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GLOSSARY

abnormal transients
A state resulting from an unusual incident in which operating parameters affecting control of radioactive materials move out of the normal operating range.

absorbed dose
The energy deposited per unit mass by ionizing radiation. The unit of absorbed dose is the rad.

air quality
A measure of the quantity of pollutants in the air.

air quality standards
The prescribed quantity of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified area.

alpha (a) particle
A positively charged particle consisting of two protons and two neutrons that is emitted from the nucleus of certain nuclides during radioactive decay. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

ambient air
The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in immediate proximity to emission sources.

aqueous
In liquid form (i.e., dissolved in water).

aquifer
A geologic formation that contains sufficient saturated permeable material to conduct groundwater and to yield worthwhile quantities of groundwater to wells and springs.

atmosphere
The layer of air surrounding the earth.

AXAIR89Q
A computer model that is used to analyze doses from accidental airborne radionuclide releases. Developed in accordance with U.S. Nuclear Regulatory Commission Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accidental Consequence Assessments at Nuclear Power Plants*, February 1993.

background exposure
See exposure to radiation.

background radiation
Normal radiation present in the lower atmosphere from cosmic rays and earth sources. Background radiation varies with location, depending on altitude and natural radioactivity present in the surrounding geology.

beta (b) particle
An elementary particle emitted from a nucleus during radioactive decay. It is negatively charged, is identical to an electron, and is easily stopped by a thin sheet of metal.

bounded
Producing greater or lesser consequences than other accidents; or would "bound" the remainder of the accidents.

burial ground
A place for burying unwanted radioactive materials in which the earth acts to contain or prevent the escape of radiation. In this EIS, materials are incorporated into concrete to prevent the leaching of materials or movement in the underground environment.

button
Plutonium metal in a hemispherical shape, weighing about 1.8 kilograms (4 pounds).

°C
Degree Celsius. °C = ° (°F - 32).

cancer
A malignant tumor of potentially unlimited growth, capable of invading surrounding tissue or spreading to other parts of the body by metastasis.

canister
A stainless-steel container in which nuclear material is sealed.

canyon
A heavily shielded building used in the chemical processing of radioactive materials to recover special isotopes for national defense or other programmatic purposes. Operation and maintenance are by remote control.

capable (fault)
Determination if a geological fault has moved at or near the ground surface within the past 35,000 years.

carcinogen
An agent capable of producing or inducing cancer.

carcinogenic
Capable of producing or inducing cancer.

cask
A heavily shielded massive container for holding nuclear materials during shipment.

cesium
Naturally occurring element with 55 protons in its nucleus. Some manmade isotopes of cesium are radioactive (e.g., cesium 134, cesium-137).

cladding
The material (generally aluminum in SRS reactors) that covers each tubular fuel and target assembly.

collective dose
The sum of the individual doses to all members of a specific population.

committed effective dose equivalent
Used in cases when a person has an intake of radioactive material to denote that the dose is calculated for a period of 50 years following the intake. (See effective dose equivalent.)

community (environmental justice definition)
A group of people or a site within a spatial scope exposed to risks that potentially threaten health, ecology, or land values, or exposed to industry that stimulates unwanted noise, smell, industrial traffic, particulate matter, or other nonaesthetic impacts.

concentration
The amount of a substance contained in a unit quantity of a sample.

condensate
Liquid water obtained by cooling the steam (overheads) produced in an evaporator system.

constituents
Parts or components of a chemical system.

converting
The process for changing special isotopes into usable chemical forms to satisfy current or projected needs for a unique product.

criticality
A state in which a self-sustaining nuclear chain reaction is achieved.

cumulative effects
Additive environmental, health, and socioeconomic effects that result from a number of similar activities in an area.

curie (Ci)
A unit of radioactivity equal to 37,000,000,000 decays per second.

daughter
A nuclide formed by the radioactive decay of another nuclide, which is the "parent."

decay, radioactive
The spontaneous transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide. The process results in the emission of nuclear radiation (alpha, beta, or gamma

radiation).

decommissioning
The removal from service of facilities such as processing plants, waste tanks, and burial grounds, and the reduction or stabilization of radioactive contamination. Decommissioning concepts include:

- Decontaminate, dismantle, and return area to original condition without restrictions.
- Partially decontaminate, isolate remaining residues, and continue surveillance and restrictions.

defense waste
Nuclear waste generated by government defense programs as distinguished from waste generated by commercial and medical facilities.

depleted uranium
A mixture of uranium isotopes where uranium-235 represents less than 0.7 percent of the uranium by mass.

design-basis accident (DBA)
A postulated accident scenario for establishing the need for certain design features; normally, the accident that causes the most severe consequence when engineered safety features function as intended.

disposal/disposition
After designation as "surplus"; movement; placement in an onsite or offsite facility after a decision that future uses are unlikely or undesirable; determining whether the disposal of items must be "retrievable" under public law.

dose rate
The radiation dose delivered per unit time (e.g., rem per year).

ecology
The science dealing with the relationship of all living things with each other and with the environment.

ecosystem
A complex of the community of living things and the environment forming a functioning whole in nature.

effective dose equivalent
A quantity used to estimate the biological effect of ionizing radiation. It is the sum over all body tissues of the product of absorbed dose, the quality factor (to account for the different penetrating ability of the various radiations), and the tissue weighting factor (to account for the different radiosensitivity of the various tissues of the body).

effluent
Liquid or airborne material released to the environment. In general usage, however, "effluent" implies liquid releases.

effluent standards

Defined limits of effluent in terms of volume, content of contaminants, temperature, etc.

EIS
Environmental impact statement, a legal document required by the National Environmental Policy Act (NEPA) of 1969, as amended, for Federal actions involving potentially significant environmental impacts.

element
One of the 105 known chemical substances that cannot be divided into simpler substances by chemical means. All isotopes of an element have the same atomic number (number of protons) but have a different number of neutrons.

Emergency Response Planning Guidelines (ERPG)
Values used to determine potential health effects from chemical accidents.

emission standards
Legally enforceable limits on the quantities and kinds of air contaminants that can be emitted into the atmosphere.

endangered species
Plants and animals in an area that are threatened with either extinction or serious depletion.

energy
The capacity to produce heat or do work.

environment
The sum of all external conditions and influences affecting the life, development, and ultimately the survival of an organism.

epicenter
The point on the earth's surface directly above the focus of an earthquake.

EPICODE
A computer model used to estimate the airborne concentration of toxic chemicals as a result of routine or accidental releases to the environment.

erosion
The process in which the actions of wind or water carry away soil and clay.

exceedence
A value over a prescribed limit.

exposure to radiation
The incidence of radiation on living or inanimate material by accident or intent. Background exposure is the exposure to natural background ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs at a person's workplace. Population exposure is the exposure to a number of persons who inhabit an area.

°F

Degree Fahrenheit. F = °C ¥ + 32.

fallout
The descent to earth and deposition on the ground of particulate matter (that might be radioactive) from the atmosphere.

fault
A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage of the earth's crust has occurred in the past.

fissile
Capable of being split or divided (fissioned) by the absorption of thermal neutrons. The most common fissile materials are uranium-233, uranium-235, and plutonium-239.

fission
The splitting of a heavy nucleus into two approximately equal parts, which are nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons. Fission can occur spontaneously or can be induced by nuclear bombardment.

fission products
Nuclei from the fission of heavy elements (primary fission products); also, the nuclei formed by the decay of the primary fission products, many of which are radioactive.

floodplain
Level land built up by flowing stream deposition and periodically submerged by floodwater from that stream.

frit
Finely ground glass.

gamma (g) rays
High-energy, short-wavelength electromagnetic radiation accompanying fission, radioactive decay, or nuclear reactions. Gamma rays are very penetrating and require relatively thick shields to absorb the rays effectively.

geology
The science that deals with the earth: the materials, processes, environments, and history of the planet, especially the lithosphere, including the rocks, their formation and structure.

glovebox
Large enclosure that separates workers from equipment used to process hazardous material but enables the workers to be in physical contact with the equipment; normally constructed of stainless steel with large acrylic/lead glass windows. Workers have access to equipment through the use of heavy-duty, lead-impregnated rubber gloves, the cuffs of which are sealed in portholes in the glovebox windows.

groundwater
The supply of fresh water under the earth's surface in an aquifer.

habitat
The place or type of site where a plant or animal naturally or normally lives and grows.

half-life (radiological)
The time in which half the atoms of a radioactive substance disintegrate to another nuclear form. Half-lives vary from millionths of a second to billions of years.

heavy metals
Metallic elements of high molecular weight, such as mercury, chromium, cadmium, lead, and arsenic, that are toxic to plants and animals at known concentrations.

HEPA filter
High efficiency particulate air filter designed to remove 99.9 percent of particles as small as 0.3 micrometer in diameter from a flowing air stream.

high-fired oxide
Oxide chemical form of plutonium produced by heating the material to approximately 1,000 C. High-fired oxide is considered more chemically stable than low-fired oxide because the higher heat removes moisture and other impurities more effectively.

high-level waste
The highly radioactive wastes that result from processing of defense materials at SRS.

historic resources
The sites, districts, structures, and objects considered limited and nonrenewable because of their association with historic events, persons, or social or historic movements.

immobilization
Conversion of high-level waste into a form that will be resistant to environmental dispersion.

intensity (earthquake)
A numerical rating used to describe the effects of earthquake ground motion on people, structures, and the earth's surface. The numerical rating is based on an earthquake intensity scale such as the Richter Scale commonly used in the United States.

interim storage
Safe and secure capacity in the near term to support continuing operations in the interim period (10 years).

involved worker
For this EIS, an SRS worker who is involved in the operation of a facility when a radioactive release occurs.

ion
An atom or molecule that has gained or lost one or more electrons to become electrically charged.

ion exchange
Process in which a solution containing soluble ions to be removed is passed over a solid ion-

exchange medium, which removes the soluble ions by exchanging them with labile ions from the surface of the column. The process is reversible so that the trapped ions can be collected (eluted) and the column regenerated.

ion-exchange medium
A substance (e.g., a resin) that preferentially removes certain ions from a solution.

ionization
The process that creates ions. Nuclear radiation, X-rays, high temperatures, and electric discharges can cause ionization.

ionizing radiation
Radiation capable of displacing electrons from atoms or molecules to produce ions.

irradiation
Exposure to radiation.

ISC2
A computerized dispersion program used to calculate ground-level concentrations of air pollutants.

isotope
An atom of a chemical element with a specific atomic number and atomic weight. Isotopes of the same element have the same number of protons but different numbers of neutrons. Isotopes are identified by the name of the element and the total number of protons and neutrons in the nucleus. For example, plutonium-239 is a plutonium atom with 239 protons and neutrons.

LADTAP
A computer program used to calculate individual and population doses from liquid pathways.

latent cancer fatalities
Deaths resulting from cancer that has become active following a latent period (i.e., a period of inactivity).

low-fired oxide
Oxide chemical form of plutonium produced by heating the material to approximately 550 C. Low-fired oxide is considered less chemically stable than high-fired oxide because the lower heat does not remove moisture and other impurities as effectively.

low-income communities
A community where 25 percent or more of the population is identified as living in poverty.

low-level waste
Radioactive waste not classified as high-level waste; the wastes (mostly salts) remaining after removal of the highly radioactive nuclides from the liquid high-level wastes for immobilization.

Mark-x (Mk-x)
An historic naming system for a specific design of fuel or target material used in SRS production reactors (e.g., Mk-31, Mk-42, Mk-16).

MAXIGASP
A computer program used to calculate doses of airborne releases of radioactivity to the maximally exposed member of the public.

maximum contaminant levels (MCLs)
The maximum permissible level of a contaminant in water that is delivered to a user of a public water system.

maximally exposed individual
A hypothetical person located to receive the maximum possible dose by a given exposure scenario.

migration
The natural travel of a material through the air, soil, or groundwater.

mitigate
To take practicable means to avoid or minimize environmental harm from a selected alternative.

monitoring
Continuing control and accountability, particularly of special nuclear materials such as plutonium-239 and highly enriched uranium, but also including oversight of hazardous or reactive compounds before they are disposed of or converted to a stable long-term storage form.

National Register of Historic Places
A list maintained by the National Park Service of architectural, historic, archaeological, and cultural sites of local, state, or national importance.

natural radiation or natural radioactivity
Background radiation. Some elements are naturally radioactive, whereas others are induced to become radioactive by bombardment in a reactor or accelerator.

NEPA
National Environmental Policy Act of 1969 (42 USC 4321); it requires the preparation of an EIS for Federal projects that could present significant impacts to the environment.

nonproliferation
The restriction of ability to easily access fissile materials in concentrations sufficient to assemble a nuclear weapon.

NO_x
Oxides of nitrogen, primarily nitrogen oxide (NO) and nitrogen dioxide (NO2). These are produced in the combustion of fossil fuels, and can constitute an air pollution problem.

NRC
Nuclear Regulatory Commission; the independent Federal commission that licenses and regulates nuclear facilities.

nuclear energy

The energy liberated by a nuclear reactor (fission or fusion) or by radioactive decay.

nuclear radiation
Radiation, usually alpha, beta, or gamma, that emanates from an unstable atomic nucleus.

nuclear reaction
An interaction between a photon, particle, or nucleus and a target nucleus, leading to the emission of one or more particles and photons.

nuclear reactor
A device in which a fission chain reaction is maintained, used for the irradiation of materials or the generation of electricity.

nuclide
An atomic nucleus specified by atomic weight, atomic number, and energy state; a radionuclide is a radioactive nuclide.

organic compounds
Chemical compounds containing carbon.

outfall
Place where liquid effluents enter the environment and are monitored.

oxide
A compound in which an element chemically combines with oxygen.

ozone
A compound of oxygen in which three oxygen atoms are chemically attached to each other.

particulates
Solid particles and liquid droplets small enough to become airborne.

passive safety system
A system that provides safety features requiring no human intervention or adverse condition to actuate.

pH
A measure of the hydrogen ion concentration in aqueous solution. Pure water has a pH of 7, acidic solutions have a pH less than 7, and basic solutions have a pH greater than 7.

people of color communities
A population classified by the U.S. Bureau of the Census as Black, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and other nonwhite persons, the composition of which is at least equal to or greater than the state minority average of a defined area or jurisdiction.

permeability
Ability of liquid to flow through rock, groundwater, soil, or other substance.

person-rem

The radiation dose to a given population; the sum of the individual doses received by a population segment.

physiographic
Geographic regions based on geologic setting.

plutonium (Pu)
A transuranic, heavy (average atomic mass about 244 atomic mass units), silvery metal with 15 isotopes that is produced by the neutron irradiation of natural uranium. Plutonium-239 is used both in nuclear weapons and commercial nuclear power applications. Plutonium-238 is used to power onboard generators during manned and unmanned space flights.

plutonium solutions
Chemical solutions containing plutonium.

poison
A material that has an affinity for absorbing neutrons. Poisons are added to nuclear materials with a potential criticality concern to lessen the likelihood of an uncontrolled nuclear reaction.

pollution
The addition of an undesirable agent to an ecosystem in excess of the rate at which natural processes can degrade, assimilate, or disperse it.

POPGASP
A computer mathematical model used to calculate doses of airborne releases of radioactivity to the population within 80 kilometers (50 miles) of the SRS.

population
In this EIS, a collection of members of the public who are located outside the boundaries of the SRS. Impacts in this EIS are estimated for the population within a given area, depending on the appropriate environmental pathways. For example, the affected population for liquid releases to the Savannah River includes downstream residents.

precipitate
A solid (used as a noun). To form a solid substance in a solution by a chemical reaction (used as a verb).

PUREX process
A chemical separation process to retrieve plutonium, uranium, and other radionuclides from reactor fuel and targets.

radiation
The emitted particles and photons from the nuclei of radioactive atoms; a shortened term for ionizing radiation or nuclear radiation as distinguished from nonionizing radiation (microwaves, ultraviolet rays, etc.).

radioactivity
The spontaneous decay of unstable atomic nuclei, accompanied by the emission of radiation.

radioisotopes
Radioactive isotopes. Some radioisotopes are naturally occurring (e.g., potassium-40) while others are produced by nuclear reactions.

radiolysis
The decomposition of a material (usually water) into different molecules due to ionizing radiation. In water, radiolysis results in the production of hydrogen gas and oxygen.

repository
A place for the disposal of immobilized high-level waste in isolation from the environment.

resin
An ion-exchange medium; organic polymer used for the preferential removal of certain ions from a solution.

Richter Scale
A scale of measure used in the United States to quantify earthquake intensity.

risk
In accident analysis, the probability weighted consequence of an accident, defined as the accident frequency per year multiplied by the dose. The term "risk" is also used commonly in other applications to describe the probability of an event occurring.

runoff
The portion of rainfall, melted snow, or irrigation water that flows across ground surface and eventually returns to streams. Runoff can carry pollutants into receiving waters.

saltstone
Low-radioactivity fraction of high-level waste from the in-tank precipitation process mixed with cement, flyash, and slag to form a concrete block.

seismicity
The tendency for earthquakes to occur.

shield
Material used to reduce the intensity of radiation that would irradiate personnel or equipment.

short-lived
A designation for radionuclides with relatively short half-lives (i.e., they decay to stable materials relatively quickly).

stabilization
The action of making a nuclear material more stable by converting its physical or chemical form or placing it in a more stable environment.

stack
A vertical pipe or flue designed to exhaust gases and suspended particulates.

strontium
Naturally occurring element with 38 protons in its nucleus. Some manmade isotopes of strontium are radioactive (e.g., strontium-89, strontium-90),

surface water
All water on the surface (streams, ponds, etc.), as distinguished from underground water.

tank farm
An installation of interconnected underground tanks for the storage of high-level radioactive liquid wastes.

target
In this EIS, a tube of material placed in a reactor to absorb neutrons and be changed to a desired end product.

transuranic waste
Waste material containing more than a specified concentration of transuranic elements (presently, more than 10 nanocuries per gram of waste).

tritium
A radioactive isotope of hydrogen; its nucleus contains one proton and two neutrons.

uninvolved worker
For this EIS, an SRS worker who is not involved in the operation of a facility when a radioactive release occurred, and who is assumed to be 640 meters (2,100 feet) from the point of release.

uranium (U)
A heavy (average atomic mass of about 238 atomic mass units), silvery-white metal with 14 radioactive isotopes. One of the isotopes, uranium-235, is most commonly used as fuel for nuclear fission and another, uranium-238, is transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

vault
A reinforced concrete structure for storing strategic nuclear materials used in national defense or other programmatic purposes.

vitrification
Incorporation of a material into a glass form.

vulnerability
Condition or weakness that could lead to exposure to the public, unnecessary or increased exposure to workers, or release of radioactive materials to the environment.

waste, radioactive
Materials from nuclear operations that are radioactive or are contaminated with radioactive materials and for which there is no practical use or for which recovery is impractical.

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ACRONYMS AND ABBREVIATIONS

AEC
: Atomic Energy Commission

ALARA
: as low as reasonably achievable

Am
: americium

AQCR
: Air Quality Control Region

ATTA
: Advanced Tactical Training Area

C
: carbon

CAA
: Clean Air Act

Ce
: cerium

CEQ
: Council on Environmental Quality

CFR
: Code of Federal Regulations

Cm
: curium

Co
: cobalt

Cs
: cesium

CSEG
: Criticality Safety Evaluation Group

CWA
: Clean Water Act

D&D
: decontamination and decommissioning

DNFSB
: Defense Nuclear Facilities Safety Board

DOE
: U.S. Department of Energy

DOT
: U.S. Department of Transportation

Du
: depleted uranium

DWPF
: Defense Waste Processing Facility

EIS

environmental impact statement
EPA
U.S. Environmental Protection Agency
ERPG
Emergency Response Planning Guideline
ES&H
Environment, Safety and Health
Eu
europium
FFA
Federal Facility Agreement
FFCA
Federal Facilities Compliance Agreement
FR
Federal Register
FWS
U.S. Fish and Wildlife Service
H
hydrogen
H-3
tritium
HEPA
high-efficiency particulate air (filter)
HEU
highly enriched uranium
HLW
high-level waste
I
iodine
IAEA
International Atomic Energy Agency
ICRP
International Commission on Radiological Protection
IMNM
Interim Management of Nuclear Materials
lcf
latent cancer fatality
LEU
low enriched uranium
MEI
maximally exposed individual
mrem
millirem (1/1000 rem)
NAAQS
National Ambient Air Quality Standard
NASA
National Aeronautics and Space Administration
NCRP
National Council on Radiation Protection and Measurements
NCSE

Nuclear Criticality Safety Evaluations

NEPA
: National Environmental Policy Act

Ni
: nickel

NIM
: Nuclear Incident Monitor

Np
: neptunium

NPDES
: National Pollutant Discharge Elimination System

OSHA
: Occupational Safety and Health Administration

PEL
: Permissible Exposure Limit

Pu
: plutonium

RBOF
: Receiving Basin for Offsite Fuel

RCRA
: Resource Conservation and Recovery Act

rem
: roentgen equivalent man

RINM
: reactor irradiated nuclear materials

ROI
: region of influence

Ru
: ruthenium

S
: sulfur

SAR
: Safety Analysis Report

SCDHEC
: South Carolina Department of Health and Environmental Control

SNF
: spent nuclear fuel

Sr
: strontium

SREL
: Savannah River Ecology Laboratory

SRS
: Savannah River Site

SRTC
: Savannah River Technology Center

TRU
: transuranic

U
: uranium

UNH

uranyl nitrate hexahydrate
USF
Uranium Solidification Facility
WSRC
Westinghouse Savannah River Company
Xe
xenon
Zr
zirconium

Abbreviations for measurements

cfm
cubic feet per minute
cfs
cubic feet per second
g
acceleration due to gravity (seismology)
/dbgraphics/eishtml/eis-0220/L
grams per liter
gpm
gallons per minute
L
liter
lb
pound
km
kilometer
m
meter
mg
milligram
mo
month
mw
megawatt
pCi
picocurie
yr
year
m
micron
mCi
microcurie
mg
microgram
°C
degrees Celsius
°F

degrees Fahrenheit

Metric System

Typically, scientific reports use metric units; therefore, this EIS presents metric units of measure (meters, liters, grams, etc.) rather than the more common U.S. Customary Units (feet, gallons, pounds, etc.). However, the text sections also provide U.S. Customary Units in parentheses for ease of understanding.

Many metric measurements presented include prefixes that denote a multiplication factor that is applied to the base standard (e.g., 1 kilometer = 1,000 meters). The following list presents these metric prefixes:

mega 1,000,000 (106; one million)

kilo 1,000 (103; one thousand)

hecto 100 (102; one hundred)

centi 0.01 (10-2; one one-hundredth)

milli 0.001 (10-3; one one-thousandth)

micro 0.000001 (10-6; one one-millionth)

nano 0.000000001 (10-9; one one-billionth)

pico 0.000000000001 (10-12; one one-quadrillionth)

DOE Order 5900.2A, "Use of the Metric System of Measurement" (3/26/92) prescribes the use of this system in DOE documents. The following list presents conversion factors for the metric units used in this EIS as an aid to readers who are more familiar with U.S. Customary Units.

Conversion from Metric to U.S. Customary Units

1 meter = 3.281 feet = 39.37 inches = 1.094 yards

1 kilometer = 0.6214 mile

1 square meter = 10.764 square feet

1 square kilometer = 0.3861 square mile = 247.1 acres

1 liter = 61.025 cubic inches = 0.2642 gallon

1 cubic meter = 35.31 cubic feet = 1.308 cubic yards = 264.2 gallons

Discharge

1 cubic meter per second = 35.31 cubic feet per second = 15,850.3 gallons per minute

Mass

1 kilogram = 2.205 pounds (mass)

1 metric ton = 2,205 pounds = 1.1023 (short) tons

Pressure

1 Pascal = 0.02089 pound per square foot

1 kilogram (force) per square meter = 0.2048 pound (force) per square foot

Velocity

1 meter per second = 3.281 feet per second = 2.237 miles per hour

1 kilometer per hour = 0.6214 mile per hour

Temperature

°C to °F, °C × 1.8 + 32 (i.e., 20°C = 20 × 1.8 + 32 = 68°F)

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APPENDIX A. LIST OF NUCLEAR MATERIALS AT THE SAVANNAH RIVER SITE

DOE has evaluated the nuclear materials stored at the Savannah River Site and grouped them into three general categories: (1) Stable, (2) Programmatic, and (3) Candidates for Stabilization. Table A-1 lists the materials grouped in these categories, briefly describes each material, the storage management activities associated with it, and its storage location.

Table A-1. Savannah River Site nuclear materials.

Description and Storage Management Activities	Location
STABLE MATERIAL	
Spent nuclear fuels stored in RBOF - Approximately 1,500 uranium-plutonium fuel elements from a number of reactors around the world, clad with aluminum, stainless-steel, zirconium, hastaloy, or nichrome. Purity of the water in RBOFa prevents fuel corrosion. RBOF has the capability to inspect fuel, and assess its condition, overpack damaged fuel, and maintain water purity and quality:	
Bundle of enriched uranium-plutonium rods, stainless-steel-clad, from Westinghouse	RBOF
Bundles of enriched uranium fuel, aluminum-clad, from French Research Reactor	RBOF
Bundles of irradiated enriched uranium fuel, aluminum-clad, from Oak Ridge	RBOF
Bundles of irradiated enriched uranium fuel, aluminum-clad, from Sterling Forest reactor	RBOF
Bundles of Japanese Materials Test Reactor enriched uranium fuel, aluminum-clad	RBOF
Depleted uranium-plutonium mixed oxide fuel, zirconium- and stainless-steel-clad, from Battelle	RBOF
Electric Power Research Institute test fuel, zirconium-clad	RBOF
Enriched uranium and thorium elements, zirconium-clad, from heavy water Components Test Reactor	RBOF
Enriched uranium oxide tubes, zirconium-clad, from the heavy water components test reactor	RBOF
Enriched uranium-plutonium from Argonne	RBOF
Enriched uranium-plutonium from Battelle	RBOF

Enriched uranium-plutonium from Vallecitos	RBOF
Enriched uranium-plutonium fuel, stainless-steel-clad, from Argonne	RBOF
Enriched uranium-plutonium fuel, stainless-steel-clad, from Oak Ridge	RBOF
Enriched uranium-plutonium fuel, zirconium-clad, from Battelle	RBOF
Enriched uranium-plutonium fuel, zirconium-clad, from Vallecitos	RBOF
Enriched uranium-plutonium fuel, zirconium-clad, from Vallecitos boiling water reactor	RBOF
Enriched uranium-plutonium-thorium fuel, stainless-steel-clad, from Dresden	RBOF
Enriched uranium-thorium fuel, stainless-steel-clad, from Elk River	RBOF
Enriched uranium-thorium fuel, stainless-steel-clad, from sodium reactor experiment	RBOF
Experimental Boiling Water Reactor fuel, uranium with zirconium-cladding	RBOF
Experimental Boiling Water Reactor enriched uranium plates, stainless-steel-clad	RBOF
Experimental Boiling Water Reactor fuel, zirconium-clad, from Argonne	RBOF
Experimental Breeder Reactor II targets	RBOF

Table A-1. (continued).

Description and Storage Management Activities	Location
Irradiated depleted uranium from Canadian deuterium reactor and heavy water components test reactor	RBOF
Irradiated depleted uranium-plutonium Shippingport-fuel, zirconium-clad, from Battelle	RBOF
Irradiated enriched uranium from Argonne	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from French Reactor Hot Flux reactor	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from Massachusetts Institute of Technology reactor	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from Oak Ridge	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from Rhode Island Nuclear Service	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from Sterling Forest reactor	RBOF

Irradiated enriched uranium fuel, aluminum-clad, from University of Michigan reactor	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from University of Missouri reactor	RBOF
Irradiated enriched uranium fuel, aluminum-clad, from University of Virginia reactor	RBOF
Irradiated enriched uranium fuel, nichrome-clad, from Idaho Chemical Processing Plant	RBOF
Irradiated enriched uranium fuel, stainless-steel-clad, from mobile low-power reactor (Idaho)	RBOF
Irradiated enriched uranium fuel, zirconium- and stainless-steel-clad, from Savannah River Laboratory Light Water Reactor	RBOF
Irradiated enriched uranium fuel, zirconium-clad, from special power excursion reactor test	RBOF
Irradiated enriched uranium pins, hastalloy-clad, from Gas Cooled Reactor Experiment - Idaho	RBOF
Irradiated enriched uranium Robinson Reactor fuel, zirconium-clad in a stainless-steel casing	RBOF
Irradiated enriched uranium, Zircaloy-clad, Mark-5 special-purpose reactor fuel	RBOF
Irradiated enriched uranium, zirconium-clad	RBOF
Irradiated enriched uranium-plutonium fuel, stainless-steel-clad, in cans from General Atomics sodium reactor	RBOF
Irradiated enriched uranium-zirconium alloy, zirconium-clad	RBOF
Irradiated Mark-31 slugs (depleted uranium, plutonium, neptunium)	RBOF
Irradiated natural uranium-plutonium rods and depleted uranium-plutonium from Taiwanese Research Reactor	RBOF
Irradiated natural uranium-plutonium rods from Taiwanese Research Reactor	RBOF
Mark-16 bundle (enriched uranium, neptunium, and plutonium)	RBOF
Mark-16 powder metallurgical assembly bundle (enriched uranium, neptunium, plutonium-238)	RBOF
Mark-18 targets	RBOF
Reject unirradiated Mark-42s from 321-M Building	RBOF
Uranium oxide scrap, stainless-steel-clad, from Babcock & Wilcox	RBOF

Uranium oxide tube, zirconium-clad, from Canadian deuterium reactor	RBOF
Uranium oxide tubes, zirconium-clad, from the heavy water components test reactor	RBOF
Uranium-plutonium mixed oxide fuel, stainless-steel-clad, from Idaho National Engineering Laboratory Experimental Breeder Reactor II	RBOF

Table A-1. (continued).

Description and Storage Management Activities	Location
Research and development material - About 260 nuclear materials, used in routine laboratory research and development activities. When not in use these materials are packaged in cans, bottles, or sample carriers and stored in laboratory hoods, gloveboxes, or cells to provide the necessary containment and storage safety:	
Americium-241 oxide scrap from Savannah River Laboratory test work	SRTC[b]
Americium, curium, plutonium-238 solution	SRTC
Depleted uranium metal	SRTC
Depleted uranium metal rods for hydride development	SRTC
Depleted uranium nitrate crystals	SRTC
Depleted uranium oxide and ring sections from tubes	SRTC
Depleted uranium oxide-aluminum powder compacted	SRTC
Depleted uranium scrap	SRTC
Depleted uranium slurry	SRTC
Enriched uranium floor sweepings	SRTC
Liquid samples from Old FB-Line ductwork (americium, curium, and plutonium-238)	SRTC
Liquid samples from Old HB-Line ductwork	SRTC
Mark-16 enriched uranium oxide powder metallurgy tube	SRTC
Natural uranium gel sphere samples	SRTC
Neptunium solution samples	SRTC
Plutonium oxide and anode heel residues	SRTC
Thorium oxide	SRTC

Unirradiated natural uranium	Building 772-F
Unirradiated normal uranium for research and development	SRTC
Uranium-233 oxide from Oak Ridge	Building 772-F
Uranyl nitrate solution sample	SRTC

Table A-1. (continued).

Description and Storage Management Activities	Location
Reactor materials in reactor areas - Approximately 420 unirradiated control rods, spargers, and targets and irradiated control rods stored in reactor disassembly basins. Construction materials are lithium-aluminum alloy clad with aluminum, and cadmium clad with aluminum. Corrosion of these materials is likely to be minimal during the next 10 years. Reactor basin water chemistry is being improved to minimize the corrosion of the targets.[c]	
Irradiated cadmium control rods	C-, K-, L-, P-Reactor Disassembly Basins
Lithium-aluminum control rods, spargers, and targets	K-, L-, P-Reactor Disassembly Basins
Securely stored actinides - Two thorium oxide spheres in Building 235-F that DOE used as production guides for startup of the Plutonium Fuel Fabrication Facility in 1977; four containers of neptunium scrap in HB-Line.	Building 235, HB-Line
Description and Storage Management Activities	
Uranium solutions in F-Canyon - Approximately 276,000 liters (73,000 gallons) of depleted uranium solution in two stainless-steel tanks in F-Canyon, seven stainless-steel tanks in A-Line, and one stainless-steel TNX tank truck. Actions during storage include monitoring concentration, specific gravity of the solution, acidity of solutions, and other properties (as required), and adding chemicals as needed to maintain chemical balances:	
Depleted uranium solution - TNX Tank Truck	F-Area Outside Facility
Depleted uranium solutions	F-Canyon, F-Area Outside Facility
Unirradiated uranium in M-Area - More than 315,000 items consisting of uranium and lithium residues from fabrication of fuel and targets for the reactors (mostly unirradiated Mark-31 targets in various stages of fabrication). Uranium varies from depleted to fully enriched uranium. Lithium stocks are lithium metal or as lithium-aluminum alloy. These materials are stored dry and routinely monitored and inventoried. If corrective actions are needed, the material would be repackaged:	

Aluminum-enriched uranium alloy, aluminum-clad slugs from Savannah River Site Nuclear Test Gauge	Building 321-M
Bare Mark-25A cores and bare Mark-25B cores	Building 313-M
Canned Mark-31 slugs	Building 305-A
Canned Mark-31 slugs, depleted uranium, nickel-plated and aluminum-clad	Building 313-M
Depleted uranium Mark-31 scrap, no cladding (reject cores)	Building 313-M
Depleted uranium sludge	Building 322-M
Depleted uranium sludge	Building 341-1M
Enriched lithium metal in cans	Building 320-M
Enriched uranium grinding residues from Building 321-M	Building 321-M
Enriched uranium oxide in filter cake	Building 313-M
Enriched uranium slugs, aluminum-clad, from Building 321-M Nuclear Test Gauge	Building 321-M
Enriched uranium-aluminum alloy Mark-16 and Mark-22 tubes, scrap, standards	Building 321-M
Enriched uranium-aluminum floor sweepings	Building 322-M
Lithium-aluminum alloy control rods and sparger slugs	Building 315-M
Lithium-aluminum alloy in castings, billets, and cores	Building 315-M
Lithium-aluminum control rods, spargers, and targets	Building 315-M
Mark-15B canned slugs	Building 313-M
Mark-22 fuel tubes, enriched uranium with aluminum cladding	Building 321-M
Mark-25 depleted uranium dummy core	Building 313-M
Mark-31 depleted uranium fuel with aluminum cladding	Building 313-M
Natural lithium metal in cans	Building 320-M
Unclad normal uranium metal fuel pins	Building 313-M
Unirradiated Mark-15A cores	Building 305-A
Unirradiated Mark-16B assemblies, spares for reactor charge	Building 321-M

Uranium-aluminum fuel tube ring section	Building 322-M
Uranium-aluminum grinding fines from fuel tube grinding	Building 322-M

Table A-1. (continued).

Description and Storage Management Activities	Location
Securely stored nuclear materials in reactor areas - Approximately 6,900 items stored dry in reactor assembly areas. Materials are unirradiated and consist of various reactor components. Included are control rods, spargers, and targets consisting of lithium-aluminum alloy clad in aluminum. Also included are aluminum-clad enriched uranium-aluminum fuel tubes. These materials are routinely monitored and inventoried. If corrective actions are needed, the material would be repackaged:	
Lithium-aluminum control rods, spargers, and targets	K- and L-Reactor Assembly
Unirradiated contaminated lithium aluminum targets	K- and L-Reactor Assembly
Unirradiated Mark-16B assemblies, spares for reactor charge	L-Reactor Assembly
Unirradiated Mark-22 assemblies with lithium target tubes	K-Reactor Assembly
Unirradiated Mark-22 fuel assemblies (enriched uranium)	L-Reactor Assembly
Depleted uranium oxide - Approximately 36,000 208-liter (55-gallon) drums containing approximately 20 metric tonse of uranium. The uranium-235 concentration is mostly below naturally occurring uranium. These drums of uranium oxide are stored in buildings to keep them out of the weather. These materials are routinely monitored and inventoried.	R-Reactor Assembly, Buildings 221-21F, 221-22F, 704-R, 714-7N, 728-F, 730-F, 772-7B
Uranyl nitrate solution in TNX - Two stainless-steel tanks outside the TNX facility contain approximately 17,400 liters (4,600 gallons) of depleted uranium nitrate solution. The tanks are in a diked Radiation Control Area designed to contain any leakage, and are routinely monitored and inventoried.	TNX
Sources, standards, and samples - SRS uses sources and standards in its many monitoring and analytical functions. Most of these sources and standards contain a small amount of nuclear material. DOE estimates that more than 20,000 sources and standards are in use.	Sitewide
Programmatic materials	
Plutonium-242	

Solution - Approximately 13,200 liters (3,500 gallons) of nitrate solution high in plutonium-242, stored in a single stainless-steel tank. Compensatory actions during storage include monitoring concentration, specific gravity of the solution, acidity of solutions, and other properties (as required), and adding chemicals to maintain chemical balance as needed.	H-Canyon
Americium and Curium	
Solution - Approximately 14,000 liters (3,800 gallons) of americium-243 and curium-244 nitrate solutions are stored in a single stainless-steel tank. Compensatory actions during storage include monitoring concentration, specific gravity of the solution, acidity of solutions, and other properties (as required), and adding chemicals to maintain chemical balance as needed.	F-Canyon
Neptunium-237	
Solutions - Approximately 6,100 liters (1,600 gallons) of neptunium nitrate solutions stored in two stainless-steel tanks. Neptunium solution from H-Frames and recycled neptunium solution from Mark-16 and Mark-22 processing.	H-Canyon
Targets - Nine Mark-53 unirradiated neptunium-aluminum alloy targets clad with aluminum, stored dry in borated storage racks. Routinely monitored and inventoried.	Building 321-M
Candidate materials for stabilization	
H-Canyon plutonium-239 solutions - Approximately 34,000 liters (9,000 gallons) of plutonium nitrate solutions stored in two stainless-steel tanks. Compensatory actions during storage include monitoring concentration, specific gravity of the solution, acidity of solutions, and other properties (as required), and adjusting chemical balance as needed.	H-Canyon

Table A-1. (continued).

Description and Storage Management Activities	Location
H-Canyon enriched uranium solutions - Approximately 228,000 liters (60,000 gallons) of enriched uranium (approximately 60 percent uranium-235) nitrate solution. Solution is in two canyon tanks and five outside tanks. All tanks are stainless-steel and outside tanks are in concrete dikes large enough to contain the solution volume of the largest single tank. Compensatory actions during storage include monitoring concentration, specific gravity of the solution, acidity of solutions, and other properties (as required), and adjusting chemical balance as needed.	H-Canyon, H-Area Outside Facilities

Plutonium and uranium stored in vaults - Approximately 3,000 packages of material. The material contains alloys, compounds, oxides, large metal pieces such as buttons and ingots, and metal fragments, and consists predominantly of plutonium-239 with some uranium-235. In addition, some scrap predominately plutonium-238 material is stored in various locations.

Low-uranium plutonium solids - Approximately 1,600 packages of plutonium-bearing solids containing low enough concentrations of uranium-235 to be processable in F-Area. Material is packaged in a metal can in a plastic bag in another metal pail or can (can/ba/dbgraphics/eishtml/eis-0220/can configuration), stored in a vault or glovebox. During storage, packages are monitored for evidence of internal pressurization or corrosion. These include evidence of bulging, weight gain, or package degradation. If conditions change, package could be radiographed to better define condition of the interior packaging. If monitoring indicates packaging failure (or imminent failure), material would be repackaged or over-packed, as needed.

Fissile plutonium solids - Approximately 1,000 packages containing more than 100 grams (3.5 ounces) of fissile material in a container. They include alloys, metals, compounds, oxides, and large metal pieces (e.g., buttons and ingots) of plutonium-239 with minimal other actinide impurities other than americium-241, the decay daughter of plutonium-239:

Depleted uranium-plutonium alloy from Argonne	Building 235-F
Depleted uranium-plutonium alloy from Zero Power Plutonium Reactor	Building 235-F
High-fired plutonium oxides from Rocky Flats	Building 235-F
Impure plutonium metal from Livermore	Building 235-F
Mixed plutonium-uranium oxide from Oak Ridge	Building 235-F
Natural uranium compounds from Battelle and Argonne	FB-Line
Natural uranium-plutonium alloy from Argonne	Building 235-F
Plutonium finished product	FB-Line
Plutonium metal	Building 235-F
Plutonium metal (Category 3) from Hanford	FB-Line
Plutonium metal	FB-Line
Plutonium metal from Argonne	FB-Line

Plutonium metal from Livermore	Building 235-F
Plutonium metal from Los Alamos	FB-Line
Plutonium oxide from Argonne	FB-Line
Plutonium oxide from Hanford	FB-Line
Plutonium oxide from Livermore	FB-Line
Plutonium oxide from Nuclear Fuel Services	FB-Line
Plutonium oxide from Rocky Flats	FB-Line
Plutonium-americium oxide	FB-Line
Plutonium-americium oxides from Rockwell	FB-Line
Plutonium-bearing alloy from Hanford	FB-Line
Plutonium-depleted uranium alloy from Argonne	FB-Line

Table A-1. (continued).

Description and Storage Management Activities	Location
Plutonium-depleted uranium compounds from Argonne	FB-Line
Plutonium-depleted uranium compounds from Hanford	FB-Line
Plutonium-depleted uranium compounds from Hanford and Argonne	FB-Line
Plutonium-depleted uranium oxide from Hanford	FB-Line
Plutonium-depleted uranium oxide material from Argonne	FB-Line
Plutonium-depleted uranium-molybdenum alloy (Zero Power Plutonium Reactor)	FB-Line
Plutonium-natural uranium compounds from Argonne	Building 235-F
Plutonium-natural uranium compounds from Argonne and Hanford	FB-Line
Plutonium-natural uranium oxide from Hanford	FB-Line
Plutonium-natural uranium oxides (high-fired) from Hanford	FB-Line
Plutonium-natural uranium oxides from Hanford	FB-Line

Scrap and residue plutonium solids - Approximately 600 packages containing reactive or unknown plutonium forms with unknown reactivity such as plutonium turnings, sand, slag, crucibles, some plutonium compounds and metal fragments, and other alloys, metals, compounds, and oxides of plutonium-239 having minimal other actinide impurities other than americium-241, the decay daughter of plutonium-239. Sand, slag, and crucibles are a process residue containing potentially reactive calcium and fluorides and could be reactive if exposed to improper conditions:	
Analytical laboratory sample residues containing plutonium-242 oxide	Building 772-F
Anode heel metal (americium-241 and plutonium-239) from Rocky Flats	FB-Line
Depleted uranium oxide material from Battelle	Building 235-F
Depleted uranium-plutonium pellets and powder	SRTC
FB-Line cabinet floor sweepings (plutonium)	FB-Line
Formed plutonium metal from Livermore	FB-Line
Miscellaneous plutonium from crucibles	FB-Line
Natural uranium compounds from Battelle and Argonne	FB-Line
Natural uranium-plutonium oxides (low-fired) from Battelle	Building 235-F
Plutonium and natural uranium-depleted uranium pellets	FB-Line
Plutonium and sweepings received from Los Alamos	FB-Line
Plutonium compounds from Westinghouse Electric	FB-Line
Plutonium metal alloy and graphite residues from Rocky Flats	Building 235-F
Plutonium metal (formed) from Livermore	FB-Line
Plutonium metal from Los Alamos (test dissolution)	Building 235-F
Plutonium metal pieces	FB-Line
Plutonium metal button fragments	FB-Line
Plutonium metal turnings	FB-Line
Plutonium metal turnings from Rocky Flats	FB-Line
Plutonium oxide	FB-Line
Plutonium oxide from Hanford	FB-Line
Plutonium oxide in crucible from Fast Flux Test Reactor at Hanford	FB-Line

Plutonium powder	FB-Line
Plutonium residues (sand, slag, and crucible)	FB-Line
Plutonium rods	FB-Line
Plutonium scrub alloy or salt buttons from Rocky Flats	Building 235-F
Plutonium turnings	FB-Line
Plutonium-depleted uranium and plutonium-depleted uranium-silicon from Argonne	FB-Line

Table A-1. (continued).

Description and Storage Management Activities	Location
Plutonium-depleted uranium and plutonium-natural uranium compounds from Nuclear Energy	FB-Line
Plutonium-depleted uranium material from Argonne	FB-Line
Plutonium-depleted uranium material from Battelle	FB-Line
Plutonium-depleted uranium material	FB-Line
Plutonium-depleted uranium oxide from Battelle	Building 235-F
Plutonium-depleted uranium residue from Hanford	FB-Line
Plutonium-depleted uranium residue from Oak Ridge	FB-Line
Plutonium-depleted uranium residue from West Virginia Medical Center	FB-Line
Plutonium-natural uranium compounds from Argonne	FB-Line
Plutonium-natural uranium compounds from Battelle	Building 235-F
Plutonium-natural uranium oxides	FB-Line
Plutonium-oxide high in plutonium-240	FB-Line
Plutonium-zirconium alloy from Argonne	FB-Line
Pump oxide mix from Hanford and Oak Ridge	FB-Line
Sand, slag, and crucible residues from Rockwell	FB-Line

Scrap depleted uranium-plutonium oxide fuel rods from Savannah River Laboratory	Building 235-F
Enriched uranium mixed solids - This grouping consists of approximately 500 packages of plutonium or neptunium alloys, metals, compounds, and oxides contaminated or mixed with enriched uranium (necessitating processing in H-Area). Package configuration is can/ba/dbgraphics/eishtml/eis-0220/can or ba/dbgraphics/eishtml/eis-0220/can/ba/dbgraphics/eishtml/eis-0220/can, stored in vaults. Neptunium solids are shielded to minimize the effects of gamma rays from protactinium-233. During storage, packages are monitored for evidence of internal pressurization or corrosion; these include evidence of bulging, weight gain, or package degradation. If conditions change, package would be radiographed to better define conditions of the interior packaging. If monitoring indicates packaging failure (or imminent failure), material would be repackaged or over-packed, as needed.	
Fissile mixed solids - Approximately 300 packages containing more than 100 grams (3.5 ounces) of fissile material per package:	
Enriched uranium alloy (passivated) from Argonne	Building 235-F
Enriched uranium alloy solids and powder from Los Alamos	Building 235-F
Enriched uranium metal or oxide from Oak Ridge	Building 235-F
Enriched uranium oxide (high-fired and contaminated with plutonium)	Building 235-F
Enriched uranium oxide (high-fired with possible plutonium contamination) from Westinghouse	Building 235-F
Enriched uranium oxide contaminated with plutonium from Rocky Flats	Building 235-F
Enriched uranium oxide from Rocky Flats	Building 235-F
Enriched uranium parts (plutonium contaminated) from Livermore	Building 235-F
Enriched uranium-plutonium alloy from Argonne	FB-Line
Enriched uranium-plutonium compound from Argonne	Building 235-F, FB-Line
Enriched uranium-plutonium compound from Rocky Flats	235-F
Enriched uranium-plutonium compound from West Virginia University reactor	235-F
Enriched uranium-plutonium compound from Westinghouse	FB-Line
Enriched uranium-plutonium compounds from Battelle	Building 235-F, FB-Line
Enriched uranium-plutonium high-fired oxides from Los Alamos	Building 235-F

Enriched uranium-plutonium metal and powder from Battelle	Building 235-F
Enriched uranium-plutonium oxide (high-fired) from Atomics International	Building 235-F
Enriched uranium-plutonium oxide from Battelle	Building 235-F

Table A-1. (continued).

Description and Storage Management Activities	Location
Enriched uranium-plutonium oxide from Rocky Flats	Building 235-F
Enriched uranium-plutonium oxide powder from Westinghouse	Building 235-F
Enriched uranium-plutonium oxides (high-fired) from Oak Ridge	FB-Line
Enriched uranium-plutonium oxides (high-fired) from Hanford	Building 235-F
Enriched uranium-plutonium oxides from Hanford	FB-Line
Enriched uranium-plutonium oxides, pellets, powder from Hanford	Building 235-F
Enriched uranium-plutonium-natural uranium oxide from Oak Ridge	Building 235-F
Enriched uranium-plutonium-neptunium compounds from Livermore	FB-Line
Plutonium-enriched uranium (passivated) alloy from Argonne	Building 235-F
Plutonium-enriched uranium alloy from Argonne	FB-Line
Plutonium-enriched uranium oxide from Los Alamos	Building 235-F
Plutonium-enriched uranium oxides from Rocky Flats	Building 235-F
Plutonium-neptunium compounds from Livermore	FB-Line
Plutonium-neptunium oxide from Hanford	FB-Line
Scrap and residue mixed solids - Approximately 200 packages containing less than 100 grams (3.5 ounces) of plutonium or neptunium per package:	
Enriched uranium and plutonium oxides from Battelle	Building 235-F
Enriched uranium and plutonium oxides from Hanford	Building 235-F
Enriched uranium-neptunium-aluminum scrap (desicooler packaging)	Building 235-F
Enriched uranium-plutonium alloy from Argonne	FB-Line

Enriched uranium-plutonium and natural uranium-plutonium oxides from Battelle	Building 235-F
Enriched uranium-plutonium compound from Argonne	Building 235-F
Enriched uranium-plutonium compounds from Battelle	235-F, FB-Line
Enriched uranium-plutonium compounds from Los Alamos	Building 235-F
Enriched uranium-plutonium from Argonne	Building 235-F
Enriched uranium-plutonium oxides from Hanford	FB-Line
Enriched uranium-plutonium reject fuel rods from Vallecitos	Building 235-F
Enriched uranium-plutonium-thorium alloy with zirconium cladding	Building 235-F
Enriched uranium-plutonium-titanium alloy (passivated) and glass from Argonne	Building 235-F
Enriched uranium-plutonium-titanium in zirconium oxide crucible from Argonne	Building 235-F
Enriched uranium-plutonium-zirconium alloy from Argonne	Building 235-F
Enriched uranium-plutonium-zirconium compound from Argonne	Building 235-F
Enriched uranium-plutonium-zirconium oxides from University of Virginia	Building 235-F
Enriched uranium-zirconium alloy from Argonne	Building 235-F
Plutonium-enriched uranium compound from Nuclear Energy	FB-Line
Plutonium-enriched uranium compound from Oak Ridge	FB-Line
Plutonium-enriched uranium-thorium alloy from Argonne	Building 235-F
Plutonium-neptunium-curium-americium compounds	FB-Line
Plutonium-thorium alloy from Battelle	Building 235-F
Plutonium-thorium compounds from Battelle	Building 235-F
Plutonium-thorium compounds from Hanford	FB-Line
Scrap (high-fired enriched uranium oxide) from Hanford	FB-Line

Table A-1. (continued).

Description and Storage Management Activities	Location
Plutonium-238 scrap materials - Approximately 120 packages of material containing quantities of plutonium-238, mostly in the form of plutonium oxide.	
Plutonium-238 miscellaneous solids and nickel-coated oxide spheres from Mound and Rocky Flats	235-F
Plutonium-238 scrap materials from H-Area	HB-Line Vaults
Description and Storage Management Activities	Location
Plutonium-238 scrap material containing iron oxide	Old HB-Line
Plutonium-238 oxide and compounds from program uses of plutonium-238	SRTC
Mark-31 targets - Approximately 16,000 target slugs, containing 147 metric tons (160 tons) of nuclear material (primarily uranium-238 and plutonium-239) clad with aluminum. Most targets are in reactor basins in stainless-steel buckets within stainless-steel boxes equipped with a loose-fitting lid. The reactor basin water chemistry is being improved to minimize the corrosion of the targets.c Approximately 2,500 of the targets are in the F-Canyon basin, where water quality is not controlled:	
Unirradiated contaminated Mark-31B slug	F-Canyon
Irradiated aluminum-clad Mark-31A targets	F-Canyon
Irradiated Mark-31 slugs (depleted uranium, plutonium, neptunium-237)	L-Reactor Disassembly Basin
Unirradiated contaminated Mark-31 slugs	K-, L-Reactor Disassembly Basins
Mark-16 and Mark-22 fuels - Approximately 3,350 enriched uranium-aluminum alloy tubular fuel elements clad with aluminum. Corrosion of these fuel tubes is primarily at galvanic couples of dissimilar metals of the hangers and the aluminum cladding. The impact of this corrosion is less than that for the Mark-31 targets. The reactor basin water chemistry is being improved to minimize the corrosion of the targets.c Approximately 40 of the elements are in H-Canyon, where basin water quality is not controlled. Two of these are from the Sterling Forest reactor and are left from earlier processing:	
Bundles of irradiated enriched uranium fuel, aluminum-clad, from Sterling Forest reactor	H-Canyon
Mark-16 irradiated fuel assemblies	K-, L-, P-Reactor Disassembly Basins, H-Canyon
Mark-22 irradiated fuel assemblies	K-, P-Reactor Disassembly Basins

Other aluminum-clad fuel and targets - About 650 aluminum-clad fuel and targets containing thorium to produce uranium-233, cobalt used as part of the reactor power control because it is a neutron absorber, thulium, monitor pins and slugs. The reactor basin water chemistry is being improved to minimize the corrosion of the targets.[c]	
Cobalt slugs	K-, L-, P-Reactor Disassembly Basins
Irradiated aluminum-clad slugs in quatrefoils	P-Reactor Disassembly Basin
Irradiated thulium slugs	L-Reactor Disassembly Basin
Mark-50A thorium elements containing uranium-233	K-, L-Reactor Disassembly Basins
Mark-42 target assemblies	P-Reactor Disassembly Basin
Special Curium target slugs	P-Reactor Disassembly Basin
Special Americium-241 targets	P-Reactor Disassembly Basin
Flux monitor pins and slugs	L-Reactor Disassembly Basin

[a]. RBOF = Receiving Basin for Offsite Fuels.

[b]. SRTC = Savannah River Technology Center.

[c]. The reactor basin water chemistry is being improved to minimize the corrosion of the targets. The water is deionized to lower its conductivity, which reduces general aluminum cladding corrosion and the galvanic couple between racks and target and fuel assemblies. Stored materials are monitored for evidence of corrosion and other failure and, as needed, repackaged to reduce sludge formation on basin bottom.

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APPENDIX B. UNCLASSIFIED SUMMARY

Programmatic Need For And Use Of Plutonium-242

Appendix B (which is classified) contains quantitative projections of plutonium-242 requirements to support research and development activities, descriptions of the uses, and analyses of the capabilities of alternative sources to meet the requirements. Appendix B also includes a description of the effects that would result from a decision to not meet the programmatic need.

The DOE decisionmaker will review Appendix B to ensure the incorporation of all applicable data in the decisions resulting from this EIS.

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APPENDIX C. FACILITY AND PROCESS DESCRIPTIONS

This appendix describes the principal facilities associated with the nuclear materials described in this environmental impact statement. The operations described are historic; the descriptions do not indicate how DOE would implement the alternatives discussed in this EIS. Figure C-1 shows the historic cycle and facilities used to produce, process, and store nuclear materials at the Savannah River Site. Chapter 2 describes the operations that would be associated with the alternatives, and includes short descriptions of proposed facilities or major modifications of SRS structures that would affect the alternatives, and of waste management facilities that would process wastes associated with stabilizing nuclear materials.

C.1 Fuel and Target Fabrication (M-Area)

M-Area (see Figure C-2) contains facilities used historically to fabricate fuel, special targets, and components for SRS production reactors. The facilities contain conventional equipment for melting, casting, and shaping metal, including furnaces, extrusion presses, lathes, handling equipment, and storage racks.

Buildings 313-M, 321-M, and 320-M contain the equipment used to fabricate depleted uranium targets, reactor fuel, and tritium targets, respectively. Building 321-M also contains the extrusion presses and finishing equipment that DOE used to extrude neptunium-237 oxide billets into neptunium targets, which were irradiated to produce plutonium-238. "Deinventory" of the facility (i.e., packaging unused nuclear materials and placing them in storage at the SRS or returning them to their sources) is underway. Buildings 313-M, 320-M, and 322-M (the Metallurgical Laboratory) have been deinventoried. Building 321-M is being deinventoried at present.

The SRS received raw aluminum, uranium, lithium, etc., at Building 315-M from commercial vendors and other DOE sites. The raw materials were cast, extruded, and machined into long cylindrical tubes or short cylindrical slugs of metal, depending on whether the reactor component was fuel or target. After fabrication, the fuel and targets were shipped to a reactor area (C, K, L, P, or R) for irradiation.

C.2 Reactors

Of the five production reactors constructed at the SRS in the early 1950s, four (C, L, P, and R) have been permanently shut down, and one (K-Reactor) is in indefinite "cold standby," (Figure C-3). R-Reactor is scheduled for decontamination and decommissioning.

Figure C-1.

Figure C-2.

Figure C-3.

Each reactor has an assembly area for the receipt, handling, and storage of new (i.e., unirradiated) fuel and targets. Racks and vaults store new fuel and targets. Similarly, each reactor has a disassembly area for the storage, handling, and shipment of irradiated fuel and targets that have been removed from the reactor. The disassembly area consists primarily of water-filled basins with metal racks designed for vertical or horizontal storage of fuel tubes, and metal buckets for storing targets. The disassembly basins are about 49 meters (160 feet) wide, 67 meters (220 feet) long and 5 to 9 meters (17 to 30 feet) deep. The volume of water in the basins ranges from 12,800,000 to 18,200,000 liters (3,380,000 to 4,800,000 gallons). The K- and L-Reactor disassembly basins are identical; the P-Reactor basin is the largest. The basins are constructed of unlined concrete coated with vinyl paint. Each has systems for circulating, filtering, and deionizing the water to maintain proper chemistry. Cranes, rigging, and handling equipment in the disassembly area can move or load fuel in casks for shipment to other areas on the Site.

Fuel and targets from M-Area were placed in storage racks or concrete vaults, then were grouped into assemblies and placed in a reactor core. The irradiation of the targets and fuel produced special isotopes. The irradiation time depended on the isotope to be produced. After their removal from the reactor core, the targets and fuel were placed in the water-filled basin to cool the fuel and targets and to allow the decay of short-lived radioactive products. The water also provided radiation shielding to operating personnel. After the targets or fuel had cooled for a brief period (12 to 18 months), they were disassembled and loaded in heavily shielded casks on rail cars (see Figure C-4), which were transferred to F- or H-Area for further processing.

C.3 Chemical Separations (F-Canyon and H-Canyon)

The similar F- and H-Canyon facilities use radiochemical processes for the separation and recovery of plutonium, neptunium, and uranium isotopes. The F-Canyon separated plutonium, irradiated natural or depleted uranium, and radioactive decay products. H-Canyon recovered uranium, highly enriched uranium-235, neptunium-237, and plutonium-238 from irradiated reactor fuels and targets. The following paragraphs apply to both canyons unless noted.

The F- and H-Canyons (see Figures C-5 and C-6; Figure C-6 also shows the Defense Waste Processing Facility in the adjoining S-Area) are reinforced concrete structures, 255 meters (836.6 feet) long, 37 meters (308 feet) wide, and 20 meters (121.4 feet) high. They are named for the two areas ("canyons") in each structure that house the large equipment (tanks, process vessels, evaporators, etc.) used in the chemical separations processes performed in each facility. The canyons are long (170 meters or 557.7 feet), narrow (an average of 6 meters or 19.7 feet), and deep

Figure C-4.

Figure C-5.

Figure C-6.

(20 meters or 65.6 feet). The "hot" and "warm" canyons in each facility are parallel and open from floor to roof. A center section, which has four floors or levels, separates the canyons. The center section contains office space, the control room for all facility operations, and support equipment such as ventilation fans. Figure C-7 is a cross-section view of a canyon facility. Processing operations involving high radiation levels (dissolution, fission product separation, and high-level radioactive

waste evaporation) would occur in the hot canyon, which has thick concrete walls to shield people outside the facility and in the center section from radiation. The final steps of the chemical separations process, which generally involve lower radiation levels, would occur in the warm canyon.

Figure C-7. F-Canyon building sections.

Services typical for a large industrial chemical facility are required to support F- and H-Canyon operations. For example, steam heats process vessels and is the motive force for transferring solutions through process cycles; lights, motors, control systems, etc., use electricity; compressed air provides pressure needed for various process monitoring systems (e.g., liquid level indicators) and powers some control systems; and a ventilation system provides conditioned air for the comfort of facility workers and for environmental control for the operation of sensitive equipment.

A separate ventilation system serves portions of the facility, such as the hot and warm canyons, that contain the radioactive process equipment. This system ensures the air pressure in such areas is below the pressure of the air outside the facility and the area occupied by workers. This design helps prevent the release of radioactive material outside the facility by ensuring that air always flows from outside to inside the process areas. Air in the process areas is exhausted from the facility through a large sand filter that removes 99.5 percent of any airborne radioactive material. A 61-meter (200-foot)-tall stack behind each canyon discharges this filtered air to the atmosphere and serves as the pathway for airborne emissions associated with the normal operation of the canyons.

There are two primary pathways for liquid effluents from the canyons:

- Condensates from secondary evaporators at the A-Line Outside Facilities containing low levels of radionuclides flow to the Effluent Treatment Facility (ETF) for further decontamination, if necessary, before their discharge to surface waters.
- A water system cools the hot and warm canyon process vessels. Underground pipes carry water to the canyons and distribute it. The water passes through coils inside the vessels (Figure C-8 shows a standard canyon process vessel) and flows back out of the canyon. Constant monitoring detects radioactivity in the water. If radioactivity is detected, the water is diverted to a treatment facility where the radioactivity is reduced below applicable limits before the water is discharged.

The equipment and processing stages in the canyons have been configured to separate and recover uranium and plutonium from irradiated fuel or targets, as described for each canyon in the following paragraphs.

C.3.1 F-Canyon (PUREX) Process

The PUREX process consists of several major operations, referred to as "unit operations," which recover plutonium and uranium from irradiated reactor targets. The targets normally would be fabricated from uranium depleted in a uranium-235 isotopic (e.g., at a level below the naturally occurring 0.711 weight percent). The irradiation process is designed to produce weapons-grade plutonium [i.e., plutonium that is greater than 93 percent plutonium-239, with the remainder of the plutonium isotopes similar to plutonium-240 and -241 (NAS 1994)]. The major unit operations are dissolution, head end, first cycle, second uranium cycle, and second plutonium cycle (see Figure C-9). Unit operations that support the product recovery operations are high-activity waste,

Figure C-8.

Figure C-9. Historic PUREX process flow.

low-activity waste, solvent recovery, laboratory waste evaporation, etc. The F-Canyon process also has recovered neptunium-237 that results from PUREX process waste; this activity, which is no longer performed, is not part of this evaluation. Processes within the inner box are conducted in F-Canyon.

The following paragraphs describe major and support unit operations in F-Canyon:

- **Dissolution** - Irradiated targets on a rail car through an air lock are brought into the south end of the hot canyon. Each target consists of a cylinder of depleted uranium clad in aluminum. The targets have been irradiated in an SRS reactor to transform a portion of the depleted uranium into plutonium. Large water-filled casks on rail cars transfer the targets. The targets are removed from the casks and loaded into a large tank called a dissolver. Sodium hydroxide removes the aluminum cladding from the targets. The cladding solution is transferred to the high-level waste tanks. Heated nitric acid in the tank dissolves the target, resulting in a solution containing depleted uranium, plutonium, and radioactive decay products from the reactor irradiation process.
- **Head End** - This process occurs in two steps to prepare the target solution for uranium and plutonium separation. First, gelatin is added to precipitate silica and other impurities. Then the solution is transferred to a centrifuge where silica and other impurities are removed as waste. The clarified product solution is adjusted with nitric acid and water in preparation for the first cycle unit operation. The waste stream generated from the process is chemically neutralized and sent to the F-Area high-level waste tanks. The major components for this operation are a gelatin "strike" tank, a centrifuge feed tank, and a centrifuge.
- **First Cycle** - First cycle operation, which occurs in the hot canyon, has two functions: (1) to remove fission products and other chemical impurities, and (2) to separate the solution into two product streams (uranium and plutonium) for further processing. This separation process occurs as the product solution passes through a series of equipment consisting of a centrifugal contactor and mixer-settler banks. Before the introduction of the feed solution from the head end process, flows of solvent and acid solution are established in the equipment. When an equilibrium is established, the feed solution is introduced. The chemical properties of the acid/solvent/feed solutions in contact with each other cause radioactive decay products to separate from the uranium and plutonium. Later in the first cycle process, the plutonium is separated from the uranium in a similar manner. The first cycle produces four process streams: plutonium (with some residual radioactive decay products), which goes to the second plutonium cycle; a uranium solution (with some residual radioactive decay products), which goes to the second uranium cycle; a solvent stream, which goes to the solvent recovery cycle; and an aqueous acid stream, which goes to the high-level waste tanks. The acid stream contains most of the radioactive decay products. The equipment for this operation consists of a centrifugal contactor, mixer-settler banks, decanter tanks, and hold tanks.
- **Second Uranium Cycle** - The second uranium cycle (in the warm canyon) purifies the uranium solution from the first cycle and prepares the uranium for transfer to the FA-Line. The purification process is a separation process that occurs in a manner similar to that described for the first cycle. The uranium product solution, which contains a low concentration of radioactive decay products, is transferred from the warm canyon to storage tanks in the FA-Line facility,

which is adjacent to the F-Canyon.

- **Second Plutonium Cycle** - The second plutonium cycle (in the warm canyon) purifies the plutonium solution from the first cycle by removing residual radioactive decay products, and prepares the plutonium for transfer to FB-Line. The purification process is a separation process that occurs in a manner similar to that described for the first cycle. The impurities are removed in an aqueous stream that goes to the low-activity waste unit operation for processing. The plutonium product solution, which contains a low concentration of radioactive decay products, is transferred to hold tanks for use as FB-Line feed material.
- **High- and Low-Activity Waste** - These unit operations reduce the volumes of the aqueous streams that contain radioactive decay products by using a series of evaporators in the hot and warm canyons. The feed to the evaporators originates with the primary separation process unit operations, such as the first cycle. The evaporator overheads, which contain most of the water and acid and very little of the radioactive decay product and chemicals used in solvent extraction, are transferred to tanks outside the building for acid recovery and recycling. The radioactive decay products and chemicals in the evaporator concentrate are neutralized and sent to the F-Area high-level waste tanks.
- **Solvent Recovery** - The primary purpose of this unit operation is to wash the solvent to remove impurities, and to recover the solvent and recycle it to solvent extraction cycles for reuse. This operation reconditions and removes impurities from the solvent. The impurities are transferred to low-activity waste for processing. A separate solvent recovery is used with each extraction cycle.
- **Laboratory Waste Evaporation** - The waste handling facilities receive high-level laboratory wastes from F-Area and the Savannah River Technology Center (SRTC) laboratories (see Section C.6.6) and transfer them to the warm canyon for evaporation. These wastes are evaporated and the recovered water is returned to the Outside Facilities for recycling and reuse. The concentrated waste is discharged to the F-Area high-level waste tanks.

C.3.2 H-Canyon Process

The H-Canyon process consists of the recovery of highly enriched uranium (HEU) from reactor fuel and the recovery of neptunium-237 and plutonium-238 from targets. This EIS evaluates the highly enriched uranium, but not the neptunium-237 and plutonium-238 processing. The major unit operations associated with highly enriched uranium are dissolution, head end, first solvent extraction cycle, second uranium solvent extraction cycle, and second neptunium (or second actinide) solvent extraction cycle (see Figure C-10). Unit operations that support the product recovery operations are high-activity waste, low-activity waste, and solvent recovery.

Figure C-10. Historic H-Canyon process flow.

The following paragraphs discuss major and support unit operations in H-Canyon:

- **Dissolution** - Irradiated reactor fuel on a rail car through an air lock is brought into the south end of the hot canyon. The fuel consists of highly enriched uranium fuel tubes clad in aluminum. As a result of the irradiation process, some of the material in the fuel was converted into radioactive decay products and other isotopes such as neptunium-237. Large water-filled casks on rail cars transport the fuel. The fuel is removed from the casks and loaded into a dissolver tank. Heated nitric acid and mercuric nitrates in the tank dissolves the fuel, resulting in a solution containing highly enriched uranium, neptunium, small quantities of plutonium, radioactive decay products from the reactor irradiation process, and the aluminum cladding.

- **Head End** - This process occurs in two steps to prepare the target solution for uranium and neptunium separation. First, gelatin is added to precipitate silica and other impurities. Then the solution is transferred to a centrifuge, where silica and other impurities are removed as waste. The clarified product solution is adjusted with nitric acid and water in preparation for the first cycle unit operation. The waste stream generated from the head end process is chemically neutralized and sent to the H-Area high-level waste tanks. The major components for this operation are a gelatin "strike" tank, a centrifuge feed tank, and a centrifuge.
- **First Cycle** - This operation, which occurs in the hot canyon, has two functions: (1) to remove radioactive decay products and other chemical impurities, and (2) to separate the solution into two product streams (highly enriched uranium and neptunium if recovery is scheduled) for further processing. During the solvent extraction process, the product solution passes through a series of mixer-settler banks. Before the introduction of the highly enriched uranium and neptunium feed solution, flows of solvent and acid (including nitric acid, as discussed for F-Area) solution start through the equipment. When equilibrium has been established, the feed solution from the head end is introduced. The chemical properties of the acid/solvent/feed solutions in contact with each other cause the radioactive decay products, the uranium, and the neptunium to separate. The first cycle produces four process streams: a highly enriched uranium solution with most of the radioactive decay product removed, which goes to the second uranium cycle; a neptunium solution with most of the radioactive decay products removed, which goes to the second neptunium cycle; a solvent stream, which goes to the solvent recovery system; and an aqueous acid stream containing most of the radioactive decay products and chemical salts used in the process, which goes to the high-level waste evaporators. If neptunium recovery is not desired, the solvent extraction cycle is revised and the neptunium is discarded with the aqueous acid stream. The equipment for this unit operation consists of mixer-settler banks, decanter tanks, and hold tanks.
- **Second Uranium Cycle** - The second uranium cycle (in the warm canyon) further purifies the highly enriched uranium solution from the first cycle and prepares it for transfer to the A-Line. The purification process is a solvent extraction process that occurs in a manner similar to that described for the first cycle. The highly enriched uranium product solution is transferred from the warm canyon to storage tanks in the A-Line facility, which is adjacent to the H-Canyon.
- **Second Neptunium (Second Product) Cycle** - The second neptunium cycle (in the warm canyon) purifies the neptunium solution from the first cycle if neptunium recovery is required by removing most of the residual radioactive decay products, and prepares the neptunium for transfer to HB-Line. The purification process is a solvent extraction process that occurs in a manner similar to that for the first cycle. The impurities are removed in an aqueous stream that goes to the low-activity waste unit operation for processing. The neptunium product solution is transferred to hold tanks for use as HB-Line feed material.
- **High- and Low-Activity Waste** - These unit operations reduce the volumes of the aqueous streams that contain radioactive decay products by using a series of evaporators in the hot and warm canyons. The feed to the evaporators originates with the primary separation process operations (e.g., the first cycle). The evaporator overheads, which contain most of the water and acid and very little of the radioactive decay product and chemicals used in solvent extraction, are transferred to tanks outside the building for acid recovery and recycling. The fission products and chemicals in the evaporator concentrate are neutralized and sent to the H-Area high-level waste tanks.
- **Solvent Recovery** - The primary purpose of this unit operation is to wash the solvent to remove impurities, and to recover and recycle the solvent extraction for reuse. The impurities are transferred to low-activity waste for processing. Solvent recovery is used with each extraction cycle.

C.4 FB-Line

The FB-Line is located on the top of the F-Canyon structure (see Figure C-11). Its exterior walls and roof are poured reinforced concrete. The portion of the structure that contains process equipment is approximately 39 meters (130 feet) long by 20 meters (67 feet) wide. The single-story extension to the north is about 11 meters (35 feet) wide by 6 meters (20 feet) long. Tanks and reaction vessels are enclosed in engineered cabinets or gloveboxes to minimize the spread of contamination and to provide shielding from radiation (see Figure C-12).

The FB-Line process includes purification and concentration of plutonium by cation exchange, precipitation of plutonium as a trifluoride, recovery of the trifluoride by filtration, drying of the trifluoride in an oxygen atmosphere, and reduction with calcium metal to form plutonium metal buttons. Figure C-13 shows the typical process flow through the line.

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APPENDIX D: ANNUAL DATA FOR PHASES ASSOCIATED WITH THE MANAGEMENT OF MATERIALS

This appendix contains the annual data used to calculate 10-year impacts from the various alternatives (see Chapter 4). Most of the alternatives would involve the use of multiple facilities and sequential steps to achieve the primary objective (i.e., stabilization or a form that satisfied program requirements). DOE estimated the annual impacts that could occur for each step or "phase" of each alternative. DOE then estimated durations for each phase of each alternative to generate the 10-year data.

This EIS uses the following generic names for the phases to facilitate the presentation of data, even though the different alternatives would involve different activities and facilities.

- **Existing Storage:** Actions associated with storing the material in its present form and configuration.
- **Characterization:** Actions that would be necessary to prepare the material for conversion, including visual inspection, weighing, and chemical and radioactive analysis. The characterization of the material would be needed to determine the implementation of proper processing technique(s).
- **Conversion:** Actions associated with changing the physical or chemical form of the material (i.e., liquid to solid). This typically would involve transfer of the material to a chemical processing facility and operation of the facility.
- **Interim Storage:** For some alternatives, the initial conversion or processing would not complete the stabilization process. Additional steps could be required, such as special packaging or further separations operations. Interim storage would include actions associated with storing the material in preparation for the next phase.
- **Additional Conversion:** Any additional actions necessary to place the material in a suitable form for continued storage, such as heating or repackaging solid forms of plutonium.
- **Packagin/dbgraphics/eishtml/eis-0220/Repackaging:** Actions necessary to place the suitable material form into an acceptable storage configuration, such as treatment in the Actinide Packaging Facility or repackaging.
- **Post-Stabilization Storage:** Actions associated with the material after it had been placed in a configuration and facility suitable for an extended storage period.

Table D-1 presents general information on actions associated with the phases for the alternatives that DOE considered for each material. In this table, "NA" indicates that a phase does not apply to an alternative.

The description of alternatives in Chapter 2 presents the projected durations for "active" phases (i.e., phases that would not involve storage) for the stabilization alternatives. For some alternatives, the latter phases are not likely to be completed by the end of the 10-year period analyzed in this EIS. For a few alternatives, the latter phases would not start within the 10-year period. Chapter 4 presents the

impacts estimated for the next 10 years for various combinations of alternatives. To ensure a complete analysis, Tables D-2 through D-44 present the estimated annual impacts for each phase of every alternative, even though some are not likely to occur within the 10-year period. In general, the highest annual data are related to the conversion phase, because this phase would involve the transfer of the nuclear material and the operation of major facilities. The values for post-stabilization storage are generally less than those for existing storage, reflecting changes in material properties or storage configuration.

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APPENDIX E. ACCIDENTS

This appendix summarizes accidents that could involve nuclear material management. It provides consequences (e.g., resulting doses) from potential releases of specific nuclear materials for each alternative discussed in this EIS.

In preparing this environmental impact statement, DOE reviewed safety analysis reports and supporting accident analyses for facilities that the alternatives described in Chapter 2 could involve. There are no accident analyses for alternatives that would involve new facilities or extensive modifications to existing facilities. In such cases, DOE used accident analyses for existing facilities at SRS that perform similar operations or that process and handle forms of nuclear material that are more hazardous than those being considered in this EIS. DOE believes that the types of accidents evaluated for such existing facilities would be comparable to those for new or modified facilities.

E.1 General Accident Information

An "accident," as discussed in this appendix, is an unplanned release of radioactive or hazardous materials resulting from "initiating" events and the additional failures resulting from the initiating event. In this case, an accident is an inadvertent release of radioactive or hazardous materials from their containers or confinement to the environment.[1] Initiating events are typically defined in three broad categories:

- External initiators originate outside the facility and potentially affect the ability of the facility to maintain confinement of its materials. Examples of external initiators include aircraft crashes, nearby explosions, and hazardous material releases from nearby facilities that could affect the ability of personnel to manage the facility and its materials properly.
- Internal initiators originate within a facility and are usually the result of facility operation. Examples of internal initiators include equipment failures and human errors.
- Natural phenomena initiators are natural occurrences such as weather-related (e.g., floods and tornadoes) and seismic events (i.e., earthquakes).

The likelihood of an accident occurring and its consequences usually depend on the type of initiator (s) causing the accident, the frequency at which that initiator occurs, and the frequency of conditions that will lead to a release caused by the initiating event. Accidents can be grouped into four categories -- anticipated accidents, unlikely accidents, extremely unlikely accidents, and not reasonably foreseeable accidents -- based on their estimated frequency or likelihood of occurrence. Table E-1 lists these accident categories and their corresponding frequency ranges.

Table E-1. Accident frequency categories.[a]

Frequency category	Frequency range (incidents per year)	Description
1. Anticipated accidents	Less than once in 10 years but greater than once in 100 years	Accidents that might occur several times during the lifetime of the facility.
2. Unlikely accidents	Less than once in 100 years but greater than once in 10,000 years	Accidents that are not likely to occur during the lifetime of the facility; natural phenomena of this probability class include Uniform Building Code-level earthquake, 100-year flood, maximum wind gust, etc.
3. Extremely unlikely accidents	Less than once in 10,000 years but greater than once in 1,000,000 years	Accidents that probably will not occur during the life cycle of the facility; this includes a severe tornado, airplane crash, etc.
4. Not reasonably foreseeable accidents	Less than once in 1,000,000 years	All other accidents (e.g., a direct meteorite strike)

[a] **Source: DOE (1994a).**

This EIS evaluation examined a full spectrum of accidents; the tables in this appendix reflect the bounding (risk or consequence) event for the frequency ranges listed in Table E-1, in which risk is defined as the product of the frequency (events per year) and the consequence of an event.

The bounding consequence events would result in the largest projected increases in latent cancer fatalities, were these accidents to occur. The bounding risk events would represent the highest individual likelihood of contracting a fatal cancer, or the highest incremental cancer fatality rate in an exposed population, expressed in units of latent cancer fatalities per year. The tables in Section E.3 present the highest point estimate of risk to the maximally exposed offsite individual for each phase in bold type. This bolded number, when compared to the 1990 United States annual average risk of dying of cancer of about 0.002 (DOC 1992), provides a perspective on whether the event would be likely to increase an individual's lifetime cancer risk due to an accident dose received in that year.

E.2 Accident Analysis Method

The accidents analyzed in this EIS would result from events that are considered "reasonably foreseeable" (expected to occur at least once in 1,000,000 years). The frequencies listed in the tables in this appendix are usually associated with the initial event that leads to a release of radioactive material. In most cases, this is a conservative frequency (i.e., it overestimates the risk) because in reality a chain of events, each with its own frequency, must occur; this includes the unlikely and highly unfavorable meteorological conditions assumed to prevail at the time of the accident. In addition, the analysis might have used conservative release assumptions to calculate potential consequences (doses) that could result from such accidents. These consequences are conservative

because the release of radioactivity from the facility associated with the initiating event (e.g., earthquake) could occur only after the failure of a number of safety systems.

For example, a release of radioactive material from a chemical separations facility (e.g., F-Canyon) could occur in the following manner: An earthquake occurs during a tank-to-tank transfer of radioactive solution in the canyon. The transfer pipe fails or ruptures but the transfer continues and half the contents of the tank spill to the floor of the canyon. Simultaneous with the pipe rupture, the walls of the canyon crack, providing a release pathway to the environment. In addition, the canyon ventilation system fails. (The ventilation system normally maintains the interior of the canyon at a lower pressure than the outside environment. In this way, air leaks are normally into rather than out of the canyon.) After the radioactive material spills, a fraction becomes airborne and passes through the cracks in the canyon walls. This airborne radioactivity is blown off the Site.

This scenario is conservative because tank-to-tank transfers do not occur on a continuous basis, and the earthquake would have to occur during a transfer. DOE assumes that the following failures would allow the release to reach the offsite population at the projected dose levels: (1) the transfer pipe fails, (2) operators fail to respond or are unable to stop the transfer, (3) the canyon walls crack sufficiently to allow the escape of 10 percent of the airborne radioactive material, and (4) power distribution and electrical relays associated with the ventilation system fail. In addition, all released material escapes the facility in the first 2 hours and the meteorological conditions are such that only limited dispersion (or dilution) of the material has occurred by the time it reaches the SRS boundary. Figure E-1 is a sample event tree that shows the effects of this hypothetical earthquake.

The analytical method described in the following sections did not include emergency response actions to accident situations (e.g., evacuation of personnel to a safe distance or notification of the public to perform such response actions as taking shelter) in its determination of potential impacts on workers or members of the public. To minimize potential human exposures and impacts on the environment from postulated accidents, the SRS has established an Emergency Plan (WSRC 1994a) that governs responses to potential accidents.

Figure E-1. Example of a fault tree.

The presentation of data in this appendix uses an alternative scientific notation that facilitates comparisons of the results in tables that sometimes cover several pages. This notation is explained below:

7.1E-01 = 7.1×10^{-1}
or = 0.71

2.4E+3 = $2.4\times10^{+3}$
or = 2,400

The use of this notation shows the relative magnitude of any data entry. The absence of an "E" notation indicates an actual number without the need for a multiple of 10.

To approximate the potential accident impact contribution for each material (or group of materials) of interest, DOE created a flow diagram showing the location, condition, and chemical or physical form of the material. If a safety analysis report provided different frequencies for an event depending on location in a facility (e.g., a fire is more likely in a glovebox than in a dissolver tank), the analysis

used the appropriate frequency for each location housing the material. In some cases, the current forms of the materials differ greatly, although two material groups both might contain primarily plutonium-239. At some point in the processing of both materials (under the preferred alternative), the original form would be lost and the newly generated form would be virtually identical. An example would be Mark-31 plutonium targets and H-Canyon plutonium solutions. After dissolution and processing, the Mark-31 targets would have formed "newly generated" plutonium solutions. These solutions would not pose the same level of concern as those in F-Canyon, which have been stored for several years longer than planned.

In addition to customizing the frequency by location, the analysis customized the source term and composition of the material to the extent possible. For example, if a solution has been processed through a canyon, concentrated, and purified by removing fission products, the source term was adjusted to the maximum concentration with fission product contributions subtracted. The effect of this type of customization is evident in the tables that list the impacts from earthquakes. The frequency remains constant, but both the quantity (in terms of curies) and the isotopic composition (e.g., more americium-241 than plutonium-239) vary by material. These variations enable discrimination of the impacts from one material to another. This discrimination can determine the potential risk reduction if the material of interest is stabilized.

If it was not possible to customize the frequency or source term for a material, the results from the safety analysis report were used. These results represent the bounding accident analysis and are useful for predictions of the impacts from a common mode failure (i.e., a severe earthquake). Table E-5 lists F-Canyon bounding severe earthquake impacts under the heading "F-Canyon (full operation)." Table E-6 lists H-Canyon bounding severe earthquake impacts under the heading "H-Canyon (limiting solution source term)."] Because severe earthquake impacts from the canyons would far exceed those from other facilities involved in the interim management of nuclear materials, a total impact due to a severe earthquake could be approximated by adding the individual impacts from F- and H-Canyons. This cumulative impact is conservative because it is unlikely that both canyons would experience the maximum effects from a severe earthquake.

E.2.1 AFFECTED FACILITIES

Appendix C discusses the facilities used for nuclear material management activities within the scope of this EIS. In addition to the primary areas that house nuclear material, other SRS facilities contain nuclear materials (e.g., the TNX facility has two tanks of depleted uranyl nitrate solution and N-Area has drums of depleted uranium oxide). DOE has evaluated these facilities for their potential hazards and has determined that safety analysis reports were not required due to the low hazards posed by the facilities. This means that a total release of materials without mitigation would result in consequences below the threshold requiring detailed analysis. As a result, the extent of quantitative impact data is limited. In most cases, the impacts will be compared to known impacts that bound those from secondary facilities. To determine the types of accident scenarios this appendix would present, DOE performed an extensive review of existing safety documentation for facilities that either perform or support activities that could be involved with management of nuclear material.

E.2.2 RADIOLOGICAL ACCIDENT ANALYSIS METHOD

DOE used computer models to determine the consequences resulting from the release of radioactivity. This evaluation assumed the release of 1 curie of pertinent isotopes to a surface stream (for liquids) or to the atmosphere at ground level and at an elevated level, such as through an exhaust

stack for the various facilities involved in the alternatives discussed in this EIS. Using the computer models, the evaluation calculated doses to an uninvolved worker, the maximally exposed offsite individual, and the offsite population within 80 kilometers (50 miles) of the Site (Simpkins 1994a,b).

DOE used two SRS-specific computer codes -- AXAIR89Q and LADTAP XL -- to calculate the doses from each of the 1-curie releases postulated. Both codes perform accident analyses described in facility safety analysis reports and postulated accident impacts presented in other EISs developed for the SRS.

The AXAIR89Q computer code (WSRC 1994b), which was developed in accordance with guidelines established by the U.S. Nuclear Regulatory Commission for modeling atmospheric releases, models the doses from airborne constituents of postulated accidental releases of radionuclides to the environment. The modeling of the various accidents postulated for the facilities associated with the different alternatives assumed conservative (99.5 percentile) meteorological conditions (e.g., direction and speed of prevailing wind). "Conservative meteorological conditions" are those for which, for a given release, the concentration of radionuclides (and the resulting doses) at a fixed downwind location will not be exceeded 99.5 percent of the time. Usually, this means a highly stable-low wind speed weather condition where the wind provides only limited dilution of the material released. Use of these meteorological conditions results in consequences approximately three to four times higher for onsite workers and between 10 and 100 times higher for the offsite population than those that would occur during average (50 percentile) meteorological conditions.

The LADTAP XL computer code was developed to model aqueous (i.e., liquid) releases of radionuclides during routine operations and potential accidents. The modeling of the aqueous releases associated with the postulated accidents described in this appendix took no credit for the holdup of radionuclides within the soils surrounding the area where the accidents would occur. In other words, the modeling assumed that the entire release would discharge directly as a liquid to the ground, migrate to the Savannah River either directly or through Fourmile Branch, Pen Branch, etc., and enter the drinking water supply.

DOE calculated most of the impacts (e.g., exposure, expressed as millirem or projected cancer incidence) to individuals from postulated accidental releases of radionuclides to the environment for the various facilities by multiplying the quantity of each isotope in the source term release (in curies per isotope) presented in the safety analysis documents by the doses calculated for a 1-curie release, as discussed in the previous paragraphs. For example, if a facility safety analysis report stated that 0.00044 curie of strontium-90 was released at ground level in the F-Area, and the projected dose to the maximally exposed offsite individual from a 1-curie release of strontium-90 at ground level in the F-Area is 0.1 millirem, then the dose to the maximally exposed offsite individual from the release would be determined by multiplying 0.00044 curie by 0.1 millirem per curie, resulting in a dose of 0.000044 millirem. The total projected dose would then equal the sum of the doses received from each radionuclide (isotope) released during the accident. This approach was not used for impacts already presented in other NEPA documents (e.g., high-level waste tank accidents or plutonium-238 accidents); in such cases, the impacts were obtained from those documents. Section E.3 presents the doses to uninvolved workers, maximally exposed offsite individuals, and the offsite population postulated for the facility radiological accidents evaluated in this appendix.

Each table in Section E.3 reflects the projected consequences in terms of dose (millirem or person-rem), point estimate of risk (dose × frequency, in units of millirem per year or person-rem per year), and latent cancer fatalities based on projections using guidelines developed by the International

Commission of Radiation Protection (see Chapter 4). These guidelines, which are based on several decades of statistical analyses, provide a projection of an individual's chance of developing a cancer that proves to be fatal over time or a projection of the number of fatal cancers that would be likely to result from a population of individuals receiving a collective dose. These numbers enable comparisons of the highest consequence accidents among alternatives and among the phases of an alternative. The projections do not reflect the actual risk to an individual or population because the analysis does not consider the frequency of the accident (likelihood of occurrence). The risk of developing cancer resulting from SRS activities to manage nuclear material would be very low because accidents with large consequences from radioactive materials have not occurred historically and are unlikely to occur in the future. Each table also contains a column listing the total number of released curies estimated for each accident. The variations in dose estimates from similar release amounts is due to the varying impacts of different radioactive isotopes (e.g., 1 curie of plutonium-239 has almost five times the impact of 1 curie of plutonium-241).

As discussed above, this appendix describes risks to uninvolved workers and members of the public from radiological accidents involving nuclear materials in a quantitative fashion using such parameters as dose, accident frequency, and latent cancer fatalities in the population (as discussed in Section E.3). However, it presents potential impacts to involved, or "close-in" workers, from postulated accidents in a qualitative rather than a quantitative (in numerical terms) fashion, primarily because there is no adequate method for calculating meaningful consequences at or near the location where the accidental release occurs (DOE 1994a). The following example illustrates this concept.

A typical method for attempting to calculate the dose to an involved worker is to assume that the material is released in a room occupied by the worker and that the material instantly disperses throughout the room. Because the worker would be in the room when the release occurred, that individual probably would breathe some fraction of the radioactive materials for a given number of seconds before leaving the room. Typically, estimates of exposure time are based on assumptions about worker response to the incident (e.g., how long before the worker left the room, or whether the worker evacuated the room through an area of higher airborne concentrations). For example, consider the instance in which the worker drops a container with 2,000 grams (4.4 pounds) of plutonium oxide powder. Depending on the size of the room where the release occurred, the assumptions made on how much of the released powder became airborne and respirable, and the length of time the exposed worker remained in the room, the calculated dose to the worker could be anywhere between 80 and 78,000 rem (DOE 1994a). The uncertainty of this estimate is large, and no additional insight into the activity is available because the occurrence is accepted as undesirable without needing to perform the calculations. Historic evidence (DOE 1994a) indicates that this would be a nonfatal accident resulting in room contamination with the potential for minor personnel contamination and assimilation. Presenting this wide range of worker dose is not helpful in comparisons of impacts among alternatives. Section E.3.2 discusses potential radiological impacts to facility workers from accidents in a facility.

E.2.3 HAZARDOUS MATERIAL ACCIDENT ANALYSIS METHODOLOGY

A full understanding of the hazards associated with SRS nuclear facilities under the alternatives considered in this EIS requires analyses of potential accidents involving both hazardous and radiological materials. For chemically toxic materials, several government agencies recommend quantifying the health effects that cause short-term consequences as threshold values of concentrations in air. Because the long-term health consequences of human exposure to hazardous materials are not as well understood as those related to radiation exposure, a determination of

potential health effects from exposures to hazardous materials is more subjective than a determination of health effects from exposure to radiation. Therefore, the consequences from accidents involving hazardous materials postulated in this appendix are in terms of airborne concentrations at various distances from the accident location, rather than dose or latent cancer fatalities. Because hazardous materials are used during the operations of each facility, the actual quantity associated with a particular alternative for the materials discussed in this EIS cannot be determined. For example, if a chemical is used to prevent microbiological growth in service water for a facility, then that chemical's tank or vessel must be assumed to be present for the duration of any facility function. Some or all of the hazardous substances could be eliminated if the mission of the facility were completed. None of the primary facilities involved in the storage or management of nuclear material is likely to complete its total mission within the period covered by this EIS.

To determine potential health effects to workers and members of the public that could result from accidents involving hazardous materials, DOE determined the airborne concentrations of such materials released during an accident where the uninvolved worker and offsite individual would be [i.e., 640 meters (2,100 feet) and the nearest SRS boundary, respectively] and compared them to the Emergency Response Planning Guideline (ERPG) values (AIHA 1991). The American Industrial Hygiene Association established these values, which depend on the material or chemical being considered, for three general severity levels to ensure that the necessary emergency actions occur to minimize worker and public exposures after accidents. These severity levels include the following:

- ERPG-1 Values. Exposure to airborne concentrations greater than ERPG-1 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience mild transient adverse health effects or perception of a clearly defined objectionable odor.
- ERPG-2 Values. Exposure to airborne concentrations greater than ERPG-2 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop irreversible or other serious health effects or symptoms that could impair one's ability to take protective action.
- ERPG-3 Values. Exposure to airborne concentrations greater than ERPG-3 values for a period greater than 1 hour results in an unacceptable likelihood that a person would experience or develop life-threatening health effects.

Because all hazardous materials do not have ERPG values, DOE could not use such values to estimate potential impacts on the public from each hazardous material accident postulated for the SRS facilities discussed in this appendix. For chemicals that do not have ERPG values, this assessment compared airborne concentrations of hazardous materials resulting from postulated accidents to the most restrictive available exposure limits established by other guidelines (WSRC 1992) to control worker exposures to hazardous materials. Table E-2 lists the hierarchy of exposure limits that DOE used to evaluate potential health effects resulting from postulated hazardous material accidents.

DOE used a bounding approach to determine the potential impacts on individuals at different positions (e.g., uninvolved workers and the maximally exposed offsite individual) from postulated accidents in each facility area from Extremely Hazardous Substances; the amounts of such substances and their locations were determined from the SRS Tier Two Emergency and Hazardous Chemical Inventory Report (WSRC 1994c). This annual report identifies the chemicals at the Site that are

Table E-2. Hierarchy of established limits and guidelines used to determine impacts from postulated hazardous material accidents.

Primary airborne concentration guideline	Hierarchy of alternative guidelines (if primary guidelines are unavailable)	Reference of alternative guideline
ERPG-3	EEGL[a] (30-minute exposure) IDLH[b]	NAS (1985) NIOSH (1990)
ERPG-2	EEGL (60-minute exposure) LOC[c] PEL-C[d] TLV-C[e] TLV-TWA[f] multiplied by 5	NAS (1985) EPA (1987) 29 CFR Part 1910.1000, Subpart Z ACGIH (1992) ACGIH (1992
ERPG-1	TWA-STEL[g] TLV-STEL[h] TLV-TWA multiplied by 3	29 CFR Part 1910.100, Subpart Z ACGIH (1992) ACGIH (1992)

[a] Emergency Exposure Guidance Level (EEGL): "A concentration of a substance in air (as a gas, vapor, or aerosol) that may be judged by the Department of Defense to be acceptable for the performance of specific tasks during emergency conditions lasting for a period of 1 to 24 hours. Exposure at an EEGL might produce reversible effects that do not impair judgment and do not interfere with proper responses to an emergency." The EEGL is "...a ceiling guidance level for a single emergency exposure, usually lasting from 1 to 24 hours -- an occurrence expected to be infrequent in the lifetime of a person."

[b] Immediately Dangerous to Life and Health (IDLH): "The maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing (e.g., severe eye irritation) or irreversible health effects."

[c] Level of Concern (LOC): "The concentration of an extremely hazardous substance in air above which there may be serious irreversible health effects or death as a result of a single exposure for a relatively short period of time."

[d] Permissible Exposure Limit - Ceiling (C): "The employee's exposure which shall not be exceeded during any part of the work day."

[e] Threshold Limit Value - Ceiling (TLV-C): "The concentration that should not be exceeded during any part of the working exposure."

[f] Threshold Limit Value - Time Weighted Average (TLV-TWA): "The time-weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect."

[g] Time Weighted Average - Short-Term Exposure Limit (TWA-STEL): "The employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day unless another time limit is specified...."

[h] Threshold Limit Value - Short-Term Exposure Limit (TLV-STEL): "The concentration to which workers can be exposed continuously for a short period of time without suffering from (1) irritation, (2) chronic or irreversible tissue damage, or (3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue, or materially reduce work

efficiency, and provided that the daily TLV-TWA is not exceeded."

hazardous or that require the establishment of emergency response procedures. Following identification of the amounts and locations of the Extremely Hazardous Substances (see Section E.4) in each area, DOE calculated the airborne concentrations at 640 meters (2,100 feet) from the point of release and the nearest SRS boundary (i.e., locations of the uninvolved worker and maximally exposed offsite individual, respectively) that would be likely from a release of the maximum inventory of each Extremely Hazardous Substance in a single location. EPICode™ (Emergency Prediction and Information Code), a commercially available computer code for modeling routine or accidental releases of hazardous chemicals to the environment (Homann 1988), calculated the airborne concentrations at the different locations.

E.3 Postulated Accidents Involving Radioactive Materials

E.3.1 Impacts to Uninvolved Workers and Members of the Public

This EIS presents the consequences and risks of bounding accidents. In this EIS, the term "bounding accident" represents postulated events or accidents that have higher consequences or risks (i.e., consequences × frequencies) than other accidents postulated in the same frequency range. A consideration of the risks associated with bounding events or accidents for a facility can establish an understanding of the overall risk to workers, members of the public, and the environment from nuclear material management activities. In addition, the risks of different alternatives can be compared relatively by comparing the risks associated with the bounding accidents for the phases of each alternative. Figure E-2 shows the concept of bounding risk accidents. The accident impact tables in this section list the bounding events for each pertinent frequency range. These tables list in bold type the highest overall point estimate of risk for the maximally exposed offsite individual and the highest consequence to the population for each phase. Some tables also list a representative selection from the full spectrum of accidents to aid in comparisons among alternatives or to demonstrate the elimination of some accidents for specific materials.

Table E-3 is a summary matrix of the facilities used for each phase of the alternatives considered for each material category. The No-Action alternative column lists the facility where the material is currently stored; this alternative has no phases. The "conversion" phase refers to any initial treatment; it is not limited to processing in a canyon. Not all alternatives have all phases (e.g., the additional conversion phase could be beyond the timeframe of this EIS).

Table E-3 is intended for use in conjunction with Tables E-4 through E-12, which list accident analysis data for each material and the facilities that could be involved in a specific phase for the corresponding material. Table E-3 can be used to determine the facility accidents analyzed that would be applicable to a specific phase. However, because the canyons and their support facilities are similar, conversion activities could occur in either area. As stated above, the tables list in bold type the maximum point estimate of risk for the maximally exposed offsite individual and the highest consequence to the population for each phase. Because an alternative might not involve every facility listed in each phase, these maximum values would not necessarily apply to all alternatives. For example, the highest point estimate of risk for the conversion phase of the H-Canyon uranium solutions (0.0000036 latent fatal cancers per year) would occur for H-Canyon. However, the Low Enriched Uranium Alternative for this material would use FA-Line for the processing phase;

therefore, the maximum point estimate of risk for this alternative during processing would be 0.0000000018 latent fatal cancer per year. As noted above, the accident consequences have been tailored to the extent possible to reflect consequences attributable to the specific material.

Table E-2

Table E-3.

Table E-4

Table E-5

Table E-6

Table E-7

Table E-8

Table E-9

a. MEI = maximally exposed individual.

b. These data were not available.

Section E.8 includes a glossary of accident descriptions. These descriptions describe the events listed in the tables. The tables use titles that indicate the facility mode as used throughout the tables [e.g., "F-Canyon (without dissolver)]." This entry means the action of dissolving would not be part of the management alternative for this material; the safety analysis report data for this mode or condition has not been used.

E.3.2 Impacts to Facility Workers from Postulated Facility Accidents

E.3.2.1 F-Canyon and H-Canyon

No fatalities to involved or "close-in" workers from the accident scenarios postulated under current or full operations in the F- or H-Canyon are a likely result of exposure to radiation. Releases from most accidents would be contained in the processing area and filtered through the canyon ventilation system. Because the ventilation system flows from areas of lowest to highest radioactivity, and because releases flow through an exhaust stack after passing through a filtration system, the doses received by workers from these accidents are not likely to be substantially larger than those received during routine operations. For postulated accidents in which the release was not likely to be maintained within the ventilation system (i.e., airborne releases from the ground level or liquid releases), involved worker exposures would be unlikely to result in adverse health effects. For an inadvertent nuclear criticality in the processing vessels, the doses to involved workers would likely be minimized due to the shielding between the vessels and the locations a worker could occupy.

E.3.2.2 FB-Line Facility

With the exception of an inadvertent nuclear criticality during processing, no fatalities to involved workers from the accident scenarios postulated under current or full operations in the FB-Line would be likely as a result of exposure to radiation (see Section E.7). Current operations primarily involve storage activities in the FB-Line vaults. Because access to storage areas in the FB-Line is limited, only a small number of individuals could receive impacts from an accidental release of material or an inadvertent nuclear criticality in a storage vault. Under full operations, potential accidents resulting from processing, such as a fire or uncontrolled chemical reaction, would not result in substantial exposures because most work would occur inside gloveboxes. Based on historic accident information, exposures to involved workers would be within limits established for routine operations if the implementation of emergency response actions occurred. Of the approximately 74 persons who could be in the FB-Line facility during processing activities, about 56 would be in areas where they could receive substantial doses from a criticality. Of the 56, an estimated 4 workers could receive lethal doses of radiation, while the other individuals would receive varying nonlethal levels.

E.3.2.3 FA-Line

For accidents postulated for FA-Line, with the exception of a red-oil explosion or a severe earthquake, no substantial injuries to involved workers are likely. The force of the explosion or flying debris initiated by the red-oil explosion could result in physical injuries to involved workers. Although the likelihood for an involved worker fatality due to radiation exposure alone after a severe earthquake is minimal, the earthquake itself could result in significant injuries or death for involved workers.

E.3.2.4 235-F Storage Vaults

With the exception of an inadvertent nuclear criticality in the storage vaults, no fatalities to involved workers from the accident scenarios postulated for the 235-F facility are likely as a result of exposure to radiation. Section E.7 discusses the criticality safety program. Because the number of persons permitted in the 235-F storage vaults is limited, the number of individuals who could be impacted from an inadvertent nuclear criticality would be limited. No more than two involved workers would be likely to receive lethal doses of radiation, with a limited number of additional individuals receiving exposures significantly above the annual administrative limit established for routine operations. For other postulated accident scenarios for the 235-F facility, exposures to involved workers are likely to be within limits established for routine operations, even if the inventories of materials within the vaults increased as a result of stabilization of materials at other SRS facilities.

E.3.2.5 HB-Line Facility

Fatalities to involved or close-in workers from the accident scenarios postulated for full operation of the HB-Line facility are not a likely result of exposure to radiation. For many of the accidents, releases would be contained in the gloveboxes and filtered through the process system and canyon ventilation systems. Because the ventilation system flows from areas of lowest to highest radioactivity, and because releases flow through an exhaust stack after passing through a filtration system, the worker doses from these accidents are not likely to be substantially larger than those received during routine operations. For postulated accidents in which the release is not likely to remain in the ventilation system, such as a ground-level airborne release initiated by a severe earthquake, involved worker exposures would be unlikely to result in adverse health effects. An inadvertent nuclear criticality is not considered credible in the HB-Line, either during current or full operations, due to the forms and isotopes of the materials. Therefore, exposures or fatalities are not

likely from inadvertent nuclear criticalities.

E.3.2.6 Uranium Solidification Facility

With the exception of an inadvertent nuclear criticality during processing, no fatalities to involved workers from the accident scenarios postulated for the Uranium Solidification Facility are likely as a result of exposure of radiation. Section E.7 discusses the criticality safety program. If an inadvertent nuclear criticality occurred, either during processing (criticality in a liquid) or packaging and storage (criticality in a powder), the radiation field generated by the criticality could lead to involved worker fatalities. However, DOE expects that the number of fatalities would be limited to two; additional individuals in the facility could receive doses that significantly exceeded their annual administrative exposure limits.

E.3.2.7 H-Area Receiving Basin for Offsite Fuels

No fatalities are likely to involved workers from the radiological accident scenarios postulated for the Receiving Basin for Offsite Fuels. Worker doses for all postulated basin accidents would be minimal.

E.3.2.8 Reactor Disassembly Basins

No fatalities are likely to involved workers from the radiological accident scenarios postulated for the reactor disassembly basins. Worker doses for all postulated basin accidents would be minimal. This conclusion is based on the fact that the fuels and targets stored in each basin are maintained at a distance below the surface level of the water sufficient to minimize involved worker exposures. In addition, in events that involved a substantial loss of basin water after which fuels and targets could be exposed to the air (e.g., draindown of half the basin water or discharge of all basin water following a severe earthquake), sufficient time would be available to allow involved workers to take the precautions necessary to evacuate the area or implement other actions to minimize exposures.

E.3.2.9 Other Facilities

In addition to the facilities discussed above, M-Area buildings, the Savannah River Technology Center, the TNX facility, and the high-level waste tanks contain nuclear materials addressed by this EIS.

No fatalities to involved workers from the accident scenarios postulated for M-Area are likely as a result of exposure to radiation. DOE anticipates that involved worker doses received from accidents would be minimal because the area serves as a storage vault for stable materials and involves only routine monitoring and maintenance activities.

No fatalities to involved workers from the accident scenarios postulated for the Savannah River Technology Center are likely as a result of exposure to radiation from accidents involving these materials, and DOE anticipates that involved worker doses received from accidents would be minimal. This conclusion is based on the very small amount of irradiated, aluminum-clad fuel assembly pieces, which would be a candidate for further stabilization in other facilities. The only alternative proposed for this material in the Savannah River Technology Center is No Action.

DOE anticipates no radiation-induced fatalities would result from accidents in the TNX facility or the waste tanks. The tanks in both areas store liquid radioactive materials and involve routine monitoring or remote transfers. The high-level waste tanks are in F- and H-Areas.

E.3.3 STABLE MATERIALS

Although this EIS considers no alternatives other than Continued Storage (No Action) for stable materials, this section summarizes the accident analyses presented in the safety analysis reports for the facilities housing these materials. These documents discuss accident impacts for an uninvolved worker and the maximally exposed individual off the Site.

E.3.3.1 Postulated Radiological Accidents for the M-Area Reactor Materials Facilities

The primary purpose of the M-Area facilities was to manufacture fuel and target assemblies. The enriched uranium storage vault is constructed of reinforced concrete with walls and roof 30 centimeters (12 inches) thick. The four walls extend 1.8 meters (6 feet) into the ground and rest on 0.6-meter (2-foot)-thick footings. The storage vault was constructed to be a "maximum resistance" area [able to withstand a Fujita Intensity Five (F-5) tornado or a Modified Mercalli VIII (MM VIII) earthquake with little or no damage]. The SRS document explaining the limited continued operations in M-Area contains accident analyses for the facilities containing the nuclear materials addressed by this EIS. The bounding event for impact on the maximally exposed individual is an explosion in Building 320-M, which would result in a risk of 0.00014 rem per year and a latent cancer fatality projection of 0.00000007. For the uninvolved worker for the same event, the estimated risk would be 0.00044 rem per year and the latent cancer fatality projection would be 0.00000018. This accident is representative of bounding events related to the storage of a variety of materials for which further stabilization is not required. This group contains all material in the Reactor Material Area, including miscellaneous depleted uranium and uranium metal, oxide, slugs, cores, sludges, enriched uranium residues, lithium aluminum control rods, spargers, targets, unirradiated Mark-22s with lithium target tubes, natural and enriched lithium metal in cans, Mark-16 and Mark-22 tubes, Mark-31 slugs, and neptunium targets. Stable material is stored in Buildings 313-M, 315-M, 320-M, 321-M, 322-M, and 341-1M. Unirradiated Mark-31 slugs (depleted uranium in aluminum housings) constitute most of the inventory. The No-Action Alternative is proposed for the materials currently stored in M-Area.

E.3.3.2 Postulated Radiological Accidents for Savannah River Technology Center

Nuclear material used or stored in the Savannah River Technology Center includes a small amount of americium and curium solution and targets; americium-241 scrap; depleted uranium slurry, metal, and oxide; enriched uranium sweepings; etc.

Under the No-Action Alternative, current research activities at the Savannah River Technology Center would continue, and DOE would continue to store equivalent amounts and types of material in Building 773-A laboratories and cells. These materials are generally stored in limited-quantity cans, bottles, or sample carriers. Most are contained further in laboratory hoods, gloveboxes, or cells. These items, or equivalent new sample quantities, would be in a safe stable form for storage for several years.

The Savannah River Technology Center Safety Analysis Report summarizes consequences from postulated accidents at the center involving areas that contain the materials listed above. The actual contribution to the accident scenarios from these materials would be negligible, but these events are bounding for all alternatives for stable materials (i.e., the No-Action Alternative). An earthquake with a magnitude of 0.2 times gravity poses the highest risk for the maximally exposed individual. The risk associated with this event would be 0.00023 rem per year and the latent cancer fatality projection would be 0.00000012. In the highly unlikely event that this accident occurred, it would cause a

projected increase of 0.48 in latent cancer fatalities. From the same event, the uninvolved worker risk would be 0.0043 rem per year and the latent cancer fatality projection would be 0.0000017.

E.3.3.3 Postulated Radiological Accidents for the TNX Research Facility

The TNX facility is a "radiological facility," as determined by the quantity of nuclear material present (DOE 1992). This hazard classification is the lowest for a facility that contains radioactive materials and requires no safety analysis report. This assessment does not summarize accident analyses for this facility because the impacts are bounded by those for several other facilities; only the No-Action Alternative would apply.

E.4 Postulated Accidents Involving Extremely Hazardous Substances

Because of the many types of materials and chemicals at the Site and the varying quantities of these materials in different locations, the analysis of potential accident scenarios involving hazardous materials was limited to substances categorized by the U.S. Environmental Protection Agency as "Extremely Hazardous Substances" (40 CFR Part 355), as designated under the Emergency Planning and Community Right-to-Know Act of 1986. Although materials not categorized as Extremely Hazardous Substances can affect the health and safety of workers and the public if released in sufficient quantities and forms, the Site has implemented programs in accordance with DOE Order requirements (e.g., DOE 1985, 1993, 1994b) that incorporate programmatic and management requirements of other government agencies, such as the Occupational Safety and Health Administration. While these materials might present hazards to workers or the public if accidentally released to the environment, their impacts are likely to be bounded by potential impacts from accidents involving Extremely Hazardous Substances; therefore, this appendix does not analyze them.

This section presents potential impacts from postulated chemical accidents at facilities that are or could be involved with safely managing or stabilizing SRS nuclear materials. For each area, it presents potential impacts of the bounding hypothetical chemical accident scenarios (as calculated using the method described in Section E.2.4).

Substances present in bulk quantities can, in some cases, be reduced or eliminated after stabilization of the associated nuclear material. In other cases (e.g., the Receiving Basin for Offsite Fuels), the chemicals support long-term facility functions independent of the interim management of the nuclear materials covered in this EIS. The accident consequences presented in this section assume a maximum chemistry inventory and are bounding for all alternatives.

Table E-10

Table E-11

Table E-12

E.4.1 POSTULATED CHEMICAL ACCIDENTS FOR F-AREA FACILITIES

Based on a review of current inventories at the facilities in the F-Area (DOE 1994c), DOE

determined that seven Extremely Hazardous Substances are in use in the area. Table E-13 lists the maximum amounts of each substance in a single location in the F-Area.

Table E-13. Inventories of Extremely Hazardous Substances[a] in F-Area.

Substance	Maximum amount in a single location (kilograms)[b,c]
Hydrochloric acid	34.0
Hydrogen fluoride	1,174.8
Hydrogen peroxide	122.5
Nitric acid	65,771.6
Phenol	0.9
Phosphorous pentoxide	0.9
Sulfuric acid	3,823.8

[a] Materials categorized as Extremely Hazardous Substances (40 CFR Part 355), as designated under the Emergency Planning and Community Right-to-Know Act of 1986.

[b] To determine the quantity in pounds, multiply by 2.2046.

[c] Amounts are based on 1993 (1-year) values.

To determine airborne concentrations at 640 meters (2,100 feet) and the nearest SRS boundary (the locations of the uninvolved worker and maximally exposed offsite individual, respectively), DOE assumed an inadvertent release to the environment of the maximum amount of each material in a single location. This method enables a comparison of the impacts of the various substances as well as impacts at the facilities housing these substances. These impacts are conservative because the analysis does not consider the frequency of an initiating event that could lead to the release of this maximum amount.

DOE used the EPICode™ computer code (see Section E.2.6) to model the release of each material. Table E-14 lists the results of the analyses and compares expected airborne concentrations at the uninvolved worker and maximally exposed individual locations to the different threshold Emergency Response and Planning Guidelines or their equivalents.

Table E-14. Impacts from potential non-seismic-initiated releases of extremely hazardous substances in F-Area

Substance released	Maximum amount in F-Area (kg)[a]	Airborne concentration (milligram per cubic meter)b				
		At 640m[c]	At Site boundary[d]	ERPG-1[e]	ERPG-2[e]	ERPG-3[e]
Hydrochloric acid	3.4E+01	6.3E-03	8.5E-05	4.5	3.0E+01	1.5E+02
Hydrogen fluoride	1.2E+03	2.2E+02	2.9	4.0	1.6E+01	4.1E+01
Hydrogen peroxide	1.2E+02	2.3E-02	3.1E-04	1.4	--	1.1E+02
Nitric acid	6.6E+04	1.4E+01	3.6	5.2	3.9E+01	7.7E+01
Phenol	9.1E-01	1.5E-04	1.7E-06	3.9E+01	1.9E+02	7.7E+02
Phosphorous pentoxide	9.1E-01	1.5E-04	1.7E-06	5.0	2.5E+01	1.0E+02
Sulfuric acid	3.8E+03	2.2E-07	3.7E-09	2.0	1.0E+01	3.0E+01

[a] To determine the quantity in pounds, multiply by 2.2046.

[b] Airborne concentrations derived assuming conservative (99.5 percentile) meteorological conditions for the Site.

[c] Location of the uninvolved worker, assumed to be located 640 meters (2,100 feet) downwind from the release.

[d] Location of the maximally exposed offsite individual, assumed to reside at the nearest SRS boundary downwind from the point of release at 10.6 kilometers (6.6 miles).

[e] Either the Emergency Response Planning Guidelines value or most restrictive exposure guideline available, as discussed in Section E.2.4 and listed in Table E-2. For substances with limits established in terms of parts per million, the value in milligrams per cubic meter was determined using the following equation: milligrams per cubic meter = (limit in parts per million) × (gram molecular weight of substance) / 24.45.

Because a severe seismic event has the potential to initiate the release of the same material from different locations in the F-Area, DOE analyzed a release of the maximum daily inventory. Table E-15 lists the results of these analyses. A total release of the entire inventory of a particular material from the F-Area to the environment is extremely unlikely, especially if the material is in several different locations, facilities, or buildings in the area. However, the assumption of a total release of the maximum inventories in the area provides a bounding estimate for the largest airborne concentrations DOE could expect following a severe earthquake.

As listed in Tables E-14 and E-15, the airborne concentrations for a gaseous release of hydrogen fluoride (hydrofluoric acid) would exceed the ERPG-3 threshold limits at 640 meters (2,100 feet) from the point of release. As explained in Section E.2.4, ERPG-3 threshold values represent concentrations at which an individual would experience or develop life-threatening health effects if

exposed for longer than 1 hour. Because individuals could be notified and evacuated to a safe location (e.g., inside a building with adequate ventilation) within 1 hour of an inadvertent release of hydrogen fluoride, DOE does not expect any life-threatening or long-term health effects to uninvolved workers. Uninvolved workers could experience mild burning of the lungs from inhaling hydrogen fluoride, burning of the eyes, and mild skin irritations. In addition, because the airborne concentrations at the nearest SRS boundary would be below ERPG-1 threshold values, no measurable health effects are likely to members of the public. However, for involved workers, there is a potential for serious worker injury and potential fatalities because of the large concentrations expected at locations close to the point of release, which could hinder personnel from taking appropriate emergency response actions.

Table E-15. Impacts from potential releases of extremely hazardous substances in F-Area resulting from a severe earthquake

		Airborne concentration (milligram per cubic meter)[b]				
Substance released	**Maximum daily amount in entire F-Area (kg)[a]**	**At 640m[c]**	**At Site boundary[d]**	**ERPG-1[e]**	**ERPG-2[e]**	**ERPG-3[e]**
Hydrochloric acid	1.0E+02	1.9E-02	2.6E-04	4.5	3.0E+01	1.5E+02
Hydrogen fluoride	1.2E+03	2.2E+02	2.9	4.0	1.6E+01	4.1E+01
Hydrogen peroxide	1.2E+02	2.3E-02	3.1E-04	1.4	--	1.1E+02
Nitric acid	2.7E+05	3.9E+02	1.4E+01	5.2	3.9E+01	7.7E+01
Phenol	1.4	2.3E-04	2.6E-06	3.9E+01	1.9E+02	7.7E+02
Phosphorous pentoxide	9.1E-01	1.5E-04	1.7E-06	5.0	2.5E+01	1.0E+02
Sulfuric acid	4.0E+03	2.3E-07	4.0E-09	2.0	1.0E+01	3.0E+01

[a] To determine the quantity in pounds, multiply by 2.2046.

[b] Airborne concentrations derived assuming conservative (99.5 percentile) meteorological conditions for the Site.

[c] Location of the uninvolved worker, assumed to be located 640 meters (2,100 feet) downwind from the release.

[d] Location of the maximally exposed offsite individual, assumed to reside at the nearest SRS boundary downwind from the point of release at 10.6 kilometers (6.6 miles).

[e] Either the Emergency Response Planning Guidelines value or most restrictive exposure guideline available, as discussed in Section E.2.4 and listed in Table E-2. For substances with limits established in terms of parts per million, the value in milligrams per cubic meter was determined using the following equation: milligrams per cubic meter = (limit in parts per million) × (gram molecular weight of substance) / 24.45.

Table E-15 indicates that, in the event of a severe earthquake, a release of the total quantity of nitric acid in the F-Area would exceed ERPG-3 values at a distance of 640 meters (2,100 feet) and ERPG-1

values at the nearest SRS boundary. As explained in Section E.2.4, the health effects from being exposed to ERPG-1 threshold values for greater than 1 hour are minor (e.g., irritation of the eyes and objectionable odor). For uninvolved and involved workers, although the release would exceed ERPG-3 threshold values, no worker fatalities from exposure to airborne acid concentrations would be likely; some individuals could experience significant short-term health effects, such as burning of the lungs and irritation of the skin. Because this scenario assumes that all nitric acid in the F-Area would be released from a single location during a severe earthquake, airborne concentrations would be lower than those listed in Table E-15.

E.4.2 POSTULATED CHEMICAL ACCIDENTS FOR H-AREA FACILITIES

Based on a review of current inventories at the various H-Area facilities (DOE 1994b), DOE determined that seven Extremely Hazardous Substances are in use in the H-Area. Table E-16 lists the maximum amounts of each substance in a single location in the H-Area.

Table E-16. Inventories of Extremely Hazardous Substances[a] in H-Area.

Substance	Maximum amount in a single location (kilograms)[b,c]
Ammonia	27.2
Hydrochloric acid	2.7
Hydrogen fluoride	2.3
Nitric acid	39,814.7
Nitric oxide	1,315.4
Phosphorous pentoxide	1.4
Sulfuric acid	0.9

[a] Materials categorized as Extremely Hazardous Substances (40 CFR Part 355), as designated under the Emergency Planning and Community Right-to-Know Act of 1986.
[b] To determine the quantity in pounds, multiply by 2.2046.
[c] Amounts are based on 1993 (1-year) values.

Table E-17 lists the results of the analyses and compares the expected airborne concentrations at the uninvolved worker and maximally exposed individual locations to the different threshold Emergency Response and Planning Guidelines or their equivalents. Because a severe seismic event has the potential to initiate the release of the same material from different locations within the H-Area, DOE analyzed a release of the maximum daily inventory to the environment. Table E-18 lists the results of these analyses.

As listed in Tables E-17 and E-18, the airborne concentrations for a gaseous release of nitric oxide would exceed the ERPG-3 threshold limits at a distance of 640 meters (2,100 feet) from the point of release. Table E-18 indicates that, in a severe earthquake, a release of the total quantities of nitric acid

in the H-Area would exceed ERPG-3 values at a distance of 640 meters (2,100 feet) and ERPG-1 values at the nearest SRS boundary. For uninvolved and involved workers, although the release would exceed ERPG-3 threshold values, no worker fatalities from exposure to the airborne acid concentrations would be likely; some individuals could experience significant short-term health effects, such as burning of the lungs and irritation of the skin. Because this scenario assumes that all nitric acid in the H-Area would be released from a single location during a severe earthquake, airborne concentrations would be lower than those listed in Table E-18.

Table E-17. Impacts from potential non-seismic-initiated releases of Extremely Hazardous Substances in H-Area

Substance released	Maximum amount in a single H-Area location (kg)[a]	Airborne concentration (milligram per cubic meter)[b]				
		At 640m[c]	At Site boundary[d]	ERPG-1[e]	ERPG-2[e]	ERPG-3[e]
Ammonia	2.7	5.1E-03	5.8E-05	2.5E+01	2.0E+02	1.0E+03
Hydrochloric acid	2.7	5.0E-04	5.7E-06	4.5	3.0E+01	1.5E+02
Hydrogen fluoride	2.3	4.3E-04	4.9E-06	4.0	1.6E+01	4.1E+01
Nitric acid	4.0E+04	9.5E+01	1.9	5.2	3.9E+01	7.7E+01
Nitric Oxide	1.3E+03	4.9E+03	4.4	9.3E+01	1.2E+02[f]	1.2E+02
Phosphorous pentoxide	1.4	1.2E-01	1.1E-03	5.0	2.5E+01	1.0E+02
Sulfuric acid	9.0E-01	1.7E-04	1.9E-06	2.0	1.0E+01	3.0E+01

[a] To determine the quantity in pounds, multiply by 2.2046.

[b] Airborne concentrations derived assuming conservative (99.5 percentile) meteorological conditions for the Site.

[c] Location of the uninvolved worker, assumed to be located 640 meters (2,100 feet) downwind from the release.

[d] Location of the maximally exposed offsite individual, assumed to reside at the nearest SRS boundary downwind from the point of release at 10.6 kilometers (6.6 miles).

[e] Either the Emergency Response Planning Guidelines value or most restrictive exposure guideline available, as discussed in Section E.2.4 and listed in Table E-2. For substances with limits established in terms of parts per million, the value in milligrams per cubic meter was determined using the following equation: milligrams per cubic meter = (limit in parts per million) × (gram molecular weight of substance) / 24.45.

[f] Alternative concentration limit guideline for ERPG-2 value (TWA × 5) was adjusted down to the next higher range value (IDLH).

Table E-18. Impacts from potential releases of extremely hazardous substances in H-Area resulting from a severe earthquake.

Substance released	Maximum daily amount in entire H-Area (kg)[a]	Airborne concentration (milligram per cubic meter)[b]				
		At 640m[c]	At Site boundary[d]	ERPG-1[e]	ERPG-2[e]	ERPG-3[e]
Ammonia	2.7E+01	5.1E-03	5.8E-05	2.5E+01	2.0E+02	1.0E+03
Hydrochloric acid	1.1E+01	2.1E-03	2.4E-05	4.5	3.0E+01	1.5E+02
Hydrogen fluoride	3.6	6.7E-04	7.6E-06	4.0	1.6E+01	4.1E+01
Nitric acid	1.2E+05	2.3E+02	5.7	5.2	3.9E+01	7.7E+01
Nitric Oxide	1.3E+03	4.9E+03	4.4	9.3E+01	1.2E+02[f]	1.2E+02
Phosphorous pentoxide	1.4	1.2E-01	1.1E-03	5.0	2.5E+01	1.0E+02
Sulfuric acid	2.7	5.0E-04	5.7E-06	2.0	1.0E+01	3.0E+01

[a] To determine the quantity in pounds, multiply by 2.2046.

[b] Airborne concentrations derived assuming conservative (99.5 percentile) meteorological conditions for the Site.

[c] Location of the uninvolved worker, assumed to be located 640 meters (2,100 feet) downwind from the release.

[d] Location of the maximally exposed offsite individual, assumed to reside at the nearest SRS boundary downwind from the point of release at 10.6 kilometers (6.6 miles).

[e] Either the Emergency Response Planning Guidelines value or most restrictive exposure guideline available, as discussed in Section E.2.4 and listed in Table E-2. For substances with limits established in terms of parts per million, the value in milligrams per cubic meter was determined using the following equation: milligrams per cubic meter = (limit in parts per million) × (gram molecular weight of substance) / 24.45.

[f] Alternative concentration limit guideline for ERPG-2 value (TWA × 5) was adjusted down to the next higher range value (IDLH).

E.4.3 POSTULATED CHEMICAL ACCIDENTS FOR K-, L-, AND P-REACTOR BASINS

Based on a review of the chemical inventory that supports the water chemistry in the L-Reactor basin, DOE determined that the only identified Extremely Hazardous Substance was a small quantity of nitric acid. For 45.6 kilograms (100 pounds) of nitric acid modeled as a liquid spill (the maximum daily amount in the basin), the airborne concentration at 640 meters (2,100 feet) would be several

orders of magnitude lower than the ERPG-1 concentration limit. DOE assumed that this was typical for all SRS reactor basins that store nuclear material.

In addition, because the airborne concentrations at the nearest SRS boundary would be considerably below ERPG-1 threshold values, no measurable health effects to members of the public would be likely. No impacts would hinder involved workers from taking appropriate emergency response actions.

E.4.4 POSTULATED CHEMICAL ACCIDENTS FOR M-AREA FACILITIES

Based on a review of current inventories at the various facilities in the M-Area (DOE 1994b), DOE determined that five Extremely Hazardous Substances are in use in the area. Table E-19 lists the maximum amounts of each substance in a single location in the M-Area. However, M-Area contains nuclear materials that require no further stabilization. Therefore, this EIS proposes no alternatives for the safe management of nuclear materials in M-Area. As a result, no further chemical accident analysis is required.

Table E-19. Inventories of Extremely Hazardous Substances[a] in M-Area.

Substance	Maximum amount in a single location (kilograms)[b,c]
Hydrochloric acid	34.0
Hydrofluoric acid	2.27
Nitric acid	34,807.5
Phenol	2.27
Sulfuric acid	15,241.0

[a] Materials categorized as Extremely Hazardous Substances (40 CFR Part 355), as designated under the Emergency Planning and Community Right-to-Know Act of 1986.

[b] To determine the quantity in pounds, multiply by 2.2046.

[c] Amounts are based on 1993 (1-year) values.

E.4.5 SAVANNAH RIVER technology center

Based on a review of current inventories at the various facilities in the Savannah River Technology Center (DOE 1994d), DOE determined that eight Extremely Hazardous Substances are in use in SRTC facilities. Table E-20 lists the total annual maximum and average daily quantities of these substances based on 1993 (1-year) inventories. In addition, Table E-20 lists the maximum amounts of each substance in a single location in the SRTC. However, the Center contains nuclear materials that require no further stabilization. Therefore, this EIS proposes no alternatives for the safe management of the nuclear materials in SRTC facilities. As a result, no further chemical accident analysis is required.

Table E-20. Inventories of Extremely Hazardous Substances[a] in Savannah River Technology Center.

Substance	Maximum amount in a single location (kilograms)[b,c]
Ammonia	0.5
Hydrochloric acid	2,215.4
Hydrogen fluoride	38.1
Nitric acid	3,864.2
Nitric oxide	0.9
Phenol	4.5
Phosphorous pentoxide	3.18
Sulfuric acid	13.6

[a] Materials categorized as Extremely Hazardous Substances (40 CFR Part 355), as designated under the Emergency Planning and Community Right-to-Know Act of 1986.

[b] To determine the quantity in pounds, multiply by 2.2046.

[c] Amounts are based on 1993 (1-year) values.

E.4.6 POSTULATED CHEMICAL ACCIDENTS FOR THE TNX AREA

Based on a review of chemical usage in the TNX area, DOE determined that no chemicals in the area were required to support the continued safe management of nuclear materials. As a result, no further chemical accident analysis was performed for the TNX area.

E.5 Environmental Justice

When the 99.5 percent meteorology model is used, the SRS sector most affected by accidents is the Northwest. Although this is not typical of weather conditions (e.g., not the prevailing wind direction), the model calculated the highest impact to an individual at the SRS boundary.

Figures 3-7 and 3-8 show the distributions, by census tracts, of people of color and low-income populations, respectively. Parts of two census tracts in the Northwest sector adjoin the SRS. Neither tract is a low-income community or a community comprised of 50 percent or more of people of color, although one of the tracts contains between 35 and 50 percent people of color.

Farther from the SRS in the Northwest sector are low-income communities and communities that contain 50 percent or more of people of color. However, other communities in the sector are not low-income and contain fewer than 35 percent people of color, and they are as close as, or closer to, the SRS boundaries than the low-income communities or the communities of people of color.

Based on the distribution of types of communities and on the low dose received by the maximally exposed individual (see tables in this appendix), the accident scenarios would not result in disproportionately high or adverse human health and environmental impacts on people of color or low-income populations.

E.6 Accident Mitigation

Although DOE expends extensive efforts and large amounts of money to prevent accidents involving radioactive and hazardous materials, accidents and inadvertent releases to the environment can still occur. Therefore, an important part of the accident analysis process is the identification of actions that can mitigate consequences from accidents if they occur.[2] This section summarizes the SRS Emergency Plan, which governs responses to accident situations that could affect Site employees or the offsite population.

The *Savannah River Site Emergency Plan* (WSRC 1994a) defines appropriate response measures for the management of SRS emergencies (e.g., radiological or hazardous material accidents). It incorporates into one document the entire process designed to respond to and mitigate the consequences of a potential accident. For example, it establishes protective action guidelines for accidents involving chemical releases to keep onsite and offsite exposures as low as possible. It accomplishes minimization or prevention of exposures by minimizing time spent in the vicinity of the hazard or the release plume, keeping personnel as far from the hazard or plume as possible (e.g., using physical barricades and evacuation), and taking advantage of available shelter.

Emergencies that could cause activation of all or portions of this plan and the SRS Emergency Response Office include the following:

- Events (operational, transportation, etc.) with the potential to cause releases above allowable limits of radiological or hazardous materials.
- Events (fires, explosions, tornadoes, hurricanes, earthquakes, dam failures, etc.) that affect or could affect safety systems designed to protect Site and offsite populations and the environment. The effectiveness of the emergency plan would depend on the severity of the event and the impact on the Site and local infrastructure.
- Events (bomb threats, hostage situations, etc.) that reduce the security posture of the Site.
- Events created by proximity to other facilities such as the Vogtle Electric Generating Plant (a commercial nuclear utility across the Savannah River from the Site) or nearby commercial chemical facilities.

Depending on the types of postulated accidents and the potential impacts that could result from those accidents, emergencies are classified in several categories in accordance with requirements defined in the DOE 5500 Series of Orders, as follows:

- Alerts are confined within the affected facility boundary; no measurable impacts to workers or members of the public outside the facility boundary are likely.
- Site Area Emergencies are events that are in progress or that have occurred involving actual or likely major failures of facility safety or safeguards systems needed for the protection of onsite personnel, the public, the environment, or national security; because they have the potential to impact workers at colocated facilities or members of the public in the SRS vicinity, these situations require notification of and coordination of responses with the appropriate local

authorities.

- General Emergencies produce consequences that require the implementation of protective actions to minimize impacts to both workers and the public; full mobilization of all available onsite and offsite resources is usually required to deal with the event and its consequences.

In accordance with the Site Emergency Plan, DOE conducts periodic drills and exercises at the SRS to develop, maintain, and test response capabilities, and validate the adequacy of emergency facilities, equipment, communications, procedures, and training. For example, drills occur for the following accident scenarios in the facilities or facility areas: facility or area evacuations, shelter protection, toxic gas releases, nuclear incident monitor alarms (following an inadvertent nuclear criticality), fire alarms, medical emergencies, and personnel accountability (to ensure that all personnel have safely evacuated a facility or area following an emergency). DOE and Westinghouse Savannah River Company conduct and evaluate periodic drills with the following organizations or groups to ensure that they continue to maintain (from both a personnel and an equipment standpoint) the capability to respond adequately to emergency situations: first aid teams; rescue teams; fire wardens, fire response and firefighting teams; SRS medical and Health Protection personnel and personnel from the Eisenhower Army Medical Center; SRS and local communications personnel and systems; SRS security forces; and SRS Health Protection agencies.

E.7 Nuclear Criticality Safety Program

As discussed above, with the exception of an inadvertent nuclear criticality, no fatalities to involved workers from accident scenarios postulated for the management, stabilization, or storage of nuclear material would be likely to result from exposure to radiation. A criticality occurs when a neutron fissions the nucleus of a fissionable material to produce energy, fission fragments, neutrons, and various radiations. While nuclear reactors are specifically designed to produce energy from fission by controlling this neutron chain reaction, nonreactor nuclear facilities at the SRS do not generally provide the same control, shielding, and containment characteristics. Thus, an inadvertent fission chain reaction (nuclear criticality) in an SRS nonreactor nuclear facility could produce harmful radiation-related effects on nearby personnel.

As a result, nuclear criticality safety has been defined as "the prevention or termination of inadvertent nuclear chain reactions in nonreactor environments." In practice, the first concept--prevention--is by far the primary goal. As a consequence, SRS maintains a nuclear criticality safety program that establishes and defines the principles, practices, and controls to be used for the prevention of criticality accidents. When it has been determined that the potential for an inadvertent nuclear criticality accident exists for a facility, the design of criticality controls, including equipment and procedures, shall meet, at a minimum, the requirements described in the WSRC Nuclear Criticality Safety Manual. For a new facility, the use of physical design features to prevent criticality would be preferable. To ensure the successful implementation of this program, a training policy recently adopted at the SRS supports the goal that all reasonable efforts shall be taken to reduce or eliminate the potential for, and consequences of, a criticality accident. Nuclear criticality safety training programs at the SRS are developed to be consistent with DOE Orders 5480.20 and 5480.24 for operating facility personnel and all other personnel requiring criticality safety training.

Positive identification of fissionable material, particularly fissile material, is essential to criticality safety. Adequate labeling of fissionable material and clear posting of work and storage areas in which

fissionable materials are present are important in avoiding the accumulation of unsafe quantities of such materials. Appropriate fissionable material labeling and area posting are maintained at SRS nonreactor nuclear facilities specifying material identification and all parameter limits subject to procedural control. Storage requirements include minimum spacing distances to prevent sufficient material from being in close proximity. Criticality "poisons," such as boron, are often used in storage racks or packaging for material.

Written plans and procedures govern operations at SRS in which criticality safety is a consideration. These plans and procedures cover startup, operations, and any modifications that might affect criticality safety. Procedures clearly specify all controlled parameters and limits related to criticality safety. All criticality safety-related limits contained in the operating procedures are based on Nuclear Criticality Safety Evaluations (NCSEs). New or revised procedures containing nuclear safety steps, criticality safety limits, or criticality safety requirements undergo review and approval by a Criticality Safety Engineering Group (CSEG) before implementation. In the event of a criticality limit violation, SRS procedures specifically govern actions to be taken in the event of an undesirable situation; the objective of such procedures is to place the operation into as stable and safe a condition as possible until a criticality safety engineer or specialist can conduct an evaluation.

Water, the most often used firefighting agent, is an efficient moderator and reflector of neutrons (i.e., it can contribute to a criticality). In the absence of moderating materials such as water, relatively large masses of dry fissile materials such as powders or metals can be handled safely. In the event of a fire, SRS nonreactor nuclear facilities maintain prefire plans prepared by the management and engineering staff of each facility with the assistance by the Criticality Safety Engineering Group, SRS fire safety engineers, and the Area Fire Department, as necessary. These plans help provide a framework for the successful combination of firefighting and criticality safety. The CSEG approves the prefire plans for each facility in which criticality safety is of concern.

The SRS maintains criticality alarm systems, or Nuclear Incident Monitors (NIMs). The primary purpose of NIM systems is to minimize, by means of quick detection and alarm, the acute dose received by personnel from a criticality (and potential recriticality) accident in areas where the cumulative absorbed dose in free air might exceed 12 rads. The secondary purpose of the NIM system is to notify people to stay clear of the evacuated area and to notify appropriate response teams.

Emergency procedures for criticality accidents are prepared for each SRS facility in which criticality safety controls are instituted or criticality alarm systems are installed. Such emergency plans are approved by the appropriate management and the cognizant Criticality Safety Engineering Group, and consistent with the Site Emergency Plan (WSRC 1994a).

E.8 Accident Descriptions

The larger facilities contain a variety of processes, equipment, and techniques used depending on the intended function. In determining the source terms for use in accident analysis, DOE examined the appropriate process or section of a facility for the specific material and adjusted the source term to correspond where necessary. The tables in Section E.3 list the "modes" or conditions to reflect the selection for that material. The following paragraphs explain the accident titles used in the tables in Section E.3.

Unpropagated fire – A fire that has localized impact and does not spread. It can be caused by ignition of flammable solvent, spontaneous burning of plutonium metal exposed to oxygen, or other causes. Radioactive particulates are dispersed in the immediate area of the fire and some might be released to the environment (e.g., during a filter fire). The fire lasts for a short period because the amount of combustible material is limited.

Inadvertent transfer – An unplanned transfer of a solution or liquid to an unintended location due to personnel error. The usual causes of such accidents are incorrectly installed piping connections or overflows from a vessel into a sump resulting from human errors.

Coil and tube failure – Some process vessels and tanks have internal coils for cooling or heating the stored solutions. The coils usually contain water or steam. The pressure inside the coils is normally higher than the pressure in the vessel. Should the coils leak or fail their internal pressure could be lost, resulting in radioactive solution entering the cooling water (or steam) system. If the leak is undetected, the contaminated water could be released through the system to the atmosphere without treatment.

Inadvertent criticality – These events are discussed in Section E.7.

Severe earthquake – An earthquake that would be expected every 5,000 years. The severity or magnitude is based on an assumed horizontal ground acceleration of 20 percent of the acceleration due to gravity. An earthquake of this magnitude could result in structural damage and a loss of confinement of nuclear materials.

Rupture storage container – Certain radioactive materials can cause a buildup of gases inside the container in which they are stored (e.g., metal can) if it contains organic materials (e.g., plastic bags). Other materials (e.g., plutonium metal) can oxidize and gain moisture if the container is not completely airtight. Eventually, the pressure buildup can cause the storage container to bulge or rupture. This could disperse the material in the area around the container and result in exposure of a worker performing routine surveillance.

Eructation - A thermal or chemical reaction causes material to spew from its container. This could be an energetic event resulting in localized contamination. For the materials discussed in this EIS, such events would occur inside the canyons and no workers would be directly affected.

Red-oil explosion - So named because the substance causing the explosion is a thick red liquid produced by the inadvertent addition of organics to a high nitrate solution. The event can be very energetic and can result in a sudden localized explosion. The radiological consequences would probably be confined to areas within the canyon facilities.

Tornado - A tornado exerts pressure due to high wind speed on the surfaces of a structure. The resulting damage could cause releases of stored materials within the structure or could disperse materials stored in pads.

Uncontrolled reaction - Adjustments are routinely made to solutions to produce a reaction under known controlled conditions. If an adjustment (e.g., adding acid) or a change in condition (e.g., heating the contents) produces unexpected or rapid reaction, that reaction is "uncontrolled." The energy from this type of reaction could cause radioactive solutions to overflow or erupt outside the

tank in which they are stored.

Propagated fire - A fire that goes beyond the area of ignition. For the materials discussed in this EIS, a propagated fire does not self-extinguish. For example, it might spread from a glovebox into the surrounding room or other areas of the facility.

Basin overflow/draindown - An unplanned movement of water, either into the reactor basins (causing an overflow) or from the reactor basins (draindown), which results in a flow of the basin water to sumps or storm drains and into the Savannah River. Basin overflow would normally be caused by human error; basin draindown could be caused by a breach of the basin integrity due to an earthquake.

Hydrogen explosion - Hydrogen gas is generated by radiolysis when water is in a tank or can with nuclear materials. If a sufficient quantity of the atmosphere in the container is hydrogen, the gas can detonate or explode, rupturing the container and releasing nuclear material.

Energetic event - Exergetic events cause penetration of the primary confinement barrier and, if sufficiently energetic, can result in the bypass of a secondary barrier. Medium energetic events include a cabinet fire, an uncontrolled reaction, and criticality.

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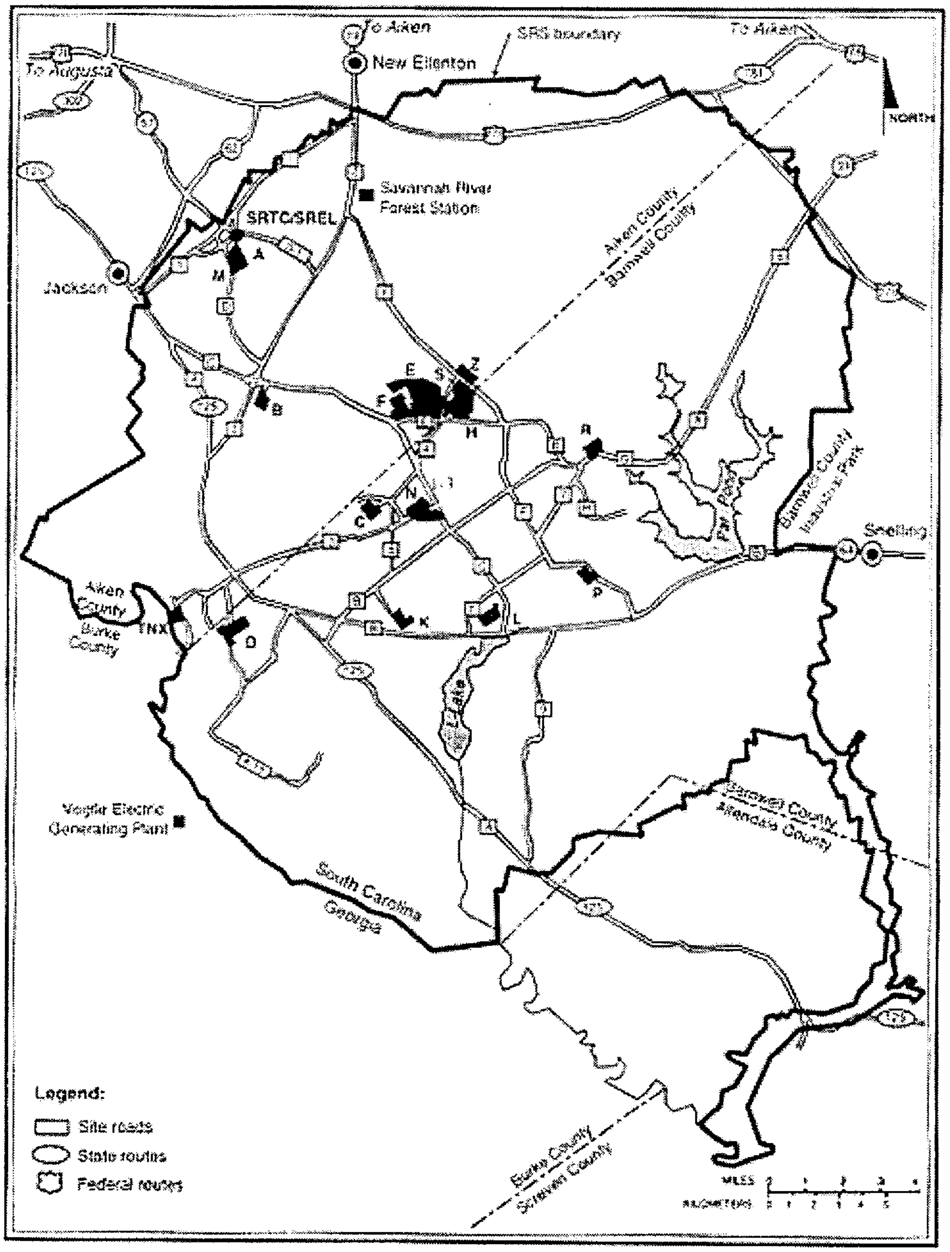

To Aiken
SRS boundary
To Aiken
New Ellenton
To Augusta
NORTH
Savannah River Forest Station
SRTC/SREL
Jackson
Aiken County
Barnwell County
Par Pond
Barnwell County Industrial Park
Snelling
Aiken County
Burke County
TNX
Vogtle Electric Generating Plant
South Carolina
Georgia
Barnwell County
Allendale County
Burke County
Screven County
Legend:
Site roads
State routes
Federal routes
MILES
KILOMETERS

Table 2-2. Comparison of the potential environmental impacts of the alternatives for stable material.

Factors	Alternatives						
	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.0006	NA[a]	NA	NA	NA	NA	NA
Worker latent cancer fatalities	0.056	NA	NA	NA	NA	NA	NA
Health effects from facility accidents[b] (projected latent cancer fatalities)	0.48	NA	NA	NA	NA	NA	NA
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.011	NA	NA	NA	NA	NA	NA
Accidents (offsite population)[c]	0.0000055	NA	NA	NA	NA	NA	NA
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.053	NA	NA	NA	NA	NA	NA
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	0	NA	NA	NA	NA	NA	NA
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	395,281	NA	NA	NA	NA	NA	NA
Waste management (10-year totals)							
High-level liquid waste generation (million liters)	0	NA	NA	NA	NA	NA	NA
Equivalent DWPF canisters	40	NA	NA	NA	NA	NA	NA
Saltstone generation (cubic meters)	11,000	NA	NA	NA	NA	NA	NA
Transuranic waste generation (cubic meters)	20	NA	NA	NA	NA	NA	NA
Hazardous/mixed waste generation (cubic meters)	60	NA	NA	NA	NA	NA	NA
Low-level radioactive waste generation (cubic meters)	41,000	NA	NA	NA	NA	NA	NA

a. NA = Not applicable.

b. Assumes highly unlikely occurrence of maximum risk accident.

c. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-3. Comparison of the potential environmental impacts of the alternatives for plutonium-242.[a]

Factors	Alternatives: Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00025	NA[b]	0.0017	NA	NA	0.0017	NA
Worker latent cancer fatalities	0.0052	NA	0.024	NA	NA	0.027	NA
Health effects from facility accidents[c] (projected latent cancer fatalities)	6.5	NA	6.5	NA	NA	6.5	NA
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00172[d]	NA	0.0012	NA	NA	0.00122	NA
Accidents (offsite population)[e]	2.0	NA	2.0	NA	NA	2.0	NA
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.012	NA	0.033	NA	NA	0.11	NA
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	3.2	NA	2.7	NA	NA	2.8	NA
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	132,990	NA	41,425	NA	NA	42,146	NA
Waste management (10-year totals)							
High-level liquid waste generation (million liters)	1.2	NA	0.12	NA	NA	0.16	NA
Equivalent DWPF canisters	20	NA	2	NA	NA	3	NA
Saltstone generation (cubic meters)	3,300	NA	330	NA	NA	420	NA
Transuranic waste generation (cubic meters)	0	NA	56	NA	NA	61	NA
Hazardous/mixed waste generation (cubic meters)	0	NA	60	NA	NA	60	NA
Low-level radioactive waste generation (cubic meters)	5,600	NA	4,300	NA	NA	4,700	NA

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Waste transportation only.
e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-4. Comparison of the potential environmental impacts of the alternatives for americium and curium.[a]

Factors	Alternatives: Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00035	NA[b]	0.00027	NA	NA	0.00027	NA
Worker latent cancer fatalities	0.028	NA	0.026	NA	NA	0.026	NA
Health effects from facility accidents[c] (projected latent cancer fatalities)	3.1	NA	6.5	NA	NA	6.5	NA
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00195[d]	NA	0.00117[d]	NA	NA	0.00117	NA
Accidents (offsite population)[e]	2.0	NA	2.0	NA	NA	2.0	NA
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.33	NA	0.33	NA	NA	0.33	NA
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	6.1	NA	5.8	NA	NA	5.8	NA
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	129,020	NA	66,993	NA	NA	66,993	NA
Waste management (10-year totals)							
High-level liquid waste generation (million liters)	1.3	NA	1.2	NA	NA	1.2	NA
Equivalent DWPF canisters	30	NA	27	NA	NA	27	NA
Saltstone generation (cubic meters)	3,400	NA	3,300	NA	NA	3,300	NA
Transuranic waste generation (cubic meters)	0	NA	0	NA	NA	0	NA
Hazardous/mixed waste generation (cubic meters)	0	NA	0	NA	NA	0	NA
Low-level radioactive waste generation (cubic meters)	6,500	NA	3,300	NA	NA	3,300	NA

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Waste transportation only.
e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-5. Comparison of the potential environmental impacts of the alternatives for neptunium.[a]

Factors	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and for Vitrific (DWPF
	Alternatives				
Health effects of Normal Operations					
Radiological health effects (10-year totals):					
Population latent cancer fatalities	0.00027	NA[b]	0.028	NA	NA
Worker latent cancer fatalities	0.006	NA	0.052	NA	NA
Health effects from facility accidents[c] (projected latent cancer fatalities)	4.1	NA	4.1	NA	NA
Health effects from transportation (projected latent cancer fatalities)					
Incident-free (involved worker)	0.00178[d]	NA	0.00302	NA	NA
Accidents (offsite population)[f]	2.0	NA	2.0	NA	NA
Air resources					
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.019	NA	0.1	NA	NA
Water resources					
Lead (micrograms per liter) in Upper Three Runs Creek	3	NA	3	NA	NA
Utilities (10-year totals)					
Electricity usage (megawatt-hour)	141,570	NA	148,946	NA	NA
Waste management (10-year totals)					
High-level liquid waste (million liters)	1.3	NA	4.2	NA	NA
Equivalent DWPF canisters	20	NA	37	NA	NA
Saltstone generation (cubic meters)	3,600	NA	11,000	NA	NA
Transuranic waste generation (cubic meters)	0	NA	160	NA	NA
Hazardous/mixed waste generation (cubic meters)	0	NA	200	NA	NA
Low-level radioactive waste generation (cubic meters)	5,700	NA	6,400	NA	NA

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.

c. Assumes highly unlikely occurrence of maximum consequence accident.

d. Waste transportation only.

e. No approved packaging for material transport; waste transport only.

f. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic w

Table 2-6. Comparison of the potential environmental impacts of the alternatives for H-Canyon plutonium-239 solutions.[a]

	Alternatives						
Factors	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00025	0.00025	0.0055	NA[b]	0.041	0.00023	NA
Worker latent cancer fatalities	0.0052	0.044	0.04	NA	0.02	0.021	NA
Health effects from facility accidents[c] (projected latent cancer fatalities)	4.1	6.5	4.1	NA	4.1	6.5	NA
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00172[d]	0.0022[e]	0.00195	NA	0.00374[d]	0.00146[e]	NA
Accidents (offsite population)[f]	2.0	2.0	2.0	NA	2.0	2.0	NA
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.012	0.14	0.033	NA	0.083	0.096	NA
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	3.2	3.3	3	NA	3	3.2	NA
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	132,990	135,462	106,221	NA	150,579	124,310	NA
Waste management (10-year totals)							
High-level liquid waste (million liters)	1.2	1.3	0.68	NA	6.8	1.0	NA
Equivalent DWPF canisters	20	24	11	NA	57	17	NA
Saltstone generation (cubic meters)	3,300	3,500	1,800	NA	19,000	2,700	NA
Transuranic waste generation (cubic meters)	0	32	160	NA	0	0	NA
Hazardous/mixed waste generation (cubic meters)	0	0	190	NA	0	0	NA
Low-level radioactive waste generation (cubic meters)	5,600	7,500	6,600	NA	6,400	4,800	NA

a. Includes transportation of associated radioactive waste.
b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.

d. Waste transportation only.

e. No approved packaging for material transport; waste transport only.

f. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-7. Comparison of the potential environmental impacts of the alternatives for H-Canyon enriched uranium solution.[a]

Factors	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
	Alternatives						
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00038	NA[b]	0.0034	0.009	0.0003	NA	NA
Worker latent cancer fatalities	0.0092	NA	0.028	0.0072	0.0072	NA	NA
Health effects from facility accidents[c] (projected latent cancer fatalities)	0.14	NA	0.14	0.14	4.1	NA	NA
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00208[d]	NA	0.000519[d]	0.000961	0.00160	NA	NA
Accidents (offsite population)[e]	2.0	NA	2.0	2.0	2.0	NA	NA
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.053	NA	0.083	0.083	0.053	NA	NA
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	3	NA	3	3	3	NA	NA
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	180,180	NA	39,944	41,672	140,283	NA	NA
Waste management (10-year totals)							
High-level liquid waste (million liters)	1.8	NA	0.72	1.7	1.4	NA	NA
Equivalent DWPF canisters	30	NA	7	17	23	NA	NA
Saltstone generation (cubic meters)	5,000	NA	2,000	4,800	3,900	NA	NA
Transuranic waste generation (cubic meters)	0	NA	0	0	0	NA	NA
Hazardous/mixed waste generation (cubic meters)	0	NA	0	0	0	NA	NA
Low-level radioactive waste generation (cubic meters)	6,300	NA	1,200	1,600	4,800	NA	NA

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Waste transportation only.
e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-8. Comparison of the potential environmental impacts of the alternatives for vault solids.[a]

Factors	Alternatives						
	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00011	0.07	0.015	NA[b]	0.07	0.12	0.00024
Worker latent cancer fatalities	0.056	0.16	0.16	NA	0.11	0.14	0.16
Health effects from facility accidents[c] (projected latent cancer fatalities)	0.31	4.1	4.5	NA	4.5	4.1	0.62
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00528	0.00742	0.00614	NA	0.00798	0.00915	0.00604
Accidents (offsite population)[d]	2.0	2.0	2.0	NA	2.0	2.0	2.0
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0.0095	0.28	0.061	NA	0.13	0.1	0.031
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	3.1	3	6.1	NA	6.1	3	7.4
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	147,220	134,048	96,085	NA	212,735	237,589	76,879
Waste management (10-year totals)							
High-level liquid waste (million liters)	0	8.2	0.03	NA	8.2	14	0
Equivalent DWPF canisters	0	60	1	NA	60	110	0
Saltstone generation (cubic meters)	0	22,000	89	NA	22,000	39,000	0
Transuranic waste generation (cubic meters)	810	520	1,300	NA	900	690	1,000
Hazardous/mixed waste generation (cubic meters)	970	480	1,400	NA	1,100	840	960
Low-level radioactive waste generation (cubic meters)	19,000	18,000	20,000	NA	19,000	16,000	23,000

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-9. Comparison of the potential environmental impacts of the alternatives for Mark-31 targets.[a]

Factors	Alternatives						
	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.00006	0.00025	0.00023	NA[b]	0.00043	0.00032	0.00006
Worker latent cancer fatalities	0.0056	0.084	0.072	NA	0.044	0.1	0.0056
Health effects from facility accidents[c] (projected latent cancer fatalities)	0.0089	6.5	6.5	NA	6.5	6.5	0.0089
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00731[d]	0.00503	0.00497	NA	0.00643	0.00542	0.00732
Accidents (offsite population)[e]	2.0	2.0	2.0	NA	2.0	2.0	2.0
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0	0.28	0.28	NA	0.23	0.34	0
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	0	3.4	3.5	NA	6.1	3.9	0
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	14	63,748	50,637	NA	44,362	71,093	14
Waste management (10-year totals)							
High-level liquid waste generation (million liters)	1.2	2.1	1.9	NA	3.7	2.6	1.2
Equivalent DWPF canisters	28	43	41	NA	78	53	28
Saltstone generation (cubic meters)	3,200	5,700	5,200	NA	10,000	7,000	3,200
Transuranic waste generation (cubic meters)	0	77	62	NA	0	93	0
Hazardous/mixed waste generation (cubic meters)	50	16	20	NA	34	16	50
Low-level radioactive waste generation (cubic meters)	29,000	18,000	18,000	NA	22,000	19,000	29,000

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.

c. Assumes highly unlikely occurrence of maximum consequence accident.

d. Waste transportation only.

e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

Table 2-10. Comparison of the potential environmental impacts of the alternatives for Mark-16 and -22 fuels.

Factors	Alternatives				
	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and for Vitrific: (DWPF
Health effects of Normal Operations					
Radiological health effects (10-year totals):					
Population latent cancer fatalities	0.000015	NA[b]	0.034	0.041	0.0008
Worker latent cancer fatalities	0.0028	NA	0.08	0.026	0.088
Health effects from facility accidents[c] (projected latent cancer fatalities)	0.0089	NA	4.1	4.1	4.1
Health effects from transportation (projected latent cancer fatalities)					
Incident-free (involved worker)	0.00377[d]	NA	0.00575	0.00740	0.01
Accidents (offsite population)[e]	2.0	NA	2.0	2.0	2.0
Air resources					
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0	NA	0.083	0.083	0.23
Water resources					
Lead (micrograms per liter) in Upper Three Runs Creek	0	NA	3	3	6.1
Utilities (10-year totals)					
Electricity usage (megawatt-hour)	10	NA	78,838	83,454	88,718
Waste management (10-year totals)					
High-level liquid waste generation (million liters)	0.57	NA	5.6	7.3	6.8
Equivalent DWPF canisters	10	NA	49	68	140
Saltstone generation (cubic meters)	1,600	NA	15,000	20,000	19,000
Transuranic waste generation (cubic meters)	0	NA	0	0	0
Hazardous/mixed waste generation (cubic meters)	20	NA	22	28	44
Low-level radioactive waste generation (cubic meters)	15,000	NA	16,000	20,000	32,000

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Waste transportation only.
e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic w

Table 2-11. Comparison of the potential environmental impacts of the alternatives for other aluminum-clad fuel and targets.[a]

Factors	Continuing Storage	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)	Vitrification (F-Canyon)	Improving Storage
	Alternatives						
Health effects of Normal Operations							
Radiological health effects (10-year totals):							
Population latent cancer fatalities	0.000005	NA[b]	NA	NA	0.0034	NA	0.000005
Worker latent cancer fatalities	0.00084	NA	NA	NA	0.0018	NA	0.00084
Health effects from facility accidents[c] (projected latent cancer fatalities)	0.0089	NA	NA	NA	4.1	NA	0.0089
Health effects from transportation (projected latent cancer fatalities)							
Incident-free (involved worker)	0.00105[d]	NA	NA	NA	0.000746	NA	0.00106
Accidents (offsite population)[e]	2.0	NA	NA	NA	2.0	NA	2.0
Air resources							
Nonradiological - Nitrogen oxide incremental concentration at SRS boundary (highest annual, micrograms per cubic meter)	0	NA	NA	NA	0.083	NA	0
Water resources							
Lead (micrograms per liter) in Upper Three Runs Creek	0	NA	NA	NA	3	NA	0
Utilities (10-year totals)							
Electricity usage (megawatt-hour)	10	NA	NA	NA	5,901	NA	10
Waste management (10-year totals)							
High-level liquid waste generation (million liters)	0.14	NA	NA	NA	0.59	NA	0.14
Equivalent DWPF canisters	0	NA	NA	NA	5	NA	0
Saltstone generation (cubic meters)	390	NA	NA	NA	1,600	NA	390
Transuranic waste generation (cubic meters)	0	NA	NA	NA	0	NA	0
Hazardous/mixed waste generation (cubic meters)	10	NA	NA	NA	4	NA	10
Low-level radioactive waste generation (cubic meters)	4,200	NA	NA	NA	2,300	NA	4,200

a. Includes transportation of associated radioactive waste.

b. NA = Not applicable.
c. Assumes highly unlikely occurrence of maximum consequence accident.
d. Waste transportation only.
e. Maximum reasonably foreseeable latent cancer fatalities from medium probability accident based on the shipment of transuranic waste.

		Operational group (curies)						
Radionuclide	Half-life	Reactors	Separations[b]	Reactor materials	Heavy water	SRTC[c]	Diffuse and fugitive[d]	Total
GASES AND VAPORS								
H-3 (oxide)	12.3 yrs	38,500	93,900		448		43.1	113,000
H-3 (elem)	12.3 yrs		58,200					58,200
H-3 Total	12.3 yrs	38,500	152,000		448		43.1	191,000
C-14	5,700		1.69×10^{-2}				4.00×10^{-6}	1.69×10^{-2}
I-129	1.6×10^{7} yrs		4.96×10^{-3}				6.88×10^{-7}	4.96×10^{-3}
I-131	8 days		8.89×10^{-5}			5.92×10^{-5}		1.48×10^{-4}
I-133	20.8 hrs					1.96×10^{-3}		1.96×10^{-3}
Xe-135	9.1 hrs					3.19×10^{-2}		3.19×10^{-2}
PARTICULATES								
Ni-63	100 yrs						2.00×10^{-7}	2.00×10^{-7}
Co-60	5.3 yrs		5.89×10^{-9}				3.34×10^{-17}	5.89×10^{-9}
S-35	87.2 days						2.00×10^{-6}	2.00×10^{-6}
Sr-89,90[e]	29.1 yrs	1.81×10^{-4}	1.88×10^{-3}	8.32×10^{-5}	7.19×10^{-6}	1.19×10^{-5}	1.11×10^{-4}	2.27×10^{-3}
Zr-95	64 days						2.39×10^{-14}	2.39×10^{-14}
Ru-106	1.0 yrs	3.99×10^{-6}	5.76×10^{-9}				4.96×10^{-12}	4.00×10^{-6}
Sb-125	2.8 yrs						7.27×10^{-15}	7.27×10^{-15}
Cs-134	2.1 yrs						1.40×10^{-17}	1.49×10^{-6}
Cs-137	30.2 yrs	1.04×10^{-4}	1.49×10^{-6}			1.51×10^{-6}	4.33×10^{-11}	6.34×10^{-4}
Ce-144	285 days						1.13×10^{-13}	1.13×10^{-13}
Eu-154	8.6 yrs						3.44×10^{-13}	3.44×10^{-13}
Eu-155	4.7 yrs						1.63×10^{-13}	1.63×10^{-13}
U-235,238	4.5×10^{9} yrs		1.86×10^{-3}	1.55×10^{-5}		2.89×10^{-8}	4.74×10^{-5}	1.92×10^{-3}
Pu-238	87.7 yrs		1.21×10^{-3}			1.00×10^{-8}	4.63×10^{-12}	1.21×10^{-3}
Pu-239[f]	2.4×10^{4} yrs	4.11×10^{-6}	1.06×10^{-3}	3.50×10^{-6}	8.42×10^{-7}	9.41×10^{-6}	4.70×10^{-7}	1.08×10^{-3}
Am-241,243	7.4×10^{3} yrs		1.42×10^{-4}			1.34×10^{-6}	8.86×10^{-13}	1.43×10^{-4}
Cm-242,244	18.1 yrs		4.96×10^{-5}			6.83×10^{-6}	7.33×10^{-12}	5.64×10^{-5}

a. Source: Arnett (1994)
b. Includes both F- and H-Area releases
c. SRTC - Savannah River Technology Center.
d. Estimated releases from minor unmonitored diffuse and fugitive sources.
e. Includes unidentified beta-gamma emissions.
f. Includes unidentified alpha emissions.

Table 4-9. Data (10-year totals) for impact analysis of various stabilization alternatives for Mark-16 and -22 fuels (from Tables D-44 through D-48).[a,b]

Factor	Continuing Storage (No Action)	Processing to Metal	Processing to Oxide	Blending Down to Low Enriched Uranium	Processing and Storage for Vitrification (DWPF)[c]	Vitrification (F-Canyon)	Improving Storage: Traditional construction schedule	Improving Storage: Acceler construc schedu
Atmospheric MEI dose (rem)	5.0×10^{-7}	NA	1.7×10^{-3}	2.0×10^{-3}	3.5×10^{-5}	NA	5.0×10^{-7}	2.3×10
Liquid MEI dose (rem)	0	NA	2.5×10^{-5}	3.1×10^{-5}	1.0×10^{-6}	NA	0	8.8×10
Total MEI dose (rem)	5.0×10^{-7}	NA	1.7×10^{-3}	2.0×10^{-3}	3.6×10^{-5}	NA	5.0×10^{-7}	1.1×10
Atmospheric population dose (person-rem)	0.032	NA	67	81	1.6	NA	0.032	0.016
Liquid population dose (person-rem)	0	NA	0.083	0.11	5.8×10^{-3}	NA	0	0.0051
Total population dose (person-rem)	0.032	NA	67	81	1.6	NA	0.032	0.021
Offsite CO concentration ($\mu g/m^3$) 1-hour average	0	NA	11	11	0	NA	0	0
Offsite CO concentration ($\mu g/m^3$) 8-hour average	0	NA	2.5	2.5	0	NA	0	0
Offsite NO_x concentration ($\mu g/m^3$) annual average	0	NA	0.083	0.083	0.23	NA	0	0
Offsite SO_2 concentration ($\mu g/m^3$) 3-hour average	0	NA	6.2×10^{-3}	6.2×10^{-3}	0	NA	0	0
Offsite SO_2 concentration ($\mu g/m^3$) 24-hour average	0	NA	1.4×10^{-3}	1.4×10^{-3}	0	NA	0	0
Offsite SO_2 concentration ($\mu g/m^3$) annual average	0	NA	8.8×10^{-5}	8.8×10^{-5}	0	NA	0	0
Offsite Gaseous Fluorides ($\mu g/m^3$) 12-hour average	0	NA	7.5×10^{-6}	4.2×10^{-3}	0.042	NA	0	0
Offsite Gaseous Fluorides ($\mu g/m^3$) 24-hour average	0	NA	3.0×10^{-6}	2.3×10^{-3}	0.023	NA	0	0
Offsite Gaseous Fluorides ($\mu g/m^3$) 1-week average	0	NA	1.6×10^{-6}	8.9×10^{-4}	8.9×10^{-3}	NA	0	0
Offsite Gaseous Fluorides ($\mu g/m^3$) 1-month average	0	NA	4.5×10^{-7}	2.5×10^{-4}	2.5×10^{-3}	NA	0	0
Offsite HNO_3 concentration ($\mu g/m^3$) 24-hour average	0	NA	0.022	0.062	0.62	NA	0	0
Offsite HNO_3 concentration ($\mu g/m^3$) annual average	0	NA	1.4×10^{-3}	4.2×10^{-3}	0.042	NA	0	0
Onsite CO concentration (mg/m^3) 8-hour average	0	NA	0.017	0.017	0	NA	0	0
Onsite NO_x concentration (mg/m^3) 1-hour average	0	NA	0.044	0.044	0.14	NA	0	0
Onsite SO_2 concentration (mg/m^3) 8-hour average	0	NA	2.5×10^{-5}	2.5×10^{-5}	0	NA	0	0
Onsite HNO_3 concentration (mg/m^3) 8-hour average	0	NA	3.9×10^{-4}	9.8×10^{-4}	9.8×10^{-3}	NA	0	0
Onsite CO_2 concentration (mg/m^3) 8-hour average	0	NA	1.2×10^{-5}	1.2×10^{-5}	0	NA	0	0
Average number of radiation workers	5	NA	121	114	138	NA	5	36
Collective worker dose (person-rem)	7.1	NA	200	66	220	NA	7.1	17
Water usage (millions of liters)	0	NA	1,000	1,400	4,800	NA	0	80
Electricity usage (megawatt-hours)	10	NA	79,000	83,000	89,000	NA	10	2,800
Steam usage (millions of kilograms)	10	NA	470	500	440	NA	10	30
Fuel usage (thousands of liters)	10	NA	3,000	3,100	2,800	NA	10	20
High-level liquid waste generation (million of liters)	0.57	NA	5.6	7.3	6.8	NA	0.57	0.37
Equivalent DWPF canisters	10	NA	49	68	1,000	NA	10	5
Saltstone generation (cubic meters)	1,600	NA	15,000	20,000	19,000	NA	1,600	800
TRU Waste generation (cubic meters)	0	NA	0	0	0	NA	0	0
Hazardous/mixed waste generation (cubic meters)	20	NA	22	28	44	NA	20	10
Low-level waste generation (cubic meters)	15,000	NA	16,000	20,000	32,000	NA	15,000	7,700

a. To be conservative, DOE derived impact data without taking credit for reductions in estimated impacts based on reprocessing of materials in similar forms that would optimize facility usage and reduce environmental impacts.
b. Abbreviations: CO = carbon monoxide; CO_2 = carbon dioxide; DWPF = Defense Waste Processing Facility; HNO_3 = nitric acid; MEI = Maximally exposed individual; NA = not applicable; NO_x = nitrogen oxides; SO_2 = sulfur dioxide; TRU = transuranic.
c. The values in this column are preliminary estimates, subject to revision after technical studies as discussed in Chapter 2.

Table E-3. Applicable facilities for each alternative.

Material (Table)	No-Action Alternative	Other alternatives	Conversion	Interim storage	Additional conversion	Post-stabilization storage
Mk-31 (Table E-4)	L-Reactor Basin	Metal	F-Canyon FA-Line FB-Line	Existing vaults[a]	Actinide Packaging Facility[b]	Storage vault[a]
		Liquid waste (DWPF)[c]	F-Canyon	High-level waste[d]		
		Dry Storage	Beyond timeframe of this EIS			
		Vitrify	F-Canyon FA-Line FB-Line	Existing vaults[a]	F-Canyon	No credible accidents resulting in a release from vitrified material.
		Oxide	F-Canyon FA-Line FB-Line	Existing vaults[a]	Actinide Packaging Facility	Storage vault[a]
Americium/curium (Table E-5)	F-Canyon	Vitrify	F-Canyon	Not applicable	Not applicable	No credible accidents resulting in a release from vitrified material.
		Waste	F-Canyon	High-level waste[d]		
		Oxide	F-Canyon F-Canyon hot cell[e]	Storage vault[a]	Beyond timeframe of this EIS	Beyond timeframe of this EIS
H-Canyon uranium solutions (Table E-6)	H-Canyon H-Outside	Oxide (low enriched uranium)	FA-Line	Storage vault[a]	Beyond timeframe of this EIS	Beyond timeframe of this EIS
		Oxide (enriched uranium)	Uranium Solidification Facility	Storage vault[f]	Beyond timeframe of this EIS	Beyond timeframe of this EIS
		Liquid waste (DWPF)	H-Canyon	High-level waste[d]		

Table E-3. (continued).

Material (Table)	No-Action Alternative	Other alternatives	Conversion	Interim storage	Additional conversion	Post-stabilization storage
H-Canyon plutonium-239 solutions (Table E-7)	H-Canyon	Oxide	H-Canyon HB-Line	Existing vaults[a]	Actinide Packaging Facility	Storage vault[a]
		Liquid waste (DWPF)	H-Canyon	High-level waste[d]		
		Vitrify	Solution transport (Section 4.3)	F-Canyon	F-Canyon	No credible accidents resulting in a release from vitrified material.
		Metal	Solution transport (Section 4.3)	F-Canyon	FB-Line Actinide Packaging Facility	Storage vault[a]
H-Canyon neptunium solutions (Table E-8)	H-Canyon	Oxide	H-Canyon HB-Line	Existing vaults[a]	Actinide Packaging Facility	Storage vault[a]
		Vitrify	Solution transport (Section 4.3)	F-Canyon	F-Canyon	No credible accidents resulting in a release from vitrified material.
		Waste	*H-Canyon*	*High-level waste[d]*		
H-Canyon plutonium-242 solutions (Table E-9)	H-Canyon[g]	Oxide	H-Canyon[g] HB-Line	Existing vaults[a]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Vitrify	H-Canyon[g] HB-Line	Existing vaults[a]	FB-Line F-Canyon	No credible accidents resulting in a release from vitrified material.
		Waste	*H-Canyon*	*High-level waste[d]*		
Mk-16/22 (Table E-10)	Reactor basins	Oxide (low enriched uranium)	F/H-Canyon[h] F/H-Outside FA-Line	Storage vault[f]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.

Dry storage	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
Oxide (enriched uranium)	H-Canyon H-Outside Uranium Solidification Facility	Storage vault[f]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
Liquid waste (DWPF)	F/H-Canyon[h] F/H-Outside	High-level waste[d]		

Table E-3. (continued).

Material (Table)	No-Action Alternative	Other alternatives	Conversion	Interim storage	Additional conversion	Post-stabilization storage
Other aluminum-clad fuels[i] (N/A)	Bounded by Mk-31 No-Action (See Table E-4) or Mk-16/22 (See Table E-10)	Liquid waste (DWPF)	Bounded by Mk16/22 liquid waste alternative (see Table E-10)			
		Dry storage	Beyond timeframe of this EIS	Beyond timeframe of this EIS	Beyond timeframe of this EIS	Beyond timeframe of this EIS
Vault solids (Table E-11)	235-F FB-Line	Metal	HB-Line Phase I H-Canyon HB-Line Phase II	Existing vaults[a]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Oxide	HB-Line Phase I H-Canyon HB-Line Phase II	Existing vaults[a]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Repackage	Actinide Packaging Facility	Storage vault[a]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Liquid waste (DWPF)	HB-Line Phase I	High-level waste[d]		
		Vitrify	HB-Line Phase I H-Canyon HB-Line Phase II	Existing vaults[a]	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
Plutonium-238 (Table E-12)	HB-Line Vault	Improving storage	Bounded by No-Action Alternative	Storage vault	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Oxide	HB-Line Phase I H-Canyon HB-Line Phase III	HB-Line vault	Beyond timeframe of this EIS.	Beyond timeframe of this EIS.
		Liquid waste (DWPF)	HB-Line Phase I H-Canyon	High-level waste[d]		

a. Accident analysis for the 235-F facility is representative for both existing and new storage vaults; for new storage vaults, the analysis assumes that the ruptured storage container accident would not be credible after repackaging and improving storage conditions.

b. The source terms associated with FB-Line drying are used in conjunction with FB-Line accidents to be representative of the new Actinide Packaging Facility.

c. DWPF = Defense Waste Processing Facility.

d. Accident analysis information for the existing tank inventory; if this information requires revision after analysis *for different isotopic* content, safety documentation will be updated in accordance with DOE Orders 5480.23 and 5480.21.

e. The americium/curium source term was used in the relevant accident scenarios for HB-Line to provide a representative accident analysis for the americium/curium Processing to Oxide Alternative.

f. Accident analysis for storage operations at the Uranium Solidification Facility are representative for new uranium storage vaults.

g. The accident analysis for F-Canyon was used for plutonium-242 alternatives because it is more representative of this solution's source term.

h. This alternative enables either canyon to process fuel; H-Canyon accidents are representative for Mk-16 and -22 processing.

i. Because this material group consists of small quantities of a wide variety of aluminum-clad fuels, the accident impacts from this material group would be minimal. Each alternative for this material group is bounded by the accident analysis presented for other groups. Therefore, impacts reference the bounding accident analysis.

Table E-4. Mark-31 plutonium-239 targets.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: Offsite MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	LCF: Offsite MEI	LCF: Offsite population
						(Point estimate of increased risk per year)		
						(Increased risk of LCF per occurrence)		
NO ACTION								
L-Reactor Basin (storage)								
Inadvertent draindown of half the basin water to the Savannah River	2.57E+03	1.08E-02	(b)	9.12E-04	0.678	(b)	**4.9E-09**	3.7E-06
						(b)	4.6E-07	3.4E-04
Severe earthquake	4.27E+05	2.00E-04	7.64E-04	5.36E-03	17.7	6.1E-09	5.4E-10	1.8E-06
						3.1E-05	2.7E-06	**8.9E-03**
Inadvertent overflow of 37,850 liters[c] of basin water through sewer system to Savannah River	15.1	1.56E-02	(b)	5.37E-06	3.99E-03	(b)	4.2E-11	3.1E-08
						(b)	2.7E-09	2.0E-06
CONVERSION								
F-Canyon (full operations)								
Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	17.0	4.00E-02	16.5	0.755	4.42E+03	2.6E-04	**1.5E-05**	**8.8E-02**
						6.6E-03	3.8E-04	2.2
Severe earthquake	73.0	2.00E-04	10.5	0.474	2.80E+03	8.4E-07	4.7E-08	2.8E-04
						4.2E-03	2.4E-04	1.4
Fire in a plutonium process vessel	56.2	6.10E-05	10.6	1.75	1.29E+04	2.6E-07	5.3E-08	3.9E-04
						4.2E-03	8.8E-04	**6.5**

Ruthenium volatilization	30.0	5.30E-02	0.105	1.77E-02	1.29E+02	2.2E-06	4.7E-07	3.4E-03
						4.2E-05	8.9E-06	6.5E-02
Inadvertent nuclear criticality	2.40E+05	1.60E-03	(b)	7.43E-03	12.9	(b)	5.9E-09	1.0E-05
						(b)	3.7E-06	6.5E-03

Table E-4. (continued).

Latent cancer fatalities (LCF)

Accident consequences Uninvolved Offsite

Quantity Uninvolved Offsite worker MEI population

Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION (continued)								
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building	24.9	1.10E-04	1.61	7.24E-02	4.30E+02	7.1E-08	4.0E-09	2.4E-05
						6.4E-04	3.6E-05	0.22
FA-Line (normal operations)								
Eructation (spewing from overpressurization) in vessel during processing	3.40E-05	4.00E-02	1.97E-04	9.04E-06	5.49E-02	3.2E-09	1.8E-10	1.1E-06
						7.9E-08	4.5E-09	2.7E-05
"Red oil" explosion (i.e., uncontrollable reaction of contaminated organic materials) in denitrator	2.30E-05	1.40E-04	1.33E-04	6.12E-06	3.71E-02	7.4E-12	4.3E-13	2.6E-09
						5.3E-08	3.1E-09	1.9E-05
Design-basis tornado	2.60	1.00E-06	(b)	2.9E-05	8.0	(b)	1.5E-14	4.0E-09
						(b)	1.5E-08	4.0E-03

Severe earthquake	1.29E-06	2.00E-04	7.47E-06	3.43E-07	2.08E-03	6.0E-13	3.4E-14	2.1E-10
						3.0E-09	1.7E-10	1.0E-06
FB-Line (processing)								
Severe earthquake	4.34	2.00E-04	11.3	0.521	3.06E+03	9.0E-07	5.2E-08	3.0E-04
						4.5E-03	2.6E-04	1.5
Inadvertent nuclear criticality in processing solution or solid	(b)	1.40E-04	(b)	2.64E-03	2.93	(b)	1.8E-10	2.1E-07
						(b)	1.3E-06	1.5E-03
Propagated fire in processing vessels or gloveboxes	0.105	5.26E-03	4.33E-02	7.13E-03	52.7	9.1E-08	1.9E-08	1.4E-04
						1.7E-05	3.6E-06	2.6E-02

Table E-4. (continued).

Latent cancer fatalities (LCF)

Accident consequences Uninvolved Offsite

Quantity Uninvolved Offsite worker MEI population

Accident released (curies) Frequency worker MEIa population (Point estimate of increased risk per year)

(per year) (rem) (rem) (person-rem) (Increased risk of LCF per occurrence)

INTERIM STORAGE								
Existing vaults (235-F)								
Rupture storage container	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09	1.4E-09	1.1E-05
(e.g., radiolytic decay)						3.4E-07	7.2E-08	5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08	7.0E-10	1.0E-06
						2.4E-04	3.5E-06	**5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08	5.0E-10	2.5E-06
						2.4E-07	1.0E-08	5.0E-05
High-Level Waste Tanks								

Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b)	3.4E-10	2.6E-08
						(b)	1.7E-06	1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09	1.1E-10	4.3E-09
						1.2E-04	5.7E-06	2.2E-04
Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07	**4.6E-08**	1.1E-04
						3.8E-05	1.8E-06	4.3E-03

ADDITIONAL CONVERSION

(New) Actinide Packaging Facility

(FB-Line drying)								
Severe earthquake	1.74	2.00E-04	4.54	0.208	1.22E+03	3.6E-07	2.0E-08	1.2E-04
						1.8E-03	1.0E-04	0.62
Inadvertent nuclear criticality	(b)	5.26E-05	(b)	2.64E-03	2.93	(b)	6.9E-11	7.7E-08
						(b)	1.3E-06	1.5E-03
Propagated fire in a glovebox	3.37E-03	5.26E-03	1.39E-03	2.29E-04	1.69	2.9E-09	6.1E-10	4.5E-06
						5.5E-07	1.2E-07	8.4E-04

Table E-4. (continued).

Latent cancer fatalities (LCF)

Accident consequences Uninvolved Offsite

Quantity Uninvolved Offsite worker MEI population

Accident released (curies) Frequency worker MEIa population (Point estimate of increased risk per year)

(per year) (rem) (rem) (person-rem) (Increased risk of LCF per occurrence)

ADDITIONAL CONVERSION (continued)

F-Canyon (second plutonium cycle contribution)

Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	0.218	4.00E-02	0.531	2.44E-02	1.44E+02	8.8E-06	**4.8E-07**	2.9E-03
						2.2E-04	1.2E-05	7.2E-02
Severe earthquake	0.365	2.00E-04	3.43	0.158	9.22E+02	2.8E-07	1.6E-08	9.2E-05
						1.4E-03	7.9E-05	0.46
Fire in a plutonium process vessel	1.59	6.10E-05	2.27	0.378	2.78E+03	5.5E-08	1.2E-08	8.5E-05
						9.0E-04	1.9E-04	**1.4**
Inadvertent nuclear criticality	2.40E+05	1.60E-03	(b)	7.43E-03	12.9	(b)	5.9E-09	1.0E-05
						(b)	3.7E-06	6.5E-03
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building.	9.65E-02	7.40E-05	0.872	4.02E-02	2.35E+02	2.6E-08	1.5E-09	8.7E-06
						3.5E-04	2.0E-05	0.12

POST-STABILIZATION STORAGE

Storage vault

Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08	**7.0E-10**	1.0E-06
						2.4E-04	3.5E-06	**5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08	5.0E-10	2.5E-06
						2.4E-07	1.0E-08	5.0E-05

a. MEI = Maximally exposed individual.

b. These data were not available.

c. To convert liters to gallons, multiply by 0.26418.

Table E-5. Americium and curium solutions.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
F-Canyon (americium/curium solutions only)								
Severe earthquake[b]	0.360	2.00E-04	5.39	0.241	1.43E+03	4.31-07 2.2E-03	2.4E-08 1.2E-04	1.4E-04 0.72
Inadvertent transfer of americium/curium solution to F-Canyon sump	1.01E-02	3.30E-02	2.12E-02	3.47E-03	26.0	2.8E-07 8.5E-06	**5.7E-08** 1.7E-06	4.3E-04 1.3E-02
Inadvertent transfer of americium/curium solution from processing vessel to ground outside building	1.73	8.80E-05	23.1	1.04	6.11E+03	1.6E-06 1.8E-02	4.6E-08 5.2E-04	2.7E-04 **3.1**
CONVERSION								
F-Canyon (full operation)								
Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	17.0	4.00E-02	16.5	0.755	4.42E+03	2.6E-04 6.6E-03	**1.5E-05** 3.8E-04	8.8E-02 2.2
Severe earthquake	73.0	2.00E-04	10.5	0.474	2.80E+03	8.4E-07 4.2E-03	4.7E-08 2.4E-04	2.8E-04 1.4
Fire in process vessel	56.2	6.10E-05	10.6	1.75	1.29E+04	2.6E-07 4.2E-03	5.3E-08 8.8E-04	3.9E-04 **6.5**
Inadvertent nuclear criticality	2.40E+05	1.60E-03	(c)	7.43E-03	12.9	(b) (b)	5.9E-09 3.7E-06	1.0E-05 6.5E-03
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building	24.9	1.10E-04	1.61	7.24E-02	4.30E+02	7.7E-08 6.4E-04	4.0E-09 3.6E-05	2.4E-05 0.22

Table E-5. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION (continued)								
F-Canyon hot cell (americium/curium line)								
Severe earthquake	0.48	2.00E-04	6.1	0.28	1.6E+03	4.9E-07 2.4E-03	2.8E-08 1.4E-04	1.6E-04 0.80
Unpropagated fire in gloveboxes	1.1	4.70E-02	2.2	0.36	2.7E+03	4.1E-05 8.8E-04	8.5E-06 1.8E-04	6.3E-02 1.4
INTERIM STORAGE								
High-Level Waste Tanks								
Severe earthquake	(c)	2.00E-04	(c)	3.41E-03	0.26	(c) (c)	3.4E-10 1.7E-06	2.6E-08 1.3E-04
Hydrogen explosion in a tank	(c)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09 1.2E-04	1.1E-10 5.7E-06	4.3E-09 2.2E-04
Waste tank filter fire	(c)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03
Existing vaults (235-F)								
Rupture of storage container (e.g., radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05

a. MEI = Maximally exposed individual.

b. Contribution from americium/curium only, not entire contents of F-Canyon.
c. These data were not available.

Table E-6. H-Canyon uranium solutions.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	LCF: Uninvolved worker	LCF: MEI	LCF: Offsite population
						(Point estimate of increased risk per year) / (Increased risk of LCF per occurrence)		
NO ACTION								
H-Canyon (normal solution term)								
Unpropagated fire in solution vessel	2.90E-02	3.56E-02	8.92E-03	5.41E-02	65.8	1.3E-07	**9.6E-07**	1.2E-03
						3.6E-06	2.7E-05	3.3E-02
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	5.61E-02	4.03E-04	3.11E-02	0.678	1.81E+02	5.0E-09	1.4E-07	3.6E-05
						1.2E-05	3.4E-04	9.1E-02
Inadvertent transfer of solution to H-Canyon sump	2.75E-04	8.06E-02	8.43E-05	5.11E-04	0.622	2.7E-09	2.1E-08	2.5E-05
						3.4E-08	2.6E-07	3.1E-04
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	19.6	2.55E-03	1.15E-02	0.253	67.6	1.2E-08	3.2E-07	8.6E-05
						4.6E-06	1.3E-04	3.4E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b)	1.0E-09	(b)
						(b)	6.6E-07	(b)
Severe earthquakes	0.149	2.00E-04	2.53E-03	1.15E-04	0.674	2.0E-10	1.2E-11	6.7E-08
						1.0E-06	5.8E-08	3.4E-04
H-Outside (UNH tank)								
Transfer error	(b)	1.75E-02	(b)	4.30E-05	0.286	(b)	3.8E-10	2.5E-06
						(b)	2.2E-08	1.4E-04
Liquid release due to severe earthquake	(b)	2.00E-04	(b)	4.58E-02	2.72E+02	(b)	4.6E-09	2.8E-05
						(b)	2.3E-05	**0.14**

Table E-6. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION								
FA-Line (normal operations)								
Eructation (spewing from overpresurization) in vessel during processing	3.40E-05	4.00E-02	1.97E-04	9.04E-06	5.49E-02	3.2E-09 7.9E-08	1.8E-10 4.5E-09	1.1E-06 2.7E-05
"Red-oil" explosion (i.e., uncontrollable reaction of contaminated organic materials) in the denitrator	2.30E-05	1.40E-04	1.33E-04	6.12E-06	3.71E-02	7.4E-12 5.3E-08	4.3E-13 3.1E-09	2.6E-09 1.9E-05
Design-basis tornado	2.60	1.00E-06	(b)	2.9E-05	8.0	(b) (b)	1.5E-14 1.5E-08	4.0E-09 4.0E-03
Severe earthquake	1.29E-06	2.00E-04	7.47E-06	3.43E-07	2.08E-03	6.0E-13 3.0E-09	3.4E-14 1.7E-10	2.1E-10 1.0E-06
Uranium Solidification Facility (normal operations)								
Severe earthquake	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09 2.4E-05	1.0E-11 5.1E-08	7.0E-08 3.5E-04
Uncontrolled chemical reaction during processing in denitrator pot	4.91E-07	4.90E-06	5.25E-07	8.22E-08	6.26E-04	1.0E-15 2.1E-10	2.0E-16 4.1E-11	1.5E-12 3.1E-07
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06 6.6E-03	1.5E-09 6.7E-06	2.1E-06 9.4E-03

Table E-6. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION (continued)								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05 8.6E-04	**3.6E-06** 1.8E-04	2.6E-02 1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05 2.4E-02	2.8E-07 7.1E-04	1.7E-03 **4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06 4.6E-05	7.6E-07 9.4E-06	5.6E-03 7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.39E-07 5.44E-05	7.97E-09 3.13E-06	4.59E-05 1.8E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b) (b)	1.0E-09 6.6E-07	(b) (b)
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06 2.2E-02	1.3E-07 6.3E-04	7.3E-04 3.7
INTERIM STORAGE								
Storage vault (Uranium Storage Facility)								
Severe earthquake	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09 2.4E-05	1.0E-11 5.1E-08	7.0E-08 3.5E-04
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06 6.6E-03	1.5E-09 6.7E-06	2.1E-06 **9.4E-03**
High-Level Waste Tanks								
Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b) (b)	3.4E-10 1.7E-06	2.6E-08 1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09 1.2E-04	1.1E-10 5.7E-06	4.3E-09 2.2E-04

Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03

a. MEI = Maximally exposed individual.
b. These data were not available.

Table E-6. H-Canyon uranium solutions.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
H-Canyon (normal solution term)								
Unpropagated fire in solution vessel	2.90E-02	3.56E-02	8.92E-03	5.41E-02	65.8	1.3E-07 3.6E-06	**9.6E-07** 2.7E-05	1.2E-03 3.3E-02
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	5.61E-02	4.03E-04	3.11E-02	0.678	1.81E+02	5.0E-09 1.2E-05	1.4E-07 3.4E-04	3.6E-05 9.1E-02
Inadvertent transfer of solution to H-Canyon sump	2.75E-04	8.06E-02	8.43E-05	5.11E-04	0.622	2.7E-09 3.4E-08	2.1E-08 2.6E-07	2.5E-05 3.1E-04
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	19.6	2.55E-03	1.15E-02	0.253	67.6	1.2E-08 4.6E-06	3.2E-07 1.3E-04	8.6E-05 3.4E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b) (b)	1.0E-09 6.6E-07	(b) (b)
Severe earthquakes	0.149	2.00E-04	2.53E-03	1.15E-04	0.674	2.0E-10 1.0E-06	1.2E-11 5.8E-08	6.7E-08 3.4E-04
H-Outside (UNH tank)								
Transfer error	(b)	1.75E-02	(b)	4.30E-05	0.286	(b) (b)	3.8E-10 2.2E-08	2.5E-06 1.4E-04
Liquid release due to severe earthquake	(b)	2.00E-04	(b)	4.58E-02	2.72E+02	(b) (b)	4.6E-09 2.3E-05	2.8E-05 **0.14**

Table E-6. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION								
FA-Line (normal operations)								
Eructation (spewing from overpresurization) in vessel during processing	3.40E-05	4.00E-02	1.97E-04	9.04E-06	5.49E-02	3.2E-09 7.9E-08	1.8E-10 4.5E-09	1.1E-06 2.7E-05
"Red-oil" explosion (i.e., uncontrollable reaction of contaminated organic materials) in the denitrator	2.30E-05	1.40E-04	1.33E-04	6.12E-06	3.71E-02	7.4E-12 5.3E-08	4.3E-13 3.1E-09	2.6E-09 1.9E-05
Design-basis tornado	2.60	1.00E-06	(b)	2.9E-05	8.0	(b) (b)	1.5E-14 1.5E-08	4.0E-09 4.0E-03
Severe earthquake	1.29E-06	2.00E-04	7.47E-06	3.43E-07	2.08E-03	6.0E-13 3.0E-09	3.4E-14 1.7E-10	2.1E-10 1.0E-06
Uranium Solidification Facility (normal operations)								
Severe earthquake	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09 2.4E-05	1.0E-11 5.1E-08	7.0E-08 3.5E-04
Uncontrolled chemical reaction during processing in denitrator pot	4.91E-07	4.90E-06	5.25E-07	8.22E-08	6.26E-04	1.0E-15 2.1E-10	2.0E-16 4.1E-11	1.5E-12 3.1E-07
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06 6.6E-03	1.5E-09 6.7E-06	2.1E-06 9.4E-03

Table E-6. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year)		
						(Increased risk of LCF per occurrence)		
CONVERSION (continued)								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05	**3.6E-06**	2.6E-02
						8.6E-04	1.8E-04	1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05	2.8E-07	1.7E-03
						2.4E-02	7.1E-04	**4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06	7.6E-07	5.6E-03
						4.6E-05	9.4E-06	7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.39E-07	7.97E-09	4.59E-05
						5.44E-05	3.13E-06	1.8E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b)	1.0E-09	(b)
						(b)	6.6E-07	(b)
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06	1.3E-07	7.3E-04
						2.2E-02	6.3E-04	3.7
INTERIM STORAGE								
Storage vault (Uranium Storage Facility)								
Severe earthquake	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09	1.0E-11	7.0E-08
						2.4E-05	5.1E-08	3.5E-04
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06	1.5E-09	2.1E-06
						6.6E-03	6.7E-06	**9.4E-03**
High-Level Waste Tanks								
Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b)	3.4E-10	2.6E-08
						(b)	1.7E-06	1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09	1.1E-10	4.3E-09
						1.2E-04	5.7E-06	2.2E-04

Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03

a. MEI = Maximally exposed individual.
b. These data were not available.

Table E-7. H-Canyon plutonium solutions.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: Offsite MEIa (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): Offsite MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year)		
						(Increased risk of LCF per occurrence)		
NO ACTION								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05	**3.6E-06**	2.6E-02
						8.6E-04	1.8E-04	1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05	2.8E-07	1.7E-03
						2.4E-02	7.1E-04	**4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06	7.6E-07	5.6E-03
						4.6E-05	9.4E-06	7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.4E-07	8.0E-09	4.6E-05
						5.4E-05	3.1E-06	1.8E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b)	1.0E-09	(b)
						(b)	6.6E-07	(b)
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06	1.3E-07	7.3E-04
						2.2E-02	6.3E-04	3.7

CONVERSION

H-Canyon (limiting solution source term)

Same accident analysis as that for the No-Action Alternative

HB-Line, Phase II (normal processing)

Severe earthquake	7.00E-04	2.00E-04	1.79E-02	8.82E-04	4.83	1.4E-09	8.3E-11	4.8E-07
						7.2E-06	4.1E-07	2.4E-03
Unpropagated fire in gloveboxes	1.60E-03	4.70E-02	6.46E-03	1.07E-03	7.88	1.2E-07	2.5E-08	1.9E-04
						2.6E-06	5.4E-07	3.9E-03

Table E-7. (continued).

Latent cancer fatalities (LCF)

Accident consequences Uninvolved Offsite

Quantity Uninvolved Offsite worker MEI population

Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
INTERIM STORAGE								
Existing Vaults (235-F)								
Rupture storage container (e.g., radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09	1.4E-09	1.1E-05
						3.4E-07	7.2E-08	5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08	7.0E-10	1.0E-06
						2.4E-04	3.5E-06	5.0E-03
Fire	2.0E-5	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08	5.0E-10	2.5E-06
						2.4E-07	1.0E-08	5.0E-05

High-Level Waste Tanks

Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b)	3.4E-10	2.6E-08
						(b)	1.7E-06	1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09	1.1E-10	4.3E-09
						1.2E-04	5.7E-06	2.2E-04
Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07	4.6E-08	1.1E-04
						3.8E-05	1.8E-06	4.3E-03
F-Canyon (without dissolver)								
Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	17.0	4.00E-02	16.5	0.755	4.42E+03	2.6E-04	**1.5E-05**	8.8E-02
						6.6E-03	3.8E-04	2.2
Severe earthquake	64.7	2.00E-04	9.91	0.447	2.64E+03	7.9E-07	4.5E-08	2.6E-04
						4.0E-03	2.2E-04	1.3
Fire in a plutonium process vessel	56.2	6.10E-05	10.6	1.75	1.29E+04	2.6E-07	5.3E-08	3.9E-04
						4.3E-03	8.8E-04	**6.5**
Inadvertent nuclear criticality	2.40E+05	1.60E-03	(b)	7.43E-03	12.9	(b)	5.9E-09	1.0E-05
						(b)	3.7E-06	6.5E-03
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building	24.9	7.40E-05	1.61	7.24E-02	4.30E+02	4.8E-08	2.7E-09	1.6E-05
						6.4E-04	3.6E-05	0.22

Table E-7. (continued).

Latent cancer fatalities (LCF)

Accident consequences Uninvolved Offsite

Quantity Uninvolved Offsite worker MEI population

Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
ADDITIONAL CONVERSION								
Actinide Packaging Facility (FB-Line drying)								
Severe earthquake	1.74	2.00E-04	4.54	0.208	1.22E+03	3.6E-07	2.0E-08	1.2E-04
						1.8E-03	1.0E-04	0.62
Inadvertent nuclear criticality	(b)	5.26E-05	(b)	2.64E-03	2.93	(b)	6.9E-11	7.7E-08
						(b)	1.3E-06	1.5E-03
Propagated fire in gloveboxes	3.37E-03	5.26E-03	1.39E-03	2.29E-04	1.69	2.9E-09	6.1E-10	4.5E-06
						5.5E-07	1.2E-07	8.4E-04
FB-Line (processing)								
Severe earthquake	4.34	2.00E-04	11.3	0.521	3.06E+03	9.0E-07	5.2E-08	3.0E-04
						4.5E-03	2.6E-04	1.5
Inadvertent nuclear criticality in processing solution or solid	(b)	1.40E-04	(b)	2.64E-03	2.93	(b)	1.8E-10	2.1E-07
						(b)	1.3E-06	1.5E-03
Propagated fire in processing vessels or gloveboxes	0.105	5.26E-03	4.33E-02	7.13E-03	52.7	9.1E-08	1.9E-08	1.4E-04
						1.7E-05	1.3E-06	2.6E-02
F-Canyon (second plutonium cycle contribution)								

Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	0.218	4.00E-02	0.531	2.44E-02	1.44E+02	8.8E-06	**4.8E-07**	2.9E-03
						2.2E-04	1.2E-05	7.2E-02
Severe earthquake	0.365	2.00E-04	3.43	0.158	9.22E+02	2.8E-07	1.6E-08	9.2E-05
						1.4E-03	7.9E-05	0.46
Fire in a plutonium process vessel	1.59	6.10E-05	2.27	0.378	2.78E+03	5.5E-08	1.2E-08	8.5E-05
						9.0E-04	1.9E-04	**1.4**
Inadvertent nuclear criticality	2.40E+05	1.60E-03	(b)	7.43E-03	12.9	(b)	5.9E-09	1.0E-05
						(b)	3.7E-06	6.5E-03
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building.	9.65E-02	7.40E-05	0.872	4.02E-02	2.35E+02	2.6E-08	1.5E-09	8.7E-06
						3.5E-04	2.0E-05	0.12

Table E-7. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: Offsite MEIa (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): Offsite MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year)		
						(Increased risk of LCF per occurrence)		
POST-STABILIZATION STORAGE								
Storage Vault								
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08	**7.0E-10**	1.0E-06
						2.4E-04	3.5E-06	**5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08	5.0E-10	2.5E-06
						2.4E-07	1.0E-08	5.0E-05

a. MEI = maximally exposed individual.

b. These data were not available.

Table E-8. H-Canyon neptunium solutions.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05 8.6E-04	**3.6E-06** 1.8E-04	2.6E-02 1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05 2.4E-02	2.8E-07 7.1E-04	1.7E-03 **4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06 4.6E-05	7.6E-07 9.4E-06	5.6E-03 7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.4E-07 5.4E-05	8.0E-09 3.1E-06	4.6E-05 1.8E-02
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06 2.2E-02	1.3E-07 6.3E-04	7.3E-04 3.7
CONVERSION								
H-Canyon (limiting solution source term)								
Same accident analysis as that for the No-Action Alternative								
HB-Line, Phase II (normal processing)								
Severe earthquake	7.00E-04	2.00E-04	1.79E-02	8.28E-04	4.83	1.4E-09 7.2E-06	8.3E-11 4.1E-07	4.8E-07 2.4E-03
Unpropagated fire in gloveboxes	1.60E-03	4.70E-02	6.46E-03	1.07E-03	7.88	1.2E-07 2.6E-06	2.5E-08 5.4E-07	1.9E-04 3.9E-03

Table E-8. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
INTERIM STORAGE								
Existing Vaults (235-F)								
Rupture storage container (e.g., radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 5.0E-03
Fire	2.0E-5	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
F-Canyon (without dissolver)								
Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	17.0	4.00E-02	16.5	0.755	4.42E+03	2.6E-04 6.6E-03	**1.5E-05** 3.8E-04	8.8E-02 2.2
Severe earthquake	64.7	2.00E-04	9.91	0.447	2.64E+03	7.9E-07 4.0E-03	4.5E-08 2.2E-04	2.6E-04 1.3
Fire in a plutonium process vessel	56.2	6.10E-05	10.6	1.75	1.29E+04	2.6E-07 4.3E-03	5.3E-08 8.8E-04	3.9E-04 **6.5**
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building	24.9	7.40E-05	1.61	7.24E-02	4.30E+02	4.8E-08 6.4E-04	2.7E-09 3.6E-05	1.6E-05 0.22
High-Level Waste Tanks								
Severe earthquake	*(b)*	*2.00E-04*	*(b)*	*3.41E-03*	*0.26*	*(b)* *(b)*	*3.4E-10* *1.7E-06*	*2.6E-08* *1.3E-04*

Hydrogen explosion in a tank	*(b)*	*2.00E-05*	*0.291*	*1.13E-02*	*0.43*	*2.3E-09* *1.2E-04*	*1.1E-10* *5.7E-06*	*4.3E-09* *2.2E-04*
Waste tank filter fire	*(b)*	*2.5E-02*	*9.55E-02*	*3.68E-03*	*8.5*	*9.6E-07* *3.8E-05*	***4.6E-08*** *1.8E-06*	*1.1E-04* *4.3E-03*

Table E-8. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
ADDITIONAL CONVERSION								
Actinide Packaging Facility (FB-Line drying)								
Severe earthquake	1.74	2.00E-04	4.54	0.208	1.22E+03	3.6E-07 1.8E-03	**2.0E-08** 1.0E-04	1.2E-04 **0.62**
Propagated fire in gloveboxes	3.37E-03	5.26E-03	1.39E-03	2.29E-04	1.69	2.9E-09 5.5E-07	6.1E-10 1.2E-07	4.5E-06 8.4E-04
F-Canyon (second plutonium cycle contribution)								
Airborne release solution resulting from coil and tube failure in F-Canyon water cooling tower	0.218	4.00E-02	0.531	2.44E-02	1.44E+02	8.8E-06 2.2E-04	**4.8E-07** 1.2E-05	2.9E-03 7.2E-02
Severe earthquake	0.365	2.00E-04	3.43	0.158	9.22E+02	2.8E-07 1.4E-03	1.6E-08 7.9E-05	9.2E-05 0.46
Fire in a process vessel	1.59	6.10E-05	2.27	0.378	2.78E+03	5.5E-08 9.0E-04	1.2E-08 1.9E-04	8.5E-05 **1.4**
Inadvertent transfer of solution from a processing vessel to the ground outside building.	9.65E-02	7.40E-05	0.872	4.02E-02	2.35E+02	2.6E-08 3.5E-04	1.5E-09 2.0E-05	8.7E-06 0.12
POST-STABILIZATION STORAGE								
Storage Vault								
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	**7.0E-10** 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05

a. MEI = maximally exposed individual.
b. These data were not available.

Table E-9. Plutonium-242.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
H/F-Canyon (without dissolver)								
Airborne release of plutonium solution resulting from coil and tube failure in F-Canyon water cooling tower	17.0	4.00E-02	16.5	0.755	4.42E+03	2.6E-04 6.6E-03	**1.5E-05** 3.8E-04	8.8E-02 2.2
Severe earthquake	64.7	2.00E-04	9.91	0.447	2.64E+03	7.9E-07 4.0E-03	4.5E-08 2.2E-04	2.6E-04 1.3
Fire in a plutonium process vessel	56.2	6.10E-05	10.6	1.75	1.29E+04	2.6E-07 4.2E-03	5.3E-08 8.8E-04	3.9E-04 **6.5**
Inadvertent transfer of plutonium solution from a processing vessel to the ground outside building	24.9	7.40E-05	1.61	7.24E-02	4.30E+02	4.8E-08 6.4E-04	2.7E-09 3.6E-05	1.6E-05 0.22
CONVERSION								
H/F-Canyon (without dissolver)								
Same accident analysis as that for the No-Action Alternative								
HB-Line, Phase II (normal processing)								
Severe earthquake	7.00E-04	2.00E-04	1.79E-02	8.28E-04	4.83	1.4E-09 7.2E-06	8.3E-11 4.1E-07	4.8E-07 2.4E-03
Unpropagated fire in gloveboxes	1.60E-03	4.70E-02	6.46E-03	1.07E-03	7.88	1.2E-07 2.6E-06	2.5E-08 5.4E-07	1.9E-04 3.9E-03

Table E-9. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
INTERIM STORAGE								
Existing Vaults (235-F)								
Rupture storage container (e.g., radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-5	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
High-Level Waste Tanks								
Severe earthquake	*(b)*	*2.00E-04*	*(b)*	*3.41E-03*	*0.26*	*(b)* *(b)*	*3.4E-10* *1.7E-06*	*2.6E-08* *1.3E-04*
Hydrogen explosion in a tank	*(b)*	*2.00E-05*	*0.291*	*1.13E-02*	*0.43*	*2.3E-09* *1.2E-04*	*1.1E-10* *5.7E-06*	*4.3E-09* *2.2E-04*
Waste tank filter fire	*(b)*	*2.5E-02*	*9.55E-02*	*3.68E-03*	*8.5*	*9.6E-07* *3.8E-05*	***4.6E-08*** *1.8E-06*	*1.1E-04* *4.3E-03*
FINAL STABILIZATION								
FB-LINE (Recovery Operations)								
Severe earthquake	0.434	2.00E-04	1.13	5.02E-02	3.06E+02	9.0E-08 4.5E-04	5.0E-09 2.5E-05	3.1E-05 1.5E-01
Inadvertent nuclear criticality in processing solution or solid	(a)	1.40E-04	(a)	2.64E-03	2.93	(a) (a)	1.8E-10 1.3E-06	2.1E-07 1.5E-03
Propagated fire in processing vessels or gloveboxes	4.31E-04	5.26E-03	1.78E-03	2.92E-05	0.216	3.7E-09 7.1E-07	7.7E-11 1.5E-08	5.7E-07 1.1E-04

Table E-9. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
F-Canyon (Second Pu cycle Pu Contribution								
Airborne release Pu solution resulting from coil & tube failure in F-Area Canyon water cooling tower	0.218	4.00E-02	0.531	2.44E-02	1.44E+02	8.8E-06 2.2E-04	**4.8E-07** 1.2E-05	2.9E-03 7.2E-02
Severe earthquake	0.365	2.00E-04	3.43	0.158	9.22E+02	2.8E-07 1.4E-03	1.6E-08 7.9E-05	9.2E-05 0.46
Fire in a plutonium process vessel	1.59	6.10E-05	2.27	0.378	2.78E+03	5.5E-08 9.0E-04	1.2E-08 1.9E-04	8.5E-05 **1.4**
Inadvertent transfer of plutonium solution from a processing vesssel to the ground outside building	9.65E-02	7.40E-05	0.872	4.02E-02	2.35E+02	2.6E-08 3.5E-04	1.5E-09 2.0E-05	8.7E-06 0.12

a. MEI = maximally exposed individual.

Table E-10. Mark-16 and -22 fuel.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	LCF: MEI	LCF: Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
L-Reactor Basin (storage)								
Inadvertent draindown of half the basin water to the Savannah River	2.57E+03	1.08E-02	(b)	9.12E-04	0.678	(b) (b)	**4.9E-09** 4.6E-07	3.7E-06 3.4E-04
Severe earthquake	4.27E+05	2.00E-04	7.64E-02	5.36E-03	17.7	6.1E-09 3.1E-05	5.4E-10 2.7E-06	1.8E-06 **8.9E-03**
Inadvertent overflow 37,850 liters[c] of basin water through sewer system to Savannah River	15.1	1.56E-02	(b)	5.37E-06	3.99E-03	(b) (b)	4.2E-11 2.7E-09	3.1E-08 2.0E-06
CONVERSION								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05 8.6E-04	**3.6E-06** 1.8E-04	2.6E-02 1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05 2.4E-02	2.8E-07 7.1E-04	1.7E-03 **4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06 4.6E-05	7.6E-07 9.4E-06	5.6E-03 7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.4E-07 5.4E-05	8.0E-09 3.1E-06	4.6E-05 1.8E-02
Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b) (b)	1.0E-09 6.6E-07	(b) (b)
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06 2.2E-02	1.3E-07 6.3E-04	7.3E-04 3.7

Table E-10. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	MEI[a] (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION (continued)								
H-Outside (UNH tank)								
Transfer error	(b)	1.75E-02	(b)	4.30E-05	0.286	(b) (b)	3.8E-10 2.2E-08	2.5E-06 1.4E-04
Liquid release due to severe earthquake	(b)	2.00E-04	(b)	4.58E-02	2.72E+02	(b) (b)	4.6E-09 2.3E-05	2.8E-05 0.14
FA-Line (normal operations)								
Eructation (spewing from overpressurization) in vessel during processing	3.40E-05	4.00E-02	1.97E-04	9.04E-06	5.49E-02	3.2E-09 7.9E-08	1.8E-10 4.5E-09	1.1E-06 2.7E-05
"Red-oil" explosion (i.e., uncontrollable reaction of contaminated organic materials) in the denitrator	2.30E-05	1.40E-04	1.33E-04	6.12E-06	3.71E-02	7.4E-12 5.3E-08	4.3E-13 3.1E-09	2.6E-09 1.9E-05
Design-basis tornado	2.60	1.00E-06	(b)	2.9E-05	8.0	(b) (b)	1.5E-14 1.5E-08	4.0E-09 4.0E-03
Severe earthquake	1.29E-06	2.00E-04	7.47E-06	3.43E-07	2.08E-03	6.0E-13 3.0E-09	3.4E-14 1.7E-10	2.1E-10 1.0E-06
Uranium Solidification Facility (normal operations)								
Severe earthquake	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09 2.4E-05	1.0E-11 5.1E-08	7.0E-08 3.5E-04
Uncontrolled chemical reaction during processing in denitrator pot	4.91E-07	4.90E-06	5.25E-07	8.22E-08	6.26E-04	1.0E-15 2.1E-10	2.0E-16 4.1E-11	1.5E-12 3.1E-07
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06 6.6E-03	1.5E-09 6.7E-06	2.1E-06 9.4E-03

Table E-10. (continued).

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: MEI[a] (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): MEI	Latent cancer fatalities (LCF): Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
INTERIM STORAGE								
New Storage Vault (USF)								
Severe earthquakes	(b)	2.00E-04	5.90E-02	1.01E-04	0.700	4.7E-09 2.4E-05	1.0E-11 5.1E-08	7.0E-08 3.5E-04
Inadvertent criticality	(b)	2.27E-04	16.4	1.33E-02	18.8	1.5E-06 6.6E-03	1.5E-09 6.7E-06	2.1E-06 **9.4E-03**
High-Level Waste Tanks								
Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b) (b)	3.4E-10 1.7E-06	2.6E-08 1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09 1.2E-04	1.1E-10 5.7E-06	4.3E-09 2.2E-04
Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03

a. MEI = maximally exposed individual.
b. These data were not available.
c. To convert liters to gallons, multiply by 0.26418.

Table E-11. Solids.

			Accident consequences			Latent cancer fatalities (LCF)		
	Quantity		Uninvolved	Offsite	Offsite	Uninvolved	Offsite	
						worker	MEI	population
Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
NO ACTION								
235-F (storage)								
Rupture storage container (e.g. radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 5.0E-03
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
FB-Line (storage)								
Severe earthquake	0.868	2.00E-04	2.27	0.104	6.12E+02	1.8E-07 9.1E-04	**1.0E-08** 5.1E-05	6.1E-05 **0.31**
Inadvertent nuclear criticality in storage and vaults	(b)	8.76E-05	(b)	1.60E-03	1.71	(b) (b)	7.0E-11 8.0E-07	7.5E-08 8.6E-04
CONVERSION								
HB-Line (Phase I with americium contribution)								

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Offsite MEIa (rem)	Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Offsite MEI	Offsite population
						(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
Propagated fire in gloveboxes containing plutonium processing vessels	0.615	5.26E-03	2.05	0.338	2.49E+03	4.3E-06 8.2E-04	8.9E-07 1.7E-04	6.5E-03 1.3
Severe earthquake	4.00E-02	2.0E-04	0.910	4.07E-02	2.43E+02	7.3E-08 3.6E-04	4.1E-09 2.0E-05	2.4E-05 0.12
CONVERSION (continued)								
H-Canyon (limiting solution source term)								
Unpropagated fire in solution vessel	0.594	2.02E-02	2.15	0.355	2.62E+03	1.7E-05 8.6E-04	**3.6E-06** 1.8E-04	2.6E-02 1.3
Inadvertent transfer from a processing vessel to the ground outside the H-Canyon building	1.32	4.00E-04	31.0	1.42	8.27E+03	1.0E-05 2.4E-02	2.8E-07 7.1E-04	1.7E-03 **4.1**
Inadvertent transfer of solution to H-Canyon sump	3.15E-02	8.10E-02	0.114	1.88E-02	1.39E+02	3.7E-06 4.6E-05	7.6E-07 9.4E-06	5.6E-03 7.0E-02
Airborne release of solutions resulting from coil and tube failure in H-Canyon cooling system	2.08E-02	2.55E-03	0.136	6.25E-03	36	1.4E-07 5.4E-05	8.0E-09 3.1E-06	4.6E-05 1.8E-02

Inadvertent nuclear criticality	4.76E+04	1.56E-03	(b)	1.32E-03	(b)	(b) (b)	1.0E-09 6.6E-07	(b) (b)
Severe earthquake	1.17	2.00E-04	27.4	1.26	7.31E+03	4.4E-06 2.2E-02	1.3E-07 6.3E-04	7.3E-04 3.7
HB-Line Phase II (normal processing)								
Severe earthquake	7.00E-04	2.00E-04	1.79E-02	8.28E-04	4.83	1.4E-09 7.2E-06	8.3E-11 4.1E-07	4.8E-07 2.4E-03
Unpropagated fire in gloveboxes	1.60E-03	4.70E-02	6.46E-03	1.07E-03	7.88	1.2E-07 2.6E-06	2.5E-08 5.4E-07	1.9E-04 3.9E-03
						Latent cancer fatalities (LCF)		
			Accident consequences			Uninvolved	Offsite	
	Quantity		Uninvolved	Offsite		worker	MEI	population
Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)		
CONVERSION (continued)								
Actinide Packaging Facility (FB-Line drying)								
Severe earthquake	1.74	2.00E-04	4.54	0.208	1.22E+03	3.6E-07 1.8E-03	2.0E-08 1.0E-04	1.2E-04 0.62
Inadvertent nuclear criticality	(b)	5.26E-05	(b)	2.64E-03	2.93	(b) (b)	6.9E-11 1.3E-06	7.7E-08 1.5E-03

Propagated fire in a glovebox	3.37E-03	5.26E-03	1.39E-03	2.29E-04	1.69	2.9E-09 5.5E-07	6.1E-10 1.2E-07	4.5E-06 8.4E-04
INTERIM STORAGE								
Existing storage								
Rupture storage container (e.g. radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
Storage Vault								
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05

					Latent cancer fatalities (LCF)	
		Accident consequences			Uninvolved	Offsite
	Quantity		Uninvolved	Offsite	worker	MEI population
Accident	released (curies)	Frequency (per year)	worker (rem)	MEIa (rem)	population (person-rem)	(Point estimate of increased risk per year) (Increased risk of LCF per occurrence)
INTERIM STORAGE (continued)						

High-Level Waste Tanks								
Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b) (b)	3.4E-10 1.7E-06	2.6E-08 1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09 1.2E-04	1.1E-10 5.7E-06	4.3E-09 2.2E-04
Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03

a. MEI = maximally exposed individual.

b. These data were not available.

Table E-12. Plutonium-238 scrap.

Accident	Quantity released (curies)	Frequency (per year)	Accident consequences: Uninvolved worker (rem)	Accident consequences: Offsite MEIa (rem)	Accident consequences: Offsite population (person-rem)	Latent cancer fatalities (LCF): Uninvolved worker	Latent cancer fatalities (LCF): Offsite MEI	Latent cancer fatalities (LCF): Offsite population
						(Point Estimate of Increased Risk per year) (Increased Risk of LCF per occurrence)		
NO ACTION								
HB-Line Vault (235-F storage)								
Rupture storage container (e.g., radiolytic decay)	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	**1.43E-09** 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
CONVERSION								
HB-Line Phase I (Pu-238 Recovery)								
Propagated fire	(b)	5.26E-03	0.185	0.100	1.21E+03	3.9E-07 7.4E-05	2.6E-07 5.0E-05	3.2E-03 0.61
Medium energetic event	(b)	3.7E-03	2.18E-02	1.18E-02	1.43E+02	3.2E-08 8.7E-06	2.2E-08 5.9E-06	2.7E-04 7.2E-02
Severe earthquake	(b)	2.0E-04	7.48E-02	9.27E-03	77.4	6.0E-09 3.0E-05	9.3E-10 4.6E-06	7.7E-06 3.9E-02

H-Canyon (Frame Waste Recovery)								
Severe earthquake	(b)	2.0E-04	1.09	1.1	9.03E+03	8.7E-08 4.4E-04	1.1E-07 5.5E-04	9.0E-04 **4.5**
Fire	(b)	2.11E-05	0.562	0.303	3.63E+03	4.7E-09 2.3E-04	3.2E-09 1.5E-04	3.8E-05 1.8
Uncontrolled reaction	(b)	7.9E-02	5.86E-02	3.16E-02	31.6	1.9E-06 2.3E-05	1.3E-06 1.6E-05	1.3E-03 1.6E-02
Transfer error to outside	(b)	4.0E-04	1.25	0.672	8.05E+03	2.0E-07 5.0E-04	1.3E-07 3.1E-04	1.6E-03 4.0
Coil and tube failure	(b)	1.5E-02	(b)	0.290	7.6E+03	(b) (b)	**2.2E-06** 1.5E-04	5.7E-02 3.8

	Accident consequences					Latent cancer fatalities (LCF)		
			Uninvolved	Offsite		Uninvolved	Offsite	
	Quantity		worker	MEIa	Offsite population	worker	MEI	population
	released	Frequency				(Point Estimate of Increased Risk per year)		
Accident	(curies)	(per year)	(rem)	(rem)	(person-rem)	(Increased Risk of LCF per occurrence)		
CONVERSION (continued)								
HB-Line Phase III (Normal Processing)								
Propagated fire	(b)	(b)	4.9E-02	2.67E-02	3.24E+02	(b) 2.0E-05	(b) 1.3E-05	(b) 0.16
Medium energetic event	(b)	7.0E-04	7.85E-03	4.24E-03	51.4	2.2E-09 3.1E-06	1.5E-09 2.1E-06	1.8E-05 2.6E-02

Severe earthquake	(b)	2.00E-04	2.00E-02	2.48E-03	20.7	1.6E-09 8.0E-06	2.4E-10 1.2E-06	2.1E-06 1.0E-02
INTERIM STORAGE								
Storage Vault								
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	**7.0E-10** 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
HB-Line Vault (235-F storage)								
Rupture storage container (e.g., radiolytic decay	5.14E-04	2.00E-02	8.62E-04	1.43E-04	1.05	6.9E-09 3.4E-07	1.4E-09 7.2E-08	1.1E-05 5.3E-04
Severe earthquake	1.05E-02	2.00E-04	0.60	7.0E-03	10	4.8E-08 2.4E-04	7.0E-10 3.5E-06	1.0E-06 **5.0E-03**
Fire	2.0E-05	5.0E-02	6.0E-04	2.0E-05	0.10	1.2E-08 2.4E-07	5.0E-10 1.0E-08	2.5E-06 5.0E-05
High-Level Waste Tanks								
Severe earthquake	(b)	2.00E-04	(b)	3.41E-03	0.26	(b) (b)	3.4E-10 1.7E-06	2.6E-08 1.3E-04
Hydrogen explosion in a tank	(b)	2.00E-05	0.291	1.13E-02	0.43	2.3E-09 1.2E-04	1.1E-10 5.7E-06	4.3E-09 2.2E-04
Waste tank filter fire	(b)	2.5E-02	9.55E-02	3.68E-03	8.5	9.6E-07 3.8E-05	**4.6E-08** 1.8E-06	1.1E-04 4.3E-03

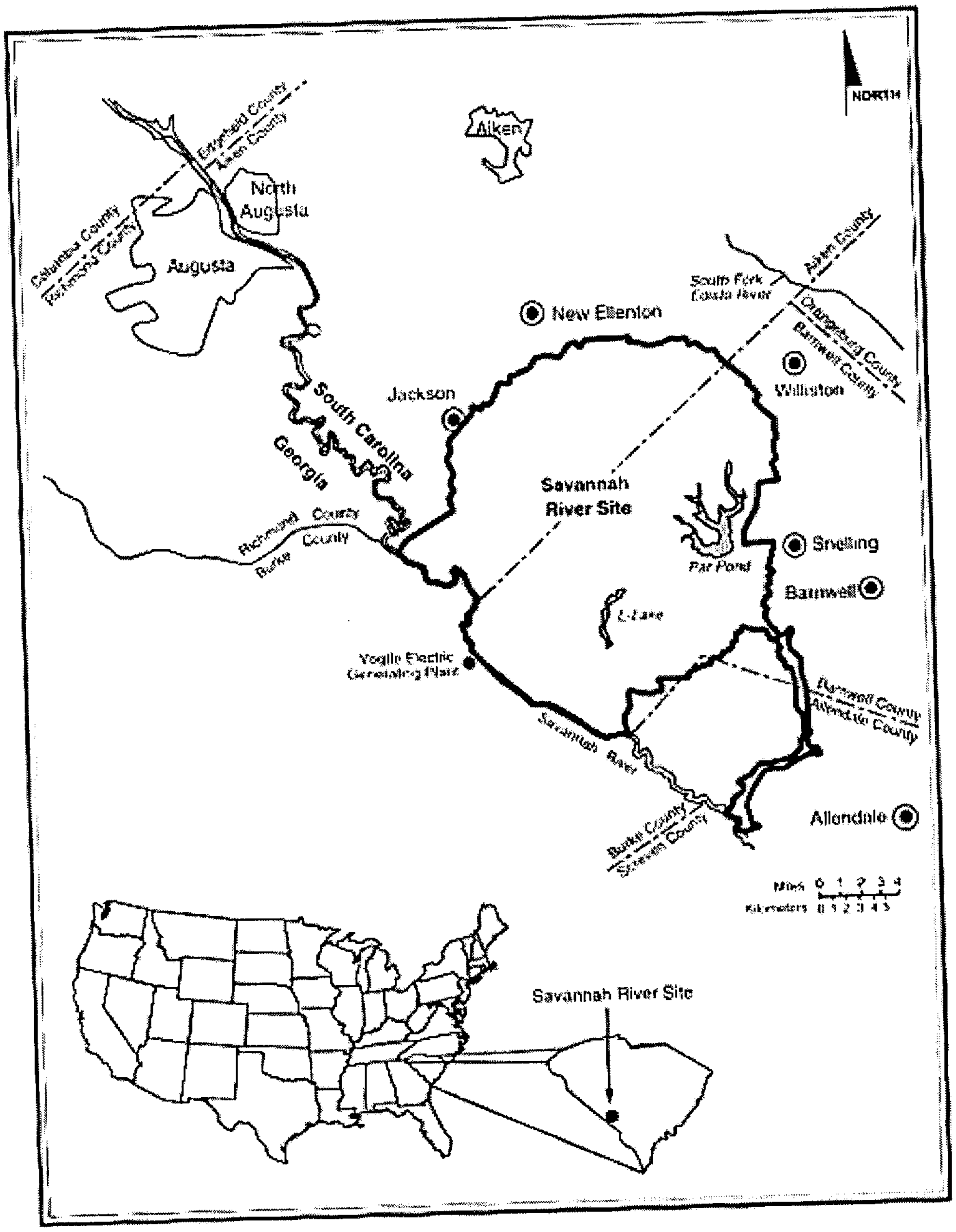
a. MEI = maximally exposed individual.

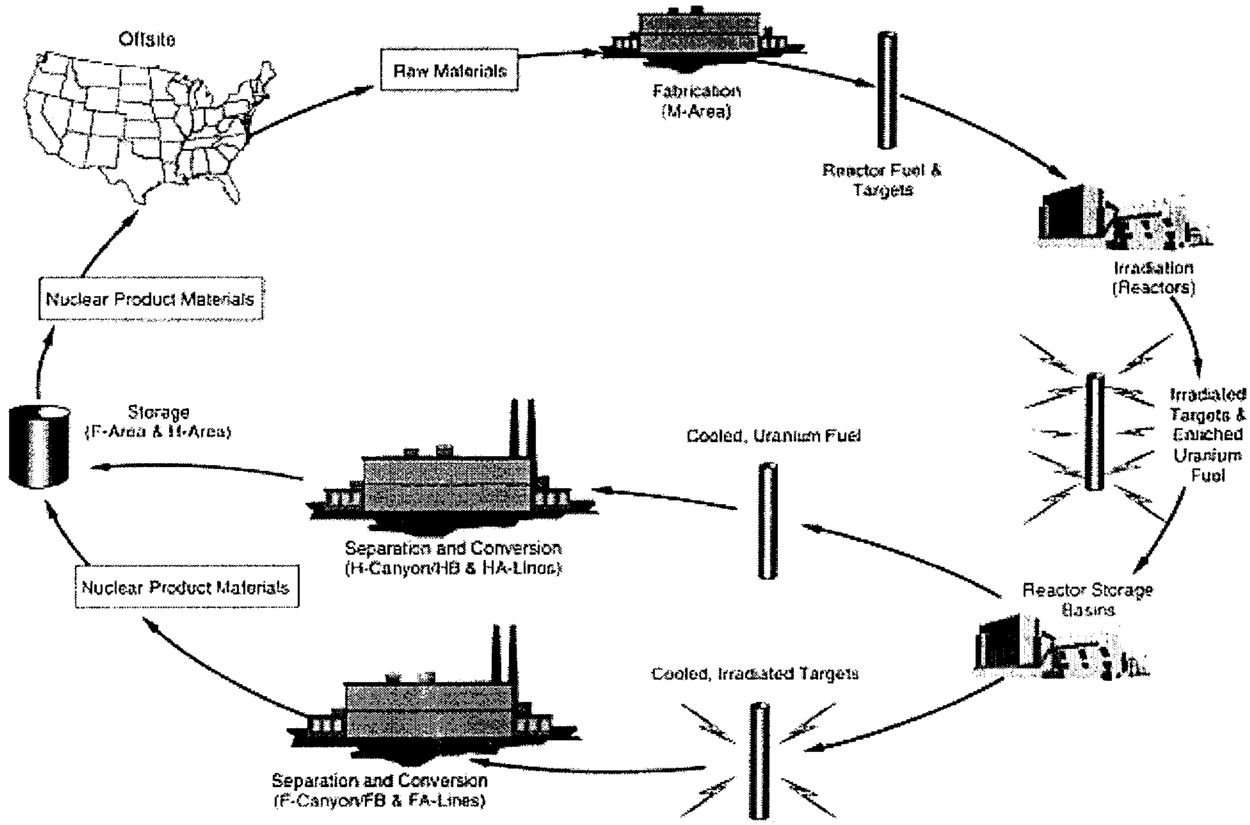
b. These data were not available.

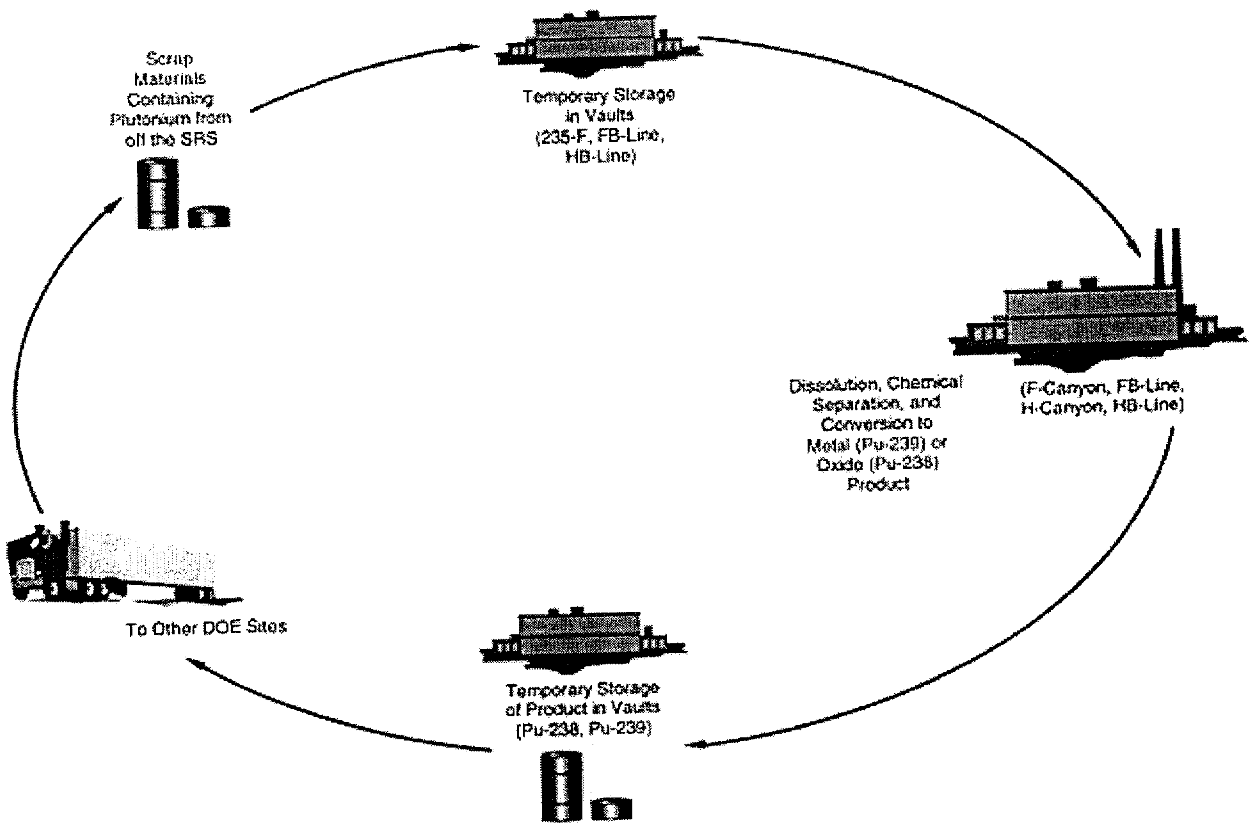
FIRST TOC TABLES

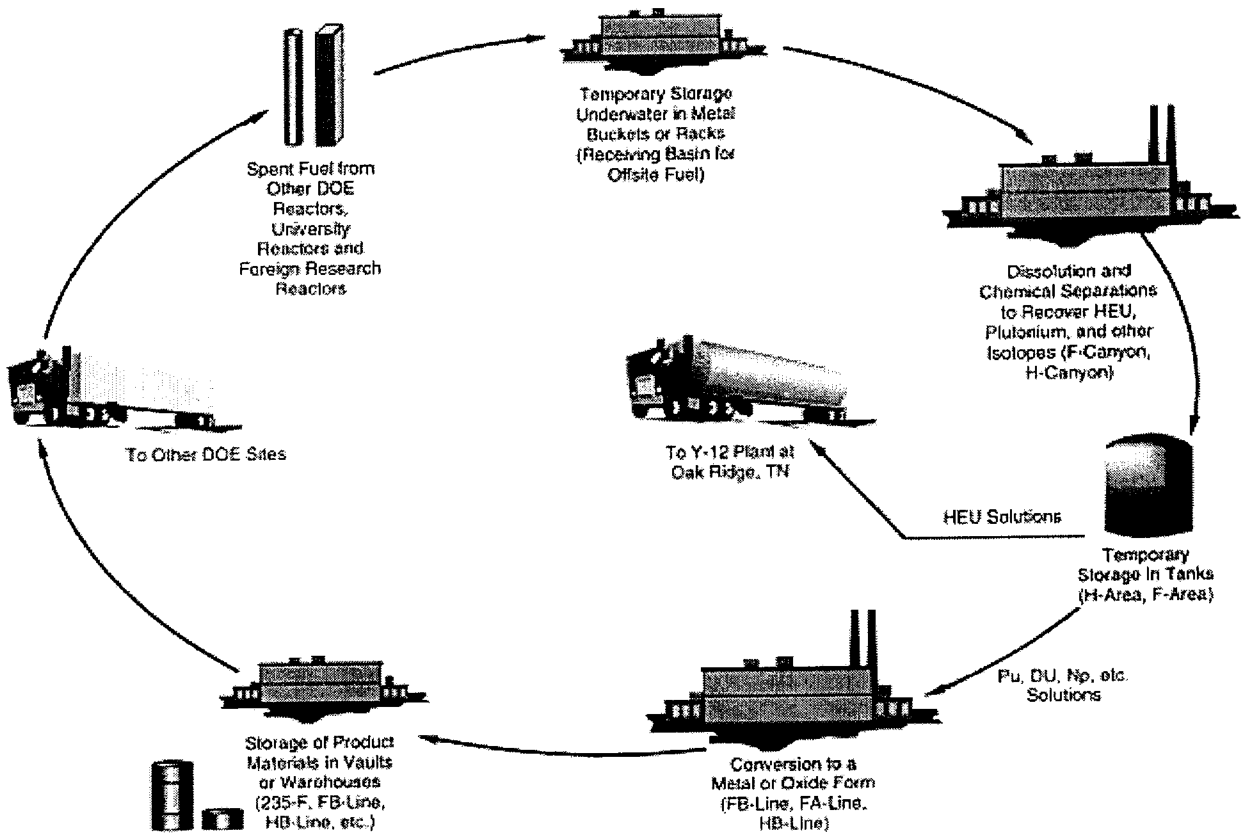
LIST OF FIGURES

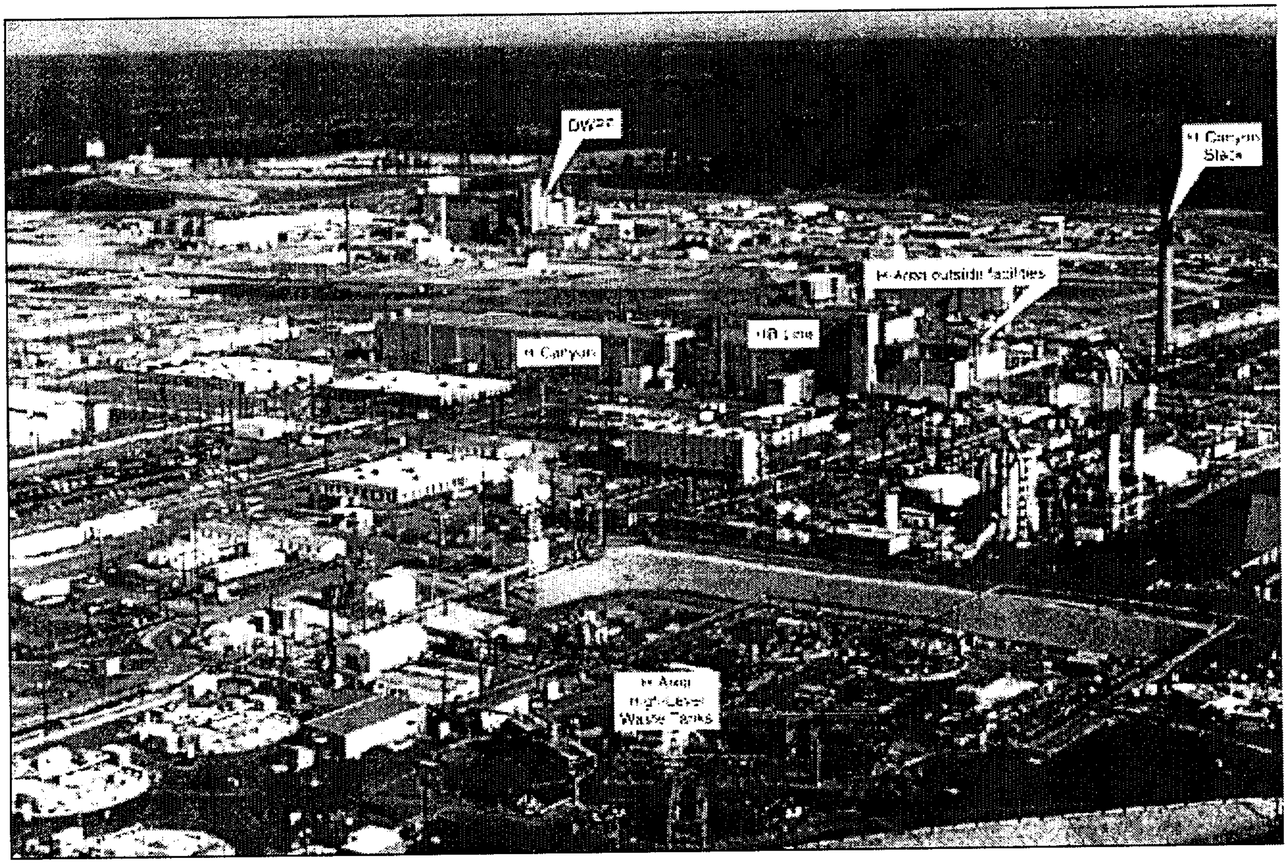
FIRST TOC TABLES

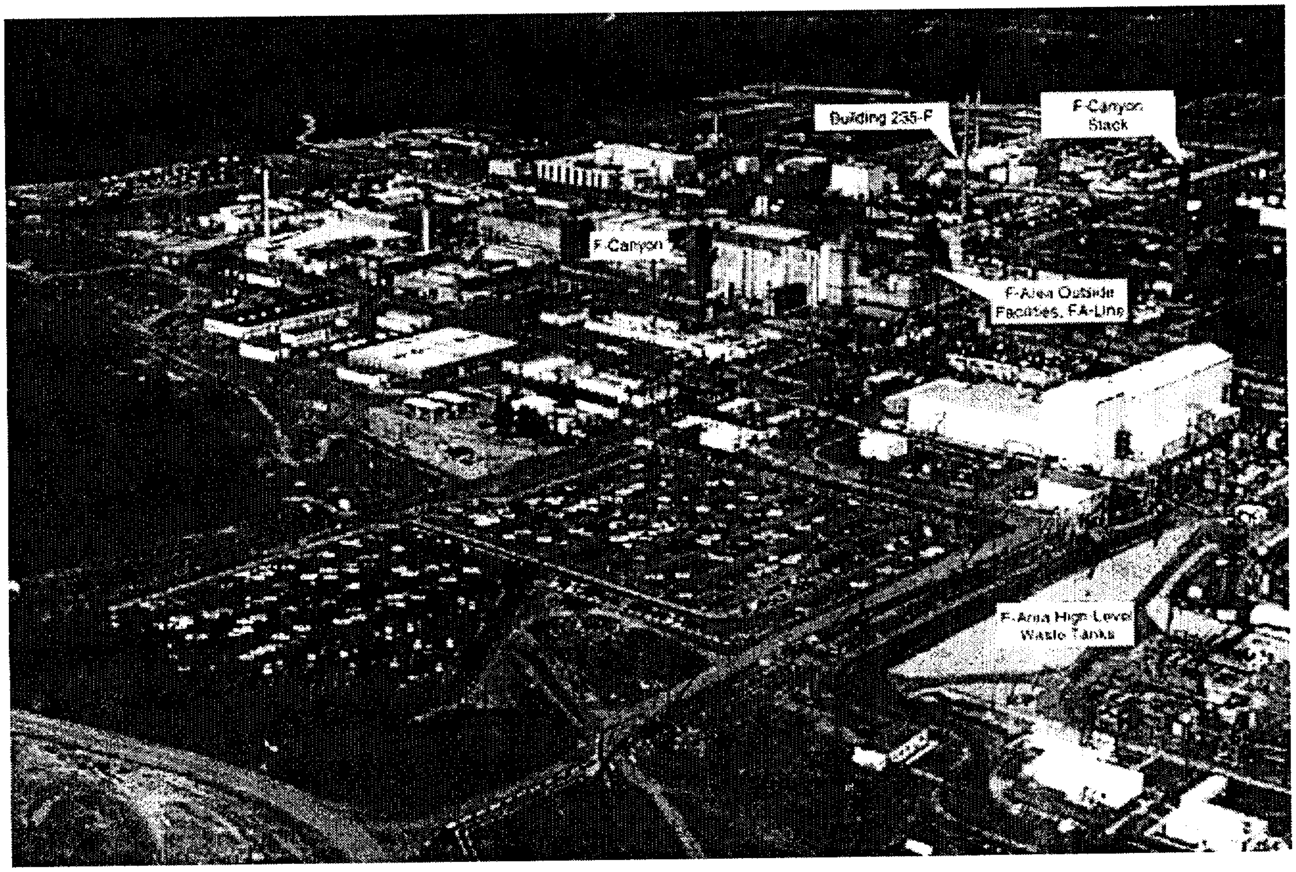

NORTH
Aiken
North Augusta
Augusta
New Ellenton
Jackson
Williston
South Carolina
Georgia
Savannah River Site
Par Pond
Snelling
Barnwell
L-Lake
Savannah River
Allendale
Savannah River Site

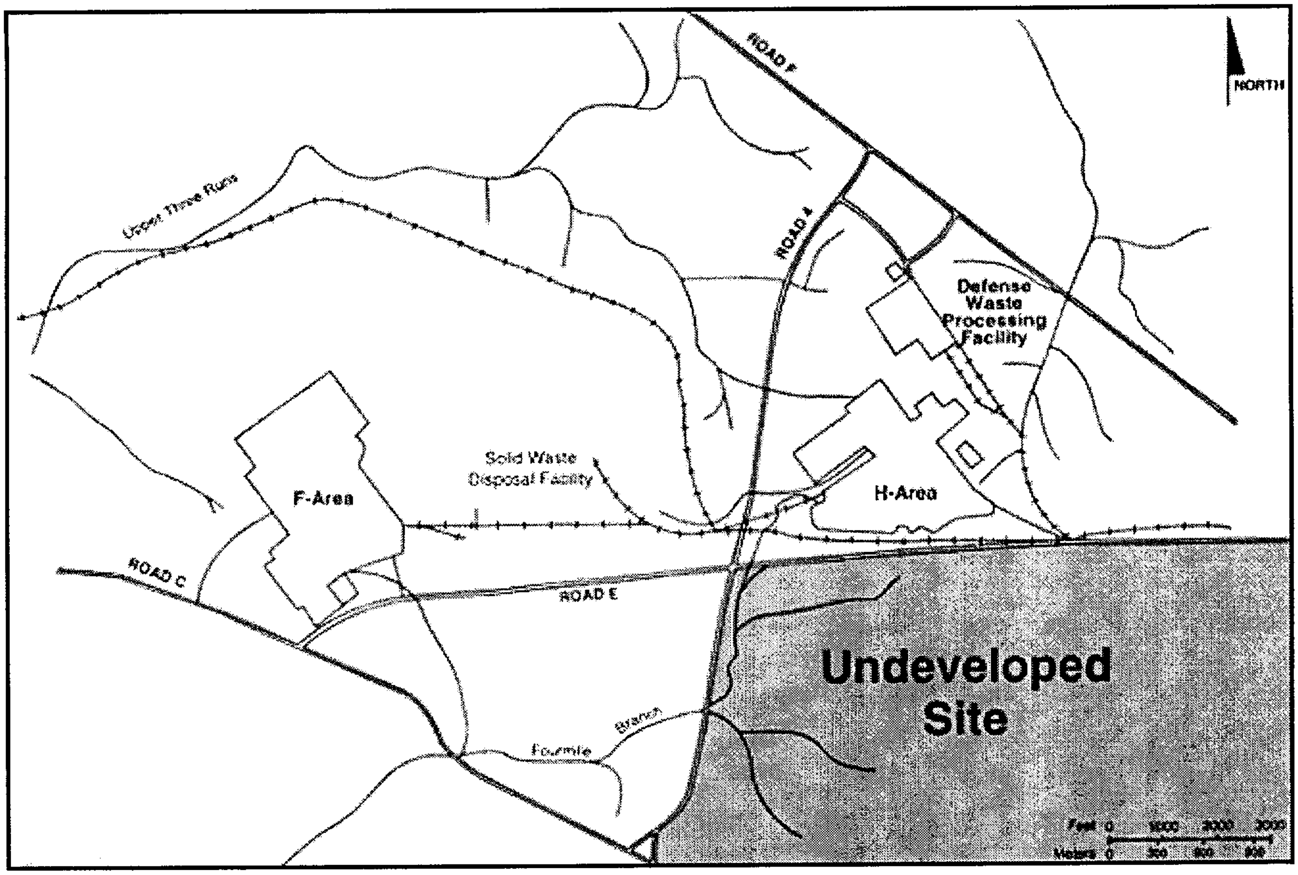

Offsite
Raw Materials
Fabrication
(M-Area)
Reactor Fuel &
Targets
Irradiation
(Reactors)
Irradiated
Targets &
Enriched
Uranium
Fuel
Reactor Storage
Basins
Cooled, Uranium Fuel
Cooled, Irradiated Targets
Separation and Conversion
(H-Canyon/HB & HA-Lines)
Separation and Conversion
(F-Canyon/FB & FA-Lines)
Storage
(F-Area & H-Area)
Nuclear Product Materials
Nuclear Product Materials

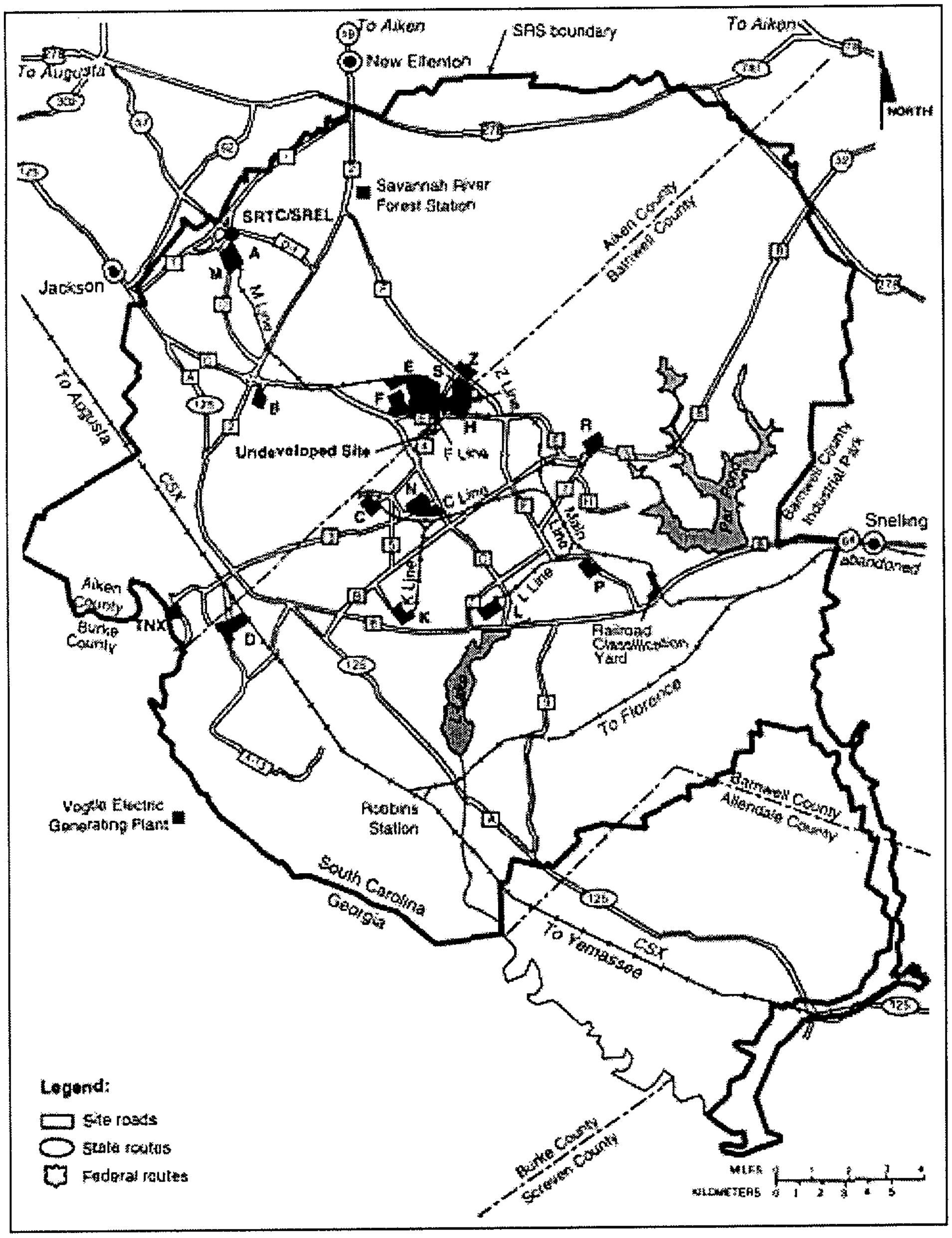

Scrap Materials Containing Plutonium from all the SRS
Temporary Storage in Vaults (235-F, FB-Line, HB-Line)
Dissolution, Chemical Separation, and Conversion to Metal (Pu-239) or Oxide (Pu-238) Product
(F-Canyon, FB-Line, H-Canyon, HB-Line)
Temporary Storage of Product in Vaults (Pu-238, Pu-239)
To Other DOE Sites

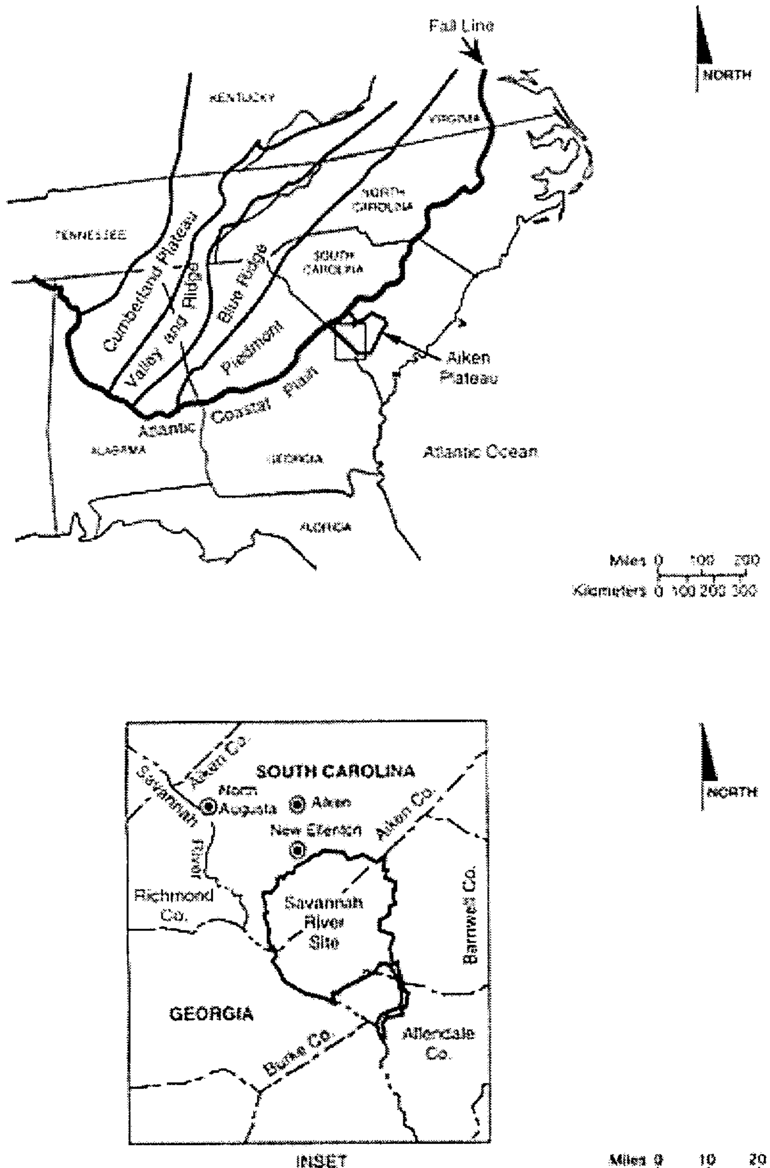

Spent Fuel from Other DOE Reactors, University Reactors and Foreign Research Reactors
Temporary Storage Underwater in Metal Buckets or Racks (Receiving Basin for Offsite Fuel)
Dissolution and Chemical Separations to Recover HEU, Plutonium, and other Isotopes (F-Canyon, H-Canyon)
Temporary Storage In Tanks (H-Area, F-Area)
HEU Solutions
To Y-12 Plant at Oak Ridge, TN
Pu, DU, Np, etc. Solutions
Conversion to a Metal or Oxide Form (FB-Line, FA-Line, HB-Line)
Storage of Product Materials in Vaults or Warehouses (235-F, FB-Line, HB-Line, etc.)
To Other DOE Sites


Waste Tanks

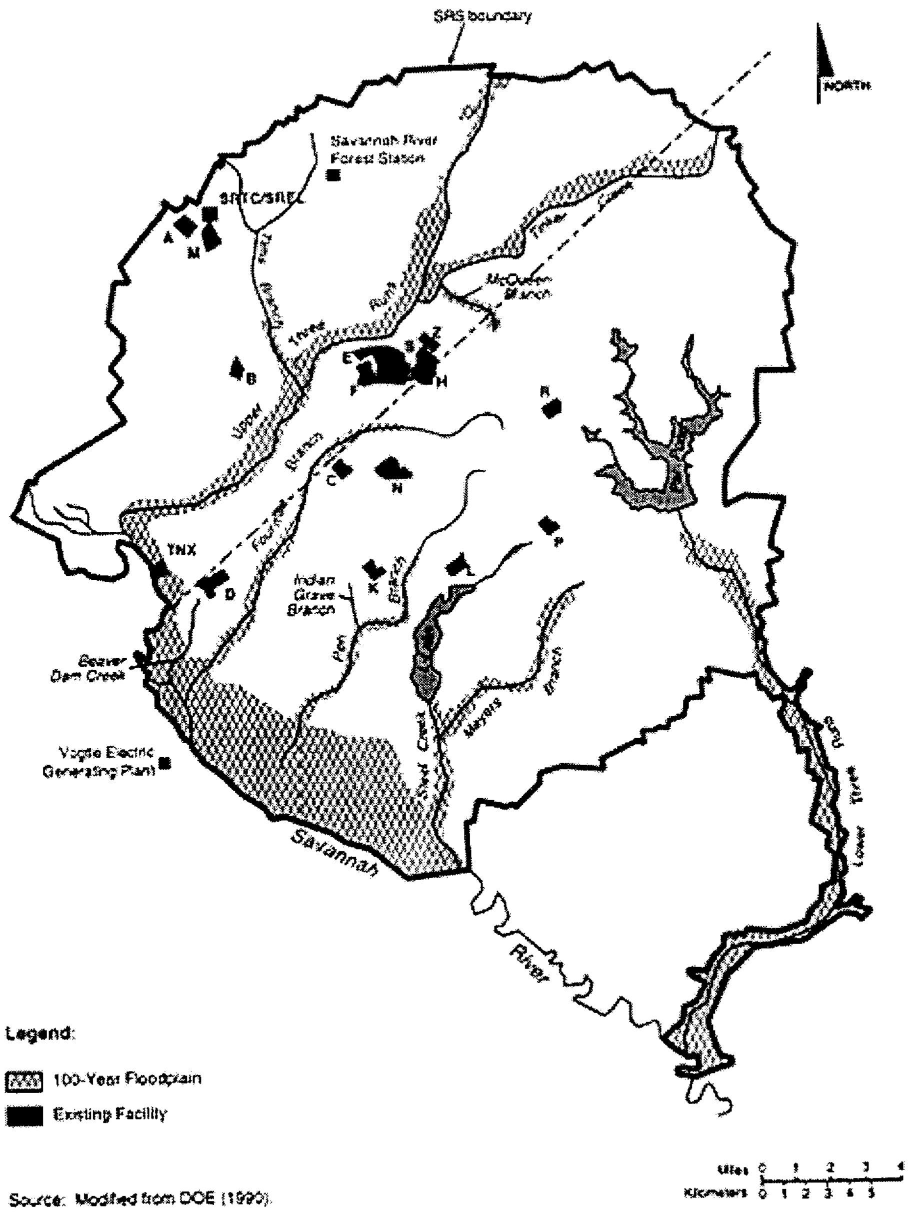

Building 235-F
F-Canyon Stack
F-Canyon
F-Area Outside Facilities, FA-Line
F-Area High-Level Waste Tanks

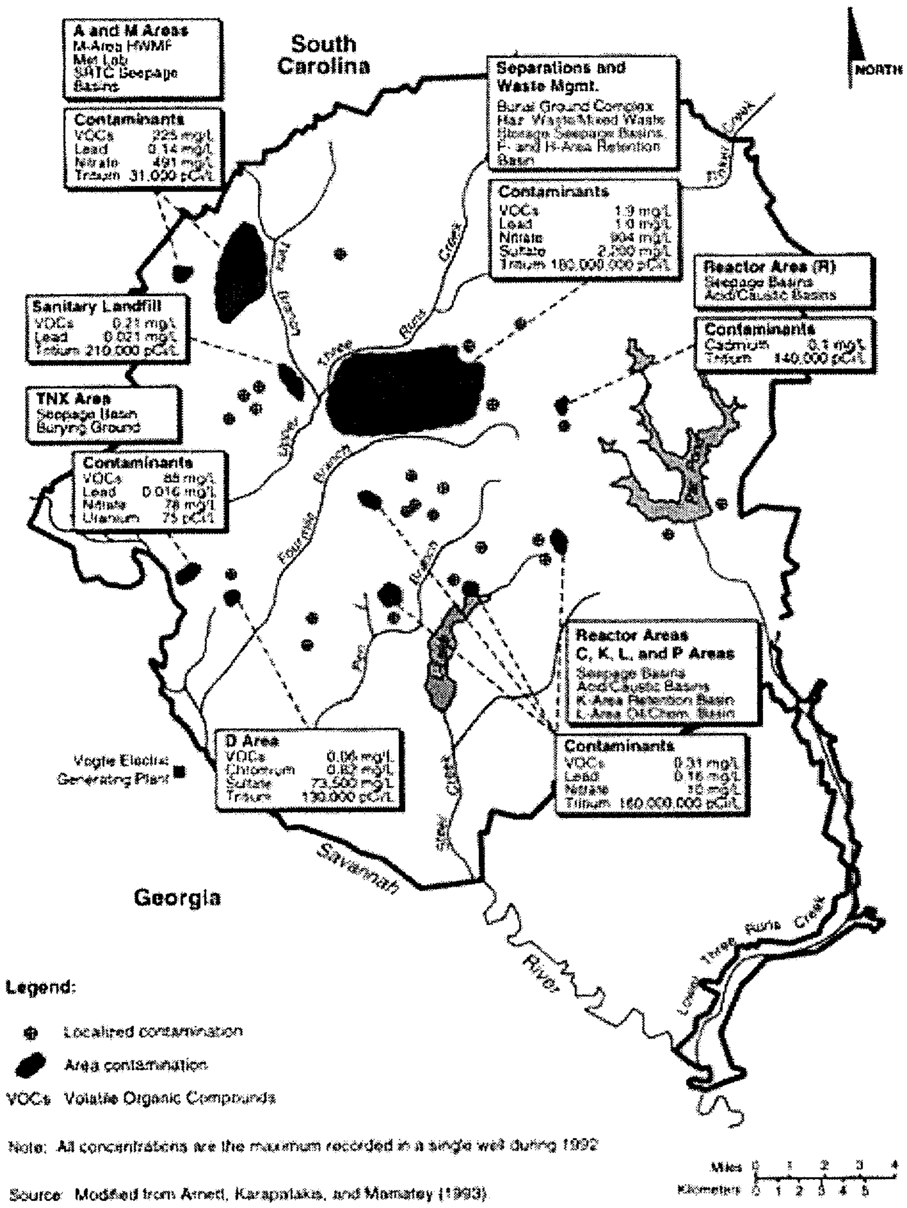

ROAD F
NORTH
Upper Three Runs
ROAD 4
Defense
Waste
Processing
Facility
Solid Waste
Disposal Facility
F-Area
H-Area
ROAD C
ROAD E
Undeveloped
Site
Fourmile
Branch
Feet
Meters


To Aiken
New Ellenton
SRS boundary
To Aiken
To Augusta
NORTH
Savannah River Forest Station
SRTC/SREL
Jackson
Aiken County
Barnwell County
To Augusta
Undeveloped Site
F Line
C Line
K Line
L Line
Main Line
Z Line
M Line
Barnwell County Industrial Park
Snelling
abandoned
CSX
Aiken County
Burke County
TNX
Railroad Classification Yard
To Florence
Vogtle Electric Generating Plant
Robbins Station
Barnwell County
Allendale County
South Carolina
Georgia
To Yemassee
CSX
Legend:
Site roads
State routes
Federal routes
Burke County
Screven County
MILES
KILOMETERS



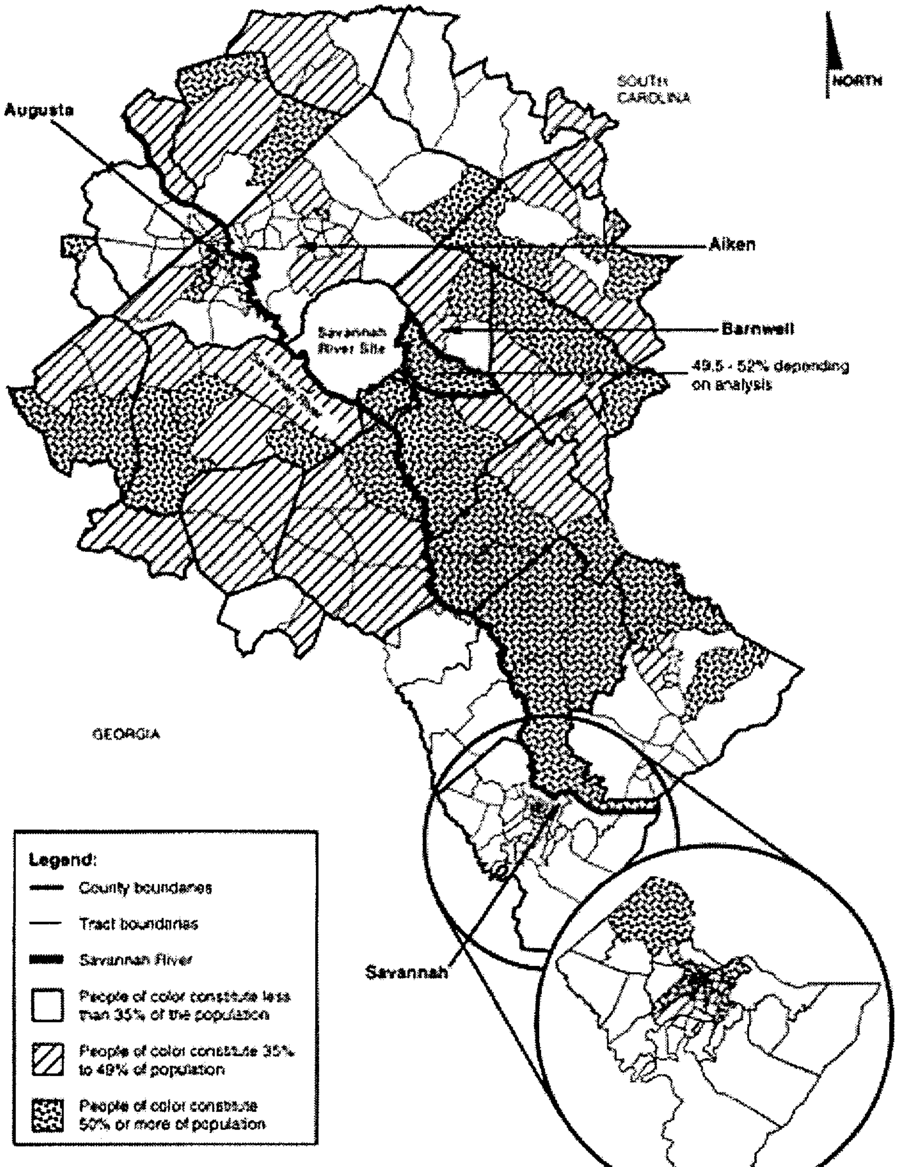
Source: Modified from DOE (1987).


SRS boundary
NORTH
Savannah River Forest Station
SRTC/SREL
A
M
B
E
F
S
Z
H
R
C
N
TNX
D
K
L
P
Indian Grave Branch
McQueen Branch
Upper Three Runs
Tims Branch
Fourmile Branch
Pen Branch
Steel Creek
Meyers Branch
Lower Three Runs
Beaver Dam Creek
Vogtle Electric Generating Plant
Savannah River
Legend:
100-Year Floodplain
Existing Facility
Source: Modified from DOE (1990).
Miles 0 1 2 3 4
Kilometers 0 1 2 3 4 5

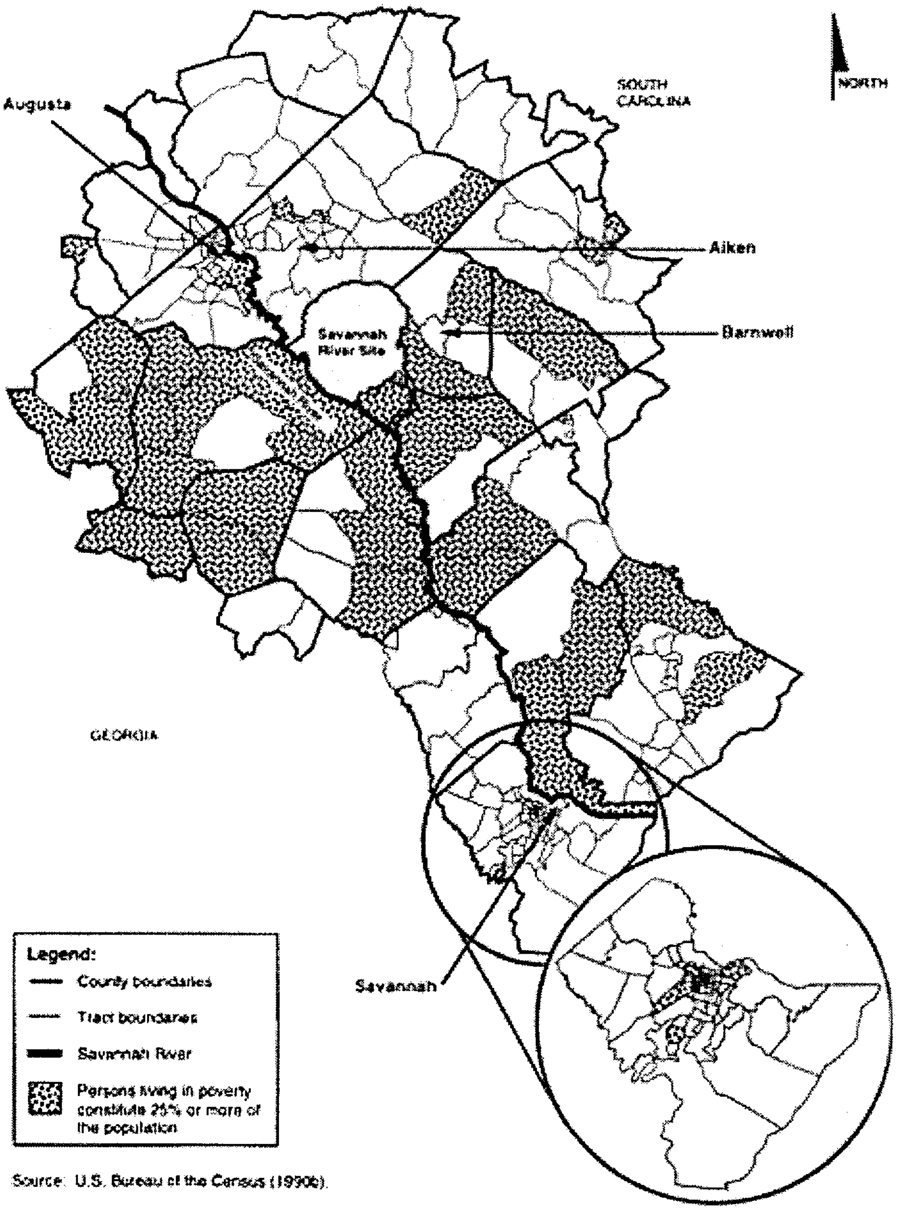


Note: All concentrations are the maximum recorded in a single well during 1992

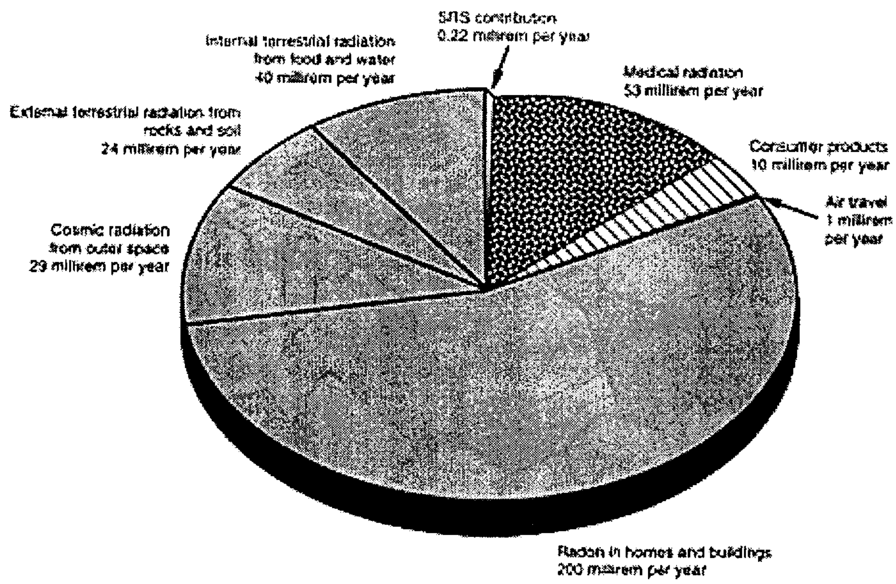
Source: Modified from Arnett, Karapatakis, and Mamatey (1993)



Source: U.S. Bureau of the Census (1990a)



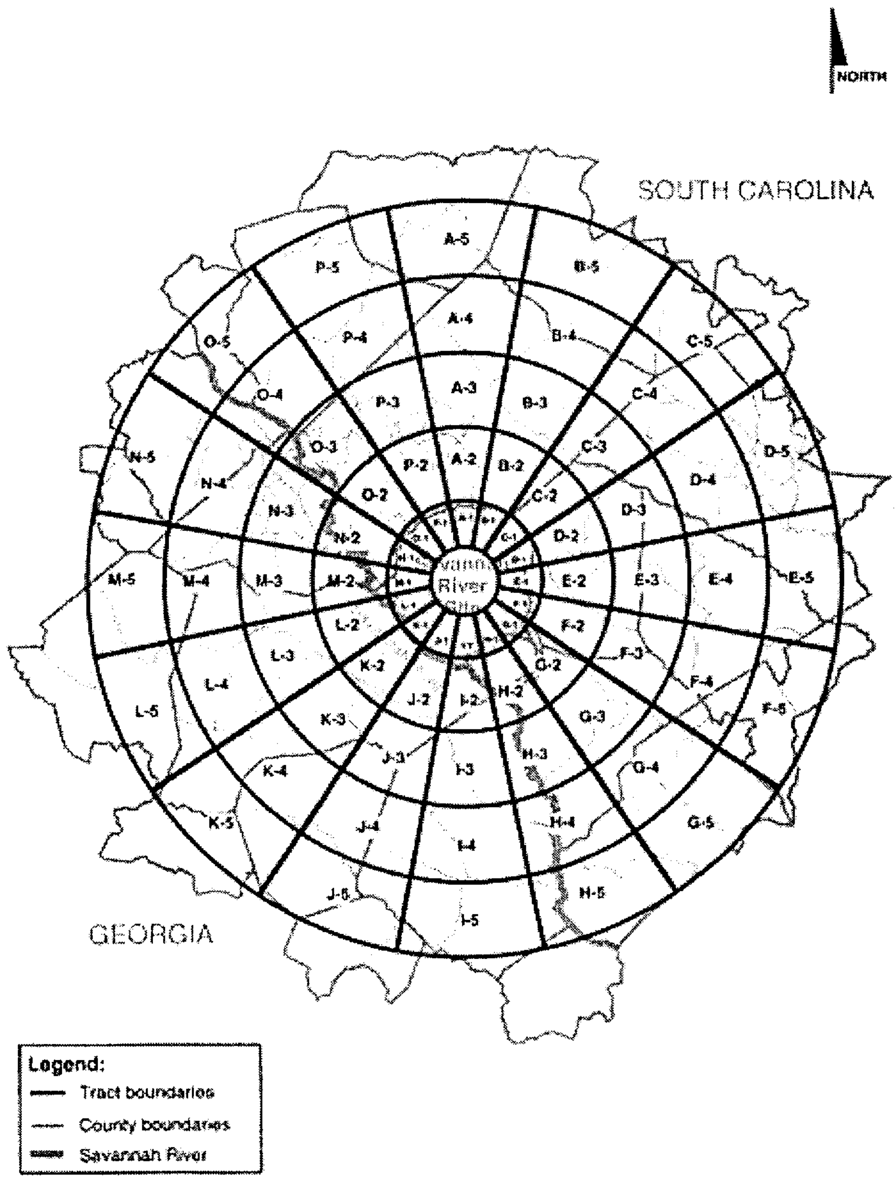
Source: U.S. Bureau of the Census (1990b).

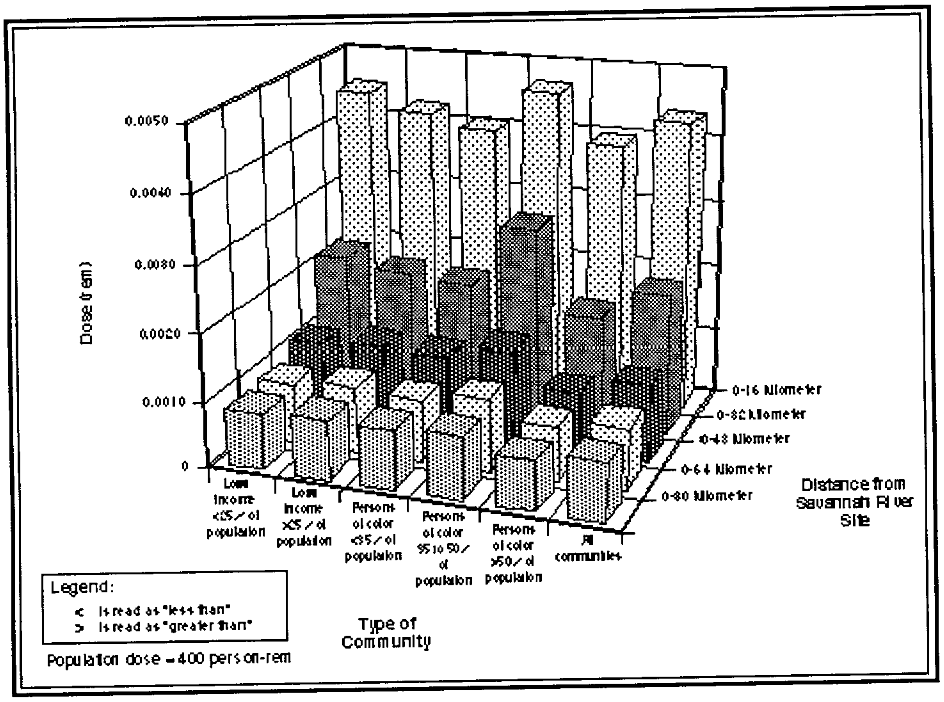


Notes:
1. Values are effective dose equivalent from NCRP (1987a) unless noted otherwise.
2. Cosmic: NCRP (1987a) reports 26 millirem per year for sea level. Multiplying value by a factor of 1.1 to correct for the altitude of 300 meters above sea level gives 29 millirem per year.
3. External terrestrial: NCRP (1987b) reports an absorbed dose rate for Augusta, Georgia, of 4 microrad per hour, which is 35 millirad per year. NCRP (1987b) uses a factor of 0.7 to convert absorbed dose in air to effective dose equivalent, so 35 x 0.7 = 24 millirem per year.
4. Value for SRS contribution is from Arnett, Karapatakis, and Mamatey (1993).

Legend:

Natural Background


NORTH
SOUTH CAROLINA
GEORGIA
A-5
A-4
A-3
A-2
B-5
B-4
B-3
B-2
C-5
C-4
C-3
C-2
D-5
D-4
D-3
D-2
E-5
E-4
E-3
E-2
F-5
F-4
F-3
F-2
G-5
G-4
G-3
G-2
H-5
H-4
H-3
H-2
I-5
I-4
I-3
I-2
J-5
J-4
J-3
J-2
K-5
K-4
K-3
K-2
L-5
L-4
L-3
L-2
M-5
M-4
M-3
M-2
N-5
N-4
N-3
N-2
O-5
O-4
O-3
O-2
P-5
P-4
P-3
P-2
River
Legend:
Tract boundaries
County boundaries
Savannah River


Dose (rem)
0.0050
0.0040
0.0080
0.0020
0.0010
0
0-16 kilometer
0-32 kilometer
0-48 kilometer
0-64 kilometer
0-80 kilometer
Distance from Savannah River Site
Low income <25% of population
Low income >25% of population
Persons of color <35% of population
Persons of color 35 to 50% of population
Persons of color >50% of population
All communities
Type of Community
Legend:
< is read as "less than"
> is read as "greater than"
Population dose = 400 person-rem