

***Supplement to Evaluation of
Naval Reactors Facility
Radioactive Waste Disposed
of at the Radioactive Waste
Management Complex from
1953 to 1999***

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**Idaho
Completion
Project**

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ABSTRACT

This report provides updated radionuclide inventory estimates for waste sent by the U.S. Department of Energy Naval Reactors Program for permanent landfill disposal at the Idaho National Laboratory's Subsurface Disposal Area. Waste disposal streams are identified based upon the waste type (i.e., activated metal, fuel material, and miscellaneous waste) The radionuclide source term for each of the waste streams presented in this report includes radionuclide contaminants of interest to the Operable Unit 7-13/14 remedial investigation/feasibility study and the performance assessment/composite analysis for the active low-level waste landfill at the Subsurface Disposal Area.

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ACRONYMS

APAC	alkaline permanganate ammonium citrate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
DOE-IBO	U.S. Department of Energy—Pittsburgh Naval Reactors Office Idaho Branch Office
ECF	Expended Core Facility
HDT	Historical Data Task
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
NRF	Naval Reactors Facility
OU	operable unit
PA/CA	performance assessment/composite analysis
PWR	pressurized water reactor
RI/FS	remedial investigation/feasibility study
RPDT	Recent and Projected Data Task
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
TSA	Transuranic Storage Area

Supplement to Evaluation of Naval Reactors Facility Radioactive Waste Disposed of at the Radioactive Waste Management Complex from 1953 to 1999

1. INTRODUCTION

This report provides updated radionuclide inventory estimates for waste sent by the U.S. Department of Energy (DOE) Naval Reactors Program to the Idaho National Laboratory (INL) for permanent landfill disposal at the Subsurface Disposal Area (SDA). The SDA occupies a portion of the Radioactive Waste Management Complex (RWMC), and is being assessed in a remedial investigation/feasibility study (RI/FS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.). The SDA also contains an active low-level waste landfill subject to performance assessment/composite analysis (PA/CA) in accordance with DOE Order 435.1, "Radioactive Waste Management." The RI/FS and the PA/CA fall within the purview of the U.S. Department of Energy Idaho Operations Office (DOE Idaho), whereas operations at the Naval Reactors Facility (NRF) are managed by the U.S. Department of Energy, Pittsburgh Naval Reactors Office Idaho Branch Operations (DOE-IBO).

Collectively, the buried waste is referred to as the source term. Parameters that describe characteristics of the source term, such as inventory estimates, are used to simulate release and migration of contaminants from buried waste. Therefore, the radionuclide inventory for the SDA is a critical element for the Operable Unit (OU) -7-13/14 RI/FS. Previous source term inventory estimates contained gaps resulting primarily from modifications to reporting requirements for waste disposal over time. This report is a supplement to the DOE-IBO report, *Evaluation of Naval Reactors Facility Radioactive Waste Dispositioned of at the Radioactive Waste Management Complex*, which is included as Appendix C of this document. Information in this report supersedes all NRF radionuclide inventory data in three previously published inventory reports: (1) *Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried in the Subsurface Disposal Area of the INEL RWMC During Years 1952 – 1983* (LMITCO 1995a); (2) *Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried or Projected to be Buried in the Subsurface Disposal Area of the INEL RWMC during the Years 1984 – 2003* (LMITCO 1995b); and (3) *A Comprehensive Inventory of Radiological and Nonradiological Contaminants in Waste Buried or Projected to be Buried in the Subsurface Disposal Area of the INEEL RWMC During the Years of 1984 to 2003 Supplemental (Volume 1 of 2)* (Little et al. 2001)^a.

1.1 Purpose

The purpose for this report is to provide reasonably complete NRF radiological inventory estimates for the OU -7-13/14 RI/FS and PA/CA (Shuman 2000). For CERCLA, the validity of the source term inventory is fundamental for developing baseline risk assessments, identifying appropriate remedial alternatives, and supporting credible evaluation of remedial alternatives (e.g., containment; in situ treatment; and retrieval, ex situ treatment, and disposal). For the PA/CA, the inventory provides the basis for defining waste acceptance criteria and maintaining authorization for the current low-level waste disposal operation in the SDA under DOE Order 435.1.

^a As indicated in the three report titles, these references evaluate both radiological and nonradiological contaminants. Only radionuclide inventories are superseded by estimates presented herein.

1.2 Scope

This report relies heavily on information provided by DOE-IBO and their contract staff at NRF. Historical radiological disposal inventories were reconstructed in close collaboration with NRF personnel using information about waste-generating processes, including reactor characteristics and operating histories. Using the information provided by DOE-IBO (see Appendix C), this report describes NRF disposal histories and documents revised estimates of radioactive contaminants dispositioned from the NRF to the SDA through 1999. The basis and methodology are presented for distributing radionuclide inventories to individual waste shipments over time. Analysis focuses on radionuclide contaminants of interest to OU -7-13/14 (Holdren and Broomfield 2004) and the PA/CA. The radionuclides addressed in this report are as follows: Am-241, C-14, Cl-36, Co-60, Cs-137, H-3, I-129, Nb-94, Ni-59, Ni-63, Np-237, Pu-238, Pu-239, Pu-240, Pu-241, Sr-90, Tc-99, U-233, U-234, U-235, U-236, and U-238.

1.3 Document Organization

Brief descriptions of the following sections of this report are given below:

- **Section 2**—provides a brief history and description of the SDA and a summary history and description of NRF and waste generating processes
- **Section 3**—documents the methods and results of the updated radionuclide waste inventory estimates for NRF for the period 1953 to 1983
- **Section 4**—documents the methods and results of updated radionuclide waste inventory estimates for NRF for the period 1984 through 1999
- **Section 5**—summarizes the inventory assessment analysis
- **Section 6**—lists references cited throughout this report
- **Appendix A**—contains a yearly inventory breakdown of NRF shipments during the HDT (LMITCO 1995a) period from 1953 to 1983
- **Appendix B**—contains a yearly inventory breakdown of NRF shipments during the RPDT (LMITCO 1995b) period from 1984 to 1999
- **Appendix C**—contains a copy of the DOE-IBO radiological waste inventory report, which provides detailed information used to develop best-estimate and upper-bound estimates for each radionuclide addressed in this report.

2. BACKGROUND

The INL is a DOE facility located 52 km (32 mi) west of Idaho Falls, Idaho and occupies 2,305 km² (890 mi²) of the northeastern portion of the Eastern Snake River Plain (Figure 1). Locations of RWMC and NRF at INL also are shown in Figure 1. Subsections that follow briefly describe the background of these two facilities, and a summary of the NRF wastes disposed of at the SDA.

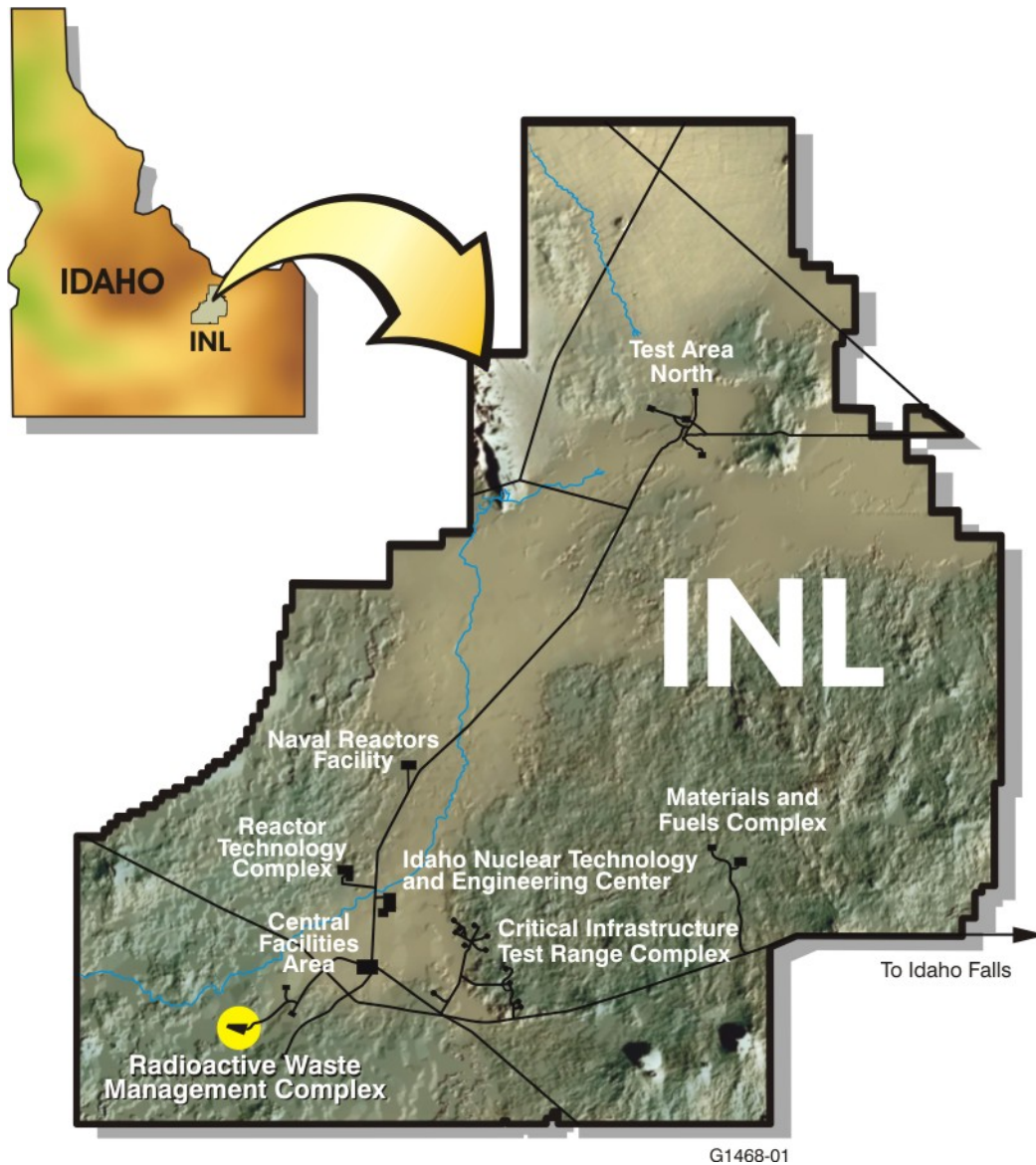


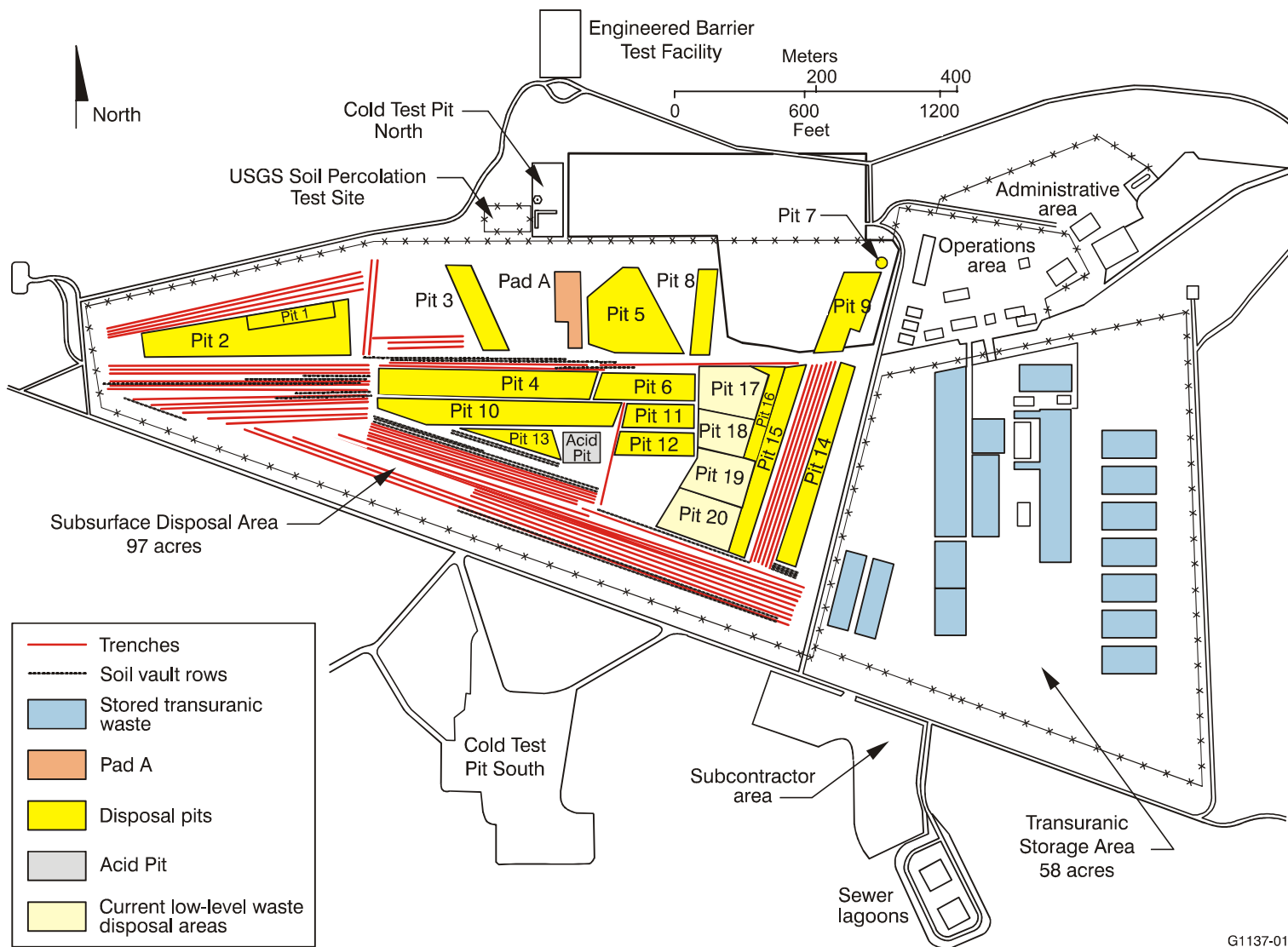
Figure 1. Map of the Idaho National Laboratory showing the location of the Radioactive Waste Management Complex, the Naval Reactors Facility, and other major facilities.

2.1 Brief History and Description of the Subsurface Disposal Area

Located in the southwestern quadrant of INL, RWMC comprises 72 ha (177 acres) subdivided into three separate areas by function: the SDA, the Transuranic Storage Area (TSA), and the administration and operations area. The SDA is a radioactive waste landfill. Contaminants in the landfill include hazardous chemicals, remote-handled fission and activation products, and transuranic radionuclides. A map of RWMC is shown in Figure 2. The original landfill, established in 1952, was called the National Reactor Testing Station Burial Ground. Now part of the SDA, the original landfill covered 5.2 ha (13 acres) and was used for shallow-land disposal of solid radioactive waste. In 1958, the disposal area was expanded to 35.6 ha (88 acres). Relocating the security fence in 1988 outside the dike surrounding the landfill established the SDA's current size as 39 ha (97 acres). The TSA was added to RWMC in 1970. Located directly east of the SDA, the TSA's 23 ha (58 acres) is used to store, prepare, and ship retrievable transuranic waste to the Waste Isolation Pilot Plant in Carlsbad, New Mexico. The 9-ha (22-acre) administration and operations area at RWMC includes administrative offices, maintenance buildings, equipment storage, and miscellaneous support facilities.

2.2 Brief History and Description of the Naval Reactors Facility

The Naval Reactors Facility was established in the early 1950s for the construction, operation, and testing of prototype Naval nuclear propulsion plants. Three prototype power plant facilities were built and operated over a 42-year period; additionally, the Expanded Core Facility (ECF) was designed, built, and used to examine and test nuclear fuel material. Appendix C provides a detailed history of the facilities and operations at NRF pertinent to the generation of radiological waste. These facilities include the prototype Naval nuclear propulsion plants: S1W, A1W, and S5G. Also included in the NRF facility description is a description of the Shippingport Atomic Power Station, the first commercial power reactor in the United States. Irradiated fuel material from the Shippingport Atomic Power Station was sent to the ECF for examination and testing.



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Figure 2. Map of the Radioactive Waste Management Complex.

3. ESTIMATED RADIOLOGICAL INVENTORIES FOR 1953 THROUGH 1983

The waste inventory data compiled for the HDT timeframe of 1953 through 1983 (LMITCO 1995a) were revised to include new information and to develop more detailed waste characterization required for the OU -7-13/14 comprehensive RI/FS. The primary goal of revising the original radiological inventory estimates was to more thoroughly evaluate and characterize waste disposals related to:

- General plant waste, fuel material, and process wastes from prototype power plants
- Fuel material waste from the Shippingport reactor pressurized water reactor (PWR)-1 core
- Miscellaneous ECF waste streams, such as activated metal end pieces, resins, sludge, and fuel material waste generated during ECF operations and by hot cell examination of Navy fuel material test specimens.

3.1 Revised Waste Disposal Streams

The original waste stream descriptions in the HDT for NRF were changed from identifying waste by the process or reactor that generated it to identifying waste streams by similar type of material. These modified waste stream descriptions more accurately reflect waste types and inventories. Modified waste stream codes and descriptions for 1953 through 1983, the HDT timeframe, are discussed below. Table 1 maps the original HDT waste stream codes and descriptions, and the modified waste stream codes to the NRF waste streams provided in Appendix C.

Waste Stream NRF-MOD-1H (Shippingport natural uranium fuel material, solid, 1960-1968)

In the 1960s, before restrictions on curie content of fission and activation products and actinides, NRF disposed of a small amount of radioactive waste at the SDA containing Shippingport PWR-1 irradiated fuel material. This waste stream includes natural uranium. Most of this waste was in solid form, consisting of individual rods or bundles of rods. Of the 214 kg total of uranium in irradiated PWR fuel material, complete fuel bundles were disposed of containing 190 kg of uranium, and individual rods or partial fuel bundles were disposed of containing 18 kg of uranium. The balance of the inventory was dissolved fuel material as discussed below.

Waste Stream NRF-MOD-2H (Shippingport natural uranium fuel material, dissolved, 1960-1968)

Approximately 3% of the total 214 kg of Shippingport fuel material sent to the SDA was dissolved and absorbed in vermiculite. The fuel material was dissolved in concentrated nitric and hydrofluoric acids for testing and analyses conducted at ECF. This waste contains natural uranium.

Waste Stream NRF-MOD-3H (Miscellaneous enriched fuel material, solid, 1960-1971)

Portions of Navy fuel material underwent nondestructive testing and measurements at ECF. Most of this fuel material was then sent to the Idaho Nuclear Technology and Engineering Center (INTEC) for reprocessing; however, some of the fuel material was sent from ECF to the SDA for disposal.

Table 1. Waste stream descriptions for Naval Reactors Program waste streams buried in the Subsurface Disposal Area from 1953 to 1983.

Naval Reactors Facility Waste Streams ^a	Historical Data Task Waste Stream Descriptions ^b		Revised Waste Stream Descriptions ^c	
	Waste Stream Number	Description of Waste	Revised Waste Stream Number	Description of Waste
Shippingport natural uranium fuel material (solid) (1960-1968)	Not specifically identified in HDT		NRF-MOD-1H	Shippingport natural uranium fuel material, solid (1960-1968)
Shippingport natural uranium fuel material (dissolved) (1960-1968)	NRF-618-1H	Dissolved PWR irradiated fuel material absorbed in vermiculite	NRF-MOD-2H	Shippingport natural uranium fuel material, dissolved (1960-1968)
Miscellaneous enriched fuel material (solid) (1953-1971)	Not specifically identified in HDT		NRF-MOD-3H	Miscellaneous enriched fuel material, solid (1953-1971)
Miscellaneous enriched fuel material (dissolved) (1953-1971)	Not specifically identified in HDT		NRF-MOD-4H	Miscellaneous enriched fuel material, dissolved (1953-1973)
Miscellaneous natural uranium fuel material (solid) (1953-1971)	Not specifically identified in HDT		NRF-MOD-5H	Miscellaneous natural fuel material, solid (1953-1971)
Unirradiated natural uranium (1963-1970)				
Core structural (1953-1997)	NRF-618-2H	Structural components from Navy core fuel bundles, end boxes, and other components (1955-1975)	NRF-MOD-6H	Core structural materials (1953-1983)
	NRF-618-3H	Structural components from Navy core fuel bundles, end boxes, and other components (1976-1980)		
	NRF-618-4H	Structural components from Navy core fuel bundles, end boxes, and other components (1981-1983)		
Zirconium chips (1953-1975)	NRF-618-5H	Zircaloy cladding from Navy cores	NRF-MOD-7H	Zirconium chips from ECF operations (1953-1975)
Liquid/APAC ^d /oil (1953-1971)	NRF-618-6H	Solidified sludge, resin, and waste liquids in vermiculite	NRF-MOD-8H	Liquid, APAC ^d , and oil from ECF and prototype plant operations (1953-1971)

Table 1. (continued).

Naval Reactors Facility Waste Streams ^a	Historical Data Task Waste Stream Descriptions ^b		Revised Waste Stream Descriptions ^c	
	Waste Stream Number	Description of Waste	Revised Waste Stream Number	Description of Waste
Sludge/resin (1953-1971)	NRF-618-6H	Solidified sludge, resin, and waste liquids in vermiculite	NRF-MOD-9H	Sludge and resins from ECF and prototype plant operations (1953-1971)
Routine/miscellaneous (1953-1993)	NRF-601-1H	Low-level compactable and noncompactable waste from operation of S1W reactor and related activities	NRF-MOD-10H	General plant waste—compactable and noncompactable waste from ECF and prototype plant operations (1953-1983)
	NRF-617-1H	Low-level compactable and noncompactable waste resulting from operation of A1W reactors		
	NRF-617-2H	Lead and asbestos		
	NRF-618-7H	Low-level compactable and noncompactable waste from work at ECF water pits and hot cells		
	NRF-633-1H	Low-level compactable and noncompactable waste resulting from operation of the S5G reactor		

HDT Historical Data Task
 ECF Expended Core Facility
 NRF Naval Reactors Facility
 PWR pressurized water reactor

- a. NRF waste streams defined by DOE-IBO (Appendix C).
- b. Waste streams defined as part of the HDT (LMITCO 1995a).
- c. Revised waste streams.
- d. Alkaline permanganate ammonium citrate (APAC) decontamination solution.

Waste Stream NRF-MOD-4H (Miscellaneous enriched fuel material, dissolved, 1953-1971)

This waste stream was generated at ECF by destructive examination of portions of irradiated fuel elements from Navy cores. The fuel material specimens were typically dissolved using a combination of hydrofluoric and nitric acids. Liquid waste from this destructive testing was highly radioactive and absorbed in vermiculite for stabilization and disposal.

Waste Stream NRF-MOD-5H (Miscellaneous natural uranium fuel material, solid, 1953-1971)

In addition to the natural uranium fuel material associated with the Shippingport fuel material, a one-time disposal of 4.845 kg of U-238 associated with natural fuel material that was irradiated in one of the prototype plants was disposed of in 1967. Four shipments of unirradiated natural uranium fuel material were also disposed of at the SDA.

Waste Stream NRF-MOD-6H (Core structural materials, 1953-1983)

Before shipment of irradiated fuel material to INTEC, structural material was cut from the cores. This scrap material consisted primarily of irradiated stainless steel with some inconel and zircaloy. The scrap material was highly radioactive because of the large quantity of activation products in the metals. This material was remote-handled and shipped to the SDA in shielded scrap casks.

Waste Stream NRF-MOD-7H (Zirconium chips from ECF operations, 1953-1975)

This waste stream was generated from the process of disassembling reactor cores received at ECF. Core structural material was cut from the reactor cores before sending the fuel elements for further examination or reprocessing at INTEC. The zirconium chips were generated during the cutting and milling operations on the fuel elements in the ECF water pits. The maximum size of the chips was $2 \times 187 \times 250$ mm. The materials were collected from the bottom of the ECF water pits and placed into 5-gal cans, which in turn were placed into a scrap cask insert and transported to the SDA.

Waste Stream NRF-MOD-8H (Liquid, APAC, and oil from ECF and prototype plant operations, 1953-1971)

Routine operations at ECF and the prototype power plants generated contaminated liquid and oil. Additionally, APAC decontamination solution was used during operations. The contaminants in this stream were associated with radioactive crud from plant systems and Navy cores from ECF operations; as such, a generic crud profile was used to estimate radionuclide activities in the waste at the time of disposal. The liquid waste was disposed of as free liquid or mixed with diatomaceous earth to form slurry-type material.

Waste Stream NRF-MOD-9H (Sludge and resins from ECF and prototype plant operations, 1953-1971)

Water purification systems were used at ECF and prototype power plants to remove contaminants from storage pools and process water. Waste from these water purification systems included filters, resins, and resin-like materials, which were shipped to the SDA for disposal. Sludge or “crud” was also typically associated with the water systems. Two major sources contributed to this waste stream:

1. The ECF storage pool water (2 to 3 million gal) was purified with celite clarity filters. These filters became unserviceable in 1974 and were replaced with fiberglass resin tanks encased in concrete vaults.
2. Primary coolant resins from the prototype power plants were disposed of every 5 to 8 years. This resin material was contained in shielded carbon steel or stainless steel tanks.

Waste Stream NRF-MOD-10H (General plant waste—compactable and noncompactable waste from ECF and prototype plant operations, 1953-1983)

Routine operations at ECF and the three prototype power plants generated significant quantities of waste. Waste was generated at ECF during receipt and shipment of reactor core and test materials, and during fuel material examination. Routine operation and maintenance of ECF also contributed to general plant waste. Waste was generated by the operation of the prototype power plants by reactor coolant sampling, maintenance and repair, and refueling. These operations required contact with contaminated plant internals, and the waste is primarily compactable (e.g., plastic bags, gloves, shoe covers, blotter paper, and other materials used to contain contamination). In addition to the compactable waste, metal valves, piping sections, or other contaminated objects may have been disposed of with the general plant waste. Most general plant waste would be classified as low-level waste.

3.2 Methodology

Summary radionuclide inventory data presented in this report, comprising inventory totals by nuclide and waste stream, were provided by DOE-IBO (Appendix C) for waste streams NRF-MOD-1H through NRF-MOD-10H. Inventory estimates for waste stream NRF-MOD-10H were developed between DOE Idaho contract staff and DOE-IBO and their contract staff as described in Appendix C.

Information provided by DOE-IBO is the result of extensive research and calculations. Preliminary information was provided in March 2004 (Dixon 2004) to DOE Idaho to support meeting enforceable OU -7-13/14 milestones under the Federal Facility Agreement and Consent Order (DOE-ID 1991). The final DOE-IBO report that documents their efforts and supersedes the information provided in Dixon (2004), was published in 2005, and is included as Appendix C to this report.

Because of the close collaboration between DOE Idaho, DOE-IBO, and respective contract staff, differences between the final DOE-IBO report (Appendix C) and the estimates developed in this report are not significant; however, there are minor differences with regard to disposal dates for fuel materials. These differences were qualitatively evaluated with respect to the baseline risk assessment and analysis of alternatives to be included in the OU -7-13/14 RI/FS, and are addressed in Section 3.6.

3.2.1 Methodology for Distributing Radionuclide Inventory

Radionuclide source terms in the SDA were distributed to individual waste shipments over time using total radionuclide inventories provided by DOE-IBO, and sorted by nuclide and waste stream. The radionuclide inventories were subdivided and distributed to provide a disposal history by year. Radionuclide activities were assigned to individual shipments using the following five-step methodology:

1. Waste shipments were segregated into chronological order and grouping by year, followed by a line-by-line review of the descriptive information for all NRF shipments in the inventory database, and assignment of waste classifications 1 through 10 (corresponding to waste stream codes NRF-MOD-1H through NRF-MOD-10H), as listed in Table 1. In the absence of information suggestive of the waste classification, the shipment was assigned waste classification 10, General Plant Waste.
2. Best-estimate and upper-bound radionuclide activities were assigned to each individual shipment. Except for General Plant Waste, the two waste streams associated with the Shippingport fuel material, and the Miscellaneous Natural Uranium Fuel Material, estimates were obtained by multiplying the reported total activity for a given radionuclide in a given waste stream (provided in Appendix C) by the ratio of the total curies reported on the shipping form to the total curies reported for all NRF shipments.
3. Shippingport fuel material (solid and dissolved, NRF-MOD-1H and NRF-MOD-2H, respectively) was distributed. Accountability records for the Shippingport fuel material (see Appendix C) provide a total uranium mass shipped to the SDA for this waste stream, and list individual shipments and their associated uranium masses. The percentage of uranium in each shipment was calculated from this information, and the weight-based percentage was then used to scale the individual radionuclide activities for each shipment from the totals provided in Appendix C.
4. Radionuclide activities provided by DOE-IBO for Miscellaneous Natural Uranium Fuel Material and Unirradiated Natural Uranium waste streams identified in Appendix C were combined into a single waste stream: NRF-MOD-5H, Miscellaneous Natural Fuel Material (solid). Two substeps were taken to assign the radionuclide activities to the shipments associated with this waste stream:
 - a. The accountability record for the single shipment of irradiated natural uranium fuel material was assigned all of the activity associated with the Miscellaneous Natural Uranium Fuel Material waste stream identified in Appendix C.
 - b. Accountability records for the four shipments of unirradiated natural fuel material (see Appendix C) provide a total uranium mass shipped to the SDA for this waste stream, and list individual shipments and their associated uranium masses. The percentage of uranium in each shipment was calculated from this information, and the weight-based percentage was then used to scale the individual uranium isotope activities for each shipment from the totals listed for the Unirradiated Natural Uranium waste stream provided in Appendix C.
5. Activities were assigned to disposal forms that did not record radioactivity for the shipment. No information on total activities was available for most shipments in the 1954 to 1956 interval and several shipments (less than 50) in the 1957 to 1983 interval. In these instances, one of two approaches was applied to assign inventories:
 - a. A similar shipment was identified by professional judgment and used as a basis for scaling by weight, volume, exposure rate, or other relevant characteristic.

- b. If a similar shipment could not be identified, the shipment was assigned 1 Ci of activity. Less than 10 shipments were arbitrarily assigned 1 Ci. The potential impact on totals was evaluated by first assigning a value of 0 Ci and then repeating the same calculation using a value of 1 Ci. The impact to the totals was less than 0.01% between the extremes of using zero and 1 Ci. However, failure to identify locations in the SDA with high concentrations of radioactivity could result from this approach.

Resulting radionuclide activities were summed for each radionuclide and for each year in the time interval of 1953 to 1983. Summary totals were checked by comparing calculated total activities to total activities provided in Appendix C. These summary totals per radionuclide per year will be used in RI/FS and PA/CA modeling for the SDA.

Best-estimate inventory summaries are provided in Table 2. Totals exactly match those provided by DOE-IBO for this time frame.

3.3 Uncertainties

Methods used by IBO to estimate comprehensive inventories of radionuclides consist of a combination of deterministic and empirical techniques. These methods were supplemented by assumptions to address bounding conditions, such as the masses of irradiated materials, material compositions, and neutron fluence rates. These supplemental assumptions were defined to produce reasonable best-estimate and upper-bound inventory estimates. Uncertainties associated with radionuclide activities presented in this report were derived on a waste stream basis, and are discussed in detail in Appendix C. Because of the highly variable and shipment-dependent nature of many of the waste streams, standard statistical uncertainty methods were not feasible to define individual uncertainty factors. As in the original HDT report (LMITCO 1995a), methodology for defining the best-estimate activities and associated upper and lower bounds was based on professional (e.g., engineering) judgment and other reasonable assumptions because data were not available to support rigorous statistical error propagation modeling.

Distributing the radionuclide source term across all historical shipments from NRF during the HDT time period included a detailed evaluation of waste descriptions, radionuclide activities, and other information provided on waste disposal records and accountability records. This information was used to correlate individual shipments with specific waste streams. Factors that contribute to the overall uncertainty associated with distributing the radionuclide inventory include: accuracy of reported curie content listed in shipping records, completeness of shipping records, and individual shipments containing multiple waste streams. Minor discrepancies exist between DOE-IBO and the records maintained in the OU 7-13/14 inventory database. The discrepancies are noted for disposal dates associated with the miscellaneous enriched and natural uranium fuel material waste streams (NRF-MOD-3H, NRF-MOD-4H, and NRF-MOD-5H). Although there are minor discrepancies in the dates listed in Tables A-3, A-4, and A-5 and those provided in Appendix C Tables 6, 7, 8, and 9, the total activities for each radionuclide associated with these waste streams are accounted for. In view of the long half-lives for the radionuclides of interest, these minor date discrepancies are not significant for the OU 7-13/14 RI/FS.

Table 2. Best-estimate radionuclide inventory by waste stream for 1953 through 1983.

Radionuclide	NRF-MOD-1H (Ci)	NRF-MOD-2H (Ci)	NRF-MOD-3H (Ci)	NRF-MOD-4H (Ci)	NRF-MOD-5H (Ci)	NRF-MOD-6H (Ci)	NRF-MOD-7H (Ci)	NRF-MOD-8H (Ci)	NRF-MOD-9H (Ci)	NRF-MOD-10H (Ci)
Am-241	1.08E+01	2.85E-01	2.38E-03	1.52E-03	2.51E-01	1.09E-01	1.78E-03	1.78E-03	8.95E-03	3.47E-01
C-14	2.84E-02	7.49E-04	2.36E-07	1.51E-07	6.60E-04	3.82E+01	3.28E+00	4.05E+00	1.65E+01	—
Cl-36	—	—	—	—	—	1.58E-01	4.95E-03	—	—	—
Co-60	—	—	—	—	—	4.75E+05	—	5.05E+02	2.54E+03	9.92E+04
Cs-137	1.06E+04	2.80E+02	2.07E+02	1.33E+02	2.46E+02	7.09E+00	4.49E-01	2.03E-01	1.02E+00	3.97E+01
H-3	4.62E+01	1.22E+00	8.17E-01	5.23E-01	1.07E+00	1.09E+02	6.70E+00	—	—	—
I-129	3.90E-03	1.03E-04	4.94E-05	3.16E-05	9.06E-05	3.82E-05	1.73E-07	2.03E-05	1.01E-04	3.97E-03
Nb-94	1.37E-05	3.62E-07	8.59E-08	5.50E-08	3.19E-07	5.06E+00	2.74E-03	1.02E-01	5.10E-01	1.98E+01
Ni-59	—	—	—	—	—	1.17E+03	3.93E-02	1.52E+00	7.65E+00	2.98E+02
Ni-63	—	—	—	—	—	1.32E+05	4.97E+00	1.52E+02	7.65E+02	1.58E+04
Np-237	2.66E-03	7.03E-05	9.70E-04	6.20E-04	6.19E-05	—	1.16E-06	1.52E-08	7.65E-08	2.98E-06
Pu-238	1.18E+01	3.12E-01	3.75E+00	2.40E+00	2.75E-01	6.93E-02	2.37E-03	1.27E-03	6.40E-03	2.48E-01
Pu-239	4.43E+01	1.17E+00	7.74E-03	4.96E-03	1.03E+00	1.64E-01	1.35E-02	2.03E-04	1.02E-03	3.97E-02
Pu-240	3.86E+01	1.02E+00	2.23E-03	1.42E-03	8.98E-01	1.01E-01	4.72E-03	1.27E-04	6.40E-04	2.48E-02
Pu-241	3.03E+03	8.01E+01	1.14E+00	7.30E-01	7.05E+01	8.57E+00	3.13E-01	5.05E-02	2.55E-01	9.92E+00
Sr-90	6.24E+03	1.65E+02	2.06E+02	1.32E+02	1.45E+02	3.74E+00	2.72E-01	2.03E-01	1.02E+00	4.78E+01
Tc-99	1.49E+00	3.93E-02	2.85E-02	1.83E-02	3.46E-02	2.03E-02	9.02E-05	5.05E-03	2.56E-02	9.92E-01
U-233	1.44E-06	3.80E-08	4.27E-07	2.73E-07	3.35E-08	—	8.79E-05	1.37E-06	6.90E-06	2.68E-04
U-234	5.80E-02	1.53E-03	7.01E-03	4.49E-03	1.29E-02	1.09E-04	7.87E-06	1.52E-06	7.70E-06	2.98E-04
U-235	9.43E-04	2.49E-05	8.60E-05	5.50E-05	5.49E-04	3.12E-06	2.00E-07	1.07E-10	5.35E-10	2.08E-08
U-236	1.00E-02	2.65E-04	8.78E-04	5.62E-04	2.33E-04	1.01E-05	6.08E-07	5.60E-09	2.81E-08	1.09E-06
U-238	6.84E-02	1.81E-03	3.75E-07	2.40E-07	1.29E-02	1.17E-04	7.07E-06	2.49E-08	1.25E-07	4.86E-06

4. ESTIMATED RADIOLOGICAL INVENTORIES FOR 1984 THROUGH 1999

The same approach described in Section 3 for the HDT timeframe, with only minor differences, was applied to develop revised inventory estimates for the RPDT timeframe. Elements specific to the RPDT period from 1984 through 1999 are described herein. Estimates for 1984 through 1997 are based on information supplied by DOE-IBO, while data for 1998 and 1999 are taken from the RPDT Supplement (Little et al. 2001). The RPDT Supplement developed estimates for 1994 through 1999; information supplied by NRF is replacing estimates in the RPDT Supplement for 1994 through 1997 and data from the RPDT Supplement for 1998 and 1999 are being duplicated here for completeness. Other differences from the HDT timeframe are described in sections that follow.

4.1 Revised Disposal Waste Streams

Waste generated at NRF during the RPDT timeframe for disposal at the SDA consisted of process wastes from prototype power plants and ECF. The original waste stream descriptions in the RPDT for NRF were changed from identifying waste by the process or reactor that generated it to identifying waste streams by similar type of material. These modified waste stream descriptions more accurately reflect waste types and inventories. Modified waste stream codes and descriptions for 1984 through 1999, the RPDT timeframe, are discussed below. Table 3 maps the original RPDT waste stream codes and descriptions, and the revised waste stream codes to the NRF waste streams provided in Appendix C.

Waste Stream NRF-MOD-6R (Core structural materials, 1984-1997)

Waste Stream NRF-MOD-6S (Core structural materials, 1998-1999)

Before shipment of irradiated fuel material to INTEC, structural material was cut from the cores at ECF. This scrap material consisted primarily of irradiated stainless steel with some inconel and zircaloy. The scrap material was highly radioactive because of the large quantity of activation products in the metals. This material was remote-handled, and shipped to the SDA in shielded scrap casks (LMITCO 1995b).

Waste Stream NRF-MOD-10R (General plant waste—compactable and noncompactable waste from ECF and prototype plant operations, 1984-1993)

Waste Stream NRF-MOD-10S (General plant waste—compactable and noncompactable waste from ECF and prototype plant operations, 1994-1999)

Routine operations at ECF and the three prototype power plants generated significant quantities of waste. Waste was generated at ECF by fuel material examination, and receipt and shipment of core materials and test materials. Routine operation and maintenance of ECF also contributed to general plant waste. Waste was generated by the operation of the prototype power plants by reactor coolant sampling, maintenance and repair, and refueling. These operations required contact with contaminated plant internals, and the waste is primarily compactable (e.g., plastic bags, gloves, shoe covers, blotter paper, and other materials used to contain contamination). In addition to the compactable waste, metal valves, piping sections, or other contaminated objects may have been disposed of with the general plant waste. Most general plant waste would be classified as low-level waste.

Table 3. Waste stream descriptions for Naval Reactors Program waste streams buried in the Subsurface Disposal Area from 1984 to 1999.

Naval Reactors Facility Waste Streams ^a	Recent and Projected Waste Stream Descriptions ^b		Revised Waste Stream Descriptions ^c	
	Waste Stream Number	Description of Waste	Revised Waste Stream Number	Description of Waste
Core structural (1953-1997)	NRF-618-4R	Structural components removed from nuclear fuel modules (e.g., end boxes) 1984 to 1988 (LMITCO 1995b)	NRF-MOD-6R	Core structural materials (1984-1997)
	NRF-618-8R	Structural components removed from nuclear fuel modules (e.g., end boxes) 1989 to 1993 (LMITCO 1995b)	NRF-MOD-6S	
	NRF-618-8	Structural components removed from nuclear fuel modules 1994 to 1999 (Little et al. 2001)		Core Structural materials (1998-1999)
Routine/miscellaneous (1953-1993)	NRF-601-2	Contaminated soil, gravel, brick, and concrete rubble from the deactivation, decontamination, and decommissioning of the S1W evaporation pond (Little et al. 2001)	NRF-MOD-10R	General plant waste – Compactable and noncompactable waste from ECF and prototype plant operations (1984-1993)
	NRF-617-1R	Low-level compactable and noncompactable waste resulting from operation of the prototype reactors and related activities from 1984 to 1993 (LMITCO 1995b)		
	NRF-617-2R	Lead and asbestos 1984 to 1993 (LMITCO 1995b)		
	NRF-618-6R	Solidified sludge, resin, waste liquids in vermiculite, Radioactive Waste Disposal System waste 1984 to 1993 (LMITCO 1995b)	NRF-MOD-10S	General plant waste – Compactable and noncompactable waste from ECF and prototype plant operations (1994-1999)
	NRF-618-6	Resin and resin containers removed from the Naval Reactors Facility prototypes (Little et al. 2001)		
	NRF-618-7R	Low-level compactable waste resulting from work at the ECF water pits and hot cells 1984 to 1993 (LMITCO 1995b)		
	NRF-618-7	Low-level compactable and noncompactable waste resulting from work at the prototypes, the ECF water pits, and the ECF hot cells (Little et al. 2001)		
	NRF-618-9	Concrete and concrete residue generated from decommissioning ECF hot cells and prototypes. Concrete and metal surfaces contain polychlorinated biphenyl in the form of dried paint (Little et al. 2001)		
	NRF-618-AA	One-time waste stream of contaminated, radioactive oil solidified in Petroset (Little et al. 2001)		

RPDT Recent and Projected Data Task

ECF Expended Core Facility

NRF Naval Reactors Facility

PWR pressurized water reactor

a. NRF waste streams defined by IBO (Appendix C).

b. Waste streams defined as part of the RPDT (LMITCO 1995b, Little et al. 2001).

c. Revised waste streams.

4.2 Methodology

The same methodologies described in Section 3.2 for the HDT timeframe was applied to develop revised estimates and distribute those estimates to waste shipments for the RPDT timeframe. Best-estimate radionuclide inventories by waste stream are provided in Table 4. For waste streams NRF-MOD-6R from 1984 through 1997, and NRF-MOD-10R from 1984 through 1993, totals exactly match those provided by DOE-IBO for these time frames. Totals for NRF-MOD-6S from 1998 and 1999, and NRF-MOD-10S from 1994 through 1999 match those in the RPDT Supplement (Little et al. 2001).

Table 4. Best-estimate radionuclide inventory (Ci) by waste stream for 1984 through 1999.

Radionuclide	NRF-MOD-6R (Ci)	NRF-MOD-10R (Ci)	NRF-MOD-6S (Ci)	NRF-MOD-10S (Ci)
Am-241	3.09E-02	7.62E-02	—	1.06E-03
C-14	1.08E+01	—	4.39E-01	6.76E-01
Cl-36	4.49E-02	—	8.23E-03	2.98E-04
Co-60	1.35E+05	2.18E+04	1.46E+03	5.88E+01
Cs-137	2.01E+00	8.72E+00	4.43E-02	9.50E-01
H-3	3.09E+01	—	2.68E+00	1.11E+01
I-129	1.08E-05	8.72E-04	3.89E-08	8.99E-04
Nb-94	1.44E+00	4.36E+00	1.32E-01	1.02E-01
Ni-59	3.31E+02	6.54E+01	2.22E+01	1.44E+00
Ni-63	3.76E+04	3.48E+03	2.67E+03	1.38E+02
Np-237	—	6.54E-07	—	—
Pu-238	1.97E-02	5.44E-02	—	4.55E-03
Pu-239	4.64E-02	8.72E-03	—	1.38E-04
Pu-240	2.87E-02	5.44E-03	—	1.40E-04
Pu-241	2.43E+00	2.18E+00	5.36E-02	2.03E-02
Sr-90	1.06E+00	8.72E+00	5.85E-02	4.28E-01
Tc-99	5.74E-03	2.18E-01	4.97E-04	1.87E-03
U-233	—	5.89E-05	—	—
U-234	3.09E-05	6.54E-05	—	—
U-235	8.84E-07	4.58E-09	—	2.98E-06
U-236	2.87E-06	2.40E-07	—	—
U-238	3.31E-05	1.07E-06	—	5.26E-08

4.3 Uncertainties

Uncertainties associated with radionuclide inventories for the period 1984 through 1997 are identical to those presented in Section 3.3 for the period 1953 through 1983. It should be noted that during this later period, waste disposal records were typically of higher quality (e.g., contained more complete information regarding waste content, and listed activities for more radionuclides). Uncertainties associated with the radionuclide activities presented in this report were derived on a waste stream basis, and are discussed in detail in Appendix C for the period 1984 through 1997, and in Little et al. (2001) for the years 1994 through 1999.

5. CONCLUSIONS AND RECOMMENDATIONS

This report documents distribution of the NRF radionuclide source term across all documented NRF waste disposal shipments sent to the SDA during the HDT, RPDT, and RPDT Supplement periods from 1953 through 1999. Best estimates from the three timeframes are presented in Table 5. The combined inventories shown in Table 5 are compiled from separate inventories presented in Sections 3 and 4.

This report presents best-estimate (Appendix A) and upper-bound (Appendix B) radionuclide inventories associated with NRF operations. Estimates are based on totals by waste stream provided by DOE-IBO (Appendix C). Technically defensible estimates of radionuclide activities for individual waste shipments from NRF to the SDA were developed from detailed investigations and reviews of shipping and waste records, nuclear material accountability forms, and extensive deterministic calculations using known irradiation histories of these waste streams.

Table 5. Summary of the Naval Reactors Facility best-estimate radionuclide inventories in waste sent to the Subsurface Disposal Area from 1953 through 1999.

Radionuclide	1953 through 1983 (Ci)	1984 through 1997 ^a (Ci)	1994 through 1999 ^b (Ci)	Total 1953 through 1999 (Ci)
Am-241	1.18E+01	1.07E-01	1.06E-03	1.19E+01
C-14	6.20E+01	1.08E+01	1.12E+00	7.40E+01
Cl-36	1.63E-01	4.49E-02	8.53E-03	2.16E-01
Co-60	5.77E+05	1.57E+05	1.52E+03	7.36E+05
Cs-137	1.15E+04	1.07E+01	9.95E-01	1.15E+04
H-3	1.66E+02	3.09E+01	1.37E+01	2.10E+02
I-129	8.30E-03	8.83E-04	8.99E-04	1.01E-02
Nb-94	2.55E+01	5.80E+00	2.34E-01	3.15E+01
Ni-59	1.48E+03	3.97E+02	2.36E+01	1.90E+03
Ni-63	1.49E+05	4.10E+04	2.81E+03	1.93E+05
Np-237	4.39E-03	6.54E-07	—	4.39E-03
Pu-238	1.89E+01	7.41E-02	4.55E-03	1.89E+01
Pu-239	4.67E+01	5.51E-02	1.38E-04	4.68E+01
Pu-240	4.07E+01	3.42E-02	1.40E-04	4.07E+01
Pu-241	3.20E+03	4.61E+00	7.38E-02	3.21E+03
Sr-90	6.93E+03	9.78E+00	4.87E-01	6.94E+03
Tc-99	2.65E+00	2.24E-01	2.37E-03	2.88E+00
U-233	3.66E-04	5.89E-05	—	4.25E-04
U-234	8.43E-02	9.63E-05	—	8.44E-02
U-235	1.66E-03	8.88E-07	2.98E-06	1.67E-03
U-236	1.19E-02	3.11E-06	—	1.20E-02
U-238	8.32E-02	3.42E-05	5.26E-08	8.33E-02

^aExcludes waste stream NRF-MOD-10S.

^bIncludes waste streams NRF-MOD-6S and NRF-MOD-10S.

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Appendix A

Naval Reactors Facility Radionuclide Inventory for Years 1953 through 1983

Appendix A

Naval Reactors Facility Radionuclide Inventory for Years 1953 through 1983

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Table A-1. NRF-MOD-1H best-estimate inventory summary (1962-1968).

	1962	1965	1967	1968	Totals
Am-241	1.87E-01	8.25E-02	1.39E-01	1.04E+01	1.08E+01
C-14	4.91E-04	2.17E-04	3.66E-04	2.73E-02	2.84E-02
Cl-36	—	—	—	—	—
Co-60	—	—	—	—	—
Cs-137	1.83E+02	8.10E+01	1.37E+02	1.02E+04	1.06E+04
H-3	7.99E-01	3.53E-01	5.95E-01	4.45E+01	4.62E+01
I-129	6.74E-05	2.98E-05	5.02E-05	3.75E-03	3.90E-03
Nb-94	2.37E-07	1.05E-07	1.76E-07	1.32E-05	1.37E-05
Ni-59	—	—	—	—	—
Ni-63	—	—	—	—	—
Np-237	4.60E-05	2.03E-05	3.43E-05	2.56E-03	2.66E-03
Pu-238	2.04E-01	9.02E-02	1.52E-01	1.14E+01	1.18E+01
Pu-239	7.66E-01	3.39E-01	5.71E-01	4.26E+01	4.43E+01
Pu-240	6.67E-01	2.95E-01	4.97E-01	3.71E+01	3.86E+01
Pu-241	5.24E+01	2.32E+01	3.90E+01	2.92E+03	3.03E+03
Sr-90	1.08E+02	4.77E+01	8.04E+01	6.00E+03	6.24E+03
Tc-99	2.58E-02	1.14E-02	1.92E-02	1.43E+00	1.49E+00
U-233	2.49E-08	1.10E-08	1.85E-08	1.39E-06	1.44E-06
U-234	1.00E-03	4.43E-04	7.47E-04	5.58E-02	5.80E-02
U-235	1.63E-05	7.21E-06	1.21E-05	9.07E-04	9.43E-04
U-236	1.73E-04	7.64E-05	1.29E-04	9.62E-03	1.00E-02
U-238	1.18E-03	5.23E-04	8.81E-04	6.58E-02	6.84E-02

Table A-2. NRF-MOD-2H best-estimate inventory summary (1960-1964).

	1960	1961	1962	1964	Totals
Am-241	5.36E-02	6.47E-02	1.52E-01	1.49E-02	2.85E-01
C-14	1.41E-04	1.70E-04	3.99E-04	3.92E-05	7.49E-04
Cl-36	—	—	—	—	—
Co-60	—	—	—	—	—
Cs-137	5.26E+01	6.35E+01	1.49E+02	1.47E+01	2.80E+02
H-3	2.29E-01	2.77E-01	6.50E-01	6.39E-02	1.22E+00
I-129	1.94E-05	2.34E-05	5.49E-05	5.39E-06	1.03E-04
Nb-94	6.81E-08	8.21E-08	1.93E-07	1.90E-08	3.62E-07
Ni-59	—	—	—	—	—
Ni-63	—	—	—	—	—
Np-237	1.32E-05	1.60E-05	3.75E-05	3.68E-06	7.03E-05
Pu-238	5.87E-02	7.08E-02	1.66E-01	1.63E-02	3.12E-01
Pu-239	2.20E-01	2.65E-01	6.23E-01	6.13E-02	1.17E+00
Pu-240	1.92E-01	2.31E-01	5.43E-01	5.34E-02	1.02E+00
Pu-241	1.51E+01	1.82E+01	4.27E+01	4.19E+00	8.01E+01
Sr-90	3.10E+01	3.74E+01	8.79E+01	8.64E+00	1.65E+02
Tc-99	7.39E-03	8.92E-03	2.09E-02	2.06E-03	3.93E-02
U-233	7.14E-09	8.62E-09	2.02E-08	1.99E-09	3.80E-08
U-234	2.88E-04	3.47E-04	8.15E-04	8.01E-05	1.53E-03
U-235	4.68E-06	5.65E-06	1.33E-05	1.30E-06	2.49E-05
U-236	4.98E-05	6.01E-05	1.41E-04	1.39E-05	2.65E-04
U-238	3.40E-04	4.11E-04	9.64E-04	9.48E-05	1.81E-03

Table A-3. NRF-MOD-3H best-estimate inventory summary (1965-1971).

	1965	1966	1967	1968	1969	1970	1971	Totals
Am-241	3.60E-05	2.06E-05	1.96E-03	8.03E-05	2.34E-04	5.36E-05	4.72E-08	2.38E-03
C-14	3.57E-09	2.04E-09	1.94E-07	7.96E-09	2.32E-08	5.31E-09	4.68E-12	2.36E-07
Cl-36	—	—	—	—	—	—	—	—
Co-60	—	—	—	—	—	—	—	—
Cs-137	3.13E+00	1.79E+00	1.70E+02	6.98E+00	2.04E+01	4.66E+00	4.11E-03	2.07E+02
H-3	1.24E-02	7.07E-03	6.71E-01	2.76E-02	8.04E-02	1.84E-02	1.62E-05	8.17E-01
I-129	7.48E-07	4.27E-07	4.06E-05	1.67E-06	4.86E-06	1.11E-06	9.80E-10	4.94E-05
Nb-94	1.30E-09	7.43E-10	7.06E-08	2.90E-09	8.46E-09	1.93E-09	1.70E-12	8.59E-08
Ni-59	—	—	—	—	—	—	—	—
Ni-63	—	—	—	—	—	—	—	—
Np-237	1.47E-05	8.39E-06	7.97E-04	3.27E-05	9.55E-05	2.18E-05	1.93E-08	9.70E-04
Pu-238	5.68E-02	3.24E-02	3.08E+00	1.26E-01	3.69E-01	8.44E-02	7.44E-05	3.75E+00
Pu-239	1.17E-04	6.69E-05	6.36E-03	2.61E-04	7.62E-04	1.74E-04	1.54E-07	7.74E-03
Pu-240	3.37E-05	1.93E-05	1.83E-03	7.52E-05	2.20E-04	5.02E-05	4.43E-08	2.23E-03
Pu-241	1.73E-02	9.86E-03	9.37E-01	3.85E-02	1.12E-01	2.57E-02	2.26E-05	1.14E+00
Sr-90	3.12E+00	1.78E+00	1.69E+02	6.95E+00	2.03E+01	4.64E+00	4.09E-03	2.06E+02
Tc-99	4.31E-04	2.46E-04	2.34E-02	9.61E-04	2.81E-03	6.41E-04	5.66E-07	2.85E-02
U-233	6.46E-09	3.69E-09	3.51E-07	1.44E-08	4.20E-08	9.61E-09	8.47E-12	4.27E-07
U-234	1.06E-04	6.06E-05	5.76E-03	2.36E-04	6.90E-04	1.58E-04	1.39E-07	7.01E-03
U-235	1.30E-06	7.44E-07	7.07E-05	2.90E-06	8.47E-06	1.94E-06	1.71E-09	8.60E-05
U-236	1.33E-05	7.59E-06	7.21E-04	2.96E-05	8.64E-05	1.98E-05	1.74E-08	8.78E-04
U-238	5.68E-09	3.24E-09	3.08E-07	1.26E-08	3.69E-08	8.44E-09	7.44E-12	3.75E-07

Table A-4. NRF-MOD-4H best-estimate inventory summary (1960-1973).

	1960	1967	1969	1970	1973	Totals
Am-241	3.45E-06	1.50E-03	5.82E-07	1.35E-05	6.48E-07	1.52E-03
C-14	3.43E-10	1.49E-07	5.78E-11	1.34E-09	6.44E-11	1.51E-07
Cl-36	—	—	—	—	—	—
Co-60	—	—	—	—	—	—
Cs-137	3.02E-01	1.31E+02	5.09E-02	1.18E+00	5.67E-02	1.33E+02
H-3	1.19E-03	5.17E-01	2.00E-04	4.63E-03	2.23E-04	5.23E-01
I-129	7.17E-08	3.12E-05	1.21E-08	2.80E-07	1.35E-08	3.16E-05
Nb-94	1.25E-10	5.43E-08	2.11E-11	4.87E-10	2.35E-11	5.50E-08
Ni-59	—	—	—	—	—	—
Ni-63	—	—	—	—	—	—
Np-237	1.41E-06	6.13E-04	2.37E-07	5.49E-06	2.64E-07	6.20E-04
Pu-238	5.45E-03	2.37E+00	9.19E-04	2.13E-02	1.02E-03	2.40E+00
Pu-239	1.13E-05	4.90E-03	1.90E-06	4.39E-05	2.12E-06	4.96E-03
Pu-240	3.22E-06	1.40E-03	5.44E-07	1.26E-05	6.06E-07	1.42E-03
Pu-241	1.66E-03	7.21E-01	2.79E-04	6.47E-03	3.11E-04	7.30E-01
Sr-90	3.00E-01	1.30E+02	5.05E-02	1.17E+00	5.63E-02	1.32E+02
Tc-99	4.15E-05	1.81E-02	7.00E-06	1.62E-04	7.80E-06	1.83E-02
U-233	6.19E-10	2.70E-07	1.04E-10	2.42E-09	1.16E-10	2.73E-07
U-234	1.02E-05	4.44E-03	1.72E-06	3.98E-05	1.91E-06	4.49E-03
U-235	1.25E-07	5.43E-05	2.11E-08	4.87E-07	2.35E-08	5.50E-05
U-236	1.28E-06	5.55E-04	2.15E-07	4.98E-06	2.40E-07	5.62E-04
U-238	5.45E-10	2.37E-07	9.19E-11	2.13E-09	1.02E-10	2.40E-07

Table A-5. NRF-MOD-5H best-estimate inventory summary (1963-1970).

	1963	1967	1970	Totals
Am-241	—	2.51E-01	—	2.51E-01
C-14	—	6.60E-04	—	6.60E-04
Cl-36	—	—	—	—
Co-60	—	—	—	—
Cs-137	—	2.46E+02	—	2.46E+02
H-3	—	1.07E+00	—	1.07E+00
I-129	—	9.06E-05	—	9.06E-05
Nb-94	—	3.19E-07	—	3.19E-07
Ni-59	—	—	—	—
Ni-63	—	—	—	—
Np-237	—	6.19E-05	—	6.19E-05
Pu-238	—	2.75E-01	—	2.75E-01
Pu-239	—	1.03E+00	—	1.03E+00
Pu-240	—	8.98E-01	—	8.98E-01
Pu-241	—	7.05E+01	—	7.05E+01
Sr-90	—	1.45E+02	—	1.45E+02
Tc-99	—	3.46E-02	—	3.46E-02
U-233	—	3.35E-08	—	3.35E-08
U-234	6.05E-03	1.35E-03	5.45E-03	1.29E-02
U-235	2.77E-04	2.20E-05	2.50E-04	5.49E-04
U-236	—	2.33E-04	—	2.33E-04
U-238	5.94E-03	1.59E-03	5.36E-03	1.29E-02

Table A-6. NRF-MOD-6H best-estimate inventory summary (1954-1964).

	1954	1955	1956	1957	1958	1959	1960	1961	1963	1964
Am-241	1.21E-07	1.18E-04	1.33E-05	2.84E-03	9.44E-06	3.13E-04	5.67E-07	9.06E-07	5.17E-05	4.12E-04
C-14	4.22E-05	4.12E-02	4.66E-03	9.95E-01	3.30E-03	1.10E-01	1.98E-04	3.17E-04	1.81E-02	1.44E-01
Cl-36	1.75E-07	1.71E-04	1.93E-05	4.12E-03	1.37E-05	4.54E-04	8.21E-07	1.31E-06	7.49E-05	5.98E-04
Co-60	5.25E-01	5.13E+02	5.80E+01	1.24E+04	4.11E+01	1.37E+03	2.47E+00	3.95E+00	2.25E+02	1.80E+03
Cs-137	7.83E-06	7.66E-03	8.66E-04	1.85E-01	6.14E-04	2.04E-02	3.68E-05	5.89E-05	3.36E-03	2.68E-02
H-3	1.21E-04	1.18E-01	1.33E-02	2.84E+00	9.44E-03	3.13E-01	5.67E-04	9.06E-04	5.17E-02	4.12E-01
I-129	4.22E-11	4.12E-08	4.66E-09	9.95E-07	3.30E-09	1.10E-07	1.98E-10	3.17E-10	1.81E-08	1.44E-07
Nb-94	5.60E-06	5.47E-03	6.18E-04	1.32E-01	4.38E-04	1.45E-02	2.63E-05	4.21E-05	2.40E-03	1.91E-02
Ni-59	1.29E-03	1.26E+00	1.43E-01	3.05E+01	1.01E-01	3.36E+00	6.07E-03	9.71E-03	5.54E-01	4.42E+00
Ni-63	1.46E-01	1.43E+02	1.62E+01	3.45E+03	1.15E+01	3.81E+02	6.88E-01	1.10E+00	6.28E+01	5.01E+02
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	7.66E-08	7.49E-05	8.47E-06	1.81E-03	6.00E-06	1.99E-04	3.60E-07	5.76E-07	3.29E-05	2.62E-04
Pu-239	1.81E-07	1.77E-04	2.00E-05	4.26E-03	1.42E-05	4.70E-04	8.50E-07	1.36E-06	7.75E-05	6.18E-04
Pu-240	1.12E-07	1.09E-04	1.24E-05	2.64E-03	8.76E-06	2.91E-04	5.26E-07	8.41E-07	4.80E-05	3.83E-04
Pu-241	9.47E-06	9.26E-03	1.05E-03	2.23E-01	7.42E-04	2.46E-02	4.45E-05	7.12E-05	4.06E-03	3.24E-02
Sr-90	4.13E-06	4.04E-03	4.57E-04	9.75E-02	3.24E-04	1.07E-02	1.94E-05	3.11E-05	1.77E-03	1.41E-02
Tc-99	2.24E-08	2.19E-05	2.47E-06	5.28E-04	1.75E-06	5.82E-05	1.05E-07	1.68E-07	9.60E-06	7.66E-05
U-233	—	—	—	—	—	—	—	—	—	—
U-234	1.21E-10	1.18E-07	1.33E-08	2.84E-06	9.44E-09	3.13E-07	5.67E-10	9.06E-10	5.17E-08	4.12E-07
U-235	3.44E-12	3.37E-09	3.80E-10	8.12E-08	2.70E-10	8.95E-09	1.62E-11	2.59E-11	1.48E-09	1.18E-08
U-236	1.12E-11	1.09E-08	1.24E-09	2.64E-07	8.76E-10	2.91E-08	5.26E-11	8.41E-11	4.80E-09	3.83E-08
U-238	1.29E-10	1.26E-07	1.43E-08	3.05E-06	1.01E-08	3.36E-07	6.07E-10	9.71E-10	5.54E-08	4.42E-07

Table A-6 (continued). NRF-MOD-6H best-estimate inventory summary (1965-1974).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Am-241	1.11E-02	2.81E-02	2.74E-02	5.12E-03	2.83E-02	3.29E-03	2.93E-04	4.08E-04	3.17E-04	1.85E-04
C-14	3.90E+00	9.84E+00	9.59E+00	1.79E+00	9.90E+00	1.15E+00	1.02E-01	1.43E-01	1.11E-01	6.46E-02
Cl-36	1.62E-02	4.08E-02	3.97E-02	7.43E-03	4.10E-02	4.77E-03	4.25E-04	5.91E-04	4.60E-04	2.68E-04
Co-60	4.86E+04	1.22E+05	1.19E+05	2.23E+04	1.23E+05	1.43E+04	1.28E+03	1.78E+03	1.38E+03	8.05E+02
Cs-137	7.25E-01	1.83E+00	1.78E+00	3.33E-01	1.84E+00	2.14E-01	1.90E-02	2.65E-02	2.06E-02	1.20E-02
H-3	1.11E+01	2.81E+01	2.74E+01	5.12E+00	2.83E+01	3.29E+00	2.93E-01	4.08E-01	3.17E-01	1.85E-01
I-129	3.90E-06	9.84E-06	9.59E-06	1.79E-06	9.90E-06	1.15E-06	1.02E-07	1.43E-07	1.11E-07	6.46E-08
Nb-94	5.18E-01	1.30E+00	1.27E+00	2.38E-01	1.31E+00	1.53E-01	1.36E-02	1.89E-02	1.47E-02	8.57E-03
Ni-59	1.19E+02	3.01E+02	2.94E+02	5.49E+01	3.03E+02	3.52E+01	3.14E+00	4.37E+00	3.40E+00	1.98E+00
Ni-63	1.35E+04	3.41E+04	3.33E+04	6.22E+03	3.43E+04	3.99E+03	3.56E+02	4.95E+02	3.85E+02	2.24E+02
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	7.09E-03	1.79E-02	1.74E-02	3.26E-03	1.80E-02	2.09E-03	1.86E-04	2.59E-04	2.02E-04	1.17E-04
Pu-239	1.67E-02	4.22E-02	4.11E-02	7.68E-03	4.24E-02	4.93E-03	4.39E-04	6.12E-04	4.76E-04	2.77E-04
Pu-240	1.04E-02	2.61E-02	2.54E-02	4.76E-03	2.63E-02	3.05E-03	2.72E-04	3.79E-04	2.95E-04	1.71E-04
Pu-241	8.76E-01	2.21E+00	2.15E+00	4.02E-01	2.22E+00	2.58E-01	2.30E-02	3.20E-02	2.49E-02	1.45E-02
Sr-90	3.82E-01	9.64E-01	9.40E-01	1.76E-01	9.70E-01	1.13E-01	1.00E-02	1.40E-02	1.09E-02	6.33E-03
Tc-99	2.07E-03	5.22E-03	5.09E-03	9.51E-04	5.25E-03	6.11E-04	5.44E-05	7.57E-05	5.89E-05	3.43E-05
U-233	—	—	—	—	—	—	—	—	—	—
U-234	1.11E-05	2.81E-05	2.74E-05	5.12E-06	2.83E-05	3.29E-06	2.93E-07	4.08E-07	3.17E-07	1.85E-07
U-235	3.19E-07	8.03E-07	7.83E-07	1.46E-07	8.08E-07	9.39E-08	8.37E-09	1.17E-08	9.06E-09	5.28E-09
U-236	1.04E-06	2.61E-06	2.54E-06	4.76E-07	2.63E-06	3.05E-07	2.72E-08	3.79E-08	2.95E-08	1.71E-08
U-238	1.19E-05	3.01E-05	2.94E-05	5.49E-06	3.03E-05	3.52E-06	3.14E-07	4.37E-07	3.40E-07	1.98E-07

Table A-6. (continued). NRF-MOD-6H best-estimate inventory summary (1975-1983).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	Totals
Am-241	1.87E-04	8.84E-05	2.09E-04	4.39E-05	1.47E-04	4.39E-05	2.02E-05	8.11E-06	6.71E-06	1.09E-01
C-14	6.54E-02	3.09E-02	7.31E-02	1.54E-02	5.16E-02	1.54E-02	7.07E-03	2.84E-03	2.35E-03	3.82E+01
Cl-36	2.71E-04	1.28E-04	3.03E-04	6.37E-05	2.14E-04	6.36E-05	2.93E-05	1.18E-05	9.73E-06	1.58E-01
Co-60	8.14E+02	3.85E+02	9.10E+02	1.91E+02	6.42E+02	1.91E+02	8.80E+01	3.54E+01	2.93E+01	4.75E+05
Cs-137	1.21E-02	5.74E-03	1.36E-02	2.86E-03	9.58E-03	2.85E-03	1.31E-03	5.27E-04	4.36E-04	7.09E+00
H-3	1.87E-01	8.84E-02	2.09E-01	4.39E-02	1.47E-01	4.39E-02	2.02E-02	8.11E-03	6.71E-03	1.09E+02
I-129	6.54E-08	3.09E-08	7.31E-08	1.54E-08	5.16E-08	1.54E-08	7.07E-09	2.84E-09	2.35E-09	3.82E-05
Nb-94	8.68E-03	4.10E-03	9.70E-03	2.04E-03	6.84E-03	2.04E-03	9.38E-04	3.77E-04	3.12E-04	5.06E+00
Ni-59	2.00E+00	9.47E-01	2.24E+00	4.71E-01	1.58E+00	4.70E-01	2.16E-01	8.69E-02	7.19E-02	1.17E+03
Ni-63	2.27E+02	1.07E+02	2.54E+02	5.34E+01	1.79E+02	5.33E+01	2.45E+01	9.85E+00	8.15E+00	1.32E+05
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	1.19E-04	5.62E-05	1.33E-04	2.79E-05	9.37E-05	2.79E-05	1.28E-05	5.16E-06	4.27E-06	6.93E-02
Pu-239	2.80E-04	1.33E-04	3.13E-04	6.59E-05	2.21E-04	6.58E-05	3.03E-05	1.22E-05	1.01E-05	1.64E-01
Pu-240	1.74E-04	8.20E-05	1.94E-04	4.08E-05	1.37E-04	4.07E-05	1.88E-05	7.53E-06	6.23E-06	1.01E-01
Pu-241	1.47E-02	6.94E-03	1.64E-02	3.45E-03	1.16E-02	3.45E-03	1.59E-03	6.37E-04	5.27E-04	8.57E+00
Sr-90	6.41E-03	3.03E-03	7.16E-03	1.51E-03	5.05E-03	1.50E-03	6.93E-04	2.78E-04	2.30E-04	3.74E+00
Tc-99	3.47E-05	1.64E-05	3.88E-05	8.16E-06	2.74E-05	8.15E-06	3.75E-06	1.51E-06	1.25E-06	2.03E-02
U-233	—	—	—	—	—	—	—	—	—	—
U-234	1.87E-07	8.84E-08	2.09E-07	4.39E-08	1.47E-07	4.39E-08	2.02E-08	8.11E-09	6.71E-09	1.09E-04
U-235	5.34E-09	2.52E-09	5.97E-09	1.26E-09	4.21E-09	1.25E-09	5.77E-10	2.32E-10	1.92E-10	3.12E-06
U-236	1.74E-08	8.20E-09	1.94E-08	4.08E-09	1.37E-08	4.07E-09	1.88E-09	7.53E-10	6.23E-10	1.01E-05
U-238	2.00E-07	9.47E-08	2.24E-07	4.71E-08	1.58E-07	4.70E-08	2.16E-08	8.69E-09	7.19E-09	1.17E-04

Table A-7. NRF-MOD-7H best-estimate inventory summary (1955-1964).

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Am-241	1.76E-11	6.13E-06	1.85E-06	7.02E-07	1.23E-05	9.33E-06	7.37E-05	8.38E-05	2.14E-04	5.58E-05
C-14	3.24E-08	1.13E-02	3.40E-03	1.29E-03	2.26E-02	1.72E-02	1.36E-01	1.54E-01	3.95E-01	1.03E-01
Cl-36	4.88E-11	1.70E-05	5.13E-06	1.95E-06	3.41E-05	2.59E-05	2.05E-04	2.33E-04	5.96E-04	1.55E-04
Co-60	—	—	—	—	—	—	—	—	—	—
Cs-137	4.43E-09	1.55E-03	4.66E-04	1.77E-04	3.10E-03	2.35E-03	1.86E-02	2.11E-02	5.41E-02	1.41E-02
H-3	6.61E-08	2.31E-02	6.95E-03	2.64E-03	4.62E-02	3.51E-02	2.78E-01	3.15E-01	8.07E-01	2.10E-01
I-129	1.71E-15	5.96E-10	1.79E-10	6.83E-11	1.19E-09	9.07E-10	7.17E-09	8.15E-09	2.08E-08	5.42E-09
Nb-94	2.70E-11	9.44E-06	2.84E-06	1.08E-06	1.89E-05	1.44E-05	1.14E-04	1.29E-04	3.30E-04	8.59E-05
Ni-59	3.88E-10	1.35E-04	4.08E-05	1.55E-05	2.71E-04	2.06E-04	1.63E-03	1.85E-03	4.73E-03	1.23E-03
Ni-63	4.90E-08	1.71E-02	5.15E-03	1.96E-03	3.43E-02	2.61E-02	2.06E-01	2.34E-01	5.99E-01	1.56E-01
Np-237	1.14E-14	4.00E-09	1.20E-09	4.58E-10	8.00E-09	6.08E-09	4.81E-08	5.46E-08	1.40E-07	3.64E-08
Pu-238	2.34E-11	8.16E-06	2.46E-06	9.35E-07	1.63E-05	1.24E-05	9.82E-05	1.12E-04	2.85E-04	7.43E-05
Pu-239	1.33E-10	4.65E-05	1.40E-05	5.33E-06	9.31E-05	7.08E-05	5.59E-04	6.36E-04	1.63E-03	4.23E-04
Pu-240	4.66E-11	1.63E-05	4.90E-06	1.86E-06	3.26E-05	2.47E-05	1.96E-04	2.22E-04	5.68E-04	1.48E-04
Pu-241	3.09E-09	1.08E-03	3.25E-04	1.23E-04	2.16E-03	1.64E-03	1.30E-02	1.47E-02	3.77E-02	9.81E-03
Sr-90	2.68E-09	9.37E-04	2.82E-04	1.07E-04	1.88E-03	1.43E-03	1.13E-02	1.28E-02	3.28E-02	8.52E-03
Tc-99	8.90E-13	3.11E-07	9.35E-08	3.56E-08	6.22E-07	4.73E-07	3.74E-06	4.25E-06	1.09E-05	2.83E-06
U-233	8.67E-13	3.03E-07	9.12E-08	3.47E-08	6.06E-07	4.61E-07	3.64E-06	4.14E-06	1.06E-05	2.75E-06
U-234	7.76E-14	2.71E-08	8.16E-09	3.10E-09	5.43E-08	4.13E-08	3.26E-07	3.71E-07	9.48E-07	2.47E-07
U-235	1.97E-15	6.89E-10	2.07E-10	7.89E-11	1.38E-09	1.05E-09	8.28E-09	9.42E-09	2.41E-08	6.27E-09
U-236	6.00E-15	2.09E-09	6.31E-10	2.40E-10	4.19E-09	3.19E-09	2.52E-08	2.86E-08	7.32E-08	1.91E-08
U-238	6.97E-14	2.43E-08	7.33E-09	2.79E-09	4.88E-08	3.71E-08	2.93E-07	3.33E-07	8.52E-07	2.22E-07

Table A-7. (continued). NRF-MOD-7H best-estimate inventory summary (1965-1975).

	1965	1966	1967	1970	1971	1973	1974	1975	Totals
Am-241	4.85E-04	2.39E-04	5.83E-06	1.75E-04	4.14E-04	1.18E-06	1.19E-06	1.78E-07	1.78E-03
C-14	8.94E-01	4.41E-01	1.07E-02	3.22E-01	7.64E-01	2.17E-03	2.19E-03	3.28E-04	3.28E+00
Cl-36	1.35E-03	6.66E-04	1.62E-05	4.85E-04	1.15E-03	3.27E-06	3.30E-06	4.95E-07	4.95E-03
Co-60	—	—	—	—	—	—	—	—	—
Cs-137	1.22E-01	6.04E-02	1.47E-03	4.40E-02	1.05E-01	2.97E-04	2.99E-04	4.49E-05	4.49E-01
H-3	1.83E+00	9.01E-01	2.19E-02	6.57E-01	1.56E+00	4.43E-03	4.46E-03	6.70E-04	6.70E+00
I-129	4.72E-08	2.33E-08	5.66E-10	1.70E-08	4.03E-08	1.14E-10	1.15E-10	1.73E-11	1.73E-07
Nb-94	7.47E-04	3.69E-04	8.97E-06	2.69E-04	6.38E-04	1.81E-06	1.83E-06	2.74E-07	2.74E-03
Ni-59	1.07E-02	5.29E-03	1.29E-04	3.85E-03	9.15E-03	2.60E-05	2.62E-05	3.93E-06	3.93E-02
Ni-63	1.35E+00	6.69E-01	1.63E-02	4.87E-01	1.16E+00	3.28E-03	3.31E-03	4.97E-04	4.97E+00
Np-237	3.16E-07	1.56E-07	3.80E-09	1.14E-07	2.70E-07	7.67E-10	7.73E-10	1.16E-10	1.16E-06
Pu-238	6.46E-04	3.19E-04	7.76E-06	2.32E-04	5.52E-04	1.57E-06	1.58E-06	2.37E-07	2.37E-03
Pu-239	3.68E-03	1.82E-03	4.42E-05	1.32E-03	3.14E-03	8.92E-06	9.00E-06	1.35E-06	1.35E-02
Pu-240	1.29E-03	6.35E-04	1.54E-05	4.63E-04	1.10E-03	3.12E-06	3.15E-06	4.72E-07	4.72E-03
Pu-241	8.53E-02	4.21E-02	1.02E-03	3.07E-02	7.29E-02	2.07E-04	2.09E-04	3.13E-05	3.13E-01
Sr-90	7.41E-02	3.66E-02	8.90E-04	2.67E-02	6.33E-02	1.80E-04	1.81E-04	2.72E-05	2.72E-01
Tc-99	2.46E-05	1.21E-05	2.95E-07	8.84E-06	2.10E-05	5.96E-08	6.01E-08	9.02E-09	9.02E-05
U-233	2.40E-05	1.18E-05	2.88E-07	8.62E-06	2.05E-05	5.81E-08	5.86E-08	8.79E-09	8.79E-05
U-234	2.15E-06	1.06E-06	2.58E-08	7.72E-07	1.83E-06	5.20E-09	5.24E-09	7.87E-10	7.87E-06
U-235	5.45E-08	2.69E-08	6.55E-10	1.96E-08	4.66E-08	1.32E-10	1.33E-10	2.00E-11	2.00E-07
U-236	1.66E-07	8.18E-08	1.99E-09	5.96E-08	1.42E-07	4.02E-10	4.05E-10	6.08E-11	6.08E-07
U-238	1.93E-06	9.51E-07	2.31E-08	6.93E-07	1.65E-06	4.67E-09	4.71E-09	7.07E-10	7.07E-06

Table A-8. NRF-MOD-8H best-estimate inventory summary (1956-1965).

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Am-241	1.54E-09	7.17E-06	1.18E-06	3.81E-07	1.11E-07	9.65E-05	1.67E-03	2.91E-06	1.17E-06	1.41E-09
C-14	3.50E-06	1.63E-02	2.69E-03	8.67E-04	2.53E-04	2.20E-01	3.79E+00	6.63E-03	2.65E-03	3.21E-06
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	4.37E-04	2.03E+00	3.35E-01	1.08E-01	3.15E-02	2.74E+01	4.73E+02	8.27E-01	3.31E-01	4.00E-04
Cs-137	1.75E-07	8.17E-04	1.35E-04	4.35E-05	1.27E-05	1.10E-02	1.90E-01	3.32E-04	1.33E-04	1.61E-07
H-3	—	—	—	—	—	—	—	—	—	—
I-129	1.75E-11	8.17E-08	1.35E-08	4.35E-09	1.27E-09	1.10E-06	1.90E-05	3.32E-08	1.33E-08	1.61E-11
Nb-94	8.82E-08	4.11E-04	6.77E-05	2.18E-05	6.37E-06	5.53E-03	9.56E-02	1.67E-04	6.69E-05	8.08E-08
Ni-59	1.31E-06	6.12E-03	1.01E-03	3.25E-04	9.49E-05	8.24E-02	1.42E+00	2.49E-03	9.96E-04	1.20E-06
Ni-63	1.31E-04	6.12E-01	1.01E-01	3.25E-02	9.49E-03	8.24E+00	1.42E+02	2.49E-01	9.96E-02	1.20E-04
Np-237	1.31E-14	6.12E-11	1.01E-11	3.25E-12	9.49E-13	8.24E-10	1.42E-08	2.49E-11	9.96E-12	1.20E-14
Pu-238	1.10E-09	5.11E-06	8.43E-07	2.72E-07	7.93E-08	6.89E-05	1.19E-03	2.08E-06	8.33E-07	1.01E-09
Pu-239	1.75E-10	8.17E-07	1.35E-07	4.35E-08	1.27E-08	1.10E-05	1.90E-04	3.32E-07	1.33E-07	1.61E-10
Pu-240	1.10E-10	5.11E-07	8.43E-08	2.72E-08	7.93E-09	6.89E-06	1.19E-04	2.08E-07	8.33E-08	1.01E-10
Pu-241	4.37E-08	2.03E-04	3.35E-05	1.08E-05	3.15E-06	2.74E-03	4.73E-02	8.27E-05	3.31E-05	4.00E-08
Sr-90	1.75E-07	8.17E-04	1.35E-04	4.35E-05	1.27E-05	1.10E-02	1.90E-01	3.32E-04	1.33E-04	1.61E-07
Tc-99	4.37E-09	2.03E-05	3.35E-06	1.08E-06	3.15E-07	2.74E-04	4.73E-03	8.27E-06	3.31E-06	4.00E-09
U-233	1.18E-12	5.52E-09	9.09E-10	2.93E-10	8.56E-11	7.43E-08	1.28E-06	2.24E-09	8.98E-10	1.09E-12
U-234	1.31E-12	6.12E-09	1.01E-09	3.25E-10	9.49E-11	8.24E-08	1.42E-06	2.49E-09	9.96E-10	1.20E-12
U-235	9.25E-17	4.31E-13	7.10E-14	2.29E-14	6.68E-15	5.80E-12	1.00E-10	1.75E-13	7.01E-14	8.48E-17
U-236	4.84E-15	2.26E-11	3.72E-12	1.20E-12	3.50E-13	3.04E-10	5.25E-09	9.17E-12	3.67E-12	4.44E-15
U-238	2.15E-14	1.00E-10	1.65E-11	5.33E-12	1.56E-12	1.35E-09	2.33E-08	4.08E-11	1.63E-11	1.97E-14

Table A-8. (continued). NRF-MOD-8H best-estimate inventory summary (1966-1971).

	1966	1967	1968	1969	1970	1971	Totals
Am-241	1.91E-06	4.52E-08	5.14E-07	3.59E-07	1.55E-10	1.21E-07	1.78E-03
C-14	4.35E-03	1.03E-04	1.17E-03	8.18E-04	3.53E-07	2.75E-04	4.05E+00
Cl-36	—	—	—	—	—	—	—
Co-60	5.43E-01	1.28E-02	1.46E-01	1.02E-01	4.41E-05	3.43E-02	5.05E+02
Cs-137	2.18E-04	5.16E-06	5.87E-05	4.10E-05	1.77E-08	1.38E-05	2.03E-01
H-3	—	—	—	—	—	—	—
I-129	2.18E-08	5.16E-10	5.87E-09	4.10E-09	1.77E-12	1.38E-09	2.03E-05
Nb-94	1.10E-04	2.59E-06	2.95E-05	2.06E-05	8.90E-09	6.93E-06	1.02E-01
Ni-59	1.63E-03	3.86E-05	4.39E-04	3.07E-04	1.33E-07	1.03E-04	1.52E+00
Ni-63	1.63E-01	3.86E-03	4.39E-02	3.07E-02	1.33E-05	1.03E-02	1.52E+02
Np-237	1.63E-11	3.86E-13	4.39E-12	3.07E-12	1.33E-15	1.03E-12	1.52E-08
Pu-238	1.37E-06	3.23E-08	3.67E-07	2.56E-07	1.11E-10	8.63E-08	1.27E-03
Pu-239	2.18E-07	5.16E-09	5.87E-08	4.10E-08	1.77E-11	1.38E-08	2.03E-04
Pu-240	1.37E-07	3.23E-09	3.67E-08	2.56E-08	1.11E-11	8.63E-09	1.27E-04
Pu-241	5.43E-05	1.28E-06	1.46E-05	1.02E-05	4.41E-09	3.43E-06	5.05E-02
Sr-90	2.18E-04	5.16E-06	5.87E-05	4.10E-05	1.77E-08	1.38E-05	2.03E-01
Tc-99	5.43E-06	1.28E-07	1.46E-06	1.02E-06	4.41E-10	3.43E-07	5.05E-03
U-233	1.47E-09	3.48E-11	3.96E-10	2.77E-10	1.20E-13	9.31E-11	1.37E-06
U-234	1.63E-09	3.86E-11	4.39E-10	3.07E-10	1.33E-13	1.03E-10	1.52E-06
U-235	1.15E-13	2.72E-15	3.09E-14	2.16E-14	9.33E-18	7.27E-15	1.07E-10
U-236	6.02E-12	1.42E-13	1.62E-12	1.13E-12	4.89E-16	3.80E-13	5.60E-09
U-238	2.68E-11	6.33E-13	7.19E-12	5.03E-12	2.17E-15	1.69E-12	2.49E-08

Table A-9. NRF-MOD-9H best-estimate inventory summary (1954-1965).

	1954	1955	1957	1958	1959	1960	1961	1963	1964	1965
Am-241	7.86E-04	1.20E-03	1.00E-03	3.63E-04	2.18E-04	4.07E-05	4.03E-04	1.55E-04	1.14E-05	3.24E-03
C-14	1.45E+00	2.22E+00	1.85E+00	6.69E-01	4.03E-01	7.51E-02	7.44E-01	2.87E-01	2.09E-02	5.98E+00
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	2.23E+02	3.41E+02	2.85E+02	1.03E+02	6.20E+01	1.16E+01	1.15E+02	4.41E+01	3.22E+00	9.20E+02
Cs-137	8.96E-02	1.37E-01	1.15E-01	4.13E-02	2.49E-02	4.64E-03	4.60E-02	1.77E-02	1.29E-03	3.70E-01
H-3	—	—	—	—	—	—	—	—	—	—
I-129	8.87E-06	1.36E-05	1.13E-05	4.09E-06	2.47E-06	4.60E-07	4.55E-06	1.75E-06	1.28E-07	3.66E-05
Nb-94	4.48E-02	6.86E-02	5.73E-02	2.07E-02	1.24E-02	2.32E-03	2.30E-02	8.86E-03	6.47E-04	1.85E-01
Ni-59	6.72E-01	1.03E+00	8.59E-01	3.10E-01	1.87E-01	3.48E-02	3.45E-01	1.33E-01	9.71E-03	2.77E+00
Ni-63	6.72E+01	1.03E+02	8.59E+01	3.10E+01	1.87E+01	3.48E+00	3.45E+01	1.33E+01	9.71E-01	2.77E+02
Np-237	6.72E-09	1.03E-08	8.59E-09	3.10E-09	1.87E-09	3.48E-10	3.45E-09	1.33E-09	9.71E-11	2.77E-08
Pu-238	5.62E-04	8.60E-04	7.19E-04	2.59E-04	1.56E-04	2.91E-05	2.89E-04	1.11E-04	8.12E-06	2.32E-03
Pu-239	8.96E-05	1.37E-04	1.15E-04	4.13E-05	2.49E-05	4.64E-06	4.60E-05	1.77E-05	1.29E-06	3.70E-04
Pu-240	5.62E-05	8.60E-05	7.19E-05	2.59E-05	1.56E-05	2.91E-06	2.89E-05	1.11E-05	8.12E-07	2.32E-04
Pu-241	2.24E-02	3.43E-02	2.86E-02	1.03E-02	6.22E-03	1.16E-03	1.15E-02	4.43E-03	3.24E-04	9.24E-02
Sr-90	8.96E-02	1.37E-01	1.15E-01	4.13E-02	2.49E-02	4.64E-03	4.60E-02	1.77E-02	1.29E-03	3.70E-01
Tc-99	2.25E-03	3.44E-03	2.87E-03	1.04E-03	6.25E-04	1.17E-04	1.15E-03	4.45E-04	3.25E-05	9.27E-03
U-233	6.06E-07	9.28E-07	7.75E-07	2.80E-07	1.68E-07	3.14E-08	3.11E-07	1.20E-07	8.76E-09	2.50E-06
U-234	6.77E-07	1.04E-06	8.65E-07	3.12E-07	1.88E-07	3.50E-08	3.47E-07	1.34E-07	9.77E-09	2.79E-06
U-235	4.70E-11	7.19E-11	6.01E-11	2.17E-11	1.31E-11	2.43E-12	2.41E-11	9.29E-12	6.79E-13	1.94E-10
U-236	2.47E-09	3.78E-09	3.15E-09	1.14E-09	6.86E-10	1.28E-10	1.27E-09	4.88E-10	3.57E-11	1.02E-08
U-238	1.10E-08	1.68E-08	1.40E-08	5.06E-09	3.05E-09	5.69E-10	5.63E-09	2.17E-09	1.59E-10	4.53E-08

Table A-9. (continued). NRF-MOD-9H best-estimate inventory summary (1966-1971).

	1966	1968	1969	1970	1971	Totals
Am-241	9.13E-05	3.77E-04	4.71E-04	1.78E-04	4.04E-04	8.95E-03
C-14	1.68E-01	6.95E-01	8.69E-01	3.28E-01	7.45E-01	1.65E+01
Cl-36	—	—	—	—	—	—
Co-60	2.59E+01	1.07E+02	1.34E+02	5.05E+01	1.15E+02	2.54E+03
Cs-137	1.04E-02	4.30E-02	5.37E-02	2.03E-02	4.60E-02	1.02E+00
H-3	—	—	—	—	—	—
I-129	1.03E-06	4.25E-06	5.32E-06	2.01E-06	4.56E-06	1.01E-04
Nb-94	5.20E-03	2.15E-02	2.68E-02	1.01E-02	2.30E-02	5.10E-01
Ni-59	7.80E-02	3.22E-01	4.03E-01	1.52E-01	3.45E-01	7.65E+00
Ni-63	7.80E+00	3.22E+01	4.03E+01	1.52E+01	3.45E+01	7.65E+02
Np-237	7.80E-10	3.22E-09	4.03E-09	1.52E-09	3.45E-09	7.65E-08
Pu-238	6.53E-05	2.70E-04	3.37E-04	1.27E-04	2.89E-04	6.40E-03
Pu-239	1.04E-05	4.30E-05	5.37E-05	2.03E-05	4.60E-05	1.02E-03
Pu-240	6.53E-06	2.70E-05	3.37E-05	1.27E-05	2.89E-05	6.40E-04
Pu-241	2.60E-03	1.07E-02	1.34E-02	5.07E-03	1.15E-02	2.55E-01
Sr-90	1.04E-02	4.30E-02	5.37E-02	2.03E-02	4.60E-02	1.02E+00
Tc-99	2.61E-04	1.08E-03	1.35E-03	5.09E-04	1.16E-03	2.56E-02
U-233	7.04E-08	2.91E-07	3.63E-07	1.37E-07	3.11E-07	6.90E-06
U-234	7.86E-08	3.24E-07	4.05E-07	1.53E-07	3.47E-07	7.70E-06
U-235	5.46E-12	2.25E-11	2.82E-11	1.06E-11	2.41E-11	5.35E-10
U-236	2.87E-10	1.18E-09	1.48E-09	5.58E-10	1.27E-09	2.81E-08
U-238	1.28E-09	5.27E-09	6.58E-09	2.48E-09	5.64E-09	1.25E-07

Table A-10. NRF-MOD-10H best-estimate inventory summary (1953-1962).

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Am-241	4.99E-06	4.10E-05	1.72E-05	9.08E-04	5.36E-04	3.34E-04	1.54E-03	1.30E-03	7.25E-03	1.07E-04
C-14	—	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	1.43E+00	1.17E+01	4.92E+00	2.60E+02	1.53E+02	9.56E+01	4.41E+02	3.73E+02	2.07E+03	3.07E+01
Cs-137	5.71E-04	4.69E-03	1.97E-03	1.04E-01	6.13E-02	3.82E-02	1.76E-01	1.49E-01	8.29E-01	1.23E-02
H-3	—	—	—	—	—	—	—	—	—	—
I-129	5.71E-08	4.69E-07	1.97E-07	1.04E-05	6.13E-06	3.82E-06	1.76E-05	1.49E-05	8.29E-05	1.23E-06
Nb-94	2.85E-04	2.34E-03	9.85E-04	5.20E-02	3.07E-02	1.91E-02	8.81E-02	7.46E-02	4.15E-01	6.15E-03
Ni-59	4.28E-03	3.51E-02	1.48E-02	7.80E-01	4.60E-01	2.87E-01	1.32E+00	1.12E+00	6.22E+00	9.22E-02
Ni-63	2.28E-01	1.87E+00	7.85E-01	4.14E+01	2.45E+01	1.52E+01	7.03E+01	5.95E+01	3.31E+02	4.90E+00
Np-237	4.28E-11	3.51E-10	1.48E-10	7.80E-09	4.60E-09	2.87E-09	1.32E-08	1.12E-08	6.22E-08	9.22E-10
Pu-238	3.56E-06	2.92E-05	1.23E-05	6.49E-04	3.83E-04	2.38E-04	1.10E-03	9.31E-04	5.18E-03	7.67E-05
Pu-239	5.71E-07	4.69E-06	1.97E-06	1.04E-04	6.13E-05	3.82E-05	1.76E-04	1.49E-04	8.29E-04	1.23E-05
Pu-240	3.56E-07	2.92E-06	1.23E-06	6.49E-05	3.83E-05	2.38E-05	1.10E-04	9.31E-05	5.18E-04	7.67E-06
Pu-241	1.43E-04	1.17E-03	4.92E-04	2.60E-02	1.53E-02	9.56E-03	4.41E-02	3.73E-02	2.07E-01	3.07E-03
Sr-90	5.71E-04	4.69E-03	1.97E-03	1.04E-01	6.13E-02	3.82E-02	1.76E-01	1.49E-01	8.29E-01	1.23E-02
Tc-99	1.43E-05	1.17E-04	4.92E-05	2.60E-03	1.53E-03	9.56E-04	4.41E-03	3.73E-03	2.07E-02	3.07E-04
U-233	3.86E-09	3.17E-08	1.33E-08	7.02E-07	4.14E-07	2.58E-07	1.19E-06	1.01E-06	5.60E-06	8.31E-08
U-234	4.28E-09	3.51E-08	1.48E-08	7.80E-07	4.60E-07	2.87E-07	1.32E-06	1.12E-06	6.22E-06	9.22E-08
U-235	3.00E-13	2.46E-12	1.03E-12	5.45E-11	3.22E-11	2.01E-11	9.25E-11	7.83E-11	4.35E-10	6.45E-12
U-236	1.57E-11	1.29E-10	5.41E-11	2.86E-09	1.69E-09	1.05E-09	4.84E-09	4.10E-09	2.28E-08	3.38E-10
U-238	6.99E-11	5.74E-10	2.41E-10	1.27E-08	7.51E-09	4.68E-09	2.16E-08	1.83E-08	1.02E-07	1.51E-09

Table A-10. (continued). NRF-MOD-10H best-estimate inventory summary (1963-1972).

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Am-241	1.12E-04	1.69E-03	1.79E-01	3.64E-02	1.11E-01	4.60E-04	4.23E-04	3.61E-05	3.10E-04	1.01E-04
C-14	—	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	3.20E+01	4.83E+02	5.13E+04	1.04E+04	3.16E+04	1.32E+02	1.21E+02	1.03E+01	8.86E+01	2.89E+01
Cs-137	1.28E-02	1.93E-01	2.05E+01	4.16E+00	1.27E+01	5.26E-02	4.84E-02	4.13E-03	3.54E-02	1.16E-02
H-3	—	—	—	—	—	—	—	—	—	—
I-129	1.28E-06	1.93E-05	2.05E-03	4.16E-04	1.27E-03	5.26E-06	4.84E-06	4.13E-07	3.54E-06	1.16E-06
Nb-94	6.40E-03	9.66E-02	1.03E+01	2.08E+00	6.33E+00	2.63E-02	2.42E-02	2.06E-03	1.77E-02	5.78E-03
Ni-59	9.60E-02	1.45E+00	1.54E+02	3.12E+01	9.49E+01	3.95E-01	3.63E-01	3.10E-02	2.66E-01	8.67E-02
Ni-63	5.11E+00	7.71E+01	8.18E+03	1.66E+03	5.04E+03	2.10E+01	1.93E+01	1.65E+00	1.41E+01	4.61E+00
Np-237	9.60E-10	1.45E-08	1.54E-06	3.12E-07	9.49E-07	3.95E-09	3.63E-09	3.10E-10	2.66E-09	8.67E-10
Pu-238	7.99E-05	1.21E-03	1.28E-01	2.60E-02	7.89E-02	3.28E-04	3.02E-04	2.58E-05	2.21E-04	7.21E-05
Pu-239	1.28E-05	1.93E-04	2.05E-02	4.16E-03	1.27E-02	5.26E-05	4.84E-05	4.13E-06	3.54E-05	1.16E-05
Pu-240	7.99E-06	1.21E-04	1.28E-02	2.60E-03	7.89E-03	3.28E-05	3.02E-05	2.58E-06	2.21E-05	7.21E-06
Pu-241	3.20E-03	4.83E-02	5.13E+00	1.04E+00	3.16E+00	1.32E-02	1.21E-02	1.03E-03	8.86E-03	2.89E-03
Sr-90	1.28E-02	1.93E-01	2.05E+01	4.16E+00	1.27E+01	5.26E-02	4.84E-02	4.13E-03	3.54E-02	1.16E-02
Tc-99	3.20E-04	4.83E-03	5.13E-01	1.04E-01	3.16E-01	1.32E-03	1.21E-03	1.03E-04	8.86E-04	2.89E-04
U-233	8.65E-08	1.31E-06	1.39E-04	2.81E-05	8.55E-05	3.56E-07	3.27E-07	2.79E-08	2.39E-07	7.81E-08
U-234	9.60E-08	1.45E-06	1.54E-04	3.12E-05	9.49E-05	3.95E-07	3.63E-07	3.10E-08	2.66E-07	8.67E-08
U-235	6.72E-12	1.01E-10	1.08E-08	2.18E-09	6.64E-09	2.76E-11	2.54E-11	2.17E-12	1.86E-11	6.07E-12
U-236	3.52E-10	5.31E-09	5.64E-07	1.14E-07	3.48E-07	1.45E-09	1.33E-09	1.13E-10	9.74E-10	3.18E-10
U-238	1.57E-09	2.37E-08	2.51E-06	5.10E-07	1.55E-06	6.45E-09	5.93E-09	5.06E-10	4.34E-09	1.42E-09

Table A-10. (continued). NRF-MOD-10H best-estimate inventory summary (1973-1981).

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Am-241	2.05E-03	2.27E-03	2.56E-04	1.41E-04	1.49E-05	1.59E-05	6.19E-05	2.38E-04	2.52E-04
C-14	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—
Co-60	5.86E+02	6.50E+02	7.33E+01	4.02E+01	4.25E+00	4.54E+00	1.77E+01	6.80E+01	7.20E+01
Cs-137	2.34E-01	2.60E-01	2.93E-02	1.61E-02	1.70E-03	1.82E-03	7.08E-03	2.72E-02	2.88E-02
H-3	—	—	—	—	—	—	—	—	—
I-129	2.34E-05	2.60E-05	2.93E-06	1.61E-06	1.70E-07	1.82E-07	7.08E-07	2.72E-06	2.88E-06
Nb-94	1.17E-01	1.30E-01	1.47E-02	8.04E-03	8.50E-04	9.09E-04	3.54E-03	1.36E-02	1.44E-02
Ni-59	1.76E+00	1.95E+00	2.20E-01	1.21E-01	1.28E-02	1.36E-02	5.31E-02	2.04E-01	2.16E-01
Ni-63	9.34E+01	1.04E+02	1.17E+01	6.41E+00	6.78E-01	7.25E-01	2.82E+00	1.09E+01	1.15E+01
Np-237	1.76E-08	1.95E-08	2.20E-09	1.21E-09	1.28E-10	1.36E-10	5.31E-10	2.04E-09	2.16E-09
Pu-238	1.46E-03	1.62E-03	1.83E-04	1.00E-04	1.06E-05	1.13E-05	4.42E-05	1.70E-04	1.80E-04
Pu-239	2.34E-04	2.60E-04	2.93E-05	1.61E-05	1.70E-06	1.82E-06	7.08E-06	2.72E-05	2.88E-05
Pu-240	1.46E-04	1.62E-04	1.83E-05	1.00E-05	1.06E-06	1.13E-06	4.42E-06	1.70E-05	1.80E-05
Pu-241	5.86E-02	6.50E-02	7.33E-03	4.02E-03	4.25E-04	4.54E-04	1.77E-03	6.80E-03	7.20E-03
Sr-90	2.34E-01	2.60E-01	2.93E-02	1.61E-02	1.70E-03	1.82E-03	7.08E-03	2.72E-02	2.88E-02
Tc-99	5.86E-03	6.50E-03	7.33E-04	4.02E-04	4.25E-05	4.54E-05	1.77E-04	6.80E-04	7.20E-04
U-233	1.58E-06	1.76E-06	1.98E-07	1.09E-07	1.15E-08	1.23E-08	4.78E-08	1.84E-07	1.95E-07
U-234	1.76E-06	1.95E-06	2.20E-07	1.21E-07	1.28E-08	1.36E-08	5.31E-08	2.04E-07	2.16E-07
U-235	1.23E-10	1.37E-10	1.54E-11	8.44E-12	8.92E-13	9.54E-13	3.71E-12	1.43E-11	1.51E-11
U-236	6.44E-09	7.15E-09	8.05E-10	4.42E-10	4.67E-11	5.00E-11	1.94E-10	7.48E-10	7.91E-10
U-238	2.87E-08	3.19E-08	3.59E-09	1.97E-09	2.08E-10	2.23E-10	8.67E-10	3.33E-09	3.53E-09

Table A-10. (continued). NRF-MOD-10H best-estimate inventory summary (1982-1983).

	1982	1983	Totals
Am-241	5.16E-05	7.74E-05	3.47E-01
C-14	—	—	—
Cl-36	—	—	—
Co-60	1.48E+01	2.21E+01	9.92E+04
Cs-137	5.90E-03	8.85E-03	3.97E+01
H-3	—	—	—
I-129	5.90E-07	8.85E-07	3.97E-03
Nb-94	2.95E-03	4.43E-03	1.98E+01
Ni-59	4.43E-02	6.64E-02	2.98E+02
Ni-63	2.35E+00	3.53E+00	1.58E+04
Np-237	4.43E-10	6.64E-10	2.98E-06
Pu-238	3.68E-05	5.52E-05	2.48E-01
Pu-239	5.90E-06	8.85E-06	3.97E-02
Pu-240	3.68E-06	5.52E-06	2.48E-02
Pu-241	1.48E-03	2.21E-03	9.92E+00
Sr-90	5.90E-03	8.85E-03	3.97E+01
Tc-99	1.48E-04	2.21E-04	9.92E-01
U-233	3.99E-08	5.98E-08	2.68E-04
U-234	4.43E-08	6.64E-08	2.98E-04
U-235	3.10E-12	4.65E-12	2.08E-08
U-236	1.62E-10	2.43E-10	1.09E-06
U-238	7.23E-10	1.08E-09	4.86E-06

Table A-11. NRF-MOD-1H upper-bound estimate inventory summary (1962-1968).

	1962	1965	1967	1968	Totals
Am-241	2.80E-01	1.24E-01	2.09E-01	1.56E+01	1.62E+01
C-14	7.36E-04	2.17E-04	3.66E-04	2.73E-02	2.86E-02
Cl-36	—	—	—	—	—
Co-60	—	—	—	—	—
Cs-137	2.75E+02	1.22E+02	2.05E+02	1.53E+04	1.59E+04
H-3	1.20E+00	5.30E-01	8.93E-01	6.67E+01	6.93E+01
I-129	1.01E-04	4.47E-05	7.54E-05	5.63E-03	5.85E-03
Nb-94	3.56E-07	1.57E-07	2.65E-07	1.98E-05	2.06E-05
Ni-59	—	—	—	—	—
Ni-63	—	—	—	—	—
Np-237	6.90E-05	3.05E-05	5.14E-05	3.84E-03	3.99E-03
Pu-238	3.06E-01	1.35E-01	2.28E-01	1.70E+01	1.77E+01
Pu-239	1.15E+00	5.08E-01	8.57E-01	6.40E+01	6.65E+01
Pu-240	1.00E+00	4.43E-01	7.46E-01	5.57E+01	5.79E+01
Pu-241	7.86E+01	3.48E+01	5.86E+01	4.38E+03	4.55E+03
Sr-90	1.62E+02	7.15E+01	1.21E+02	9.01E+03	9.36E+03
Tc-99	3.87E-02	1.71E-02	2.89E-02	2.16E+00	2.24E+00
U-233	2.49E-08	1.10E-08	1.85E-08	1.39E-06	1.44E-06
U-234	1.00E-03	4.43E-04	7.47E-04	5.58E-02	5.80E-02
U-235	1.63E-05	7.21E-06	1.21E-05	9.07E-04	9.43E-04
U-236	1.73E-04	7.64E-05	1.29E-04	9.62E-03	1.00E-02
U-238	1.18E-03	5.23E-04	8.81E-04	6.58E-02	6.84E-02

Table A-12. NRF-MOD-2H upper-bound estimate inventory summary (1960-1964).

	1960	1961	1962	1964	Totals
Am-241	8.03E-02	9.69E-02	2.27E-01	2.24E-02	4.27E-01
C-14	2.11E-04	2.54E-04	5.97E-04	5.86E-05	1.12E-03
Cl-36	—	—	—	—	—
Co-60	—	—	—	—	—
Cs-137	7.90E+01	9.53E+01	2.24E+02	2.20E+01	4.20E+02
H-3	3.44E-01	4.15E-01	9.75E-01	9.58E-02	1.83E+00
I-129	2.91E-05	3.52E-05	8.26E-05	8.12E-06	1.55E-04
Nb-94	1.02E-07	1.23E-07	2.89E-07	2.84E-08	5.43E-07
Ni-59	—	—	—	—	—
Ni-63	—	—	—	—	—
Np-237	1.97E-05	2.38E-05	5.59E-05	5.50E-06	1.05E-04
Pu-238	8.78E-02	1.06E-01	2.49E-01	2.45E-02	4.67E-01
Pu-239	3.29E-01	3.97E-01	9.32E-01	9.16E-02	1.75E+00
Pu-240	2.88E-01	3.47E-01	8.15E-01	8.01E-02	1.53E+00
Pu-241	2.26E+01	2.72E+01	6.39E+01	6.28E+00	1.20E+02
Sr-90	4.66E+01	5.63E+01	1.32E+02	1.30E+01	2.48E+02
Tc-99	1.11E-02	1.34E-02	3.14E-02	3.09E-03	5.90E-02
U-233	7.14E-09	8.62E-09	2.02E-08	1.99E-09	3.80E-08
U-234	2.88E-04	3.47E-04	8.15E-04	8.01E-05	1.53E-03
U-235	4.68E-06	5.65E-06	1.33E-05	1.30E-06	2.49E-05
U-236	4.98E-05	6.01E-05	1.41E-04	1.39E-05	2.65E-04
U-238	3.40E-04	4.11E-04	9.64E-04	9.48E-05	1.81E-03

Table A-13. NRF-MOD-3H upper-bound estimate inventory summary (1965-1971).

	1965	1966	1967	1968	1969	1970	1971	Totals
Am-241	6.48E-05	3.70E-05	3.52E-03	1.44E-04	4.21E-04	9.63E-05	8.49E-08	4.28E-03
C-14	6.43E-09	3.68E-09	3.49E-07	1.43E-08	4.18E-08	9.56E-09	8.43E-12	4.25E-07
Cl-36	—	—	—	—	—	—	—	—
Co-60	—	—	—	—	—	—	—	—
Cs-137	5.64E+00	3.23E+00	3.06E+02	1.26E+01	3.67E+01	8.39E+00	7.40E-03	3.73E+02
H-3	2.22E-02	1.27E-02	1.21E+00	4.96E-02	1.45E-01	3.31E-02	2.92E-05	1.47E+00
I-129	1.35E-06	7.69E-07	7.30E-05	3.00E-06	8.75E-06	2.00E-06	1.76E-09	8.89E-05
Nb-94	2.35E-09	1.34E-09	1.27E-07	5.23E-09	1.53E-08	3.49E-09	3.08E-12	1.55E-07
Ni-59	—	—	—	—	—	—	—	—
Ni-63	—	—	—	—	—	—	—	—
Np-237	2.65E-05	1.51E-05	1.44E-03	5.90E-05	1.72E-04	3.94E-05	3.47E-08	1.75E-03
Pu-238	1.02E-01	5.84E-02	5.55E+00	2.28E-01	6.64E-01	1.52E-01	1.34E-04	6.75E+00
Pu-239	2.10E-04	1.20E-04	1.14E-02	4.69E-04	1.37E-03	3.13E-04	2.76E-07	1.39E-02
Pu-240	6.07E-05	3.47E-05	3.29E-03	1.35E-04	3.95E-04	9.02E-05	7.96E-08	4.01E-03
Pu-241	3.10E-02	1.77E-02	1.68E+00	6.91E-02	2.02E-01	4.61E-02	4.07E-05	2.05E+00
Sr-90	5.61E+00	3.21E+00	3.05E+02	1.25E+01	3.65E+01	8.35E+00	7.36E-03	3.71E+02
Tc-99	7.76E-04	4.44E-04	4.21E-02	1.73E-03	5.05E-03	1.15E-03	1.02E-06	5.13E-02
U-233	7.75E-09	4.43E-09	4.21E-07	1.73E-08	5.04E-08	1.15E-08	1.02E-11	5.12E-07
U-234	1.27E-04	7.27E-05	6.91E-03	2.84E-04	8.28E-04	1.89E-04	1.67E-07	8.41E-03
U-235	1.56E-06	8.91E-07	8.46E-05	3.47E-06	1.01E-05	2.32E-06	2.04E-09	1.03E-04
U-236	1.59E-05	9.08E-06	8.63E-04	3.54E-05	1.03E-04	2.36E-05	2.08E-08	1.05E-03
U-238	6.81E-09	3.89E-09	3.70E-07	1.52E-08	4.43E-08	1.01E-08	8.93E-12	4.50E-07

Table A-14. NRF-MOD-4H upper-bound estimate inventory summary (1960-1973).

	1960	1967	1969	1970	1973	Totals
Am-241	6.22E-06	2.71E-03	1.05E-06	2.43E-05	1.17E-06	2.74E-03
C-14	6.17E-10	2.69E-07	1.04E-10	2.41E-09	1.16E-10	2.72E-07
Cl-36	—	—	—	—	—	—
Co-60	—	—	—	—	—	—
Cs-137	5.42E-01	2.36E+02	9.15E-02	2.12E+00	1.02E-01	2.39E+02
H-3	2.14E-03	9.30E-01	3.60E-04	8.34E-03	4.01E-04	9.41E-01
I-129	1.29E-07	5.62E-05	2.18E-08	5.04E-07	2.43E-08	5.69E-05
Nb-94	2.25E-10	9.78E-08	3.79E-11	8.77E-10	4.22E-11	9.90E-08
Ni-59	—	—	—	—	—	—
Ni-63	—	—	—	—	—	—
Np-237	2.54E-06	1.11E-03	4.29E-07	9.92E-06	4.78E-07	1.12E-03
Pu-238	9.80E-03	4.27E+00	1.65E-03	3.83E-02	1.84E-03	4.32E+00
Pu-239	2.03E-05	8.82E-03	3.42E-06	7.91E-05	3.81E-06	8.93E-03
Pu-240	5.81E-06	2.53E-03	9.80E-07	2.27E-05	1.09E-06	2.56E-03
Pu-241	2.97E-03	1.29E+00	5.01E-04	1.16E-02	5.59E-04	1.31E+00
Sr-90	5.40E-01	2.35E+02	9.11E-02	2.11E+00	1.02E-01	2.38E+02
Tc-99	7.47E-05	3.25E-02	1.26E-05	2.91E-04	1.40E-05	3.29E-02
U-233	7.44E-10	3.24E-07	1.26E-10	2.91E-09	1.40E-10	3.28E-07
U-234	1.22E-05	5.33E-03	2.06E-06	4.77E-05	2.30E-06	5.39E-03
U-235	1.50E-07	6.52E-05	2.53E-08	5.85E-07	2.81E-08	6.60E-05
U-236	1.53E-06	6.66E-04	2.58E-07	5.97E-06	2.87E-07	6.74E-04
U-238	6.54E-10	2.85E-07	1.10E-10	2.55E-09	1.23E-10	2.88E-07

Table A-15. NRF-MOD-5H upper-bound estimate inventory summary (1963-1970).

	1963	1967	1970	Totals
Am-241	—	3.76E-01	—	3.76E-01
C-14	—	9.90E-04	—	9.90E-04
Cl-36	—	—	—	—
Co-60	—	—	—	—
Cs-137	—	3.69E+02	—	3.69E+02
H-3	—	1.61E+00	—	1.61E+00
I-129	—	1.36E-04	—	1.36E-04
Nb-94	—	4.79E-07	—	4.79E-07
Ni-59	—	—	—	—
Ni-63	—	—	—	—
Np-237	—	9.27E-05	—	9.27E-05
Pu-238	—	4.13E-01	—	4.13E-01
Pu-239	—	1.54E+00	—	1.54E+00
Pu-240	—	1.35E+00	—	1.35E+00
Pu-241	—	1.06E+02	—	1.06E+02
Sr-90	—	2.18E+02	—	2.18E+02
Tc-99	—	5.19E-02	—	5.19E-02
U-233	—	3.35E-08	—	3.35E-08
U-234	6.05E-03	1.35E-03	5.45E-03	1.29E-02
U-235	2.77E-04	2.20E-05	2.50E-04	5.49E-04
U-236	—	2.33E-04	—	2.33E-04
U-238	5.94E-03	1.59E-03	5.36E-03	1.29E-02

Table A-16. NRF-MOD-6H upper-bound estimate inventory summary (1954-1964).

	1954	1955	1956	1957	1958	1959	1960	1961	1963	1964
Am-241	2.41E-07	2.36E-04	2.66E-05	5.69E-03	1.89E-05	6.27E-04	1.13E-06	1.81E-06	1.03E-04	8.24E-04
C-14	8.44E-05	8.25E-02	9.32E-03	1.99E+00	6.61E-03	2.19E-01	3.97E-04	6.34E-04	3.62E-02	2.89E-01
Cl-36	3.49E-07	3.41E-04	3.85E-05	8.22E-03	2.73E-05	9.07E-04	1.64E-06	2.62E-06	1.50E-04	1.19E-03
Co-60	1.03E+00	1.01E+03	1.14E+02	2.44E+04	8.09E+01	2.69E+03	4.86E+00	7.77E+00	4.43E+02	3.53E+03
Cs-137	1.55E-05	1.52E-02	1.71E-03	3.65E-01	1.21E-03	4.03E-02	7.28E-05	1.16E-04	6.65E-03	5.30E-02
H-3	2.32E-04	2.27E-01	2.57E-02	5.48E+00	1.82E-02	6.04E-01	1.09E-03	1.75E-03	9.97E-02	7.95E-01
I-129	8.35E-11	8.16E-08	9.23E-09	1.97E-06	6.54E-09	2.17E-07	3.93E-10	6.28E-10	3.58E-08	2.86E-07
Nb-94	1.12E-05	1.09E-02	1.24E-03	2.64E-01	8.76E-04	2.91E-02	5.26E-05	8.41E-05	4.80E-03	3.83E-02
Ni-59	2.50E-03	2.44E+00	2.76E-01	5.89E+01	1.96E-01	6.49E+00	1.17E-02	1.88E-02	1.07E+00	8.54E+00
Ni-63	2.93E-01	2.86E+02	3.23E+01	6.90E+03	2.29E+01	7.61E+02	1.38E+00	2.20E+00	1.26E+02	1.00E+03
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	1.55E-07	1.52E-04	1.71E-05	3.65E-03	1.21E-05	4.03E-04	7.28E-07	1.16E-06	6.65E-05	5.30E-04
Pu-239	3.62E-07	3.54E-04	3.99E-05	8.53E-03	2.83E-05	9.40E-04	1.70E-06	2.72E-06	1.55E-04	1.24E-03
Pu-240	2.24E-07	2.19E-04	2.47E-05	5.28E-03	1.75E-05	5.82E-04	1.05E-06	1.68E-06	9.60E-05	7.66E-04
Pu-241	1.89E-05	1.85E-02	2.09E-03	4.47E-01	1.48E-03	4.92E-02	8.90E-05	1.42E-04	8.12E-03	6.48E-02
Sr-90	8.26E-06	8.08E-03	9.13E-04	1.95E-01	6.47E-04	2.15E-02	3.88E-05	6.21E-05	3.54E-03	2.83E-02
Tc-99	4.48E-08	4.38E-05	4.95E-06	1.06E-03	3.51E-06	1.16E-04	2.10E-07	3.37E-07	1.92E-05	1.53E-04
U-233	—	—	—	—	—	—	—	—	—	—
U-234	2.41E-10	2.36E-07	2.66E-08	5.69E-06	1.89E-08	6.27E-07	1.13E-09	1.81E-09	1.03E-07	8.24E-07
U-235	6.89E-12	6.73E-09	7.61E-10	1.62E-07	5.39E-10	1.79E-08	3.24E-11	5.18E-11	2.95E-09	2.36E-08
U-236	2.24E-11	2.19E-08	2.47E-09	5.28E-07	1.75E-09	5.82E-08	1.05E-10	1.68E-10	9.60E-09	7.66E-08
U-238	2.58E-10	2.53E-07	2.85E-08	6.09E-06	2.02E-08	6.72E-07	1.21E-09	1.94E-09	1.11E-07	8.83E-07

Table A-16. (continued). NRF-MOD-6H upper-bound estimate inventory summary (1965-1974).

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Am-241	2.23E-02	5.62E-02	5.48E-02	1.02E-02	5.66E-02	6.58E-03	5.86E-04	8.16E-04	6.35E-04	3.69E-04
C-14	7.80E+00	1.97E+01	1.92E+01	3.58E+00	1.98E+01	2.30E+00	2.05E-01	2.85E-01	2.22E-01	1.29E-01
Cl-36	3.23E-02	8.13E-02	7.93E-02	1.48E-02	8.18E-02	9.51E-03	8.47E-04	1.18E-03	9.18E-04	5.34E-04
Co-60	9.56E+04	2.41E+05	2.35E+05	4.39E+04	2.42E+05	2.82E+04	2.51E+03	3.50E+03	2.72E+03	1.58E+03
Cs-137	1.43E+00	3.61E+00	3.52E+00	6.58E-01	3.64E+00	4.23E-01	3.76E-02	5.24E-02	4.08E-02	2.37E-02
H-3	2.15E+01	5.42E+01	5.29E+01	9.88E+00	5.45E+01	6.34E+00	5.65E-01	7.86E-01	6.12E-01	3.56E-01
I-129	7.72E-06	1.95E-05	1.90E-05	3.55E-06	1.96E-05	2.28E-06	2.03E-07	2.83E-07	2.20E-07	1.28E-07
Nb-94	1.04E+00	2.61E+00	2.54E+00	4.76E-01	2.63E+00	3.05E-01	2.72E-02	3.79E-02	2.95E-02	1.71E-02
Ni-59	2.31E+02	5.82E+02	5.68E+02	1.06E+02	5.86E+02	6.81E+01	6.06E+00	8.45E+00	6.57E+00	3.83E+00
Ni-63	2.71E+04	6.83E+04	6.66E+04	1.24E+04	6.87E+04	7.98E+03	7.11E+02	9.90E+02	7.70E+02	4.48E+02
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	1.43E-02	3.61E-02	3.52E-02	6.58E-03	3.64E-02	4.23E-03	3.76E-04	5.24E-04	4.08E-04	2.37E-04
Pu-239	3.34E-02	8.43E-02	8.22E-02	1.54E-02	8.48E-02	9.86E-03	8.78E-04	1.22E-03	9.52E-04	5.54E-04
Pu-240	2.07E-02	5.22E-02	5.09E-02	9.51E-03	5.25E-02	6.11E-03	5.44E-04	7.57E-04	5.89E-04	3.43E-04
Pu-241	1.75E+00	4.42E+00	4.31E+00	8.05E-01	4.44E+00	5.17E-01	4.60E-02	6.41E-02	4.99E-02	2.90E-02
Sr-90	7.64E-01	1.93E+00	1.88E+00	3.51E-01	1.94E+00	2.25E-01	2.01E-02	2.80E-02	2.18E-02	1.27E-02
Tc-99	4.14E-03	1.04E-02	1.02E-02	1.90E-03	1.05E-02	1.22E-03	1.09E-04	1.51E-04	1.18E-04	6.86E-05
U-233	—	—	—	—	—	—	—	—	—	—
U-234	2.23E-05	5.62E-05	5.48E-05	1.02E-05	5.66E-05	6.58E-06	5.86E-07	8.16E-07	6.35E-07	3.69E-07
U-235	6.37E-07	1.61E-06	1.57E-06	2.93E-07	1.62E-06	1.88E-07	1.67E-08	2.33E-08	1.81E-08	1.06E-08
U-236	2.07E-06	5.22E-06	5.09E-06	9.51E-07	5.25E-06	6.11E-07	5.44E-08	7.57E-08	5.89E-08	3.43E-08
U-238	2.39E-05	6.02E-05	5.87E-05	1.10E-05	6.06E-05	7.04E-06	6.27E-07	8.74E-07	6.80E-07	3.96E-07

Table A-16. (continued). NRF-MOD-6H upper-bound estimate inventory summary (1975-1983).

	1975	1976	1977	1978	1979	1980	1981	1982	1983	Totals
Am-241	3.74E-04	1.77E-04	4.18E-04	8.79E-05	2.95E-04	8.77E-05	4.04E-05	1.62E-05	1.34E-05	2.18E-01
C-14	1.31E-01	6.18E-02	1.46E-01	3.08E-02	1.03E-01	3.07E-02	1.41E-02	5.68E-03	4.70E-03	7.63E+01
Cl-36	5.41E-04	2.56E-04	6.04E-04	1.27E-04	4.26E-04	1.27E-04	5.84E-05	2.35E-05	1.94E-05	3.16E-01
Co-60	1.60E+03	7.57E+02	1.79E+03	3.77E+02	1.26E+03	3.76E+02	1.73E+02	6.95E+01	5.75E+01	9.35E+05
Cs-137	2.40E-02	1.14E-02	2.69E-02	5.65E-03	1.90E-02	5.64E-03	2.60E-03	1.04E-03	8.63E-04	1.40E+01
H-3	3.60E-01	1.70E-01	4.03E-01	8.47E-02	2.84E-01	8.46E-02	3.90E-02	1.56E-02	1.29E-02	2.10E+02
I-129	1.29E-07	6.12E-08	1.45E-07	3.04E-08	1.02E-07	3.04E-08	1.40E-08	5.62E-09	4.65E-09	7.56E-05
Nb-94	1.74E-02	8.20E-03	1.94E-02	4.08E-03	1.37E-02	4.07E-03	1.88E-03	7.53E-04	6.23E-04	1.01E+01
Ni-59	3.87E+00	1.83E+00	4.33E+00	9.10E-01	3.05E+00	9.09E-01	4.18E-01	1.68E-01	1.39E-01	2.26E+03
Ni-63	4.54E+02	2.15E+02	5.07E+02	1.07E+02	3.58E+02	1.07E+02	4.91E+01	1.97E+01	1.63E+01	2.65E+05
Np-237	—	—	—	—	—	—	—	—	—	—
Pu-238	2.40E-04	1.14E-04	2.69E-04	5.65E-05	1.90E-04	5.64E-05	2.60E-05	1.04E-05	8.63E-06	1.40E-01
Pu-239	5.61E-04	2.65E-04	6.27E-04	1.32E-04	4.42E-04	1.32E-04	6.06E-05	2.43E-05	2.01E-05	3.27E-01
Pu-240	3.47E-04	1.64E-04	3.88E-04	8.16E-05	2.74E-04	8.15E-05	3.75E-05	1.51E-05	1.25E-05	2.03E-01
Pu-241	2.94E-02	1.39E-02	3.28E-02	6.91E-03	2.32E-02	6.89E-03	3.17E-03	1.27E-03	1.05E-03	1.71E+01
Sr-90	1.28E-02	6.06E-03	1.43E-02	3.01E-03	1.01E-02	3.01E-03	1.39E-03	5.56E-04	4.60E-04	7.48E+00
Tc-99	6.94E-05	3.28E-05	7.76E-05	1.63E-05	5.48E-05	1.63E-05	7.50E-06	3.01E-06	2.49E-06	4.05E-02
U-233	—	—	—	—	—	—	—	—	—	—
U-234	3.74E-07	1.77E-07	4.18E-07	8.79E-08	2.95E-07	8.77E-08	4.04E-08	1.62E-08	1.34E-08	2.18E-04
U-235	1.07E-08	5.05E-09	1.19E-08	2.51E-09	8.42E-09	2.51E-09	1.15E-09	4.64E-10	3.84E-10	6.23E-06
U-236	3.47E-08	1.64E-08	3.88E-08	8.16E-09	2.74E-08	8.15E-09	3.75E-09	1.51E-09	1.25E-09	2.03E-05
U-238	4.00E-07	1.89E-07	4.48E-07	9.42E-08	3.16E-07	9.40E-08	4.33E-08	1.74E-08	1.44E-08	2.34E-04

Table A-17. NRF-MOD-7H upper-bound estimate inventory summary (1955-1964).

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Am-241	3.96E-11	1.38E-05	4.16E-06	1.58E-06	2.77E-05	2.10E-05	1.66E-04	1.89E-04	4.83E-04	1.26E-04
C-14	7.28E-08	2.54E-02	7.65E-03	2.91E-03	5.09E-02	3.87E-02	3.06E-01	3.48E-01	8.89E-01	2.31E-01
Cl-36	1.09E-10	3.82E-05	1.15E-05	4.38E-06	7.66E-05	5.82E-05	4.60E-04	5.23E-04	1.34E-03	3.48E-04
Co-60	—	—	—	—	—	—	—	—	—	—
Cs-137	9.96E-09	3.48E-03	1.05E-03	3.98E-04	6.97E-03	5.29E-03	4.18E-02	4.76E-02	1.22E-01	3.17E-02
H-3	1.49E-07	5.20E-02	1.57E-02	5.96E-03	1.04E-01	7.92E-02	6.26E-01	7.11E-01	1.82E+00	4.73E-01
I-129	3.84E-15	1.34E-09	4.03E-10	1.53E-10	2.68E-09	2.04E-09	1.61E-08	1.83E-08	4.69E-08	1.22E-08
Nb-94	6.09E-11	2.12E-05	6.40E-06	2.43E-06	4.26E-05	3.23E-05	2.56E-04	2.91E-04	7.43E-04	1.93E-04
Ni-59	8.72E-10	3.04E-04	9.17E-05	3.49E-05	6.10E-04	4.63E-04	3.66E-03	4.16E-03	1.06E-02	2.77E-03
Ni-63	1.10E-07	3.86E-02	1.16E-02	4.42E-03	7.72E-02	5.87E-02	4.64E-01	5.27E-01	1.35E+00	3.51E-01
Np-237	2.57E-14	8.99E-09	2.71E-09	1.03E-09	1.80E-08	1.37E-08	1.08E-07	1.23E-07	3.14E-07	8.18E-08
Pu-238	5.26E-11	1.84E-05	5.53E-06	2.10E-06	3.68E-05	2.79E-05	2.21E-04	2.51E-04	6.42E-04	1.67E-04
Pu-239	3.00E-10	1.05E-04	3.15E-05	1.20E-05	2.10E-04	1.59E-04	1.26E-03	1.43E-03	3.66E-03	9.53E-04
Pu-240	1.05E-10	3.65E-05	1.10E-05	4.18E-06	7.31E-05	5.56E-05	4.39E-04	4.99E-04	1.28E-03	3.32E-04
Pu-241	6.94E-09	2.42E-03	7.30E-04	2.78E-04	4.86E-03	3.69E-03	2.92E-02	3.31E-02	8.48E-02	2.21E-02
Sr-90	6.04E-09	2.11E-03	6.35E-04	2.41E-04	4.22E-03	3.21E-03	2.54E-02	2.88E-02	7.37E-02	1.92E-02
Tc-99	2.00E-12	6.99E-07	2.11E-07	8.01E-08	1.40E-06	1.06E-06	8.41E-06	9.56E-06	2.45E-05	6.36E-06
U-233	1.95E-12	6.82E-07	2.05E-07	7.81E-08	1.37E-06	1.04E-06	8.20E-06	9.32E-06	2.38E-05	6.21E-06
U-234	1.75E-13	6.10E-08	1.84E-08	6.98E-09	1.22E-07	9.28E-08	7.33E-07	8.33E-07	2.13E-06	5.55E-07
U-235	4.44E-15	1.55E-09	4.67E-10	1.78E-10	3.10E-09	2.36E-09	1.86E-08	2.12E-08	5.42E-08	1.41E-08
U-236	1.35E-14	4.72E-09	1.42E-09	5.40E-10	9.45E-09	7.18E-09	5.68E-08	6.45E-08	1.65E-07	4.29E-08
U-238	1.57E-13	5.48E-08	1.65E-08	6.27E-09	1.10E-07	8.33E-08	6.59E-07	7.49E-07	1.92E-06	4.98E-07

Table A-17. (continued). NRF-MOD-7H upper-bound estimate inventory summary (1965-1975).

	1965	1966	1967	1970	1971	1973	1974	1975	Totals
Am-241	1.09E-03	5.39E-04	1.31E-05	3.93E-04	9.34E-04	2.65E-06	2.67E-06	4.01E-07	4.01E-03
C-14	2.01E+00	9.93E-01	2.42E-02	7.24E-01	1.72E+00	4.88E-03	4.92E-03	7.38E-04	7.38E+00
Cl-36	3.03E-03	1.49E-03	3.63E-05	1.09E-03	2.58E-03	7.34E-06	7.40E-06	1.11E-06	1.11E-02
Co-60	—	—	—	—	—	—	—	—	—
Cs-137	2.75E-01	1.36E-01	3.31E-03	9.90E-02	2.35E-01	6.67E-04	6.73E-04	1.01E-04	1.01E+00
H-3	4.12E+00	2.03E+00	4.94E-02	1.48E+00	3.52E+00	9.98E-03	1.01E-02	1.51E-03	1.51E+01
I-129	1.06E-07	5.23E-08	1.27E-09	3.81E-08	9.06E-08	2.57E-10	2.59E-10	3.89E-11	3.89E-07
Nb-94	1.68E-03	8.30E-04	2.02E-05	6.05E-04	1.44E-03	4.08E-06	4.11E-06	6.17E-07	6.17E-03
Ni-59	2.41E-02	1.19E-02	2.89E-04	8.67E-03	2.06E-02	5.84E-05	5.89E-05	8.84E-06	8.84E-02
Ni-63	3.05E+00	1.51E+00	3.67E-02	1.10E+00	2.61E+00	7.40E-03	7.46E-03	1.12E-03	1.12E+01
Np-237	7.11E-07	3.51E-07	8.54E-09	2.56E-07	6.08E-07	1.72E-09	1.74E-09	2.61E-10	2.61E-06
Pu-238	1.45E-03	7.17E-04	1.74E-05	5.23E-04	1.24E-03	3.52E-06	3.55E-06	5.33E-07	5.33E-03
Pu-239	8.29E-03	4.09E-03	9.95E-05	2.98E-03	7.08E-03	2.01E-05	2.03E-05	3.04E-06	3.04E-02
Pu-240	2.89E-03	1.43E-03	3.47E-05	1.04E-03	2.47E-03	7.00E-06	7.06E-06	1.06E-06	1.06E-02
Pu-241	1.92E-01	9.47E-02	2.30E-03	6.90E-02	1.64E-01	4.65E-04	4.69E-04	7.04E-05	7.04E-01
Sr-90	1.67E-01	8.23E-02	2.00E-03	6.00E-02	1.42E-01	4.04E-04	4.08E-04	6.12E-05	6.12E-01
Tc-99	5.53E-05	2.73E-05	6.64E-07	1.99E-05	4.73E-05	1.34E-07	1.35E-07	2.03E-08	2.03E-04
U-233	5.40E-05	2.66E-05	6.48E-07	1.94E-05	4.61E-05	1.31E-07	1.32E-07	1.98E-08	1.98E-04
U-234	4.82E-06	2.38E-06	5.79E-08	1.74E-06	4.12E-06	1.17E-08	1.18E-08	1.77E-09	1.77E-05
U-235	1.23E-07	6.05E-08	1.47E-09	4.41E-08	1.05E-07	2.97E-10	3.00E-10	4.50E-11	4.50E-07
U-236	3.73E-07	1.84E-07	4.48E-09	1.34E-07	3.19E-07	9.05E-10	9.13E-10	1.37E-10	1.37E-06
U-238	4.33E-06	2.14E-06	5.20E-08	1.56E-06	3.70E-06	1.05E-08	1.06E-08	1.59E-09	1.59E-05

Table A-18. NRF-MOD-8H upper-bound estimate inventory summary (1956-1965).

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Am-241	3.07E-09	1.43E-05	2.36E-06	7.60E-07	2.22E-07	1.93E-04	3.33E-03	5.81E-06	2.33E-06	2.81E-09
C-14	7.00E-06	3.26E-02	5.38E-03	1.73E-03	5.06E-04	4.39E-01	7.59E+00	1.33E-02	5.31E-03	6.42E-06
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	8.73E-04	4.07E+00	6.70E-01	2.16E-01	6.31E-02	5.48E+01	9.46E+02	1.65E+00	6.62E-01	8.00E-04
Cs-137	3.50E-07	1.63E-03	2.69E-04	8.67E-05	2.53E-05	2.20E-02	3.79E-01	6.63E-04	2.65E-04	3.21E-07
H-3	—	—	—	—	—	—	—	—	—	—
I-129	3.51E-11	1.63E-07	2.69E-08	8.69E-09	2.54E-09	2.20E-06	3.80E-05	6.65E-08	2.66E-08	3.22E-11
Nb-94	1.75E-07	8.17E-04	1.35E-04	4.35E-05	1.27E-05	1.10E-02	1.90E-01	3.32E-04	1.33E-04	1.61E-07
Ni-59	2.63E-06	1.22E-02	2.02E-03	6.51E-04	1.90E-04	1.65E-01	2.85E+00	4.98E-03	1.99E-03	2.41E-06
Ni-63	2.63E-04	1.22E+00	2.02E-01	6.51E-02	1.90E-02	1.65E+01	2.85E+02	4.98E-01	1.99E-01	2.41E-04
Np-237	2.63E-14	1.22E-10	2.02E-11	6.51E-12	1.90E-12	1.65E-09	2.85E-08	4.98E-11	1.99E-11	2.41E-14
Pu-238	2.19E-09	1.02E-05	1.68E-06	5.42E-07	1.58E-07	1.37E-04	2.37E-03	4.14E-06	1.66E-06	2.00E-09
Pu-239	3.51E-10	1.63E-06	2.69E-07	8.69E-08	2.54E-08	2.20E-05	3.80E-04	6.65E-07	2.66E-07	3.22E-10
Pu-240	2.19E-10	1.02E-06	1.68E-07	5.42E-08	1.58E-08	1.37E-05	2.37E-04	4.14E-07	1.66E-07	2.00E-10
Pu-241	8.73E-08	4.07E-04	6.70E-05	2.16E-05	6.31E-06	5.48E-03	9.46E-02	1.65E-04	6.62E-05	8.00E-08
Sr-90	3.50E-07	1.63E-03	2.69E-04	8.67E-05	2.53E-05	2.20E-02	3.79E-01	6.63E-04	2.65E-04	3.21E-07
Tc-99	8.73E-09	4.07E-05	6.70E-06	2.16E-06	6.31E-07	5.48E-04	9.46E-03	1.65E-05	6.62E-06	8.00E-09
U-233	2.37E-12	1.10E-08	1.82E-09	5.87E-10	1.71E-10	1.49E-07	2.57E-06	4.48E-09	1.80E-09	2.17E-12
U-234	2.63E-12	1.22E-08	2.02E-09	6.51E-10	1.90E-10	1.65E-07	2.85E-06	4.98E-09	1.99E-09	2.41E-12
U-235	1.84E-16	8.58E-13	1.41E-13	4.56E-14	1.33E-14	1.16E-11	2.00E-10	3.49E-13	1.40E-13	1.69E-16
U-236	9.68E-15	4.51E-11	7.43E-12	2.40E-12	6.99E-13	6.07E-10	1.05E-08	1.83E-11	7.34E-12	8.87E-15
U-238	4.30E-14	2.00E-10	3.30E-11	1.06E-11	3.10E-12	2.70E-09	4.66E-08	8.13E-11	3.26E-11	3.94E-14

Table A-18. (continued). NRF-MOD-8H upper-bound estimate inventory summary (1966-1971).

	1966	1967	1968	1969	1970	1971	Totals
Am-241	3.82E-06	9.02E-08	1.03E-06	7.17E-07	3.10E-10	2.41E-07	3.55E-03
C-14	8.71E-03	2.06E-04	2.34E-03	1.64E-03	7.07E-07	5.50E-04	8.10E+00
Cl-36	—	—	—	—	—	—	—
Co-60	1.09E+00	2.57E-02	2.92E-01	2.04E-01	8.81E-05	6.86E-02	1.01E+03
Cs-137	4.35E-04	1.03E-05	1.17E-04	8.18E-05	3.53E-08	2.75E-05	4.05E-01
H-3	—	—	—	—	—	—	—
I-129	4.37E-08	1.03E-09	1.17E-08	8.20E-09	3.54E-12	2.76E-09	4.06E-05
Nb-94	2.18E-04	5.16E-06	5.87E-05	4.10E-05	1.77E-08	1.38E-05	2.03E-01
Ni-59	3.27E-03	7.72E-05	8.78E-04	6.14E-04	2.65E-07	2.07E-04	3.04E+00
Ni-63	3.27E-01	7.72E-03	8.78E-02	6.14E-02	2.65E-05	2.07E-02	3.04E+02
Np-237	3.27E-11	7.72E-13	8.78E-12	6.14E-12	2.65E-15	2.07E-12	3.04E-08
Pu-238	2.72E-06	6.43E-08	7.31E-07	5.11E-07	2.21E-10	1.72E-07	2.53E-03
Pu-239	4.37E-07	1.03E-08	1.17E-07	8.20E-08	3.54E-11	2.76E-08	4.06E-04
Pu-240	2.72E-07	6.43E-09	7.31E-08	5.11E-08	2.21E-11	1.72E-08	2.53E-04
Pu-241	1.09E-04	2.57E-06	2.92E-05	2.04E-05	8.81E-09	6.86E-06	1.01E-01
Sr-90	4.35E-04	1.03E-05	1.17E-04	8.18E-05	3.53E-08	2.75E-05	4.05E-01
Tc-99	1.09E-05	2.57E-07	2.92E-06	2.04E-06	8.81E-10	6.86E-07	1.01E-02
U-233	2.95E-09	6.96E-11	7.92E-10	5.53E-10	2.39E-13	1.86E-10	2.74E-06
U-234	3.27E-09	7.72E-11	8.78E-10	6.14E-10	2.65E-13	2.07E-10	3.04E-06
U-235	2.29E-13	5.41E-15	6.15E-14	4.30E-14	1.86E-17	1.45E-14	2.13E-10
U-236	1.20E-11	2.85E-13	3.24E-12	2.26E-12	9.77E-16	7.61E-13	1.12E-08
U-238	5.34E-11	1.26E-12	1.44E-11	1.00E-11	4.34E-15	3.38E-12	4.97E-08

Table A-19. NRF-MOD-9H upper-bound estimate inventory summary (1954-1965).

	1954	1955	1957	1958	1959	1960	1961	1963	1964	1965
Am-241	1.57E-03	2.41E-03	2.01E-03	7.25E-04	4.37E-04	8.15E-05	8.07E-04	3.11E-04	2.27E-05	6.48E-03
C-14	2.89E+00	4.42E+00	3.69E+00	1.33E+00	8.03E-01	1.50E-01	1.48E+00	5.71E-01	4.18E-02	1.19E+01
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	4.46E+02	6.83E+02	5.70E+02	2.06E+02	1.24E+02	2.31E+01	2.29E+02	8.82E+01	6.45E+00	1.84E+03
Cs-137	1.79E-01	2.74E-01	2.29E-01	8.27E-02	4.98E-02	9.28E-03	9.20E-02	3.54E-02	2.59E-03	7.39E-01
H-3	—	—	—	—	—	—	—	—	—	—
I-129	1.79E-05	2.74E-05	2.29E-05	8.27E-06	4.98E-06	9.28E-07	9.20E-06	3.54E-06	2.59E-07	7.39E-05
Nb-94	8.96E-02	1.37E-01	1.15E-01	4.13E-02	2.49E-02	4.64E-03	4.60E-02	1.77E-02	1.29E-03	3.70E-01
Ni-59	1.34E+00	2.06E+00	1.72E+00	6.20E-01	3.73E-01	6.96E-02	6.90E-01	2.66E-01	1.94E-02	5.54E+00
Ni-63	1.34E+02	2.06E+02	1.72E+02	6.20E+01	3.73E+01	6.96E+00	6.90E+01	2.66E+01	1.94E+00	5.54E+02
Np-237	1.34E-08	2.06E-08	1.72E-08	6.20E-09	3.73E-09	6.96E-10	6.90E-09	2.66E-09	1.94E-10	5.54E-08
Pu-238	1.12E-03	1.72E-03	1.44E-03	5.19E-04	3.12E-04	5.83E-05	5.77E-04	2.22E-04	1.62E-05	4.64E-03
Pu-239	1.79E-04	2.74E-04	2.29E-04	8.27E-05	4.98E-05	9.28E-06	9.20E-05	3.54E-05	2.59E-06	7.39E-04
Pu-240	1.12E-04	1.72E-04	1.44E-04	5.19E-05	3.12E-05	5.83E-06	5.77E-05	2.22E-05	1.62E-06	4.64E-04
Pu-241	4.48E-02	6.86E-02	5.73E-02	2.07E-02	1.24E-02	2.32E-03	2.30E-02	8.86E-03	6.47E-04	1.85E-01
Sr-90	1.79E-01	2.74E-01	2.29E-01	8.27E-02	4.98E-02	9.28E-03	9.20E-02	3.54E-02	2.59E-03	7.39E-01
Tc-99	4.49E-03	6.87E-03	5.74E-03	2.07E-03	1.25E-03	2.33E-04	2.30E-03	8.88E-04	6.49E-05	1.85E-02
U-233	1.21E-06	1.86E-06	1.55E-06	5.59E-07	3.37E-07	6.28E-08	6.22E-07	2.40E-07	1.75E-08	5.00E-06
U-234	1.35E-06	2.07E-06	1.73E-06	6.24E-07	3.76E-07	7.01E-08	6.94E-07	2.68E-07	1.95E-08	5.58E-06
U-235	9.40E-11	1.44E-10	1.20E-10	4.34E-11	2.61E-11	4.87E-12	4.82E-11	1.86E-11	1.36E-12	3.88E-10
U-236	4.94E-09	7.56E-09	6.31E-09	2.28E-09	1.37E-09	2.56E-10	2.53E-09	9.76E-10	7.13E-11	2.04E-08
U-238	2.20E-08	3.36E-08	2.81E-08	1.01E-08	6.10E-09	1.14E-09	1.13E-08	4.34E-09	3.17E-10	9.06E-08

Table A-19. (continued). NRF-MOD-9H upper-bound estimate inventory summary (1966-1971).

	1966	1968	1969	1970	1971	Totals
Am-241	1.83E-04	7.54E-04	9.42E-04	3.56E-04	8.08E-04	1.79E-02
C-14	3.36E-01	1.39E+00	1.73E+00	6.54E-01	1.48E+00	3.29E+01
Cl-36	—	—	—	—	—	—
Co-60	5.18E+01	2.14E+02	2.67E+02	1.01E+02	2.29E+02	5.08E+03
Cs-137	2.08E-02	8.59E-02	1.07E-01	4.05E-02	9.21E-02	2.04E+00
H-3	—	—	—	—	—	—
I-129	2.08E-06	8.59E-06	1.07E-05	4.05E-06	9.21E-06	2.04E-04
Nb-94	1.04E-02	4.30E-02	5.37E-02	2.03E-02	4.60E-02	1.02E+00
Ni-59	1.56E-01	6.45E-01	8.05E-01	3.04E-01	6.90E-01	1.53E+01
Ni-63	1.56E+01	6.45E+01	8.05E+01	3.04E+01	6.90E+01	1.53E+03
Np-237	1.56E-09	6.45E-09	8.05E-09	3.04E-09	6.90E-09	1.53E-07
Pu-238	1.31E-04	5.39E-04	6.74E-04	2.54E-04	5.78E-04	1.28E-02
Pu-239	2.08E-05	8.59E-05	1.07E-04	4.05E-05	9.21E-05	2.04E-03
Pu-240	1.31E-05	5.39E-05	6.74E-05	2.54E-05	5.78E-05	1.28E-03
Pu-241	5.20E-03	2.15E-02	2.68E-02	1.01E-02	2.30E-02	5.10E-01
Sr-90	2.08E-02	8.59E-02	1.07E-01	4.05E-02	9.21E-02	2.04E+00
Tc-99	5.21E-04	2.15E-03	2.69E-03	1.02E-03	2.31E-03	5.11E-02
U-233	1.41E-07	5.81E-07	7.27E-07	2.74E-07	6.23E-07	1.38E-05
U-234	1.57E-07	6.49E-07	8.11E-07	3.06E-07	6.95E-07	1.54E-05
U-235	1.09E-11	4.51E-11	5.63E-11	2.13E-11	4.83E-11	1.07E-09
U-236	5.73E-10	2.37E-09	2.96E-09	1.12E-09	2.54E-09	5.62E-08
U-238	2.55E-09	1.05E-08	1.32E-08	4.97E-09	1.13E-08	2.50E-07

Table A-20. NRF-MOD-10H upper-bound estimate inventory summary (1953-1962).

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
Am-241	9.98E-06	8.19E-05	3.44E-05	1.82E-03	1.07E-03	6.68E-04	3.08E-03	2.61E-03	1.45E-02	2.15E-04
C-14	—	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	2.85E+00	2.34E+01	9.85E+00	5.20E+02	3.07E+02	1.91E+02	8.81E+02	7.46E+02	4.15E+03	6.15E+01
Cs-137	1.14E-03	9.37E-03	3.94E-03	2.08E-01	1.23E-01	7.64E-02	3.53E-01	2.99E-01	1.66E+00	2.46E-02
H-3	—	—	—	—	—	—	—	—	—	—
I-129	1.14E-07	9.37E-07	3.94E-07	2.08E-05	1.23E-05	7.64E-06	3.53E-05	2.99E-05	1.66E-04	2.46E-06
Nb-94	5.71E-04	4.69E-03	1.97E-03	1.04E-01	6.13E-02	3.82E-02	1.76E-01	1.49E-01	8.29E-01	1.23E-02
Ni-59	8.56E-03	7.03E-02	2.95E-02	1.56E+00	9.20E-01	5.73E-01	2.64E+00	2.24E+00	1.24E+01	1.84E-01
Ni-63	4.55E-01	3.74E+00	1.57E+00	8.29E+01	4.89E+01	3.05E+01	1.41E+02	1.19E+02	6.62E+02	9.81E+00
Np-237	8.56E-11	7.03E-10	2.95E-10	1.56E-08	9.20E-09	5.73E-09	2.64E-08	2.24E-08	1.24E-07	1.84E-09
Pu-238	7.12E-06	5.85E-05	2.46E-05	1.30E-03	7.65E-04	4.77E-04	2.20E-03	1.86E-03	1.04E-02	1.53E-04
Pu-239	1.14E-06	9.37E-06	3.94E-06	2.08E-04	1.23E-04	7.64E-05	3.53E-04	2.99E-04	1.66E-03	2.46E-05
Pu-240	7.12E-07	5.85E-06	2.46E-06	1.30E-04	7.65E-05	4.77E-05	2.20E-04	1.86E-04	1.04E-03	1.53E-05
Pu-241	2.85E-04	2.34E-03	9.85E-04	5.20E-02	3.07E-02	1.91E-02	8.81E-02	7.46E-02	4.15E-01	6.15E-03
Sr-90	1.14E-03	9.37E-03	3.94E-03	2.08E-01	1.23E-01	7.64E-02	3.53E-01	2.99E-01	1.66E+00	2.46E-02
Tc-99	2.85E-05	2.34E-04	9.85E-05	5.20E-03	3.07E-03	1.91E-03	8.81E-03	7.46E-03	4.15E-02	6.15E-04
U-233	7.71E-09	6.33E-08	2.66E-08	1.40E-06	8.29E-07	5.16E-07	2.38E-06	2.02E-06	1.12E-05	1.66E-07
U-234	8.56E-09	7.03E-08	2.95E-08	1.56E-06	9.20E-07	5.73E-07	2.64E-06	2.24E-06	1.24E-05	1.84E-07
U-235	5.99E-13	4.92E-12	2.07E-12	1.09E-10	6.44E-11	4.01E-11	1.85E-10	1.57E-10	8.71E-10	1.29E-11
U-236	3.14E-11	2.58E-10	1.08E-10	5.71E-09	3.37E-09	2.10E-09	9.69E-09	8.20E-09	4.56E-08	6.76E-10
U-238	1.40E-10	1.15E-09	4.84E-10	2.56E-08	1.51E-08	9.40E-09	4.33E-08	3.67E-08	2.04E-07	3.02E-09

Table A-20. (continued). NRF-MOD-10H upper-bound estimate inventory summary (1963-1972).

	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Am-241	2.24E-04	3.38E-03	3.59E-01	7.28E-02	2.21E-01	9.20E-04	8.46E-04	7.22E-05	6.20E-04	2.02E-04
C-14	—	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—	—
Co-60	6.40E+01	9.66E+02	1.03E+05	2.08E+04	6.33E+04	2.63E+02	2.42E+02	2.06E+01	1.77E+02	5.78E+01
Cs-137	2.56E-02	3.87E-01	4.10E+01	8.33E+00	2.53E+01	1.05E-01	9.68E-02	8.26E-03	7.09E-02	2.31E-02
H-3	—	—	—	—	—	—	—	—	—	—
I-129	2.56E-06	3.87E-05	4.10E-03	8.33E-04	2.53E-03	1.05E-05	9.68E-06	8.26E-07	7.09E-06	2.31E-06
Nb-94	1.28E-02	1.93E-01	2.05E+01	4.16E+00	1.27E+01	5.26E-02	4.84E-02	4.13E-03	3.54E-02	1.16E-02
Ni-59	1.92E-01	2.90E+00	3.08E+02	6.24E+01	1.90E+02	7.90E-01	7.26E-01	6.19E-02	5.32E-01	1.73E-01
Ni-63	1.02E+01	1.54E+02	1.64E+04	3.32E+03	1.01E+04	4.20E+01	3.86E+01	3.29E+00	2.83E+01	9.22E+00
Np-237	1.92E-09	2.90E-08	3.08E-06	6.24E-07	1.90E-06	7.90E-09	7.26E-09	6.19E-10	5.32E-09	1.73E-09
Pu-238	1.60E-04	2.41E-03	2.56E-01	5.20E-02	1.58E-01	6.57E-04	6.04E-04	5.15E-05	4.42E-04	1.44E-04
Pu-239	2.56E-05	3.87E-04	4.10E-02	8.33E-03	2.53E-02	1.05E-04	9.68E-05	8.26E-06	7.09E-05	2.31E-05
Pu-240	1.60E-05	2.41E-04	2.56E-02	5.20E-03	1.58E-02	6.57E-05	6.04E-05	5.15E-06	4.42E-05	1.44E-05
Pu-241	6.40E-03	9.66E-02	1.03E+01	2.08E+00	6.33E+00	2.63E-02	2.42E-02	2.06E-03	1.77E-02	5.78E-03
Sr-90	2.56E-02	3.87E-01	4.10E+01	8.33E+00	2.53E+01	1.05E-01	9.68E-02	8.26E-03	7.09E-02	2.31E-02
Tc-99	6.40E-04	9.66E-03	1.03E+00	2.08E-01	6.33E-01	2.63E-03	2.42E-03	2.06E-04	1.77E-03	5.78E-04
U-233	1.73E-07	2.61E-06	2.77E-04	5.63E-05	1.71E-04	7.11E-07	6.54E-07	5.58E-08	4.79E-07	1.56E-07
U-234	1.92E-07	2.90E-06	3.08E-04	6.24E-05	1.90E-04	7.90E-07	7.26E-07	6.19E-08	5.32E-07	1.73E-07
U-235	1.34E-11	2.03E-10	2.15E-08	4.37E-09	1.33E-08	5.52E-11	5.08E-11	4.33E-12	3.72E-11	1.21E-11
U-236	7.04E-10	1.06E-08	1.13E-06	2.29E-07	6.95E-07	2.89E-09	2.66E-09	2.27E-10	1.95E-09	6.35E-10
U-238	3.15E-09	4.75E-08	5.04E-06	1.02E-06	3.11E-06	1.29E-08	1.19E-08	1.01E-09	8.71E-09	2.84E-09

Table A-20. (continued). NRF-MOD-10H upper-bound estimate inventory summary (1973-1981).

	1973	1974	1975	1976	1977	1978	1979	1980	1981
Am-241	4.10E-03	4.55E-03	5.12E-04	2.81E-04	2.97E-05	3.18E-05	1.24E-04	4.76E-04	5.03E-04
C-14	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—
Co-60	1.17E+03	1.30E+03	1.47E+02	8.04E+01	8.50E+00	9.09E+00	3.54E+01	1.36E+02	1.44E+02
Cs-137	4.69E-01	5.20E-01	5.86E-02	3.22E-02	3.40E-03	3.64E-03	1.42E-02	5.44E-02	5.76E-02
H-3	—	—	—	—	—	—	—	—	—
I-129	4.69E-05	5.20E-05	5.86E-06	3.22E-06	3.40E-07	3.64E-07	1.42E-06	5.44E-06	5.76E-06
Nb-94	2.34E-01	2.60E-01	2.93E-02	1.61E-02	1.70E-03	1.82E-03	7.08E-03	2.72E-02	2.88E-02
Ni-59	3.51E+00	3.90E+00	4.40E-01	2.41E-01	2.55E-02	2.73E-02	1.06E-01	4.08E-01	4.32E-01
Ni-63	1.87E+02	2.07E+02	2.34E+01	1.28E+01	1.36E+00	1.45E+00	5.64E+00	2.17E+01	2.30E+01
Np-237	3.51E-08	3.90E-08	4.40E-09	2.41E-09	2.55E-10	2.73E-10	1.06E-09	4.08E-09	4.32E-09
Pu-238	2.92E-03	3.25E-03	3.66E-04	2.01E-04	2.12E-05	2.27E-05	8.83E-05	3.40E-04	3.59E-04
Pu-239	4.69E-04	5.20E-04	5.86E-05	3.22E-05	3.40E-06	3.64E-06	1.42E-05	5.44E-05	5.76E-05
Pu-240	2.92E-04	3.25E-04	3.66E-05	2.01E-05	2.12E-06	2.27E-06	8.83E-06	3.40E-05	3.59E-05
Pu-241	1.17E-01	1.30E-01	1.47E-02	8.04E-03	8.50E-04	9.09E-04	3.54E-03	1.36E-02	1.44E-02
Sr-90	4.69E-01	5.20E-01	5.86E-02	3.22E-02	3.40E-03	3.64E-03	1.42E-02	5.44E-02	5.76E-02
Tc-99	1.17E-02	1.30E-02	1.47E-03	8.04E-04	8.50E-05	9.09E-05	3.54E-04	1.36E-03	1.44E-03
U-233	3.17E-06	3.51E-06	3.96E-07	2.17E-07	2.30E-08	2.46E-08	9.56E-08	3.68E-07	3.89E-07
U-234	3.51E-06	3.90E-06	4.40E-07	2.41E-07	2.55E-08	2.73E-08	1.06E-07	4.08E-07	4.32E-07
U-235	2.46E-10	2.73E-10	3.08E-11	1.69E-11	1.78E-12	1.91E-12	7.43E-12	2.86E-11	3.02E-11
U-236	1.29E-08	1.43E-08	1.61E-09	8.84E-10	9.34E-11	9.99E-11	3.89E-10	1.50E-09	1.58E-09
U-238	5.76E-08	6.40E-08	7.21E-09	3.95E-09	4.18E-10	4.47E-10	1.74E-09	6.69E-09	7.08E-09

Table A-20. (continued). NRF-MOD-10H upper-bound estimate inventory summary (1982-1983).

	1982	1983	Totals
Am-241	1.03E-04	1.55E-04	6.94E-01
C-14	—	—	—
Cl-36	—	—	—
Co-60	2.95E+01	4.43E+01	1.98E+05
Cs-137	1.18E-02	1.77E-02	7.94E+01
H-3	—	—	—
I-129	1.18E-06	1.77E-06	7.94E-03
Nb-94	5.90E-03	8.85E-03	3.97E+01
Ni-59	8.85E-02	1.33E-01	5.95E+02
Ni-63	4.71E+00	7.06E+00	3.16E+04
Np-237	8.85E-10	1.33E-09	5.95E-06
Pu-238	7.36E-05	1.10E-04	4.95E-01
Pu-239	1.18E-05	1.77E-05	7.94E-02
Pu-240	7.36E-06	1.10E-05	4.95E-02
Pu-241	2.95E-03	4.43E-03	1.98E+01
Sr-90	1.18E-02	1.77E-02	7.94E+01
Tc-99	2.95E-04	4.43E-04	1.98E+00
U-233	7.97E-08	1.20E-07	5.36E-04
U-234	8.85E-08	1.33E-07	5.95E-04
U-235	6.19E-12	9.29E-12	4.16E-08
U-236	3.24E-10	4.87E-10	2.18E-06
U-238	1.45E-09	2.18E-09	9.76E-06

Appendix B

Naval Reactors Facility Radionuclide Inventory for Years 1984 through 1999

Appendix B

Naval Reactors Facility Radionuclide Inventory for Years 1984 through 1999

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Table B-1. NRF-MOD-6R best-estimate inventory summary (1984-1989).

	1984	1985	1986	1987	1988	1989
Am-241	3.26E-04	6.87E-03	1.74E-03	1.42E-03	3.26E-04	6.02E-03
C-14	1.14E-01	2.40E+00	6.09E-01	4.97E-01	1.14E-01	2.11E+00
Cl-36	4.72E-04	9.95E-03	2.52E-03	2.06E-03	4.73E-04	8.73E-03
Co-60	1.42E+03	2.99E+04	7.58E+03	6.19E+03	1.42E+03	2.62E+04
Cs-137	2.12E-02	4.46E-01	1.13E-01	9.24E-02	2.12E-02	3.92E-01
H-3	3.26E-01	6.87E+00	1.74E+00	1.42E+00	3.26E-01	6.02E+00
I-129	1.14E-07	2.40E-06	6.09E-07	4.97E-07	1.14E-07	2.11E-06
Nb-94	1.51E-02	3.19E-01	8.08E-02	6.60E-02	1.51E-02	2.80E-01
Ni-59	3.49E+00	7.36E+01	1.86E+01	1.52E+01	3.49E+00	6.45E+01
Ni-63	3.95E+02	8.34E+03	2.11E+03	1.73E+03	3.96E+02	7.31E+03
Np-237	—	—	—	—	—	—
Pu-238	2.07E-04	4.36E-03	1.11E-03	9.03E-04	2.07E-04	3.83E-03
Pu-239	4.88E-04	1.03E-02	2.61E-03	2.13E-03	4.89E-04	9.04E-03
Pu-240	3.02E-04	6.38E-03	1.62E-03	1.32E-03	3.03E-04	5.59E-03
Pu-241	2.56E-02	5.39E-01	1.37E-01	1.12E-01	2.56E-02	4.73E-01
Sr-90	1.12E-02	2.35E-01	5.97E-02	4.87E-02	1.12E-02	2.07E-01
Tc-99	6.05E-05	1.28E-03	3.23E-04	2.64E-04	6.05E-05	1.12E-03
U-233	—	—	—	—	—	—
U-234	3.26E-07	6.87E-06	1.74E-06	1.42E-06	3.26E-07	6.02E-06
U-235	9.30E-09	1.96E-07	4.97E-08	4.06E-08	9.31E-09	1.72E-07
U-236	3.02E-08	6.38E-07	1.62E-07	1.32E-07	3.03E-08	5.59E-07
U-238	3.49E-07	7.36E-06	1.86E-06	1.52E-06	3.49E-07	6.45E-06

Table B-1. (continued). NRF-MOD-6R best-estimate inventory summary (1990-1996).

	1990	1991	1992	1993	1994	1996	Totals
Am-241	3.36E-03	4.96E-03	2.41E-03	2.03E-03	1.47E-03	2.91E-08	3.09E-02
C-14	1.18E+00	1.73E+00	8.44E-01	7.11E-01	5.13E-01	1.02E-05	1.08E+01
Cl-36	4.88E-03	7.19E-03	3.50E-03	2.95E-03	2.13E-03	4.22E-08	4.49E-02
Co-60	1.47E+04	2.16E+04	1.05E+04	8.85E+03	6.39E+03	1.27E-01	1.35E+05
Cs-137	2.19E-01	3.22E-01	1.57E-01	1.32E-01	9.53E-02	1.89E-06	2.01E+00
H-3	3.36E+00	4.96E+00	2.41E+00	2.03E+00	1.47E+00	2.91E-05	3.09E+01
I-129	1.18E-06	1.73E-06	8.44E-07	7.11E-07	5.13E-07	1.02E-11	1.08E-05
Nb-94	1.56E-01	2.30E-01	1.12E-01	9.43E-02	6.81E-02	1.35E-06	1.44E+00
Ni-59	3.61E+01	5.31E+01	2.58E+01	2.18E+01	1.57E+01	3.12E-04	3.31E+02
Ni-63	4.09E+03	6.02E+03	2.93E+03	2.47E+03	1.78E+03	3.54E-02	3.76E+04
Np-237	—	—	—	—	—	—	—
Pu-238	2.14E-03	3.15E-03	1.53E-03	1.29E-03	9.32E-04	1.85E-08	1.97E-02
Pu-239	5.05E-03	7.44E-03	3.62E-03	3.05E-03	2.20E-03	4.37E-08	4.64E-02
Pu-240	3.12E-03	4.60E-03	2.24E-03	1.89E-03	1.36E-03	2.70E-08	2.87E-02
Pu-241	2.64E-01	3.89E-01	1.90E-01	1.60E-01	1.15E-01	2.29E-06	2.43E+00
Sr-90	1.15E-01	1.70E-01	8.27E-02	6.96E-02	5.03E-02	9.98E-07	1.06E+00
Tc-99	6.25E-04	9.21E-04	4.48E-04	3.77E-04	2.72E-04	5.41E-09	5.74E-03
U-233	—	—	—	—	—	—	—
U-234	3.36E-06	4.96E-06	2.41E-06	2.03E-06	1.47E-06	2.91E-11	3.09E-05
U-235	9.61E-08	1.42E-07	6.89E-08	5.80E-08	4.19E-08	8.32E-13	8.84E-07
U-236	3.12E-07	4.60E-07	2.24E-07	1.89E-07	1.36E-07	2.70E-12	2.87E-06
U-238	3.61E-06	5.31E-06	2.58E-06	2.18E-06	1.57E-06	3.12E-11	3.31E-05

Table B-2. NRF-MOD-6S best-estimate inventory summary (1998-1999).

	1998	1999	Total
Am-241	—	—	—
C-14	2.99E-01	1.41E-01	4.39E-01
Cl-36	5.79E-03	2.44E-03	8.23E-03
Co-60	1.03E+03	4.33E+02	1.46E+03
Cs-137	—	4.43E-02	4.43E-02
H-3	2.11E+00	5.71E-01	2.68E+00
I-129	1.98E-08	1.92E-08	3.89E-08
Nb-94	1.20E-01	1.24E-02	1.32E-01
Ni-59	1.63E+01	5.92E+00	2.22E+01
Ni-63	1.95E+03	7.19E+02	2.67E+03
Np-237	—	—	—
Pu-238	—	—	—
Pu-239	—	—	—
Pu-240	—	—	—
Pu-241	3.38E-02	1.97E-02	5.36E-02
Sr-90	2.40E-02	3.45E-02	5.85E-02
Tc-99	2.57E-04	2.40E-04	4.97E-04
U-233	—	—	—
U-234	—	—	—
U-235	—	—	—
U-236	—	—	—
U-238	—	—	—

Table B-3. NRF-MOD-10R best-estimate inventory summary (1984-1989).

	1984	1985	1986	1987	1988	1989
Am-241	6.14E-02	2.25E-05	2.51E-05	8.60E-04	8.97E-06	1.46E-04
C-14	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—
Co-60	1.76E+04	6.42E+00	7.17E+00	2.46E+02	2.57E+00	4.18E+01
Cs-137	7.03E+00	2.57E-03	2.87E-03	9.84E-02	1.03E-03	1.67E-02
H-3	—	—	—	—	—	—
I-129	7.03E-04	2.57E-07	2.87E-07	9.84E-06	1.03E-07	1.67E-06
Nb-94	3.52E+00	1.28E-03	1.43E-03	4.92E-02	5.13E-04	8.37E-03
Ni-59	5.27E+01	1.93E-02	2.15E-02	7.38E-01	7.70E-03	1.26E-01
Ni-63	2.80E+03	1.02E+00	1.14E+00	3.93E+01	4.09E-01	6.67E+00
Np-237	5.27E-07	1.93E-10	2.15E-10	7.38E-09	7.70E-11	1.26E-09
Pu-238	4.39E-02	1.60E-05	1.79E-05	6.14E-04	6.41E-06	1.04E-04
Pu-239	7.03E-03	2.57E-06	2.87E-06	9.84E-05	1.03E-06	1.67E-05
Pu-240	4.39E-03	1.60E-06	1.79E-06	6.14E-05	6.41E-07	1.04E-05
Pu-241	1.76E+00	6.42E-04	7.17E-04	2.46E-02	2.57E-04	4.18E-03
Sr-90	7.03E+00	2.57E-03	2.87E-03	9.84E-02	1.03E-03	1.67E-02
Tc-99	1.76E-01	6.42E-05	7.17E-05	2.46E-03	2.57E-05	4.18E-04
U-233	4.75E-05	1.74E-08	1.94E-08	6.65E-07	6.94E-09	1.13E-07
U-234	5.27E-05	1.93E-08	2.15E-08	7.38E-07	7.70E-09	1.26E-07
U-235	3.69E-09	1.35E-12	1.50E-12	5.17E-11	5.39E-13	8.78E-12
U-236	1.93E-07	7.06E-11	7.88E-11	2.71E-09	2.82E-11	4.60E-10
U-238	8.61E-07	3.15E-10	3.51E-10	1.21E-08	1.26E-10	2.05E-09

Table B-3. (continued). NRF-MOD-10R best-estimate inventory summary (1990-1993).

	1990	1991	1992	1993	Totals
Am-241	1.24E-02	9.85E-04	8.65E-06	3.60E-05	7.59E-02
C-14	—	—	—	—	—
Cl-36	—	—	—	—	—
Co-60	3.54E+03	2.82E+02	2.47E+00	1.03E+01	2.17E+04
Cs-137	1.42E+00	1.13E-01	9.90E-04	4.12E-03	8.69E+00
H-3	—	—	—	—	—
I-129	1.42E-04	1.13E-05	9.90E-08	4.12E-07	8.69E-04
Nb-94	7.09E-01	5.64E-02	4.95E-04	2.06E-03	4.34E+00
Ni-59	1.06E+01	8.46E-01	7.42E-03	3.09E-02	6.52E+01
Ni-63	5.65E+02	4.50E+01	3.95E-01	1.64E+00	3.46E+03
Np-237	1.06E-07	8.46E-09	7.42E-11	3.09E-10	6.52E-07
Pu-238	8.85E-03	7.04E-04	6.17E-06	2.57E-05	5.42E-02
Pu-239	1.42E-03	1.13E-04	9.90E-07	4.12E-06	8.69E-03
Pu-240	8.85E-04	7.04E-05	6.17E-07	2.57E-06	5.42E-03
Pu-241	3.54E-01	2.82E-02	2.47E-04	1.03E-03	2.17E+00
Sr-90	1.42E+00	1.13E-01	9.90E-04	4.12E-03	8.69E+00
Tc-99	3.54E-02	2.82E-03	2.47E-05	1.03E-04	2.17E-01
U-233	9.58E-06	7.62E-07	6.69E-09	2.79E-08	5.87E-05
U-234	1.06E-05	8.46E-07	7.42E-09	3.09E-08	6.52E-05
U-235	7.44E-10	5.92E-11	5.19E-13	2.16E-12	4.56E-09
U-236	3.90E-08	3.10E-09	2.72E-11	1.13E-10	2.39E-07
U-238	1.74E-07	1.38E-08	1.21E-10	5.05E-10	1.06E-06

Table B-4. NRF-MOD-10S best-estimate inventory summary (1994-1999).

	1994	1995	1996	1997	1998	1999	Total
Am-241	3.48E-05	1.72E-04	2.09E-08	5.18E-06	5.06E-06	8.45E-04	1.06E-03
C-14	1.44E-02	5.08E-01	6.83E-03	1.61E-02	6.21E-02	6.91E-02	6.76E-01
Cl-36	1.26E-05	2.12E-04	5.40E-06	9.62E-06	2.47E-05	3.42E-05	2.98E-04
Co-60	5.35E+00	4.03E+01	9.58E-01	1.70E+00	4.38E+00	6.05E+00	5.88E+01
Cs-137	7.07E-01	3.28E-02	1.59E-01	7.67E-04	9.66E-04	4.95E-02	9.50E-01
H-3	8.64E+00	1.99E-01	2.19E+00	1.61E-03	1.41E-02	9.65E-03	1.11E+01
I-129	1.51E-05	2.47E-06	7.20E-07	8.80E-04	2.72E-07	4.44E-07	8.99E-04
Nb-94	5.77E-03	1.09E-02	2.12E-03	5.90E-02	1.04E-02	1.34E-02	1.02E-01
Ni-59	7.11E-02	1.61E-01	6.73E-03	4.46E-02	9.95E-01	1.59E-01	1.44E+00
Ni-63	6.74E+00	1.55E+01	7.35E-01	1.52E+00	1.08E+02	5.30E+00	1.38E+02
Np-237	—	—	—	—	—	—	—
Pu-238	1.06E-05	1.27E-04	2.87E-03	8.03E-04	2.58E-05	7.17E-04	4.55E-03
Pu-239	5.23E-06	1.97E-05	—	—	—	1.13E-04	1.38E-04
Pu-240	3.02E-06	1.25E-05	—	—	—	1.25E-04	1.40E-04
Pu-241	2.46E-04	4.38E-03	7.03E-04	—	—	1.49E-02	2.03E-02
Sr-90	1.47E-01	2.37E-02	1.62E-01	3.48E-02	1.72E-03	5.88E-02	4.28E-01
Tc-99	2.76E-04	5.39E-04	8.33E-05	7.36E-04	6.97E-05	1.64E-04	1.87E-03
U-233	—	—	—	—	—	—	—
U-234	—	—	—	—	—	—	—
U-235	—	—	—	2.98E-06	—	—	2.98E-06
U-236	—	—	—	—	—	—	—
U-238	—	—	—	5.26E-08	—	—	5.26E-08

Table B-5. NRF-MOD-6R upper-bound estimate inventory summary (1984-1989).

	1984	1985	1986	1987	1988	1989
Am-241	6.51E-04	1.37E-02	3.48E-03	2.84E-03	6.52E-04	1.20E-02
C-14	2.28E-01	4.81E+00	1.22E+00	9.95E-01	2.28E-01	4.22E+00
Cl-36	9.42E-04	1.99E-02	5.03E-03	4.11E-03	9.43E-04	1.74E-02
Co-60	2.79E+03	5.88E+04	1.49E+04	1.22E+04	2.79E+03	5.16E+04
Cs-137	4.19E-02	8.83E-01	2.24E-01	1.83E-01	4.19E-02	7.74E-01
H-3	6.28E-01	1.32E+01	3.36E+00	2.74E+00	6.29E-01	1.16E+01
I-129	2.26E-07	4.76E-06	1.21E-06	9.85E-07	2.26E-07	4.17E-06
Nb-94	3.02E-02	6.38E-01	1.62E-01	1.32E-01	3.03E-02	5.59E-01
Ni-59	6.75E+00	1.42E+02	3.60E+01	2.94E+01	6.75E+00	1.25E+02
Ni-63	7.91E+02	1.67E+04	4.23E+03	3.45E+03	7.92E+02	1.46E+04
Np-237	—	—	—	—	—	—
Pu-238	4.19E-04	8.83E-03	2.24E-03	1.83E-03	4.19E-04	7.74E-03
Pu-239	9.77E-04	2.06E-02	5.22E-03	4.26E-03	9.78E-04	1.81E-02
Pu-240	6.05E-04	1.28E-02	3.23E-03	2.64E-03	6.05E-04	1.12E-02
Pu-241	5.12E-02	1.08E+00	2.73E-01	2.23E-01	5.12E-02	9.47E-01
Sr-90	2.23E-02	4.71E-01	1.19E-01	9.75E-02	2.23E-02	4.13E-01
Tc-99	1.21E-04	2.55E-03	6.46E-04	5.28E-04	1.21E-04	2.24E-03
U-233	—	—	—	—	—	—
U-234	6.51E-07	1.37E-05	3.48E-06	2.84E-06	6.52E-07	1.20E-05
U-235	1.86E-08	3.92E-07	9.94E-08	8.12E-08	1.86E-08	3.44E-07
U-236	6.05E-08	1.28E-06	3.23E-07	2.64E-07	6.05E-08	1.12E-06
U-238	6.98E-07	1.47E-05	3.73E-06	3.05E-06	6.98E-07	1.29E-05

Table B-5. (continued). NRF-MOD-6R upper-bound estimate inventory summary (1990-1996).

	1990	1991	1992	1993	1994	1996	Totals
Am-241	6.73E-03	9.91E-03	4.82E-03	4.06E-03	2.93E-03	5.82E-08	6.19E-02
C-14	2.36E+00	3.47E+00	1.69E+00	1.42E+00	1.03E+00	2.04E-05	2.17E+01
Cl-36	9.73E-03	1.43E-02	6.98E-03	5.88E-03	4.24E-03	8.42E-08	8.95E-02
Co-60	2.88E+04	4.25E+04	2.07E+04	1.74E+04	1.26E+04	2.50E-01	2.65E+05
Cs-137	4.33E-01	6.37E-01	3.10E-01	2.61E-01	1.89E-01	3.74E-06	3.98E+00
H-3	6.49E+00	9.56E+00	4.65E+00	3.92E+00	2.83E+00	5.61E-05	5.97E+01
I-129	2.33E-06	3.43E-06	1.67E-06	1.41E-06	1.02E-06	2.02E-11	2.14E-05
Nb-94	3.12E-01	4.60E-01	2.24E-01	1.89E-01	1.36E-01	2.70E-06	2.87E+00
Ni-59	6.97E+01	1.03E+02	5.00E+01	4.21E+01	3.04E+01	6.03E-04	6.41E+02
Ni-63	8.17E+03	1.20E+04	5.86E+03	4.93E+03	3.56E+03	7.07E-02	7.51E+04
Np-237	—	—	—	—	—	—	—
Pu-238	4.33E-03	6.37E-03	3.10E-03	2.61E-03	1.89E-03	3.74E-08	3.98E-02
Pu-239	1.01E-02	1.49E-02	7.24E-03	6.09E-03	4.40E-03	8.73E-08	9.28E-02
Pu-240	6.25E-03	9.21E-03	4.48E-03	3.77E-03	2.72E-03	5.41E-08	5.74E-02
Pu-241	5.29E-01	7.79E-01	3.79E-01	3.19E-01	2.30E-01	4.57E-06	4.86E+00
Sr-90	2.31E-01	3.40E-01	1.65E-01	1.39E-01	1.01E-01	2.00E-06	2.12E+00
Tc-99	1.25E-03	1.84E-03	8.96E-04	7.54E-04	5.45E-04	1.08E-08	1.15E-02
U-233	—	—	—	—	—	—	—
U-234	6.73E-06	9.91E-06	4.82E-06	4.06E-06	2.93E-06	5.82E-11	6.19E-05
U-235	1.92E-07	2.83E-07	1.38E-07	1.16E-07	8.38E-08	1.66E-12	1.77E-06
U-236	6.25E-07	9.21E-07	4.48E-07	3.77E-07	2.72E-07	5.41E-12	5.74E-06
U-238	7.21E-06	1.06E-05	5.17E-06	4.35E-06	3.14E-06	6.24E-11	6.63E-05

Table B-6. NRF-MOD-6S best-estimate inventory summary (1998-1999).

	1998	1999	Total
Am-241	—	—	—
C-14	7.31E-01	3.44E-01	1.08E+00
Cl-36	5.79E-03	2.44E-03	8.23E-03
Co-60	2.44E+03	1.03E+03	3.47E+03
Cs-137	—	9.74E-02	9.74E-02
H-3	4.97E+00	1.34E+00	6.32E+00
I-129	7.19E-08	6.97E-08	1.42E-07
Nb-94	1.20E-01	1.24E-02	1.32E-01
Ni-59	1.63E+01	5.92E+00	2.22E+01
Ni-63	4.57E+03	1.68E+03	6.25E+03
Np-237	—	—	—
Pu-238	—	—	—
Pu-239	—	—	—
Pu-240	—	—	—
Pu-241	3.38E-02	1.97E-02	5.36E-02
Sr-90	5.77E-02	8.28E-02	1.41E-01
Tc-99	5.87E-04	5.48E-04	1.13E-03
U-233	—	—	—
U-234	—	—	—
U-235	—	—	—
U-236	—	—	—
U-238	—	—	—

Table B-7. NRF-MOD-10R upper-bound estimate inventory summary (1984-1989).

	1984	1985	1986	1987	1988	1989
Am-241	1.23E-01	4.49E-05	5.01E-05	1.72E-03	1.79E-05	2.93E-04
C-14	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—
Co-60	3.52E+04	1.28E+01	1.43E+01	4.92E+02	5.13E+00	8.37E+01
Cs-137	1.41E+01	5.14E-03	5.73E-03	1.97E-01	2.05E-03	3.35E-02
H-3	—	—	—	—	—	—
I-129	1.41E-03	5.14E-07	5.73E-07	1.97E-05	2.05E-07	3.35E-06
Nb-94	7.03E+00	2.57E-03	2.87E-03	9.84E-02	1.03E-03	1.67E-02
Ni-59	1.05E+02	3.85E-02	4.30E-02	1.48E+00	1.54E-02	2.51E-01
Ni-63	5.61E+03	2.05E+00	2.29E+00	7.85E+01	8.19E-01	1.33E+01
Np-237	1.05E-06	3.85E-10	4.30E-10	1.48E-08	1.54E-10	2.51E-09
Pu-238	8.77E-02	3.21E-05	3.58E-05	1.23E-03	1.28E-05	2.09E-04
Pu-239	1.41E-02	5.14E-06	5.73E-06	1.97E-04	2.05E-06	3.35E-05
Pu-240	8.77E-03	3.21E-06	3.58E-06	1.23E-04	1.28E-06	2.09E-05
Pu-241	3.52E+00	1.28E-03	1.43E-03	4.92E-02	5.13E-04	8.37E-03
Sr-90	1.41E+01	5.14E-03	5.73E-03	1.97E-01	2.05E-03	3.35E-02
Tc-99	3.52E-01	1.28E-04	1.43E-04	4.92E-03	5.13E-05	8.37E-04
U-233	9.50E-05	3.47E-08	3.87E-08	1.33E-06	1.39E-08	2.26E-07
U-234	1.05E-04	3.85E-08	4.30E-08	1.48E-06	1.54E-08	2.51E-07
U-235	7.38E-09	2.70E-12	3.01E-12	1.03E-10	1.08E-12	1.76E-11
U-236	3.86E-07	1.41E-10	1.58E-10	5.41E-09	5.64E-11	9.20E-10
U-238	1.72E-06	6.30E-10	7.02E-10	2.41E-08	2.52E-10	4.10E-09

Table B-7. (continued). NRF-MOD-10R upper-bound estimate inventory summary (1990-1993).

	1990	1991	1992	1993	Totals
Am-241	2.48E-02	1.97E-03	1.73E-05	7.21E-05	1.52E-01
C-14	—	—	—	—	—
Cl-36	—	—	—	—	—
Co-60	7.09E+03	5.64E+02	4.95E+00	2.06E+01	4.34E+04
Cs-137	2.84E+00	2.25E-01	1.98E-03	8.25E-03	1.74E+01
H-3	—	—	—	—	—
I-129	2.84E-04	2.25E-05	1.98E-07	8.25E-07	1.74E-03
Nb-94	1.42E+00	1.13E-01	9.90E-04	4.12E-03	8.69E+00
Ni-59	2.13E+01	1.69E+00	1.48E-02	6.18E-02	1.30E+02
Ni-63	1.13E+03	8.99E+01	7.89E-01	3.29E+00	6.93E+03
Np-237	2.13E-07	1.69E-08	1.48E-10	6.18E-10	1.30E-06
Pu-238	1.77E-02	1.41E-03	1.23E-05	5.15E-05	1.08E-01
Pu-239	2.84E-03	2.25E-04	1.98E-06	8.25E-06	1.74E-02
Pu-240	1.77E-03	1.41E-04	1.23E-06	5.15E-06	1.08E-02
Pu-241	7.09E-01	5.64E-02	4.95E-04	2.06E-03	4.34E+00
Sr-90	2.84E+00	2.25E-01	1.98E-03	8.25E-03	1.74E+01
Tc-99	7.09E-02	5.64E-03	4.95E-05	2.06E-04	4.34E-01
U-233	1.92E-05	1.52E-06	1.34E-08	5.57E-08	1.17E-04
U-234	2.13E-05	1.69E-06	1.48E-08	6.18E-08	1.30E-04
U-235	1.49E-09	1.18E-10	1.04E-12	4.33E-12	9.12E-09
U-236	7.79E-08	6.20E-09	5.44E-11	2.27E-10	4.77E-07
U-238	3.47E-07	2.76E-08	2.42E-10	1.01E-09	2.13E-06

Table B-8. NRF-MOD-10S best-estimate inventory summary (1994-1999).

	1994	1995	1996	1997	1998	1999	Total
Am-241	3.48E-05	1.72E-04	2.09E-08	5.18E-06	5.06E-06	8.45E-04	1.06E-03
C-14	3.56E-02	1.25E+00	1.69E-02	3.97E-02	1.53E-01	1.71E-01	1.67E+00
Cl-36	1.26E-05	2.12E-04	5.40E-06	9.62E-06	2.47E-05	3.42E-05	2.98E-04
Co-60	1.27E+01	9.60E+01	2.28E+00	4.06E+00	1.04E+01	1.44E+01	1.40E+02
Cs-137	1.45E+00	6.73E-02	3.26E-01	1.57E-03	1.98E-03	1.01E-01	1.95E+00
H-3	2.04E+01	4.69E-01	5.16E+00	3.79E-03	3.32E-02	2.28E-02	2.61E+01
I-129	5.48E-05	9.00E-06	2.62E-06	3.20E-03	9.89E-07	1.62E-06	3.27E-03
Nb-94	5.77E-03	1.09E-02	2.12E-03	5.90E-02	1.04E-02	1.34E-02	1.02E-01
Ni-59	7.11E-02	1.61E-01	6.73E-03	4.46E-02	9.95E-01	1.59E-01	1.44E+00
Ni-63	1.58E+01	3.62E+01	1.72E+00	3.55E+00	2.53E+02	1.24E+01	3.23E+02
Np-237	—	—	—	—	—	—	—
Pu-238	1.06E-05	1.27E-04	2.87E-03	8.03E-04	2.58E-05	7.17E-04	4.55E-03
Pu-239	5.23E-06	1.97E-05	—	—	—	1.13E-04	1.38E-04
Pu-240	3.02E-06	1.25E-05	—	—	—	1.25E-04	1.40E-04
Pu-241	2.46E-04	4.38E-03	7.03E-04	—	—	1.49E-02	2.03E-02
Sr-90	3.53E-01	5.69E-02	3.90E-01	8.35E-02	4.13E-03	1.41E-01	1.03E+00
Tc-99	6.30E-04	1.23E-03	1.90E-04	1.68E-03	1.59E-04	3.75E-04	4.26E-03
U-233	—	—	—	—	—	—	—
U-234	—	—	—	—	—	—	—
U-235	—	—	—	2.98E-06	—	—	2.98E-06
U-236	—	—	—	—	—	—	—
U-238	—	—	—	3.44E-07	—	—	3.44E-07

