04
Sm-150	2.146E-04	2.146E-04	2.146E-04	2.146E-04	2.146E-04	2.146E-04	2.146E-04
Eu-150	3.606E-13	3.470E-13	3.339E-13	3.213E-13	3.033E-13	2.754E-13	1.758E-21
Sm-151	1.068E-05	1.052E-05	1.036E-05	1.020E-05	9.968E-06	9.591E-06	5.056E-09
Eu-151	5.213E-07	6.846E-07	8.454E-07	1.004E-06	1.237E-06	1.613E-06	1.120E-05
Sm-152	1.183E-04	1.183E-04	1.183E-04	1.183E-04	1.183E-04	1.183E-04	1.183E-04
Eu-152	5.306E-08	4.792E-08	4.328E-08	3.908E-08	3.354E-08	2.600E-08	5.297E-30
Gd-152	3.163E-08	3.306E-08	3.436E-08	3.552E-08	3.707E-08	3.917E-08	4.641E-08
Eu-153	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04
Gd-153	3.027E-11	3.736E-12	4.611E-13	5.690E-14	2.467E-15	1.321E-17	0.00
Sm-154	3.645E-05	3.645E-05	3.645E-05	3.645E-05	3.645E-05	3.645E-05	3.645E-05
Eu-154	2.172E-05	1.848E-05	1.573E-05	1.339E-05	1.051E-05	7.026E-06	0.00
Gd-154	1.965E-05	2.288E-05	2.563E-05	2.797E-05	3.085E-05	3.434E-05	4.136E-05
Eu-155	5.349E-06	4.045E-06	3.058E-06	2.312E-06	1.520E-06	7.559E-07	0.00
Gd-155	7.170E-06	8.474E-06	9.460E-06	1.021E-05	1.100E-05	1.176E-05	1.252E-05
Gd-156	6.435E-05	6.435E-05	6.435E-05	6.435E-05	6.435E-05	6.435E-05	6.435E-05
Gd-157	7.836E-08	7.836E-08	7.836E-08	7.836E-08	7.836E-08	7.836E-08	7.836E-08
Gd-158	1.771E-05	1.771E-05	1.771E-05	1.771E-05	1.771E-05	1.771E-05	1.771E-05
Tb-159	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06
Gd-160	1.334E-06	1.334E-06	1.334E-06	1.334E-06	1.334E-06	1.334E-06	1.334E-06
Tb-160	3.729E-17	3.390E-20	3.082E-23	2.802E-26	7.680E-31	0.00	0.00
Dy-160	3.048E-07	3.048E-07	3.048E-07	3.048E-07	3.048E-07	3.048E-07	3.048E-07
Dy-161	4.259E-07	4.259E-07	4.259E-07	4.259E-07	4.259E-07	4.259E-07	4.259E-07
Dy-162	3.886E-07	3.886E-07	3.886E-07	3.886E-07	3.886E-07	3.886E-07	3.886E-07
Dy-163	3.128E-07	3.128E-07	3.128E-07	3.128E-07	3.128E-07	3.128E-07	3.128E-07
Dy-164	4.587E-08	4.587E-08	4.587E-08	4.587E-08	4.587E-08	4.587E-08	4.587E-08
Ho-165	1.573E-07	1.573E-07	1.573E-07	1.573E-07	1.573E-07	1.573E-07	1.573E-07
Ho-166m	1.643E-09	1.641E-09	1.639E-09	1.637E-09	1.634E-09	1.629E-09	9.251E-10
Er-166	5.032E-08	5.032E-08	5.033E-08	5.033E-08	5.033E-08	5.034E-08	5.104E-08

TABLE F.3.c. Fission Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-167	3.226E-09	3.226E-09	3.226E-09	3.226E-09	3.226E-09	3.226E-09	3.226E-09
Er-168	8.938E-09	8.938E-09	8.938E-09	8.938E-09	8.938E-09	8.938E-09	8.938E-09
Tm-169	6.241E-11	6.241E-11	6.241E-11	6.241E-11	6.241E-11	6.241E-11	6.241E-11
Er-170	3.122E-14	3.122E-14	3.122E-14	3.122E-14	3.122E-14	3.122E-14	3.122E-14
Tm-170	4.268E-17	8.320E-19	1.621E-20	3.244E-22	9.755E-24	5.175E-28	0.00
Yb-170	2.076E-11	2.076E-11	2.076E-11	2.076E-11	2.076E-11	2.076E-11	2.076E-11
Tm-171	4.694E-14	2.280E-14	1.108E-14	5.380E-15	1.821E-15	2.996E-16	0.00
Yb-171	1.194E-12	1.219E-12	1.230E-12	1.236E-12	1.240E-12	1.241E-12	1.241E-12
Yb-172	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14	5.269E-14
Total	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02

TABLE F.3.d. Fission Product Inventory by Isotope at 35 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	4.112E-08	3.675E-08	3.285E-08	2.936E-08	2.481E-08	1.874E-08	2.417E-32
Li-6	1.565E-10	1.565E-10	1.565E-10	1.565E-10	1.565E-10	1.565E-10	1.565E-10
Li-7	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11
Be-9	2.052E-11	2.052E-11	2.052E-11	2.052E-11	2.052E-11	2.052E-11	2.052E-11
Be-10	1.370E-10	1.370E-10	1.370E-10	1.370E-10	1.370E-10	1.370E-10	1.369E-10
C-14	2.767E-11	2.767E-11	2.766E-11	2.765E-11	2.764E-11	2.763E-11	2.454E-11
Zn-66	3.358E-14	3.358E-14	3.358E-14	3.358E-14	3.358E-14	3.358E-14	3.358E-14
Zn-67	1.368E-15	1.368E-15	1.368E-15	1.368E-15	1.368E-15	1.368E-15	1.368E-15
Ga-71	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12
Ge-72	2.580E-08	2.580E-08	2.580E-08	2.580E-08	2.580E-08	2.580E-08	2.580E-08
Ge-73	5.040E-08	5.040E-08	5.040E-08	5.040E-08	5.040E-08	5.040E-08	5.040E-08
Ge-74	1.071E-07	1.071E-07	1.071E-07	1.071E-07	1.071E-07	1.071E-07	1.071E-07
As-75	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07
Ge-76	5.147E-07	5.147E-07	5.147E-07	5.147E-07	5.147E-07	5.147E-07	5.147E-07
Se-76	7.056E-09	7.056E-09	7.056E-09	7.056E-09	7.056E-09	7.056E-09	7.056E-09
Se-77	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06
Se-78	2.549E-06	2.549E-06	2.549E-06	2.549E-06	2.549E-06	2.549E-06	2.549E-06
Se-79	6.073E-06	6.073E-06	6.072E-06	6.072E-06	6.072E-06	6.072E-06	6.009E-06
Br-79	6.073E-10	7.369E-10	8.665E-10	9.961E-10	1.190E-09	1.514E-09	6.468E-08
Se-80	1.365E-05	1.365E-05	1.365E-05	1.365E-05	1.365E-05	1.365E-05	1.365E-05
Kr-80	2.835E-10	2.835E-10	2.835E-10	2.835E-10	2.835E-10	2.835E-10	2.835E-10
Br-81	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.177E-05
Kr-81	3.201E-11	3.201E-11	3.201E-11	3.201E-11	3.201E-11	3.201E-11	3.190E-11
Se-82	3.352E-05	3.352E-05	3.352E-05	3.352E-05	3.352E-05	3.352E-05	3.352E-05
Kr-82	1.198E-06	1.198E-06	1.198E-06	1.198E-06	1.198E-06	1.198E-06	1.198E-06
Kr-83	3.807E-05	3.807E-05	3.807E-05	3.807E-05	3.807E-05	3.807E-05	3.807E-05
Kr-84	1.133E-04	1.133E-04	1.133E-04	1.133E-04	1.133E-04	1.133E-04	1.133E-04
Kr-85	1.379E-05	1.212E-05	1.065E-05	9.357E-06	7.707E-06	5.578E-06	1.693E-33
Rb-85	1.033E-04	1.050E-04	1.065E-04	1.077E-04	1.094E-04	1.115E-04	1.171E-04
Kr-86	1.816E-04	1.816E-04	1.816E-04	1.816E-04	1.816E-04	1.816E-04	1.816E-04
Sr-86	4.940E-07	4.940E-07	4.940E-07	4.940E-07	4.940E-07	4.940E-07	4.940E-07
Rb-87	2.323E-04	2.323E-04	2.323E-04	2.323E-04	2.323E-04	2.323E-04	2.323E-04
Sr-87	4.518E-09	4.518E-09	4.518E-09	4.518E-09	4.518E-09	4.518E-09	4.521E-09
Sr-88	3.326E-04	3.326E-04	3.326E-04	3.326E-04	3.326E-04	3.326E-04	3.326E-04
Y-89	4.319E-04	4.319E-04	4.319E-04	4.319E-04	4.319E-04	4.319E-04	4.319E-04
Sr-90	4.176E-04	3.982E-04	3.797E-04	3.620E-04	3.371E-04	2.993E-04	2.217E-14
Y-90	1.047E-07	9.985E-08	9.521E-08	9.079E-08	8.453E-08	7.504E-08	5.559E-18
Zr-90	1.081E-04	1.275E-04	1.460E-04	1.636E-04	1.886E-04	2.264E-04	5.258E-04
Y-91	9.694E-17	1.690E-20	2.947E-24	5.138E-28	1.183E-33	0.00	0.00
Zr-91	5.668E-04	5.668E-04	5.668E-04	5.668E-04	5.668E-04	5.668E-04	5.668E-04
Zr-92	6.249E-04	6.249E-04	6.249E-04	6.249E-04	6.249E-04	6.249E-04	6.249E-04
Zr-93	7.117E-04	7.117E-04	7.117E-04	7.117E-04	7.117E-04	7.117E-04	7.114E-04
Nb-93	7.851E-10	1.070E-09	1.390E-09	1.741E-09	2.320E-09	3.405E-09	3.175E-07
Nb-93m	2.296E-09	2.656E-09	2.981E-09	3.274E-09	3.662E-09	4.191E-09	6.008E-09
Zr-94	7.468E-04	7.468E-04	7.468E-04	7.468E-04	7.468E-04	7.468E-04	7.468E-04
Nb-94	9.562E-10	9.561E-10	9.561E-10	9.560E-10	9.559E-10	9.557E-10	9.243E-10

TABLE F.3.d. Fission Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	1.593E-15	5.823E-19	2.129E-22	7.784E-26	5.442E-31	0.00	0.00
Nb-95	1.943E-15	7.103E-19	2.597E-22	9.495E-26	4.961E-33	0.00	0.00
Mo-95	7.572E-04	7.572E-04	7.572E-04	7.572E-04	7.572E-04	7.572E-04	7.572E-04
Zr-96	8.190E-04	8.190E-04	8.190E-04	8.190E-04	8.190E-04	8.190E-04	8.190E-04
Mo-96	4.818E-05	4.818E-05	4.818E-05	4.818E-05	4.818E-05	4.818E-05	4.818E-05
Mo-97	8.226E-04	8.226E-04	8.226E-04	8.226E-04	8.226E-04	8.226E-04	8.226E-04
Mo-98	8.678E-04	8.678E-04	8.678E-04	8.678E-04	8.678E-04	8.678E-04	8.678E-04
Tc-98	8.058E-09	8.058E-09	8.058E-09	8.058E-09	8.058E-09	8.058E-09	8.057E-09
Tc-99	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.891E-04
Ru-99	2.391E-08	2.906E-08	3.421E-08	3.937E-08	4.709E-08	5.997E-08	2.580E-06
Mo-100	9.855E-04	9.855E-04	9.855E-04	9.855E-04	9.855E-04	9.855E-04	9.855E-04
Ru-100	1.216E-04	1.216E-04	1.216E-04	1.216E-04	1.216E-04	1.216E-04	1.216E-04
Ru-101	8.233E-04	8.233E-04	8.233E-04	8.233E-04	8.233E-04	8.233E-04	8.233E-04
Ru-102	8.538E-04	8.538E-04	8.538E-04	8.538E-04	8.538E-04	8.538E-04	8.538E-04
Rh-102	2.599E-10	1.611E-10	9.990E-11	6.194E-11	3.024E-11	9.152E-12	0.00
Rh-103	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04
Ru-104	6.478E-04	6.478E-04	6.478E-04	6.478E-04	6.478E-04	6.478E-04	6.478E-04
Pd-104	3.093E-04	3.093E-04	3.093E-04	3.093E-04	3.093E-04	3.093E-04	3.093E-04
Pd-105	4.794E-04	4.794E-04	4.794E-04	4.794E-04	4.794E-04	4.794E-04	4.794E-04
Ru-106	1.789E-06	4.522E-07	1.143E-07	2.889E-08	3.671E-09	1.179E-10	0.00
Rh-106	1.681E-12	4.250E-13	1.074E-13	2.715E-14	3.451E-15	1.108E-16	0.00
Pd-106	4.546E-04	4.559E-04	4.563E-04	4.564E-04	4.564E-04	4.564E-04	4.564E-04
Pd-107	2.895E-04	2.895E-04	2.895E-04	2.895E-04	2.895E-04	2.895E-04	2.894E-04
Ag-107	2.642E-10	3.259E-10	3.877E-10	4.495E-10	5.422E-10	6.966E-10	3.096E-08
Pd-108	2.012E-04	2.012E-04	2.012E-04	2.012E-04	2.012E-04	2.012E-04	2.012E-04
Ag-108m	1.634E-12	1.617E-12	1.599E-12	1.582E-12	1.556E-12	1.514E-12	7.201E-15
Cd-108	6.483E-10	6.483E-10	6.483E-10	6.483E-10	6.484E-10	6.484E-10	6.485E-10
Ag-109	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.714E-05
Cd-109	2.619E-14	8.794E-15	2.953E-15	9.916E-16	1.930E-16	1.261E-17	0.00
Pd-110	6.598E-05	6.598E-05	6.598E-05	6.598E-05	6.598E-05	6.598E-05	6.598E-05
Ag-110m	1.855E-09	2.445E-10	3.223E-11	4.248E-12	2.033E-13	1.283E-15	0.00
Cd-110	5.468E-05	5.468E-05	5.468E-05	5.468E-05	5.468E-05	5.468E-05	5.468E-05
Cd-111	3.605E-05	3.605E-05	3.605E-05	3.605E-05	3.605E-05	3.605E-05	3.605E-05
Cd-112	2.136E-05	2.136E-05	2.136E-05	2.136E-05	2.136E-05	2.136E-05	2.136E-05
Cd-113	1.534E-07	1.535E-07	1.535E-07	1.535E-07	1.535E-07	1.536E-07	1.537E-07
Cd-113m	2.405E-07	2.187E-07	1.989E-07	1.809E-07	1.569E-07	1.237E-07	7.435E-28
In-113	1.173E-07	1.391E-07	1.589E-07	1.769E-07	2.009E-07	2.340E-07	3.576E-07
Cd-114	2.763E-05	2.763E-05	2.763E-05	2.763E-05	2.763E-05	2.763E-05	2.763E-05
Sn-114	4.237E-09	4.237E-09	4.237E-09	4.237E-09	4.237E-09	4.237E-09	4.237E-09
In-115	2.368E-06	2.368E-06	2.368E-06	2.368E-06	2.368E-06	2.368E-06	2.368E-06
Sn-115	3.825E-07	3.825E-07	3.825E-07	3.825E-07	3.825E-07	3.825E-07	3.825E-07
Cd-116	9.788E-06	9.788E-06	9.788E-06	9.788E-06	9.788E-06	9.788E-06	9.788E-06
Sn-116	9.384E-06	9.384E-06	9.384E-06	9.384E-06	9.384E-06	9.384E-06	9.384E-06
Sn-117	9.883E-06	9.883E-06	9.883E-06	9.883E-06	9.883E-06	9.883E-06	9.883E-06
Sn-118	9.946E-06	9.946E-06	9.946E-06	9.946E-06	9.946E-06	9.946E-06	9.946E-06
Sn-119	9.927E-06	9.927E-06	9.927E-06	9.927E-06	9.927E-06	9.927E-06	9.927E-06

TABLE F.3.d. Fission Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	6.143E-11	7.778E-12	9.849E-13	1.247E-13	5.620E-15	3.207E-17	0.00
Sn-120	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05	1.010E-05
Sn-121m	3.799E-09	3.695E-09	3.594E-09	3.496E-09	3.353E-09	3.129E-09	3.907E-15
Sb-121	9.669E-06	9.669E-06	9.670E-06	9.670E-06	9.670E-06	9.670E-06	9.673E-06
Sn-122	1.108E-05	1.108E-05	1.108E-05	1.108E-05	1.108E-05	1.108E-05	1.108E-05
Te-122	7.905E-07	7.905E-07	7.905E-07	7.905E-07	7.905E-07	7.905E-07	7.905E-07
Sn-123	1.754E-12	3.480E-14	6.903E-16	1.370E-17	3.826E-20	2.121E-24	0.00
Sb-123	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.193E-05
Te-123	1.146E-08	1.146E-08	1.146E-08	1.146E-08	1.146E-08	1.146E-08	1.146E-08
Te-123m	4.827E-15	7.019E-17	1.020E-18	1.484E-20	2.131E-23	5.430E-28	0.00
Sn-124	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05
Te-124	6.221E-07	6.221E-07	6.221E-07	6.221E-07	6.221E-07	6.221E-07	6.221E-07
Sb-125	2.584E-06	1.567E-06	9.498E-07	5.758E-07	2.718E-07	7.777E-08	0.00
Te-125	1.996E-05	2.100E-05	2.162E-05	2.200E-05	2.231E-05	2.251E-05	2.258E-05
Te-125m	3.615E-08	2.192E-08	1.329E-08	8.056E-09	3.802E-09	1.088E-09	0.00
Sn-126	3.235E-05	3.235E-05	3.234E-05	3.234E-05	3.234E-05	3.234E-05	3.212E-05
Sb-126	1.537E-12	1.537E-12	1.537E-12	1.537E-12	1.537E-12	1.537E-12	1.526E-12
Sb-126m	1.168E-14	1.168E-14	1.168E-14	1.168E-14	1.168E-14	1.168E-14	1.160E-14
Te-126	9.516E-07	9.520E-07	9.525E-07	9.529E-07	9.536E-07	9.547E-07	1.174E-06
Te-127	2.536E-15	2.437E-17	2.341E-19	2.249E-21	2.118E-24	1.917E-29	0.00
Te-127m	7.245E-13	6.960E-15	6.688E-17	6.425E-19	6.051E-22	5.476E-27	0.00
I-127	6.469E-05	6.469E-05	6.469E-05	6.469E-05	6.469E-05	6.469E-05	6.469E-05
Te-128	1.254E-04	1.254E-04	1.254E-04	1.254E-04	1.254E-04	1.254E-04	1.254E-04
Xe-128	4.357E-06	4.357E-06	4.357E-06	4.357E-06	4.357E-06	4.357E-06	4.357E-06
I-129	1.997E-04	1.997E-04	1.997E-04	1.997E-04	1.997E-04	1.997E-04	1.997E-04
Xe-129	2.913E-08	2.915E-08	2.917E-08	2.918E-08	2.921E-08	2.925E-08	3.789E-08
Te-130	3.921E-04	3.921E-04	3.921E-04	3.921E-04	3.921E-04	3.921E-04	3.921E-04
Xe-130	1.678E-05	1.678E-05	1.678E-05	1.678E-05	1.678E-05	1.678E-05	1.678E-05
Xe-131	4.295E-04	4.295E-04	4.295E-04	4.295E-04	4.295E-04	4.295E-04	4.295E-04
Xe-132	1.196E-03	1.196E-03	1.196E-03	1.196E-03	1.196E-03	1.196E-03	1.196E-03
Ba-132	2.387E-09	2.387E-09	2.387E-09	2.387E-09	2.387E-09	2.387E-09	2.387E-09
Cs-133	1.150E-03	1.150E-03	1.150E-03	1.150E-03	1.150E-03	1.150E-03	1.150E-03
Xe-134	1.540E-03	1.540E-03	1.540E-03	1.540E-03	1.540E-03	1.540E-03	1.540E-03
Cs-134	1.407E-05	7.182E-06	3.667E-06	1.872E-06	6.828E-07	1.272E-07	0.00
Ba-134	1.860E-04	1.929E-04	1.964E-04	1.982E-04	1.994E-04	1.999E-04	2.000E-04
Cs-135	4.466E-04	4.466E-04	4.466E-04	4.466E-04	4.466E-04	4.466E-04	4.464E-04
Ba-135	7.556E-07	7.559E-07	7.561E-07	7.564E-07	7.568E-07	7.575E-07	8.893E-07
Xe-136	2.360E-03	2.360E-03	2.360E-03	2.360E-03	2.360E-03	2.360E-03	2.360E-03
Ba-136	2.593E-05	2.593E-05	2.593E-05	2.593E-05	2.593E-05	2.593E-05	2.593E-05
Cs-137	1.055E-03	1.008E-03	9.620E-04	9.186E-04	8.571E-04	7.636E-04	1.119E-13
Ba-137	2.506E-04	2.982E-04	3.437E-04	3.872E-04	4.487E-04	5.422E-04	1.306E-03
Ba-137m	1.614E-10	1.541E-10	1.472E-10	1.405E-10	1.311E-10	1.168E-10	1.712E-20
Ba-138	1.321E-03	1.321E-03	1.321E-03	1.321E-03	1.321E-03	1.321E-03	1.321E-03
La-138	4.723E-09	4.723E-09	4.723E-09	4.723E-09	4.723E-09	4.723E-09	4.723E-09
La-139	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03
Ce-140	1.291E-03	1.291E-03	1.291E-03	1.291E-03	1.291E-03	1.291E-03	1.291E-03

TABLE F.3.d. Fission Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Pr-141	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03
Ce-142	1.160E-03	1.160E-03	1.160E-03	1.160E-03	1.160E-03	1.160E-03	1.160E-03
Nd-142	3.430E-05	3.430E-05	3.430E-05	3.430E-05	3.430E-05	3.430E-05	3.430E-05
Nd-143	7.306E-04	7.306E-04	7.306E-04	7.306E-04	7.306E-04	7.306E-04	7.306E-04
Ce-144	7.446E-07	1.254E-07	2.112E-08	3.558E-09	2.459E-10	2.863E-12	0.00
Pr-144	3.144E-11	5.296E-12	8.919E-13	1.502E-13	1.038E-14	1.209E-16	0.00
Pr-144m	1.572E-13	2.647E-14	4.459E-15	7.509E-16	5.190E-17	6.042E-19	0.00
Nd-144	1.400E-03	1.401E-03	1.401E-03	1.401E-03	1.401E-03	1.401E-03	1.401E-03
Nd-145	6.743E-04	6.743E-04	6.743E-04	6.743E-04	6.743E-04	6.743E-04	6.743E-04
Nd-146	7.294E-04	7.294E-04	7.294E-04	7.294E-04	7.294E-04	7.294E-04	7.294E-04
Pm-146	2.773E-09	2.156E-09	1.675E-09	1.302E-09	8.921E-10	4.751E-10	0.00
Sm-146	1.233E-08	1.256E-08	1.274E-08	1.288E-08	1.303E-08	1.318E-08	1.336E-08
Pm-147	2.079E-05	1.226E-05	7.227E-06	4.260E-06	1.928E-06	5.146E-07	0.00
Sm-147	1.869E-04	1.954E-04	2.004E-04	2.034E-04	2.057E-04	2.072E-04	2.077E-04
Nd-148	3.893E-04	3.893E-04	3.893E-04	3.893E-04	3.893E-04	3.893E-04	3.893E-04
Sm-148	2.058E-04	2.058E-04	2.058E-04	2.058E-04	2.058E-04	2.058E-04	2.058E-04
Sm-149	1.860E-06	1.860E-06	1.860E-06	1.860E-06	1.860E-06	1.860E-06	1.860E-06
Nd-150	1.967E-04	1.967E-04	1.967E-04	1.967E-04	1.967E-04	1.967E-04	1.967E-04
Sm-150	2.488E-04	2.488E-04	2.488E-04	2.488E-04	2.488E-04	2.488E-04	2.488E-04
Eu-150	3.851E-13	3.706E-13	3.566E-13	3.431E-13	3.238E-13	2.941E-13	1.880E-21
Sm-151	1.138E-05	1.121E-05	1.104E-05	1.087E-05	1.062E-05	1.022E-05	5.386E-09
Eu-151	5.522E-07	7.262E-07	8.975E-07	1.066E-06	1.314E-06	1.716E-06	1.193E-05
Sm-152	1.313E-04	1.313E-04	1.313E-04	1.314E-04	1.314E-04	1.314E-04	1.314E-04
Eu-152	4.740E-08	4.280E-08	3.866E-08	3.491E-08	2.996E-08	2.322E-08	4.732E-30
Gd-152	2.818E-08	2.946E-08	3.062E-08	3.166E-08	3.304E-08	3.492E-08	4.139E-08
Eu-153	1.207E-04	1.207E-04	1.207E-04	1.207E-04	1.207E-04	1.207E-04	1.207E-04
Gd-153	3.380E-11	4.172E-12	5.148E-13	6.354E-14	2.755E-15	1.474E-17	0.00
Sm-154	4.468E-05	4.468E-05	4.468E-05	4.468E-05	4.468E-05	4.468E-05	4.468E-05
Eu-154	2.838E-05	2.416E-05	2.056E-05	1.750E-05	1.374E-05	9.184E-06	0.00
Gd-154	2.575E-05	2.997E-05	3.357E-05	3.663E-05	4.039E-05	4.495E-05	5.413E-05
Eu-155	6.990E-06	5.285E-06	3.996E-06	3.022E-06	1.987E-06	9.878E-07	0.00
Gd-155	9.344E-06	1.105E-05	1.234E-05	1.331E-05	1.435E-05	1.535E-05	1.633E-05
Gd-156	9.393E-05	9.393E-05	9.393E-05	9.393E-05	9.393E-05	9.393E-05	9.393E-05
Gd-157	9.749E-08	9.749E-08	9.749E-08	9.749E-08	9.749E-08	9.749E-08	9.749E-08
Gd-158	2.372E-05	2.372E-05	2.372E-05	2.372E-05	2.372E-05	2.372E-05	2.372E-05
Tb-159	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06
Gd-160	1.687E-06	1.687E-06	1.687E-06	1.687E-06	1.687E-06	1.687E-06	1.687E-06
Tb-160	5.627E-17	5.115E-20	4.650E-23	4.227E-26	1.159E-30	0.00	0.00
Dy-160	4.354E-07	4.354E-07	4.354E-07	4.354E-07	4.354E-07	4.354E-07	4.354E-07
Dy-161	5.254E-07	5.254E-07	5.254E-07	5.254E-07	5.254E-07	5.254E-07	5.254E-07
Dy-162	4.879E-07	4.879E-07	4.879E-07	4.879E-07	4.879E-07	4.879E-07	4.879E-07
Dy-163	4.222E-07	4.222E-07	4.222E-07	4.222E-07	4.222E-07	4.222E-07	4.222E-07
Dy-164	6.074E-08	6.074E-08	6.074E-08	6.074E-08	6.074E-08	6.074E-08	6.074E-08
Ho-165	2.280E-07	2.280E-07	2.280E-07	2.280E-07	2.280E-07	2.280E-07	2.280E-07
Ho-166m	2.766E-09	2.763E-09	2.760E-09	2.756E-09	2.752E-09	2.744E-09	1.558E-09
Er-166	7.651E-08	7.651E-08	7.652E-08	7.652E-08	7.653E-08	7.653E-08	7.772E-08

TABLE F.3.d. Fission Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-167	4.136E-09	4.136E-09	4.136E-09	4.136E-09	4.136E-09	4.136E-09	4.136E-09
Er-168	1.275E-08	1.275E-08	1.275E-08	1.275E-08	1.275E-08	1.275E-08	1.275E-08
Tm-169	9.901E-11	9.901E-11	9.901E-11	9.901E-11	9.901E-11	9.901E-11	9.901E-11
Er-170	5.858E-14	5.858E-14	5.858E-14	5.858E-14	5.858E-14	5.858E-14	5.858E-14
Tm-170	8.102E-17	1.579E-18	3.078E-20	5.959E-22	0.00	0.00	0.00
Yb-170	3.874E-11	3.874E-11	3.874E-11	3.874E-11	3.874E-11	3.874E-11	3.874E-11
Tm-171	1.066E-13	5.178E-14	2.515E-14	1.222E-14	4.137E-15	6.803E-16	0.00
Yb-171	2.656E-12	2.711E-12	2.737E-12	2.750E-12	2.758E-12	2.762E-12	2.762E-12
Yb-172	1.398E-13	1.398E-13	1.398E-13	1.398E-13	1.398E-13	1.398E-13	1.398E-13
Total	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02

TABLE F.3.e. Fission Product Inventory by Isotope at 40 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	4.768E-08	4.262E-08	3.809E-08	3.405E-08	2.877E-08	2.173E-08	2.806E-32
Li-6	1.551E-10	1.551E-10	1.551E-10	1.551E-10	1.551E-10	1.551E-10	1.551E-10
Li-7	1.217E-11	1.217E-11	1.217E-11	1.217E-11	1.217E-11	1.217E-11	1.217E-11
Be-9	2.340E-11	2.340E-11	2.340E-11	2.340E-11	2.340E-11	2.340E-11	2.340E-11
Be-10	1.563E-10	1.563E-10	1.563E-10	1.563E-10	1.563E-10	1.563E-10	1.563E-10
C-14	3.158E-11	3.157E-11	3.156E-11	3.155E-11	3.154E-11	3.152E-11	2.800E-11
Zn-66	3.659E-14	3.659E-14	3.659E-14	3.659E-14	3.659E-14	3.659E-14	3.659E-14
Zn-67	1.480E-15	1.480E-15	1.480E-15	1.480E-15	1.480E-15	1.480E-15	1.480E-15
Ga-71	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12
Ge-72	3.006E-08	3.006E-08	3.006E-08	3.006E-08	3.006E-08	3.006E-08	3.006E-08
Ge-73	5.761E-08	5.761E-08	5.761E-08	5.761E-08	5.761E-08	5.761E-08	5.761E-08
Ge-74	1.230E-07	1.230E-07	1.230E-07	1.230E-07	1.230E-07	1.230E-07	1.230E-07
As-75	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07
Ge-76	5.801E-07	5.801E-07	5.801E-07	5.801E-07	5.801E-07	5.801E-07	5.801E-07
Se-76	9.218E-09	9.218E-09	9.218E-09	9.218E-09	9.218E-09	9.218E-09	9.218E-09
Se-77	1.146E-06	1.146E-06	1.146E-06	1.146E-06	1.146E-06	1.146E-06	1.146E-06
Se-78	2.904E-06	2.904E-06	2.904E-06	2.904E-06	2.904E-06	2.904E-06	2.904E-06
Se-79	6.855E-06	6.855E-06	6.855E-06	6.855E-06	6.855E-06	6.854E-06	6.783E-06
Br-79	6.847E-10	8.309E-10	9.772E-10	1.124E-09	1.343E-09	1.709E-09	7.301E-08
Se-80	1.537E-05	1.537E-05	1.537E-05	1.537E-05	1.537E-05	1.537E-05	1.537E-05
Kr-80	3.349E-10	3.349E-10	3.349E-10	3.349E-10	3.349E-10	3.349E-10	3.349E-10
Br-81	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.424E-05
Kr-81	4.174E-11	4.174E-11	4.174E-11	4.174E-11	4.174E-11	4.174E-11	4.160E-11
Se-82	3.747E-05	3.747E-05	3.747E-05	3.747E-05	3.747E-05	3.747E-05	3.747E-05
Kr-82	1.527E-06	1.527E-06	1.527E-06	1.527E-06	1.527E-06	1.527E-06	1.527E-06
Kr-83	4.015E-05	4.015E-05	4.015E-05	4.015E-05	4.015E-05	4.015E-05	4.015E-05
Kr-84	1.283E-04	1.283E-04	1.283E-04	1.283E-04	1.283E-04	1.283E-04	1.283E-04
Kr-85	1.528E-05	1.343E-05	1.180E-05	1.037E-05	8.540E-06	6.181E-06	1.871E-33
Rb-85	1.143E-04	1.162E-04	1.178E-04	1.193E-04	1.211E-04	1.234E-04	1.296E-04
Kr-86	2.006E-04	2.006E-04	2.006E-04	2.006E-04	2.006E-04	2.006E-04	2.006E-04
Sr-86	6.409E-07	6.409E-07	6.409E-07	6.409E-07	6.409E-07	6.409E-07	6.409E-07
Rb-87	2.562E-04	2.562E-04	2.562E-04	2.562E-04	2.562E-04	2.562E-04	2.562E-04
Sr-87	6.273E-09	6.273E-09	6.273E-09	6.273E-09	6.273E-09	6.273E-09	6.277E-09
Sr-88	3.666E-04	3.666E-04	3.666E-04	3.666E-04	3.666E-04	3.666E-04	3.666E-04
Y-89	4.750E-04	4.750E-04	4.750E-04	4.750E-04	4.750E-04	4.750E-04	4.750E-04
Sr-90	4.594E-04	4.380E-04	4.177E-04	3.982E-04	3.708E-04	3.292E-04	2.438E-14
Y-90	1.152E-07	1.098E-07	1.047E-07	9.987E-08	9.298E-08	8.255E-08	6.115E-18
Zr-90	1.195E-04	1.408E-04	1.612E-04	1.806E-04	2.081E-04	2.497E-04	5.790E-04
Y-91	1.048E-16	1.827E-20	3.186E-24	5.554E-28	1.279E-33	0.00	0.00
Zr-91	6.266E-04	6.266E-04	6.266E-04	6.266E-04	6.266E-04	6.266E-04	6.266E-04
Zr-92	6.953E-04	6.953E-04	6.953E-04	6.953E-04	6.953E-04	6.953E-04	6.953E-04
Zr-93	7.940E-04	7.940E-04	7.940E-04	7.940E-04	7.940E-04	7.940E-04	7.936E-04
Nb-93	8.801E-10	1.198E-09	1.556E-09	1.948E-09	2.595E-09	3.805E-09	3.542E-07
Nb-93m	2.566E-09	2.967E-09	3.329E-09	3.656E-09	4.089E-09	4.677E-09	6.702E-09
Zr-94	8.411E-04	8.411E-04	8.411E-04	8.411E-04	8.411E-04	8.411E-04	8.411E-04
Nb-94	1.131E-09	1.131E-09	1.131E-09	1.131E-09	1.131E-09	1.131E-09	1.094E-09

TABLE F.3.e. Fission Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	1.783E-15	6.521E-19	2.384E-22	8.717E-26	6.094E-31	0.00	0.00
Nb-95	2.175E-15	7.953E-19	2.908E-22	1.063E-25	5.555E-33	0.00	0.00
Mo-95	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04	8.448E-04
Zr-96	9.257E-04	9.257E-04	9.257E-04	9.257E-04	9.257E-04	9.257E-04	9.257E-04
Mo-96	6.344E-05	6.344E-05	6.344E-05	6.344E-05	6.344E-05	6.344E-05	6.344E-05
Mo-97	9.336E-04	9.336E-04	9.336E-04	9.336E-04	9.336E-04	9.336E-04	9.336E-04
Mo-98	9.899E-04	9.899E-04	9.899E-04	9.899E-04	9.899E-04	9.899E-04	9.899E-04
Tc-98	1.064E-08	1.064E-08	1.064E-08	1.064E-08	1.064E-08	1.064E-08	1.064E-08
Tc-99	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.804E-04
Ru-99	2.669E-08	3.243E-08	3.818E-08	4.393E-08	5.255E-08	6.692E-08	2.879E-06
Mo-100	1.126E-03	1.126E-03	1.126E-03	1.126E-03	1.126E-03	1.126E-03	1.126E-03
Ru-100	1.602E-04	1.602E-04	1.602E-04	1.602E-04	1.602E-04	1.602E-04	1.602E-04
Ru-101	9.384E-04	9.384E-04	9.384E-04	9.384E-04	9.384E-04	9.384E-04	9.384E-04
Ru-102	9.937E-04	9.937E-04	9.937E-04	9.937E-04	9.937E-04	9.937E-04	9.937E-04
Rh-102	3.367E-10	2.088E-10	1.294E-10	8.026E-11	3.918E-11	1.186E-11	0.00
Rh-103	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04
Ru-104	7.675E-04	7.675E-04	7.675E-04	7.675E-04	7.675E-04	7.675E-04	7.675E-04
Pd-104	4.016E-04	4.016E-04	4.016E-04	4.016E-04	4.016E-04	4.016E-04	4.016E-04
Pd-105	5.652E-04	5.652E-04	5.652E-04	5.652E-04	5.652E-04	5.652E-04	5.652E-04
Ru-106	2.170E-06	5.484E-07	1.386E-07	3.504E-08	4.452E-09	1.430E-10	0.00
Rh-106	2.039E-12	5.155E-13	1.303E-13	3.293E-14	4.185E-15	1.344E-16	0.00
Pd-106	5.606E-04	5.622E-04	5.626E-04	5.627E-04	5.628E-04	5.628E-04	5.628E-04
Pd-107	3.522E-04	3.522E-04	3.522E-04	3.522E-04	3.522E-04	3.522E-04	3.521E-04
Ag-107	3.206E-10	3.958E-10	4.709E-10	5.461E-10	6.588E-10	8.467E-10	3.767E-08
Pd-108	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04
Ag-108m	2.040E-12	2.018E-12	1.996E-12	1.974E-12	1.942E-12	1.890E-12	8.988E-15
Cd-108	9.041E-10	9.041E-10	9.041E-10	9.041E-10	9.041E-10	9.041E-10	9.043E-10
Ag-109	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.137E-04
Cd-109	4.155E-14	1.395E-14	4.686E-15	1.573E-15	3.062E-16	2.001E-17	0.00
Pd-110	8.075E-05	8.075E-05	8.075E-05	8.075E-05	8.075E-05	8.075E-05	8.075E-05
Ag-110m	2.549E-09	3.361E-10	4.430E-11	5.840E-12	2.795E-13	1.764E-15	0.00
Cd-110	7.599E-05	7.599E-05	7.599E-05	7.599E-05	7.599E-05	7.599E-05	7.599E-05
Cd-111	4.409E-05	4.409E-05	4.409E-05	4.409E-05	4.409E-05	4.409E-05	4.409E-05
Cd-112	2.598E-05	2.598E-05	2.598E-05	2.598E-05	2.598E-05	2.598E-05	2.598E-05
Cd-113	1.573E-07	1.573E-07	1.573E-07	1.574E-07	1.574E-07	1.574E-07	1.576E-07
Cd-113m	3.010E-07	2.737E-07	2.489E-07	2.263E-07	1.963E-07	1.548E-07	9.302E-28
In-113	1.449E-07	1.722E-07	1.970E-07	2.195E-07	2.496E-07	2.910E-07	4.456E-07
Cd-114	3.286E-05	3.286E-05	3.286E-05	3.286E-05	3.286E-05	3.286E-05	3.286E-05
Sn-114	5.967E-09	5.967E-09	5.967E-09	5.967E-09	5.967E-09	5.967E-09	5.967E-09
In-115	2.416E-06	2.416E-06	2.416E-06	2.416E-06	2.416E-06	2.416E-06	2.416E-06
Sn-115	4.459E-07	4.459E-07	4.459E-07	4.459E-07	4.459E-07	4.459E-07	4.459E-07
Cd-116	1.143E-05	1.143E-05	1.143E-05	1.143E-05	1.143E-05	1.143E-05	1.143E-05
Sn-116	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05	1.142E-05
Sn-117	1.153E-05	1.153E-05	1.153E-05	1.153E-05	1.153E-05	1.153E-05	1.153E-05
Sn-118	1.160E-05	1.160E-05	1.160E-05	1.160E-05	1.160E-05	1.160E-05	1.160E-05
Sn-119	1.158E-05	1.158E-05	1.158E-05	1.158E-05	1.158E-05	1.158E-05	1.158E-05

TABLE F.3.e. Fission Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	7.503E-11	9.500E-12	1.203E-12	1.523E-13	6.864E-15	3.917E-17	0.00
Sn-120	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.178E-05	1.178E-05
Sn-121m	4.484E-09	4.361E-09	4.242E-09	4.126E-09	3.958E-09	3.692E-09	4.611E-15
Sb-121	1.111E-05	1.111E-05	1.111E-05	1.111E-05	1.111E-05	1.111E-05	1.111E-05
Sn-122	1.289E-05	1.289E-05	1.289E-05	1.289E-05	1.289E-05	1.289E-05	1.289E-05
Te-122	1.061E-06	1.061E-06	1.061E-06	1.061E-06	1.061E-06	1.061E-06	1.061E-06
Sn-123	2.044E-12	4.054E-14	8.043E-16	1.596E-17	4.459E-20	2.472E-24	0.00
Sb-123	1.376E-05	1.376E-05	1.376E-05	1.376E-05	1.376E-05	1.376E-05	1.376E-05
Te-123	1.642E-08	1.642E-08	1.642E-08	1.642E-08	1.642E-08	1.642E-08	1.642E-08
Te-123m	7.631E-15	1.109E-16	1.613E-18	2.346E-20	3.365E-23	8.577E-28	0.00
Sn-124	1.719E-05	1.719E-05	1.719E-05	1.719E-05	1.719E-05	1.719E-05	1.719E-05
Te-124	8.437E-07	8.437E-07	8.437E-07	8.437E-07	8.437E-07	8.437E-07	8.437E-07
Sb-125	3.024E-06	1.833E-06	1.111E-06	6.737E-07	3.180E-07	9.100E-08	0.00
Te-125	2.331E-05	2.452E-05	2.525E-05	2.569E-05	2.605E-05	2.628E-05	2.638E-05
Te-125m	4.230E-08	2.565E-08	1.555E-08	9.426E-09	4.448E-09	1.273E-09	0.00
Sn-126	3.774E-05	3.774E-05	3.774E-05	3.774E-05	3.774E-05	3.774E-05	3.748E-05
Sb-126	1.793E-12	1.793E-12	1.793E-12	1.793E-12	1.793E-12	1.793E-12	1.781E-12
Sb-126m	1.363E-14	1.363E-14	1.363E-14	1.363E-14	1.363E-14	1.363E-14	1.354E-14
Te-126	1.166E-06	1.166E-06	1.167E-06	1.167E-06	1.168E-06	1.170E-06	1.425E-06
Te-127	2.971E-15	2.855E-17	2.743E-19	2.635E-21	2.482E-24	2.245E-29	0.00
Te-127m	8.487E-13	8.154E-15	7.834E-17	7.527E-19	7.089E-22	6.414E-27	0.00
I-127	7.495E-05	7.495E-05	7.495E-05	7.495E-05	7.495E-05	7.495E-05	7.495E-05
Te-128	1.455E-04	1.455E-04	1.455E-04	1.455E-04	1.455E-04	1.455E-04	1.455E-04
Xe-128	5.934E-06	5.934E-06	5.934E-06	5.934E-06	5.934E-06	5.934E-06	5.934E-06
I-129	2.288E-04	2.288E-04	2.288E-04	2.288E-04	2.288E-04	2.288E-04	2.288E-04
Xe-129	4.592E-08	4.594E-08	4.596E-08	4.598E-08	4.601E-08	4.606E-08	5.596E-08
Te-130	4.529E-04	4.529E-04	4.529E-04	4.529E-04	4.529E-04	4.529E-04	4.529E-04
Xe-130	2.256E-05	2.256E-05	2.256E-05	2.256E-05	2.256E-05	2.256E-05	2.256E-05
Xe-131	4.614E-04	4.614E-04	4.614E-04	4.614E-04	4.614E-04	4.614E-04	4.614E-04
Xe-132	1.407E-03	1.407E-03	1.407E-03	1.407E-03	1.407E-03	1.407E-03	1.407E-03
Ba-132	3.138E-09	3.138E-09	3.138E-09	3.138E-09	3.138E-09	3.138E-09	3.138E-09
Cs-133	1.275E-03	1.275E-03	1.275E-03	1.275E-03	1.275E-03	1.275E-03	1.275E-03
Xe-134	1.758E-03	1.758E-03	1.758E-03	1.758E-03	1.758E-03	1.758E-03	1.758E-03
Cs-134	1.800E-05	9.188E-06	4.690E-06	2.395E-06	8.735E-07	1.627E-07	0.00
Ba-134	2.386E-04	2.474E-04	2.519E-04	2.542E-04	2.557E-04	2.564E-04	2.566E-04
Cs-135	4.717E-04	4.717E-04	4.717E-04	4.717E-04	4.717E-04	4.717E-04	4.715E-04
Ba-135	1.142E-06	1.143E-06	1.143E-06	1.143E-06	1.144E-06	1.144E-06	1.284E-06
Xe-136	2.752E-03	2.752E-03	2.752E-03	2.752E-03	2.752E-03	2.752E-03	2.752E-03
Ba-136	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05
Cs-137	1.207E-03	1.152E-03	1.100E-03	1.050E-03	9.800E-04	8.731E-04	1.280E-13
Ba-137	2.864E-04	3.409E-04	3.930E-04	4.426E-04	5.130E-04	6.199E-04	1.493E-03
Ba-137m	1.846E-10	1.763E-10	1.683E-10	1.607E-10	1.499E-10	1.336E-10	1.958E-20
Ba-138	1.501E-03	1.501E-03	1.501E-03	1.501E-03	1.501E-03	1.501E-03	1.501E-03
La-138	4.767E-09	4.767E-09	4.767E-09	4.767E-09	4.767E-09	4.767E-09	4.767E-09
La-139	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03
Ce-140	1.472E-03	1.472E-03	1.472E-03	1.472E-03	1.472E-03	1.472E-03	1.472E-03

TABLE F.3.e. Fission Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Pr-141	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03
Ce-142	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03
Nd-142	4.548E-05	4.548E-05	4.548E-05	4.548E-05	4.548E-05	4.548E-05	4.548E-05
Nd-143	7.702E-04	7.702E-04	7.702E-04	7.702E-04	7.702E-04	7.702E-04	7.702E-04
Ce-144	8.357E-07	1.408E-07	2.371E-08	3.993E-09	2.760E-10	3.213E-12	0.00
Pr-144	3.529E-11	5.944E-12	1.001E-12	1.686E-13	1.165E-14	1.357E-16	0.00
Pr-144m	1.764E-13	2.971E-14	5.004E-15	8.428E-16	5.825E-17	6.782E-19	0.00
Nd-144	1.635E-03	1.635E-03	1.635E-03	1.635E-03	1.635E-03	1.635E-03	1.635E-03
Nd-145	7.461E-04	7.461E-04	7.461E-04	7.461E-04	7.461E-04	7.461E-04	7.461E-04
Nd-146	8.470E-04	8.470E-04	8.470E-04	8.470E-04	8.470E-04	8.470E-04	8.470E-04
Pm-146	3.411E-09	2.651E-09	2.060E-09	1.601E-09	1.097E-09	5.843E-10	0.00
Sm-146	1.501E-08	1.529E-08	1.551E-08	1.568E-08	1.587E-08	1.606E-08	1.627E-08
Pm-147	2.138E-05	1.260E-05	7.429E-06	4.380E-06	1.983E-06	5.290E-07	0.00
Sm-147	1.890E-04	1.978E-04	2.030E-04	2.060E-04	2.084E-04	2.099E-04	2.104E-04
Nd-148	4.446E-04	4.446E-04	4.446E-04	4.446E-04	4.446E-04	4.446E-04	4.446E-04
Sm-148	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04	2.454E-04
Sm-149	1.963E-06	1.963E-06	1.963E-06	1.963E-06	1.963E-06	1.963E-06	1.963E-06
Nd-150	2.280E-04	2.280E-04	2.280E-04	2.280E-04	2.280E-04	2.280E-04	2.280E-04
Sm-150	2.822E-04	2.822E-04	2.822E-04	2.822E-04	2.822E-04	2.822E-04	2.822E-04
Eu-150	4.081E-13	3.927E-13	3.779E-13	3.636E-13	3.432E-13	3.117E-13	1.992E-21
Sm-151	1.208E-05	1.189E-05	1.171E-05	1.153E-05	1.127E-05	1.084E-05	5.715E-09
Eu-151	5.835E-07	7.681E-07	9.499E-07	1.129E-06	1.392E-06	1.818E-06	1.265E-05
Sm-152	1.429E-04	1.429E-04	1.429E-04	1.429E-04	1.429E-04	1.429E-04	1.430E-04
Eu-152	4.277E-08	3.862E-08	3.488E-08	3.150E-08	2.703E-08	2.095E-08	4.269E-30
Gd-152	2.531E-08	2.646E-08	2.751E-08	2.845E-08	2.969E-08	3.139E-08	3.722E-08
Eu-153	1.390E-04	1.390E-04	1.390E-04	1.390E-04	1.390E-04	1.390E-04	1.390E-04
Gd-153	3.671E-11	4.531E-12	5.592E-13	6.901E-14	2.992E-15	1.601E-17	0.00
Sm-154	5.336E-05	5.336E-05	5.336E-05	5.336E-05	5.336E-05	5.336E-05	5.336E-05
Eu-154	3.506E-05	2.984E-05	2.540E-05	2.162E-05	1.698E-05	1.135E-05	0.00
Gd-154	3.193E-05	3.715E-05	4.159E-05	4.537E-05	5.002E-05	5.565E-05	6.699E-05
Eu-155	8.684E-06	6.566E-06	4.965E-06	3.754E-06	2.468E-06	1.227E-06	0.00
Gd-155	1.159E-05	1.370E-05	1.530E-05	1.652E-05	1.780E-05	1.904E-05	2.027E-05
Gd-156	1.311E-04	1.311E-04	1.311E-04	1.311E-04	1.311E-04	1.311E-04	1.311E-04
Gd-157	1.207E-07	1.207E-07	1.207E-07	1.207E-07	1.207E-07	1.207E-07	1.207E-07
Gd-158	3.109E-05	3.109E-05	3.109E-05	3.109E-05	3.109E-05	3.109E-05	3.109E-05
Tb-159	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06
Gd-160	2.066E-06	2.066E-06	2.066E-06	2.066E-06	2.066E-06	2.066E-06	2.066E-06
Tb-160	8.017E-17	7.288E-20	6.625E-23	6.023E-26	1.651E-30	0.00	0.00
Dy-160	5.896E-07	5.896E-07	5.896E-07	5.896E-07	5.896E-07	5.896E-07	5.896E-07
Dy-161	6.353E-07	6.353E-07	6.353E-07	6.353E-07	6.353E-07	6.353E-07	6.353E-07
Dy-162	5.944E-07	5.944E-07	5.944E-07	5.944E-07	5.944E-07	5.944E-07	5.944E-07
Dy-163	5.470E-07	5.470E-07	5.470E-07	5.470E-07	5.470E-07	5.470E-07	5.470E-07
Dy-164	7.788E-08	7.788E-08	7.788E-08	7.788E-08	7.788E-08	7.788E-08	7.788E-08
Ho-165	3.178E-07	3.178E-07	3.178E-07	3.178E-07	3.178E-07	3.178E-07	3.178E-07
Ho-166m	4.410E-09	4.405E-09	4.400E-09	4.395E-09	4.388E-09	4.375E-09	2.484E-09
Er-166	1.129E-07	1.129E-07	1.129E-07	1.129E-07	1.129E-07	1.129E-07	1.148E-07

TABLE F.3.e. Fission Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-167	5.385E-09	5.385E-09	5.385E-09	5.385E-09	5.385E-09	5.385E-09	5.385E-09
Er-168	1.784E-08	1.784E-08	1.784E-08	1.784E-08	1.784E-08	1.784E-08	1.784E-08
Tm-169	1.498E-10	1.498E-10	1.498E-10	1.498E-10	1.498E-10	1.498E-10	1.498E-10
Er-170	1.018E-13	1.018E-13	1.018E-13	1.018E-13	1.018E-13	1.018E-13	1.018E-13
Tm-170	1.424E-16	2.775E-18	5.410E-20	1.048E-21	0.00	0.00	0.00
Yb-170	6.698E-11	6.698E-11	6.698E-11	6.698E-11	6.698E-11	6.698E-11	6.698E-11
Tm-171	2.182E-13	1.060E-13	5.149E-14	2.501E-14	8.469E-15	1.393E-15	0.00
Yb-171	5.333E-12	5.446E-12	5.500E-12	5.527E-12	5.543E-12	5.550E-12	5.552E-12
Yb-172	3.271E-13	3.271E-13	3.271E-13	3.271E-13	3.271E-13	3.271E-13	3.271E-13
Total	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02

TABLE F.3.f. Fission Product Inventory by Isotope at 45 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	5.434E-08	4.857E-08	4.341E-08	3.880E-08	3.279E-08	2.476E-08	3.192E-32
Li-6	1.527E-10	1.527E-10	1.527E-10	1.527E-10	1.527E-10	1.527E-10	1.527E-10
Li-7	1.367E-11	1.367E-11	1.367E-11	1.367E-11	1.367E-11	1.367E-11	1.367E-11
Be-9	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11	2.628E-11
Be-10	1.756E-10	1.756E-10	1.756E-10	1.756E-10	1.756E-10	1.756E-10	1.755E-10
C-14	3.547E-11	3.546E-11	3.546E-11	3.545E-11	3.543E-11	3.541E-11	3.145E-11
Zn-66	3.934E-14	3.934E-14	3.934E-14	3.934E-14	3.934E-14	3.934E-14	3.934E-14
Zn-67	1.581E-15	1.581E-15	1.581E-15	1.581E-15	1.581E-15	1.581E-15	1.581E-15
Ga-71	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12
Ge-72	3.440E-08	3.440E-08	3.440E-08	3.440E-08	3.440E-08	3.440E-08	3.440E-08
Ge-73	6.476E-08	6.476E-08	6.476E-08	6.476E-08	6.476E-08	6.476E-08	6.476E-08
Ge-74	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07	1.390E-07
As-75	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07
Ge-76	6.442E-07	6.442E-07	6.442E-07	6.442E-07	6.442E-07	6.442E-07	6.442E-07
Se-76	1.164E-08	1.164E-08	1.164E-08	1.164E-08	1.164E-08	1.164E-08	1.164E-08
Se-77	1.255E-06	1.255E-06	1.255E-06	1.255E-06	1.255E-06	1.255E-06	1.255E-06
Se-78	3.258E-06	3.258E-06	3.258E-06	3.258E-06	3.258E-06	3.258E-06	3.258E-06
Se-79	7.623E-06	7.623E-06	7.623E-06	7.623E-06	7.622E-06	7.622E-06	7.543E-06
Br-79	7.600E-10	9.227E-10	1.085E-09	1.248E-09	1.492E-09	1.899E-09	8.118E-08
Se-80	1.706E-05	1.706E-05	1.706E-05	1.706E-05	1.706E-05	1.706E-05	1.706E-05
Kr-80	3.869E-10	3.869E-10	3.869E-10	3.869E-10	3.869E-10	3.869E-10	3.869E-10
Br-81	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.658E-05
Kr-81	5.293E-11	5.293E-11	5.293E-11	5.293E-11	5.293E-11	5.293E-11	5.276E-11
Se-82	4.129E-05	4.129E-05	4.129E-05	4.129E-05	4.129E-05	4.129E-05	4.129E-05
Kr-82	1.885E-06	1.885E-06	1.885E-06	1.885E-06	1.885E-06	1.885E-06	1.885E-06
Kr-83	4.171E-05	4.171E-05	4.171E-05	4.171E-05	4.171E-05	4.171E-05	4.171E-05
Kr-84	1.433E-04	1.433E-04	1.433E-04	1.433E-04	1.433E-04	1.433E-04	1.433E-04
Kr-85	1.671E-05	1.468E-05	1.290E-05	1.134E-05	9.337E-06	6.758E-06	2.045E-33
Rb-85	1.248E-04	1.268E-04	1.286E-04	1.302E-04	1.322E-04	1.348E-04	1.415E-04
Kr-86	2.185E-04	2.185E-04	2.185E-04	2.185E-04	2.185E-04	2.185E-04	2.185E-04
Sr-86	8.056E-07	8.056E-07	8.056E-07	8.056E-07	8.056E-07	8.056E-07	8.056E-07
Rb-87	2.788E-04	2.788E-04	2.788E-04	2.788E-04	2.788E-04	2.788E-04	2.788E-04
Sr-87	8.469E-09	8.469E-09	8.469E-09	8.469E-09	8.469E-09	8.469E-09	8.473E-09
Sr-88	3.986E-04	3.986E-04	3.986E-04	3.986E-04	3.986E-04	3.986E-04	3.986E-04
Y-89	5.155E-04	5.155E-04	5.155E-04	5.155E-04	5.155E-04	5.155E-04	5.155E-04
Sr-90	4.986E-04	4.754E-04	4.533E-04	4.322E-04	4.024E-04	3.573E-04	2.646E-14
Y-90	1.250E-07	1.192E-07	1.137E-07	1.084E-07	1.009E-07	8.959E-08	6.636E-18
Zr-90	1.303E-04	1.535E-04	1.756E-04	1.967E-04	2.265E-04	2.716E-04	6.290E-04
Y-91	1.124E-16	1.960E-20	3.417E-24	5.957E-28	1.371E-33	0.00	0.00
Zr-91	6.833E-04	6.833E-04	6.833E-04	6.833E-04	6.833E-04	6.833E-04	6.833E-04
Zr-92	7.630E-04	7.630E-04	7.630E-04	7.630E-04	7.630E-04	7.630E-04	7.630E-04
Zr-93	8.731E-04	8.731E-04	8.731E-04	8.731E-04	8.731E-04	8.731E-04	8.727E-04
Nb-93	9.721E-10	1.323E-09	1.716E-09	2.148E-09	2.859E-09	4.191E-09	3.895E-07
Nb-93m	2.827E-09	3.267E-09	3.665E-09	4.024E-09	4.499E-09	5.146E-09	7.370E-09
Zr-94	9.337E-04	9.337E-04	9.337E-04	9.337E-04	9.337E-04	9.337E-04	9.337E-04
Nb-94	1.307E-09	1.307E-09	1.307E-09	1.307E-09	1.307E-09	1.307E-09	1.264E-09

TABLE F.3.f. Fission Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Zr-95	1.973E-15	7.213E-19	2.637E-22	9.642E-26	6.741E-31	0.00	0.00
Nb-95	2.406E-15	8.797E-19	3.216E-22	1.176E-25	6.145E-33	0.00	0.00
Mo-95	9.285E-04	9.285E-04	9.285E-04	9.285E-04	9.285E-04	9.285E-04	9.285E-04
Zr-96	1.031E-03	1.031E-03	1.031E-03	1.031E-03	1.031E-03	1.031E-03	1.031E-03
Mo-96	8.077E-05	8.077E-05	8.077E-05	8.077E-05	8.077E-05	8.077E-05	8.077E-05
Mo-97	1.043E-03	1.043E-03	1.043E-03	1.043E-03	1.043E-03	1.043E-03	1.043E-03
Mo-98	1.112E-03	1.112E-03	1.112E-03	1.112E-03	1.112E-03	1.112E-03	1.112E-03
Tc-98	1.357E-08	1.357E-08	1.357E-08	1.357E-08	1.357E-08	1.357E-08	1.357E-08
Tc-99	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.665E-04
Ru-99	2.930E-08	3.562E-08	4.193E-08	4.824E-08	5.770E-08	7.348E-08	3.161E-06
Mo-100	1.266E-03	1.266E-03	1.266E-03	1.266E-03	1.266E-03	1.266E-03	1.266E-03
Ru-100	2.042E-04	2.042E-04	2.042E-04	2.042E-04	2.042E-04	2.042E-04	2.042E-04
Ru-101	1.052E-03	1.052E-03	1.052E-03	1.052E-03	1.052E-03	1.052E-03	1.052E-03
Ru-102	1.137E-03	1.137E-03	1.137E-03	1.137E-03	1.137E-03	1.137E-03	1.137E-03
Rh-102	4.205E-10	2.607E-10	1.616E-10	1.002E-10	4.892E-11	1.481E-11	0.00
Rh-103	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04
Ru-104	8.911E-04	8.911E-04	8.911E-04	8.911E-04	8.911E-04	8.911E-04	8.911E-04
Pd-104	5.030E-04	5.030E-04	5.030E-04	5.030E-04	5.030E-04	5.030E-04	5.030E-04
Pd-105	6.517E-04	6.517E-04	6.517E-04	6.517E-04	6.517E-04	6.517E-04	6.517E-04
Ru-106	2.563E-06	6.479E-07	1.638E-07	4.140E-08	5.261E-09	1.690E-10	0.00
Rh-106	2.410E-12	6.090E-13	1.539E-13	3.891E-14	4.945E-15	1.588E-16	0.00
Pd-106	6.748E-04	6.767E-04	6.772E-04	6.773E-04	6.774E-04	6.774E-04	6.774E-04
Pd-107	4.177E-04	4.177E-04	4.177E-04	4.177E-04	4.177E-04	4.177E-04	4.176E-04
Ag-107	3.795E-10	4.686E-10	5.578E-10	6.469E-10	7.806E-10	1.003E-09	4.468E-08
Pd-108	2.915E-04	2.915E-04	2.915E-04	2.915E-04	2.915E-04	2.915E-04	2.915E-04
Ag-108m	2.484E-12	2.457E-12	2.430E-12	2.404E-12	2.365E-12	2.301E-12	1.094E-14
Cd-108	1.208E-09	1.208E-09	1.208E-09	1.208E-09	1.208E-09	1.208E-09	1.208E-09
Ag-109	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04
Cd-109	6.195E-14	2.080E-14	6.985E-15	2.346E-15	4.564E-16	2.982E-17	0.00
Pd-110	9.637E-05	9.637E-05	9.637E-05	9.637E-05	9.637E-05	9.637E-05	9.637E-05
Ag-110	5.075E-17	6.689E-18	8.817E-19	1.162E-19	5.563E-21	3.510E-23	0.00
Ag-110m	3.348E-09	4.414E-10	5.818E-11	7.670E-12	3.671E-13	2.316E-15	0.00
Cd-110	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04	1.011E-04
Cd-111	5.274E-05	5.274E-05	5.274E-05	5.274E-05	5.274E-05	5.274E-05	5.274E-05
Cd-112	3.096E-05	3.096E-05	3.096E-05	3.096E-05	3.096E-05	3.096E-05	3.096E-05
Cd-113	1.605E-07	1.605E-07	1.606E-07	1.606E-07	1.606E-07	1.607E-07	1.609E-07
Cd-113m	3.692E-07	3.357E-07	3.053E-07	2.776E-07	2.407E-07	1.898E-07	1.141E-27
In-113	1.758E-07	2.092E-07	2.396E-07	2.673E-07	3.041E-07	3.550E-07	5.446E-07
Cd-114	3.827E-05	3.827E-05	3.827E-05	3.827E-05	3.827E-05	3.827E-05	3.827E-05
Sn-114	8.102E-09	8.102E-09	8.102E-09	8.102E-09	8.102E-09	8.102E-09	8.102E-09
In-115	2.456E-06	2.456E-06	2.456E-06	2.456E-06	2.456E-06	2.456E-06	2.456E-06
Sn-115	5.104E-07	5.104E-07	5.104E-07	5.104E-07	5.104E-07	5.104E-07	5.104E-07
Cd-116	1.311E-05	1.311E-05	1.311E-05	1.311E-05	1.311E-05	1.311E-05	1.311E-05
Sn-116	1.354E-05	1.354E-05	1.354E-05	1.354E-05	1.354E-05	1.354E-05	1.354E-05
Sn-117	1.321E-05	1.321E-05	1.321E-05	1.321E-05	1.321E-05	1.321E-05	1.321E-05
Sn-118	1.329E-05	1.329E-05	1.329E-05	1.329E-05	1.329E-05	1.329E-05	1.329E-05

TABLE F.3.f. Fission Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119	1.327E-05	1.327E-05	1.327E-05	1.327E-05	1.327E-05	1.327E-05	1.327E-05
Sn-119m	8.975E-11	1.136E-11	1.439E-12	1.822E-13	8.211E-15	4.686E-17	0.00
Sn-120	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05
Sn-121m	5.184E-09	5.042E-09	4.904E-09	4.770E-09	4.575E-09	4.269E-09	5.331E-15
Sb-121	1.254E-05	1.254E-05	1.254E-05	1.254E-05	1.254E-05	1.254E-05	1.254E-05
Sn-122	1.475E-05	1.475E-05	1.475E-05	1.475E-05	1.475E-05	1.475E-05	1.475E-05
Te-122	1.374E-06	1.374E-06	1.374E-06	1.374E-06	1.374E-06	1.374E-06	1.374E-06
Sn-123	2.335E-12	4.633E-14	9.191E-16	1.824E-17	5.100E-20	2.827E-24	0.00
Sb-123	1.559E-05	1.559E-05	1.559E-05	1.559E-05	1.559E-05	1.559E-05	1.559E-05
Te-123	2.247E-08	2.247E-08	2.247E-08	2.247E-08	2.247E-08	2.247E-08	2.247E-08
Te-123m	1.141E-14	1.659E-16	2.412E-18	3.507E-20	6.441E-23	1.642E-27	0.00
Sn-124	1.961E-05	1.961E-05	1.961E-05	1.961E-05	1.961E-05	1.961E-05	1.961E-05
Te-124	1.106E-06	1.106E-06	1.106E-06	1.106E-06	1.106E-06	1.106E-06	1.106E-06
Sb-125	3.471E-06	2.104E-06	1.275E-06	7.732E-07	3.650E-07	1.044E-07	0.00
Te-125	2.672E-05	2.810E-05	2.894E-05	2.945E-05	2.986E-05	3.013E-05	3.023E-05
Te-125m	4.854E-08	2.944E-08	1.785E-08	1.082E-08	5.105E-09	1.461E-09	0.00
Sn-126	4.324E-05	4.324E-05	4.324E-05	4.324E-05	4.323E-05	4.323E-05	4.294E-05
Sb-126	2.054E-12	2.054E-12	2.054E-12	2.054E-12	2.054E-12	2.054E-12	2.040E-12
Sb-126m	1.562E-14	1.562E-14	1.562E-14	1.562E-14	1.562E-14	1.562E-14	1.551E-14
Te-126	1.400E-06	1.401E-06	1.401E-06	1.402E-06	1.403E-06	1.404E-06	1.697E-06
Te-127	3.409E-15	3.275E-17	3.147E-19	3.023E-21	2.847E-24	2.576E-29	0.00
Te-127m	9.737E-13	9.354E-15	8.989E-17	8.636E-19	8.133E-22	7.360E-27	0.00
I-127	8.519E-05	8.519E-05	8.519E-05	8.519E-05	8.519E-05	8.519E-05	8.519E-05
Te-128	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04	1.659E-04
Xe-128	7.789E-06	7.789E-06	7.789E-06	7.789E-06	7.789E-06	7.789E-06	7.789E-06
I-129	2.575E-04	2.575E-04	2.575E-04	2.575E-04	2.575E-04	2.575E-04	2.574E-04
Xe-129	6.864E-08	6.866E-08	6.868E-08	6.870E-08	6.874E-08	6.880E-08	7.994E-08
Te-130	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04	5.142E-04
Xe-130	2.927E-05	2.927E-05	2.927E-05	2.927E-05	2.927E-05	2.927E-05	2.927E-05
Xe-131	4.875E-04	4.875E-04	4.875E-04	4.875E-04	4.875E-04	4.875E-04	4.875E-04
Xe-132	1.625E-03	1.625E-03	1.625E-03	1.625E-03	1.625E-03	1.625E-03	1.625E-03
Ba-132	3.986E-09	3.986E-09	3.986E-09	3.986E-09	3.986E-09	3.986E-09	3.986E-09
Cs-133	1.390E-03	1.390E-03	1.390E-03	1.390E-03	1.390E-03	1.390E-03	1.390E-03
Xe-134	1.975E-03	1.975E-03	1.975E-03	1.975E-03	1.975E-03	1.975E-03	1.975E-03
Cs-134	2.220E-05	1.133E-05	5.787E-06	2.954E-06	1.078E-06	2.007E-07	0.00
Ba-134	2.957E-04	3.065E-04	3.121E-04	3.149E-04	3.168E-04	3.177E-04	3.179E-04
Cs-135	4.979E-04	4.979E-04	4.979E-04	4.979E-04	4.979E-04	4.979E-04	4.977E-04
Ba-135	1.640E-06	1.641E-06	1.641E-06	1.641E-06	1.642E-06	1.642E-06	1.789E-06
Xe-136	3.148E-03	3.148E-03	3.148E-03	3.148E-03	3.148E-03	3.148E-03	3.148E-03
Ba-136	3.755E-05	3.755E-05	3.755E-05	3.755E-05	3.755E-05	3.755E-05	3.755E-05
Cs-137	1.358E-03	1.297E-03	1.238E-03	1.182E-03	1.103E-03	9.827E-04	1.440E-13
Ba-137	3.223E-04	3.836E-04	4.422E-04	4.981E-04	5.773E-04	6.976E-04	1.680E-03
Ba-137m	2.078E-10	1.984E-10	1.894E-10	1.809E-10	1.687E-10	1.503E-10	2.204E-20
Ba-138	1.679E-03	1.679E-03	1.679E-03	1.679E-03	1.679E-03	1.679E-03	1.679E-03
La-138	4.737E-09	4.737E-09	4.737E-09	4.737E-09	4.737E-09	4.737E-09	4.737E-09
La-139	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03

TABLE F.3.f. Fission Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ce-140	1.652E-03	1.652E-03	1.652E-03	1.652E-03	1.652E-03	1.652E-03	1.652E-03
Pr-141	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03
Ce-142	1.468E-03	1.468E-03	1.468E-03	1.468E-03	1.468E-03	1.468E-03	1.468E-03
Nd-142	5.829E-05	5.829E-05	5.829E-05	5.829E-05	5.829E-05	5.829E-05	5.829E-05
Nd-143	8.000E-04	8.000E-04	8.000E-04	8.000E-04	8.000E-04	8.000E-04	8.000E-04
Ce-144	9.256E-07	1.559E-07	2.626E-08	4.422E-09	3.057E-10	3.558E-12	0.00
Pr-144	3.908E-11	6.582E-12	1.109E-12	1.867E-13	1.291E-14	1.502E-16	0.00
Pr-144m	1.954E-13	3.291E-14	5.542E-15	9.334E-16	6.452E-17	7.511E-19	0.00
Nd-144	1.875E-03	1.876E-03	1.876E-03	1.876E-03	1.876E-03	1.876E-03	1.876E-03
Nd-145	8.130E-04	8.130E-04	8.130E-04	8.130E-04	8.130E-04	8.130E-04	8.130E-04
Nd-146	9.683E-04	9.683E-04	9.683E-04	9.683E-04	9.683E-04	9.683E-04	9.683E-04
Pm-146	4.069E-09	3.163E-09	2.458E-09	1.910E-09	1.309E-09	6.971E-10	0.00
Sm-146	1.767E-08	1.801E-08	1.827E-08	1.847E-08	1.870E-08	1.892E-08	1.918E-08
Pm-147	2.180E-05	1.285E-05	7.578E-06	4.467E-06	2.022E-06	5.396E-07	0.00
Sm-147	1.891E-04	1.980E-04	2.033E-04	2.064E-04	2.089E-04	2.104E-04	2.109E-04
Nd-148	4.998E-04	4.998E-04	4.998E-04	4.998E-04	4.998E-04	4.998E-04	4.998E-04
Sm-148	2.841E-04	2.841E-04	2.841E-04	2.841E-04	2.841E-04	2.841E-04	2.841E-04
Sm-149	2.074E-06	2.074E-06	2.074E-06	2.074E-06	2.074E-06	2.074E-06	2.074E-06
Nd-150	2.596E-04	2.596E-04	2.596E-04	2.596E-04	2.596E-04	2.596E-04	2.596E-04
Sm-150	3.140E-04	3.140E-04	3.140E-04	3.140E-04	3.140E-04	3.140E-04	3.140E-04
Eu-150	4.295E-13	4.133E-13	3.977E-13	3.827E-13	3.612E-13	3.281E-13	2.098E-21
Sm-151	1.274E-05	1.255E-05	1.235E-05	1.216E-05	1.189E-05	1.144E-05	6.029E-09
Eu-151	6.138E-07	8.086E-07	1.000E-06	1.189E-06	1.467E-06	1.916E-06	1.335E-05
Sm-152	1.531E-04	1.531E-04	1.531E-04	1.531E-04	1.531E-04	1.531E-04	1.531E-04
Eu-152	3.893E-08	3.516E-08	3.175E-08	2.867E-08	2.461E-08	1.907E-08	3.885E-30
Gd-152	2.291E-08	2.396E-08	2.491E-08	2.576E-08	2.690E-08	2.844E-08	3.375E-08
Eu-153	1.556E-04	1.556E-04	1.556E-04	1.556E-04	1.556E-04	1.556E-04	1.556E-04
Gd-153	3.926E-11	4.846E-12	5.980E-13	7.381E-14	3.200E-15	1.713E-17	0.00
Sm-154	6.242E-05	6.242E-05	6.242E-05	6.242E-05	6.242E-05	6.242E-05	6.242E-05
Eu-154	4.148E-05	3.531E-05	3.005E-05	2.558E-05	2.008E-05	1.342E-05	0.00
Gd-154	3.794E-05	4.411E-05	4.937E-05	5.384E-05	5.934E-05	6.600E-05	7.942E-05
Eu-155	1.035E-05	7.825E-06	5.917E-06	4.474E-06	2.941E-06	1.462E-06	0.00
Gd-155	1.380E-05	1.632E-05	1.823E-05	1.967E-05	2.120E-05	2.268E-05	2.414E-05
Gd-156	1.761E-04	1.761E-04	1.761E-04	1.761E-04	1.761E-04	1.761E-04	1.761E-04
Gd-157	1.480E-07	1.480E-07	1.480E-07	1.480E-07	1.480E-07	1.480E-07	1.480E-07
Gd-158	4.006E-05	4.006E-05	4.006E-05	4.006E-05	4.006E-05	4.006E-05	4.006E-05
Tb-159	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06
Gd-160	2.467E-06	2.467E-06	2.467E-06	2.467E-06	2.467E-06	2.467E-06	2.467E-06
Tb-160	1.094E-16	9.945E-20	9.041E-23	8.219E-26	2.253E-30	0.00	0.00
Dy-160	7.666E-07	7.666E-07	7.666E-07	7.666E-07	7.666E-07	7.666E-07	7.666E-07
Dy-161	7.565E-07	7.565E-07	7.565E-07	7.565E-07	7.565E-07	7.565E-07	7.565E-07
Dy-162	7.086E-07	7.086E-07	7.086E-07	7.086E-07	7.086E-07	7.086E-07	7.086E-07
Dy-163	6.862E-07	6.862E-07	6.862E-07	6.862E-07	6.862E-07	6.862E-07	6.862E-07
Dy-164	9.713E-08	9.713E-08	9.713E-08	9.713E-08	9.713E-08	9.713E-08	9.713E-08
Ho-165	4.285E-07	4.285E-07	4.285E-07	4.285E-07	4.285E-07	4.285E-07	4.285E-07
Ho-166m	6.723E-09	6.716E-09	6.708E-09	6.700E-09	6.688E-09	6.669E-09	3.786E-09

TABLE F.3.f. Fission Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Er-166	1.619E-07	1.619E-07	1.620E-07	1.620E-07	1.620E-07	1.620E-07	1.649E-07
Er-167	7.079E-09	7.079E-09	7.079E-09	7.079E-09	7.079E-09	7.079E-09	7.079E-09
Er-168	2.468E-08	2.468E-08	2.468E-08	2.468E-08	2.468E-08	2.468E-08	2.468E-08
Tm-169	2.195E-10	2.195E-10	2.195E-10	2.195E-10	2.195E-10	2.195E-10	2.195E-10
Er-170	1.672E-13	1.672E-13	1.672E-13	1.672E-13	1.672E-13	1.672E-13	1.672E-13
Tm-170	2.369E-16	4.618E-18	9.002E-20	1.743E-21	9.726E-24	5.160E-28	0.00
Yb-170	1.094E-10	1.094E-10	1.094E-10	1.094E-10	1.094E-10	1.094E-10	1.094E-10
Tm-171	4.136E-13	2.009E-13	9.759E-14	4.741E-14	1.605E-14	2.640E-15	0.00
Yb-171	9.912E-12	1.012E-11	1.023E-11	1.028E-11	1.031E-11	1.032E-11	1.033E-11
Yb-172	6.947E-13	6.947E-13	6.947E-13	6.947E-13	6.947E-13	6.947E-13	6.947E-13
Total	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02

TABLE F.3.g. Fission Product Inventory by Isotope at 50 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-3	6.107E-08	5.458E-08	4.879E-08	4.361E-08	3.685E-08	2.783E-08	3.590E-32
Li-6	1.497E-10	1.497E-10	1.497E-10	1.497E-10	1.497E-10	1.497E-10	1.497E-10
Li-7	1.517E-11	1.517E-11	1.517E-11	1.517E-11	1.517E-11	1.517E-11	1.517E-11
Be-9	2.915E-11	2.915E-11	2.915E-11	2.915E-11	2.915E-11	2.915E-11	2.915E-11
Be-10	1.949E-10	1.949E-10	1.949E-10	1.949E-10	1.949E-10	1.949E-10	1.948E-10
C-14	3.936E-11	3.935E-11	3.934E-11	3.933E-11	3.932E-11	3.929E-11	3.490E-11
Zn-66	4.190E-14	4.190E-14	4.190E-14	4.190E-14	4.190E-14	4.190E-14	4.190E-14
Zn-67	1.672E-15	1.672E-15	1.672E-15	1.672E-15	1.672E-15	1.672E-15	1.672E-15
Zn-68	5.209E-17	5.209E-17	5.209E-17	5.209E-17	5.209E-17	5.209E-17	5.209E-17
Ga-71	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12
Ge-72	3.882E-08	3.882E-08	3.882E-08	3.882E-08	3.882E-08	3.882E-08	3.882E-08
Ge-73	7.183E-08	7.183E-08	7.183E-08	7.183E-08	7.183E-08	7.183E-08	7.183E-08
Ge-74	1.551E-07	1.551E-07	1.551E-07	1.551E-07	1.551E-07	1.551E-07	1.551E-07
As-75	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07
Ge-76	7.074E-07	7.074E-07	7.074E-07	7.074E-07	7.074E-07	7.074E-07	7.074E-07
Se-76	1.432E-08	1.432E-08	1.432E-08	1.432E-08	1.432E-08	1.432E-08	1.432E-08
Se-77	1.358E-06	1.358E-06	1.358E-06	1.358E-06	1.358E-06	1.358E-06	1.358E-06
Se-78	3.611E-06	3.611E-06	3.611E-06	3.611E-06	3.611E-06	3.611E-06	3.611E-06
Se-79	8.378E-06	8.378E-06	8.378E-06	8.378E-06	8.378E-06	8.377E-06	8.290E-06
Br-79	8.336E-10	1.012E-09	1.191E-09	1.370E-09	1.638E-09	2.085E-09	8.923E-08
Se-80	1.871E-05	1.871E-05	1.871E-05	1.871E-05	1.871E-05	1.871E-05	1.871E-05
Kr-80	4.392E-10	4.392E-10	4.392E-10	4.392E-10	4.392E-10	4.392E-10	4.392E-10
Br-81	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.882E-05
Kr-81	6.561E-11	6.561E-11	6.561E-11	6.561E-11	6.561E-11	6.560E-11	6.539E-11
Se-82	4.501E-05	4.501E-05	4.501E-05	4.501E-05	4.501E-05	4.501E-05	4.501E-05
Kr-82	2.268E-06	2.268E-06	2.268E-06	2.268E-06	2.268E-06	2.268E-06	2.268E-06
Kr-83	4.288E-05	4.288E-05	4.288E-05	4.288E-05	4.288E-05	4.288E-05	4.288E-05
Kr-84	1.580E-04	1.580E-04	1.580E-04	1.580E-04	1.580E-04	1.580E-04	1.580E-04
Kr-85	1.808E-05	1.589E-05	1.396E-05	1.227E-05	1.011E-05	7.314E-06	2.216E-33
Rb-85	1.349E-04	1.370E-04	1.390E-04	1.407E-04	1.428E-04	1.456E-04	1.529E-04
Kr-86	2.357E-04	2.357E-04	2.357E-04	2.357E-04	2.357E-04	2.357E-04	2.357E-04
Sr-86	9.876E-07	9.876E-07	9.876E-07	9.876E-07	9.876E-07	9.876E-07	9.876E-07
Rb-87	3.003E-04	3.003E-04	3.003E-04	3.003E-04	3.003E-04	3.003E-04	3.003E-04
Sr-87	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08
Sr-88	4.291E-04	4.291E-04	4.291E-04	4.291E-04	4.291E-04	4.291E-04	4.291E-04
Y-89	5.538E-04	5.538E-04	5.538E-04	5.538E-04	5.538E-04	5.538E-04	5.538E-04
Sr-90	5.357E-04	5.108E-04	4.871E-04	4.644E-04	4.324E-04	3.839E-04	2.844E-14
Y-90	1.343E-07	1.281E-07	1.221E-07	1.165E-07	1.084E-07	9.627E-08	7.131E-18
Zr-90	1.406E-04	1.656E-04	1.893E-04	2.120E-04	2.440E-04	2.925E-04	6.765E-04
Y-91	1.200E-16	2.091E-20	3.647E-24	6.358E-28	1.464E-33	0.00	0.00
Zr-91	7.375E-04	7.375E-04	7.375E-04	7.375E-04	7.375E-04	7.375E-04	7.375E-04
Zr-92	8.286E-04	8.286E-04	8.286E-04	8.286E-04	8.286E-04	8.286E-04	8.286E-04
Zr-93	9.497E-04	9.497E-04	9.497E-04	9.497E-04	9.497E-04	9.497E-04	9.492E-04
Nb-93	1.062E-09	1.443E-09	1.871E-09	2.341E-09	3.116E-09	4.565E-09	4.237E-07
Nb-93m	3.079E-09	3.558E-09	3.990E-09	4.381E-09	4.897E-09	5.599E-09	8.017E-09
Zr-94	1.025E-03	1.025E-03	1.025E-03	1.025E-03	1.025E-03	1.025E-03	1.025E-03

TABLE F.3.g. Fission Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Nb-94	1.482E-09	1.482E-09	1.482E-09	1.482E-09	1.482E-09	1.482E-09	1.433E-09
Zr-95	2.161E-15	7.901E-19	2.889E-22	1.056E-25	7.383E-31	0.00	0.00
Nb-95	2.636E-15	9.636E-19	3.523E-22	1.288E-25	6.731E-33	0.00	0.00
Mo-95	1.009E-03	1.009E-03	1.009E-03	1.009E-03	1.009E-03	1.009E-03	1.009E-03
Zr-96	1.135E-03	1.135E-03	1.135E-03	1.135E-03	1.135E-03	1.135E-03	1.135E-03
Mo-96	1.001E-04	1.001E-04	1.001E-04	1.001E-04	1.001E-04	1.001E-04	1.001E-04
Mo-97	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03
Mo-98	1.234E-03	1.234E-03	1.234E-03	1.234E-03	1.234E-03	1.234E-03	1.234E-03
Tc-98	1.685E-08	1.685E-08	1.685E-08	1.685E-08	1.685E-08	1.685E-08	1.685E-08
Tc-99	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.048E-03
Ru-99	3.177E-08	3.862E-08	4.546E-08	5.230E-08	6.256E-08	7.966E-08	3.426E-06
Mo-100	1.406E-03	1.406E-03	1.406E-03	1.406E-03	1.406E-03	1.406E-03	1.406E-03
Ru-100	2.530E-04	2.530E-04	2.530E-04	2.530E-04	2.530E-04	2.530E-04	2.530E-04
Ru-101	1.165E-03	1.165E-03	1.165E-03	1.165E-03	1.165E-03	1.165E-03	1.165E-03
Ru-102	1.284E-03	1.284E-03	1.284E-03	1.284E-03	1.284E-03	1.284E-03	1.284E-03
Rh-102	5.098E-10	3.160E-10	1.960E-10	1.215E-10	5.931E-11	1.795E-11	0.00
Rh-103	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04
Ru-104	1.018E-03	1.018E-03	1.018E-03	1.018E-03	1.018E-03	1.018E-03	1.018E-03
Pd-104	6.121E-04	6.121E-04	6.121E-04	6.121E-04	6.121E-04	6.121E-04	6.121E-04
Pd-105	7.381E-04	7.381E-04	7.381E-04	7.381E-04	7.381E-04	7.381E-04	7.381E-04
Ru-106	2.964E-06	7.492E-07	1.894E-07	4.786E-08	6.083E-09	1.954E-10	0.00
Rh-106	2.786E-12	7.042E-13	1.780E-13	4.499E-14	5.717E-15	1.837E-16	0.00
Pd-106	7.964E-04	7.986E-04	7.991E-04	7.993E-04	7.993E-04	7.993E-04	7.993E-04
Pd-107	4.852E-04	4.852E-04	4.852E-04	4.852E-04	4.852E-04	4.852E-04	4.851E-04
Ag-107	4.401E-10	5.436E-10	6.472E-10	7.507E-10	9.060E-10	1.165E-09	5.190E-08
Pd-108	3.390E-04	3.390E-04	3.390E-04	3.390E-04	3.390E-04	3.390E-04	3.390E-04
Ag-108m	2.965E-12	2.933E-12	2.901E-12	2.869E-12	2.823E-12	2.747E-12	1.306E-14
Cd-108	1.559E-09	1.559E-09	1.559E-09	1.559E-09	1.559E-09	1.559E-09	1.559E-09
Ag-109	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04
Cd-109	8.785E-14	2.950E-14	9.905E-15	3.326E-15	6.472E-16	4.229E-17	0.00
Pd-110	1.126E-04	1.126E-04	1.126E-04	1.126E-04	1.126E-04	1.126E-04	1.126E-04
Ag-110	6.427E-17	8.473E-18	1.117E-18	1.472E-19	7.046E-21	4.445E-23	0.00
Ag-110m	4.241E-09	5.591E-10	7.370E-11	9.715E-12	4.650E-13	2.933E-15	0.00
Cd-110	1.300E-04	1.300E-04	1.300E-04	1.300E-04	1.300E-04	1.300E-04	1.300E-04
Cd-111	6.195E-05	6.195E-05	6.195E-05	6.195E-05	6.195E-05	6.195E-05	6.195E-05
Cd-112	3.625E-05	3.625E-05	3.625E-05	3.625E-05	3.625E-05	3.625E-05	3.625E-05
Cd-113	1.630E-07	1.630E-07	1.631E-07	1.631E-07	1.632E-07	1.632E-07	1.634E-07
Cd-113m	4.455E-07	4.051E-07	3.684E-07	3.350E-07	2.905E-07	2.291E-07	1.377E-27
In-113	2.099E-07	2.503E-07	2.869E-07	3.203E-07	3.647E-07	4.261E-07	6.549E-07
Cd-114	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05
Sn-114	1.068E-08	1.068E-08	1.068E-08	1.068E-08	1.068E-08	1.068E-08	1.068E-08
In-115	2.492E-06	2.492E-06	2.492E-06	2.492E-06	2.492E-06	2.492E-06	2.492E-06
Sn-115	5.756E-07	5.756E-07	5.756E-07	5.756E-07	5.756E-07	5.756E-07	5.756E-07
Cd-116	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05	1.482E-05
Sn-116	1.574E-05	1.574E-05	1.574E-05	1.574E-05	1.574E-05	1.574E-05	1.574E-05
Sn-117	1.492E-05	1.492E-05	1.492E-05	1.492E-05	1.492E-05	1.492E-05	1.492E-05

TABLE F.3.g. Fission Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-118	1.502E-05	1.502E-05	1.502E-05	1.502E-05	1.502E-05	1.502E-05	1.502E-05
Sn-119	1.500E-05	1.500E-05	1.500E-05	1.500E-05	1.500E-05	1.500E-05	1.500E-05
Sn-119m	1.056E-10	1.337E-11	1.693E-12	2.144E-13	9.658E-15	5.512E-17	0.00
Sn-120	1.524E-05	1.524E-05	1.524E-05	1.524E-05	1.524E-05	1.524E-05	1.524E-05
Sn-121m	5.896E-09	5.735E-09	5.578E-09	5.425E-09	5.204E-09	4.855E-09	6.064E-15
Sb-121	1.395E-05	1.395E-05	1.395E-05	1.395E-05	1.395E-05	1.395E-05	1.396E-05
Sn-122	1.663E-05	1.663E-05	1.663E-05	1.663E-05	1.663E-05	1.663E-05	1.663E-05
Te-122	1.730E-06	1.730E-06	1.730E-06	1.730E-06	1.730E-06	1.730E-06	1.730E-06
Sn-123	2.627E-12	5.212E-14	1.034E-15	2.051E-17	5.728E-20	3.176E-24	0.00
Sb-123	1.742E-05	1.742E-05	1.742E-05	1.742E-05	1.742E-05	1.742E-05	1.742E-05
Te-123	2.967E-08	2.967E-08	2.967E-08	2.967E-08	2.967E-08	2.967E-08	2.967E-08
Te-123m	1.632E-14	2.374E-16	3.451E-18	5.017E-20	9.229E-23	2.352E-27	0.00
Sn-124	2.205E-05	2.205E-05	2.205E-05	2.205E-05	2.205E-05	2.205E-05	2.205E-05
Te-124	1.409E-06	1.409E-06	1.409E-06	1.409E-06	1.409E-06	1.409E-06	1.409E-06
Sb-125	3.922E-06	2.378E-06	1.441E-06	8.738E-07	4.125E-07	1.180E-07	0.00
Te-125	3.017E-05	3.174E-05	3.269E-05	3.326E-05	3.373E-05	3.403E-05	3.415E-05
Te-125m	5.486E-08	3.327E-08	2.017E-08	1.223E-08	5.769E-09	1.651E-09	0.00
Sn-126	4.881E-05	4.881E-05	4.881E-05	4.881E-05	4.881E-05	4.881E-05	4.847E-05
Sb-126	2.319E-12	2.319E-12	2.319E-12	2.319E-12	2.319E-12	2.319E-12	2.303E-12
Sb-126m	1.763E-14	1.763E-14	1.763E-14	1.763E-14	1.763E-14	1.763E-14	1.751E-14
Te-126	1.654E-06	1.655E-06	1.656E-06	1.657E-06	1.658E-06	1.659E-06	1.990E-06
Te-127	3.845E-15	3.694E-17	3.549E-19	3.410E-21	3.211E-24	2.906E-29	0.00
Te-127m	1.098E-12	1.055E-14	1.014E-16	9.740E-19	9.173E-22	8.300E-27	0.00
I-127	9.533E-05	9.533E-05	9.533E-05	9.533E-05	9.533E-05	9.533E-05	9.533E-05
Te-128	1.864E-04	1.864E-04	1.864E-04	1.864E-04	1.864E-04	1.864E-04	1.864E-04
Xe-128	9.926E-06	9.926E-06	9.926E-06	9.926E-06	9.926E-06	9.926E-06	9.926E-06
I-129	2.855E-04	2.855E-04	2.855E-04	2.855E-04	2.855E-04	2.855E-04	2.855E-04
Xe-129	9.824E-08	9.826E-08	9.829E-08	9.831E-08	9.835E-08	9.841E-08	1.108E-07
Te-130	5.759E-04	5.759E-04	5.759E-04	5.759E-04	5.759E-04	5.759E-04	5.759E-04
Xe-130	3.692E-05	3.692E-05	3.692E-05	3.692E-05	3.692E-05	3.692E-05	3.692E-05
Xe-131	5.088E-04	5.088E-04	5.088E-04	5.088E-04	5.088E-04	5.088E-04	5.088E-04
Xe-132	1.849E-03	1.849E-03	1.849E-03	1.849E-03	1.849E-03	1.849E-03	1.849E-03
Ba-132	4.927E-09	4.927E-09	4.927E-09	4.927E-09	4.927E-09	4.927E-09	4.927E-09
Cs-133	1.496E-03	1.496E-03	1.496E-03	1.496E-03	1.496E-03	1.496E-03	1.496E-03
Xe-134	2.192E-03	2.192E-03	2.192E-03	2.192E-03	2.192E-03	2.192E-03	2.192E-03
Cs-134	2.661E-05	1.359E-05	6.936E-06	3.541E-06	1.292E-06	2.405E-07	0.00
Ba-134	3.564E-04	3.694E-04	3.760E-04	3.794E-04	3.817E-04	3.827E-04	3.830E-04
Cs-135	5.264E-04	5.264E-04	5.264E-04	5.264E-04	5.264E-04	5.264E-04	5.263E-04
Ba-135	2.259E-06	2.259E-06	2.259E-06	2.260E-06	2.260E-06	2.261E-06	2.417E-06
Xe-136	3.548E-03	3.548E-03	3.548E-03	3.548E-03	3.548E-03	3.548E-03	3.548E-03
Ba-136	4.397E-05	4.397E-05	4.397E-05	4.397E-05	4.397E-05	4.397E-05	4.397E-05
Cs-137	1.509E-03	1.441E-03	1.376E-03	1.314E-03	1.226E-03	1.092E-03	1.601E-13
Ba-137	3.582E-04	4.264E-04	4.914E-04	5.536E-04	6.416E-04	7.754E-04	1.868E-03
Ba-137m	2.309E-10	2.205E-10	2.105E-10	2.010E-10	1.876E-10	1.671E-10	2.449E-20
Ba-138	1.857E-03	1.857E-03	1.857E-03	1.857E-03	1.857E-03	1.857E-03	1.857E-03
La-138	4.654E-09	4.654E-09	4.654E-09	4.654E-09	4.654E-09	4.654E-09	4.654E-09

TABLE F.3.g. Fission Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
La-139	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03
Ce-140	1.833E-03	1.833E-03	1.833E-03	1.833E-03	1.833E-03	1.833E-03	1.833E-03
Pr-141	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03
Ce-142	1.621E-03	1.621E-03	1.621E-03	1.621E-03	1.621E-03	1.621E-03	1.621E-03
Nd-142	7.270E-05	7.270E-05	7.270E-05	7.270E-05	7.270E-05	7.270E-05	7.270E-05
Nd-143	8.218E-04	8.218E-04	8.218E-04	8.218E-04	8.218E-04	8.218E-04	8.218E-04
Ce-144	1.015E-06	1.709E-07	2.878E-08	4.848E-09	3.351E-10	3.901E-12	0.00
Pr-144	4.285E-11	7.216E-12	1.215E-12	2.047E-13	1.415E-14	1.647E-16	0.00
Pr-144m	2.142E-13	3.607E-14	6.076E-15	1.023E-15	7.073E-17	8.234E-19	0.00
Nd-144	2.119E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03
Nd-145	8.755E-04	8.755E-04	8.755E-04	8.755E-04	8.755E-04	8.755E-04	8.755E-04
Nd-146	1.093E-03	1.093E-03	1.093E-03	1.093E-03	1.093E-03	1.093E-03	1.093E-03
Pm-146	4.742E-09	3.686E-09	2.865E-09	2.226E-09	1.525E-09	8.124E-10	0.00
Sm-146	2.028E-08	2.067E-08	2.097E-08	2.121E-08	2.147E-08	2.173E-08	2.203E-08
Pm-147	2.214E-05	1.305E-05	7.694E-06	4.536E-06	2.053E-06	5.479E-07	0.00
Sm-147	1.878E-04	1.969E-04	2.023E-04	2.054E-04	2.079E-04	2.094E-04	2.099E-04
Nd-148	5.549E-04	5.549E-04	5.549E-04	5.549E-04	5.549E-04	5.549E-04	5.549E-04
Sm-148	3.215E-04	3.215E-04	3.215E-04	3.215E-04	3.215E-04	3.215E-04	3.215E-04
Sm-149	2.188E-06	2.188E-06	2.188E-06	2.188E-06	2.188E-06	2.188E-06	2.188E-06
Nd-150	2.916E-04	2.916E-04	2.916E-04	2.916E-04	2.916E-04	2.916E-04	2.916E-04
Sm-150	3.453E-04	3.453E-04	3.453E-04	3.453E-04	3.453E-04	3.453E-04	3.453E-04
Eu-150	4.507E-13	4.336E-13	4.173E-13	4.015E-13	3.790E-13	3.442E-13	2.199E-21
Sm-151	1.339E-05	1.319E-05	1.299E-05	1.279E-05	1.250E-05	1.202E-05	6.338E-09
Eu-151	6.438E-07	8.485E-07	1.050E-06	1.249E-06	1.541E-06	2.013E-06	1.403E-05
Sm-152	1.624E-04	1.624E-04	1.624E-04	1.624E-04	1.624E-04	1.624E-04	1.624E-04
Eu-152	3.582E-08	3.235E-08	2.921E-08	2.638E-08	2.264E-08	1.755E-08	3.575E-30
Gd-152	2.095E-08	2.191E-08	2.279E-08	2.358E-08	2.462E-08	2.604E-08	3.093E-08
Eu-153	1.706E-04	1.706E-04	1.706E-04	1.706E-04	1.706E-04	1.706E-04	1.706E-04
Gd-153	4.161E-11	5.136E-12	6.338E-13	7.822E-14	3.391E-15	1.815E-17	0.00
Sm-154	7.181E-05	7.181E-05	7.181E-05	7.181E-05	7.181E-05	7.181E-05	7.181E-05
Eu-154	4.751E-05	4.044E-05	3.442E-05	2.930E-05	2.300E-05	1.537E-05	0.00
Gd-154	4.364E-05	5.072E-05	5.674E-05	6.186E-05	6.815E-05	7.578E-05	9.116E-05
Eu-155	1.193E-05	9.024E-06	6.824E-06	5.160E-06	3.392E-06	1.687E-06	0.00
Gd-155	1.589E-05	1.880E-05	2.100E-05	2.267E-05	2.443E-05	2.614E-05	2.783E-05
Gd-156	2.283E-04	2.283E-04	2.283E-04	2.283E-04	2.283E-04	2.283E-04	2.283E-04
Gd-157	1.789E-07	1.789E-07	1.789E-07	1.789E-07	1.789E-07	1.789E-07	1.789E-07
Gd-158	5.086E-05	5.086E-05	5.086E-05	5.086E-05	5.086E-05	5.086E-05	5.086E-05
Tb-159	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06
Gd-160	2.884E-06	2.884E-06	2.884E-06	2.884E-06	2.884E-06	2.884E-06	2.884E-06
Tb-160	1.443E-16	1.312E-19	1.193E-22	1.084E-25	2.973E-30	0.00	0.00
Dy-160	9.657E-07	9.657E-07	9.657E-07	9.657E-07	9.657E-07	9.657E-07	9.657E-07
Dy-161	8.895E-07	8.895E-07	8.895E-07	8.895E-07	8.895E-07	8.895E-07	8.895E-07
Dy-162	8.313E-07	8.313E-07	8.313E-07	8.313E-07	8.313E-07	8.313E-07	8.313E-07
Dy-163	8.394E-07	8.394E-07	8.394E-07	8.394E-07	8.394E-07	8.394E-07	8.394E-07
Dy-164	1.184E-07	1.184E-07	1.184E-07	1.184E-07	1.184E-07	1.184E-07	1.184E-07
Ho-165	5.613E-07	5.613E-07	5.613E-07	5.613E-07	5.613E-07	5.613E-07	5.613E-07

TABLE F.3.g. Fission Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ho-166m	9.865E-09	9.854E-09	9.842E-09	9.831E-09	9.814E-09	9.785E-09	5.556E-09
Er-166	2.265E-07	2.265E-07	2.265E-07	2.265E-07	2.265E-07	2.266E-07	2.308E-07
Er-167	9.331E-09	9.331E-09	9.331E-09	9.331E-09	9.331E-09	9.331E-09	9.331E-09
Er-168	3.391E-08	3.391E-08	3.391E-08	3.391E-08	3.391E-08	3.391E-08	3.391E-08
Tm-169	3.148E-10	3.148E-10	3.148E-10	3.148E-10	3.148E-10	3.148E-10	3.148E-10
Er-170	2.632E-13	2.632E-13	2.632E-13	2.632E-13	2.632E-13	2.632E-13	2.632E-13
Tm-170	3.788E-16	7.383E-18	1.439E-19	2.810E-21	1.569E-23	8.324E-28	0.00
Yb-170	1.714E-10	1.714E-10	1.714E-10	1.714E-10	1.714E-10	1.714E-10	1.714E-10
Tm-171	7.390E-13	3.590E-13	1.744E-13	8.471E-14	2.868E-14	4.716E-15	0.00
Yb-171	1.735E-11	1.773E-11	1.792E-11	1.801E-11	1.806E-11	1.809E-11	1.809E-11
Yb-172	1.366E-12	1.366E-12	1.366E-12	1.366E-12	1.366E-12	1.366E-12	1.366E-12
Total	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02

TABLE F.4.a. Actinide Inventory by Isotope at 20 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	7.128E-07	7.628E-07	8.151E-07	8.694E-07	9.540E-07	1.102E-06	1.894E-05
Pb-207	7.077E-15	1.078E-14	1.529E-14	2.060E-14	3.004E-14	4.969E-14	9.192E-11
Pb-208	1.882E-11	2.749E-11	3.690E-11	4.674E-11	6.184E-11	8.694E-11	6.081E-10
Pb-212	7.276E-15	8.126E-15	8.629E-15	8.897E-15	9.014E-15	8.841E-15	8.795E-19
Ra-224	6.347E-14	7.088E-14	7.527E-14	7.761E-14	7.863E-14	7.712E-14	7.672E-18
Ra-226	2.462E-13	3.364E-13	4.413E-13	5.609E-13	7.680E-13	1.188E-12	2.180E-09
Ac-227	5.722E-14	7.106E-14	8.480E-14	9.845E-14	1.188E-13	1.522E-13	6.331E-12
Th-228	1.233E-11	1.374E-11	1.459E-11	1.505E-11	1.525E-11	1.497E-11	1.491E-15
Th-229	5.785E-13	5.916E-13	6.061E-13	6.219E-13	6.481E-13	6.983E-13	3.673E-10
Th-230	4.703E-09	5.530E-09	6.364E-09	7.203E-09	8.473E-09	1.062E-08	5.812E-07
Th-231	3.935E-14	3.935E-14	3.935E-14	3.935E-14	3.935E-14	3.936E-14	3.988E-14
Th-232	7.207E-10	8.692E-10	1.018E-09	1.166E-09	1.389E-09	1.761E-09	7.689E-08
Th-234	1.393E-11	1.393E-11	1.393E-11	1.393E-11	1.393E-11	1.393E-11	1.393E-11
Pa-231	4.217E-10	4.405E-10	4.592E-10	4.780E-10	5.061E-10	5.529E-10	9.692E-09
Pa-233	7.786E-12	7.818E-12	7.857E-12	7.901E-12	7.975E-12	8.119E-12	3.177E-11
U-232	5.650E-10	5.845E-10	5.919E-10	5.921E-10	5.846E-10	5.632E-10	5.547E-14
U-233	1.462E-09	1.616E-09	1.770E-09	1.926E-09	2.157E-09	2.534E-09	2.115E-07
U-234	1.480E-04	1.490E-04	1.501E-04	1.512E-04	1.527E-04	1.552E-04	2.180E-04
U-235	9.677E-03	9.678E-03	9.678E-03	9.678E-03	9.679E-03	9.679E-03	9.809E-03
U-236	2.551E-03	2.552E-03	2.552E-03	2.552E-03	2.553E-03	2.554E-03	2.712E-03
U-237	1.949E-11	1.770E-11	1.608E-11	1.460E-11	1.264E-11	9.936E-12	5.764E-18
U-238	9.592E-01	9.592E-01	9.592E-01	9.592E-01	9.592E-01	9.592E-01	9.592E-01
Np-235	2.853E-14	7.944E-15	2.212E-15	6.160E-16	9.053E-17	3.705E-18	0.00
Np-236	1.877E-10	1.877E-10	1.877E-10	1.877E-10	1.877E-10	1.877E-10	1.866E-10
Np-237	2.292E-04	2.302E-04	2.313E-04	2.326E-04	2.348E-04	2.390E-04	9.353E-04
Np-238	2.585E-13	2.561E-13	2.538E-13	2.515E-13	2.481E-13	2.425E-13	2.780E-15
Np-239	2.290E-11	2.290E-11	2.289E-11	2.289E-11	2.288E-11	2.287E-11	2.086E-11
Pu-236	8.071E-11	4.963E-11	3.052E-11	1.877E-11	9.050E-12	2.684E-12	4.163E-16
Pu-238	7.061E-05	6.951E-05	6.843E-05	6.737E-05	6.581E-05	6.328E-05	4.335E-08
Pu-239	4.730E-03	4.730E-03	4.729E-03	4.729E-03	4.729E-03	4.728E-03	4.599E-03
Pu-240	1.633E-03	1.633E-03	1.632E-03	1.632E-03	1.632E-03	1.632E-03	1.472E-03
Pu-241	6.296E-04	5.718E-04	5.193E-04	4.717E-04	4.082E-04	3.209E-04	1.864E-10
Pu-242	2.068E-04	2.068E-04	2.068E-04	2.068E-04	2.068E-04	2.068E-04	2.066E-04
Pu-244	2.973E-09	2.973E-09	2.973E-09	2.973E-09	2.973E-09	2.973E-09	2.973E-09
Am-241	2.771E-04	3.339E-04	3.853E-04	4.316E-04	4.928E-04	5.758E-04	1.886E-04
Am-242m	1.379E-06	1.366E-06	1.354E-06	1.341E-06	1.323E-06	1.293E-06	1.482E-08
Am-242	1.649E-11	1.634E-11	1.619E-11	1.605E-11	1.583E-11	1.547E-11	1.773E-13
Am-243	2.665E-05	2.664E-05	2.664E-05	2.663E-05	2.662E-05	2.661E-05	2.427E-05
Cm-242	4.212E-09	3.349E-09	3.282E-09	3.251E-09	3.207E-09	3.130E-09	3.586E-11
Cm-243	1.350E-07	1.286E-07	1.225E-07	1.167E-07	1.085E-07	9.604E-08	4.279E-18
Cm-244	3.610E-06	3.344E-06	3.097E-06	2.869E-06	2.558E-06	2.112E-06	1.083E-22
Cm-245	1.211E-07	1.211E-07	1.210E-07	1.210E-07	1.210E-07	1.209E-07	1.117E-07
Cm-246	8.947E-09	8.944E-09	8.942E-09	8.939E-09	8.935E-09	8.929E-09	7.735E-09
Cm-247	5.231E-11	5.231E-11	5.231E-11	5.231E-11	5.231E-11	5.231E-11	5.231E-11
Cm-248	1.627E-12	1.627E-12	1.627E-12	1.627E-12	1.627E-12	1.627E-12	1.624E-12

TABLE F.4.a. Actinide Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cf-249	1.238E-14	1.240E-14	1.236E-14	1.232E-14	1.224E-14	1.212E-14	1.745E-15
Cf-250	1.241E-15	1.116E-15	1.004E-15	9.030E-16	7.703E-16	5.910E-16	1.316E-25
Total	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01

TABLE F.4.b. Actinide Inventory by Isotope at 25 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	1.152E-06	1.227E-06	1.305E-06	1.385E-06	1.507E-06	1.718E-06	2.411E-05
Pb-207	7.306E-15	1.112E-14	1.573E-14	2.114E-14	3.069E-14	5.036E-14	7.317E-11
Pb-208	2.803E-11	4.140E-11	5.599E-11	7.131E-11	9.488E-11	1.342E-10	9.509E-10
Pb-212	1.117E-14	1.257E-14	1.341E-14	1.387E-14	1.409E-14	1.384E-14	1.359E-18
Bi-212	1.059E-15	1.192E-15	1.272E-15	1.316E-15	1.336E-15	1.313E-15	1.289E-19
Ra-224	9.740E-14	1.096E-13	1.170E-13	1.210E-13	1.229E-13	1.208E-13	1.185E-17
Ra-226	2.261E-13	3.092E-13	4.060E-13	5.168E-13	7.093E-13	1.102E-12	2.440E-09
Ac-227	5.897E-14	7.292E-14	8.659E-14	1.000E-13	1.197E-13	1.514E-13	4.980E-12
Th-228	1.892E-11	2.126E-11	2.268E-11	2.345E-11	2.384E-11	2.345E-11	2.303E-15
Th-229	9.322E-13	9.475E-13	9.646E-13	9.834E-13	1.015E-12	1.076E-12	4.739E-10
Th-230	4.322E-09	5.099E-09	5.885E-09	6.681E-09	7.892E-09	9.958E-09	6.596E-07
Th-231	3.048E-14	3.048E-14	3.048E-14	3.048E-14	3.048E-14	3.048E-14	3.103E-14
Th-232	8.165E-10	9.830E-10	1.150E-09	1.316E-09	1.566E-09	1.982E-09	8.645E-08
Th-234	1.386E-11	1.386E-11	1.386E-11	1.386E-11	1.386E-11	1.386E-11	1.386E-11
Pa-231	4.292E-10	4.437E-10	4.582E-10	4.728E-10	4.945E-10	5.308E-10	7.624E-09
Pa-233	1.040E-11	1.044E-11	1.049E-11	1.054E-11	1.063E-11	1.081E-11	4.064E-11
U-232	8.771E-10	9.108E-10	9.245E-10	9.259E-10	9.152E-10	8.824E-10	8.582E-14
U-233	1.692E-09	1.897E-09	2.104E-09	2.312E-09	2.620E-09	3.122E-09	2.720E-07
U-234	1.385E-04	1.402E-04	1.420E-04	1.437E-04	1.462E-04	1.503E-04	2.521E-04
U-235	7.496E-03	7.496E-03	7.496E-03	7.496E-03	7.497E-03	7.498E-03	7.632E-03
U-236	2.860E-03	2.860E-03	2.861E-03	2.861E-03	2.862E-03	2.863E-03	3.057E-03
U-237	2.470E-11	2.243E-11	2.037E-11	1.850E-11	1.601E-11	1.259E-11	1.973E-17
U-238	9.549E-01	9.549E-01	9.549E-01	9.549E-01	9.549E-01	9.549E-01	9.549E-01
Np-235	4.545E-14	1.266E-14	3.524E-15	9.815E-16	1.442E-16	5.902E-18	0.00
Np-236	2.741E-10	2.741E-10	2.741E-10	2.741E-10	2.741E-10	2.741E-10	2.725E-10
Np-237	3.061E-04	3.073E-04	3.087E-04	3.103E-04	3.131E-04	3.184E-04	1.197E-03
Np-238	3.283E-13	3.253E-13	3.224E-13	3.194E-13	3.151E-13	3.080E-13	3.530E-15
Np-239	4.883E-11	4.883E-11	4.882E-11	4.881E-11	4.879E-11	4.877E-11	4.448E-11
Pu-236	1.347E-10	8.283E-11	5.094E-11	3.132E-11	1.510E-11	4.479E-12	6.080E-16
Pu-238	1.147E-04	1.130E-04	1.112E-04	1.095E-04	1.069E-04	1.028E-04	6.480E-08
Pu-239	4.918E-03	4.918E-03	4.918E-03	4.918E-03	4.917E-03	4.916E-03	4.785E-03
Pu-240	1.993E-03	1.993E-03	1.993E-03	1.993E-03	1.994E-03	1.994E-03	1.802E-03
Pu-241	7.977E-04	7.245E-04	6.580E-04	5.976E-04	5.172E-04	4.066E-04	6.379E-10
Pu-242	3.477E-04	3.477E-04	3.477E-04	3.477E-04	3.477E-04	3.477E-04	3.474E-04
Pu-244	8.609E-09	8.609E-09	8.609E-09	8.609E-09	8.609E-09	8.609E-09	8.609E-09
Am-241	3.459E-04	4.179E-04	4.830E-04	5.417E-04	6.193E-04	7.245E-04	2.379E-04
Am-242m	1.751E-06	1.735E-06	1.719E-06	1.704E-06	1.680E-06	1.643E-06	1.883E-08
Am-242	2.094E-11	2.075E-11	2.057E-11	2.038E-11	2.010E-11	1.965E-11	2.252E-13
Am-243	5.683E-05	5.681E-05	5.680E-05	5.679E-05	5.678E-05	5.675E-05	5.176E-05
Cm-242	5.604E-09	4.265E-09	4.169E-09	4.128E-09	4.073E-09	3.975E-09	4.554E-11
Cm-243	2.694E-07	2.566E-07	2.444E-07	2.328E-07	2.164E-07	1.916E-07	8.538E-18
Cm-244	1.030E-05	9.541E-06	8.838E-06	8.187E-06	7.299E-06	6.027E-06	3.091E-22
Cm-245	4.144E-07	4.143E-07	4.143E-07	4.142E-07	4.141E-07	4.139E-07	3.821E-07
Cm-246	4.110E-08	4.109E-08	4.107E-08	4.106E-08	4.104E-08	4.101E-08	3.553E-08
Cm-247	3.125E-10	3.125E-10	3.125E-10	3.125E-10	3.125E-10	3.125E-10	3.125E-10
Cm-248	1.281E-11	1.281E-11	1.281E-11	1.281E-11	1.281E-11	1.281E-11	1.278E-11

TABLE F.4.b. Actinide Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cf-249	1.174E-13	1.176E-13	1.173E-13	1.168E-13	1.161E-13	1.150E-13	1.655E-14
Cf-250	1.343E-14	1.208E-14	1.087E-14	9.773E-15	8.337E-15	6.396E-15	1.870E-24
Cf-251	6.441E-15	6.431E-15	6.422E-15	6.412E-15	6.397E-15	6.372E-15	2.991E-15
Total	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01

TABLE F.4.c. Actinide Inventory by Isotope at 30 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	1.665E-06	1.775E-06	1.886E-06	1.998E-06	2.168E-06	2.454E-06	2.873E-05
Pb-207	7.353E-15	1.118E-14	1.581E-14	2.120E-14	3.070E-14	5.008E-14	5.774E-11
Pb-208	3.880E-11	5.781E-11	7.867E-11	1.006E-10	1.345E-10	1.910E-10	1.368E-09
Pb-212	1.582E-14	1.792E-14	1.920E-14	1.990E-14	2.025E-14	1.993E-14	1.930E-18
Bi-209	1.142E-15	1.386E-15	1.633E-15	1.884E-15	2.267E-15	2.929E-15	1.462E-11
Bi-212	1.501E-15	1.700E-15	1.821E-15	1.888E-15	1.921E-15	1.891E-15	1.831E-19
Ra-224	1.380E-13	1.563E-13	1.674E-13	1.736E-13	1.767E-13	1.739E-13	1.684E-17
Ra-226	2.071E-13	2.835E-13	3.729E-13	4.755E-13	6.547E-13	1.023E-12	2.768E-09
Ac-227	5.933E-14	7.317E-14	8.659E-14	9.964E-14	1.185E-13	1.484E-13	3.874E-12
Th-228	2.681E-11	3.031E-11	3.246E-11	3.365E-11	3.428E-11	3.376E-11	3.272E-15
Th-229	1.407E-12	1.424E-12	1.443E-12	1.465E-12	1.501E-12	1.572E-12	5.659E-10
Th-230	3.965E-09	4.697E-09	5.442E-09	6.201E-09	7.366E-09	9.373E-09	7.573E-07
Th-231	2.324E-14	2.324E-14	2.324E-14	2.324E-14	2.325E-14	2.325E-14	2.381E-14
Th-232	8.893E-10	1.069E-09	1.248E-09	1.427E-09	1.696E-09	2.145E-09	9.340E-08
Th-234	1.380E-11	1.380E-11	1.380E-11	1.380E-11	1.380E-11	1.380E-11	1.380E-11
Pa-231	4.287E-10	4.398E-10	4.509E-10	4.619E-10	4.785E-10	5.062E-10	5.930E-09
Pa-233	1.300E-11	1.305E-11	1.310E-11	1.316E-11	1.327E-11	1.348E-11	4.788E-11
U-232	1.254E-09	1.306E-09	1.328E-09	1.332E-09	1.318E-09	1.271E-09	1.220E-13
U-233	1.883E-09	2.140E-09	2.399E-09	2.658E-09	3.043E-09	3.669E-09	3.230E-07
U-234	1.299E-04	1.325E-04	1.350E-04	1.375E-04	1.411E-04	1.470E-04	2.940E-04
U-235	5.716E-03	5.716E-03	5.716E-03	5.717E-03	5.717E-03	5.718E-03	5.856E-03
U-236	3.080E-03	3.081E-03	3.081E-03	3.082E-03	3.083E-03	3.084E-03	3.312E-03
U-237	2.865E-11	2.602E-11	2.363E-11	2.146E-11	1.858E-11	1.460E-11	5.190E-17
U-238	9.504E-01	9.504E-01	9.504E-01	9.504E-01	9.504E-01	9.504E-01	9.504E-01
Np-235	6.557E-14	1.826E-14	5.085E-15	1.416E-15	2.081E-16	8.515E-18	0.00
Np-236	3.654E-10	3.654E-10	3.653E-10	3.653E-10	3.653E-10	3.653E-10	3.632E-10
Np-237	3.827E-04	3.841E-04	3.857E-04	3.876E-04	3.907E-04	3.968E-04	1.410E-03
Np-238	3.651E-13	3.618E-13	3.585E-13	3.552E-13	3.504E-13	3.425E-13	3.926E-15
Np-239	8.728E-11	8.727E-11	8.725E-11	8.723E-11	8.721E-11	8.717E-11	7.950E-11
Pu-236	2.032E-10	1.250E-10	7.684E-11	4.725E-11	2.278E-11	6.757E-12	8.104E-16
Pu-238	1.661E-04	1.635E-04	1.609E-04	1.584E-04	1.547E-04	1.488E-04	8.702E-08
Pu-239	5.039E-03	5.039E-03	5.039E-03	5.038E-03	5.038E-03	5.037E-03	4.906E-03
Pu-240	2.328E-03	2.329E-03	2.331E-03	2.331E-03	2.333E-03	2.334E-03	2.116E-03
Pu-241	9.253E-04	8.404E-04	7.632E-04	6.932E-04	6.000E-04	4.716E-04	1.678E-09
Pu-242	5.072E-04	5.072E-04	5.072E-04	5.072E-04	5.072E-04	5.072E-04	5.067E-04
Pu-244	2.006E-08	2.006E-08	2.006E-08	2.006E-08	2.006E-08	2.006E-08	2.006E-08
Am-241	3.935E-04	4.770E-04	5.525E-04	6.207E-04	7.107E-04	8.328E-04	2.744E-04
Am-242m	1.947E-06	1.929E-06	1.912E-06	1.895E-06	1.869E-06	1.827E-06	2.094E-08
Am-242	2.329E-11	2.308E-11	2.287E-11	2.266E-11	2.235E-11	2.185E-11	2.504E-13
Am-243	1.016E-04	1.015E-04	1.015E-04	1.015E-04	1.015E-04	1.014E-04	9.251E-05
Cm-242	6.581E-09	4.759E-09	4.636E-09	4.591E-09	4.530E-09	4.420E-09	5.064E-11
Cm-243	4.503E-07	4.289E-07	4.086E-07	3.892E-07	3.618E-07	3.204E-07	1.427E-17
Cm-244	2.352E-05	2.179E-05	2.018E-05	1.869E-05	1.666E-05	1.376E-05	7.057E-22
Cm-245	1.090E-06	1.090E-06	1.090E-06	1.090E-06	1.089E-06	1.089E-06	1.005E-06
Cm-246	1.386E-07	1.386E-07	1.386E-07	1.385E-07	1.385E-07	1.383E-07	1.198E-07
Cm-247	1.308E-09	1.308E-09	1.308E-09	1.308E-09	1.308E-09	1.308E-09	1.308E-09

TABLE F.4.c. Actinide Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cm-248	6.773E-11	6.774E-11	6.774E-11	6.774E-11	6.774E-11	6.774E-11	6.760E-11
Bk-249	4.946E-15	1.016E-15	2.089E-16	4.293E-17	4.000E-18	7.660E-20	0.00
Cf-249	7.189E-13	7.199E-13	7.179E-13	7.152E-13	7.110E-13	7.040E-13	1.014E-13
Cf-250	9.115E-14	8.198E-14	7.374E-14	6.632E-14	5.657E-14	4.341E-14	1.598E-23
Cf-251	4.766E-14	4.759E-14	4.751E-14	4.744E-14	4.733E-14	4.715E-14	2.213E-14
Cf-252	5.361E-15	3.170E-15	1.874E-15	1.108E-15	5.038E-16	1.354E-16	0.00
Total	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01

TABLE F.4.d. Actinide Inventory by Isotope at 35 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	2.239E-06	2.394E-06	2.549E-06	2.704E-06	2.935E-06	3.316E-06	3.347E-05
Pb-207	7.248E-15	1.102E-14	1.557E-14	2.086E-14	3.014E-14	4.898E-14	4.545E-11
Pb-208	5.082E-11	7.626E-11	1.043E-10	1.339E-10	1.795E-10	2.559E-10	1.847E-09
Pb-212	2.112E-14	2.404E-14	2.583E-14	2.683E-14	2.735E-14	2.694E-14	2.578E-18
Bi-209	1.653E-15	1.999E-15	2.349E-15	2.703E-15	3.243E-15	4.167E-15	1.702E-11
Bi-212	2.003E-15	2.280E-15	2.450E-15	2.545E-15	2.594E-15	2.556E-15	2.445E-19
Ra-224	1.842E-13	2.097E-13	2.253E-13	2.340E-13	2.386E-13	2.350E-13	2.248E-17
Ra-226	1.892E-13	2.593E-13	3.418E-13	4.369E-13	6.040E-13	9.501E-13	3.143E-09
Ac-227	5.850E-14	7.202E-14	8.505E-14	9.761E-14	1.156E-13	1.437E-13	2.996E-12
Th-228	3.579E-11	4.066E-11	4.368E-11	4.537E-11	4.628E-11	4.563E-11	4.369E-15
Th-229	2.003E-12	2.021E-12	2.042E-12	2.066E-12	2.107E-12	2.188E-12	6.561E-10
Th-230	3.633E-09	4.324E-09	5.033E-09	5.762E-09	6.889E-09	8.856E-09	8.685E-07
Th-231	1.753E-14	1.753E-14	1.753E-14	1.754E-14	1.754E-14	1.754E-14	1.811E-14
Th-232	9.412E-10	1.129E-09	1.316E-09	1.504E-09	1.785E-09	2.254E-09	9.788E-08
Th-234	1.373E-11	1.373E-11	1.373E-11	1.373E-11	1.373E-11	1.373E-11	1.373E-11
Pa-231	4.212E-10	4.295E-10	4.379E-10	4.462E-10	4.587E-10	4.796E-10	4.587E-09
Pa-233	1.553E-11	1.558E-11	1.564E-11	1.571E-11	1.583E-11	1.607E-11	5.499E-11
U-232	1.686E-09	1.761E-09	1.793E-09	1.799E-09	1.781E-09	1.719E-09	1.631E-13
U-233	2.043E-09	2.350E-09	2.658E-09	2.968E-09	3.427E-09	4.175E-09	3.730E-07
U-234	1.223E-04	1.257E-04	1.291E-04	1.324E-04	1.373E-04	1.451E-04	3.414E-04
U-235	4.312E-03	4.312E-03	4.312E-03	4.313E-03	4.313E-03	4.314E-03	4.454E-03
U-236	3.220E-03	3.221E-03	3.221E-03	3.222E-03	3.222E-03	3.224E-03	3.478E-03
U-237	3.266E-11	2.966E-11	2.694E-11	2.446E-11	2.117E-11	1.665E-11	1.129E-16
U-238	9.457E-01	9.457E-01	9.457E-01	9.457E-01	9.457E-01	9.457E-01	9.457E-01
Np-235	8.774E-14	2.443E-14	6.804E-15	1.895E-15	2.784E-16	1.139E-17	0.00
Np-236	4.573E-10	4.573E-10	4.573E-10	4.573E-10	4.573E-10	4.573E-10	4.546E-10
Np-237	4.572E-04	4.588E-04	4.606E-04	4.627E-04	4.662E-04	4.731E-04	1.619E-03
Np-238	3.782E-13	3.748E-13	3.714E-13	3.680E-13	3.630E-13	3.548E-13	4.067E-15
Np-239	1.391E-10	1.390E-10	1.390E-10	1.390E-10	1.389E-10	1.389E-10	1.267E-10
Pu-236	2.846E-10	1.750E-10	1.076E-10	6.618E-11	3.191E-11	9.464E-12	1.014E-15
Pu-238	2.221E-04	2.187E-04	2.152E-04	2.119E-04	2.069E-04	1.990E-04	1.096E-07
Pu-239	5.102E-03	5.102E-03	5.101E-03	5.101E-03	5.101E-03	5.100E-03	4.972E-03
Pu-240	2.574E-03	2.577E-03	2.580E-03	2.582E-03	2.585E-03	2.589E-03	2.358E-03
Pu-241	1.055E-03	9.579E-04	8.700E-04	7.901E-04	6.839E-04	5.376E-04	3.650E-09
Pu-242	6.812E-04	6.812E-04	6.812E-04	6.812E-04	6.812E-04	6.812E-04	6.804E-04
Pu-244	4.010E-08	4.010E-08	4.010E-08	4.010E-08	4.010E-08	4.010E-08	4.010E-08
Am-241	4.375E-04	5.328E-04	6.189E-04	6.966E-04	7.993E-04	9.386E-04	3.105E-04
Am-242m	2.017E-06	1.999E-06	1.981E-06	1.963E-06	1.936E-06	1.892E-06	2.169E-08
Am-242	2.413E-11	2.391E-11	2.369E-11	2.348E-11	2.316E-11	2.264E-11	2.595E-13
Am-243	1.618E-04	1.618E-04	1.618E-04	1.617E-04	1.617E-04	1.616E-04	1.474E-04
Cm-242	7.212E-09	4.948E-09	4.804E-09	4.756E-09	4.693E-09	4.579E-09	5.246E-11
Cm-243	6.634E-07	6.319E-07	6.019E-07	5.733E-07	5.330E-07	4.720E-07	2.103E-17
Cm-244	4.578E-05	4.240E-05	3.928E-05	3.639E-05	3.244E-05	2.679E-05	1.374E-21
Cm-245	2.371E-06	2.370E-06	2.370E-06	2.370E-06	2.369E-06	2.368E-06	2.186E-06
Cm-246	3.765E-07	3.764E-07	3.763E-07	3.762E-07	3.761E-07	3.758E-07	3.255E-07
Cm-247	4.279E-09	4.279E-09	4.279E-09	4.279E-09	4.279E-09	4.279E-09	4.279E-09

TABLE F.4.d. Actinide Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cm-248	2.720E-10	2.720E-10	2.720E-10	2.720E-10	2.720E-10	2.720E-10	2.715E-10
Bk-249	2.263E-14	4.651E-15	9.559E-16	1.965E-16	1.830E-17	3.505E-19	0.00
Cf-249	3.243E-12	3.248E-12	3.239E-12	3.227E-12	3.208E-12	3.176E-12	4.573E-13
Cf-250	4.450E-13	4.003E-13	3.600E-13	3.238E-13	2.762E-13	2.119E-13	9.718E-23
Cf-251	2.486E-13	2.482E-13	2.478E-13	2.475E-13	2.469E-13	2.459E-13	1.154E-13
Cf-252	3.434E-14	2.030E-14	1.200E-14	7.098E-15	3.227E-15	8.674E-16	0.00
Total	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01

TABLE F.4.e. Actinide Inventory by Isotope at 40 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	2.872E-06	3.087E-06	3.299E-06	3.508E-06	3.816E-06	4.315E-06	3.807E-05
Pb-207	7.019E-15	1.067E-14	1.507E-14	2.018E-14	2.912E-14	4.719E-14	3.576E-11
Pb-208	6.362E-11	9.601E-11	1.318E-10	1.697E-10	2.282E-10	3.262E-10	2.370E-09
Pb-212	2.683E-14	3.067E-14	3.303E-14	3.436E-14	3.508E-14	3.459E-14	3.272E-18
Bi-209	2.269E-15	2.737E-15	3.209E-15	3.686E-15	4.409E-15	5.643E-15	1.918E-11
Bi-212	2.545E-15	2.909E-15	3.134E-15	3.260E-15	3.327E-15	3.281E-15	3.104E-19
Ra-224	2.341E-13	2.676E-13	2.882E-13	2.998E-13	3.060E-13	3.017E-13	2.854E-17
Ra-226	1.725E-13	2.370E-13	3.132E-13	4.015E-13	5.577E-13	8.843E-13	3.550E-09
Ac-227	5.667E-14	6.971E-14	8.219E-14	9.416E-14	1.112E-13	1.375E-13	2.310E-12
Th-228	4.548E-11	5.188E-11	5.587E-11	5.811E-11	5.936E-11	5.858E-11	5.547E-15
Th-229	2.708E-12	2.728E-12	2.751E-12	2.777E-12	2.821E-12	2.910E-12	7.367E-10
Th-230	3.327E-09	3.982E-09	4.661E-09	5.364E-09	6.462E-09	8.404E-09	9.882E-07
Th-231	1.311E-14	1.311E-14	1.311E-14	1.311E-14	1.311E-14	1.311E-14	1.369E-14
Th-232	9.753E-10	1.167E-09	1.359E-09	1.550E-09	1.838E-09	2.318E-09	1.003E-07
Th-234	1.366E-11	1.366E-11	1.366E-11	1.366E-11	1.366E-11	1.366E-11	1.366E-11
Pa-231	4.073E-10	4.136E-10	4.198E-10	4.261E-10	4.354E-10	4.510E-10	3.537E-09
Pa-233	1.786E-11	1.792E-11	1.799E-11	1.806E-11	1.819E-11	1.845E-11	6.126E-11
U-232	2.156E-09	2.255E-09	2.299E-09	2.308E-09	2.286E-09	2.207E-09	2.071E-13
U-233	2.172E-09	2.525E-09	2.880E-09	3.235E-09	3.763E-09	4.622E-09	4.173E-07
U-234	1.154E-04	1.198E-04	1.240E-04	1.282E-04	1.344E-04	1.444E-04	3.922E-04
U-235	3.223E-03	3.224E-03	3.224E-03	3.224E-03	3.225E-03	3.225E-03	3.366E-03
U-236	3.293E-03	3.294E-03	3.294E-03	3.295E-03	3.296E-03	3.297E-03	3.571E-03
U-237	3.614E-11	3.282E-11	2.981E-11	2.707E-11	2.343E-11	1.842E-11	2.134E-16
U-238	9.408E-01	9.408E-01	9.408E-01	9.408E-01	9.408E-01	9.408E-01	9.408E-01
Np-235	1.106E-13	3.079E-14	8.574E-15	2.388E-15	3.509E-16	1.436E-17	0.00
Np-236	5.453E-10	5.453E-10	5.453E-10	5.453E-10	5.453E-10	5.453E-10	5.421E-10
Np-237	5.259E-04	5.276E-04	5.295E-04	5.318E-04	5.357E-04	5.432E-04	1.804E-03
Np-238	3.793E-13	3.758E-13	3.724E-13	3.691E-13	3.640E-13	3.558E-13	4.078E-15
Np-239	2.028E-10	2.027E-10	2.027E-10	2.027E-10	2.026E-10	2.025E-10	1.847E-10
Pu-236	3.755E-10	2.309E-10	1.420E-10	8.731E-11	4.210E-11	1.248E-11	1.210E-15
Pu-238	2.808E-04	2.764E-04	2.721E-04	2.679E-04	2.616E-04	2.515E-04	1.325E-07
Pu-239	5.124E-03	5.124E-03	5.123E-03	5.123E-03	5.123E-03	5.122E-03	5.001E-03
Pu-240	2.745E-03	2.750E-03	2.755E-03	2.759E-03	2.765E-03	2.773E-03	2.541E-03
Pu-241	1.167E-03	1.060E-03	9.627E-04	8.743E-04	7.568E-04	5.949E-04	6.902E-09
Pu-242	8.644E-04	8.644E-04	8.644E-04	8.644E-04	8.644E-04	8.644E-04	8.634E-04
Pu-244	7.173E-08	7.173E-08	7.173E-08	7.173E-08	7.173E-08	7.173E-08	7.173E-08
Am-241	4.738E-04	5.792E-04	6.745E-04	7.605E-04	8.742E-04	1.028E-03	3.416E-04
Am-242m	2.023E-06	2.005E-06	1.986E-06	1.968E-06	1.942E-06	1.898E-06	2.175E-08
Am-242	2.420E-11	2.398E-11	2.376E-11	2.355E-11	2.323E-11	2.270E-11	2.602E-13
Am-243	2.360E-04	2.359E-04	2.359E-04	2.358E-04	2.358E-04	2.356E-04	2.149E-04
Cm-242	7.653E-09	4.981E-09	4.819E-09	4.770E-09	4.706E-09	4.592E-09	5.261E-11
Cm-243	8.936E-07	8.511E-07	8.107E-07	7.722E-07	7.179E-07	6.357E-07	2.832E-17
Cm-244	7.969E-05	7.382E-05	6.838E-05	6.334E-05	5.647E-05	4.663E-05	2.391E-21
Cm-245	4.483E-06	4.483E-06	4.482E-06	4.481E-06	4.480E-06	4.478E-06	4.134E-06
Cm-246	8.671E-07	8.669E-07	8.666E-07	8.664E-07	8.660E-07	8.653E-07	7.496E-07
Cm-247	1.158E-08	1.158E-08	1.158E-08	1.158E-08	1.158E-08	1.158E-08	1.158E-08

TABLE F.4.e. Actinide Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cm-248	8.835E-10	8.836E-10	8.836E-10	8.836E-10	8.836E-10	8.836E-10	8.819E-10
Bk-249	8.179E-14	1.681E-14	3.455E-15	7.100E-16	6.615E-17	1.267E-18	0.00
Cf-249	1.157E-11	1.159E-11	1.156E-11	1.152E-11	1.145E-11	1.134E-11	1.632E-12
Cf-250	1.690E-12	1.520E-12	1.367E-12	1.230E-12	1.049E-12	8.049E-13	4.565E-22
Cf-251	9.933E-13	9.917E-13	9.902E-13	9.887E-13	9.864E-13	9.826E-13	4.612E-13
Cf-252	1.645E-13	9.727E-14	5.751E-14	3.400E-14	1.546E-14	4.156E-15	0.00
Total	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01

TABLE F.4.f. Actinide Inventory by Isotope at 45 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	3.572E-06	3.862E-06	4.146E-06	4.423E-06	4.826E-06	5.468E-06	4.245E-05
Pb-207	6.699E-15	1.019E-14	1.438E-14	1.925E-14	2.775E-14	4.487E-14	2.822E-11
Pb-208	7.672E-11	1.163E-10	1.602E-10	2.067E-10	2.786E-10	3.992E-10	2.915E-09
Pb-212	3.275E-14	3.755E-14	4.053E-14	4.221E-14	4.313E-14	4.256E-14	3.988E-18
Bi-209	2.981E-15	3.588E-15	4.198E-15	4.812E-15	5.744E-15	7.327E-15	2.100E-11
Bi-212	3.106E-15	3.562E-15	3.844E-15	4.004E-15	4.091E-15	4.037E-15	3.783E-19
Ra-224	2.857E-13	3.276E-13	3.535E-13	3.682E-13	3.762E-13	3.712E-13	3.479E-17
Ra-226	1.572E-13	2.164E-13	2.869E-13	3.691E-13	5.155E-13	8.251E-13	3.970E-09
Ac-227	5.409E-14	6.651E-14	7.835E-14	8.964E-14	1.056E-13	1.300E-13	1.781E-12
Th-228	5.549E-11	6.352E-11	6.854E-11	7.138E-11	7.299E-11	7.208E-11	6.760E-15
Th-229	3.508E-12	3.528E-12	3.552E-12	3.580E-12	3.627E-12	3.723E-12	8.038E-10
Th-230	3.047E-09	3.672E-09	4.325E-09	5.007E-09	6.082E-09	8.011E-09	1.112E-06
Th-231	9.725E-15	9.726E-15	9.727E-15	9.728E-15	9.730E-15	9.733E-15	1.031E-14
Th-232	9.948E-10	1.188E-09	1.381E-09	1.574E-09	1.863E-09	2.346E-09	1.012E-07
Th-234	1.359E-11	1.359E-11	1.359E-11	1.359E-11	1.359E-11	1.359E-11	1.359E-11
Pa-231	3.888E-10	3.934E-10	3.980E-10	4.027E-10	4.096E-10	4.212E-10	2.727E-09
Pa-233	1.992E-11	1.998E-11	2.005E-11	2.014E-11	2.028E-11	2.055E-11	6.632E-11
U-232	2.643E-09	2.770E-09	2.826E-09	2.839E-09	2.813E-09	2.716E-09	2.524E-13
U-233	2.273E-09	2.667E-09	3.062E-09	3.459E-09	4.048E-09	5.004E-09	4.538E-07
U-234	1.094E-04	1.147E-04	1.198E-04	1.249E-04	1.324E-04	1.445E-04	4.444E-04
U-235	2.392E-03	2.392E-03	2.392E-03	2.393E-03	2.393E-03	2.394E-03	2.534E-03
U-236	3.314E-03	3.314E-03	3.315E-03	3.315E-03	3.316E-03	3.318E-03	3.607E-03
U-237	3.883E-11	3.527E-11	3.203E-11	2.909E-11	2.518E-11	1.979E-11	3.642E-16
U-238	9.359E-01	9.359E-01	9.359E-01	9.359E-01	9.359E-01	9.359E-01	9.359E-01
Np-235	1.329E-13	3.701E-14	1.031E-14	2.870E-15	4.218E-16	1.726E-17	0.00
Np-236	6.257E-10	6.257E-10	6.257E-10	6.257E-10	6.256E-10	6.256E-10	6.219E-10
Np-237	5.866E-04	5.883E-04	5.904E-04	5.928E-04	5.970E-04	6.050E-04	1.953E-03
Np-238	3.718E-13	3.684E-13	3.651E-13	3.618E-13	3.568E-13	3.488E-13	3.998E-15
Np-239	2.764E-10	2.764E-10	2.763E-10	2.763E-10	2.762E-10	2.761E-10	2.518E-10
Pu-236	4.720E-10	2.903E-10	1.785E-10	1.098E-10	5.293E-11	1.570E-11	1.388E-15
Pu-238	3.403E-04	3.350E-04	3.297E-04	3.246E-04	3.170E-04	3.047E-04	1.552E-07
Pu-239	5.128E-03	5.127E-03	5.127E-03	5.127E-03	5.127E-03	5.126E-03	5.012E-03
Pu-240	2.856E-03	2.865E-03	2.873E-03	2.880E-03	2.890E-03	2.904E-03	2.684E-03
Pu-241	1.254E-03	1.139E-03	1.035E-03	9.396E-04	8.132E-04	6.393E-04	1.178E-08
Pu-242	1.049E-03	1.049E-03	1.049E-03	1.049E-03	1.049E-03	1.049E-03	1.048E-03
Pu-244	1.179E-07	1.179E-07	1.179E-07	1.179E-07	1.179E-07	1.179E-07	1.179E-07
Am-241	5.001E-04	6.134E-04	7.159E-04	8.084E-04	9.305E-04	1.096E-03	3.654E-04
Am-242m	1.983E-06	1.965E-06	1.947E-06	1.929E-06	1.903E-06	1.860E-06	2.132E-08
Am-242	2.372E-11	2.351E-11	2.329E-11	2.308E-11	2.277E-11	2.225E-11	2.551E-13
Am-243	3.217E-04	3.216E-04	3.216E-04	3.215E-04	3.214E-04	3.213E-04	2.930E-04
Cm-242	7.939E-09	4.902E-09	4.724E-09	4.676E-09	4.613E-09	4.502E-09	5.157E-11
Cm-243	1.132E-06	1.078E-06	1.027E-06	9.781E-07	9.093E-07	8.052E-07	3.587E-17
Cm-244	1.274E-04	1.180E-04	1.093E-04	1.013E-04	9.027E-05	7.455E-05	3.823E-21
Cm-245	7.650E-06	7.649E-06	7.647E-06	7.646E-06	7.644E-06	7.641E-06	7.054E-06
Cm-246	1.762E-06	1.762E-06	1.761E-06	1.761E-06	1.760E-06	1.759E-06	1.523E-06
Cm-247	2.708E-08	2.708E-08	2.708E-08	2.708E-08	2.708E-08	2.708E-08	2.709E-08

TABLE F.4.f. Actinide Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cm-248	2.434E-09	2.434E-09	2.434E-09	2.434E-09	2.434E-09	2.434E-09	2.429E-09
Bk-249	2.462E-13	5.059E-14	1.040E-14	2.137E-15	1.991E-16	3.812E-18	0.00
Cf-249	3.444E-11	3.450E-11	3.441E-11	3.428E-11	3.408E-11	3.374E-11	4.858E-12
Cf-250	5.288E-12	4.756E-12	4.278E-12	3.847E-12	3.282E-12	2.518E-12	1.756E-21
Cf-251	3.234E-12	3.229E-12	3.224E-12	3.219E-12	3.211E-12	3.199E-12	1.501E-12
Cf-252	6.304E-13	3.727E-13	2.204E-13	1.303E-13	5.924E-14	1.592E-14	0.00
Total	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01

TABLE F.4.g. Actinide Inventory by Isotope at 50 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He-4	4.331E-06	4.714E-06	5.085E-06	5.444E-06	5.962E-06	6.774E-06	4.663E-05
Pb-207	6.315E-15	9.605E-15	1.356E-14	1.815E-14	2.614E-14	4.222E-14	2.238E-11
Pb-208	8.965E-11	1.364E-10	1.884E-10	2.435E-10	3.289E-10	4.720E-10	3.461E-09
Pb-212	3.863E-14	4.443E-14	4.802E-14	5.006E-14	5.120E-14	5.055E-14	4.697E-18
Bi-209	3.775E-15	4.532E-15	5.292E-15	6.057E-15	7.214E-15	9.176E-15	2.247E-11
Bi-212	3.664E-15	4.214E-15	4.555E-15	4.749E-15	4.857E-15	4.795E-15	4.455E-19
Ra-224	3.370E-13	3.875E-13	4.189E-13	4.367E-13	4.466E-13	4.410E-13	4.097E-17
Ra-226	1.431E-13	1.976E-13	2.629E-13	3.396E-13	4.773E-13	7.718E-13	4.385E-09
Ac-227	5.100E-14	6.271E-14	7.383E-14	8.440E-14	9.931E-14	1.219E-13	1.377E-12
Th-228	6.547E-11	7.514E-11	8.121E-11	8.466E-11	8.665E-11	8.562E-11	7.962E-15
Th-229	4.377E-12	4.399E-12	4.424E-12	4.452E-12	4.502E-12	4.604E-12	8.570E-10
Th-230	2.793E-09	3.390E-09	4.021E-09	4.686E-09	5.744E-09	7.667E-09	1.234E-06
Th-231	7.171E-15	7.173E-15	7.174E-15	7.175E-15	7.177E-15	7.180E-15	7.752E-15
Th-232	1.003E-09	1.194E-09	1.386E-09	1.578E-09	1.866E-09	2.345E-09	1.008E-07
Th-234	1.351E-11	1.351E-11	1.351E-11	1.351E-11	1.351E-11	1.351E-11	1.351E-11
Pa-231	3.670E-10	3.704E-10	3.738E-10	3.772E-10	3.823E-10	3.908E-10	2.107E-09
Pa-233	2.168E-11	2.174E-11	2.181E-11	2.190E-11	2.204E-11	2.233E-11	7.016E-11
U-232	3.131E-09	3.285E-09	3.353E-09	3.370E-09	3.341E-09	3.227E-09	2.973E-13
U-233	2.349E-09	2.778E-09	3.208E-09	3.639E-09	4.279E-09	5.319E-09	4.821E-07
U-234	1.041E-04	1.102E-04	1.162E-04	1.222E-04	1.309E-04	1.451E-04	4.957E-04
U-235	1.764E-03	1.764E-03	1.764E-03	1.765E-03	1.765E-03	1.766E-03	1.906E-03
U-236	3.294E-03	3.294E-03	3.295E-03	3.295E-03	3.296E-03	3.298E-03	3.600E-03
U-237	4.075E-11	3.701E-11	3.361E-11	3.053E-11	2.642E-11	2.077E-11	5.731E-16
U-238	9.308E-01	9.308E-01	9.308E-01	9.308E-01	9.308E-01	9.308E-01	9.308E-01
Np-235	1.538E-13	4.284E-14	1.193E-14	3.322E-15	4.882E-16	1.998E-17	0.00
Np-236	6.961E-10	6.961E-10	6.961E-10	6.961E-10	6.961E-10	6.960E-10	6.919E-10
Np-237	6.382E-04	6.400E-04	6.422E-04	6.447E-04	6.490E-04	6.574E-04	2.066E-03
Np-238	3.576E-13	3.543E-13	3.511E-13	3.479E-13	3.432E-13	3.355E-13	3.845E-15
Np-239	3.573E-10	3.573E-10	3.572E-10	3.571E-10	3.570E-10	3.568E-10	3.255E-10
Pu-236	5.705E-10	3.508E-10	2.157E-10	1.326E-10	6.397E-11	1.897E-11	1.544E-15
Pu-238	3.981E-04	3.919E-04	3.858E-04	3.797E-04	3.709E-04	3.565E-04	1.768E-07
Pu-239	5.123E-03	5.123E-03	5.123E-03	5.122E-03	5.122E-03	5.122E-03	5.016E-03
Pu-240	2.931E-03	2.944E-03	2.957E-03	2.968E-03	2.983E-03	3.004E-03	2.807E-03
Pu-241	1.316E-03	1.195E-03	1.086E-03	9.860E-04	8.534E-04	6.708E-04	1.853E-08
Pu-242	1.228E-03	1.228E-03	1.228E-03	1.228E-03	1.228E-03	1.228E-03	1.226E-03
Pu-244	1.813E-07	1.813E-07	1.813E-07	1.813E-07	1.813E-07	1.813E-07	1.813E-07
Am-241	5.169E-04	6.359E-04	7.434E-04	8.405E-04	9.687E-04	1.143E-03	3.820E-04
Am-242m	1.907E-06	1.890E-06	1.873E-06	1.856E-06	1.831E-06	1.789E-06	2.051E-08
Am-242	2.281E-11	2.261E-11	2.240E-11	2.220E-11	2.190E-11	2.140E-11	2.453E-13
Am-243	4.158E-04	4.157E-04	4.156E-04	4.155E-04	4.154E-04	4.152E-04	3.787E-04
Cm-242	8.081E-09	4.735E-09	4.545E-09	4.497E-09	4.437E-09	4.330E-09	4.960E-11
Cm-243	1.365E-06	1.300E-06	1.238E-06	1.179E-06	1.096E-06	9.709E-07	4.326E-17
Cm-244	1.901E-04	1.761E-04	1.631E-04	1.511E-04	1.347E-04	1.113E-04	5.705E-21
Cm-245	1.204E-05	1.204E-05	1.203E-05	1.203E-05	1.203E-05	1.203E-05	1.110E-05
Cm-246	3.249E-06	3.248E-06	3.247E-06	3.246E-06	3.245E-06	3.242E-06	2.809E-06
Cm-247	5.649E-08	5.649E-08	5.649E-08	5.649E-08	5.649E-08	5.649E-08	5.649E-08

TABLE F.4.g. Actinide Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cm-248	5.888E-09	5.889E-09	5.890E-09	5.890E-09	5.890E-09	5.890E-09	5.878E-09
Bk-249	6.416E-13	1.319E-13	2.710E-14	5.570E-15	5.189E-16	9.937E-18	0.00
Cf-249	8.886E-11	8.902E-11	8.877E-11	8.844E-11	8.792E-11	8.706E-11	1.253E-11
Cf-250	1.421E-11	1.278E-11	1.150E-11	1.034E-11	8.821E-12	6.768E-12	5.775E-21
Cf-251	8.971E-12	8.957E-12	8.943E-12	8.930E-12	8.909E-12	8.875E-12	4.165E-12
Cf-252	2.028E-12	1.199E-12	7.089E-13	4.191E-13	1.906E-13	5.122E-14	0.00
Total	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01

TABLE F.5.a. Fission Product Inventory by Element at 20 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	2.223E-08	1.987E-08	1.776E-08	1.587E-08	1.341E-08	1.013E-08	1.307E-32
Li	1.468E-10	1.468E-10	1.468E-10	1.468E-10	1.468E-10	1.468E-10	1.468E-10
Be	9.054E-11	9.054E-11	9.053E-11	9.053E-11	9.053E-11	9.053E-11	9.050E-11
C	1.590E-11	1.590E-11	1.590E-11	1.589E-11	1.589E-11	1.588E-11	1.410E-11
Zn	2.343E-14	2.343E-14	2.343E-14	2.343E-14	2.343E-14	2.343E-14	2.343E-14
Ga	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13	5.401E-13
Ge	4.120E-07	4.120E-07	4.120E-07	4.120E-07	4.120E-07	4.120E-07	4.120E-07
As	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07	1.266E-07
Se	3.457E-05	3.457E-05	3.457E-05	3.457E-05	3.457E-05	3.457E-05	3.454E-05
Br	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.350E-05	1.354E-05
Kr	2.204E-04	2.193E-04	2.184E-04	2.176E-04	2.165E-04	2.152E-04	2.116E-04
Rb	2.154E-04	2.165E-04	2.174E-04	2.182E-04	2.193E-04	2.206E-04	2.242E-04
Sr	4.861E-04	4.735E-04	4.614E-04	4.500E-04	4.338E-04	4.092E-04	2.149E-04
Y	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04	2.805E-04
Zr	2.200E-03	2.212E-03	2.224E-03	2.236E-03	2.252E-03	2.276E-03	2.471E-03
Nb	2.348E-09	2.747E-09	3.147E-09	3.547E-09	4.146E-09	5.145E-09	2.009E-07
Mo	2.025E-03	2.025E-03	2.025E-03	2.025E-03	2.025E-03	2.025E-03	2.025E-03
Tc	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.840E-04	4.824E-04
Ru	1.290E-03	1.290E-03	1.290E-03	1.290E-03	1.290E-03	1.290E-03	1.291E-03
Rh	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04	3.112E-04
Pd	7.693E-04	7.699E-04	7.701E-04	7.701E-04	7.701E-04	7.701E-04	7.701E-04
Ag	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.714E-05	4.715E-05
Cd	5.824E-05	5.823E-05	5.822E-05	5.822E-05	5.821E-05	5.819E-05	5.814E-05
In	2.144E-06	2.153E-06	2.162E-06	2.169E-06	2.180E-06	2.194E-06	2.246E-06
Sn	5.642E-05	5.642E-05	5.642E-05	5.642E-05	5.642E-05	5.641E-05	5.630E-05
Sb	1.328E-05	1.275E-05	1.243E-05	1.223E-05	1.208E-05	1.198E-05	1.194E-05
Te	2.934E-04	2.940E-04	2.943E-04	2.945E-04	2.946E-04	2.947E-04	2.949E-04
I	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04
Xe	3.029E-03	3.029E-03	3.029E-03	3.029E-03	3.029E-03	3.029E-03	3.029E-03
Cs	1.679E-03	1.649E-03	1.622E-03	1.596E-03	1.561E-03	1.508E-03	1.072E-03
Ba	9.897E-04	1.019E-03	1.046E-03	1.072E-03	1.107E-03	1.161E-03	1.596E-03
La	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04	7.399E-04
Ce	1.429E-03	1.428E-03	1.428E-03	1.428E-03	1.428E-03	1.428E-03	1.428E-03
Pr	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04	6.828E-04
Nd	2.436E-03	2.436E-03	2.436E-03	2.436E-03	2.436E-03	2.436E-03	2.436E-03
Pm	1.688E-05	9.949E-06	5.866E-06	3.458E-06	1.565E-06	4.178E-07	0.00
Sm	5.093E-04	5.161E-04	5.200E-04	5.223E-04	5.240E-04	5.248E-04	5.170E-04
Eu	7.310E-05	7.113E-05	6.952E-05	6.822E-05	6.672E-05	6.507E-05	6.970E-05
Gd	4.799E-05	5.011E-05	5.184E-05	5.328E-05	5.498E-05	5.694E-05	6.053E-05
Tb	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06	1.462E-06
Dy	7.482E-07	7.482E-07	7.482E-07	7.482E-07	7.482E-07	7.482E-07	7.482E-07
Ho	6.507E-08	6.506E-08	6.506E-08	6.506E-08	6.506E-08	6.506E-08	6.486E-08
Er	2.533E-08	2.533E-08	2.533E-08	2.533E-08	2.533E-08	2.533E-08	2.553E-08
Tm	1.945E-11	1.945E-11	1.944E-11	1.944E-11	1.944E-11	1.944E-11	1.944E-11
Yb	4.329E-12	4.332E-12	4.333E-12	4.334E-12	4.334E-12	4.335E-12	4.335E-12
Total	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02	2.058E-02

TABLE F.5.b. Fission Product Inventory by Element at 25 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	2.837E-08	2.536E-08	2.267E-08	2.026E-08	1.712E-08	1.293E-08	1.667E-32
Li	1.586E-10	1.586E-10	1.586E-10	1.586E-10	1.586E-10	1.586E-10	1.586E-10
Be	1.129E-10	1.129E-10	1.129E-10	1.129E-10	1.129E-10	1.129E-10	1.129E-10
C	1.984E-11	1.983E-11	1.983E-11	1.982E-11	1.982E-11	1.980E-11	1.759E-11
Zn	2.768E-14	2.768E-14	2.768E-14	2.768E-14	2.768E-14	2.768E-14	2.768E-14
Ga	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13	6.943E-13
Ge	5.087E-07	5.087E-07	5.087E-07	5.087E-07	5.087E-07	5.087E-07	5.087E-07
As	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07	1.566E-07
Se	4.226E-05	4.226E-05	4.226E-05	4.226E-05	4.226E-05	4.226E-05	4.221E-05
Br	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.641E-05	1.646E-05
Kr	2.655E-04	2.642E-04	2.631E-04	2.621E-04	2.608E-04	2.592E-04	2.549E-04
Rb	2.583E-04	2.596E-04	2.607E-04	2.617E-04	2.630E-04	2.646E-04	2.689E-04
Sr	5.811E-04	5.661E-04	5.517E-04	5.380E-04	5.187E-04	4.893E-04	2.572E-04
Y	3.351E-04	3.351E-04	3.350E-04	3.350E-04	3.350E-04	3.350E-04	3.350E-04
Zr	2.678E-03	2.693E-03	2.707E-03	2.721E-03	2.740E-03	2.770E-03	3.001E-03
Nb	2.921E-09	3.406E-09	3.892E-09	4.377E-09	5.105E-09	6.319E-09	2.441E-07
Mo	2.515E-03	2.515E-03	2.515E-03	2.515E-03	2.515E-03	2.515E-03	2.515E-03
Tc	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.921E-04	5.902E-04
Ru	1.661E-03	1.661E-03	1.660E-03	1.660E-03	1.660E-03	1.660E-03	1.662E-03
Rh	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04	3.749E-04
Pd	1.078E-03	1.079E-03	1.079E-03	1.079E-03	1.079E-03	1.079E-03	1.079E-03
Ag	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.362E-05	6.363E-05
Cd	8.369E-05	8.368E-05	8.367E-05	8.366E-05	8.365E-05	8.363E-05	8.355E-05
In	2.298E-06	2.311E-06	2.322E-06	2.333E-06	2.347E-06	2.367E-06	2.439E-06
Sn	7.288E-05	7.288E-05	7.288E-05	7.288E-05	7.288E-05	7.288E-05	7.273E-05
Sb	1.685E-05	1.616E-05	1.575E-05	1.550E-05	1.529E-05	1.516E-05	1.511E-05
Te	3.739E-04	3.746E-04	3.750E-04	3.753E-04	3.755E-04	3.756E-04	3.758E-04
I	1.849E-04	1.849E-04	1.849E-04	1.849E-04	1.849E-04	1.849E-04	1.849E-04
Xe	3.856E-03	3.856E-03	3.856E-03	3.856E-03	3.856E-03	3.856E-03	3.856E-03
Cs	2.023E-03	1.985E-03	1.951E-03	1.919E-03	1.875E-03	1.808E-03	1.263E-03
Ba	1.249E-03	1.287E-03	1.321E-03	1.353E-03	1.398E-03	1.465E-03	2.009E-03
La	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04	9.160E-04
Ce	1.773E-03	1.772E-03	1.772E-03	1.772E-03	1.772E-03	1.772E-03	1.772E-03
Pr	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04	8.430E-04
Nd	3.015E-03	3.016E-03	3.016E-03	3.016E-03	3.016E-03	3.016E-03	3.016E-03
Pm	1.872E-05	1.103E-05	6.505E-06	3.835E-06	1.736E-06	4.634E-07	0.00
Sm	6.223E-04	6.298E-04	6.342E-04	6.367E-04	6.386E-04	6.395E-04	6.310E-04
Eu	1.005E-04	9.738E-05	9.486E-05	9.280E-05	9.039E-05	8.771E-05	9.113E-05
Gd	7.509E-05	7.833E-05	8.100E-05	8.321E-05	8.582E-05	8.886E-05	9.441E-05
Tb	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06	2.053E-06
Dy	1.084E-06	1.084E-06	1.084E-06	1.084E-06	1.084E-06	1.084E-06	1.084E-06
Ho	1.048E-07	1.048E-07	1.048E-07	1.048E-07	1.048E-07	1.048E-07	1.044E-07
Er	4.062E-08	4.063E-08	4.063E-08	4.063E-08	4.063E-08	4.063E-08	4.102E-08
Tm	3.676E-11	3.675E-11	3.674E-11	3.674E-11	3.674E-11	3.674E-11	3.674E-11
Yb	1.052E-11	1.053E-11	1.054E-11	1.054E-11	1.054E-11	1.054E-11	1.054E-11
Total	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02	2.569E-02

TABLE F.5.c. Fission Product Inventory by Element at 30 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	3.467E-08	3.099E-08	2.770E-08	2.476E-08	2.092E-08	1.580E-08	2.038E-32
Li	1.648E-10	1.648E-10	1.648E-10	1.648E-10	1.648E-10	1.648E-10	1.648E-10
Be	1.353E-10	1.353E-10	1.353E-10	1.353E-10	1.353E-10	1.353E-10	1.352E-10
C	2.376E-11	2.376E-11	2.375E-11	2.374E-11	2.374E-11	2.372E-11	2.107E-11
Zn	3.152E-14	3.152E-14	3.152E-14	3.152E-14	3.152E-14	3.152E-14	3.152E-14
Ga	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13	8.510E-13
Ge	6.040E-07	6.040E-07	6.040E-07	6.040E-07	6.040E-07	6.040E-07	6.040E-07
As	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07	1.861E-07
Se	4.967E-05	4.967E-05	4.967E-05	4.967E-05	4.967E-05	4.967E-05	4.962E-05
Br	1.916E-05	1.917E-05	1.917E-05	1.917E-05	1.917E-05	1.917E-05	1.922E-05
Kr	3.079E-04	3.065E-04	3.052E-04	3.040E-04	3.026E-04	3.007E-04	2.957E-04
Rb	2.983E-04	2.998E-04	3.011E-04	3.023E-04	3.037E-04	3.056E-04	3.106E-04
Sr	6.692E-04	6.519E-04	6.354E-04	6.196E-04	5.973E-04	5.636E-04	2.966E-04
Y	3.855E-04	3.855E-04	3.855E-04	3.854E-04	3.854E-04	3.854E-04	3.854E-04
Zr	3.137E-03	3.154E-03	3.170E-03	3.186E-03	3.208E-03	3.242E-03	3.509E-03
Nb	3.484E-09	4.051E-09	4.618E-09	5.186E-09	6.036E-09	7.454E-09	2.852E-07
Mo	3.001E-03	3.001E-03	3.001E-03	3.001E-03	3.001E-03	3.001E-03	3.001E-03
Tc	6.947E-04	6.947E-04	6.947E-04	6.947E-04	6.947E-04	6.946E-04	6.924E-04
Ru	2.048E-03	2.047E-03	2.046E-03	2.046E-03	2.046E-03	2.046E-03	2.048E-03
Rh	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04	4.303E-04
Pd	1.422E-03	1.424E-03	1.424E-03	1.424E-03	1.424E-03	1.424E-03	1.424E-03
Ag	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.034E-05	8.036E-05
Cd	1.142E-04	1.141E-04	1.141E-04	1.141E-04	1.141E-04	1.141E-04	1.140E-04
In	2.403E-06	2.419E-06	2.435E-06	2.449E-06	2.468E-06	2.494E-06	2.590E-06
Sn	9.005E-05	9.005E-05	9.005E-05	9.005E-05	9.005E-05	9.005E-05	8.986E-05
Sb	2.049E-05	1.964E-05	1.913E-05	1.881E-05	1.856E-05	1.840E-05	1.834E-05
Te	4.561E-04	4.570E-04	4.575E-04	4.578E-04	4.581E-04	4.582E-04	4.585E-04
I	2.246E-04	2.246E-04	2.246E-04	2.246E-04	2.246E-04	2.246E-04	2.246E-04
Xe	4.696E-03	4.696E-03	4.696E-03	4.696E-03	4.696E-03	4.696E-03	4.696E-03
Cs	2.351E-03	2.305E-03	2.263E-03	2.225E-03	2.171E-03	2.091E-03	1.437E-03
Ba	1.514E-03	1.560E-03	1.602E-03	1.640E-03	1.694E-03	1.774E-03	2.429E-03
La	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03	1.089E-03
Ce	2.114E-03	2.113E-03	2.113E-03	2.113E-03	2.113E-03	2.113E-03	2.113E-03
Pr	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04	9.995E-04
Nd	3.588E-03	3.589E-03	3.589E-03	3.589E-03	3.589E-03	3.589E-03	3.589E-03
Pm	1.996E-05	1.177E-05	6.939E-06	4.091E-06	1.852E-06	4.944E-07	0.00
Sm	7.293E-04	7.373E-04	7.420E-04	7.447E-04	7.467E-04	7.477E-04	7.386E-04
Eu	1.287E-04	1.243E-04	1.208E-04	1.178E-04	1.144E-04	1.105E-04	1.123E-04
Gd	1.103E-04	1.149E-04	1.186E-04	1.217E-04	1.254E-04	1.296E-04	1.374E-04
Tb	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06	2.709E-06
Dy	1.478E-06	1.478E-06	1.478E-06	1.478E-06	1.478E-06	1.478E-06	1.478E-06
Ho	1.590E-07	1.590E-07	1.590E-07	1.590E-07	1.590E-07	1.590E-07	1.583E-07
Er	6.249E-08	6.249E-08	6.249E-08	6.249E-08	6.249E-08	6.250E-08	6.320E-08
Tm	6.246E-11	6.243E-11	6.242E-11	6.241E-11	6.241E-11	6.241E-11	6.241E-11
Yb	2.201E-11	2.203E-11	2.204E-11	2.205E-11	2.205E-11	2.205E-11	2.205E-11
Total	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02	3.080E-02

TABLE F.5.d. Fission Product Inventory by Element at 35 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	4.112E-08	3.675E-08	3.285E-08	2.936E-08	2.481E-08	1.874E-08	2.417E-32
Li	1.671E-10	1.671E-10	1.671E-10	1.671E-10	1.671E-10	1.671E-10	1.671E-10
Be	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10
C	2.767E-11	2.767E-11	2.766E-11	2.765E-11	2.764E-11	2.763E-11	2.454E-11
Zn	3.497E-14	3.497E-14	3.497E-14	3.497E-14	3.497E-14	3.497E-14	3.497E-14
Ga	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12	1.009E-12
Ge	6.980E-07	6.980E-07	6.980E-07	6.980E-07	6.980E-07	6.980E-07	6.980E-07
As	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07	2.151E-07
Se	5.683E-05	5.683E-05	5.683E-05	5.683E-05	5.683E-05	5.683E-05	5.677E-05
Br	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.177E-05	2.183E-05
Kr	3.480E-04	3.463E-04	3.448E-04	3.435E-04	3.419E-04	3.397E-04	3.342E-04
Rb	3.356E-04	3.373E-04	3.387E-04	3.400E-04	3.417E-04	3.438E-04	3.494E-04
Sr	7.507E-04	7.313E-04	7.128E-04	6.951E-04	6.702E-04	6.323E-04	3.331E-04
Y	4.320E-04	4.320E-04	4.320E-04	4.319E-04	4.319E-04	4.319E-04	4.319E-04
Zr	3.577E-03	3.597E-03	3.615E-03	3.633E-03	3.658E-03	3.696E-03	3.995E-03
Nb	4.037E-09	4.682E-09	5.327E-09	5.971E-09	6.939E-09	8.551E-09	3.245E-07
Mo	3.481E-03	3.481E-03	3.481E-03	3.481E-03	3.481E-03	3.481E-03	3.481E-03
Tc	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.916E-04	7.891E-04
Ru	2.448E-03	2.447E-03	2.447E-03	2.447E-03	2.447E-03	2.447E-03	2.449E-03
Rh	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04	4.778E-04
Pd	1.800E-03	1.801E-03	1.802E-03	1.802E-03	1.802E-03	1.802E-03	1.802E-03
Ag	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.714E-05	9.717E-05
Cd	1.499E-04	1.499E-04	1.499E-04	1.499E-04	1.498E-04	1.498E-04	1.497E-04
In	2.486E-06	2.507E-06	2.527E-06	2.545E-06	2.569E-06	2.602E-06	2.726E-06
Sn	1.079E-04	1.079E-04	1.079E-04	1.079E-04	1.079E-04	1.079E-04	1.076E-04
Sb	2.418E-05	2.316E-05	2.255E-05	2.217E-05	2.187E-05	2.167E-05	2.160E-05
Te	5.399E-04	5.409E-04	5.415E-04	5.419E-04	5.422E-04	5.424E-04	5.427E-04
I	2.644E-04	2.644E-04	2.644E-04	2.644E-04	2.644E-04	2.644E-04	2.643E-04
Xe	5.547E-03	5.547E-03	5.547E-03	5.547E-03	5.547E-03	5.547E-03	5.548E-03
Cs	2.666E-03	2.611E-03	2.562E-03	2.517E-03	2.454E-03	2.360E-03	1.597E-03
Ba	1.784E-03	1.839E-03	1.888E-03	1.933E-03	1.996E-03	2.090E-03	2.854E-03
La	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03	1.260E-03
Ce	2.452E-03	2.451E-03	2.451E-03	2.451E-03	2.451E-03	2.451E-03	2.451E-03
Pr	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03	1.152E-03
Nd	4.155E-03	4.155E-03	4.155E-03	4.155E-03	4.155E-03	4.155E-03	4.155E-03
Pm	2.080E-05	1.226E-05	7.228E-06	4.262E-06	1.929E-06	5.151E-07	0.00
Sm	8.307E-04	8.391E-04	8.439E-04	8.467E-04	8.488E-04	8.499E-04	8.402E-04
Eu	1.567E-04	1.509E-04	1.462E-04	1.423E-04	1.378E-04	1.326E-04	1.326E-04
Gd	1.546E-04	1.605E-04	1.654E-04	1.694E-04	1.742E-04	1.798E-04	1.899E-04
Tb	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06	3.431E-06
Dy	1.932E-06	1.932E-06	1.932E-06	1.932E-06	1.932E-06	1.932E-06	1.932E-06
Ho	2.307E-07	2.307E-07	2.307E-07	2.307E-07	2.307E-07	2.307E-07	2.295E-07
Er	9.340E-08	9.340E-08	9.341E-08	9.341E-08	9.341E-08	9.342E-08	9.461E-08
Tm	9.911E-11	9.906E-11	9.903E-11	9.902E-11	9.901E-11	9.901E-11	9.901E-11
Yb	4.154E-11	4.159E-11	4.162E-11	4.163E-11	4.164E-11	4.165E-11	4.165E-11
Total	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02	3.589E-02

TABLE F.5.e. Fission Product Inventory by Element at 40 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	4.768E-08	4.262E-08	3.809E-08	3.405E-08	2.877E-08	2.173E-08	2.806E-32
Li	1.673E-10	1.673E-10	1.673E-10	1.673E-10	1.673E-10	1.673E-10	1.673E-10
Be	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10
C	3.158E-11	3.157E-11	3.156E-11	3.155E-11	3.154E-11	3.152E-11	2.800E-11
Zn	3.810E-14	3.810E-14	3.810E-14	3.810E-14	3.810E-14	3.810E-14	3.810E-14
Ga	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12	1.168E-12
Ge	7.907E-07	7.907E-07	7.907E-07	7.907E-07	7.907E-07	7.907E-07	7.907E-07
As	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07	2.435E-07
Se	6.376E-05	6.376E-05	6.376E-05	6.376E-05	6.376E-05	6.376E-05	6.369E-05
Br	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.424E-05	2.431E-05
Kr	3.859E-04	3.840E-04	3.824E-04	3.810E-04	3.791E-04	3.768E-04	3.706E-04
Rb	3.706E-04	3.724E-04	3.740E-04	3.755E-04	3.773E-04	3.797E-04	3.858E-04
Sr	8.266E-04	8.052E-04	7.849E-04	7.655E-04	7.380E-04	6.964E-04	3.672E-04
Y	4.752E-04	4.751E-04	4.751E-04	4.751E-04	4.751E-04	4.751E-04	4.750E-04
Zr	4.002E-03	4.024E-03	4.044E-03	4.063E-03	4.091E-03	4.132E-03	4.461E-03
Nb	4.577E-09	5.297E-09	6.016E-09	6.735E-09	7.814E-09	9.613E-09	3.620E-07
Mo	3.958E-03	3.958E-03	3.958E-03	3.958E-03	3.958E-03	3.958E-03	3.958E-03
Tc	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.832E-04	8.804E-04
Ru	2.862E-03	2.861E-03	2.860E-03	2.860E-03	2.860E-03	2.860E-03	2.863E-03
Rh	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04	5.182E-04
Pd	2.206E-03	2.207E-03	2.208E-03	2.208E-03	2.208E-03	2.208E-03	2.208E-03
Ag	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.137E-04	1.138E-04
Cd	1.908E-04	1.908E-04	1.908E-04	1.907E-04	1.907E-04	1.907E-04	1.905E-04
In	2.561E-06	2.588E-06	2.613E-06	2.635E-06	2.665E-06	2.707E-06	2.861E-06
Sn	1.262E-04	1.262E-04	1.262E-04	1.262E-04	1.262E-04	1.262E-04	1.259E-04
Sb	2.789E-05	2.670E-05	2.598E-05	2.554E-05	2.519E-05	2.496E-05	2.487E-05
Te	6.248E-04	6.260E-04	6.267E-04	6.272E-04	6.275E-04	6.278E-04	6.281E-04
I	3.038E-04	3.038E-04	3.038E-04	3.038E-04	3.038E-04	3.038E-04	3.037E-04
Xe	6.407E-03	6.407E-03	6.407E-03	6.407E-03	6.407E-03	6.407E-03	6.407E-03
Cs	2.971E-03	2.907E-03	2.851E-03	2.799E-03	2.727E-03	2.619E-03	1.746E-03
Ba	2.058E-03	2.122E-03	2.178E-03	2.230E-03	2.302E-03	2.410E-03	3.283E-03
La	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03	1.429E-03
Ce	2.787E-03	2.786E-03	2.786E-03	2.786E-03	2.786E-03	2.786E-03	2.786E-03
Pr	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03	1.302E-03
Nd	4.716E-03	4.717E-03	4.717E-03	4.717E-03	4.717E-03	4.717E-03	4.717E-03
Pm	2.138E-05	1.260E-05	7.431E-06	4.381E-06	1.984E-06	5.296E-07	0.00
Sm	9.269E-04	9.355E-04	9.405E-04	9.434E-04	9.455E-04	9.466E-04	9.363E-04
Eu	1.833E-04	1.762E-04	1.703E-04	1.655E-04	1.598E-04	1.534E-04	1.516E-04
Gd	2.080E-04	2.153E-04	2.213E-04	2.263E-04	2.323E-04	2.391E-04	2.517E-04
Tb	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06	4.218E-06
Dy	2.444E-06	2.444E-06	2.444E-06	2.444E-06	2.444E-06	2.444E-06	2.444E-06
Ho	3.222E-07	3.222E-07	3.222E-07	3.222E-07	3.222E-07	3.222E-07	3.203E-07
Er	1.361E-07	1.361E-07	1.361E-07	1.361E-07	1.361E-07	1.361E-07	1.380E-07
Tm	1.500E-10	1.499E-10	1.498E-10	1.498E-10	1.498E-10	1.498E-10	1.498E-10
Yb	7.264E-11	7.275E-11	7.280E-11	7.283E-11	7.285E-11	7.285E-11	7.285E-11
Total	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02	4.098E-02

TABLE F.5.f. Fission Product Inventory by Element at 45 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	5.434E-08	4.857E-08	4.341E-08	3.880E-08	3.279E-08	2.476E-08	3.192E-32
Li	1.663E-10	1.663E-10	1.663E-10	1.663E-10	1.663E-10	1.663E-10	1.663E-10
Be	2.019E-10	2.019E-10	2.019E-10	2.019E-10	2.019E-10	2.019E-10	2.018E-10
C	3.547E-11	3.546E-11	3.546E-11	3.545E-11	3.543E-11	3.541E-11	3.145E-11
Zn	4.097E-14	4.097E-14	4.097E-14	4.097E-14	4.097E-14	4.097E-14	4.097E-14
Ga	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12	1.327E-12
Ge	8.824E-07	8.824E-07	8.824E-07	8.824E-07	8.824E-07	8.824E-07	8.824E-07
As	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07	2.714E-07
Se	7.050E-05	7.050E-05	7.050E-05	7.050E-05	7.049E-05	7.049E-05	7.042E-05
Br	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.658E-05	2.666E-05
Kr	4.221E-04	4.201E-04	4.183E-04	4.167E-04	4.147E-04	4.121E-04	4.054E-04
Rb	4.036E-04	4.056E-04	4.074E-04	4.090E-04	4.110E-04	4.135E-04	4.203E-04
Sr	8.980E-04	8.748E-04	8.527E-04	8.316E-04	8.018E-04	7.567E-04	3.994E-04
Y	5.156E-04	5.156E-04	5.156E-04	5.156E-04	5.156E-04	5.156E-04	5.155E-04
Zr	4.414E-03	4.437E-03	4.460E-03	4.481E-03	4.510E-03	4.556E-03	4.913E-03
Nb	5.106E-09	5.897E-09	6.688E-09	7.479E-09	8.666E-09	1.064E-08	3.982E-07
Mo	4.431E-03	4.431E-03	4.431E-03	4.431E-03	4.431E-03	4.431E-03	4.431E-03
Tc	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.696E-04	9.665E-04
Ru	3.287E-03	3.285E-03	3.285E-03	3.285E-03	3.285E-03	3.285E-03	3.288E-03
Rh	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04	5.522E-04
Pd	2.635E-03	2.637E-03	2.637E-03	2.638E-03	2.638E-03	2.638E-03	2.638E-03
Ag	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04	1.299E-04
Cd	2.367E-04	2.367E-04	2.367E-04	2.366E-04	2.366E-04	2.366E-04	2.364E-04
In	2.632E-06	2.666E-06	2.696E-06	2.724E-06	2.760E-06	2.811E-06	3.001E-06
Sn	1.449E-04	1.449E-04	1.449E-04	1.449E-04	1.449E-04	1.449E-04	1.446E-04
Sb	3.160E-05	3.023E-05	2.940E-05	2.890E-05	2.849E-05	2.823E-05	2.813E-05
Te	7.107E-04	7.121E-04	7.129E-04	7.134E-04	7.138E-04	7.141E-04	7.145E-04
I	3.426E-04	3.426E-04	3.426E-04	3.426E-04	3.426E-04	3.426E-04	3.426E-04
Xe	7.273E-03	7.273E-03	7.273E-03	7.273E-03	7.273E-03	7.273E-03	7.273E-03
Cs	3.268E-03	3.196E-03	3.131E-03	3.073E-03	2.992E-03	2.870E-03	1.887E-03
Ba	2.336E-03	2.408E-03	2.473E-03	2.531E-03	2.612E-03	2.734E-03	3.717E-03
La	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03	1.595E-03
Ce	3.121E-03	3.121E-03	3.120E-03	3.120E-03	3.120E-03	3.120E-03	3.120E-03
Pr	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03	1.448E-03
Nd	5.274E-03	5.275E-03	5.275E-03	5.275E-03	5.275E-03	5.275E-03	5.275E-03
Pm	2.181E-05	1.286E-05	7.580E-06	4.469E-06	2.023E-06	5.403E-07	0.00
Sm	1.018E-03	1.026E-03	1.031E-03	1.034E-03	1.036E-03	1.038E-03	1.027E-03
Eu	2.080E-04	1.995E-04	1.926E-04	1.868E-04	1.801E-04	1.724E-04	1.689E-04
Gd	2.705E-04	2.792E-04	2.864E-04	2.923E-04	2.993E-04	3.075E-04	3.223E-04
Tb	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06	5.073E-06
Dy	3.015E-06	3.015E-06	3.015E-06	3.015E-06	3.015E-06	3.015E-06	3.015E-06
Ho	4.353E-07	4.353E-07	4.352E-07	4.352E-07	4.352E-07	4.352E-07	4.323E-07
Er	1.937E-07	1.937E-07	1.937E-07	1.937E-07	1.937E-07	1.938E-07	1.966E-07
Tm	2.199E-10	2.197E-10	2.196E-10	2.196E-10	2.195E-10	2.195E-10	2.195E-10
Yb	1.200E-10	1.202E-10	1.204E-10	1.204E-10	1.204E-10	1.204E-10	1.204E-10
Total	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02	4.607E-02

TABLE F.5.g. Fission Product Inventory by Element at 50 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H	6.107E-08	5.458E-08	4.879E-08	4.361E-08	3.685E-08	2.783E-08	3.590E-32
Li	1.649E-10	1.649E-10	1.649E-10	1.649E-10	1.649E-10	1.649E-10	1.649E-10
Be	2.240E-10	2.240E-10	2.240E-10	2.240E-10	2.240E-10	2.240E-10	2.239E-10
C	3.936E-11	3.935E-11	3.934E-11	3.933E-11	3.932E-11	3.929E-11	3.490E-11
Zn	4.362E-14	4.362E-14	4.362E-14	4.362E-14	4.362E-14	4.362E-14	4.362E-14
Ga	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12	1.486E-12
Ge	9.732E-07	9.732E-07	9.732E-07	9.732E-07	9.732E-07	9.732E-07	9.732E-07
As	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07	2.989E-07
Se	7.708E-05	7.708E-05	7.708E-05	7.708E-05	7.708E-05	7.708E-05	7.699E-05
Br	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.882E-05	2.891E-05
Kr	4.570E-04	4.548E-04	4.528E-04	4.511E-04	4.490E-04	4.462E-04	4.389E-04
Rb	4.351E-04	4.373E-04	4.392E-04	4.409E-04	4.431E-04	4.459E-04	4.532E-04
Sr	9.658E-04	9.409E-04	9.171E-04	8.945E-04	8.625E-04	8.139E-04	4.301E-04
Y	5.540E-04	5.539E-04	5.539E-04	5.539E-04	5.539E-04	5.539E-04	5.538E-04
Zr	4.816E-03	4.841E-03	4.865E-03	4.887E-03	4.919E-03	4.968E-03	5.351E-03
Nb	5.623E-09	6.484E-09	7.344E-09	8.204E-09	9.495E-09	1.165E-08	4.332E-07
Mo	4.901E-03	4.901E-03	4.901E-03	4.901E-03	4.901E-03	4.901E-03	4.901E-03
Tc	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.051E-03	1.048E-03
Ru	3.723E-03	3.720E-03	3.720E-03	3.720E-03	3.720E-03	3.720E-03	3.723E-03
Rh	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04	5.805E-04
Pd	3.083E-03	3.086E-03	3.086E-03	3.086E-03	3.086E-03	3.086E-03	3.086E-03
Ag	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.454E-04	1.455E-04
Cd	2.875E-04	2.874E-04	2.874E-04	2.873E-04	2.873E-04	2.872E-04	2.870E-04
In	2.702E-06	2.742E-06	2.779E-06	2.812E-06	2.857E-06	2.918E-06	3.147E-06
Sn	1.640E-04	1.640E-04	1.640E-04	1.640E-04	1.640E-04	1.640E-04	1.637E-04
Sb	3.529E-05	3.374E-05	3.281E-05	3.224E-05	3.178E-05	3.148E-05	3.137E-05
Te	7.974E-04	7.989E-04	7.999E-04	8.004E-04	8.009E-04	8.012E-04	8.016E-04
I	3.809E-04	3.809E-04	3.809E-04	3.809E-04	3.809E-04	3.809E-04	3.808E-04
Xe	8.145E-03	8.145E-03	8.145E-03	8.145E-03	8.145E-03	8.145E-03	8.145E-03
Cs	3.559E-03	3.477E-03	3.406E-03	3.340E-03	3.250E-03	3.115E-03	2.022E-03
Ba	2.617E-03	2.698E-03	2.770E-03	2.836E-03	2.926E-03	3.061E-03	4.153E-03
La	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03	1.760E-03
Ce	3.454E-03	3.453E-03	3.453E-03	3.453E-03	3.453E-03	3.453E-03	3.453E-03
Pr	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03	1.592E-03
Nd	5.829E-03	5.830E-03	5.830E-03	5.830E-03	5.830E-03	5.830E-03	5.830E-03
Pm	2.214E-05	1.305E-05	7.697E-06	4.538E-06	2.055E-06	5.487E-07	0.00
Sm	1.104E-03	1.113E-03	1.118E-03	1.121E-03	1.124E-03	1.125E-03	1.113E-03
Eu	2.307E-04	2.210E-04	2.129E-04	2.063E-04	1.986E-04	1.897E-04	1.846E-04
Gd	3.417E-04	3.517E-04	3.599E-04	3.667E-04	3.748E-04	3.841E-04	4.012E-04
Tb	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06	5.998E-06
Dy	3.644E-06	3.644E-06	3.644E-06	3.644E-06	3.644E-06	3.644E-06	3.644E-06
Ho	5.712E-07	5.712E-07	5.712E-07	5.712E-07	5.712E-07	5.711E-07	5.669E-07
Er	2.697E-07	2.697E-07	2.698E-07	2.698E-07	2.698E-07	2.698E-07	2.740E-07
Tm	3.155E-10	3.152E-10	3.150E-10	3.149E-10	3.148E-10	3.148E-10	3.148E-10
Yb	1.901E-10	1.905E-10	1.907E-10	1.908E-10	1.908E-10	1.909E-10	1.909E-10
Total	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02	5.115E-02

TABLE F.6.a. Actinide Inventory by Element at 20 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	7.128E-07	7.628E-07	8.151E-07	8.694E-07	9.540E-07	1.102E-06	1.894E-05
Pb	1.883E-11	2.751E-11	3.693E-11	4.677E-11	6.188E-11	8.700E-11	1.007E-09
Bi	1.141E-15	1.323E-15	1.474E-15	1.605E-15	1.781E-15	2.055E-15	9.433E-12
Ra	3.097E-13	4.074E-13	5.167E-13	6.386E-13	8.468E-13	1.265E-12	2.180E-09
Ac	5.722E-14	7.106E-14	8.480E-14	9.845E-14	1.188E-13	1.522E-13	6.332E-12
Th	5.450E-09	6.428E-09	7.411E-09	8.399E-09	9.892E-09	1.241E-08	6.585E-07
Pa	4.295E-10	4.483E-10	4.671E-10	4.859E-10	5.141E-10	5.610E-10	9.723E-09
U	9.716E-01	9.716E-01	9.716E-01	9.716E-01	9.716E-01	9.716E-01	9.719E-01
Np	2.292E-04	2.302E-04	2.313E-04	2.326E-04	2.348E-04	2.390E-04	9.353E-04
Pu	7.269E-03	7.210E-03	7.156E-03	7.107E-03	7.042E-03	6.951E-03	6.278E-03
Am	3.052E-04	3.620E-04	4.133E-04	4.596E-04	5.208E-04	6.038E-04	2.129E-04
Cm	3.879E-06	3.606E-06	3.353E-06	3.119E-06	2.799E-06	2.341E-06	1.195E-07
Cf	1.419E-14	1.406E-14	1.391E-14	1.375E-14	1.354E-14	1.324E-14	1.991E-15
Total	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01	9.794E-01

TABLE F.6.b. Actinide Inventory by Element at 25 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	1.152E-06	1.227E-06	1.305E-06	1.385E-06	1.507E-06	1.718E-06	2.411E-05
Pb	2.805E-11	4.142E-11	5.602E-11	7.135E-11	9.492E-11	1.342E-10	1.363E-09
Bi	1.803E-15	2.098E-15	2.343E-15	2.555E-15	2.834E-15	3.261E-15	1.220E-11
Ra	3.236E-13	4.189E-13	5.231E-13	6.379E-13	8.323E-13	1.223E-12	2.440E-09
Ac	5.897E-14	7.292E-14	8.659E-14	1.000E-13	1.197E-13	1.514E-13	4.982E-12
Th	5.172E-09	6.118E-09	7.072E-09	8.035E-09	9.497E-09	1.198E-08	7.465E-07
Pa	4.396E-10	4.541E-10	4.687E-10	4.833E-10	5.052E-10	5.416E-10	7.664E-09
U	9.654E-01	9.654E-01	9.654E-01	9.654E-01	9.654E-01	9.654E-01	9.658E-01
Np	3.061E-04	3.073E-04	3.087E-04	3.103E-04	3.131E-04	3.184E-04	1.197E-03
Pu	8.171E-03	8.096E-03	8.028E-03	7.966E-03	7.883E-03	7.767E-03	6.935E-03
Am	4.045E-04	4.765E-04	5.415E-04	6.002E-04	6.777E-04	7.829E-04	2.896E-04
Cm	1.103E-05	1.026E-05	9.542E-06	8.879E-06	7.975E-06	6.678E-06	4.180E-07
Cf	1.379E-13	1.364E-13	1.347E-13	1.331E-13	1.309E-13	1.278E-13	1.955E-14
Total	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01	9.743E-01

TABLE F.6.c. Actinide Inventory by Element at 30 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	1.665E-06	1.775E-06	1.886E-06	1.998E-06	2.168E-06	2.454E-06	2.873E-05
Pb	3.883E-11	5.784E-11	7.871E-11	1.007E-10	1.345E-10	1.911E-10	1.805E-09
Bi	2.644E-15	3.087E-15	3.455E-15	3.772E-15	4.189E-15	4.821E-15	1.465E-11
Ra	3.452E-13	4.399E-13	5.404E-13	6.492E-13	8.315E-13	1.197E-12	2.768E-09
Ac	5.933E-14	7.317E-14	8.660E-14	9.964E-14	1.185E-13	1.485E-13	3.876E-12
Th	4.897E-09	5.811E-09	6.738E-09	7.678E-09	9.112E-09	1.157E-08	8.513E-07
Pa	4.417E-10	4.528E-10	4.640E-10	4.751E-10	4.918E-10	5.197E-10	5.978E-09
U	9.593E-01	9.593E-01	9.593E-01	9.593E-01	9.593E-01	9.593E-01	9.598E-01
Np	3.827E-04	3.841E-04	3.857E-04	3.876E-04	3.907E-04	3.968E-04	1.410E-03
Pu	8.966E-03	8.879E-03	8.800E-03	8.729E-03	8.633E-03	8.499E-03	7.529E-03
Am	4.970E-04	5.805E-04	6.559E-04	7.241E-04	8.140E-04	9.361E-04	3.669E-04
Cm	2.521E-05	2.345E-05	2.182E-05	2.032E-05	1.826E-05	1.532E-05	1.127E-06
Bk	4.946E-15	1.016E-15	2.089E-16	4.293E-17	4.000E-18	7.660E-20	4.490E-28
Cf	8.630E-13	8.527E-13	8.410E-13	8.301E-13	8.154E-13	7.947E-13	1.235E-13
Total	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01	9.692E-01

TABLE F.6.d. Actinide Inventory by Element at 35 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	2.239E-06	2.394E-06	2.549E-06	2.704E-06	2.935E-06	3.316E-06	3.347E-05
Pb	5.085E-11	7.629E-11	1.043E-10	1.339E-10	1.796E-10	2.560E-10	2.320E-09
Bi	3.656E-15	4.280E-15	4.800E-15	5.249E-15	5.838E-15	6.725E-15	1.705E-11
Ra	3.735E-13	4.692E-13	5.673E-13	6.711E-13	8.428E-13	1.185E-12	3.143E-09
Ac	5.851E-14	7.203E-14	8.506E-14	9.762E-14	1.156E-13	1.437E-13	2.999E-12
Th	4.625E-09	5.509E-09	6.409E-09	7.326E-09	8.736E-09	1.117E-08	9.671E-07
Pa	4.367E-10	4.451E-10	4.535E-10	4.619E-10	4.746E-10	4.956E-10	4.642E-09
U	9.533E-01	9.533E-01	9.533E-01	9.533E-01	9.533E-01	9.533E-01	9.539E-01
Np	4.572E-04	4.588E-04	4.606E-04	4.627E-04	4.662E-04	4.731E-04	1.619E-03
Pu	9.634E-03	9.537E-03	9.448E-03	9.367E-03	9.258E-03	9.107E-03	8.011E-03
Am	6.014E-04	6.966E-04	7.826E-04	8.603E-04	9.629E-04	1.102E-03	4.580E-04
Cm	4.920E-05	4.579E-05	4.264E-05	3.971E-05	3.573E-05	3.001E-05	2.516E-06
Bk	2.263E-14	4.651E-15	9.559E-16	1.965E-16	1.830E-17	3.505E-19	2.731E-27
Cf	3.971E-12	3.917E-12	3.859E-12	3.805E-12	3.734E-12	3.635E-12	5.727E-13
Total	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01	9.641E-01

TABLE F.6.e. Actinide Inventory by Element at 40 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	2.872E-06	3.087E-06	3.299E-06	3.508E-06	3.816E-06	4.315E-06	3.807E-05
Pb	6.365E-11	9.606E-11	1.319E-10	1.697E-10	2.283E-10	3.263E-10	2.885E-09
Bi	4.814E-15	5.647E-15	6.343E-15	6.946E-15	7.737E-15	8.925E-15	1.921E-11
Ra	4.067E-13	5.046E-13	6.015E-13	7.014E-13	8.638E-13	1.186E-12	3.550E-09
Ac	5.668E-14	6.972E-14	8.220E-14	9.417E-14	1.112E-13	1.375E-13	2.313E-12
Th	4.364E-09	5.217E-09	6.092E-09	6.989E-09	8.376E-09	1.080E-08	1.089E-06
Pa	4.252E-10	4.315E-10	4.378E-10	4.441E-10	4.536E-10	4.694E-10	3.598E-09
U	9.474E-01	9.475E-01	9.475E-01	9.475E-01	9.475E-01	9.475E-01	9.481E-01
Np	5.259E-04	5.276E-04	5.295E-04	5.318E-04	5.357E-04	5.432E-04	1.804E-03
Pu	1.018E-02	1.007E-02	9.978E-03	9.889E-03	9.771E-03	9.607E-03	8.405E-03
Am	7.118E-04	8.171E-04	9.123E-04	9.983E-04	1.112E-03	1.266E-03	5.565E-04
Cm	8.596E-05	8.004E-05	7.455E-05	6.948E-05	6.255E-05	5.263E-05	4.896E-06
Bk	8.179E-14	1.681E-14	3.455E-15	7.100E-16	6.615E-17	1.267E-18	1.283E-26
Cf	1.442E-11	1.420E-11	1.398E-11	1.377E-11	1.350E-11	1.313E-11	2.093E-12
Total	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01	9.590E-01

TABLE F.6.f. Actinide Inventory by Element at 45 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	3.572E-06	3.862E-06	4.146E-06	4.423E-06	4.826E-06	5.468E-06	4.245E-05
Pb	7.676E-11	1.164E-10	1.603E-10	2.067E-10	2.787E-10	3.993E-10	3.476E-09
Bi	6.088E-15	7.150E-15	8.043E-15	8.817E-15	9.836E-15	1.137E-14	2.103E-11
Ra	4.429E-13	5.441E-13	6.405E-13	7.374E-13	8.919E-13	1.197E-12	3.970E-09
Ac	5.410E-14	6.652E-14	7.836E-14	8.966E-14	1.057E-13	1.300E-13	1.784E-12
Th	4.115E-09	4.940E-09	5.791E-09	6.669E-09	8.036E-09	1.045E-08	1.214E-06
Pa	4.087E-10	4.134E-10	4.181E-10	4.228E-10	4.299E-10	4.417E-10	2.793E-09
U	9.417E-01	9.417E-01	9.417E-01	9.417E-01	9.417E-01	9.417E-01	9.425E-01
Np	5.866E-04	5.883E-04	5.904E-04	5.928E-04	5.970E-04	6.050E-04	1.953E-03
Pu	1.063E-02	1.052E-02	1.041E-02	1.032E-02	1.020E-02	1.002E-02	8.744E-03
Am	8.238E-04	9.370E-04	1.039E-03	1.132E-03	1.254E-03	1.419E-03	6.584E-04
Cm	1.380E-04	1.285E-04	1.198E-04	1.117E-04	1.006E-04	8.479E-05	8.607E-06
Bk	2.462E-13	5.059E-14	1.040E-14	2.137E-15	1.991E-16	3.812E-18	4.935E-26
Cf	4.359E-11	4.286E-11	4.213E-11	4.147E-11	4.063E-11	3.948E-11	6.359E-12
Total	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01	9.539E-01

TABLE F.6.g. Actinide Inventory by Element at 50 MWd/kgM, g/gU

Element	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
He	4.331E-06	4.714E-06	5.085E-06	5.444E-06	5.962E-06	6.774E-06	4.663E-05
Pb	8.969E-11	1.365E-10	1.885E-10	2.436E-10	3.290E-10	4.721E-10	4.069E-09
Bi	7.440E-15	8.746E-15	9.848E-15	1.081E-14	1.207E-14	1.397E-14	2.251E-11
Ra	4.802E-13	5.852E-13	6.819E-13	7.765E-13	9.241E-13	1.213E-12	4.385E-09
Ac	5.102E-14	6.273E-14	7.385E-14	8.442E-14	9.932E-14	1.219E-13	1.380E-12
Th	3.879E-09	4.678E-09	5.507E-09	6.366E-09	7.714E-09	1.012E-08	1.335E-06
Pa	3.887E-10	3.921E-10	3.956E-10	3.991E-10	4.044E-10	4.132E-10	2.178E-09
U	9.360E-01	9.360E-01	9.360E-01	9.360E-01	9.360E-01	9.360E-01	9.368E-01
Np	6.382E-04	6.400E-04	6.422E-04	6.447E-04	6.490E-04	6.574E-04	2.066E-03
Pu	1.100E-02	1.088E-02	1.078E-02	1.068E-02	1.056E-02	1.038E-02	9.049E-03
Am	9.346E-04	1.053E-03	1.161E-03	1.258E-03	1.386E-03	1.560E-03	7.607E-04
Cm	2.069E-04	1.928E-04	1.797E-04	1.676E-04	1.512E-04	1.276E-04	1.397E-05
Bk	6.416E-13	1.319E-13	2.710E-14	5.570E-15	5.189E-16	9.937E-18	1.623E-25
Cf	1.141E-10	1.120E-10	1.099E-10	1.081E-10	1.058E-10	1.028E-10	1.670E-11
Total	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01	9.488E-01

TABLE F.7.a. Fuel Activation Product Inventory by Isotope at 20 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.214E-08	1.214E-08	1.214E-08	1.214E-08	1.214E-08	1.214E-08	1.214E-08
H-2	7.035E-12	7.035E-12	7.035E-12	7.035E-12	7.035E-12	7.035E-12	7.035E-12
H-3	2.977E-11	2.661E-11	2.378E-11	2.126E-11	1.796E-11	1.357E-11	1.749E-35
He-3	1.353E-11	1.669E-11	1.951E-11	2.204E-11	2.533E-11	2.973E-11	4.330E-11
He-4	5.263E-05	5.263E-05	5.263E-05	5.263E-05	5.263E-05	5.263E-05	5.263E-05
Li-6	1.459E-14	1.459E-14	1.459E-14	1.459E-14	1.459E-14	1.459E-14	1.459E-14
Be-9	1.036E-10	1.036E-10	1.036E-10	1.036E-10	1.036E-10	1.036E-10	1.036E-10
Be-10	2.791E-11	2.791E-11	2.791E-11	2.791E-11	2.791E-11	2.791E-11	2.790E-11
B-11	1.706E-08	1.706E-08	1.706E-08	1.706E-08	1.706E-08	1.706E-08	1.706E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	5.207E-06	5.207E-06	5.207E-06	5.207E-06	5.207E-06	5.207E-06	5.207E-06
C-14	1.656E-07	1.656E-07	1.656E-07	1.655E-07	1.655E-07	1.654E-07	1.469E-07
N-14	4.953E-05	4.953E-05	4.953E-05	4.953E-05	4.953E-05	4.953E-05	4.955E-05
N-15	2.037E-07	2.037E-07	2.037E-07	2.037E-07	2.037E-07	2.037E-07	2.037E-07
O-16	1.342E-01	1.342E-01	1.342E-01	1.342E-01	1.342E-01	1.342E-01	1.342E-01
O-17	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	2.381E-10	2.381E-10	2.381E-10	2.381E-10	2.381E-10	2.381E-10	2.381E-10
Ne-21	7.525E-15	7.525E-15	7.525E-15	7.525E-15	7.525E-15	7.525E-15	7.525E-15
Ne-22	5.370E-15	5.370E-15	5.370E-15	5.370E-15	5.370E-15	5.370E-15	5.370E-15
Na-23	4.346E-16	4.346E-16	4.346E-16	4.346E-16	4.346E-16	4.346E-16	4.346E-16
Mg-24	1.336E-10	1.336E-10	1.336E-10	1.336E-10	1.336E-10	1.336E-10	1.336E-10
Mg-25	1.406E-10	1.406E-10	1.406E-10	1.406E-10	1.406E-10	1.406E-10	1.406E-10
Mg-26	6.423E-11	6.423E-11	6.423E-11	6.423E-11	6.423E-11	6.423E-11	6.423E-11
Al-27	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05
Si-28	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05
Si-29	2.198E-06	2.198E-06	2.198E-06	2.198E-06	2.198E-06	2.198E-06	2.198E-06
Si-30	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06
P-31	2.911E-10	2.911E-10	2.911E-10	2.911E-10	2.911E-10	2.911E-10	2.911E-10
S-32	2.337E-10	2.337E-10	2.337E-10	2.337E-10	2.337E-10	2.337E-10	2.337E-10
S-33	9.690E-14	9.690E-14	9.690E-14	9.690E-14	9.690E-14	9.690E-14	9.690E-14
S-34	1.608E-11	1.608E-11	1.608E-11	1.608E-11	1.608E-11	1.608E-11	1.608E-11
S-36	2.197E-13	2.671E-13	3.145E-13	3.619E-13	4.330E-13	5.515E-13	2.375E-11
Cl-35	7.914E-06	7.914E-06	7.914E-06	7.914E-06	7.914E-06	7.914E-06	7.914E-06
Cl-36	5.417E-07	5.417E-07	5.417E-07	5.417E-07	5.417E-07	5.417E-07	5.404E-07
Cl-37	2.859E-06	2.859E-06	2.859E-06	2.859E-06	2.859E-06	2.859E-06	2.859E-06
Ar-36	1.133E-11	1.378E-11	1.623E-11	1.868E-11	2.235E-11	2.846E-11	1.226E-09
Ar-38	2.063E-09	2.063E-09	2.063E-09	2.063E-09	2.063E-09	2.063E-09	2.063E-09
Ar-39	2.329E-11	2.317E-11	2.305E-11	2.294E-11	2.276E-11	2.247E-11	1.798E-12
Ar-40	5.000E-11	5.000E-11	5.000E-11	5.000E-11	5.000E-11	5.000E-11	5.000E-11
K-39	5.842E-13	7.039E-13	8.230E-13	9.416E-13	1.118E-12	1.410E-12	2.208E-11
K-40	1.025E-08	1.025E-08	1.025E-08	1.025E-08	1.025E-08	1.025E-08	1.025E-08
K-41	2.456E-10	2.461E-10	2.466E-10	2.471E-10	2.478E-10	2.489E-10	4.790E-10
Ca-40	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05	4.384E-05
Ca-41	2.755E-08	2.755E-08	2.755E-08	2.755E-08	2.755E-08	2.755E-08	2.732E-08
Ca-42	3.070E-07	3.070E-07	3.070E-07	3.070E-07	3.070E-07	3.070E-07	3.070E-07

TABLE F.7.a. Fuel Activation Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-43	6.290E-08	6.290E-08	6.290E-08	6.290E-08	6.290E-08	6.290E-08	6.290E-08
Ca-44	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06
Ca-45	1.579E-14	7.063E-16	3.159E-17	1.413E-18	1.337E-20	5.657E-24	0.00
Ca-46	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09
Ca-48	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07
Sc-45	1.651E-09	1.651E-09	1.651E-09	1.651E-09	1.651E-09	1.651E-09	1.651E-09
Ti-46	2.734E-11	2.734E-11	2.734E-11	2.734E-11	2.734E-11	2.734E-11	2.734E-11
Ti-47	2.019E-12	2.019E-12	2.019E-12	2.019E-12	2.019E-12	2.019E-12	2.019E-12
Ti-48	3.075E-15	3.075E-15	3.075E-15	3.075E-15	3.075E-15	3.075E-15	3.075E-15
Ti-49	1.771E-10	1.771E-10	1.771E-10	1.771E-10	1.771E-10	1.771E-10	1.771E-10
Ti-50	3.237E-13	3.237E-13	3.237E-13	3.237E-13	3.237E-13	3.237E-13	3.237E-13
Cr-53	6.033E-16	6.033E-16	6.033E-16	6.033E-16	6.033E-16	6.033E-16	6.033E-16
Cr-54	2.608E-16	2.608E-16	2.608E-16	2.608E-16	2.608E-16	2.608E-16	2.608E-16
Mn-55	3.714E-10	3.877E-10	3.972E-10	4.028E-10	4.072E-10	4.098E-10	4.108E-10
Fe-55	3.936E-11	2.309E-11	1.355E-11	7.950E-12	3.573E-12	9.422E-13	0.00
Fe-56	1.287E-09	1.287E-09	1.287E-09	1.287E-09	1.287E-09	1.287E-09	1.287E-09
Fe-57	3.127E-11	3.127E-11	3.127E-11	3.127E-11	3.127E-11	3.127E-11	3.127E-11
Fe-58	5.311E-09	5.311E-09	5.311E-09	5.311E-09	5.311E-09	5.311E-09	5.311E-09
Co-59	1.354E-09	1.356E-09	1.359E-09	1.361E-09	1.365E-09	1.371E-09	2.575E-09
Co-60	4.359E-11	3.351E-11	2.576E-11	1.980E-11	1.334E-11	6.913E-12	0.00
Ni-58	1.898E-05	1.898E-05	1.898E-05	1.898E-05	1.898E-05	1.898E-05	1.898E-05
Ni-59	1.425E-07	1.425E-07	1.425E-07	1.425E-07	1.424E-07	1.424E-07	1.412E-07
Ni-60	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06
Ni-61	3.655E-07	3.655E-07	3.655E-07	3.655E-07	3.655E-07	3.655E-07	3.655E-07
Ni-62	1.054E-06	1.054E-06	1.054E-06	1.054E-06	1.054E-06	1.054E-06	1.054E-06
Ni-63	2.174E-08	2.142E-08	2.110E-08	2.078E-08	2.032E-08	1.957E-08	1.216E-11
Ni-64	2.812E-07	2.812E-07	2.812E-07	2.812E-07	2.812E-07	2.812E-07	2.812E-07
Cu-63	1.567E-09	1.892E-09	2.213E-09	2.528E-09	2.993E-09	3.744E-09	2.330E-08
Cu-65	7.010E-10	7.010E-10	7.010E-10	7.010E-10	7.010E-10	7.010E-10	7.010E-10
Zn-64	5.383E-13	5.383E-13	5.383E-13	5.383E-13	5.383E-13	5.383E-13	5.383E-13
Zn-66	1.393E-12	1.393E-12	1.393E-12	1.393E-12	1.393E-12	1.393E-12	1.393E-12
Zn-67	6.926E-16	6.926E-16	6.926E-16	6.926E-16	6.926E-16	6.926E-16	6.926E-16
Ru-104	8.963E-16	8.963E-16	8.963E-16	8.963E-16	8.963E-16	8.963E-16	8.963E-16
Pd-104	1.976E-13	1.976E-13	1.976E-13	1.976E-13	1.976E-13	1.976E-13	1.976E-13
Pd-105	1.075E-15	1.075E-15	1.075E-15	1.075E-15	1.075E-15	1.075E-15	1.075E-15
Pd-106	4.177E-12	4.177E-12	4.177E-12	4.177E-12	4.177E-12	4.177E-12	4.177E-12
Pd-107	1.961E-13	1.961E-13	1.961E-13	1.961E-13	1.961E-13	1.961E-13	1.961E-13
Pd-108	1.415E-09	1.451E-09	1.487E-09	1.523E-09	1.575E-09	1.661E-09	4.747E-09
Pd-110	7.587E-10	7.587E-10	7.587E-10	7.587E-10	7.587E-10	7.587E-10	7.587E-10
Ag-107	5.055E-07	5.055E-07	5.055E-07	5.055E-07	5.055E-07	5.055E-07	5.055E-07
Ag-108m	3.665E-09	3.626E-09	3.586E-09	3.547E-09	3.490E-09	3.396E-09	1.615E-11
Ag-109	2.706E-07	2.706E-07	2.706E-07	2.706E-07	2.706E-07	2.706E-07	2.706E-07
Ag-110m	3.540E-12	4.667E-13	6.152E-14	8.110E-15	3.881E-16	2.449E-18	0.00
Cd-108	5.478E-08	5.478E-08	5.479E-08	5.479E-08	5.480E-08	5.480E-08	5.510E-08
Cd-109	1.601E-12	5.374E-13	1.805E-13	6.060E-14	1.179E-14	7.705E-16	0.00
Cd-110	2.604E-07	2.604E-07	2.604E-07	2.604E-07	2.604E-07	2.604E-07	2.604E-07
Cd-111	5.596E-09	5.596E-09	5.596E-09	5.596E-09	5.596E-09	5.596E-09	5.596E-09

TABLE F.7.a. Fuel Activation Product Inventory by Isotope at 20 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Cd-112	1.198E-10	1.198E-10	1.198E-10	1.198E-10	1.198E-10	1.198E-10	1.198E-10
Cd-113	1.817E-14	1.817E-14	1.817E-14	1.817E-14	1.817E-14	1.817E-14	1.817E-14
Cd-114	3.186E-13	3.186E-13	3.186E-13	3.186E-13	3.186E-13	3.186E-13	3.186E-13
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.b. Fuel Activation Product Inventory by Isotope at 25 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.543E-08	1.543E-08	1.543E-08	1.543E-08	1.543E-08	1.543E-08	1.543E-08
H-2	1.135E-11	1.135E-11	1.135E-11	1.135E-11	1.135E-11	1.135E-11	1.135E-11
H-3	4.893E-15	4.374E-15	3.909E-15	3.494E-15	2.953E-15	2.230E-15	0.00
He-3	2.111E-15	2.630E-15	3.095E-15	3.510E-15	4.051E-15	4.774E-15	7.004E-15
He-4	1.949E-06	1.949E-06	1.949E-06	1.949E-06	1.949E-06	1.949E-06	1.949E-06
Li-6	2.138E-14	2.138E-14	2.138E-14	2.138E-14	2.138E-14	2.138E-14	2.138E-14
Be-9	1.316E-10	1.316E-10	1.316E-10	1.316E-10	1.316E-10	1.316E-10	1.316E-10
Be-10	4.410E-11	4.410E-11	4.410E-11	4.410E-11	4.410E-11	4.410E-11	4.409E-11
B-10	1.591E-16	1.973E-16	2.356E-16	2.738E-16	3.311E-16	4.266E-16	1.915E-14
B-11	2.166E-08	2.166E-08	2.166E-08	2.166E-08	2.166E-08	2.166E-08	2.166E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	6.543E-06	6.543E-06	6.543E-06	6.543E-06	6.543E-06	6.543E-06	6.543E-06
C-14	2.103E-07	2.102E-07	2.102E-07	2.101E-07	2.101E-07	2.099E-07	1.865E-07
N-14	4.948E-05	4.948E-05	4.948E-05	4.948E-05	4.948E-05	4.948E-05	4.950E-05
N-15	2.059E-07	2.059E-07	2.059E-07	2.059E-07	2.059E-07	2.059E-07	2.059E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05	5.432E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10
Ne-21	1.213E-14	1.213E-14	1.213E-14	1.213E-14	1.213E-14	1.213E-14	1.213E-14
Ne-22	8.661E-15	8.661E-15	8.661E-15	8.661E-15	8.661E-15	8.661E-15	8.661E-15
Na-23	7.013E-16	7.013E-16	7.013E-16	7.013E-16	7.013E-16	7.013E-16	7.013E-16
Mg-24	1.697E-10	1.697E-10	1.697E-10	1.697E-10	1.697E-10	1.697E-10	1.697E-10
Mg-25	1.785E-10	1.785E-10	1.785E-10	1.785E-10	1.785E-10	1.785E-10	1.785E-10
Mg-26	8.162E-11	8.162E-11	8.162E-11	8.162E-11	8.162E-11	8.162E-11	8.162E-11
Al-27	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05	4.538E-05
Si-28	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05
Si-29	2.200E-06	2.200E-06	2.200E-06	2.200E-06	2.200E-06	2.200E-06	2.200E-06
Si-30	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06
P-31	3.698E-10	3.698E-10	3.698E-10	3.698E-10	3.698E-10	3.698E-10	3.698E-10
S-32	2.942E-10	2.942E-10	2.942E-10	2.942E-10	2.942E-10	2.942E-10	2.942E-10
S-33	1.554E-13	1.554E-13	1.554E-13	1.554E-13	1.554E-13	1.554E-13	1.554E-13
S-34	2.042E-11	2.042E-11	2.042E-11	2.042E-11	2.042E-11	2.042E-11	2.042E-11
S-36	2.756E-13	3.351E-13	3.947E-13	4.542E-13	5.436E-13	6.924E-13	2.984E-11
Cl-35	7.777E-06	7.777E-06	7.777E-06	7.777E-06	7.777E-06	7.777E-06	7.777E-06
Cl-36	6.805E-07	6.805E-07	6.805E-07	6.805E-07	6.805E-07	6.805E-07	6.790E-07
Cl-37	2.861E-06	2.861E-06	2.861E-06	2.861E-06	2.861E-06	2.861E-06	2.861E-06
Ar-36	1.421E-11	1.729E-11	2.036E-11	2.344E-11	2.805E-11	3.574E-11	1.541E-09
Ar-38	2.620E-09	2.620E-09	2.620E-09	2.620E-09	2.620E-09	2.620E-09	2.620E-09
Ar-39	2.704E-11	2.690E-11	2.677E-11	2.663E-11	2.642E-11	2.608E-11	2.088E-12
Ar-40	7.827E-11	7.827E-11	7.827E-11	7.827E-11	7.827E-11	7.827E-11	7.827E-11
K-39	6.831E-13	8.221E-13	9.604E-13	1.098E-12	1.303E-12	1.641E-12	2.564E-11
K-40	1.292E-08	1.292E-08	1.292E-08	1.292E-08	1.292E-08	1.292E-08	1.292E-08
K-41	3.934E-10	3.940E-10	3.946E-10	3.952E-10	3.961E-10	3.976E-10	6.897E-10
Ca-40	4.383E-05	4.383E-05	4.383E-05	4.383E-05	4.383E-05	4.383E-05	4.383E-05
Ca-41	3.498E-08	3.498E-08	3.498E-08	3.498E-08	3.498E-08	3.498E-08	3.469E-08

TABLE F.7.b. Fuel Activation Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-42	3.069E-07	3.069E-07	3.069E-07	3.069E-07	3.069E-07	3.069E-07	3.069E-07
Ca-43	6.281E-08	6.281E-08	6.281E-08	6.281E-08	6.281E-08	6.281E-08	6.281E-08
Ca-44	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06	1.040E-06
Ca-45	2.034E-14	9.100E-16	4.071E-17	1.821E-18	1.723E-20	7.290E-24	0.00
Ca-46	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09	1.820E-09
Ca-48	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07	1.030E-07
Sc-45	2.087E-09	2.087E-09	2.087E-09	2.087E-09	2.087E-09	2.087E-09	2.087E-09
Ti-46	4.399E-11	4.399E-11	4.399E-11	4.399E-11	4.399E-11	4.399E-11	4.399E-11
Ti-47	2.580E-12	2.580E-12	2.580E-12	2.580E-12	2.580E-12	2.580E-12	2.580E-12
Ti-48	4.971E-15	4.971E-15	4.971E-15	4.971E-15	4.971E-15	4.971E-15	4.971E-15
Ti-49	2.248E-10	2.248E-10	2.248E-10	2.248E-10	2.248E-10	2.248E-10	2.248E-10
Ti-50	5.226E-13	5.226E-13	5.226E-13	5.226E-13	5.226E-13	5.226E-13	5.226E-13
V-51	4.179E-11	4.179E-11	4.179E-11	4.179E-11	4.179E-11	4.179E-11	4.179E-11
Cr-52	2.023E-13	2.023E-13	2.023E-13	2.023E-13	2.023E-13	2.023E-13	2.023E-13
Cr-53	8.132E-11	8.132E-11	8.132E-11	8.132E-11	8.132E-11	8.132E-11	8.132E-11
Cr-54	1.248E-09	1.250E-09	1.250E-09	1.250E-09	1.250E-09	1.250E-09	1.250E-09
Mn-54	1.805E-12	3.571E-13	7.064E-14	1.398E-14	1.230E-15	2.141E-17	0.00
Mn-55	1.218E-08	1.272E-08	1.303E-08	1.322E-08	1.336E-08	1.345E-08	1.348E-08
Fe-54	2.853E-06	2.853E-06	2.853E-06	2.853E-06	2.853E-06	2.853E-06	2.853E-06
Fe-55	1.302E-09	7.640E-10	4.483E-10	2.630E-10	1.182E-10	3.117E-11	0.00
Fe-56	4.670E-05	4.670E-05	4.670E-05	4.670E-05	4.670E-05	4.670E-05	4.670E-05
Fe-57	1.384E-06	1.384E-06	1.384E-06	1.384E-06	1.384E-06	1.384E-06	1.384E-06
Fe-58	1.660E-07	1.660E-07	1.660E-07	1.660E-07	1.660E-07	1.660E-07	1.660E-07
Co-59	2.426E-09	2.429E-09	2.432E-09	2.435E-09	2.439E-09	2.447E-09	3.936E-09
Co-60	7.504E-11	5.768E-11	4.434E-11	3.408E-11	2.297E-11	1.190E-11	0.00
Ni-58	1.893E-05	1.893E-05	1.893E-05	1.893E-05	1.893E-05	1.893E-05	1.893E-05
Ni-59	1.761E-07	1.761E-07	1.761E-07	1.761E-07	1.761E-07	1.761E-07	1.746E-07
Ni-60	7.549E-06	7.549E-06	7.549E-06	7.549E-06	7.549E-06	7.549E-06	7.549E-06
Ni-61	3.741E-07	3.741E-07	3.741E-07	3.741E-07	3.741E-07	3.741E-07	3.741E-07
Ni-62	1.048E-06	1.048E-06	1.048E-06	1.048E-06	1.048E-06	1.048E-06	1.048E-06
Ni-63	2.741E-08	2.700E-08	2.660E-08	2.620E-08	2.561E-08	2.467E-08	1.533E-11
Ni-64	2.813E-07	2.813E-07	2.813E-07	2.813E-07	2.813E-07	2.813E-07	2.813E-07
Cu-63	1.971E-09	2.381E-09	2.785E-09	3.183E-09	3.768E-09	4.715E-09	2.937E-08
Cu-65	8.898E-10	8.898E-10	8.898E-10	8.898E-10	8.898E-10	8.898E-10	8.898E-10
Zn-64	8.656E-13	8.656E-13	8.656E-13	8.656E-13	8.656E-13	8.656E-13	8.656E-13
Zn-66	2.246E-12	2.246E-12	2.246E-12	2.246E-12	2.246E-12	2.246E-12	2.246E-12
Zn-67	1.416E-15	1.416E-15	1.416E-15	1.416E-15	1.416E-15	1.416E-15	1.416E-15
Ru-104	1.121E-15	1.121E-15	1.121E-15	1.121E-15	1.121E-15	1.121E-15	1.121E-15
Pd-104	2.470E-13	2.470E-13	2.470E-13	2.470E-13	2.470E-13	2.470E-13	2.470E-13
Pd-105	1.705E-15	1.705E-15	1.705E-15	1.705E-15	1.705E-15	1.705E-15	1.705E-15
Pd-106	5.214E-12	5.214E-12	5.214E-12	5.214E-12	5.214E-12	5.214E-12	5.214E-12
Pd-107	2.472E-13	2.472E-13	2.472E-13	2.472E-13	2.472E-13	2.472E-13	2.472E-13
Pd-108	1.744E-09	1.790E-09	1.835E-09	1.879E-09	1.945E-09	2.052E-09	5.914E-09
Pd-110	8.885E-10	8.885E-10	8.885E-10	8.885E-10	8.885E-10	8.885E-10	8.885E-10
Ag-107	4.906E-07	4.906E-07	4.906E-07	4.906E-07	4.906E-07	4.906E-07	4.906E-07
Ag-108m	4.587E-09	4.538E-09	4.488E-09	4.440E-09	4.368E-09	4.250E-09	2.021E-11
Ag-109	2.251E-07	2.251E-07	2.252E-07	2.252E-07	2.252E-07	2.252E-07	2.252E-07

TABLE F.7.b. Fuel Activation Product Inventory by Isotope at 25 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-110m	3.868E-12	5.099E-13	6.721E-14	8.859E-15	4.240E-16	2.675E-18	0.00
Cd-108	6.851E-08	6.852E-08	6.852E-08	6.853E-08	6.853E-08	6.854E-08	6.891E-08
Cd-109	2.466E-12	8.282E-13	2.781E-13	9.339E-14	1.817E-14	1.187E-15	0.00
Cd-110	3.031E-07	3.031E-07	3.031E-07	3.031E-07	3.031E-07	3.031E-07	3.031E-07
Cd-111	8.461E-09	8.461E-09	8.461E-09	8.461E-09	8.461E-09	8.461E-09	8.461E-09
Cd-112	2.334E-10	2.334E-10	2.334E-10	2.334E-10	2.334E-10	2.334E-10	2.334E-10
Cd-113	3.572E-14	3.572E-14	3.572E-14	3.572E-14	3.572E-14	3.572E-14	3.572E-14
Cd-114	8.047E-13	8.047E-13	8.047E-13	8.047E-13	8.047E-13	8.047E-13	8.047E-13
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.c. Fuel Activation Product Inventory by Isotope at 30 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.885E-08	1.885E-08	1.885E-08	1.885E-08	1.885E-08	1.885E-08	1.885E-08
H-2	1.696E-11	1.696E-11	1.696E-11	1.696E-11	1.696E-11	1.696E-11	1.696E-11
H-3	8.336E-15	7.451E-15	6.660E-15	5.952E-15	5.030E-15	3.799E-15	0.00
He-3	3.545E-15	4.430E-15	5.221E-15	5.928E-15	6.851E-15	8.082E-15	1.188E-14
He-4	2.382E-06	2.382E-06	2.382E-06	2.382E-06	2.382E-06	2.382E-06	2.382E-06
Li-6	2.909E-14	2.909E-14	2.909E-14	2.909E-14	2.909E-14	2.909E-14	2.909E-14
Li-7	1.759E-16	1.759E-16	1.759E-16	1.759E-16	1.759E-16	1.759E-16	1.759E-16
Be-9	1.608E-10	1.608E-10	1.608E-10	1.608E-10	1.608E-10	1.608E-10	1.608E-10
Be-10	6.499E-11	6.499E-11	6.499E-11	6.499E-11	6.499E-11	6.499E-11	6.496E-11
B-10	2.239E-16	2.802E-16	3.365E-16	3.928E-16	4.773E-16	6.180E-16	2.820E-14
B-11	2.647E-08	2.647E-08	2.647E-08	2.647E-08	2.647E-08	2.647E-08	2.647E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	7.940E-06	7.940E-06	7.940E-06	7.940E-06	7.940E-06	7.940E-06	7.940E-06
C-14	2.569E-07	2.569E-07	2.568E-07	2.568E-07	2.567E-07	2.565E-07	2.278E-07
N-14	4.943E-05	4.943E-05	4.943E-05	4.943E-05	4.943E-05	4.943E-05	4.946E-05
N-15	2.082E-07	2.082E-07	2.082E-07	2.082E-07	2.082E-07	2.082E-07	2.082E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	3.696E-10	3.696E-10	3.696E-10	3.696E-10	3.696E-10	3.696E-10	3.696E-10
Ne-21	1.812E-14	1.812E-14	1.812E-14	1.812E-14	1.812E-14	1.812E-14	1.812E-14
Ne-22	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14
Na-23	1.048E-15	1.048E-15	1.048E-15	1.048E-15	1.048E-15	1.048E-15	1.048E-15
Mg-24	2.074E-10	2.074E-10	2.074E-10	2.074E-10	2.074E-10	2.074E-10	2.074E-10
Mg-25	2.182E-10	2.182E-10	2.182E-10	2.182E-10	2.182E-10	2.182E-10	2.182E-10
Mg-26	9.985E-11	9.985E-11	9.985E-11	9.985E-11	9.985E-11	9.985E-11	9.985E-11
Al-27	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05
Si-28	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05
Si-29	2.203E-06	2.203E-06	2.203E-06	2.203E-06	2.203E-06	2.203E-06	2.203E-06
Si-30	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06
P-31	4.520E-10	4.520E-10	4.520E-10	4.520E-10	4.520E-10	4.520E-10	4.520E-10
S-32	3.563E-10	3.563E-10	3.563E-10	3.563E-10	3.563E-10	3.563E-10	3.563E-10
S-33	2.308E-13	2.308E-13	2.308E-13	2.308E-13	2.308E-13	2.308E-13	2.308E-13
S-34	2.497E-11	2.497E-11	2.497E-11	2.497E-11	2.497E-11	2.497E-11	2.497E-11
S-36	3.325E-13	4.045E-13	4.765E-13	5.485E-13	6.564E-13	8.364E-13	3.607E-11
Cl-35	7.635E-06	7.635E-06	7.635E-06	7.635E-06	7.635E-06	7.635E-06	7.635E-06
Cl-36	8.226E-07	8.226E-07	8.226E-07	8.226E-07	8.226E-07	8.225E-07	8.207E-07
Cl-37	2.864E-06	2.864E-06	2.864E-06	2.864E-06	2.864E-06	2.864E-06	2.864E-06
Ar-36	1.714E-11	2.086E-11	2.458E-11	2.829E-11	3.387E-11	4.316E-11	1.862E-09
Ar-38	3.204E-09	3.204E-09	3.204E-09	3.204E-09	3.204E-09	3.204E-09	3.204E-09
Ar-39	3.027E-11	3.011E-11	2.996E-11	2.980E-11	2.957E-11	2.919E-11	2.337E-12
Ar-40	1.139E-10	1.139E-10	1.139E-10	1.139E-10	1.139E-10	1.139E-10	1.139E-10
K-39	7.697E-13	9.252E-13	1.080E-12	1.234E-12	1.463E-12	1.842E-12	2.870E-11
K-40	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08
K-41	5.840E-10	5.847E-10	5.854E-10	5.862E-10	5.873E-10	5.891E-10	9.461E-10
Ca-40	4.382E-05	4.382E-05	4.382E-05	4.382E-05	4.382E-05	4.382E-05	4.382E-05

TABLE F.7.c. Fuel Activation Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-41	4.276E-08	4.276E-08	4.276E-08	4.276E-08	4.275E-08	4.275E-08	4.240E-08
Ca-42	3.068E-07	3.068E-07	3.068E-07	3.068E-07	3.068E-07	3.068E-07	3.068E-07
Ca-43	6.271E-08	6.271E-08	6.271E-08	6.271E-08	6.271E-08	6.271E-08	6.271E-08
Ca-44	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06
Ca-45	2.552E-14	1.141E-15	5.106E-17	2.284E-18	2.160E-20	9.142E-24	0.00
Ca-46	1.819E-09	1.819E-09	1.819E-09	1.819E-09	1.819E-09	1.819E-09	1.819E-09
Ca-48	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07
Sc-45	2.540E-09	2.540E-09	2.540E-09	2.540E-09	2.540E-09	2.540E-09	2.540E-09
Ti-46	6.556E-11	6.556E-11	6.556E-11	6.556E-11	6.556E-11	6.556E-11	6.556E-11
Ti-47	3.181E-12	3.181E-12	3.181E-12	3.181E-12	3.181E-12	3.181E-12	3.181E-12
Ti-48	7.454E-15	7.454E-15	7.454E-15	7.454E-15	7.454E-15	7.454E-15	7.454E-15
Ti-49	2.746E-10	2.746E-10	2.746E-10	2.746E-10	2.746E-10	2.746E-10	2.746E-10
Ti-50	7.806E-13	7.806E-13	7.806E-13	7.806E-13	7.806E-13	7.806E-13	7.806E-13
V-51	5.100E-11	5.100E-11	5.100E-11	5.100E-11	5.100E-11	5.100E-11	5.100E-11
Cr-52	3.018E-13	3.018E-13	3.018E-13	3.018E-13	3.018E-13	3.018E-13	3.018E-13
Cr-53	9.896E-11	9.896E-11	9.896E-11	9.896E-11	9.896E-11	9.896E-11	9.896E-11
Cr-54	1.525E-09	1.527E-09	1.527E-09	1.527E-09	1.527E-09	1.527E-09	1.527E-09
Mn-54	2.244E-12	4.440E-13	8.784E-14	1.738E-14	1.529E-15	2.662E-17	0.00
Mn-55	1.485E-08	1.551E-08	1.590E-08	1.613E-08	1.630E-08	1.641E-08	1.645E-08
Fe-54	2.850E-06	2.850E-06	2.850E-06	2.850E-06	2.850E-06	2.850E-06	2.850E-06
Fe-55	1.602E-09	9.402E-10	5.517E-10	3.237E-10	1.455E-10	3.836E-11	0.00
Fe-56	4.664E-05	4.664E-05	4.664E-05	4.664E-05	4.664E-05	4.664E-05	4.664E-05
Fe-57	1.443E-06	1.443E-06	1.443E-06	1.443E-06	1.443E-06	1.443E-06	1.443E-06
Fe-58	1.685E-07	1.685E-07	1.685E-07	1.685E-07	1.685E-07	1.685E-07	1.685E-07
Co-59	3.311E-09	3.314E-09	3.318E-09	3.322E-09	3.327E-09	3.336E-09	5.106E-09
Co-60	1.122E-10	8.625E-11	6.630E-11	5.096E-11	3.435E-11	1.779E-11	0.00
Ni-58	1.889E-05	1.889E-05	1.889E-05	1.889E-05	1.889E-05	1.889E-05	1.889E-05
Ni-59	2.093E-07	2.093E-07	2.093E-07	2.093E-07	2.093E-07	2.093E-07	2.075E-07
Ni-60	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06	7.550E-06
Ni-61	3.832E-07	3.832E-07	3.832E-07	3.832E-07	3.832E-07	3.832E-07	3.832E-07
Ni-62	1.042E-06	1.042E-06	1.042E-06	1.042E-06	1.042E-06	1.042E-06	1.042E-06
Ni-63	3.325E-08	3.275E-08	3.226E-08	3.178E-08	3.107E-08	2.992E-08	1.859E-11
Ni-64	2.814E-07	2.814E-07	2.814E-07	2.814E-07	2.814E-07	2.814E-07	2.814E-07
Cu-63	2.385E-09	2.883E-09	3.373E-09	3.855E-09	4.565E-09	5.714E-09	3.562E-08
Cu-65	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09
Zn-64	1.291E-12	1.291E-12	1.291E-12	1.291E-12	1.291E-12	1.291E-12	1.291E-12
Zn-66	3.354E-12	3.354E-12	3.354E-12	3.354E-12	3.354E-12	3.354E-12	3.354E-12
Zn-67	2.583E-15	2.583E-15	2.583E-15	2.583E-15	2.583E-15	2.583E-15	2.583E-15
Ru-104	1.349E-15	1.349E-15	1.349E-15	1.349E-15	1.349E-15	1.349E-15	1.349E-15
Pd-104	2.968E-13	2.968E-13	2.968E-13	2.968E-13	2.968E-13	2.968E-13	2.968E-13
Pd-105	2.504E-15	2.504E-15	2.504E-15	2.504E-15	2.504E-15	2.504E-15	2.504E-15
Pd-106	6.261E-12	6.261E-12	6.261E-12	6.261E-12	6.261E-12	6.261E-12	6.261E-12
Pd-107	2.999E-13	2.999E-13	2.999E-13	2.999E-13	2.999E-13	2.999E-13	2.998E-13
Pd-108	2.067E-09	2.121E-09	2.175E-09	2.229E-09	2.308E-09	2.438E-09	7.087E-09
Pd-110	1.001E-09	1.001E-09	1.001E-09	1.001E-09	1.001E-09	1.001E-09	1.001E-09
Ag-107	4.754E-07	4.754E-07	4.754E-07	4.754E-07	4.754E-07	4.754E-07	4.754E-07
Ag-108m	5.523E-09	5.463E-09	5.404E-09	5.345E-09	5.258E-09	5.117E-09	2.433E-11

TABLE F.7.c. Fuel Activation Product Inventory by Isotope at 30 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-109	1.858E-07	1.858E-07	1.858E-07	1.858E-07	1.858E-07	1.858E-07	1.858E-07
Ag-110m	4.064E-12	5.357E-13	7.062E-14	9.309E-15	4.455E-16	2.812E-18	0.00
Cd-108	8.243E-08	8.243E-08	8.244E-08	8.244E-08	8.245E-08	8.246E-08	8.290E-08
Cd-109	3.528E-12	1.185E-12	3.978E-13	1.336E-13	2.599E-14	1.698E-15	0.00
Cd-110	3.392E-07	3.392E-07	3.392E-07	3.392E-07	3.392E-07	3.392E-07	3.392E-07
Cd-111	1.183E-08	1.183E-08	1.183E-08	1.183E-08	1.183E-08	1.183E-08	1.183E-08
Cd-112	4.049E-10	4.049E-10	4.049E-10	4.049E-10	4.049E-10	4.049E-10	4.049E-10
Cd-113	6.235E-14	6.235E-14	6.235E-14	6.235E-14	6.235E-14	6.235E-14	6.235E-14
Cd-114	1.737E-12	1.737E-12	1.737E-12	1.737E-12	1.737E-12	1.737E-12	1.737E-12
In-115	3.192E-16	3.192E-16	3.192E-16	3.192E-16	3.192E-16	3.192E-16	3.192E-16
Sn-116	2.037E-16	2.037E-16	2.037E-16	2.037E-16	2.037E-16	2.037E-16	2.037E-16
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.d. Fuel Activation Product Inventory by Isotope at 35 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	2.242E-08	2.242E-08	2.242E-08	2.242E-08	2.242E-08	2.242E-08	2.242E-08
H-2	2.400E-11	2.400E-11	2.400E-11	2.400E-11	2.400E-11	2.400E-11	2.400E-11
H-3	1.309E-14	1.170E-14	1.046E-14	9.349E-15	7.900E-15	5.967E-15	0.00
He-3	5.512E-15	6.903E-15	8.146E-15	9.256E-15	1.071E-14	1.264E-14	1.861E-14
He-4	2.834E-06	2.834E-06	2.834E-06	2.834E-06	2.834E-06	2.834E-06	2.834E-06
Li-6	3.756E-14	3.756E-14	3.756E-14	3.756E-14	3.756E-14	3.756E-14	3.756E-14
Li-7	2.559E-16	2.559E-16	2.559E-16	2.559E-16	2.559E-16	2.559E-16	2.559E-16
Be-9	1.913E-10	1.913E-10	1.913E-10	1.913E-10	1.913E-10	1.913E-10	1.913E-10
Be-10	9.108E-11	9.108E-11	9.108E-11	9.108E-11	9.108E-11	9.108E-11	9.104E-11
B-10	3.025E-16	3.814E-16	4.603E-16	5.392E-16	6.576E-16	8.549E-16	3.952E-14
B-11	3.147E-08	3.147E-08	3.147E-08	3.147E-08	3.147E-08	3.147E-08	3.147E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	9.398E-06	9.398E-06	9.398E-06	9.398E-06	9.398E-06	9.398E-06	9.398E-06
C-14	3.056E-07	3.055E-07	3.054E-07	3.054E-07	3.053E-07	3.051E-07	2.710E-07
N-14	4.938E-05	4.938E-05	4.938E-05	4.938E-05	4.938E-05	4.938E-05	4.941E-05
N-15	2.105E-07	2.105E-07	2.105E-07	2.105E-07	2.105E-07	2.105E-07	2.105E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05	5.433E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	4.398E-10	4.398E-10	4.398E-10	4.398E-10	4.398E-10	4.398E-10	4.398E-10
Ne-21	2.565E-14	2.565E-14	2.565E-14	2.565E-14	2.565E-14	2.565E-14	2.565E-14
Ne-22	1.833E-14	1.833E-14	1.833E-14	1.833E-14	1.833E-14	1.833E-14	1.833E-14
Na-23	1.485E-15	1.485E-15	1.485E-15	1.485E-15	1.485E-15	1.485E-15	1.485E-15
Mg-24	2.467E-10	2.467E-10	2.467E-10	2.467E-10	2.467E-10	2.467E-10	2.467E-10
Mg-25	2.596E-10	2.596E-10	2.596E-10	2.596E-10	2.596E-10	2.596E-10	2.596E-10
Mg-26	1.189E-10	1.189E-10	1.189E-10	1.189E-10	1.189E-10	1.189E-10	1.189E-10
Al-27	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05	4.537E-05
Si-28	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05	4.172E-05
Si-29	2.206E-06	2.206E-06	2.206E-06	2.206E-06	2.206E-06	2.206E-06	2.206E-06
Si-30	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06	1.503E-06
P-31	5.378E-10	5.378E-10	5.378E-10	5.378E-10	5.378E-10	5.378E-10	5.378E-10
S-32	4.200E-10	4.200E-10	4.200E-10	4.200E-10	4.200E-10	4.200E-10	4.200E-10
S-33	3.248E-13	3.248E-13	3.248E-13	3.248E-13	3.248E-13	3.248E-13	3.248E-13
S-34	2.972E-11	2.972E-11	2.972E-11	2.972E-11	2.972E-11	2.972E-11	2.972E-11
S-36	3.905E-13	4.751E-13	5.598E-13	6.444E-13	7.714E-13	9.830E-13	4.241E-11
Cl-35	7.490E-06	7.490E-06	7.490E-06	7.490E-06	7.490E-06	7.490E-06	7.490E-06
Cl-36	9.673E-07	9.673E-07	9.673E-07	9.673E-07	9.673E-07	9.673E-07	9.651E-07
Cl-37	2.868E-06	2.868E-06	2.868E-06	2.868E-06	2.868E-06	2.868E-06	2.868E-06
Ar-36	2.013E-11	2.450E-11	2.887E-11	3.324E-11	3.979E-11	5.072E-11	2.190E-09
Ar-38	3.813E-09	3.813E-09	3.813E-09	3.813E-09	3.813E-09	3.813E-09	3.813E-09
Ar-39	3.304E-11	3.287E-11	3.270E-11	3.253E-11	3.228E-11	3.187E-11	2.551E-12
Ar-40	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10	1.575E-10
K-39	8.457E-13	1.016E-12	1.185E-12	1.353E-12	1.603E-12	2.016E-12	3.134E-11
K-40	1.850E-08	1.850E-08	1.850E-08	1.850E-08	1.850E-08	1.850E-08	1.850E-08
K-41	8.215E-10	8.223E-10	8.232E-10	8.241E-10	8.254E-10	8.276E-10	1.252E-09
Ca-40	4.381E-05	4.381E-05	4.381E-05	4.381E-05	4.381E-05	4.381E-05	4.381E-05

TABLE F.7.d. Fuel Activation Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-41	5.087E-08	5.087E-08	5.087E-08	5.087E-08	5.087E-08	5.086E-08	5.044E-08
Ca-42	3.067E-07	3.067E-07	3.067E-07	3.067E-07	3.067E-07	3.067E-07	3.067E-07
Ca-43	6.260E-08	6.260E-08	6.260E-08	6.260E-08	6.260E-08	6.260E-08	6.260E-08
Ca-44	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06
Ca-45	3.092E-14	1.383E-15	6.187E-17	2.767E-18	2.618E-20	1.108E-23	0.00
Ca-46	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09
Ca-48	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07	1.029E-07
Sc-45	3.007E-09	3.007E-09	3.007E-09	3.007E-09	3.007E-09	3.007E-09	3.007E-09
Ti-46	9.255E-11	9.255E-11	9.255E-11	9.255E-11	9.255E-11	9.255E-11	9.255E-11
Ti-47	3.825E-12	3.825E-12	3.825E-12	3.825E-12	3.825E-12	3.825E-12	3.825E-12
Ti-48	1.060E-14	1.060E-14	1.060E-14	1.060E-14	1.060E-14	1.060E-14	1.060E-14
Ti-49	3.265E-10	3.265E-10	3.265E-10	3.265E-10	3.265E-10	3.265E-10	3.265E-10
Ti-50	1.105E-12	1.105E-12	1.105E-12	1.105E-12	1.105E-12	1.105E-12	1.105E-12
V-51	6.058E-11	6.058E-11	6.058E-11	6.058E-11	6.058E-11	6.058E-11	6.058E-11
Cr-52	4.266E-13	4.266E-13	4.266E-13	4.266E-13	4.266E-13	4.266E-13	4.266E-13
Cr-53	1.172E-10	1.172E-10	1.172E-10	1.172E-10	1.172E-10	1.172E-10	1.172E-10
Cr-54	1.814E-09	1.816E-09	1.816E-09	1.816E-09	1.816E-09	1.816E-09	1.816E-09
Mn-54	2.708E-12	5.357E-13	1.060E-13	2.097E-14	1.845E-15	3.212E-17	0.00
Mn-55	1.762E-08	1.841E-08	1.887E-08	1.915E-08	1.936E-08	1.949E-08	1.953E-08
Fe-54	2.847E-06	2.847E-06	2.847E-06	2.847E-06	2.847E-06	2.847E-06	2.847E-06
Fe-55	1.918E-09	1.126E-09	6.604E-10	3.875E-10	1.741E-10	4.592E-11	0.00
Fe-56	4.658E-05	4.658E-05	4.658E-05	4.658E-05	4.658E-05	4.658E-05	4.658E-05
Fe-57	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06
Fe-58	1.710E-07	1.710E-07	1.710E-07	1.710E-07	1.710E-07	1.710E-07	1.710E-07
Co-59	4.310E-09	4.314E-09	4.318E-09	4.323E-09	4.329E-09	4.339E-09	6.384E-09
Co-60	1.611E-10	1.238E-10	9.518E-11	7.317E-11	4.931E-11	2.555E-11	0.00
Ni-58	1.884E-05	1.884E-05	1.884E-05	1.884E-05	1.884E-05	1.884E-05	1.884E-05
Ni-59	2.419E-07	2.419E-07	2.419E-07	2.419E-07	2.419E-07	2.419E-07	2.398E-07
Ni-60	7.552E-06	7.552E-06	7.552E-06	7.552E-06	7.552E-06	7.552E-06	7.552E-06
Ni-61	3.927E-07	3.927E-07	3.927E-07	3.927E-07	3.927E-07	3.927E-07	3.927E-07
Ni-62	1.036E-06	1.036E-06	1.036E-06	1.036E-06	1.036E-06	1.036E-06	1.036E-06
Ni-63	3.925E-08	3.866E-08	3.809E-08	3.752E-08	3.668E-08	3.532E-08	2.195E-11
Ni-64	2.816E-07	2.816E-07	2.816E-07	2.816E-07	2.816E-07	2.816E-07	2.816E-07
Cu-63	2.809E-09	3.396E-09	3.975E-09	4.544E-09	5.383E-09	6.739E-09	4.204E-08
Cu-65	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09
Zn-64	1.821E-12	1.821E-12	1.821E-12	1.821E-12	1.821E-12	1.821E-12	1.821E-12
Zn-66	4.747E-12	4.747E-12	4.747E-12	4.747E-12	4.747E-12	4.747E-12	4.747E-12
Zn-67	4.347E-15	4.347E-15	4.347E-15	4.347E-15	4.347E-15	4.347E-15	4.347E-15
Ru-104	1.578E-15	1.578E-15	1.578E-15	1.578E-15	1.578E-15	1.578E-15	1.578E-15
Pd-104	3.471E-13	3.471E-13	3.471E-13	3.471E-13	3.471E-13	3.471E-13	3.471E-13
Pd-105	3.481E-15	3.481E-15	3.481E-15	3.481E-15	3.481E-15	3.481E-15	3.481E-15
Pd-106	7.314E-12	7.314E-12	7.314E-12	7.314E-12	7.314E-12	7.314E-12	7.314E-12
Pd-107	3.539E-13	3.539E-13	3.539E-13	3.539E-13	3.539E-13	3.539E-13	3.539E-13
Pd-108	2.380E-09	2.445E-09	2.508E-09	2.571E-09	2.664E-09	2.815E-09	8.261E-09
Pd-110	1.096E-09	1.096E-09	1.096E-09	1.096E-09	1.096E-09	1.096E-09	1.096E-09
Ag-107	4.600E-07	4.600E-07	4.600E-07	4.600E-07	4.600E-07	4.600E-07	4.600E-07
Ag-108m	6.468E-09	6.398E-09	6.329E-09	6.260E-09	6.158E-09	5.992E-09	2.850E-11

TABLE F.7.d. Fuel Activation Product Inventory by Isotope at 35 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-109	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07
Ag-110m	4.115E-12	5.425E-13	7.151E-14	9.427E-15	4.512E-16	2.847E-18	0.00
Cd-108	9.646E-08	9.647E-08	9.648E-08	9.648E-08	9.649E-08	9.650E-08	9.702E-08
Cd-109	4.764E-12	1.600E-12	5.372E-13	1.804E-13	3.510E-14	2.293E-15	0.00
Cd-110	3.691E-07	3.691E-07	3.691E-07	3.691E-07	3.691E-07	3.691E-07	3.691E-07
Cd-111	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08	1.567E-08
Cd-112	6.471E-10	6.471E-10	6.471E-10	6.471E-10	6.471E-10	6.471E-10	6.471E-10
Cd-113	1.023E-13	1.023E-13	1.023E-13	1.023E-13	1.023E-13	1.023E-13	1.023E-13
Cd-114	3.383E-12	3.383E-12	3.383E-12	3.383E-12	3.383E-12	3.383E-12	3.383E-12
In-115	7.046E-16	7.046E-16	7.046E-16	7.046E-16	7.046E-16	7.046E-16	7.046E-16
Sn-116	5.302E-16	5.302E-16	5.302E-16	5.302E-16	5.302E-16	5.302E-16	5.302E-16
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.e. Fuel Activation Product Inventory by Isotope at 40 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	2.609E-08	2.609E-08	2.609E-08	2.609E-08	2.609E-08	2.609E-08	2.609E-08
H-2	3.255E-11	3.255E-11	3.255E-11	3.255E-11	3.255E-11	3.255E-11	3.255E-11
H-3	1.931E-14	1.726E-14	1.543E-14	1.379E-14	1.165E-14	8.802E-15	1.135E-38
He-3	8.073E-15	1.012E-14	1.196E-14	1.360E-14	1.573E-14	1.858E-14	2.739E-14
He-4	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.302E-06	3.302E-06
Li-6	4.663E-14	4.663E-14	4.663E-14	4.663E-14	4.663E-14	4.663E-14	4.663E-14
Li-7	3.541E-16	3.541E-16	3.541E-16	3.541E-16	3.541E-16	3.541E-16	3.541E-16
Be-9	2.227E-10	2.227E-10	2.227E-10	2.227E-10	2.227E-10	2.227E-10	2.227E-10
Be-10	1.227E-10	1.227E-10	1.227E-10	1.227E-10	1.227E-10	1.227E-10	1.226E-10
B-10	3.957E-16	5.020E-16	6.083E-16	7.146E-16	8.740E-16	1.140E-15	5.320E-14
B-11	3.664E-08	3.664E-08	3.664E-08	3.664E-08	3.664E-08	3.664E-08	3.664E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	1.091E-05	1.091E-05	1.091E-05	1.091E-05	1.091E-05	1.091E-05	1.091E-05
C-14	3.558E-07	3.557E-07	3.556E-07	3.556E-07	3.554E-07	3.552E-07	3.155E-07
N-14	4.932E-05	4.932E-05	4.932E-05	4.932E-05	4.932E-05	4.932E-05	4.936E-05
N-15	2.130E-07	2.130E-07	2.130E-07	2.130E-07	2.130E-07	2.130E-07	2.130E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.434E-05	5.434E-05	5.434E-05	5.434E-05	5.434E-05	5.434E-05	5.434E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	5.123E-10	5.123E-10	5.123E-10	5.123E-10	5.123E-10	5.123E-10	5.123E-10
Ne-21	3.480E-14	3.480E-14	3.480E-14	3.480E-14	3.480E-14	3.480E-14	3.480E-14
Ne-22	2.488E-14	2.488E-14	2.488E-14	2.488E-14	2.488E-14	2.488E-14	2.488E-14
Na-23	2.016E-15	2.016E-15	2.016E-15	2.016E-15	2.016E-15	2.016E-15	2.016E-15
Mg-24	2.874E-10	2.874E-10	2.874E-10	2.874E-10	2.874E-10	2.874E-10	2.874E-10
Mg-25	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10	3.024E-10
Mg-26	1.386E-10	1.386E-10	1.386E-10	1.386E-10	1.386E-10	1.386E-10	1.386E-10
Al-27	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05
Si-28	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05
Si-29	2.209E-06	2.209E-06	2.209E-06	2.209E-06	2.209E-06	2.209E-06	2.209E-06
Si-30	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06
P-31	6.265E-10	6.265E-10	6.265E-10	6.265E-10	6.265E-10	6.265E-10	6.265E-10
S-32	4.845E-10	4.845E-10	4.845E-10	4.845E-10	4.845E-10	4.845E-10	4.845E-10
S-33	4.380E-13	4.380E-13	4.380E-13	4.380E-13	4.380E-13	4.380E-13	4.380E-13
S-34	3.464E-11	3.464E-11	3.464E-11	3.464E-11	3.464E-11	3.464E-11	3.464E-11
S-36	4.490E-13	5.464E-13	6.438E-13	7.412E-13	8.873E-13	1.131E-12	4.881E-11
Cl-35	7.344E-06	7.344E-06	7.344E-06	7.344E-06	7.344E-06	7.344E-06	7.344E-06
Cl-36	1.113E-06	1.113E-06	1.113E-06	1.113E-06	1.113E-06	1.113E-06	1.111E-06
Cl-37	2.873E-06	2.873E-06	2.873E-06	2.873E-06	2.873E-06	2.873E-06	2.873E-06
Ar-36	2.313E-11	2.816E-11	3.319E-11	3.822E-11	4.577E-11	5.834E-11	2.520E-09
Ar-38	4.444E-09	4.444E-09	4.444E-09	4.444E-09	4.444E-09	4.444E-09	4.444E-09
Ar-39	3.543E-11	3.524E-11	3.506E-11	3.488E-11	3.461E-11	3.417E-11	2.735E-12
Ar-40	2.092E-10	2.092E-10	2.092E-10	2.092E-10	2.092E-10	2.092E-10	2.092E-10
K-39	9.126E-13	1.095E-12	1.276E-12	1.456E-12	1.725E-12	2.168E-12	3.360E-11
K-40	2.138E-08	2.138E-08	2.138E-08	2.138E-08	2.138E-08	2.138E-08	2.138E-08
K-41	1.108E-09	1.109E-09	1.110E-09	1.111E-09	1.112E-09	1.115E-09	1.609E-09
Ca-40	4.380E-05	4.380E-05	4.380E-05	4.380E-05	4.380E-05	4.380E-05	4.380E-05

TABLE F.7.e. Fuel Activation Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-41	5.925E-08	5.925E-08	5.925E-08	5.925E-08	5.925E-08	5.924E-08	5.875E-08
Ca-42	3.066E-07	3.066E-07	3.066E-07	3.066E-07	3.066E-07	3.066E-07	3.066E-07
Ca-43	6.249E-08	6.249E-08	6.249E-08	6.249E-08	6.249E-08	6.249E-08	6.249E-08
Ca-44	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06	1.039E-06
Ca-45	3.644E-14	1.630E-15	7.291E-17	3.261E-18	3.084E-20	1.305E-23	0.00
Ca-46	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09	1.818E-09
Ca-48	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07
Sc-45	3.486E-09	3.486E-09	3.486E-09	3.486E-09	3.486E-09	3.486E-09	3.486E-09
Ti-46	1.252E-10	1.252E-10	1.252E-10	1.252E-10	1.252E-10	1.252E-10	1.252E-10
Ti-47	4.514E-12	4.514E-12	4.514E-12	4.514E-12	4.514E-12	4.514E-12	4.514E-12
Ti-48	1.447E-14	1.447E-14	1.447E-14	1.447E-14	1.447E-14	1.447E-14	1.447E-14
Ti-49	3.800E-10	3.800E-10	3.800E-10	3.800E-10	3.800E-10	3.800E-10	3.800E-10
Ti-50	1.498E-12	1.498E-12	1.498E-12	1.498E-12	1.498E-12	1.498E-12	1.498E-12
V-51	7.045E-11	7.045E-11	7.045E-11	7.045E-11	7.045E-11	7.045E-11	7.045E-11
Cr-52	5.780E-13	5.780E-13	5.780E-13	5.780E-13	5.780E-13	5.780E-13	5.780E-13
Cr-53	1.358E-10	1.358E-10	1.358E-10	1.358E-10	1.358E-10	1.358E-10	1.358E-10
Cr-54	2.111E-09	2.114E-09	2.114E-09	2.115E-09	2.115E-09	2.115E-09	2.115E-09
Mn-54	3.183E-12	6.296E-13	1.246E-13	2.464E-14	2.169E-15	3.775E-17	0.00
Mn-55	2.047E-08	2.139E-08	2.194E-08	2.226E-08	2.251E-08	2.266E-08	2.271E-08
Fe-54	2.844E-06	2.844E-06	2.844E-06	2.844E-06	2.844E-06	2.844E-06	2.844E-06
Fe-55	2.245E-09	1.317E-09	7.727E-10	4.534E-10	2.038E-10	5.373E-11	0.00
Fe-56	4.651E-05	4.651E-05	4.651E-05	4.651E-05	4.651E-05	4.651E-05	4.651E-05
Fe-57	1.566E-06	1.566E-06	1.566E-06	1.566E-06	1.566E-06	1.566E-06	1.566E-06
Fe-58	1.737E-07	1.737E-07	1.737E-07	1.737E-07	1.737E-07	1.737E-07	1.737E-07
Co-59	5.407E-09	5.412E-09	5.417E-09	5.421E-09	5.428E-09	5.440E-09	7.753E-09
Co-60	2.230E-10	1.714E-10	1.318E-10	1.013E-10	6.827E-11	3.537E-11	0.00
Ni-58	1.879E-05	1.879E-05	1.879E-05	1.879E-05	1.879E-05	1.879E-05	1.879E-05
Ni-59	2.735E-07	2.735E-07	2.735E-07	2.735E-07	2.735E-07	2.735E-07	2.712E-07
Ni-60	7.557E-06	7.557E-06	7.557E-06	7.557E-06	7.557E-06	7.557E-06	7.557E-06
Ni-61	4.024E-07	4.024E-07	4.024E-07	4.024E-07	4.024E-07	4.024E-07	4.024E-07
Ni-62	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06
Ni-63	4.535E-08	4.467E-08	4.400E-08	4.334E-08	4.237E-08	4.081E-08	2.536E-11
Ni-64	2.819E-07	2.819E-07	2.819E-07	2.819E-07	2.819E-07	2.819E-07	2.819E-07
Cu-63	3.240E-09	3.918E-09	4.586E-09	5.244E-09	6.213E-09	7.779E-09	4.856E-08
Cu-65	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09
Zn-64	2.459E-12	2.459E-12	2.459E-12	2.459E-12	2.459E-12	2.459E-12	2.459E-12
Zn-66	6.438E-12	6.438E-12	6.438E-12	6.438E-12	6.438E-12	6.438E-12	6.438E-12
Zn-67	6.861E-15	6.861E-15	6.861E-15	6.861E-15	6.861E-15	6.861E-15	6.861E-15
Ru-104	1.808E-15	1.808E-15	1.808E-15	1.808E-15	1.808E-15	1.808E-15	1.808E-15
Pd-104	3.970E-13	3.970E-13	3.970E-13	3.970E-13	3.970E-13	3.970E-13	3.970E-13
Pd-105	4.637E-15	4.637E-15	4.637E-15	4.637E-15	4.637E-15	4.637E-15	4.637E-15
Pd-106	8.362E-12	8.362E-12	8.362E-12	8.362E-12	8.362E-12	8.362E-12	8.362E-12
Pd-107	4.089E-13	4.089E-13	4.089E-13	4.089E-13	4.089E-13	4.089E-13	4.088E-13
Pd-108	2.682E-09	2.755E-09	2.828E-09	2.900E-09	3.006E-09	3.180E-09	9.421E-09
Pd-110	1.177E-09	1.177E-09	1.177E-09	1.177E-09	1.177E-09	1.177E-09	1.177E-09
Ag-107	4.447E-07	4.447E-07	4.447E-07	4.447E-07	4.447E-07	4.447E-07	4.447E-07
Ag-108m	7.413E-09	7.333E-09	7.253E-09	7.174E-09	7.058E-09	6.868E-09	3.266E-11

TABLE F.7.e. Fuel Activation Product Inventory by Isotope at 40 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-109	1.238E-07	1.238E-07	1.238E-07	1.238E-07	1.238E-07	1.238E-07	1.238E-07
Ag-110m	4.035E-12	5.319E-13	7.011E-14	9.242E-15	4.423E-16	2.791E-18	0.00
Cd-108	1.105E-07	1.105E-07	1.105E-07	1.105E-07	1.105E-07	1.105E-07	1.111E-07
Cd-109	6.141E-12	2.062E-12	6.924E-13	2.325E-13	4.524E-14	2.956E-15	0.00
Cd-110	3.932E-07	3.932E-07	3.932E-07	3.932E-07	3.932E-07	3.932E-07	3.932E-07
Cd-111	1.986E-08	1.986E-08	1.986E-08	1.986E-08	1.986E-08	1.986E-08	1.986E-08
Cd-112	9.700E-10	9.700E-10	9.700E-10	9.700E-10	9.700E-10	9.700E-10	9.700E-10
Cd-113	1.533E-13	1.533E-13	1.533E-13	1.533E-13	1.533E-13	1.533E-13	1.533E-13
Cd-114	5.994E-12	5.994E-12	5.994E-12	5.994E-12	5.994E-12	5.994E-12	5.994E-12
In-115	1.373E-15	1.373E-15	1.373E-15	1.373E-15	1.373E-15	1.373E-15	1.373E-15
Sn-116	1.196E-15	1.196E-15	1.196E-15	1.196E-15	1.196E-15	1.196E-15	1.196E-15
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.f. Fuel Activation Product Inventory by Isotope at 45 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	2.987E-08	2.987E-08	2.987E-08	2.987E-08	2.987E-08	2.987E-08	2.987E-08
H-2	4.269E-11	4.269E-11	4.269E-11	4.269E-11	4.269E-11	4.269E-11	4.269E-11
H-3	2.713E-14	2.425E-14	2.168E-14	1.937E-14	1.637E-14	1.237E-14	1.596E-38
He-3	1.128E-14	1.416E-14	1.673E-14	1.904E-14	2.204E-14	2.604E-14	3.841E-14
He-4	3.782E-06	3.782E-06	3.782E-06	3.782E-06	3.782E-06	3.782E-06	3.782E-06
Li-6	5.617E-14	5.617E-14	5.617E-14	5.617E-14	5.617E-14	5.617E-14	5.617E-14
Li-7	4.718E-16	4.718E-16	4.718E-16	4.718E-16	4.718E-16	4.718E-16	4.718E-16
Be-9	2.551E-10	2.551E-10	2.551E-10	2.551E-10	2.551E-10	2.551E-10	2.551E-10
Be-10	1.600E-10	1.600E-10	1.600E-10	1.600E-10	1.600E-10	1.600E-10	1.599E-10
B-10	5.043E-16	6.429E-16	7.816E-16	9.202E-16	1.128E-15	1.475E-15	6.939E-14
B-11	4.195E-08	4.195E-08	4.195E-08	4.195E-08	4.195E-08	4.195E-08	4.195E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	1.245E-05	1.245E-05	1.245E-05	1.245E-05	1.245E-05	1.245E-05	1.245E-05
C-14	4.074E-07	4.073E-07	4.072E-07	4.071E-07	4.070E-07	4.067E-07	3.612E-07
N-14	4.927E-05	4.927E-05	4.927E-05	4.927E-05	4.927E-05	4.927E-05	4.932E-05
N-15	2.155E-07	2.155E-07	2.155E-07	2.155E-07	2.155E-07	2.155E-07	2.155E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	5.868E-10	5.868E-10	5.868E-10	5.868E-10	5.868E-10	5.868E-10	5.868E-10
Ne-21	4.564E-14	4.564E-14	4.564E-14	4.564E-14	4.564E-14	4.564E-14	4.564E-14
Ne-22	3.265E-14	3.265E-14	3.265E-14	3.265E-14	3.265E-14	3.265E-14	3.265E-14
Na-23	2.647E-15	2.647E-15	2.647E-15	2.647E-15	2.647E-15	2.647E-15	2.647E-15
Mg-24	3.292E-10	3.292E-10	3.292E-10	3.292E-10	3.292E-10	3.292E-10	3.292E-10
Mg-25	3.464E-10	3.464E-10	3.464E-10	3.464E-10	3.464E-10	3.464E-10	3.464E-10
Mg-26	1.589E-10	1.589E-10	1.589E-10	1.589E-10	1.589E-10	1.589E-10	1.589E-10
Al-27	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05	4.536E-05
Si-28	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05
Si-29	2.213E-06	2.213E-06	2.213E-06	2.213E-06	2.213E-06	2.213E-06	2.213E-06
Si-30	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06
P-31	7.177E-10	7.177E-10	7.177E-10	7.177E-10	7.177E-10	7.177E-10	7.177E-10
S-32	5.494E-10	5.494E-10	5.494E-10	5.494E-10	5.494E-10	5.494E-10	5.494E-10
S-33	5.709E-13	5.709E-13	5.709E-13	5.709E-13	5.709E-13	5.709E-13	5.709E-13
S-34	3.971E-11	3.971E-11	3.971E-11	3.971E-11	3.971E-11	3.971E-11	3.971E-11
S-36	5.078E-13	6.180E-13	7.282E-13	8.384E-13	1.004E-12	1.279E-12	5.522E-11
Cl-35	7.196E-06	7.196E-06	7.196E-06	7.196E-06	7.196E-06	7.196E-06	7.196E-06
Cl-36	1.260E-06	1.260E-06	1.260E-06	1.260E-06	1.260E-06	1.260E-06	1.257E-06
Cl-37	2.879E-06	2.879E-06	2.879E-06	2.879E-06	2.879E-06	2.879E-06	2.879E-06
Ar-36	2.616E-11	3.185E-11	3.754E-11	4.323E-11	5.176E-11	6.599E-11	2.851E-09
Ar-38	5.093E-09	5.093E-09	5.093E-09	5.093E-09	5.093E-09	5.093E-09	5.093E-09
Ar-39	3.749E-11	3.730E-11	3.711E-11	3.691E-11	3.663E-11	3.616E-11	2.894E-12
Ar-40	2.690E-10	2.690E-10	2.690E-10	2.690E-10	2.690E-10	2.690E-10	2.690E-10
K-39	9.717E-13	1.164E-12	1.356E-12	1.547E-12	1.831E-12	2.300E-12	3.557E-11
K-40	2.429E-08	2.429E-08	2.429E-08	2.429E-08	2.429E-08	2.429E-08	2.429E-08
K-41	1.444E-09	1.445E-09	1.447E-09	1.448E-09	1.449E-09	1.452E-09	2.019E-09
Ca-40	4.379E-05	4.379E-05	4.379E-05	4.379E-05	4.379E-05	4.379E-05	4.379E-05

TABLE F.7.f. Fuel Activation Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-41	6.786E-08	6.786E-08	6.786E-08	6.786E-08	6.786E-08	6.786E-08	6.729E-08
Ca-42	3.065E-07	3.065E-07	3.065E-07	3.065E-07	3.065E-07	3.065E-07	3.065E-07
Ca-43	6.238E-08	6.238E-08	6.238E-08	6.238E-08	6.238E-08	6.238E-08	6.238E-08
Ca-44	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06
Ca-45	4.207E-14	1.882E-15	8.416E-17	3.765E-18	3.561E-20	1.507E-23	0.00
Ca-46	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09
Ca-48	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07	1.028E-07
Sc-45	3.972E-09	3.973E-09	3.973E-09	3.973E-09	3.973E-09	3.973E-09	3.973E-09
Ti-46	1.636E-10	1.636E-10	1.636E-10	1.636E-10	1.636E-10	1.636E-10	1.636E-10
Ti-47	5.250E-12	5.250E-12	5.250E-12	5.250E-12	5.250E-12	5.250E-12	5.250E-12
Ti-48	1.913E-14	1.913E-14	1.913E-14	1.913E-14	1.913E-14	1.913E-14	1.913E-14
Ti-49	4.350E-10	4.350E-10	4.350E-10	4.350E-10	4.350E-10	4.350E-10	4.350E-10
Ti-50	1.965E-12	1.965E-12	1.965E-12	1.965E-12	1.965E-12	1.965E-12	1.965E-12
V-51	8.056E-11	8.056E-11	8.056E-11	8.056E-11	8.056E-11	8.056E-11	8.056E-11
Cr-52	7.573E-13	7.573E-13	7.573E-13	7.573E-13	7.573E-13	7.573E-13	7.573E-13
Cr-53	1.548E-10	1.548E-10	1.548E-10	1.548E-10	1.548E-10	1.548E-10	1.548E-10
Cr-54	2.417E-09	2.420E-09	2.421E-09	2.421E-09	2.421E-09	2.421E-09	2.421E-09
Mn-54	3.666E-12	7.253E-13	1.435E-13	2.839E-14	2.498E-15	4.349E-17	0.00
Mn-55	2.338E-08	2.445E-08	2.508E-08	2.544E-08	2.573E-08	2.590E-08	2.596E-08
Fe-54	2.840E-06	2.840E-06	2.840E-06	2.840E-06	2.840E-06	2.840E-06	2.840E-06
Fe-55	2.579E-09	1.513E-09	8.879E-10	5.210E-10	2.341E-10	6.174E-11	0.00
Fe-56	4.645E-05	4.645E-05	4.645E-05	4.645E-05	4.645E-05	4.645E-05	4.645E-05
Fe-57	1.631E-06	1.631E-06	1.631E-06	1.631E-06	1.631E-06	1.631E-06	1.631E-06
Fe-58	1.764E-07	1.764E-07	1.764E-07	1.764E-07	1.764E-07	1.764E-07	1.764E-07
Co-59	6.588E-09	6.593E-09	6.598E-09	6.604E-09	6.612E-09	6.625E-09	9.195E-09
Co-60	2.993E-10	2.300E-10	1.768E-10	1.359E-10	9.161E-11	4.746E-11	0.00
Ni-58	1.874E-05	1.874E-05	1.874E-05	1.874E-05	1.874E-05	1.874E-05	1.874E-05
Ni-59	3.040E-07	3.040E-07	3.040E-07	3.040E-07	3.040E-07	3.039E-07	3.014E-07
Ni-60	7.563E-06	7.563E-06	7.563E-06	7.563E-06	7.563E-06	7.563E-06	7.563E-06
Ni-61	4.125E-07	4.125E-07	4.125E-07	4.125E-07	4.125E-07	4.125E-07	4.125E-07
Ni-62	1.023E-06	1.023E-06	1.023E-06	1.023E-06	1.023E-06	1.023E-06	1.023E-06
Ni-63	5.150E-08	5.073E-08	4.997E-08	4.923E-08	4.813E-08	4.635E-08	2.880E-11
Ni-64	2.823E-07	2.823E-07	2.823E-07	2.823E-07	2.823E-07	2.823E-07	2.823E-07
Cu-63	3.676E-09	4.446E-09	5.205E-09	5.952E-09	7.052E-09	8.831E-09	5.515E-08
Cu-65	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09
Zn-64	3.207E-12	3.207E-12	3.207E-12	3.207E-12	3.207E-12	3.207E-12	3.207E-12
Zn-66	8.444E-12	8.444E-12	8.444E-12	8.444E-12	8.444E-12	8.444E-12	8.444E-12
Zn-67	1.030E-14	1.030E-14	1.030E-14	1.030E-14	1.030E-14	1.030E-14	1.030E-14
Ru-104	2.035E-15	2.035E-15	2.035E-15	2.035E-15	2.035E-15	2.035E-15	2.035E-15
Pd-104	4.465E-13	4.465E-13	4.465E-13	4.465E-13	4.465E-13	4.465E-13	4.465E-13
Pd-105	5.970E-15	5.970E-15	5.970E-15	5.970E-15	5.970E-15	5.970E-15	5.970E-15
Pd-106	9.400E-12	9.400E-12	9.400E-12	9.400E-12	9.400E-12	9.400E-12	9.400E-12
Pd-107	4.643E-13	4.643E-13	4.643E-13	4.643E-13	4.643E-13	4.643E-13	4.643E-13
Pd-108	2.969E-09	3.051E-09	3.133E-09	3.214E-09	3.334E-09	3.530E-09	1.056E-08
Pd-110	1.243E-09	1.243E-09	1.243E-09	1.243E-09	1.243E-09	1.243E-09	1.243E-09
Ag-107	4.295E-07	4.295E-07	4.295E-07	4.295E-07	4.295E-07	4.295E-07	4.295E-07
Ag-108m	8.351E-09	8.261E-09	8.171E-09	8.082E-09	7.951E-09	7.737E-09	3.679E-11

TABLE F.7.f. Fuel Activation Product Inventory by Isotope at 45 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-109	1.002E-07	1.002E-07	1.002E-07	1.002E-07	1.002E-07	1.002E-07	1.002E-07
Ag-110m	3.857E-12	5.084E-13	6.702E-14	8.834E-15	4.228E-16	2.667E-18	0.00
Cd-108	1.244E-07	1.244E-07	1.244E-07	1.244E-07	1.244E-07	1.244E-07	1.251E-07
Cd-109	7.637E-12	2.564E-12	8.611E-13	2.892E-13	5.627E-14	3.677E-15	0.00
Cd-110	4.122E-07	4.122E-07	4.122E-07	4.122E-07	4.122E-07	4.122E-07	4.122E-07
Cd-111	2.436E-08	2.436E-08	2.436E-08	2.436E-08	2.436E-08	2.436E-08	2.436E-08
Cd-112	1.382E-09	1.382E-09	1.382E-09	1.382E-09	1.382E-09	1.382E-09	1.382E-09
Cd-113	2.185E-13	2.185E-13	2.185E-13	2.185E-13	2.185E-13	2.185E-13	2.185E-13
Cd-114	9.902E-12	9.902E-12	9.902E-12	9.902E-12	9.902E-12	9.902E-12	9.902E-12
In-115	2.459E-15	2.459E-15	2.459E-15	2.459E-15	2.459E-15	2.459E-15	2.459E-15
Sn-116	2.430E-15	2.430E-15	2.430E-15	2.430E-15	2.430E-15	2.430E-15	2.430E-15
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.7.g. Fuel Activation Product Inventory by Isotope at 50 MWd/kgM, g/gU

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	3.373E-08	3.373E-08	3.373E-08	3.373E-08	3.373E-08	3.373E-08	3.373E-08
H-2	5.448E-11	5.448E-11	5.448E-11	5.448E-11	5.448E-11	5.448E-11	5.448E-11
H-3	3.666E-14	3.276E-14	2.929E-14	2.618E-14	2.212E-14	1.671E-14	2.155E-38
He-3	1.517E-14	1.907E-14	2.254E-14	2.565E-14	2.971E-14	3.512E-14	5.183E-14
He-4	4.274E-06	4.274E-06	4.274E-06	4.274E-06	4.274E-06	4.274E-06	4.274E-06
Li-6	6.608E-14	6.608E-14	6.608E-14	6.608E-14	6.608E-14	6.608E-14	6.608E-14
Li-7	6.098E-16	6.098E-16	6.098E-16	6.098E-16	6.098E-16	6.098E-16	6.098E-16
Be-9	2.882E-10	2.882E-10	2.882E-10	2.882E-10	2.882E-10	2.882E-10	2.882E-10
Be-10	2.034E-10	2.034E-10	2.034E-10	2.034E-10	2.034E-10	2.034E-10	2.033E-10
B-10	6.288E-16	8.050E-16	9.812E-16	1.157E-15	1.422E-15	1.862E-15	8.819E-14
B-11	4.738E-08	4.738E-08	4.738E-08	4.738E-08	4.738E-08	4.738E-08	4.738E-08
C-12	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05	2.134E-05
C-13	1.404E-05	1.404E-05	1.404E-05	1.404E-05	1.404E-05	1.404E-05	1.404E-05
C-14	4.601E-07	4.600E-07	4.599E-07	4.598E-07	4.596E-07	4.594E-07	4.080E-07
N-14	4.921E-05	4.921E-05	4.921E-05	4.921E-05	4.921E-05	4.921E-05	4.927E-05
N-15	2.181E-07	2.181E-07	2.181E-07	2.181E-07	2.181E-07	2.181E-07	2.181E-07
O-16	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01	1.341E-01
O-17	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05	5.435E-05
O-18	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04	3.086E-04
F-19	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05	1.130E-05
Ne-20	6.631E-10	6.631E-10	6.631E-10	6.631E-10	6.631E-10	6.631E-10	6.631E-10
Ne-21	5.827E-14	5.827E-14	5.827E-14	5.827E-14	5.827E-14	5.827E-14	5.827E-14
Ne-22	4.170E-14	4.170E-14	4.170E-14	4.170E-14	4.170E-14	4.170E-14	4.170E-14
Na-23	3.382E-15	3.382E-15	3.382E-15	3.382E-15	3.382E-15	3.382E-15	3.382E-15
Mg-24	3.720E-10	3.720E-10	3.720E-10	3.720E-10	3.720E-10	3.720E-10	3.720E-10
Mg-25	3.915E-10	3.915E-10	3.915E-10	3.915E-10	3.915E-10	3.915E-10	3.915E-10
Mg-26	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10	1.797E-10
Al-27	4.535E-05	4.535E-05	4.535E-05	4.535E-05	4.535E-05	4.535E-05	4.535E-05
Si-28	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05	4.173E-05
Si-29	2.216E-06	2.216E-06	2.216E-06	2.216E-06	2.216E-06	2.216E-06	2.216E-06
Si-30	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06	1.504E-06
Si-32	1.523E-16	1.520E-16	1.517E-16	1.514E-16	1.509E-16	1.501E-16	5.278E-17
P-31	8.111E-10	8.111E-10	8.111E-10	8.111E-10	8.111E-10	8.111E-10	8.111E-10
S-32	6.146E-10	6.146E-10	6.146E-10	6.146E-10	6.146E-10	6.146E-10	6.146E-10
S-33	7.242E-13	7.242E-13	7.242E-13	7.242E-13	7.242E-13	7.242E-13	7.242E-13
S-34	4.490E-11	4.490E-11	4.490E-11	4.490E-11	4.490E-11	4.490E-11	4.490E-11
S-36	5.666E-13	6.896E-13	8.125E-13	9.355E-13	1.120E-12	1.427E-12	6.162E-11
Cl-35	7.048E-06	7.048E-06	7.048E-06	7.048E-06	7.048E-06	7.048E-06	7.048E-06
Cl-36	1.405E-06	1.405E-06	1.405E-06	1.405E-06	1.405E-06	1.405E-06	1.402E-06
Cl-37	2.886E-06	2.886E-06	2.886E-06	2.886E-06	2.886E-06	2.886E-06	2.886E-06
Ar-36	2.918E-11	3.553E-11	4.188E-11	4.823E-11	5.775E-11	7.362E-11	3.181E-09
Ar-38	5.758E-09	5.758E-09	5.758E-09	5.758E-09	5.758E-09	5.758E-09	5.758E-09
Ar-39	3.930E-11	3.910E-11	3.889E-11	3.869E-11	3.840E-11	3.791E-11	3.034E-12
Ar-40	3.371E-10	3.371E-10	3.371E-10	3.371E-10	3.371E-10	3.371E-10	3.371E-10
K-39	1.024E-12	1.226E-12	1.427E-12	1.627E-12	1.925E-12	2.417E-12	3.729E-11
K-40	2.721E-08	2.721E-08	2.721E-08	2.721E-08	2.721E-08	2.721E-08	2.721E-08
K-41	1.833E-09	1.834E-09	1.835E-09	1.837E-09	1.839E-09	1.842E-09	2.482E-09

TABLE F.7.g. Fuel Activation Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ca-40	4.377E-05	4.377E-05	4.377E-05	4.377E-05	4.377E-05	4.377E-05	4.377E-05
Ca-41	7.668E-08	7.668E-08	7.668E-08	7.668E-08	7.667E-08	7.667E-08	7.603E-08
Ca-42	3.063E-07	3.063E-07	3.063E-07	3.063E-07	3.063E-07	3.063E-07	3.063E-07
Ca-43	6.227E-08	6.227E-08	6.227E-08	6.227E-08	6.227E-08	6.227E-08	6.227E-08
Ca-44	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06	1.038E-06
Ca-45	4.776E-14	2.136E-15	9.556E-17	4.274E-18	4.044E-20	1.711E-23	0.00
Ca-46	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09	1.817E-09
Ca-48	1.027E-07	1.027E-07	1.027E-07	1.027E-07	1.027E-07	1.027E-07	1.027E-07
Sc-45	4.466E-09	4.466E-09	4.466E-09	4.466E-09	4.466E-09	4.466E-09	4.466E-09
Ti-46	2.081E-10	2.081E-10	2.081E-10	2.081E-10	2.081E-10	2.081E-10	2.081E-10
Ti-47	6.037E-12	6.037E-12	6.037E-12	6.037E-12	6.037E-12	6.037E-12	6.037E-12
Ti-48	2.463E-14	2.463E-14	2.463E-14	2.463E-14	2.463E-14	2.463E-14	2.463E-14
Ti-49	4.911E-10	4.911E-10	4.911E-10	4.911E-10	4.911E-10	4.911E-10	4.911E-10
Ti-50	2.507E-12	2.507E-12	2.507E-12	2.507E-12	2.507E-12	2.507E-12	2.507E-12
V-51	9.088E-11	9.088E-11	9.088E-11	9.088E-11	9.088E-11	9.088E-11	9.088E-11
Cr-52	9.653E-13	9.653E-13	9.653E-13	9.653E-13	9.653E-13	9.653E-13	9.653E-13
Cr-53	1.741E-10	1.741E-10	1.741E-10	1.741E-10	1.741E-10	1.741E-10	1.741E-10
Cr-54	2.730E-09	2.733E-09	2.734E-09	2.734E-09	2.734E-09	2.734E-09	2.734E-09
Mn-54	4.156E-12	8.223E-13	1.627E-13	3.218E-14	2.832E-15	4.931E-17	0.00
Mn-55	2.636E-08	2.757E-08	2.827E-08	2.869E-08	2.901E-08	2.921E-08	2.928E-08
Fe-54	2.837E-06	2.837E-06	2.837E-06	2.837E-06	2.837E-06	2.837E-06	2.837E-06
Fe-55	2.921E-09	1.714E-09	1.005E-09	5.899E-10	2.651E-10	6.991E-11	0.00
Fe-56	4.639E-05	4.639E-05	4.639E-05	4.639E-05	4.639E-05	4.639E-05	4.639E-05
Fe-57	1.696E-06	1.696E-06	1.696E-06	1.696E-06	1.696E-06	1.696E-06	1.696E-06
Fe-58	1.791E-07	1.791E-07	1.791E-07	1.791E-07	1.791E-07	1.791E-07	1.791E-07
Co-59	7.839E-09	7.845E-09	7.851E-09	7.856E-09	7.865E-09	7.879E-09	1.070E-08
Co-60	3.909E-10	3.005E-10	2.310E-10	1.775E-10	1.197E-10	6.199E-11	0.00
Ni-58	1.869E-05	1.869E-05	1.869E-05	1.869E-05	1.869E-05	1.869E-05	1.869E-05
Ni-59	3.331E-07	3.331E-07	3.331E-07	3.331E-07	3.331E-07	3.331E-07	3.303E-07
Ni-60	7.571E-06	7.571E-06	7.571E-06	7.571E-06	7.571E-06	7.571E-06	7.572E-06
Ni-61	4.227E-07	4.227E-07	4.227E-07	4.227E-07	4.227E-07	4.227E-07	4.227E-07
Ni-62	1.016E-06	1.016E-06	1.016E-06	1.016E-06	1.016E-06	1.016E-06	1.016E-06
Ni-63	5.769E-08	5.683E-08	5.598E-08	5.514E-08	5.391E-08	5.192E-08	3.226E-11
Ni-64	2.827E-07	2.827E-07	2.827E-07	2.827E-07	2.827E-07	2.827E-07	2.827E-07
Cu-63	4.115E-09	4.977E-09	5.827E-09	6.664E-09	7.897E-09	9.890E-09	6.177E-08
Cu-65	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09
Zn-64	4.069E-12	4.069E-12	4.069E-12	4.069E-12	4.069E-12	4.069E-12	4.069E-12
Zn-66	1.078E-11	1.078E-11	1.078E-11	1.078E-11	1.078E-11	1.078E-11	1.078E-11
Zn-67	1.483E-14	1.483E-14	1.483E-14	1.483E-14	1.483E-14	1.483E-14	1.483E-14
Zn-68	1.839E-16	1.839E-16	1.839E-16	1.839E-16	1.839E-16	1.839E-16	1.839E-16
Ru-104	2.259E-15	2.259E-15	2.259E-15	2.259E-15	2.259E-15	2.259E-15	2.259E-15
Pd-104	4.951E-13	4.951E-13	4.951E-13	4.951E-13	4.951E-13	4.951E-13	4.951E-13
Pd-105	7.476E-15	7.476E-15	7.476E-15	7.476E-15	7.476E-15	7.476E-15	7.476E-15
Pd-106	1.042E-11	1.042E-11	1.042E-11	1.042E-11	1.042E-11	1.042E-11	1.042E-11
Pd-107	5.201E-13	5.201E-13	5.201E-13	5.201E-13	5.201E-13	5.201E-13	5.201E-13
Pd-108	3.240E-09	3.332E-09	3.422E-09	3.512E-09	3.646E-09	3.863E-09	1.167E-08
Pd-110	1.298E-09	1.298E-09	1.298E-09	1.298E-09	1.298E-09	1.298E-09	1.298E-09

TABLE F.7.g. Fuel Activation Product Inventory by Isotope at 50 MWd/kgM, g/gU (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Ag-107	4.144E-07	4.144E-07	4.144E-07	4.144E-07	4.144E-07	4.144E-07	4.144E-07
Ag-108m	9.278E-09	9.178E-09	9.078E-09	8.980E-09	8.834E-09	8.596E-09	4.088E-11
Ag-109	8.073E-08	8.074E-08	8.074E-08	8.074E-08	8.074E-08	8.074E-08	8.074E-08
Ag-110m	3.617E-12	4.767E-13	6.284E-14	8.284E-15	3.965E-16	2.502E-18	0.00
Cd-108	1.381E-07	1.381E-07	1.381E-07	1.381E-07	1.381E-07	1.381E-07	1.389E-07
Cd-109	9.228E-12	3.099E-12	1.041E-12	3.494E-13	6.799E-14	4.443E-15	0.00
Cd-110	4.267E-07	4.267E-07	4.267E-07	4.267E-07	4.267E-07	4.267E-07	4.267E-07
Cd-111	2.907E-08	2.907E-08	2.907E-08	2.907E-08	2.907E-08	2.907E-08	2.907E-08
Cd-112	1.891E-09	1.891E-09	1.891E-09	1.891E-09	1.891E-09	1.891E-09	1.891E-09
Cd-113	2.989E-13	2.989E-13	2.989E-13	2.989E-13	2.989E-13	2.989E-13	2.989E-13
Cd-114	1.547E-11	1.547E-11	1.547E-11	1.547E-11	1.547E-11	1.547E-11	1.547E-11
In-115	4.121E-15	4.121E-15	4.121E-15	4.121E-15	4.121E-15	4.121E-15	4.121E-15
Sn-116	4.546E-15	4.546E-15	4.546E-15	4.546E-15	4.546E-15	4.546E-15	4.546E-15
Total	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01	1.348E-01

TABLE F.8.a. Cladding Activation Product Inventory by Isotope at 20 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.203E-05	1.203E-05	1.203E-05	1.203E-05	1.203E-05	1.203E-05	1.203E-05
H-2	1.750E-08	1.750E-08	1.750E-08	1.750E-08	1.750E-08	1.750E-08	1.750E-08
H-3	2.609E-14	2.332E-14	2.084E-14	1.863E-14	1.574E-14	1.189E-14	1.533E-38
He-3	1.150E-14	1.427E-14	1.674E-14	1.896E-14	2.184E-14	2.570E-14	3.759E-14
He-4	6.088E-08	6.088E-08	6.088E-08	6.088E-08	6.088E-08	6.088E-08	6.088E-08
Li-6	9.863E-14	9.863E-14	9.863E-14	9.863E-14	9.863E-14	9.863E-14	9.863E-14
Be-9	7.004E-10	7.004E-10	7.004E-10	7.004E-10	7.004E-10	7.004E-10	7.004E-10
Be-10	1.815E-11	1.815E-11	1.815E-11	1.815E-11	1.815E-11	1.815E-11	1.815E-11
B-11	1.436E-08	1.436E-08	1.436E-08	1.436E-08	1.436E-08	1.436E-08	1.436E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.801E-06	1.801E-06	1.801E-06	1.801E-06	1.801E-06	1.801E-06	1.801E-06
C-14	1.261E-07	1.260E-07	1.260E-07	1.260E-07	1.259E-07	1.258E-07	1.118E-07
N-14	4.169E-05	4.169E-05	4.169E-05	4.169E-05	4.169E-05	4.169E-05	4.170E-05
N-15	1.698E-07	1.698E-07	1.698E-07	1.698E-07	1.698E-07	1.698E-07	1.698E-07
O-16	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03
O-17	5.039E-07	5.039E-07	5.039E-07	5.039E-07	5.039E-07	5.039E-07	5.039E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	1.655E-12	1.655E-12	1.655E-12	1.655E-12	1.655E-12	1.655E-12	1.655E-12
Ne-22	9.457E-15	9.457E-15	9.457E-15	9.457E-15	9.457E-15	9.457E-15	9.457E-15
Mg-24	1.177E-10	1.177E-10	1.177E-10	1.177E-10	1.177E-10	1.177E-10	1.177E-10
Mg-25	2.476E-10	2.476E-10	2.476E-10	2.476E-10	2.476E-10	2.476E-10	2.476E-10
Mg-26	1.132E-10	1.132E-10	1.132E-10	1.132E-10	1.132E-10	1.132E-10	1.132E-10
Al-27	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.873E-06	3.873E-06	3.873E-06	3.873E-06	3.873E-06	3.873E-06	3.873E-06
Si-30	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06
P-31	5.130E-10	5.130E-10	5.130E-10	5.130E-10	5.130E-10	5.130E-10	5.130E-10
S-32	7.288E-14	7.288E-14	7.288E-14	7.288E-14	7.288E-14	7.288E-14	7.290E-14
Ca-44	1.696E-15	1.696E-15	1.696E-15	1.696E-15	1.696E-15	1.696E-15	1.696E-15
Ti-47	1.285E-10	1.285E-10	1.285E-10	1.285E-10	1.285E-10	1.285E-10	1.285E-10
Ti-48	2.073E-13	2.073E-13	2.073E-13	2.073E-13	2.073E-13	2.073E-13	2.073E-13
Ti-49	3.510E-10	3.510E-10	3.510E-10	3.510E-10	3.510E-10	3.510E-10	3.510E-10
Ti-50	1.413E-09	1.413E-09	1.413E-09	1.413E-09	1.413E-09	1.413E-09	1.413E-09
V-50	5.028E-09	5.028E-09	5.028E-09	5.028E-09	5.028E-09	5.028E-09	5.028E-09
V-51	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06	1.031E-06
Cr-50	4.076E-05	4.076E-05	4.076E-05	4.076E-05	4.076E-05	4.076E-05	4.076E-05
Cr-52	8.324E-04	8.324E-04	8.324E-04	8.324E-04	8.324E-04	8.324E-04	8.324E-04
Cr-53	9.872E-05	9.872E-05	9.872E-05	9.872E-05	9.872E-05	9.872E-05	9.872E-05
Cr-54	2.731E-05	2.731E-05	2.731E-05	2.731E-05	2.731E-05	2.731E-05	2.731E-05
Mn-54	5.494E-11	1.087E-11	2.150E-12	4.254E-13	3.744E-14	6.517E-16	0.00
Mn-55	3.763E-07	3.922E-07	4.015E-07	4.069E-07	4.112E-07	4.138E-07	4.147E-07
Fe-54	1.118E-04	1.118E-04	1.118E-04	1.118E-04	1.118E-04	1.118E-04	1.118E-04
Fe-55	3.835E-08	2.250E-08	1.320E-08	7.747E-09	3.482E-09	9.181E-10	0.00
Fe-56	1.830E-03	1.830E-03	1.830E-03	1.830E-03	1.830E-03	1.830E-03	1.830E-03
Fe-57	5.199E-05	5.199E-05	5.199E-05	5.199E-05	5.199E-05	5.199E-05	5.199E-05
Fe-58	6.193E-06	6.193E-06	6.193E-06	6.193E-06	6.193E-06	6.193E-06	6.193E-06
Co-59	1.218E-08	1.218E-08	1.218E-08	1.218E-08	1.218E-08	1.218E-08	1.218E-08

TABLE F.8.a. Cladding Activation Product Inventory by Isotope at 20 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Co-60	1.640E-10	1.261E-10	9.692E-11	7.451E-11	5.021E-11	2.601E-11	0.00
Ni-60	3.064E-10	3.444E-10	3.735E-10	3.960E-10	4.203E-10	4.445E-10	4.705E-10
Ni-61	6.814E-13	6.814E-13	6.814E-13	6.814E-13	6.814E-13	6.814E-13	6.814E-13
Sr-87	8.565E-09	8.565E-09	8.565E-09	8.565E-09	8.565E-09	8.565E-09	8.565E-09
Sr-88	8.102E-07	8.102E-07	8.102E-07	8.102E-07	8.102E-07	8.102E-07	8.102E-07
Sr-90	1.718E-11	1.638E-11	1.562E-11	1.489E-11	1.387E-11	1.231E-11	9.118E-22
Y-89	6.168E-08	6.168E-08	6.168E-08	6.168E-08	6.168E-08	6.168E-08	6.168E-08
Y-90	4.308E-15	4.107E-15	3.916E-15	3.734E-15	3.477E-15	3.087E-15	2.286E-25
Zr-90	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01
Zr-91	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01
Zr-92	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01
Zr-93	1.534E-04	1.534E-04	1.534E-04	1.534E-04	1.534E-04	1.534E-04	1.533E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.877E-02	2.877E-02	2.877E-02	2.877E-02	2.877E-02	2.877E-02	2.877E-02
Nb-93	1.587E-10	2.190E-10	2.868E-10	3.616E-10	4.853E-10	7.172E-10	6.839E-08
Nb-93m	4.830E-10	5.617E-10	6.328E-10	6.970E-10	7.818E-10	8.973E-10	1.295E-09
Nb-94	5.696E-14	5.695E-14	5.695E-14	5.695E-14	5.694E-14	5.693E-14	5.506E-14
Mo-95	5.570E-05	5.570E-05	5.570E-05	5.570E-05	5.570E-05	5.570E-05	5.570E-05
Mo-96	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06
Mo-97	8.526E-05	8.526E-05	8.526E-05	8.526E-05	8.526E-05	8.526E-05	8.526E-05
Mo-98	4.976E-07	4.976E-07	4.976E-07	4.976E-07	4.976E-07	4.976E-07	4.976E-07
Mo-100	2.232E-14	2.232E-14	2.232E-14	2.232E-14	2.232E-14	2.232E-14	2.232E-14
Tc-99	7.970E-11	7.970E-11	7.970E-11	7.970E-11	7.970E-11	7.970E-11	7.944E-11
Ru-99	1.987E-15	2.506E-15	3.025E-15	3.544E-15	4.322E-15	5.618E-15	2.594E-13
Ru-100	3.071E-12	3.071E-12	3.071E-12	3.071E-12	3.071E-12	3.071E-12	3.071E-12
Ru-101	8.052E-15	8.052E-15	8.052E-15	8.052E-15	8.052E-15	8.052E-15	8.052E-15
Cd-111	8.911E-12	8.911E-12	8.911E-12	8.911E-12	8.911E-12	8.911E-12	8.911E-12
Cd-112	7.641E-11	7.641E-11	7.641E-11	7.641E-11	7.641E-11	7.641E-11	7.641E-11
Cd-113	3.405E-13	3.405E-13	3.405E-13	3.405E-13	3.405E-13	3.405E-13	3.405E-13
Cd-114	8.252E-09	8.252E-09	8.252E-09	8.252E-09	8.252E-09	8.252E-09	8.252E-09
Cd-116	5.619E-11	5.619E-11	5.619E-11	5.619E-11	5.619E-11	5.619E-11	5.619E-11
In-113	1.635E-06	1.635E-06	1.635E-06	1.635E-06	1.635E-06	1.635E-06	1.635E-06
In-115	2.781E-11	2.781E-11	2.781E-11	2.781E-11	2.781E-11	2.781E-11	2.781E-11
Sn-112	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04	1.397E-04
Sn-113	1.799E-13	2.211E-15	2.717E-17	3.339E-19	4.581E-22	7.670E-27	0.00
Sn-114	9.654E-05	9.654E-05	9.654E-05	9.654E-05	9.654E-05	9.654E-05	9.654E-05
Sn-115	5.121E-05	5.121E-05	5.121E-05	5.121E-05	5.121E-05	5.121E-05	5.121E-05
Sn-116	2.135E-03	2.135E-03	2.135E-03	2.135E-03	2.135E-03	2.135E-03	2.135E-03
Sn-117	1.153E-03	1.153E-03	1.153E-03	1.153E-03	1.153E-03	1.153E-03	1.153E-03
Sn-118	3.612E-03	3.612E-03	3.612E-03	3.612E-03	3.612E-03	3.612E-03	3.612E-03
Sn-119	1.310E-03	1.310E-03	1.310E-03	1.310E-03	1.310E-03	1.310E-03	1.310E-03
Sn-119m	3.222E-09	4.079E-10	5.166E-11	6.541E-12	2.947E-13	1.682E-15	0.00
Sn-120	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03
Sn-121m	2.490E-08	2.422E-08	2.355E-08	2.291E-08	2.198E-08	2.050E-08	2.561E-14
Sn-122	7.082E-04	7.082E-04	7.082E-04	7.082E-04	7.082E-04	7.082E-04	7.082E-04
Sn-123	3.385E-13	6.715E-15	1.332E-16	2.643E-18	7.383E-21	4.093E-25	0.00
Sn-124	8.711E-04	8.711E-04	8.711E-04	8.711E-04	8.711E-04	8.711E-04	8.711E-04

TABLE F.8.a. Cladding Activation Product Inventory by Isotope at 20 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sb-121	4.633E-06	4.633E-06	4.634E-06	4.635E-06	4.636E-06	4.637E-06	4.658E-06
Sb-123	4.926E-07	4.926E-07	4.926E-07	4.926E-07	4.926E-07	4.926E-07	4.926E-07
Sb-125	6.370E-07	3.862E-07	2.341E-07	1.419E-07	6.699E-08	1.917E-08	0.00
Te-122	2.078E-07	2.078E-07	2.078E-07	2.078E-07	2.078E-07	2.078E-07	2.078E-07
Te-123	2.226E-09	2.226E-09	2.226E-09	2.226E-09	2.226E-09	2.226E-09	2.226E-09
Te-124	1.324E-08	1.324E-08	1.324E-08	1.324E-08	1.324E-08	1.324E-08	1.324E-08
Te-125	5.142E-06	5.397E-06	5.551E-06	5.644E-06	5.720E-06	5.769E-06	5.788E-06
Te-125m	8.910E-09	5.403E-09	3.275E-09	1.986E-09	9.370E-10	2.681E-10	0.00
Te-126	3.890E-08	3.890E-08	3.890E-08	3.890E-08	3.890E-08	3.890E-08	3.890E-08
Te-128	1.139E-13	1.139E-13	1.139E-13	1.139E-13	1.139E-13	1.139E-13	1.139E-13
I-127	9.709E-11	9.709E-11	9.709E-11	9.709E-11	9.709E-11	9.709E-11	9.709E-11
Xe-128	1.781E-12	1.781E-12	1.781E-12	1.781E-12	1.781E-12	1.781E-12	1.781E-12
Xe-129	4.027E-15	4.027E-15	4.027E-15	4.027E-15	4.027E-15	4.027E-15	4.027E-15
Yb-172	1.807E-15	1.807E-15	1.807E-15	1.807E-15	1.807E-15	1.807E-15	1.807E-15
Yb-173	1.198E-15	1.198E-15	1.198E-15	1.198E-15	1.198E-15	1.198E-15	1.198E-15
Lu-175	3.628E-08	3.628E-08	3.628E-08	3.628E-08	3.628E-08	3.628E-08	3.628E-08
Lu-176	9.776E-10	9.776E-10	9.776E-10	9.776E-10	9.776E-10	9.776E-10	9.776E-10
Hf-174	4.191E-08	4.191E-08	4.191E-08	4.191E-08	4.191E-08	4.191E-08	4.191E-08
Hf-176	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06	2.016E-06
Hf-177	5.264E-07	5.264E-07	5.264E-07	5.264E-07	5.264E-07	5.264E-07	5.264E-07
Hf-178	1.149E-05	1.149E-05	1.149E-05	1.149E-05	1.149E-05	1.149E-05	1.149E-05
Hf-179	1.747E-05	1.747E-05	1.747E-05	1.747E-05	1.747E-05	1.747E-05	1.747E-05
Hf-180	2.286E-05	2.286E-05	2.286E-05	2.286E-05	2.286E-05	2.286E-05	2.286E-05
Hf-182	1.357E-09	1.357E-09	1.357E-09	1.357E-09	1.357E-09	1.357E-09	1.357E-09
Ta-181	6.310E-07	6.310E-07	6.310E-07	6.310E-07	6.310E-07	6.310E-07	6.310E-07
Ta-182	1.482E-14	2.283E-16	4.968E-17	4.749E-17	4.747E-17	4.747E-17	4.746E-17
W-182	5.275E-08	5.275E-08	5.275E-08	5.275E-08	5.275E-08	5.275E-08	5.275E-08
W-183	4.348E-08	4.348E-08	4.348E-08	4.348E-08	4.348E-08	4.348E-08	4.348E-08
W-184	2.157E-09	2.157E-09	2.157E-09	2.157E-09	2.157E-09	2.157E-09	2.157E-09
W-186	3.124E-14	3.124E-14	3.124E-14	3.124E-14	3.124E-14	3.124E-14	3.124E-14
Re-185	3.754E-12	3.754E-12	3.754E-12	3.754E-12	3.754E-12	3.754E-12	3.754E-12
Re-187	1.206E-15	1.206E-15	1.206E-15	1.206E-15	1.206E-15	1.206E-15	1.206E-15
Os-186	4.671E-13	4.671E-13	4.671E-13	4.671E-13	4.671E-13	4.671E-13	4.671E-13
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.b. Cladding Activation Product Inventory by Isotope at 25 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.204E-05	1.204E-05	1.204E-05	1.204E-05	1.204E-05	1.204E-05	1.204E-05
H-2	2.126E-08	2.126E-08	2.126E-08	2.126E-08	2.126E-08	2.126E-08	2.126E-08
H-3	4.629E-14	4.137E-14	3.698E-14	3.305E-14	2.793E-14	2.110E-14	2.721E-38
He-3	2.000E-14	2.492E-14	2.931E-14	3.324E-14	3.836E-14	4.520E-14	6.629E-14
He-4	7.731E-08	7.731E-08	7.731E-08	7.731E-08	7.731E-08	7.731E-08	7.731E-08
Li-6	1.445E-13	1.445E-13	1.445E-13	1.445E-13	1.445E-13	1.445E-13	1.445E-13
Be-9	8.893E-10	8.893E-10	8.893E-10	8.893E-10	8.893E-10	8.893E-10	8.893E-10
Be-10	2.314E-11	2.314E-11	2.314E-11	2.314E-11	2.314E-11	2.314E-11	2.313E-11
B-11	1.823E-08	1.823E-08	1.823E-08	1.823E-08	1.823E-08	1.823E-08	1.823E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.813E-06	1.813E-06	1.813E-06	1.813E-06	1.813E-06	1.813E-06	1.813E-06
C-14	1.600E-07	1.600E-07	1.599E-07	1.599E-07	1.598E-07	1.597E-07	1.419E-07
N-14	4.165E-05	4.165E-05	4.165E-05	4.165E-05	4.165E-05	4.165E-05	4.166E-05
N-15	1.712E-07	1.712E-07	1.712E-07	1.712E-07	1.712E-07	1.712E-07	1.712E-07
O-16	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03
O-17	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	2.101E-12	2.101E-12	2.101E-12	2.101E-12	2.101E-12	2.101E-12	2.101E-12
Ne-22	1.525E-14	1.525E-14	1.525E-14	1.525E-14	1.525E-14	1.525E-14	1.525E-14
Na-23	1.236E-15	1.236E-15	1.236E-15	1.236E-15	1.236E-15	1.236E-15	1.236E-15
Mg-24	1.495E-10	1.495E-10	1.495E-10	1.495E-10	1.495E-10	1.495E-10	1.495E-10
Mg-25	3.145E-10	3.145E-10	3.145E-10	3.145E-10	3.145E-10	3.145E-10	3.145E-10
Mg-26	1.438E-10	1.438E-10	1.438E-10	1.438E-10	1.438E-10	1.438E-10	1.438E-10
Al-27	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.877E-06	3.877E-06	3.877E-06	3.877E-06	3.877E-06	3.877E-06	3.877E-06
Si-30	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06	2.648E-06
P-31	6.516E-10	6.516E-10	6.516E-10	6.516E-10	6.516E-10	6.516E-10	6.516E-10
S-32	1.175E-13	1.175E-13	1.175E-13	1.175E-13	1.175E-13	1.175E-13	1.176E-13
Ca-44	2.729E-15	2.729E-15	2.729E-15	2.729E-15	2.729E-15	2.729E-15	2.729E-15
Ca-46	1.097E-15	1.097E-15	1.097E-15	1.097E-15	1.097E-15	1.097E-15	1.097E-15
Ti-47	1.626E-10	1.626E-10	1.626E-10	1.626E-10	1.626E-10	1.626E-10	1.626E-10
Ti-48	3.331E-13	3.331E-13	3.331E-13	3.331E-13	3.331E-13	3.331E-13	3.331E-13
Ti-49	4.452E-10	4.452E-10	4.452E-10	4.452E-10	4.452E-10	4.452E-10	4.452E-10
Ti-50	1.800E-09	1.800E-09	1.800E-09	1.800E-09	1.800E-09	1.800E-09	1.800E-09
V-50	6.262E-09	6.262E-09	6.262E-09	6.262E-09	6.262E-09	6.262E-09	6.262E-09
V-51	1.304E-06	1.304E-06	1.304E-06	1.304E-06	1.304E-06	1.304E-06	1.304E-06
Cr-50	4.049E-05	4.049E-05	4.049E-05	4.049E-05	4.049E-05	4.049E-05	4.049E-05
Cr-52	8.311E-04	8.311E-04	8.311E-04	8.311E-04	8.311E-04	8.311E-04	8.311E-04
Cr-53	9.924E-05	9.924E-05	9.924E-05	9.924E-05	9.924E-05	9.924E-05	9.924E-05
Cr-54	2.808E-05	2.808E-05	2.808E-05	2.808E-05	2.808E-05	2.808E-05	2.808E-05
Mn-54	7.064E-11	1.398E-11	2.765E-12	5.470E-13	4.813E-14	8.379E-16	0.00
Mn-55	4.770E-07	4.972E-07	5.091E-07	5.161E-07	5.215E-07	5.248E-07	5.260E-07
Fe-54	1.117E-04	1.117E-04	1.117E-04	1.117E-04	1.117E-04	1.117E-04	1.117E-04
Fe-55	4.900E-08	2.875E-08	1.687E-08	9.897E-09	4.448E-09	1.173E-09	0.00
Fe-56	1.828E-03	1.828E-03	1.828E-03	1.828E-03	1.828E-03	1.828E-03	1.828E-03
Fe-57	5.418E-05	5.418E-05	5.418E-05	5.418E-05	5.418E-05	5.418E-05	5.418E-05

TABLE F.8.b. Cladding Activation Product Inventory by Isotope at 25 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-58	6.246E-06	6.246E-06	6.246E-06	6.246E-06	6.246E-06	6.246E-06	6.246E-06
Co-59	1.537E-08	1.537E-08	1.537E-08	1.537E-08	1.537E-08	1.537E-08	1.537E-08
Co-60	2.642E-10	2.031E-10	1.561E-10	1.200E-10	8.086E-11	4.189E-11	0.00
Ni-60	4.913E-10	5.524E-10	5.994E-10	6.355E-10	6.746E-10	7.136E-10	7.555E-10
Ni-61	1.392E-12	1.392E-12	1.392E-12	1.392E-12	1.392E-12	1.392E-12	1.392E-12
Ni-62	1.732E-15	1.732E-15	1.732E-15	1.732E-15	1.732E-15	1.732E-15	1.732E-15
Sr-87	1.077E-08	1.077E-08	1.077E-08	1.077E-08	1.077E-08	1.077E-08	1.077E-08
Sr-88	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06	1.029E-06
Sr-90	2.767E-11	2.639E-11	2.516E-11	2.399E-11	2.234E-11	1.983E-11	1.469E-21
Y-89	7.834E-08	7.834E-08	7.834E-08	7.834E-08	7.834E-08	7.834E-08	7.834E-08
Y-90	6.939E-15	6.617E-15	6.309E-15	6.016E-15	5.601E-15	4.973E-15	3.683E-25
Zr-90	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01	4.974E-01
Zr-91	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01	1.091E-01
Zr-92	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01	1.693E-01
Zr-93	1.944E-04	1.944E-04	1.944E-04	1.944E-04	1.944E-04	1.944E-04	1.943E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.875E-02	2.875E-02	2.875E-02	2.875E-02	2.875E-02	2.875E-02	2.875E-02
Nb-93	2.003E-10	2.765E-10	3.625E-10	4.571E-10	6.137E-10	9.075E-10	8.668E-08
Nb-93m	6.110E-10	7.108E-10	8.010E-10	8.825E-10	9.901E-10	1.137E-09	1.641E-09
Nb-94	9.150E-14	9.149E-14	9.149E-14	9.148E-14	9.147E-14	9.146E-14	8.845E-14
Mo-95	7.015E-05	7.015E-05	7.015E-05	7.015E-05	7.015E-05	7.015E-05	7.015E-05
Mo-96	2.791E-06	2.791E-06	2.791E-06	2.791E-06	2.791E-06	2.791E-06	2.791E-06
Mo-97	1.081E-04	1.081E-04	1.081E-04	1.081E-04	1.081E-04	1.081E-04	1.081E-04
Mo-98	8.013E-07	8.013E-07	8.013E-07	8.013E-07	8.013E-07	8.013E-07	8.013E-07
Mo-100	5.852E-14	5.852E-14	5.852E-14	5.852E-14	5.852E-14	5.852E-14	5.852E-14
Tc-99	1.614E-10	1.614E-10	1.614E-10	1.614E-10	1.614E-10	1.614E-10	1.609E-10
Ru-99	4.011E-15	5.062E-15	6.113E-15	7.163E-15	8.739E-15	1.137E-14	5.253E-13
Ru-100	7.910E-12	7.910E-12	7.910E-12	7.910E-12	7.910E-12	7.910E-12	7.910E-12
Ru-101	2.633E-14	2.633E-14	2.633E-14	2.633E-14	2.633E-14	2.633E-14	2.633E-14
Cd-111	1.123E-11	1.123E-11	1.123E-11	1.123E-11	1.123E-11	1.123E-11	1.123E-11
Cd-112	9.596E-11	9.596E-11	9.596E-11	9.596E-11	9.596E-11	9.596E-11	9.596E-11
Cd-113	3.428E-13	3.428E-13	3.428E-13	3.428E-13	3.428E-13	3.428E-13	3.428E-13
Cd-114	1.297E-08	1.297E-08	1.297E-08	1.297E-08	1.297E-08	1.297E-08	1.297E-08
Cd-116	7.146E-11	7.146E-11	7.146E-11	7.146E-11	7.146E-11	7.146E-11	7.146E-11
In-113	2.024E-06	2.024E-06	2.024E-06	2.024E-06	2.024E-06	2.024E-06	2.024E-06
In-115	2.934E-11	2.934E-11	2.934E-11	2.934E-11	2.934E-11	2.934E-11	2.934E-11
Sn-112	1.392E-04	1.392E-04	1.392E-04	1.392E-04	1.392E-04	1.392E-04	1.392E-04
Sn-113	2.309E-13	2.837E-15	3.487E-17	4.285E-19	5.878E-22	9.841E-27	0.00
Sn-114	9.661E-05	9.661E-05	9.661E-05	9.661E-05	9.661E-05	9.661E-05	9.661E-05
Sn-115	5.019E-05	5.019E-05	5.019E-05	5.019E-05	5.019E-05	5.019E-05	5.019E-05
Sn-116	2.131E-03	2.131E-03	2.131E-03	2.131E-03	2.131E-03	2.131E-03	2.131E-03
Sn-117	1.155E-03	1.155E-03	1.155E-03	1.155E-03	1.155E-03	1.155E-03	1.155E-03
Sn-118	3.609E-03	3.609E-03	3.609E-03	3.609E-03	3.609E-03	3.609E-03	3.609E-03
Sn-119	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03	1.315E-03
Sn-119m	4.149E-09	5.254E-10	6.653E-11	8.425E-12	3.796E-13	2.166E-15	0.00
Sn-120	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03	4.912E-03
Sn-121m	3.163E-08	3.077E-08	2.993E-08	2.911E-08	2.792E-08	2.605E-08	3.253E-14

TABLE F.8.b. Cladding Activation Product Inventory by Isotope at 25 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-122	7.081E-04	7.081E-04	7.081E-04	7.081E-04	7.081E-04	7.081E-04	7.081E-04
Sn-123	4.359E-13	8.648E-15	1.716E-16	3.404E-18	9.524E-21	5.280E-25	0.00
Sn-124	8.696E-04	8.696E-04	8.696E-04	8.696E-04	8.696E-04	8.696E-04	8.696E-04
Sb-121	5.813E-06	5.814E-06	5.815E-06	5.816E-06	5.817E-06	5.819E-06	5.845E-06
Sb-123	6.216E-07	6.216E-07	6.216E-07	6.216E-07	6.216E-07	6.216E-07	6.216E-07
Sb-125	8.121E-07	4.923E-07	2.985E-07	1.809E-07	8.540E-08	2.444E-08	0.00
Te-122	3.309E-07	3.309E-07	3.309E-07	3.309E-07	3.309E-07	3.309E-07	3.309E-07
Te-123	4.035E-09	4.035E-09	4.035E-09	4.035E-09	4.035E-09	4.035E-09	4.035E-09
Te-123m	1.332E-15	1.937E-17	2.816E-19	4.088E-21	1.160E-23	2.956E-28	0.00
Te-124	2.243E-08	2.243E-08	2.243E-08	2.243E-08	2.243E-08	2.243E-08	2.243E-08
Te-125	6.508E-06	6.832E-06	7.029E-06	7.148E-06	7.245E-06	7.307E-06	7.331E-06
Te-125m	1.136E-08	6.888E-09	4.176E-09	2.531E-09	1.195E-09	3.418E-10	0.00
Te-126	6.258E-08	6.258E-08	6.258E-08	6.258E-08	6.258E-08	6.258E-08	6.258E-08
Te-128	2.947E-13	2.947E-13	2.947E-13	2.947E-13	2.947E-13	2.947E-13	2.947E-13
I-127	1.976E-10	1.976E-10	1.976E-10	1.976E-10	1.976E-10	1.976E-10	1.976E-10
Xe-128	4.607E-12	4.607E-12	4.607E-12	4.607E-12	4.607E-12	4.607E-12	4.607E-12
Xe-129	1.317E-14	1.317E-14	1.317E-14	1.317E-14	1.317E-14	1.317E-14	1.317E-14
Yb-172	2.662E-15	2.662E-15	2.662E-15	2.662E-15	2.662E-15	2.662E-15	2.662E-15
Yb-173	1.960E-15	1.960E-15	1.960E-15	1.960E-15	1.960E-15	1.960E-15	1.960E-15
Lu-175	3.996E-08	3.996E-08	3.996E-08	3.996E-08	3.996E-08	3.996E-08	3.996E-08
Lu-176	1.186E-09	1.186E-09	1.186E-09	1.186E-09	1.186E-09	1.186E-09	1.186E-09
Hf-174	3.454E-08	3.454E-08	3.454E-08	3.454E-08	3.454E-08	3.454E-08	3.454E-08
Hf-176	1.842E-06	1.842E-06	1.842E-06	1.842E-06	1.842E-06	1.842E-06	1.842E-06
Hf-177	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07	3.212E-07
Hf-178	9.314E-06	9.314E-06	9.314E-06	9.314E-06	9.314E-06	9.314E-06	9.314E-06
Hf-179	1.855E-05	1.855E-05	1.855E-05	1.855E-05	1.855E-05	1.855E-05	1.855E-05
Hf-180	2.414E-05	2.414E-05	2.414E-05	2.414E-05	2.414E-05	2.414E-05	2.414E-05
Hf-182	2.224E-09	2.224E-09	2.224E-09	2.224E-09	2.224E-09	2.224E-09	2.224E-09
Ta-181	7.935E-07	7.935E-07	7.935E-07	7.935E-07	7.935E-07	7.935E-07	7.935E-07
Ta-182	2.113E-14	3.354E-16	8.096E-17	7.785E-17	7.781E-17	7.781E-17	7.780E-17
W-182	7.404E-08	7.404E-08	7.404E-08	7.404E-08	7.404E-08	7.404E-08	7.404E-08
W-183	7.874E-08	7.874E-08	7.874E-08	7.874E-08	7.874E-08	7.874E-08	7.874E-08
W-184	4.966E-09	4.966E-09	4.966E-09	4.966E-09	4.966E-09	4.966E-09	4.966E-09
W-186	1.116E-13	1.116E-13	1.116E-13	1.116E-13	1.116E-13	1.116E-13	1.116E-13
Re-185	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11	1.067E-11
Re-187	5.485E-15	5.485E-15	5.485E-15	5.485E-15	5.485E-15	5.485E-15	5.485E-15
Os-186	1.686E-12	1.686E-12	1.686E-12	1.686E-12	1.686E-12	1.686E-12	1.686E-12
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.c. Cladding Activation Product Inventory by Isotope at 30 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.205E-05	1.205E-05	1.205E-05	1.205E-05	1.205E-05	1.205E-05	1.205E-05
H-2	2.520E-08	2.520E-08	2.520E-08	2.520E-08	2.520E-08	2.520E-08	2.520E-08
H-3	7.513E-14	6.716E-14	6.002E-14	5.365E-14	4.534E-14	3.424E-14	4.417E-38
He-3	3.198E-14	3.996E-14	4.709E-14	5.347E-14	6.178E-14	7.287E-14	1.071E-13
He-4	9.449E-08	9.449E-08	9.449E-08	9.449E-08	9.449E-08	9.449E-08	9.449E-08
Li-6	1.966E-13	1.966E-13	1.966E-13	1.966E-13	1.966E-13	1.966E-13	1.966E-13
Be-9	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09	1.087E-09
Be-10	2.839E-11	2.839E-11	2.839E-11	2.839E-11	2.839E-11	2.839E-11	2.838E-11
B-11	2.228E-08	2.228E-08	2.228E-08	2.228E-08	2.228E-08	2.228E-08	2.228E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.826E-06	1.826E-06	1.826E-06	1.826E-06	1.826E-06	1.826E-06	1.826E-06
C-14	1.955E-07	1.955E-07	1.954E-07	1.954E-07	1.953E-07	1.952E-07	1.733E-07
N-14	4.160E-05	4.160E-05	4.160E-05	4.160E-05	4.160E-05	4.160E-05	4.163E-05
N-15	1.727E-07	1.727E-07	1.727E-07	1.727E-07	1.727E-07	1.727E-07	1.727E-07
O-16	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03
O-17	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07	5.040E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	2.569E-12	2.569E-12	2.569E-12	2.569E-12	2.569E-12	2.569E-12	2.569E-12
Ne-22	2.279E-14	2.279E-14	2.279E-14	2.279E-14	2.279E-14	2.279E-14	2.279E-14
Na-23	1.847E-15	1.847E-15	1.847E-15	1.847E-15	1.847E-15	1.847E-15	1.847E-15
Mg-24	1.827E-10	1.827E-10	1.827E-10	1.827E-10	1.827E-10	1.827E-10	1.827E-10
Mg-25	3.844E-10	3.844E-10	3.844E-10	3.844E-10	3.844E-10	3.844E-10	3.844E-10
Mg-26	1.760E-10	1.760E-10	1.760E-10	1.760E-10	1.760E-10	1.760E-10	1.760E-10
Al-27	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05	3.998E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.883E-06	3.883E-06	3.883E-06	3.883E-06	3.883E-06	3.883E-06	3.883E-06
Si-30	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06
P-31	7.965E-10	7.965E-10	7.965E-10	7.965E-10	7.965E-10	7.965E-10	7.965E-10
S-32	1.756E-13	1.756E-13	1.756E-13	1.756E-13	1.756E-13	1.756E-13	1.757E-13
Ca-44	4.067E-15	4.067E-15	4.067E-15	4.067E-15	4.067E-15	4.067E-15	4.067E-15
Ca-46	1.638E-15	1.638E-15	1.638E-15	1.638E-15	1.638E-15	1.638E-15	1.638E-15
Ti-47	1.980E-10	1.980E-10	1.980E-10	1.980E-10	1.980E-10	1.980E-10	1.980E-10
Ti-48	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13
Ti-49	5.435E-10	5.435E-10	5.435E-10	5.435E-10	5.435E-10	5.435E-10	5.435E-10
Ti-50	2.206E-09	2.206E-09	2.206E-09	2.206E-09	2.206E-09	2.206E-09	2.206E-09
V-50	7.500E-09	7.500E-09	7.500E-09	7.500E-09	7.500E-09	7.500E-09	7.500E-09
V-51	1.587E-06	1.587E-06	1.587E-06	1.587E-06	1.587E-06	1.587E-06	1.587E-06
Cr-50	4.021E-05	4.021E-05	4.021E-05	4.021E-05	4.021E-05	4.021E-05	4.021E-05
Cr-52	8.298E-04	8.298E-04	8.298E-04	8.298E-04	8.298E-04	8.298E-04	8.298E-04
Cr-53	9.979E-05	9.979E-05	9.979E-05	9.979E-05	9.979E-05	9.979E-05	9.979E-05
Cr-54	2.889E-05	2.889E-05	2.889E-05	2.889E-05	2.889E-05	2.889E-05	2.889E-05
Mn-54	8.784E-11	1.738E-11	3.438E-12	6.802E-13	5.985E-14	1.042E-15	0.00
Mn-55	5.818E-07	6.067E-07	6.213E-07	6.299E-07	6.366E-07	6.406E-07	6.421E-07
Fe-54	1.116E-04	1.116E-04	1.116E-04	1.116E-04	1.116E-04	1.116E-04	1.116E-04
Fe-55	6.030E-08	3.538E-08	2.076E-08	1.218E-08	5.474E-09	1.443E-09	0.00
Fe-56	1.825E-03	1.825E-03	1.825E-03	1.825E-03	1.825E-03	1.825E-03	1.825E-03
Fe-57	5.647E-05	5.647E-05	5.647E-05	5.647E-05	5.647E-05	5.647E-05	5.647E-05

TABLE F.8.c. Cladding Activation Product Inventory by Isotope at 30 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-58	6.304E-06	6.304E-06	6.304E-06	6.304E-06	6.304E-06	6.304E-06	6.304E-06
Co-59	1.867E-08	1.867E-08	1.867E-08	1.867E-08	1.867E-08	1.867E-08	1.867E-08
Co-60	3.942E-10	3.030E-10	2.329E-10	1.791E-10	1.207E-10	6.252E-11	0.00
Ni-60	7.295E-10	8.207E-10	8.908E-10	9.447E-10	1.003E-09	1.061E-09	1.124E-09
Ni-61	2.537E-12	2.537E-12	2.537E-12	2.537E-12	2.537E-12	2.537E-12	2.537E-12
Ni-62	3.859E-15	3.859E-15	3.859E-15	3.859E-15	3.859E-15	3.859E-15	3.859E-15
Sr-87	1.304E-08	1.304E-08	1.304E-08	1.304E-08	1.304E-08	1.304E-08	1.304E-08
Sr-88	1.257E-06	1.257E-06	1.257E-06	1.257E-06	1.257E-06	1.257E-06	1.257E-06
Sr-90	4.130E-11	3.938E-11	3.755E-11	3.581E-11	3.334E-11	2.960E-11	2.192E-21
Y-89	9.576E-08	9.576E-08	9.576E-08	9.576E-08	9.576E-08	9.576E-08	9.576E-08
Y-90	1.036E-14	9.876E-15	9.417E-15	8.980E-15	8.361E-15	7.423E-15	5.498E-25
Zr-90	4.973E-01	4.973E-01	4.973E-01	4.973E-01	4.973E-01	4.973E-01	4.973E-01
Zr-91	1.090E-01	1.090E-01	1.090E-01	1.090E-01	1.090E-01	1.090E-01	1.090E-01
Zr-92	1.694E-01	1.694E-01	1.694E-01	1.694E-01	1.694E-01	1.694E-01	1.694E-01
Zr-93	2.371E-04	2.371E-04	2.371E-04	2.371E-04	2.371E-04	2.371E-04	2.370E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.873E-02	2.873E-02	2.873E-02	2.873E-02	2.873E-02	2.873E-02	2.873E-02
Nb-93	2.432E-10	3.360E-10	4.407E-10	5.561E-10	7.469E-10	1.105E-09	1.057E-07
Nb-93m	7.436E-10	8.656E-10	9.758E-10	1.075E-09	1.207E-09	1.386E-09	2.001E-09
Nb-94	1.364E-13	1.364E-13	1.364E-13	1.364E-13	1.363E-13	1.363E-13	1.318E-13
Mo-95	8.502E-05	8.502E-05	8.502E-05	8.502E-05	8.502E-05	8.502E-05	8.502E-05
Mo-96	4.145E-06	4.145E-06	4.145E-06	4.145E-06	4.145E-06	4.145E-06	4.145E-06
Mo-97	1.318E-04	1.318E-04	1.318E-04	1.318E-04	1.318E-04	1.318E-04	1.318E-04
Mo-98	1.195E-06	1.195E-06	1.195E-06	1.195E-06	1.195E-06	1.195E-06	1.195E-06
Mo-100	1.322E-13	1.322E-13	1.322E-13	1.322E-13	1.322E-13	1.322E-13	1.322E-13
Tc-98	1.154E-15	1.154E-15	1.154E-15	1.154E-15	1.154E-15	1.154E-15	1.154E-15
Tc-99	2.915E-10	2.915E-10	2.915E-10	2.915E-10	2.915E-10	2.914E-10	2.905E-10
Ru-99	7.212E-15	9.109E-15	1.101E-14	1.290E-14	1.575E-14	2.049E-14	9.484E-13
Ru-100	1.748E-11	1.748E-11	1.748E-11	1.748E-11	1.748E-11	1.748E-11	1.748E-11
Ru-101	7.109E-14	7.109E-14	7.109E-14	7.109E-14	7.109E-14	7.109E-14	7.109E-14
Cd-111	1.362E-11	1.362E-11	1.362E-11	1.362E-11	1.362E-11	1.362E-11	1.362E-11
Cd-112	1.159E-10	1.159E-10	1.159E-10	1.159E-10	1.159E-10	1.159E-10	1.159E-10
Cd-113	3.452E-13	3.452E-13	3.452E-13	3.452E-13	3.452E-13	3.452E-13	3.452E-13
Cd-114	1.891E-08	1.891E-08	1.891E-08	1.891E-08	1.891E-08	1.891E-08	1.891E-08
Cd-116	8.747E-11	8.747E-11	8.747E-11	8.747E-11	8.747E-11	8.747E-11	8.747E-11
In-113	2.410E-06	2.410E-06	2.410E-06	2.410E-06	2.410E-06	2.410E-06	2.410E-06
In-115	3.085E-11	3.085E-11	3.085E-11	3.085E-11	3.085E-11	3.085E-11	3.085E-11
Sn-112	1.387E-04	1.387E-04	1.387E-04	1.387E-04	1.387E-04	1.387E-04	1.387E-04
Sn-113	2.896E-13	3.559E-15	4.374E-17	5.376E-19	7.390E-22	1.237E-26	0.00
Sn-114	9.670E-05	9.670E-05	9.670E-05	9.670E-05	9.670E-05	9.670E-05	9.670E-05
Sn-115	4.914E-05	4.914E-05	4.914E-05	4.914E-05	4.914E-05	4.914E-05	4.914E-05
Sn-116	2.125E-03	2.125E-03	2.125E-03	2.125E-03	2.125E-03	2.125E-03	2.125E-03
Sn-117	1.157E-03	1.157E-03	1.157E-03	1.157E-03	1.157E-03	1.157E-03	1.157E-03
Sn-118	3.606E-03	3.606E-03	3.606E-03	3.606E-03	3.606E-03	3.606E-03	3.606E-03
Sn-119	1.320E-03	1.320E-03	1.320E-03	1.320E-03	1.320E-03	1.320E-03	1.320E-03
Sn-119m	5.181E-09	6.560E-10	8.307E-11	1.052E-11	4.740E-13	2.704E-15	0.00
Sn-120	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03

TABLE F.8.c. Cladding Activation Product Inventory by Isotope at 30 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-121m	3.868E-08	3.763E-08	3.660E-08	3.560E-08	3.414E-08	3.186E-08	3.978E-14
Sn-122	7.079E-04	7.079E-04	7.079E-04	7.079E-04	7.079E-04	7.079E-04	7.079E-04
Sn-123	5.479E-13	1.087E-14	2.157E-16	4.279E-18	1.198E-20	6.639E-25	0.00
Sn-124	8.679E-04	8.679E-04	8.679E-04	8.679E-04	8.679E-04	8.679E-04	8.679E-04
Sb-121	7.017E-06	7.018E-06	7.019E-06	7.020E-06	7.022E-06	7.024E-06	7.056E-06
Sb-123	7.548E-07	7.548E-07	7.548E-07	7.548E-07	7.548E-07	7.548E-07	7.548E-07
Sb-125	9.972E-07	6.045E-07	3.665E-07	2.222E-07	1.049E-07	3.001E-08	0.00
Te-122	4.877E-07	4.877E-07	4.877E-07	4.877E-07	4.877E-07	4.877E-07	4.877E-07
Te-123	6.564E-09	6.564E-09	6.564E-09	6.564E-09	6.564E-09	6.564E-09	6.564E-09
Te-123m	2.466E-15	3.585E-17	5.213E-19	7.581E-21	2.151E-23	5.481E-28	0.00
Te-124	3.529E-08	3.529E-08	3.529E-08	3.529E-08	3.529E-08	3.529E-08	3.529E-08
Te-125	7.926E-06	8.324E-06	8.565E-06	8.712E-06	8.831E-06	8.906E-06	8.937E-06
Te-125m	1.395E-08	8.458E-09	5.127E-09	3.108E-09	1.467E-09	4.197E-10	0.00
Te-126	9.328E-08	9.328E-08	9.328E-08	9.328E-08	9.328E-08	9.328E-08	9.328E-08
Te-128	6.545E-13	6.545E-13	6.545E-13	6.545E-13	6.545E-13	6.545E-13	6.545E-13
I-127	3.583E-10	3.583E-10	3.583E-10	3.583E-10	3.583E-10	3.583E-10	3.583E-10
Xe-128	1.022E-11	1.022E-11	1.022E-11	1.022E-11	1.022E-11	1.022E-11	1.022E-11
Xe-129	3.555E-14	3.555E-14	3.555E-14	3.555E-14	3.555E-14	3.555E-14	3.555E-14
Xe-130	1.291E-15	1.291E-15	1.291E-15	1.291E-15	1.291E-15	1.291E-15	1.291E-15
Yb-172	3.625E-15	3.625E-15	3.625E-15	3.625E-15	3.625E-15	3.625E-15	3.625E-15
Yb-173	2.864E-15	2.864E-15	2.864E-15	2.864E-15	2.864E-15	2.864E-15	2.864E-15
Lu-175	4.213E-08	4.213E-08	4.213E-08	4.213E-08	4.213E-08	4.213E-08	4.213E-08
Lu-176	1.336E-09	1.336E-09	1.336E-09	1.336E-09	1.336E-09	1.336E-09	1.336E-09
Hf-174	2.822E-08	2.822E-08	2.822E-08	2.822E-08	2.822E-08	2.822E-08	2.822E-08
Hf-176	1.678E-06	1.678E-06	1.678E-06	1.678E-06	1.678E-06	1.678E-06	1.678E-06
Hf-177	2.283E-07	2.283E-07	2.283E-07	2.283E-07	2.283E-07	2.283E-07	2.283E-07
Hf-178	7.424E-06	7.424E-06	7.424E-06	7.424E-06	7.424E-06	7.424E-06	7.424E-06
Hf-179	1.909E-05	1.909E-05	1.909E-05	1.909E-05	1.909E-05	1.909E-05	1.909E-05
Hf-180	2.554E-05	2.554E-05	2.554E-05	2.554E-05	2.554E-05	2.554E-05	2.554E-05
Hf-182	3.392E-09	3.392E-09	3.392E-09	3.392E-09	3.392E-09	3.392E-09	3.391E-09
Ta-181	9.628E-07	9.628E-07	9.628E-07	9.628E-07	9.628E-07	9.628E-07	9.628E-07
Ta-182	2.833E-14	4.640E-16	1.229E-16	1.187E-16	1.187E-16	1.187E-16	1.186E-16
W-182	9.675E-08	9.675E-08	9.675E-08	9.675E-08	9.675E-08	9.675E-08	9.675E-08
W-183	1.279E-07	1.279E-07	1.279E-07	1.279E-07	1.279E-07	1.279E-07	1.279E-07
W-184	9.872E-09	9.872E-09	9.872E-09	9.872E-09	9.872E-09	9.872E-09	9.872E-09
W-186	3.180E-13	3.180E-13	3.180E-13	3.180E-13	3.180E-13	3.180E-13	3.180E-13
Re-185	2.522E-11	2.522E-11	2.522E-11	2.522E-11	2.522E-11	2.522E-11	2.522E-11
Re-187	1.919E-14	1.919E-14	1.919E-14	1.919E-14	1.919E-14	1.919E-14	1.919E-14
Os-186	4.862E-12	4.862E-12	4.862E-12	4.862E-12	4.862E-12	4.862E-12	4.862E-12
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.d. Cladding Activation Product Inventory by Isotope at 35 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.206E-05	1.206E-05	1.206E-05	1.206E-05	1.206E-05	1.206E-05	1.206E-05
H-2	2.931E-08	2.931E-08	2.931E-08	2.931E-08	2.931E-08	2.931E-08	2.931E-08
H-3	1.141E-13	1.020E-13	9.117E-14	8.149E-14	6.886E-14	5.201E-14	6.702E-38
He-3	4.807E-14	6.019E-14	7.102E-14	8.070E-14	9.333E-14	1.102E-13	1.622E-13
He-4	1.124E-07	1.124E-07	1.124E-07	1.124E-07	1.124E-07	1.124E-07	1.124E-07
Li-6	2.539E-13	2.539E-13	2.539E-13	2.539E-13	2.539E-13	2.539E-13	2.539E-13
Be-9	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09	1.293E-09
Be-10	3.391E-11	3.391E-11	3.391E-11	3.391E-11	3.391E-11	3.391E-11	3.390E-11
B-11	2.649E-08	2.649E-08	2.649E-08	2.649E-08	2.649E-08	2.649E-08	2.649E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.840E-06	1.840E-06	1.840E-06	1.840E-06	1.840E-06	1.840E-06	1.840E-06
C-14	2.325E-07	2.324E-07	2.324E-07	2.323E-07	2.322E-07	2.321E-07	2.062E-07
N-14	4.156E-05	4.156E-05	4.156E-05	4.156E-05	4.156E-05	4.156E-05	4.159E-05
N-15	1.742E-07	1.742E-07	1.742E-07	1.742E-07	1.742E-07	1.742E-07	1.742E-07
O-16	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03
O-17	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	3.056E-12	3.056E-12	3.056E-12	3.056E-12	3.056E-12	3.056E-12	3.056E-12
Ne-21	1.343E-15	1.343E-15	1.343E-15	1.343E-15	1.343E-15	1.343E-15	1.343E-15
Ne-22	3.226E-14	3.226E-14	3.226E-14	3.226E-14	3.226E-14	3.226E-14	3.226E-14
Na-23	2.617E-15	2.617E-15	2.617E-15	2.617E-15	2.617E-15	2.617E-15	2.617E-15
Mg-24	2.174E-10	2.174E-10	2.174E-10	2.174E-10	2.174E-10	2.174E-10	2.174E-10
Mg-25	4.574E-10	4.574E-10	4.574E-10	4.574E-10	4.574E-10	4.574E-10	4.574E-10
Mg-26	2.095E-10	2.095E-10	2.095E-10	2.095E-10	2.095E-10	2.095E-10	2.095E-10
Al-27	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.888E-06	3.888E-06	3.888E-06	3.888E-06	3.888E-06	3.888E-06	3.888E-06
Si-30	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06
P-31	9.477E-10	9.477E-10	9.477E-10	9.477E-10	9.477E-10	9.477E-10	9.477E-10
S-32	2.486E-13	2.486E-13	2.486E-13	2.486E-13	2.486E-13	2.486E-13	2.487E-13
Ca-44	5.741E-15	5.741E-15	5.741E-15	5.741E-15	5.741E-15	5.741E-15	5.741E-15
Ca-46	2.316E-15	2.316E-15	2.316E-15	2.316E-15	2.316E-15	2.316E-15	2.316E-15
Ti-47	2.347E-10	2.347E-10	2.347E-10	2.347E-10	2.347E-10	2.347E-10	2.347E-10
Ti-48	6.994E-13	6.994E-13	6.994E-13	6.994E-13	6.994E-13	6.994E-13	6.994E-13
Ti-49	6.459E-10	6.459E-10	6.459E-10	6.459E-10	6.459E-10	6.459E-10	6.459E-10
Ti-50	2.633E-09	2.633E-09	2.633E-09	2.633E-09	2.633E-09	2.633E-09	2.633E-09
V-50	8.737E-09	8.737E-09	8.737E-09	8.737E-09	8.737E-09	8.737E-09	8.737E-09
V-51	1.879E-06	1.879E-06	1.879E-06	1.879E-06	1.879E-06	1.879E-06	1.879E-06
Cr-50	3.992E-05	3.992E-05	3.992E-05	3.992E-05	3.992E-05	3.992E-05	3.992E-05
Cr-52	8.284E-04	8.284E-04	8.284E-04	8.284E-04	8.284E-04	8.284E-04	8.284E-04
Cr-53	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04
Cr-54	2.975E-05	2.975E-05	2.975E-05	2.975E-05	2.975E-05	2.975E-05	2.975E-05
Mn-54	1.060E-10	2.097E-11	4.148E-12	8.207E-13	7.221E-14	1.257E-15	0.00
Mn-55	6.907E-07	7.206E-07	7.381E-07	7.484E-07	7.564E-07	7.612E-07	7.629E-07
Fe-54	1.114E-04	1.114E-04	1.114E-04	1.114E-04	1.114E-04	1.114E-04	1.114E-04
Fe-55	7.219E-08	4.236E-08	2.485E-08	1.458E-08	6.553E-09	1.728E-09	0.00
Fe-56	1.823E-03	1.823E-03	1.823E-03	1.823E-03	1.823E-03	1.823E-03	1.823E-03

TABLE F.8.d. Cladding Activation Product Inventory by Isotope at 35 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-57	5.885E-05	5.885E-05	5.885E-05	5.885E-05	5.885E-05	5.885E-05	5.885E-05
Fe-58	6.367E-06	6.367E-06	6.367E-06	6.367E-06	6.367E-06	6.367E-06	6.367E-06
Co-59	2.208E-08	2.208E-08	2.208E-08	2.208E-08	2.208E-08	2.208E-08	2.208E-08
Co-60	5.572E-10	4.283E-10	3.292E-10	2.531E-10	1.706E-10	8.836E-11	0.00
Ni-60	1.026E-09	1.155E-09	1.254E-09	1.330E-09	1.413E-09	1.495E-09	1.584E-09
Ni-61	4.262E-12	4.262E-12	4.262E-12	4.262E-12	4.262E-12	4.262E-12	4.262E-12
Ni-62	7.717E-15	7.717E-15	7.717E-15	7.717E-15	7.717E-15	7.717E-15	7.717E-15
Sr-87	1.535E-08	1.535E-08	1.535E-08	1.535E-08	1.535E-08	1.535E-08	1.535E-08
Sr-88	1.495E-06	1.495E-06	1.495E-06	1.495E-06	1.495E-06	1.495E-06	1.495E-06
Sr-90	5.841E-11	5.569E-11	5.310E-11	5.064E-11	4.715E-11	4.186E-11	3.100E-21
Y-89	1.139E-07	1.139E-07	1.139E-07	1.139E-07	1.139E-07	1.139E-07	1.139E-07
Y-90	1.465E-14	1.397E-14	1.332E-14	1.270E-14	1.182E-14	1.050E-14	7.775E-25
Zr-90	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01
Zr-91	1.089E-01	1.089E-01	1.089E-01	1.089E-01	1.089E-01	1.089E-01	1.089E-01
Zr-92	1.696E-01	1.696E-01	1.696E-01	1.696E-01	1.696E-01	1.696E-01	1.696E-01
Zr-93	2.815E-04	2.815E-04	2.815E-04	2.815E-04	2.815E-04	2.815E-04	2.814E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.870E-02	2.870E-02	2.870E-02	2.870E-02	2.870E-02	2.870E-02	2.870E-02
Nb-93	2.875E-10	3.975E-10	5.217E-10	6.585E-10	8.848E-10	1.310E-09	1.255E-07
Nb-93m	8.811E-10	1.026E-09	1.157E-09	1.275E-09	1.431E-09	1.644E-09	2.376E-09
Nb-94	1.923E-13	1.923E-13	1.923E-13	1.922E-13	1.922E-13	1.922E-13	1.859E-13
Mo-95	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04	1.003E-04
Mo-96	5.828E-06	5.828E-06	5.828E-06	5.828E-06	5.828E-06	5.828E-06	5.828E-06
Mo-97	1.566E-04	1.566E-04	1.566E-04	1.566E-04	1.566E-04	1.566E-04	1.566E-04
Mo-98	1.689E-06	1.689E-06	1.689E-06	1.689E-06	1.689E-06	1.689E-06	1.689E-06
Mo-100	2.675E-13	2.675E-13	2.675E-13	2.675E-13	2.675E-13	2.675E-13	2.675E-13
Tc-98	2.291E-15	2.291E-15	2.291E-15	2.291E-15	2.291E-15	2.291E-15	2.291E-15
Tc-99	4.851E-10	4.851E-10	4.851E-10	4.851E-10	4.851E-10	4.851E-10	4.835E-10
Ru-99	1.196E-14	1.512E-14	1.827E-14	2.143E-14	2.617E-14	3.406E-14	1.579E-12
Ru-100	3.467E-11	3.467E-11	3.467E-11	3.467E-11	3.467E-11	3.467E-11	3.467E-11
Ru-101	1.677E-13	1.677E-13	1.677E-13	1.677E-13	1.677E-13	1.677E-13	1.677E-13
Ru-102	2.585E-15	2.585E-15	2.585E-15	2.585E-15	2.585E-15	2.585E-15	2.585E-15
Cd-111	1.607E-11	1.607E-11	1.607E-11	1.607E-11	1.607E-11	1.607E-11	1.607E-11
Cd-112	1.363E-10	1.363E-10	1.363E-10	1.363E-10	1.363E-10	1.363E-10	1.363E-10
Cd-113	3.479E-13	3.479E-13	3.479E-13	3.479E-13	3.479E-13	3.479E-13	3.479E-13
Cd-114	2.614E-08	2.614E-08	2.614E-08	2.614E-08	2.614E-08	2.614E-08	2.614E-08
Cd-116	1.042E-10	1.042E-10	1.042E-10	1.042E-10	1.042E-10	1.042E-10	1.042E-10
In-113	2.790E-06	2.790E-06	2.790E-06	2.790E-06	2.790E-06	2.790E-06	2.790E-06
In-115	3.264E-11	3.264E-11	3.264E-11	3.264E-11	3.264E-11	3.264E-11	3.264E-11
Sn-112	1.382E-04	1.382E-04	1.382E-04	1.382E-04	1.382E-04	1.382E-04	1.382E-04
Sn-113	3.499E-13	4.300E-15	5.285E-17	6.495E-19	8.836E-22	1.479E-26	0.00
Sn-114	9.682E-05	9.682E-05	9.682E-05	9.682E-05	9.682E-05	9.682E-05	9.682E-05
Sn-115	4.808E-05	4.808E-05	4.808E-05	4.808E-05	4.808E-05	4.808E-05	4.808E-05
Sn-116	2.120E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03	2.120E-03
Sn-117	1.159E-03	1.159E-03	1.159E-03	1.159E-03	1.159E-03	1.159E-03	1.159E-03
Sn-118	3.604E-03	3.604E-03	3.604E-03	3.604E-03	3.604E-03	3.604E-03	3.604E-03
Sn-119	1.325E-03	1.325E-03	1.325E-03	1.325E-03	1.325E-03	1.325E-03	1.325E-03

TABLE F.8.d. Cladding Activation Product Inventory by Isotope at 35 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	6.269E-09	7.938E-10	1.005E-10	1.273E-11	5.735E-13	3.272E-15	0.00
Sn-120	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03	4.913E-03
Sn-121m	4.605E-08	4.479E-08	4.356E-08	4.237E-08	4.064E-08	3.792E-08	4.736E-14
Sn-122	7.078E-04	7.078E-04	7.078E-04	7.078E-04	7.078E-04	7.078E-04	7.078E-04
Sn-123	6.641E-13	1.318E-14	2.614E-16	5.186E-18	1.448E-20	8.026E-25	0.00
Sn-124	8.662E-04	8.662E-04	8.662E-04	8.662E-04	8.662E-04	8.662E-04	8.662E-04
Sb-121	8.241E-06	8.243E-06	8.244E-06	8.245E-06	8.247E-06	8.249E-06	8.287E-06
Sb-123	8.919E-07	8.919E-07	8.919E-07	8.919E-07	8.919E-07	8.919E-07	8.919E-07
Sb-125	1.191E-06	7.220E-07	4.377E-07	2.654E-07	1.253E-07	3.584E-08	0.00
Te-122	6.809E-07	6.809E-07	6.809E-07	6.809E-07	6.809E-07	6.809E-07	6.809E-07
Te-123	9.912E-09	9.913E-09	9.913E-09	9.913E-09	9.913E-09	9.913E-09	9.913E-09
Te-123m	4.165E-15	6.056E-17	8.804E-19	1.280E-20	1.846E-23	4.704E-28	0.00
Te-124	5.268E-08	5.268E-08	5.268E-08	5.268E-08	5.268E-08	5.268E-08	5.268E-08
Te-125	9.395E-06	9.870E-06	1.016E-05	1.033E-05	1.048E-05	1.057E-05	1.060E-05
Te-125m	1.666E-08	1.010E-08	6.124E-09	3.713E-09	1.752E-09	5.013E-10	0.00
Te-126	1.317E-07	1.317E-07	1.317E-07	1.317E-07	1.317E-07	1.317E-07	1.317E-07
Te-128	1.304E-12	1.304E-12	1.304E-12	1.304E-12	1.304E-12	1.304E-12	1.304E-12
I-127	5.992E-10	5.992E-10	5.992E-10	5.992E-10	5.992E-10	5.992E-10	5.992E-10
Xe-128	2.036E-11	2.036E-11	2.036E-11	2.036E-11	2.036E-11	2.036E-11	2.036E-11
Xe-129	8.383E-14	8.383E-14	8.383E-14	8.383E-14	8.383E-14	8.383E-14	8.383E-14
Xe-130	3.628E-15	3.628E-15	3.628E-15	3.628E-15	3.628E-15	3.628E-15	3.628E-15
Yb-172	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15
Yb-173	3.864E-15	3.864E-15	3.864E-15	3.864E-15	3.864E-15	3.864E-15	3.864E-15
Lu-175	4.298E-08	4.298E-08	4.298E-08	4.298E-08	4.298E-08	4.298E-08	4.298E-08
Lu-176	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09
Hf-174	2.285E-08	2.285E-08	2.285E-08	2.285E-08	2.285E-08	2.285E-08	2.285E-08
Hf-176	1.522E-06	1.522E-06	1.522E-06	1.522E-06	1.522E-06	1.522E-06	1.522E-06
Hf-177	1.825E-07	1.825E-07	1.825E-07	1.825E-07	1.825E-07	1.825E-07	1.825E-07
Hf-178	5.850E-06	5.850E-06	5.850E-06	5.850E-06	5.850E-06	5.850E-06	5.850E-06
Hf-179	1.915E-05	1.915E-05	1.915E-05	1.915E-05	1.915E-05	1.915E-05	1.915E-05
Hf-180	2.701E-05	2.701E-05	2.701E-05	2.701E-05	2.701E-05	2.701E-05	2.701E-05
Hf-182	4.910E-09	4.910E-09	4.910E-09	4.910E-09	4.910E-09	4.910E-09	4.910E-09
Ta-181	1.139E-06	1.139E-06	1.139E-06	1.139E-06	1.139E-06	1.139E-06	1.139E-06
Ta-182	3.596E-14	6.099E-16	1.771E-16	1.718E-16	1.718E-16	1.718E-16	1.718E-16
W-182	1.204E-07	1.204E-07	1.204E-07	1.204E-07	1.204E-07	1.204E-07	1.204E-07
W-183	1.926E-07	1.926E-07	1.926E-07	1.926E-07	1.926E-07	1.926E-07	1.926E-07
W-184	1.772E-08	1.772E-08	1.772E-08	1.772E-08	1.772E-08	1.772E-08	1.772E-08
W-186	7.747E-13	7.747E-13	7.747E-13	7.747E-13	7.747E-13	7.747E-13	7.747E-13
Re-185	5.236E-11	5.236E-11	5.236E-11	5.236E-11	5.236E-11	5.236E-11	5.236E-11
Re-187	5.578E-14	5.578E-14	5.578E-14	5.578E-14	5.578E-14	5.578E-14	5.578E-14
Os-186	1.198E-11	1.198E-11	1.198E-11	1.198E-11	1.198E-11	1.198E-11	1.198E-11
Os-188	3.165E-15	3.165E-15	3.165E-15	3.165E-15	3.165E-15	3.165E-15	3.165E-15
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.e. Cladding Activation Product Inventory by Isotope at 40 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.207E-05	1.207E-05	1.207E-05	1.207E-05	1.207E-05	1.207E-05	1.207E-05
H-2	3.356E-08	3.356E-08	3.356E-08	3.356E-08	3.356E-08	3.356E-08	3.356E-08
H-3	1.643E-13	1.468E-13	1.313E-13	1.173E-13	9.914E-14	7.488E-14	9.655E-38
He-3	6.869E-14	8.614E-14	1.017E-13	1.157E-13	1.339E-13	1.581E-13	2.330E-13
He-4	1.310E-07	1.310E-07	1.310E-07	1.310E-07	1.310E-07	1.310E-07	1.310E-07
Li-6	3.152E-13	3.152E-13	3.152E-13	3.152E-13	3.152E-13	3.152E-13	3.152E-13
Be-9	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09	1.506E-09
Be-10	3.967E-11	3.967E-11	3.967E-11	3.967E-11	3.967E-11	3.967E-11	3.965E-11
B-11	3.084E-08	3.084E-08	3.084E-08	3.084E-08	3.084E-08	3.084E-08	3.084E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.854E-06	1.854E-06	1.854E-06	1.854E-06	1.854E-06	1.854E-06	1.854E-06
C-14	2.707E-07	2.706E-07	2.706E-07	2.705E-07	2.704E-07	2.702E-07	2.400E-07
N-14	4.152E-05	4.152E-05	4.152E-05	4.152E-05	4.152E-05	4.152E-05	4.155E-05
N-15	1.757E-07	1.757E-07	1.757E-07	1.757E-07	1.757E-07	1.757E-07	1.757E-07
O-16	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03	1.245E-03
O-17	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07	5.041E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	3.560E-12	3.560E-12	3.560E-12	3.560E-12	3.560E-12	3.560E-12	3.560E-12
Ne-21	1.822E-15	1.822E-15	1.822E-15	1.822E-15	1.822E-15	1.822E-15	1.822E-15
Ne-22	4.378E-14	4.378E-14	4.378E-14	4.378E-14	4.378E-14	4.378E-14	4.378E-14
Na-23	3.553E-15	3.553E-15	3.553E-15	3.553E-15	3.553E-15	3.553E-15	3.553E-15
Mg-24	2.532E-10	2.532E-10	2.532E-10	2.532E-10	2.532E-10	2.532E-10	2.532E-10
Mg-25	5.328E-10	5.328E-10	5.328E-10	5.328E-10	5.328E-10	5.328E-10	5.328E-10
Mg-26	2.443E-10	2.443E-10	2.443E-10	2.443E-10	2.443E-10	2.443E-10	2.443E-10
Al-27	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05	3.997E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.893E-06	3.893E-06	3.893E-06	3.893E-06	3.893E-06	3.893E-06	3.893E-06
Si-30	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06	2.649E-06
P-31	1.104E-09	1.104E-09	1.104E-09	1.104E-09	1.104E-09	1.104E-09	1.104E-09
S-32	3.374E-13	3.374E-13	3.374E-13	3.374E-13	3.374E-13	3.374E-13	3.375E-13
Ca-44	7.768E-15	7.768E-15	7.768E-15	7.768E-15	7.768E-15	7.768E-15	7.768E-15
Ca-46	3.140E-15	3.140E-15	3.140E-15	3.140E-15	3.140E-15	3.140E-15	3.140E-15
Ti-47	2.722E-10	2.722E-10	2.722E-10	2.722E-10	2.722E-10	2.722E-10	2.722E-10
Ti-48	9.453E-13	9.453E-13	9.453E-13	9.453E-13	9.453E-13	9.453E-13	9.453E-13
Ti-49	7.513E-10	7.513E-10	7.513E-10	7.513E-10	7.513E-10	7.513E-10	7.513E-10
Ti-50	3.076E-09	3.076E-09	3.076E-09	3.076E-09	3.076E-09	3.076E-09	3.076E-09
V-50	9.958E-09	9.958E-09	9.958E-09	9.958E-09	9.958E-09	9.958E-09	9.958E-09
V-51	2.179E-06	2.179E-06	2.179E-06	2.179E-06	2.179E-06	2.179E-06	2.179E-06
Cr-50	3.962E-05	3.962E-05	3.962E-05	3.962E-05	3.962E-05	3.962E-05	3.962E-05
Cr-52	8.270E-04	8.270E-04	8.270E-04	8.270E-04	8.270E-04	8.270E-04	8.270E-04
Cr-53	1.009E-04	1.009E-04	1.009E-04	1.009E-04	1.009E-04	1.009E-04	1.009E-04
Cr-54	3.063E-05	3.063E-05	3.063E-05	3.063E-05	3.063E-05	3.063E-05	3.063E-05
Mn-54	1.246E-10	2.464E-11	4.875E-12	9.645E-13	8.488E-14	1.478E-15	0.00
Mn-55	8.030E-07	8.379E-07	8.584E-07	8.704E-07	8.798E-07	8.855E-07	8.875E-07
Fe-54	1.113E-04	1.113E-04	1.113E-04	1.113E-04	1.113E-04	1.113E-04	1.113E-04
Fe-55	8.447E-08	4.956E-08	2.908E-08	1.706E-08	7.668E-09	2.022E-09	0.00
Fe-56	1.820E-03	1.820E-03	1.820E-03	1.820E-03	1.820E-03	1.820E-03	1.820E-03

TABLE F.8.e. Cladding Activation Product Inventory by Isotope at 40 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-57	6.130E-05	6.130E-05	6.130E-05	6.130E-05	6.130E-05	6.130E-05	6.130E-05
Fe-58	6.436E-06	6.436E-06	6.436E-06	6.436E-06	6.436E-06	6.436E-06	6.436E-06
Co-59	2.557E-08	2.557E-08	2.557E-08	2.557E-08	2.557E-08	2.557E-08	2.557E-08
Co-60	7.540E-10	5.796E-10	4.455E-10	3.425E-10	2.308E-10	1.196E-10	0.00
Ni-60	1.384E-09	1.559E-09	1.693E-09	1.796E-09	1.908E-09	2.019E-09	2.138E-09
Ni-61	6.716E-12	6.716E-12	6.716E-12	6.716E-12	6.716E-12	6.716E-12	6.716E-12
Ni-62	1.417E-14	1.417E-14	1.417E-14	1.417E-14	1.417E-14	1.417E-14	1.417E-14
Sr-87	1.770E-08	1.770E-08	1.770E-08	1.770E-08	1.770E-08	1.770E-08	1.770E-08
Sr-88	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06	1.741E-06
Sr-90	7.916E-11	7.548E-11	7.197E-11	6.862E-11	6.389E-11	5.672E-11	4.202E-21
Y-89	1.327E-07	1.327E-07	1.327E-07	1.327E-07	1.327E-07	1.327E-07	1.327E-07
Y-90	1.985E-14	1.893E-14	1.805E-14	1.721E-14	1.602E-14	1.422E-14	1.054E-24
Zr-90	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01	4.972E-01
Zr-91	1.088E-01	1.088E-01	1.088E-01	1.088E-01	1.088E-01	1.088E-01	1.088E-01
Zr-92	1.697E-01	1.697E-01	1.697E-01	1.697E-01	1.697E-01	1.697E-01	1.697E-01
Zr-93	3.272E-04	3.272E-04	3.272E-04	3.272E-04	3.272E-04	3.272E-04	3.270E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.868E-02	2.868E-02	2.868E-02	2.868E-02	2.868E-02	2.868E-02	2.868E-02
Nb-93	3.329E-10	4.607E-10	6.048E-10	7.637E-10	1.027E-09	1.520E-09	1.459E-07
Nb-93m	1.022E-09	1.191E-09	1.343E-09	1.481E-09	1.663E-09	1.910E-09	2.762E-09
Nb-94	2.592E-13	2.592E-13	2.592E-13	2.591E-13	2.591E-13	2.591E-13	2.505E-13
Mo-95	1.157E-04	1.157E-04	1.157E-04	1.157E-04	1.157E-04	1.157E-04	1.157E-04
Mo-96	7.852E-06	7.852E-06	7.852E-06	7.852E-06	7.852E-06	7.852E-06	7.852E-06
Mo-97	1.820E-04	1.820E-04	1.820E-04	1.820E-04	1.820E-04	1.820E-04	1.820E-04
Mo-98	2.288E-06	2.288E-06	2.288E-06	2.288E-06	2.288E-06	2.288E-06	2.288E-06
Mo-100	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13	4.959E-13
Tc-98	4.176E-15	4.176E-15	4.176E-15	4.176E-15	4.176E-15	4.176E-15	4.176E-15
Tc-99	7.574E-10	7.573E-10	7.573E-10	7.573E-10	7.573E-10	7.573E-10	7.549E-10
Ru-99	1.862E-14	2.355E-14	2.847E-14	3.340E-14	4.080E-14	5.312E-14	2.464E-12
Ru-100	6.316E-11	6.316E-11	6.316E-11	6.316E-11	6.316E-11	6.316E-11	6.316E-11
Ru-101	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13	3.555E-13
Ru-102	6.393E-15	6.393E-15	6.393E-15	6.393E-15	6.393E-15	6.393E-15	6.393E-15
Cd-111	1.857E-11	1.857E-11	1.857E-11	1.857E-11	1.857E-11	1.857E-11	1.857E-11
Cd-112	1.568E-10	1.568E-10	1.568E-10	1.568E-10	1.568E-10	1.568E-10	1.568E-10
Cd-113	3.502E-13	3.502E-13	3.502E-13	3.502E-13	3.502E-13	3.502E-13	3.502E-13
Cd-114	3.465E-08	3.465E-08	3.465E-08	3.465E-08	3.465E-08	3.465E-08	3.465E-08
Cd-116	1.216E-10	1.216E-10	1.216E-10	1.216E-10	1.216E-10	1.216E-10	1.216E-10
In-113	3.161E-06	3.161E-06	3.161E-06	3.161E-06	3.161E-06	3.161E-06	3.161E-06
In-115	3.489E-11	3.489E-11	3.489E-11	3.489E-11	3.489E-11	3.489E-11	3.489E-11
Sn-112	1.376E-04	1.376E-04	1.376E-04	1.376E-04	1.376E-04	1.376E-04	1.376E-04
Sn-113	4.109E-13	5.050E-15	6.206E-17	7.627E-19	1.037E-21	1.737E-26	0.00
Sn-114	9.695E-05	9.695E-05	9.695E-05	9.695E-05	9.695E-05	9.695E-05	9.695E-05
Sn-115	4.700E-05	4.700E-05	4.700E-05	4.700E-05	4.700E-05	4.700E-05	4.700E-05
Sn-116	2.115E-03	2.115E-03	2.115E-03	2.115E-03	2.115E-03	2.115E-03	2.115E-03
Sn-117	1.161E-03	1.161E-03	1.161E-03	1.161E-03	1.161E-03	1.161E-03	1.161E-03
Sn-118	3.601E-03	3.601E-03	3.601E-03	3.601E-03	3.601E-03	3.601E-03	3.601E-03
Sn-119	1.330E-03	1.330E-03	1.330E-03	1.330E-03	1.330E-03	1.330E-03	1.330E-03

TABLE F.8.e. Cladding Activation Product Inventory by Isotope at 40 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	7.380E-09	9.345E-10	1.183E-10	1.498E-11	6.752E-13	3.852E-15	0.00
Sn-120	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03
Sn-121m	5.366E-08	5.219E-08	5.077E-08	4.938E-08	4.736E-08	4.419E-08	5.519E-14
Sn-122	7.076E-04	7.076E-04	7.076E-04	7.076E-04	7.076E-04	7.076E-04	7.076E-04
Sn-123	7.825E-13	1.553E-14	3.080E-16	6.111E-18	1.709E-20	9.473E-25	0.00
Sn-124	8.645E-04	8.645E-04	8.645E-04	8.645E-04	8.645E-04	8.645E-04	8.645E-04
Sb-121	9.472E-06	9.474E-06	9.475E-06	9.477E-06	9.479E-06	9.482E-06	9.526E-06
Sb-123	1.032E-06	1.032E-06	1.032E-06	1.032E-06	1.032E-06	1.032E-06	1.032E-06
Sb-125	1.391E-06	8.430E-07	5.110E-07	3.098E-07	1.462E-07	4.184E-08	0.00
Te-122	9.106E-07	9.106E-07	9.106E-07	9.106E-07	9.106E-07	9.106E-07	9.106E-07
Te-123	1.414E-08	1.414E-08	1.414E-08	1.414E-08	1.414E-08	1.414E-08	1.414E-08
Te-123m	6.560E-15	9.537E-17	1.387E-18	2.017E-20	2.901E-23	7.394E-28	0.00
Te-124	7.533E-08	7.533E-08	7.533E-08	7.533E-08	7.533E-08	7.533E-08	7.533E-08
Te-125	1.090E-05	1.146E-05	1.180E-05	1.200E-05	1.217E-05	1.227E-05	1.231E-05
Te-125m	1.945E-08	1.179E-08	7.150E-09	4.334E-09	2.045E-09	5.853E-10	0.00
Te-126	1.782E-07	1.782E-07	1.782E-07	1.782E-07	1.782E-07	1.782E-07	1.782E-07
Te-128	2.387E-12	2.387E-12	2.387E-12	2.387E-12	2.387E-12	2.387E-12	2.387E-12
I-127	9.399E-10	9.399E-10	9.399E-10	9.399E-10	9.399E-10	9.399E-10	9.399E-10
I-129	1.958E-15	1.958E-15	1.958E-15	1.958E-15	1.958E-15	1.958E-15	1.958E-15
Xe-128	3.724E-11	3.724E-11	3.724E-11	3.724E-11	3.724E-11	3.724E-11	3.724E-11
Xe-129	1.777E-13	1.777E-13	1.777E-13	1.777E-13	1.777E-13	1.777E-13	1.777E-13
Xe-130	8.972E-15	8.972E-15	8.972E-15	8.972E-15	8.972E-15	8.972E-15	8.972E-15
Yb-172	5.744E-15	5.744E-15	5.744E-15	5.744E-15	5.744E-15	5.744E-15	5.744E-15
Yb-173	4.906E-15	4.906E-15	4.906E-15	4.906E-15	4.906E-15	4.906E-15	4.906E-15
Lu-175	4.275E-08	4.275E-08	4.275E-08	4.275E-08	4.275E-08	4.275E-08	4.275E-08
Lu-176	1.472E-09	1.472E-09	1.472E-09	1.472E-09	1.472E-09	1.472E-09	1.472E-09
Hf-174	1.837E-08	1.837E-08	1.837E-08	1.837E-08	1.837E-08	1.837E-08	1.837E-08
Hf-176	1.376E-06	1.376E-06	1.376E-06	1.376E-06	1.376E-06	1.376E-06	1.376E-06
Hf-177	1.562E-07	1.562E-07	1.562E-07	1.562E-07	1.562E-07	1.562E-07	1.562E-07
Hf-178	4.582E-06	4.582E-06	4.582E-06	4.582E-06	4.582E-06	4.582E-06	4.582E-06
Hf-179	1.883E-05	1.883E-05	1.883E-05	1.883E-05	1.883E-05	1.883E-05	1.883E-05
Hf-180	2.850E-05	2.850E-05	2.850E-05	2.850E-05	2.850E-05	2.850E-05	2.850E-05
Hf-182	6.828E-09	6.828E-09	6.828E-09	6.828E-09	6.828E-09	6.828E-09	6.827E-09
Ta-181	1.321E-06	1.321E-06	1.321E-06	1.321E-06	1.321E-06	1.321E-06	1.321E-06
Ta-182	4.397E-14	7.742E-16	2.454E-16	2.389E-16	2.389E-16	2.389E-16	2.388E-16
W-182	1.445E-07	1.445E-07	1.445E-07	1.445E-07	1.445E-07	1.445E-07	1.445E-07
W-183	2.733E-07	2.733E-07	2.733E-07	2.733E-07	2.733E-07	2.733E-07	2.733E-07
W-184	2.939E-08	2.939E-08	2.939E-08	2.939E-08	2.939E-08	2.939E-08	2.939E-08
W-186	1.671E-12	1.671E-12	1.671E-12	1.671E-12	1.671E-12	1.671E-12	1.671E-12
Re-185	9.837E-11	9.837E-11	9.837E-11	9.837E-11	9.837E-11	9.837E-11	9.837E-11
Re-187	1.403E-13	1.403E-13	1.403E-13	1.403E-13	1.403E-13	1.403E-13	1.403E-13
Os-186	2.618E-11	2.618E-11	2.618E-11	2.618E-11	2.618E-11	2.618E-11	2.618E-11
Os-188	9.352E-15	9.352E-15	9.352E-15	9.352E-15	9.352E-15	9.352E-15	9.352E-15
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.f. Cladding Activation Product Inventory by Isotope at 45 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.208E-05	1.208E-05	1.208E-05	1.208E-05	1.208E-05	1.208E-05	1.208E-05
H-2	3.794E-08	3.794E-08	3.794E-08	3.794E-08	3.794E-08	3.794E-08	3.794E-08
H-3	2.266E-13	2.026E-13	1.811E-13	1.618E-13	1.368E-13	1.033E-13	1.331E-37
He-3	9.423E-14	1.183E-13	1.398E-13	1.590E-13	1.841E-13	2.176E-13	3.209E-13
He-4	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.500E-07	1.500E-07
Li-6	3.797E-13	3.797E-13	3.797E-13	3.797E-13	3.797E-13	3.797E-13	3.797E-13
Be-9	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09	1.724E-09
Be-10	4.563E-11	4.563E-11	4.563E-11	4.563E-11	4.563E-11	4.563E-11	4.561E-11
B-11	3.531E-08	3.531E-08	3.531E-08	3.531E-08	3.531E-08	3.531E-08	3.531E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.869E-06	1.869E-06	1.869E-06	1.869E-06	1.869E-06	1.869E-06	1.869E-06
C-14	3.099E-07	3.098E-07	3.098E-07	3.097E-07	3.096E-07	3.094E-07	2.748E-07
N-14	4.147E-05	4.147E-05	4.147E-05	4.147E-05	4.147E-05	4.147E-05	4.150E-05
N-15	1.773E-07	1.773E-07	1.773E-07	1.773E-07	1.773E-07	1.773E-07	1.773E-07
O-16	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03
O-17	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	4.078E-12	4.078E-12	4.078E-12	4.078E-12	4.078E-12	4.078E-12	4.078E-12
Ne-21	2.390E-15	2.390E-15	2.390E-15	2.390E-15	2.390E-15	2.390E-15	2.390E-15
Ne-22	5.745E-14	5.745E-14	5.745E-14	5.745E-14	5.745E-14	5.745E-14	5.745E-14
Na-23	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15	4.664E-15
Mg-24	2.901E-10	2.901E-10	2.901E-10	2.901E-10	2.901E-10	2.901E-10	2.901E-10
Mg-25	6.103E-10	6.103E-10	6.103E-10	6.103E-10	6.103E-10	6.103E-10	6.103E-10
Mg-26	2.800E-10	2.800E-10	2.800E-10	2.800E-10	2.800E-10	2.800E-10	2.800E-10
Al-27	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.899E-06	3.899E-06	3.899E-06	3.899E-06	3.899E-06	3.899E-06	3.899E-06
Si-30	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06
P-31	1.265E-09	1.265E-09	1.265E-09	1.265E-09	1.265E-09	1.265E-09	1.265E-09
S-32	4.427E-13	4.427E-13	4.427E-13	4.427E-13	4.427E-13	4.427E-13	4.428E-13
Ca-44	1.016E-14	1.016E-14	1.016E-14	1.016E-14	1.016E-14	1.016E-14	1.016E-14
Ca-46	4.116E-15	4.116E-15	4.116E-15	4.116E-15	4.116E-15	4.116E-15	4.116E-15
Ti-47	3.105E-10	3.105E-10	3.105E-10	3.105E-10	3.105E-10	3.105E-10	3.105E-10
Ti-48	1.235E-12	1.235E-12	1.235E-12	1.235E-12	1.235E-12	1.235E-12	1.235E-12
Ti-49	8.594E-10	8.594E-10	8.594E-10	8.594E-10	8.594E-10	8.594E-10	8.594E-10
Ti-50	3.535E-09	3.535E-09	3.535E-09	3.535E-09	3.535E-09	3.535E-09	3.535E-09
V-50	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08	1.116E-08
V-51	2.484E-06	2.484E-06	2.484E-06	2.484E-06	2.484E-06	2.484E-06	2.484E-06
Cr-50	3.932E-05	3.932E-05	3.932E-05	3.932E-05	3.932E-05	3.932E-05	3.932E-05
Cr-52	8.256E-04	8.256E-04	8.256E-04	8.256E-04	8.256E-04	8.256E-04	8.256E-04
Cr-53	1.015E-04	1.015E-04	1.015E-04	1.015E-04	1.015E-04	1.015E-04	1.015E-04
Cr-54	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05	3.155E-05
Mn-54	1.435E-10	2.839E-11	5.617E-12	1.111E-12	9.779E-14	1.702E-15	0.00
Mn-55	9.181E-07	9.582E-07	9.817E-07	9.955E-07	1.006E-06	1.013E-06	1.015E-06
Fe-54	1.112E-04	1.112E-04	1.112E-04	1.112E-04	1.112E-04	1.112E-04	1.112E-04
Fe-55	9.707E-08	5.695E-08	3.342E-08	1.961E-08	8.812E-09	2.324E-09	0.00
Fe-56	1.818E-03	1.818E-03	1.818E-03	1.818E-03	1.818E-03	1.818E-03	1.818E-03

TABLE F.8.f. Cladding Activation Product Inventory by Isotope at 45 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-57	6.382E-05	6.382E-05	6.382E-05	6.382E-05	6.382E-05	6.382E-05	6.382E-05
Fe-58	6.509E-06	6.509E-06	6.509E-06	6.509E-06	$.509E-06	6.509E-06	6.509E-06
Co-59	2.911E-08	2.911E-08	2.911E-08	2.911E-08	2.911E-08	2.911E-08	2.911E-08
Co-60	9.860E-10	7.579E-10	5.826E-10	4.479E-10	3.018E-10	1.564E-10	0.00
Ni-60	1.806E-09	2.034E-09	2.210E-09	2.344E-09	2.490E-09	2.636E-09	2.792E-09
Ni-61	1.006E-11	1.006E-11	1.006E-11	1.006E-11	1.006E-11	1.006E-11	1.006E-11
Ni-62	2.432E-14	2.432E-14	2.432E-14	2.432E-14	2.432E-14	2.432E-14	2.432E-14
Sr-87	2.005E-08	2.005E-08	2.005E-08	2.005E-08	2.005E-08	2.005E-08	2.005E-08
Sr-88	1.994E-06	1.994E-06	1.994E-06	1.994E-06	1.994E-06	1.994E-06	1.994E-06
Sr-90	1.037E-10	9.890E-11	9.430E-11	8.992E-11	8.372E-11	7.433E-11	5.506E-21
Y-89	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07	1.521E-07
Y-90	2.601E-14	2.480E-14	2.365E-14	2.255E-14	2.100E-14	1.864E-14	1.381E-24
Zr-90	4.971E-01	4.971E-01	4.971E-01	4.971E-01	4.971E-01	4.971E-01	4.971E-01
Zr-91	1.087E-01	1.087E-01	1.087E-01	1.087E-01	1.087E-01	1.087E-01	1.087E-01
Zr-92	1.698E-01	1.698E-01	1.698E-01	1.698E-01	1.698E-01	1.698E-01	1.698E-01
Zr-93	3.739E-04	3.739E-04	3.739E-04	3.739E-04	3.739E-04	3.739E-04	3.737E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.865E-02	2.865E-02	2.865E-02	2.865E-02	2.865E-02	2.865E-02	2.865E-02
Nb-93	3.795E-10	5.253E-10	6.899E-10	8.714E-10	1.172E-09	1.736E-09	1.667E-07
Nb-93m	1.167E-09	1.360E-09	1.534E-09	1.691E-09	1.899E-09	2.182E-09	3.156E-09
Nb-94	3.374E-13	3.374E-13	3.374E-13	3.373E-13	3.373E-13	3.373E-13	3.262E-13
Mo-95	1.313E-04	1.313E-04	1.313E-04	1.313E-04	1.313E-04	1.313E-04	1.313E-04
Mo-96	1.023E-05	1.023E-05	1.023E-05	1.023E-05	1.023E-05	1.023E-05	1.023E-05
Mo-97	2.080E-04	2.080E-04	2.080E-04	2.080E-04	2.080E-04	2.080E-04	2.080E-04
Mo-98	2.997E-06	2.997E-06	2.997E-06	2.997E-06	2.997E-06	2.997E-06	2.997E-06
Mo-100	8.581E-13	8.581E-13	8.581E-13	8.581E-13	8.581E-13	8.581E-13	8.581E-13
Tc-98	7.118E-15	7.118E-15	7.118E-15	7.118E-15	7.118E-15	7.118E-15	7.117E-15
Tc-99	1.124E-09	1.124E-09	1.124E-09	1.124E-09	1.124E-09	1.124E-09	1.120E-09
Ru-99	2.757E-14	3.489E-14	4.220E-14	4.952E-14	6.049E-14	7.878E-14	3.658E-12
Ru-100	1.076E-10	1.076E-10	1.076E-10	1.076E-10	1.076E-10	1.076E-10	1.076E-10
Ru-101	6.929E-13	6.929E-13	6.929E-13	6.929E-13	6.929E-13	6.929E-13	6.929E-13
Ru-102	1.430E-14	1.430E-14	1.430E-14	1.430E-14	1.430E-14	1.430E-14	1.430E-14
Cd-111	2.109E-11	2.109E-11	2.109E-11	2.109E-11	2.109E-11	2.109E-11	2.109E-11
Cd-112	1.773E-10	1.773E-10	1.773E-10	1.773E-10	1.773E-10	1.773E-10	1.773E-10
Cd-113	3.525E-13	3.525E-13	3.525E-13	3.525E-13	3.525E-13	3.525E-13	3.525E-13
Cd-114	4.443E-08	4.443E-08	4.443E-08	4.443E-08	4.443E-08	4.443E-08	4.443E-08
Cd-116	1.395E-10	1.395E-10	1.395E-10	1.395E-10	1.395E-10	1.395E-10	1.395E-10
In-113	3.519E-06	3.519E-06	3.519E-06	3.519E-06	3.519E-06	3.519E-06	3.519E-06
In-115	3.771E-11	3.771E-11	3.771E-11	3.771E-11	3.771E-11	3.771E-11	3.771E-11
Sn-112	1.371E-04	1.371E-04	1.371E-04	1.371E-04	1.371E-04	1.371E-04	1.371E-04
Sn-113	4.727E-13	5.809E-15	7.139E-17	8.774E-19	1.190E-21	1.992E-26	0.00
Sn-114	9.712E-05	9.712E-05	9.712E-05	9.712E-05	9.712E-05	9.712E-05	9.712E-05
Sn-115	4.591E-05	4.591E-05	4.591E-05	4.591E-05	4.591E-05	4.591E-05	4.591E-05
Sn-116	2.109E-03	2.109E-03	2.109E-03	2.109E-03	2.109E-03	2.109E-03	2.109E-03
Sn-117	1.163E-03	1.163E-03	1.163E-03	1.163E-03	1.163E-03	1.163E-03	1.163E-03
Sn-118	3.598E-03	3.598E-03	3.598E-03	3.598E-03	3.598E-03	3.598E-03	3.598E-03
Sn-119	1.336E-03	1.336E-03	1.336E-03	1.336E-03	1.336E-03	1.336E-03	1.336E-03

TABLE F.8.f. Cladding Activation Product Inventory by Isotope at 45 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119m	8.515E-09	1.078E-09	1.365E-10	1.729E-11	7.790E-13	4.445E-15	0.00
Sn-120	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03	4.914E-03
Sn-121m	6.149E-08	5.981E-08	5.817E-08	5.658E-08	5.427E-08	5.064E-08	6.324E-14
Sn-122	7.075E-04	7.075E-04	7.075E-04	7.075E-04	7.075E-04	7.075E-04	7.075E-04
Sn-123	9.033E-13	1.792E-14	3.555E-16	7.053E-18	1.971E-20	1.093E-24	0.00
Sn-124	8.627E-04	8.627E-04	8.627E-04	8.627E-04	8.627E-04	8.627E-04	8.627E-04
Sb-121	1.070E-05	1.070E-05	1.071E-05	1.071E-05	1.071E-05	1.071E-05	1.076E-05
Sb-123	1.173E-06	1.173E-06	1.173E-06	1.173E-06	1.173E-06	1.173E-06	1.173E-06
Sb-125	1.594E-06	9.665E-07	5.859E-07	3.552E-07	1.677E-07	4.798E-08	0.00
Te-122	1.177E-06	1.177E-06	1.177E-06	1.177E-06	1.177E-06	1.177E-06	1.177E-06
Te-123	1.930E-08	1.930E-08	1.930E-08	1.930E-08	1.930E-08	1.930E-08	1.930E-08
Te-123m	9.789E-15	1.423E-16	2.069E-18	3.008E-20	4.313E-23	1.099E-27	0.00
Te-124	1.041E-07	1.041E-07	1.041E-07	1.041E-07	1.041E-07	1.041E-07	1.041E-07
Te-125	1.245E-05	1.308E-05	1.347E-05	1.370E-05	1.389E-05	1.401E-05	1.406E-05
Te-125m	2.230E-08	1.352E-08	8.198E-09	4.970E-09	2.345E-09	6.711E-10	0.00
Te-126	2.332E-07	2.332E-07	2.332E-07	2.332E-07	2.332E-07	2.332E-07	2.332E-07
Te-128	4.084E-12	4.084E-12	4.084E-12	4.084E-12	4.084E-12	4.084E-12	4.084E-12
I-127	1.402E-09	1.402E-09	1.402E-09	1.402E-09	1.402E-09	1.402E-09	1.402E-09
I-129	3.825E-15	3.825E-15	3.825E-15	3.825E-15	3.825E-15	3.825E-15	3.825E-15
Xe-128	6.367E-11	6.367E-11	6.367E-11	6.367E-11	6.367E-11	6.367E-11	6.367E-11
Xe-129	3.460E-13	3.460E-13	3.460E-13	3.460E-13	3.460E-13	3.460E-13	3.460E-13
Xe-130	2.005E-14	2.005E-14	2.005E-14	2.005E-14	2.005E-14	2.005E-14	2.005E-14
Yb-172	6.834E-15	6.834E-15	6.834E-15	6.834E-15	6.834E-15	6.834E-15	6.834E-15
Yb-173	5.944E-15	5.944E-15	5.944E-15	5.944E-15	5.944E-15	5.944E-15	5.944E-15
Lu-175	4.166E-08	4.166E-08	4.166E-08	4.166E-08	4.166E-08	4.166E-08	4.166E-08
Lu-176	1.473E-09	1.473E-09	1.473E-09	1.473E-09	1.473E-09	1.473E-09	1.473E-09
Hf-174	1.468E-08	1.468E-08	1.468E-08	1.468E-08	1.468E-08	1.468E-08	1.468E-08
Hf-176	1.241E-06	1.241E-06	1.241E-06	1.241E-06	1.241E-06	1.241E-06	1.241E-06
Hf-177	1.378E-07	1.378E-07	1.378E-07	1.378E-07	1.378E-07	1.378E-07	1.378E-07
Hf-178	3.579E-06	3.579E-06	3.579E-06	3.579E-06	3.579E-06	3.579E-06	3.579E-06
Hf-179	1.822E-05	1.822E-05	1.822E-05	1.822E-05	1.822E-05	1.822E-05	1.822E-05
Hf-180	2.998E-05	2.998E-05	2.998E-05	2.998E-05	2.998E-05	2.998E-05	2.998E-05
Hf-182	9.194E-09	9.194E-09	9.194E-09	9.194E-09	9.194E-09	9.194E-09	9.193E-09
Ta-181	1.506E-06	1.506E-06	1.506E-06	1.506E-06	1.506E-06	1.506E-06	1.506E-06
Ta-182	5.226E-14	9.574E-16	3.294E-16	3.217E-16	3.216E-16	3.216E-16	3.216E-16
W-182	1.687E-07	1.687E-07	1.687E-07	1.687E-07	1.687E-07	1.687E-07	1.687E-07
W-183	3.705E-07	3.705E-07	3.705E-07	3.705E-07	3.705E-07	3.705E-07	3.705E-07
W-184	4.582E-08	4.582E-08	4.582E-08	4.582E-08	4.582E-08	4.582E-08	4.582E-08
W-186	3.278E-12	3.278E-12	3.278E-12	3.278E-12	3.278E-12	3.278E-12	3.278E-12
Re-185	1.709E-10	1.709E-10	1.709E-10	1.709E-10	1.709E-10	1.709E-10	1.709E-10
Re-187	3.154E-13	3.154E-13	3.154E-13	3.154E-13	3.154E-13	3.154E-13	3.154E-13
Os-186	5.200E-11	5.200E-11	5.200E-11	5.200E-11	5.200E-11	5.200E-11	5.200E-11
Os-188	2.425E-14	2.425E-14	2.425E-14	2.425E-14	2.425E-14	2.425E-14	2.425E-14
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

TABLE F.8.g. Cladding Activation Product Inventory by Isotope at 50 MWd/kgM, g/gZr

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
H-1	1.209E-05	1.209E-05	1.209E-05	1.209E-05	1.209E-05	1.209E-05	1.209E-05
H-2	4.242E-08	4.242E-08	4.242E-08	4.242E-08	4.242E-08	4.242E-08	4.242E-08
H-3	3.020E-13	2.699E-13	2.412E-13	2.156E-13	1.822E-13	1.376E-13	1.775E-37
He-3	1.250E-13	1.571E-13	1.857E-13	2.113E-13	2.448E-13	2.893E-13	4.270E-13
He-4	1.695E-07	1.695E-07	1.695E-07	1.695E-07	1.695E-07	1.695E-07	1.695E-07
Li-6	4.466E-13	4.466E-13	4.466E-13	4.466E-13	4.466E-13	4.466E-13	4.466E-13
Be-9	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09	1.948E-09
Be-10	5.178E-11	5.178E-11	5.178E-11	5.178E-11	5.178E-11	5.178E-11	5.176E-11
B-11	3.988E-08	3.988E-08	3.988E-08	3.988E-08	3.988E-08	3.988E-08	3.988E-08
C-12	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04	1.442E-04
C-13	1.884E-06	1.884E-06	1.884E-06	1.884E-06	1.884E-06	1.884E-06	1.884E-06
C-14	3.500E-07	3.499E-07	3.499E-07	3.498E-07	3.496E-07	3.494E-07	3.104E-07
N-14	4.142E-05	4.142E-05	4.142E-05	4.142E-05	4.142E-05	4.142E-05	4.146E-05
N-15	1.790E-07	1.790E-07	1.790E-07	1.790E-07	1.790E-07	1.790E-07	1.790E-07
O-16	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.244E-03
O-17	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07	5.042E-07
O-18	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06	2.863E-06
F-19	4.609E-12	4.609E-12	4.609E-12	4.609E-12	4.609E-12	4.609E-12	4.609E-12
Ne-21	3.051E-15	3.051E-15	3.051E-15	3.051E-15	3.051E-15	3.051E-15	3.051E-15
Ne-22	7.336E-14	7.336E-14	7.336E-14	7.336E-14	7.336E-14	7.336E-14	7.336E-14
Na-23	5.959E-15	5.959E-15	5.959E-15	5.959E-15	5.959E-15	5.959E-15	5.959E-15
Mg-24	3.277E-10	3.277E-10	3.277E-10	3.277E-10	3.277E-10	3.277E-10	3.277E-10
Mg-25	6.896E-10	6.896E-10	6.896E-10	6.896E-10	6.896E-10	6.896E-10	6.896E-10
Mg-26	3.167E-10	3.167E-10	3.167E-10	3.167E-10	3.167E-10	3.167E-10	3.167E-10
Al-27	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05	3.996E-05
Si-28	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05	7.349E-05
Si-29	3.905E-06	3.905E-06	3.905E-06	3.905E-06	3.905E-06	3.905E-06	3.905E-06
Si-30	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06	2.650E-06
P-31	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09	1.429E-09
S-32	5.652E-13	5.652E-13	5.652E-13	5.652E-13	5.652E-13	5.652E-13	5.654E-13
Ca-44	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14	1.294E-14
Ca-46	5.251E-15	5.251E-15	5.251E-15	5.251E-15	5.251E-15	5.251E-15	5.251E-15
Ti-47	3.493E-10	3.493E-10	3.493E-10	3.493E-10	3.493E-10	3.493E-10	3.493E-10
Ti-48	1.571E-12	1.571E-12	1.571E-12	1.571E-12	1.571E-12	1.571E-12	1.571E-12
Ti-49	9.698E-10	9.698E-10	9.698E-10	9.698E-10	9.698E-10	9.698E-10	9.698E-10
Ti-50	4.008E-09	4.008E-09	4.008E-09	4.008E-09	4.008E-09	4.008E-09	4.008E-09
V-50	1.232E-08	1.232E-08	1.232E-08	1.232E-08	1.232E-08	1.232E-08	1.232E-08
V-51	2.793E-06	2.793E-06	2.793E-06	2.793E-06	2.793E-06	2.793E-06	2.793E-06
Cr-50	3.901E-05	3.901E-05	3.901E-05	3.901E-05	3.901E-05	3.901E-05	3.901E-05
Cr-52	8.241E-04	8.241E-04	8.241E-04	8.241E-04	8.241E-04	8.241E-04	8.241E-04
Cr-53	1.021E-04	1.021E-04	1.021E-04	1.021E-04	1.021E-04	1.021E-04	1.021E-04
Cr-54	3.249E-05	3.249E-05	3.249E-05	3.249E-05	3.249E-05	3.249E-05	3.249E-05
Mn-54	1.627E-10	3.218E-11	6.367E-12	1.260E-12	1.108E-13	1.930E-15	0.00
Mn-55	1.036E-06	1.081E-06	1.108E-06	1.123E-06	1.136E-06	1.143E-06	1.145E-06
Fe-54	1.110E-04	1.110E-04	1.110E-04	1.110E-04	1.110E-04	1.110E-04	1.110E-04
Fe-55	1.099E-07	6.449E-08	3.784E-08	2.220E-08	9.978E-09	2.631E-09	0.00
Fe-56	1.815E-03	1.815E-03	1.815E-03	1.815E-03	1.815E-03	1.815E-03	1.815E-03

TABLE F.8.g. Cladding Activation Product Inventory by Isotope at 50 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Fe-57	6.638E-05	6.638E-05	6.638E-05	6.638E-05	6.638E-05	6.638E-05	6.638E-05
Fe-58	6.587E-06	6.587E-06	6.587E-06	6.587E-06	6.587E-06	6.587E-06	6.587E-06
Co-59	3.270E-08	3.270E-08	3.270E-08	3.270E-08	3.270E-08	3.270E-08	3.270E-08
Co-60	1.254E-09	9.640E-10	7.410E-10	5.696E-10	3.839E-10	1.989E-10	0.00
Ni-60	2.294E-09	2.584E-09	2.807E-09	2.978E-09	3.164E-09	3.349E-09	3.548E-09
Ni-61	1.447E-11	1.447E-11	1.447E-11	1.447E-11	1.447E-11	1.447E-11	1.447E-11
Ni-62	3.952E-14	3.952E-14	3.952E-14	3.952E-14	3.952E-14	3.952E-14	3.952E-14
Sr-87	2.240E-08	2.240E-08	2.240E-08	2.240E-08	2.240E-08	2.240E-08	2.240E-08
Sr-88	2.253E-06	2.253E-06	2.253E-06	2.253E-06	2.253E-06	2.253E-06	2.253E-06
Sr-90	1.323E-10	1.261E-10	1.203E-10	1.147E-10	1.068E-10	9.478E-11	7.021E-21
Y-89	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.718E-07	1.718E-07
Y-90	3.317E-14	3.163E-14	3.016E-14	2.875E-14	2.677E-14	2.377E-14	1.761E-24
Zr-90	4.970E-01	4.970E-01	4.970E-01	4.970E-01	4.970E-01	4.970E-01	4.970E-01
Zr-91	1.086E-01	1.086E-01	1.086E-01	1.086E-01	1.086E-01	1.086E-01	1.086E-01
Zr-92	1.699E-01	1.699E-01	1.699E-01	1.699E-01	1.699E-01	1.699E-01	1.699E-01
Zr-93	4.215E-04	4.215E-04	4.215E-04	4.215E-04	4.215E-04	4.215E-04	4.213E-04
Zr-94	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01	1.755E-01
Zr-96	2.862E-02	2.862E-02	2.862E-02	2.862E-02	2.862E-02	2.862E-02	2.862E-02
Nb-93	4.269E-10	5.913E-10	7.767E-10	9.812E-10	1.320E-09	1.955E-09	1.880E-07
Nb-93m	1.315E-09	1.532E-09	1.729E-09	1.906E-09	2.141E-09	2.460E-09	3.558E-09
Nb-94	4.271E-13	4.271E-13	4.271E-13	4.271E-13	4.270E-13	4.269E-13	4.129E-13
Mo-95	1.469E-04	1.469E-04	1.469E-04	1.469E-04	1.469E-04	1.469E-04	1.469E-04
Mo-96	1.296E-05	1.296E-05	1.296E-05	1.296E-05	1.296E-05	1.296E-05	1.296E-05
Mo-97	2.346E-04	2.346E-04	2.346E-04	2.346E-04	2.346E-04	2.346E-04	2.346E-04
Mo-98	3.820E-06	3.820E-06	3.820E-06	3.820E-06	3.820E-06	3.820E-06	3.820E-06
Mo-100	1.404E-12	1.404E-12	1.404E-12	1.404E-12	1.404E-12	1.404E-12	1.404E-12
Tc-98	1.149E-14	1.149E-14	1.149E-14	1.149E-14	1.149E-14	1.149E-14	1.149E-14
Tc-99	1.601E-09	1.601E-09	1.601E-09	1.601E-09	1.601E-09	1.601E-09	1.596E-09
Ru-99	3.921E-14	4.963E-14	6.005E-14	7.048E-14	8.611E-14	1.122E-13	5.210E-12
Ru-100	1.734E-10	1.734E-10	1.734E-10	1.734E-10	1.734E-10	1.734E-10	1.734E-10
Ru-101	1.262E-12	1.262E-12	1.262E-12	1.262E-12	1.262E-12	1.262E-12	1.262E-12
Ru-102	2.946E-14	2.946E-14	2.946E-14	2.946E-14	2.946E-14	2.946E-14	2.946E-14
Cd-111	2.363E-11	2.363E-11	2.363E-11	2.363E-11	2.363E-11	2.363E-11	2.363E-11
Cd-112	1.978E-10	1.978E-10	1.978E-10	1.978E-10	1.978E-10	1.978E-10	1.978E-10
Cd-113	3.549E-13	3.549E-13	3.549E-13	3.549E-13	3.549E-13	3.549E-13	3.549E-13
Cd-114	5.543E-08	5.543E-08	5.543E-08	5.543E-08	5.543E-08	5.543E-08	5.543E-08
Cd-116	1.579E-10	1.579E-10	1.579E-10	1.579E-10	1.579E-10	1.579E-10	1.579E-10
In-113	3.864E-06	3.864E-06	3.864E-06	3.864E-06	3.864E-06	3.864E-06	3.864E-06
In-115	4.115E-11	4.115E-11	4.115E-11	4.115E-11	4.115E-11	4.115E-11	4.115E-11
Sn-112	1.366E-04	1.366E-04	1.366E-04	1.366E-04	1.366E-04	1.366E-04	1.366E-04
Sn-113	5.347E-13	6.571E-15	8.075E-17	9.924E-19	1.346E-21	2.253E-26	0.00
Sn-114	9.730E-05	9.730E-05	9.730E-05	9.730E-05	9.730E-05	9.730E-05	9.730E-05
Sn-115	4.483E-05	4.483E-05	4.483E-05	4.483E-05	4.483E-05	4.483E-05	4.483E-05
Sn-116	2.103E-03	2.103E-03	2.103E-03	2.103E-03	2.103E-03	2.103E-03	2.103E-03
Sn-117	1.166E-03	1.166E-03	1.166E-03	1.166E-03	1.166E-03	1.166E-03	1.166E-03
Sn-118	3.595E-03	3.595E-03	3.595E-03	3.595E-03	3.595E-03	3.595E-03	3.595E-03
Sn-119	1.342E-03	1.342E-03	1.342E-03	1.342E-03	1.342E-03	1.342E-03	1.342E-03

TABLE F.8.g. Cladding Activation Product Inventory by Isotope at 50 MWd/kgM, g/gZr (contd)

Isotope	6 Years	8 Years	10 Years	12 Years	15 Years	20 Years	1000 Years
Sn-119	9.665E-09	1.224E-09	1.550E-10	1.962E-11	8.842E-13	5.044E-15	0.00
Sn-120	4.915E-03	4.915E-03	4.915E-03	4.915E-03	4.915E-03	4.915E-03	4.915E-03
Sn-121m	6.950E-08	6.760E-08	6.575E-08	6.395E-08	6.134E-08	5.723E-08	7.148E-14
Sn-122	7.073E-04	7.073E-04	7.073E-04	7.073E-04	7.073E-04	7.073E-04	7.073E-04
Sn-123	1.025E-12	2.034E-14	4.036E-16	8.007E-18	2.239E-20	1.241E-24	0.00
Sn-124	8.609E-04	8.609E-04	8.609E-04	8.609E-04	8.609E-04	8.609E-04	8.609E-04
Sb-121	1.193E-05	1.193E-05	1.193E-05	1.193E-05	1.194E-05	1.194E-05	1.200E-05
Sb-123	1.316E-06	1.316E-06	1.316E-06	1.316E-06	1.316E-06	1.316E-06	1.316E-06
Sb-125	1.801E-06	1.092E-06	6.620E-07	4.013E-07	1.894E-07	5.421E-08	0.00
Te-122	1.481E-06	1.481E-06	1.481E-06	1.481E-06	1.481E-06	1.481E-06	1.481E-06
Te-123	2.543E-08	2.543E-08	2.543E-08	2.543E-08	2.543E-08	2.543E-08	2.543E-08
Te-123m	1.398E-14	2.033E-16	2.955E-18	4.297E-20	7.908E-23	2.015E-27	0.00
Te-124	1.397E-07	1.397E-07	1.397E-07	1.397E-07	1.397E-07	1.397E-07	1.397E-07
Te-125	1.401E-05	1.473E-05	1.517E-05	1.543E-05	1.565E-05	1.579E-05	1.584E-05
Te-125m	2.520E-08	1.528E-08	9.262E-09	5.615E-09	2.650E-09	7.582E-10	0.00
Te-126	2.969E-07	2.969E-07	2.969E-07	2.969E-07	2.969E-07	2.969E-07	2.969E-07
Te-128	6.614E-12	6.614E-12	6.614E-12	6.614E-12	6.614E-12	6.614E-12	6.614E-12
I-127	2.006E-09	2.006E-09	2.006E-09	2.006E-09	2.006E-09	2.006E-09	2.006E-09
I-129	6.979E-15	6.979E-15	6.979E-15	6.979E-15	6.979E-15	6.979E-15	6.979E-15
Xe-128	1.031E-10	1.031E-10	1.031E-10	1.031E-10	1.031E-10	1.031E-10	1.031E-10
Xe-129	6.294E-13	6.294E-13	6.294E-13	6.294E-13	6.294E-13	6.294E-13	6.294E-13
Xe-130	4.128E-14	4.128E-14	4.128E-14	4.128E-14	4.128E-14	4.128E-14	4.128E-14
Yb-172	7.909E-15	7.909E-15	7.909E-15	7.909E-15	7.909E-15	7.909E-15	7.909E-15
Yb-173	6.939E-15	6.939E-15	6.939E-15	6.939E-15	6.939E-15	6.939E-15	6.939E-15
Yb-174	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15	1.240E-15
Lu-175	3.994E-08	3.994E-08	3.994E-08	3.994E-08	3.994E-08	3.994E-08	3.994E-08
Lu-176	1.442E-09	1.442E-09	1.442E-09	1.442E-09	1.442E-09	1.442E-09	1.442E-09
Hf-174	1.167E-08	1.167E-08	1.167E-08	1.167E-08	1.167E-08	1.167E-08	1.167E-08
Hf-176	1.117E-06	1.117E-06	1.117E-06	1.117E-06	1.117E-06	1.117E-06	1.117E-06
Hf-177	1.231E-07	1.231E-07	1.231E-07	1.231E-07	1.231E-07	1.231E-07	1.231E-07
Hf-178	2.795E-06	2.795E-06	2.795E-06	2.795E-06	2.795E-06	2.795E-06	2.795E-06
Hf-179	1.740E-05	1.740E-05	1.740E-05	1.740E-05	1.740E-05	1.740E-05	1.740E-05
Hf-180	3.140E-05	3.140E-05	3.140E-05	3.140E-05	3.140E-05	3.140E-05	3.140E-05
Hf-182	1.206E-08	1.206E-08	1.206E-08	1.206E-08	1.206E-08	1.206E-08	1.206E-08
Ta-181	1.695E-06	1.695E-06	1.695E-06	1.695E-06	1.695E-06	1.695E-06	1.695E-06
Ta-182	6.075E-14	1.160E-15	4.310E-16	4.220E-16	4.219E-16	4.219E-16	4.219E-16
W-182	1.928E-07	1.928E-07	1.928E-07	1.928E-07	1.928E-07	1.928E-07	1.928E-07
W-183	4.841E-07	4.841E-07	4.841E-07	4.841E-07	4.841E-07	4.841E-07	4.841E-07
W-184	6.798E-08	6.798E-08	6.798E-08	6.798E-08	6.798E-08	6.798E-08	6.798E-08
W-186	5.955E-12	5.955E-12	5.955E-12	5.955E-12	5.955E-12	5.955E-12	5.955E-12
Re-185	2.788E-10	2.788E-10	2.788E-10	2.788E-10	2.788E-10	2.788E-10	2.788E-10
Re-187	6.473E-13	6.473E-13	6.473E-13	6.473E-13	6.473E-13	6.473E-13	6.473E-13
Os-186	9.570E-11	9.570E-11	9.570E-11	9.570E-11	9.570E-11	9.570E-11	9.570E-11
Os-188	5.660E-14	5.660E-14	5.660E-14	5.660E-14	5.660E-14	5.660E-14	5.660E-14
Os-189	1.043E-15	1.043E-15	1.043E-15	1.043E-15	1.043E-15	1.043E-15	1.043E-15
Total	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00

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