CHAPTER 9: GLOSSARY

Absorbed dose: The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest in that material. Expressed in units of radiation absorbed dose or grays, where 1 radiation absorbed dose equals 0.01 gray. Also, see "radiation absorbed dose."

Accident sequence: An initiating event followed by system failures or operator errors, which can result in significant core damage, confinement system failure, and/or radionuclide releases.

Accountable weapon: The number of weapons associated with each missile or aircraft type limited by treaty. This does not include non-strategic nuclear forces, Department of Defense spares or spares needed to replace weapons disassembled by DOE surveillance testing.

Acute exposure: The exposure incurred during and shortly after a radiological release. Generally, the period of acute exposure ends when long-term interdiction is established, as necessary. For convenience, the period of acute exposure is normally assumed to end 1 week after the inception of a radiological accident.

Air pollutant: Any substance in air which could, if in high enough concentration, harm man, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

Air Quality Control Region (AQCR): Geographic subdivisions of the U.S., designed to deal with pollution on a regional or local level. Some regions span more than one state.

Air quality standards: The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

Alpha activity: The emission of alpha particles by fissionable materials (uranium or plutonium).

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

Alpha wastes: Wastes containing radioactive isotopes which decay by producing alpha particles.

Ambient air: The surrounding atmosphere as it exists around people, plants, and structures. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

American Indian Religious Freedom Act of 1978: This Act establishes national policy to protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise their traditional religions, including the rights of access to religious sites, use and possession of sacred objects, and the freedom to worship through traditional ceremonies and rites.

Anadromous Fish Conservation Act: This act seeks to enhance the conservation and development of the anadromous fishery resources of the United States that are subject to depletion from water

resources development.

Aquatic biota: The sum total of living organisms within any designated aquatic area.

Aquifer: A saturated geologic unit through which significant quantities of water can migrate under natural hydraulic gradients.

Aquitard: A less-permeable geologic unit in a stratigraphic sequence. The unit is not permeable enough to transmit significant quantities of water. Aquitards separate aquifers.

Archaeological sites (resources): Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.

Artifact: An object produced or shaped by human workmanship of archaeological or historical interest.

As low as reasonably achievable: A concept applied to the quantity of radioactivity released in routine operation of a nuclear system or facility, including "anticipated operational occurrences." It takes into account the state of technology, economics of improvements in relation to benefits to public health and safety, and other societal and economic considerations in relation to the use of nuclear energy in the public interest.

Atmospheric dispersion: The process of air pollutants being dispersed in the atmosphere. This occurs by the wind that carries the pollutants away from their source and by turbulent air motion that results from solar heating of the Earth's surface and air movement over rough terrain and surfaces.

Atomic Energy Act of 1954: This Act was originally enacted in 1946 and amended in 1954. For the purpose of this Programmatic Environmental Impact Statement "...a program for Government control of the possession, use, and production of atomic energy and special nuclear material whether owned by the Government or others, so directed as to make the maximum contribution to the common defense and security and the national welfare, and to provide continued assurance of the Government's ability to enter into and enforce agreements with nations or groups of nations for the control of special nuclear materials and atomic weapons..." (Section 3(c)).

Atomic Energy Commission: A five-member commission, established by the Atomic Energy Act of 1946, to supervise nuclear weapons design, development, manufacturing, maintenance, modification, and dismantlement. In 1974, the Atomic Energy Commission was abolished and all functions were transferred to the Nuclear Regulatory Commission and the Administrator of the Energy Research and Development Administration. The Energy Research and Development Administration was later terminated and its functions vested by law in the Administrator were transferred to the Secretary of Energy.

B-25 Package: A container designed for the storage of low level waste.

Background radiation: Ionizing radiation present in the environment from cosmic rays and natural sources in the Earth; background radiation varies considerably with location. Also, see"natural radiation."

Badged worker: A worker equipped with an individual dosimeter who has the potential to be

exposed to radiation.

Bald and Golden Eagle Protection Act: This act states that it is unlawful to take, pursue, molest, or disturb the American bald and golden eagle, their nests, or their eggs, anywhere in the United States.

Baseline: A quantitative expression of conditions, costs, schedule, or technical progress to serve as a base or standard for measurement during the performance of an effort; the established plan against which the status of resources and the progress of a project can be measured. For this Programmatic Environmental Impact Statement, the environmental baseline is the site environmental conditions as they are projected to occur in 2005.

Beamlets: Independent laser beams.

BEIR V: Biological Effects of Ionizing Radiation; referring to the fifth in a series of committee reports from the National Research Council.

Beryllium: An extremely lightweight, strong metal used in weapons systems.

Benthic: Plants and animals dwelling at the bottom of oceans, lakes, rivers, and other surface waters.

Best Available Control Technology (BACT): A term used in the Federal Clean Air Act that means the most stringent level of air pollutant control considering economics for a specific type of source based on demonstrated technology.

Beta particle: A charged particle emitted from the nucleus of an atom during radioactive decay. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

Beyond Evaluation Basis Accident (BEBA): An accident, generally with more severe impacts to onsite personnel and the public than a EBA or DBA, initiated by operational or external causes with an estimated probability of occurrence less than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process. For those cases where a DBA is defined, these accidents are often referred to as Beyond Design Basis Accidents or Severe Accidents.

Biota (biotic): The plant and animal life of a region.

Boost: The process by which fusion of deuterium-tritium gas inside the pit of a nuclear weapon produces neutrons that increase the fission output of the primary.

Bremsstrahlung: The electromagnetic radiation produced by an accelerated charged particle, usually an electron.

Burial ground: A place for burying unwanted (i.e., radioactive) materials in which the earth acts as a receptacle to prevent the dispersion of wastes in the environment and the escape of radiation.

Burn: Fusion of two light nuclei (usually deuterium and tritium) to form a heavier nucleus (helium) accompanied by the release of neutrons and energy.

Calcination: The process of converting high-level waste to unconsolidated granules or powder. Calcined solid wastes are primarily salts and oxides of metals (heavy metals) and components of high level waste (also called calcining).

Caldera: A large crater formed by the collapse of the central part of a volcano.

Cancer: The name given to a group of diseases characterized by uncontrolled cellular growth with cells having invasive characteristics such that the disease can transfer from one organ to another.

Canned subassembly: The component of a nuclear weapon which contains the secondary uranium and lithium elements.

Capability-based deterrence: Deterrence based on the capability to respond to stockpile reliability and safety problems and to meet new requirements.

Capable fault: A fault that has exhibited one or more of the following characteristics (10 CFR 100, Appendix A):

1. Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.
2. Macro-seismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault.
3. A structural relationship to a capable fault according to characteristics (1) or (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other.

Capacity factor: The ratio of the annual average power load of a power plant to its rated capacity.

Carbon adsorption: A unit physiochemical process in which organic and certain inorganic compounds in a liquid stream are absorbed on a bed of activated carbon; used in water or waste purification and chemical processing.

Carbon dioxide: A colorless, odorless, nonpoisonous gas that is a normal component of the ambient air; it is an expiration product of normal plant and animal life.

Carbon monoxide: A colorless, odorless gas that is toxic if breathed in high concentration over a period of time.

Carolina bay: Ovate, intermittently flooded depression of a type occurring on the Coastal Plain from New Jersey to Florida.

Cask (radioactive materials): A container that meets all applicable regulatory requirements for shipping spent nuclear fuel or high-level waste.

Cesium: A silver-white alkali metal. A radioactive isotope of cesium, cesium-137, is a common fission product.

Chemical oxygen demand: A measure of the quantity of chemically oxidizable components present

in water.

Chronic exposure: Low-level radiation exposure incurred over a long period of time.

Claystone: A massive sedimentary rock made up largely of clay minerals having the composition of shale, but lacking its fine lamination.

Clean Air Act: This Act mandates and enforces air pollutant emissions standards for stationary sources and motor vehicles.

Clean Air Act Amendments of 1990: Expands the Environmental Protection Agency's enforcement powers and adds restrictions on air toxics, ozone depleting chemicals, stationary and mobile emissions sources, and emissions implicated in rain and global warming.

Clean Water Act of 1972, 1987: This Act regulates the discharge of pollutants from a point source into navigable waters of the United States in compliance with a National Pollution Discharge Elimination System permit as well as regulates discharges to or dredging of wetlands.

Climatology: The science that deals with climates and investigates their phenomena and causes.

Code of Federal Regulations: All Federal regulations in force are published in codified form in the Code of Federal Regulations.

Collective committed effective dose equivalent: The committed effective dose equivalent of radiation for a population.

Combined impact: Depending on the scope of the program concerned, a Programmatic Environmental Impact Statement may address more than one "Purpose and Need," each with its own set of alternatives. These several actions, however, may have common environments. The sum of these impacts with respect to the site concerned are combined impacts, as opposed to cumulative impacts, which incorporate the site-specific impacts of activities not otherwise related to the actions and alternatives in question.

Command disable: A subsystem of command and control features that destroys a weapon's ability to produce a nuclear yield.

Committed dose equivalent: The predicted total dose equivalent to a tissue or organ over a 50-year period after an intake of radionuclide into the body. It does not include external dose contributions. Committed dose equivalent is expressed in units of rem or Sievert. The committed effective dose equivalent is the sum of the committed dose equivalents to various tissues of the body, each multiplied by the appropriate weighting factor.

Common mode failure: A failure or defect affecting an entire class of weapon or weapon component: a particular concern with the enduring stockpile since it contains about seven weapon systems, many of which use components with common design features, or components manufactured using identical or similar processes.

Community (biotic): All plants and animals occupying a specific area under relatively similar conditions.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (or Superfund): This Act provides regulatory framework for remediation of past contamination from hazardous waste. If a site meets the Act's requirements for designation, it is ranked along with other "Superfund" sites and is listed on the National Priorities List. This ranking is the Environmental Protection Agency's way of determining which sites have the highest priority for cleanup.

Comprehensive Test Ban Treaty (CTBT): A proposed treaty prohibiting nuclear tests of all magnitudes.

Computational Modeling: The use of a computer to develop a mathematical model of a complex system or process and to provide conditions for testing it.

Conceptual design: Efforts to develop a project scope that will satisfy program needs; ensure project feasibility and attainable performance levels of the project for congressional consideration; develop project criteria and design parameters for all engineering disciplines; and identify applicable codes and standards, quality assurance requirements, environmental studies, construction materials, space allowances, energy conservation features, health, safety, safeguards, and security requirements and any other features or requirements necessary to describe the project.

Consumptive water use: The difference in the volume of water withdrawn from a body of water and the amount released back into the body of water.

Container: The metal envelope in the waste package that provides the primary containment function of the waste package and is designed to meet the containment requirements of 10 CFR 60.

Conventional weapon: A nonnuclear weapon.

Credible accident: An accident that has a probability of occurrence greater than or equal to one in a million years.

Cretaceous Period: Geologic time making up the end of the Mesozoic Era, dating from approximately 144 million to 66 million years ago.

Criteria pollutants: Six air pollutants for which national ambient air quality standards are established by the Environmental Protection Agency under title I of the *Federal Clean Air Act* : sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (smaller than 10 microns in diameter), and lead.

Critical habitat: Defined in the Endangered Species Act of 1973 as "specific areas within the geographical area occupied by [an endangered or threatened] species..., essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographical area occupied by the species... that are essential for the conservation of the species."

Cultural resources: Archaeological sites, architectural features, traditional use areas, and Native American sacred sites or special use areas.

Cumulative impacts: In an Environmental Impact Statement, the impact on the environment which

results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal), private industry, or individuals undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Curie: A unit of radioactivity equal to 37 billion disintegrations per second; also a quantity of any nuclide or mixture of nuclides having 1 curie of radioactivity.

Decay heat (radioactivity): The heat produced by the decay of certain radionuclides.

Decay (radioactive): The decrease in the amount of any radioactive material with the passage of time, due to the spontaneous transformation of an unstable nuclide into a different nuclide or into a different energy state of the same nuclide; the emission of nuclear radiation (alpha, beta, or gamma radiation) is part of the process.

Decontamination: The actions taken to reduce or remove substances that pose a substantial present or potential hazard to human health or the environment, such as radioactive or chemical contamination from facilities, equipment, or soils by washing, heating, chemical or electrochemical action, mechanical cleaning, or other techniques.

Deflagration: Rapid and powerful self-sustained burning of a propellant or explosive.

Delivery system (carrier): The military "vehicle" (e.g. ballistic or cruise missile, artillery shell, airplane, submarine) by which a nuclear weapon would be delivered; most warheads have been designed for specific delivery systems.

Demilitarization: An irreversible modification or destruction of a weapons component or part of a component to the extent required to prevent use in its original weapon purpose.

Depleted uranium: Uranium whose content of the isotope uranium-235 is less than 0.7 percent, which is the uranium-235 content of naturally occurring uranium.

Deposition: In geology, the laying down of potential rock-forming materials; sedimentation. In atmospheric transport, the settling out on ground and building surfaces of atmospheric aerosols and particles ("dry deposition") or their removal from the air to the ground by precipitation ("wet deposition" or "rainout").

Design laboratory: Department of Energy facilities involved in the design of nuclear weapons.

Deuterium: A nonradioactive isotope of the element hydrogen with one neutron and one proton in the atomic nucleus.

Direct economic effects: The initial increases in output from different sectors of the economy resulting from some new activity within a predefined geographic region.

Direct Effect Multiplier: The total change in regional earnings and employment in all related industries as a result of a one-dollar change in earnings and a one-job change in a given industry.

Direct jobs: The number of workers required at a site to implement an alternative.

Disposition: The ultimate "fate" or end use of a surplus Department of Energy facility following the transfer of the facility to the Office of the Assistant Secretary for Environmental Waste Management.

Dolomite: Calcium magnesium carbonate, a limestone-like mineral.

Dose: The energy imparted to matter by ionizing radiation. The unit of absorbed dose is the rad.

Dose commitment: The dose an organ or tissue would receive during a specified period of time (e.g., 50 to 100 years) as a result of intake (as by ingestion or inhalation) of one or more radionuclides from a defined release, frequently over a year's time.

Dose equivalent: The product of absorbed dose in rad (or gray) and the effect of this type of radiation in tissue and a quality factor. Dose equivalent is expressed in units of rem or Sievert, where 1 rem equals 0.01 Sievert. The dose equivalent to an organ, tissue, or the whole body will be that received from the direct exposure plus the 50-year committed dose equivalent received from the radionuclides taken into the body during the year.

Dosimeter: A small device (instrument) carried by a radiation worker that measures cumulative radiation dose (e.g., film badge or ionization chamber).

Downthrow: The rocks on the side of a fault that have moved downward relative to the rocks on the other side of the fault.

Drainage basin: An aboveground area that supplies the water to a particular stream.

Drawdown: The height difference between the natural water level in a formation and the reduced water level in the formation caused by the withdrawal of groundwater.

Drinking-water standards: The prescribed level of constituents or characteristics in a drinking water supply that cannot be exceeded legally.

Dual use/dual benefit: Projects that have uses in or benefits for the defense sector and the private industry or civilian sector.

Effective dose equivalent: The summation of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value and can be used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation that would be contributed by that particular tissue. The effective dose equivalent includes the committed effective dose equivalent from internal deposition of radionuclides, and the effective dose equivalent due to penetrating radiation from sources external to the body. Effective dose equivalent is expressed in units of rem (or Sievert).

Effluent: A gas or fluid discharged into the environment.

Emission standards: Legally enforceable limits on the quantities and/or kinds of air contaminants that can be emitted into the atmosphere.

Empirical: Something that is based on actual measurement, observation, or experience rather than on theory.

Endangered species: Defined in the Endangered Species Act of 1973 as "any species which is in danger of extinction throughout all or a significant portion of its range."

Endangered Species Act of 1973: This Act requires Federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Enduring stockpile: Weapons types expected to be retained in the smaller stockpile for the foreseeable future.

Energetic material: Generic term for high explosives and propellants.

Enhanced experimental and computational capabilities: Include aboveground experimental capabilities to study technical issues regarding weapons primaries, specifically high-resolution, multiple-time, multiple-view hydrodynamic experiments using simulant material.

Enhanced weapons and materials surveillance technologies: Includes hydrodynamic testing on test units built, when possible, with aged stockpile components (with modified pits using simulant materials) to provide important data on the effects of aging on weapons safety and performance.

Entrainment: The involuntary capture and inclusion of organisms in streams of flowing water, a term often applied to the cooling water systems. The organisms involved may include phyto- and zoo-plankton, fish eggs and larvae (ichthyoplankton), shellfish larvae, and other forms of aquatic life.

Environment, safety, and health program: In the context of the Department of Energy, encompasses those Department of Energy requirements, activities, and functions in the conduct of all Department of Energy and Department of Energy-controlled operations that are concerned with: impacts to the biosphere; compliance with environmental laws, regulations, and standards controlling air, water, and soil pollution; limiting the risks to the well-being of both operating personnel and the general public to acceptably low levels; and protecting property adequately against accidental loss and damage. Typical activities and functions related to this program include, but are not limited to, environmental protection, occupational safety, fire protection, industrial hygiene, health physics, occupational medicine, and process and facilities safety, nuclear safety, emergency preparedness, quality assurance, and radioactive and hazardous waste management.

Environmental assessment: A written environmental analysis that is prepared pursuant to the National Environmental Policy Act to determine whether a Federal action would significantly affect the environment and thus require preparation of a more detailed environmental impact statement. If the action would not significantly affect the environment, then a finding of no significant impact is prepared.

Environmental impact statement: A document required of Federal agencies by the National Environmental Policy Act for major proposals significantly affecting the environment. A tool for decision-making, it describes the positive and negative effects of the undertaking and alternative

actions.

Environmental justice: The fair treatment of people of all races, cultures, incomes, and educational levels with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no population of people should be forced to shoulder a disproportionate share of the negative environmental impacts of pollution or environmental hazards due to a lack of political or economic strength.

Environmental survey: A documented, multidisciplined assessment (with sampling and analysis) of a facility to determine environmental conditions and to identify environmental problems requiring corrective action.

Eocene: A geologic epoch early in the Cenozoic Era, dating from approximately 54 to 38 million years ago.

Epicenter: The point on the Earth's surface directly above the focus of an earthquake.

Epidemiology: The science concerned with the study of events that determine and influence the frequency and distribution of disease, injury, and other health-related events and their causes in a defined human population.

Evaluation Basis Accident (EBA): An accident, generally with small impacts to the public, initiated by operational or external causes with an estimated probability of occurrence greater than 10^{-6} per year and used for estimating the impacts of a planned new or modified facility and/or process when a Safety Analysis Report, that would define a Design Basis Accident (DBA), has not been prepared. A DBA is used to establish the performance requirements of structures, systems, and components that are necessary to maintain them in a safe shutdown condition indefinitely or to prevent or mitigate the consequences of the DBA so that the public and onsite personnel are not exposed to radiation in excess of appropriate guideline values.

Explosion (conventional): A chemical reaction or change of state that occurs in an exceedingly short time with the generation of high temperatures and large quantities of gaseous reaction products.

Explosion (nuclear): An explosion for which the energy is produced by a nuclear transformation, either fission or fusion. The term typically implies the release of enormous amounts (kilotons) of energy.

Exposure limit: The level of exposure to a hazardous chemical (set by law or a standard) at which or below which adverse human health effects are not expected to occur:

- Reference dose is the chronic exposure dose (mg or kg per day) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.
- Reference concentration is the chronic exposure concentration (mg/m3) for a given hazardous chemical at which or below which adverse human non-cancer health effects are not expected to occur.

Fault: A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred. A normal fault occurs when the hanging wall has been depressed in relation to the footwall. A reverse fault occurs when the hanging wall has been raised in relation to

the footwall.

Finding of No Significant Impact: A document by a Federal agency briefly presenting the reasons why an action, not otherwise excluded, will not have a significant effect on the human environment and will not require an environmental impact statement.

Fissile material: Plutonium-239, uranium-233, uranium-235, or any material containing any of the foregoing.

Fission: The splitting of a heavy atomic nucleus into two nuclei of lighter elements, accompanied by the release of energy and generally one or more neutrons. Fission can occur spontaneously or be induced by neutron bombardment.

Fission products: Nuclei formed by 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.

Fissure: A long and narrow crack in the earth.

Floodplain: The lowlands adjoining inland and coastal waters and relatively flat areas including at a minimum that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0 percent) floodplain. The critical action floodplain is defined as the 500-year (0.2 percent) floodplain.

Flux: Rate of flow through a unit area. See "neutron flux."

Formation: In geology, the primary unit of formal stratigraphic mapping or description. Most formations possess certain distinctive features.

Fossil: Impression or trace of an animal or plant of past geological ages that has been preserved in the earth's crust.

Fossiliferous: Containing a relatively large number of fossils.

Fugitive emissions: Emissions to the atmosphere from pumps, valves, flanges, seals, and other process points not vented through a stack. Also includes emissions from area sources such as ponds, lagoons, landfills, and piles of stored material.

Fusion: Nuclear reaction in which light nuclei are fused together to form a heavier nucleus, accompanied by the release of immense amounts of energy and fast neutrons.

Fusion ignition: A thermonuclear burn condition created when laser beams ignite and fuse a target containing a mixture of hydrogen isotopes.

Galvin Report: A study conducted for the Department of Energy as a post-Cold War assessment of DOE's ten largest laboratories. The overall objective of the study was to examine options for change within these laboratories and to propose specific alternatives for redirecting the scientific and engineering resources of these instructions toward the economic, environmental, defense, scientific, and energy needs of the Nation.

Gamma rays: High-energy, short-wavelength, electromagnetic radiation accompanying fission and emitted from the nucleus of an atom. Gamma rays are very penetrating and can be stopped only by dense materials (such as lead) or a thick layer of shielding materials.

Gaussian plume: The distribution of material (a plume) in the atmosphere resulting from the release of pollutants from a stack or other source. The distribution of concentrations about the centerline of the plume, which is assumed to decrease as a function of its distance from the source and centerline (Gaussian distribution), depends on the mean wind speed and atmospheric stability.

Genetic effects: The outcome resulting from exposure to mutagenic chemicals or radiation which results in genetic changes in germ line or somatic cells.

- Effects on genetic material in germ line (sex cells) cause trait modifications that can be passed from parents to offspring.
- Effects on genetic material in somatic cells result in tissue or organ modifications (e.g. liver tumors) that do not pass from parents to offspring.

Geologic repository (mined geologic repository): A facility for the disposal of nuclear waste; the waste is isolated by placement in a continuous, stable geologic formation at depths greater than 300 meters.

Geology: The science that deals with the Earth: the materials, processes, environments, and history of the planet, including the rocks and their formation and structure.

Getter: Organic compounds used along with desiccants to control internal environments in nuclear weapons.

Glove box: An airtight box used to work with hazardous material, vented to a closed filtering system, having gloves attached inside of the box to protect the worker.

Groundwater: The supply of water found beneath the Earth's surface, usually in aquifers, which may supply wells and springs.

Half-life (radiological): The time in which half the atoms of a radioactive substance disintegrate to another nuclear form; this varies for specific radioisotopes from millionths of a second to billions of years.

Hazard Index: A summation of the Hazard Quotients for all chemicals now being used at a site and those proposed to be added to yield cumulative levels for a site. A Hazard Index value of 1.0 or less means that no adverse human health effects (non-cancer) are expected to occur.

Hazard quotient: The value used as an assessment of non-cancer associated toxic effects of chemicals, e.g., kidney or liver dysfunction. It is independent of a cancer risk, which is calculated only for those chemicals identified as carcinogens.

Hazard chemical: Under 29 CFR 1910, Subpart Z, "hazardous chemicals" are defined as "any chemical which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and

reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic systm, and agents that damage the lungs, skin, eyes or mucous membranes.

Hazardous material: A material, including a hazardous substance, as defined by 49 CFR 171.8 which poses a risk to health, safety, and property when transported or handled.

Hazardous/toxic waste: Any solid waste (can also be semisolid or liquid, or contain gaseous material) having the characteristics of ignitability, corrosivity, toxicity, or reactivity, defined by the *Resource Conservation and Recovery Act and identified or listed in 40 CFR 261 or by the Toxic Substances Control Act*.

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

High efficiency particulate air filter: *A filter used to remove particulates from dry gaseous effluent streams.*

High energy pulsed power: *A technique used in compressing electrical energy and storing it at high levels and then releasing it to a target in a very short time.*

High explosives fabrication: *The ability to fabricate any chemical compound or mechanical mixture that, when subjected to heat, impact, fraction, friction, shock, or other suitable initiation stimulus, undergoes a very rapid chemical change with the evolution of large volumes of highly heated gases that exert pressures in the surrounding medium.*

High-level waste: *The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.*

Highly enriched uranium: *Uranium in which the abundance of the isotope uranium-235 is increased well above normal (naturally occurring) levels.*

Historic resources: *Archaeological sites, architectural structures, and objects produced after the advent of written history dating to the time of the first Euro-American contact in an area.*

Holocene: *The current epoch of geologic time, which began approximately 10,000 years ago.*

HT: *Tritiated hydrogen gas which emits a low-energy beta particle and has a half-life of 12.3 years.*

Hydraulic gradient: *The difference in hydraulic head at two points divided by the distance between two points.*

Hydrodynamic test: *High-explosive nonnuclear experiment to investigate hydrodynamic aspects of primary function up to mid to late stages of pit implosion.*

Hydrodynamics: *The study of the motion of a fluid and of the interactions of the fluid with its boundaries, especially in the case of an incompressible inviscid fluid.*

Hydrology: *The science dealing with the properties, distribution, and circulation of natural water systems.*

Hydronuclear experiment: *Very low-yield experiment (less than a few pounds of nuclear energy released) to assess primary performance and safety with normal detonation.*

Ignition: *Self-sustained fusion burn of light nuclei.*

Impingement: *The process by which aquatic organisms too large to pass through the screens of a water intake structure become caught on the screens and are unable to escape.*

Implosion: *The sudden inward compression and reduction in volume of fissionable material with ordinary explosives in a nuclear weapon.*

Incident-free risk: *The radiological or chemical impacts resulting from packages aboard vehicles in normal transport. This includes the radiation or hazardous chemical exposure of specific population groups such as crew, passengers, and bystanders.*

Indirect economic effects: *Indirect effects result from the need to supply industries experiencing direct economic effects with additional outputs to allow them to increase their production. The additional output from each directly affected industry requires inputs from other industries within a region (i.e., purchases of goods and services). This results in a multiplier effect to show the change in total economic activity resulting from a new activity in a region.*

Induced economic effects: *The spending of households resulting from direct and indirect economic effects. Increases in output from a new economic activity lead to an increase in household spending throughout the economy as firms increase their labor inputs.*

Indirect jobs: *Within a regional economic area, jobs generated or lost in related industries as a result of a change in direct employment.*

Inertial confinement fusion (ICF): *A laser initiated nuclear fusion using the inertial properties of the reactants as a confinement mechanism.*

Injection wells: *A well that takes water from the surface into the ground, either through gravity or by mechanical means.*

Insensitive high explosive: *A high explosive that is specifically formulated to be less sensitive to shock and other stimuli that might be encountered in an accident; usually based on the compound TATB (triaminotrinitrobenzene); insensitive high explosives have lower energy densities than conventional high explosives and thus more material is required to produce the same explosive energy.*

Interbedded: *Occurring between beds or lying in a bed parallel to other beds of a different material.*

Interim (permit) status: *Period during which treatment, storage, and disposal facilities coming under the Resource Conservation and Recovery Act of 1980 are temporarily permitted to operate while awaiting denial or issuance of a permanent permit.*

Intrusive pit reuse: *A process which involves opening of a pit, modifying internal surfaces and features, and reassembly.*

Ion: *An atom that has too many or too few electrons, causing it to be chemically active; an electron that is not associated (in orbit) with a nucleus.*

Ion exchange: *A unit physiochemical process that removes anions and cations, including radionuclides, from liquid streams (usually water) for the purpose of purification or decontamination.*

Ionizing radiation: *Alpha particles, beta particles, gamma rays, x rays, neutrons, high speed electrons, high speed protons, and other particles or electromagnetic radiation that can displace electrons from atoms or molecules, thereby producing ions.*

Isotope: *An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of protons but different numbers of neutrons and different atomic masses.*

Joint test assembly: *A nonnuclear test configuration, with diagnostic instrumentation, of a warhead or bomb.*

Joule: *A metric unit of energy, work, or heat, equivalent to 1 watt-second, 0.737 foot-pound, or 0.239 calories.*

Klystron: *An electron tube used for the generation of ultrahigh-frequency current.*

Lacustrine wetland: *Lakes, ponds, and other enclosed open waters at least 8 ha (20 acres) in extent and not dominated by trees, shrubs, and emergent vegetation.*

Large release: *A release of radioactive material that would result in doses greater than 25 rem to the whole body or 300 rem to the thyroid at 1.6 kilometer from the control perimeter (security fence) of a reactor facility.*

Laser: *A device that produces a beam of monochromatic (single-color) "light" in which the waves of light are all in phase. This condition creates a beam that has relatively little scattering and has a high concentration of energy per unit area.*

Latent fatalities: *Fatalities associated with acute and chronic environmental exposures to chemical or radiation.*

Limited-lifetime component: *A weapon component that decays with age and must be replaced periodically.*

Lithic: *Pertaining to stone or a stone tool.*

Loam: *A soil composed of a mixture of clay, silt, sand, and organic matter.*

Long-lived radionuclides: *Radioactive isotopes with half-lives greater than about 30 years.*

Low-level waste: *Waste that contains radioactivity but is not classified as high-level waste, transuranic waste, spent nuclear fuel, or "11e(2) by-product material" as defined by DOE Order 5820.2A, Radioactive Waste Management. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranic waste is less than 100 nanocuries per gram. Some low-level waste is considered classified because of the nature of the generating process and/or constituents, because the waste would tell too much about the process.*

Manufacturing: see "production".

Maximum contaminant level: *The maximum permissible level of a contaminant in water delivered to any user of a public water system. Maximum contaminant levels are enforceable standards.*

Maximally exposed individual: *A hypothetical person who could potentially receive the maximum dose of radiation or hazardous chemicals.*

Megajoule: *A unit of heat, work, or energy equal to 1 million joules. See "Joule".*

Megawatt: *A unit of power equal to 1 million watts. Megawatt thermal is commonly used to define heat produced, while megawatt electric defines electricity produced.*

Meteorology: *The science dealing with the atmosphere and its phenomena, especially as relating to weather.*

Microelectronics: *Integrated circuits and electronic devices constructed of individual circuit elements with dimensions of micrometers (10-6 m) on a carrier with dimensions of a centimeter (10-2 m).*

Migration: *The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.*

Migratory Bird Treaty Act: *This act states that it is unlawful to pursue, take, attempt to take, capture, possess, or kill any migratory bird, or any part, nest, or egg of any such bird other than permitted activities.*

Miller Report: *A report subsequently published by SNL as Stockpile Surveillance Past and Future (SAND 95-2751) that describes a number of weapons systems that have been in the Nation's stockpile. The report provides historical examples of some of the problems with systems and documents several examples of unanticipated problems that arose following deployment of a weapons system of the stockpile.*

Miocene Epoch: *Geologic time in the Cenozoic Era dating from 26 to 7 million years ago.*

Mix: *Mixing of materials, usually with different densities and velocities, that can adversely affect*

nuclear weapon performance.

Mixed waste: *Waste that contains both "hazardous waste" and "radioactive waste" as defined in this glossary.*

Mock nuclear material: *Material that is nonradioactive and nonfissile but similar in density and other characteristics to nuclear material and is used in place of a weapon's nuclear parts in hydrodynamic experiments and flight tests.*

Modified Mercalli intensity: *A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground shaking with 12 divisions, from I (not felt by people) to XII (damage nearly total).*

National Ambient Air Quality Standards: *Air quality standards established by the Clean Air Act, as amended. The primary National Ambient Air Quality Standards are intended to protect the public health with an adequate margin of safety, and the secondary National Ambient Air Quality Standards are intended to protect the public welfare from any known or anticipated adverse effects of a pollutant.*

National Emission Standards for Hazardous Air Pollutants: *A set of national emission standards for listed hazardous pollutants emitted from specific classes or categories of new and existing sources. These were implemented in the Clean Air Act Amendments of 1977.*

National Environmental Policy Act of 1969: *This Act is the basic national charter for the protection of the environment. It requires the preparation of an environmental impact statement for every major Federal action that may significantly affect the quality of the human or natural environment. Its main purpose is to provide environmental information to decision makers and the public so that actions are based on an understanding of the potential environmental consequences of a proposed action and its reasonable alternatives.*

National Environmental Research Park: *An outdoor laboratory set aside for ecological research to study the environmental impacts of energy developments. National environmental research parks were established by the Department of Energy to provide protected land areas for research and education in the environmental sciences and to demonstrate the environmental compatibility of energy technology development and use.*

National Historic Preservation Act of 1966, as amended: *This Act provides that property resources with significant national historic value be placed on the National Register of Historic Places. It does not require any permits but, pursuant to Federal code, if a proposed action might impact an historic property resource, it mandates consultation with the proper agencies.*

National Pollutant Discharge Elimination System: *Federal permitting system required for hazardous effluents regulated through the Clean Water Act, as amended.*

National Register of Historic Places: *A list maintained by the Secretary of the Interior of districts, sites, buildings, structures, and objects of prehistoric or historic local, state, or national significance. The list is expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a)(1)(A) of the National Historic Preservation Act of 1966, as amended.*

Neutron: *An uncharged elementary particle with a mass slightly greater than that of the proton, found in the nucleus of every atom heavier than hydrogen-1; a free neutron is unstable and decays with a half-life of about 13 minutes into an electron and a proton.*

Neutron flux: *The product of neutron number density and velocity (energy) giving an apparent number of neutrons flowing through a unit area per unit time.*

Nitrogen oxides: *Refers to the oxides of nitrogen, primarily NO (nitrogen oxide) and NO2 (nitrogen dioxide). These are produced in the combustion of fossil fuels and can constitute an air pollution problem. When nitrogen dioxide combines with volatile organic compounds, such as ammonia or carbon monoxide, ozone is produced.*

Nonattainment area: *An air quality control region (or portion thereof) in which the Environmental Protection Agency has determined that ambient air concentrations exceed national ambient air quality standards for one or more criteria pollutants.*

Nondestructive evaluation: *Test method that does not involve damage to or destruction of the test sample; includes the use of ultrasonics, radiography, magnetic flux, and other techniques.*

Nonintrusive modification pit *reuse: Process which includes modification to the external surfaces and features of the pit. The pit remains sealed with the possible exception of cutting the pit tube.*

Noninvasive imaging: *Imaging method that does not damage the test specimen; includes radiography, computed tomography, and other techniques.*

Nonnuclear component: *Any one of thousands of parts that do not contain radioactive or fissile material that are required in a nuclear weapon.*

Nonnuclear fabrication: *Ability to fabricate nonnuclear components and perform nonnuclear component surveillance.*

Nonproliferation: *Preventing the spread of nuclear weapons, nuclear weapon materials, and nuclear weapon technology.*

Nonproliferation Treaty: *A treaty with the aim of controlling the spread of nuclear weapons technologies, limiting the number of nuclear weapons states and pursuing, in good faith, effective measures relating to the cessation of the nuclear arms race. They treaty does not invoke stockpile reductions by nuclear states, and it does not address actions of nuclear states in maintaining their stockpiles.*

Nova: *A 10- beam, 100-TW neodymium glass fusion laser facility at Lawrence Livermore National Laboratory that was completed in 1984 and used for inertial confinement fusion target irradiation experiments.*

Nuclear assembly: *Collective term for the primary, secondary, and radiation case.*

Nuclear component: *A part of a nuclear weapon that contains fissionable or fusionable material.*

Nuclear facility: *A facility whose operations involve radioactive materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. Included are facilities that: produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium; conduct separations operations; conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations. Incidental use of radioactive materials in a facility operation (e.g.,check sources, radioactive sources, and X-ray machines) does not necessarily require a facility to be included in this definition.*

Nuclear grade: *Material of a quality adequate for use in a nuclear application.*

Nuclear material: *Composite term applied to: (1) special nuclear material; (2) source material such as uranium or thorium or ores containing uranium or thorium; and (3) by-product material, which is any radioactive material that is made radioactive by exposure to the radiation incident to the process of producing or using special nuclear material.*

Nuclear Posture Review: *A report, led by the Department of Defense, which addressed possible changes in U.S. nuclear policy (e.g., deployment status, targeting, force structure) and which recommendations and decisions will likely dictate further changes in the U.S. nuclear weapons program. The nuclear posture review commits the U.S. to maintaining a safe and reliable nuclear deterrent.*

Nuclear production: *Production operations for components of nuclear weapons that are fabricated from nuclear materials, including plutonium and uranium.*

Nuclear reaction: *A reaction in which an atomic nucleus is transformed into another isotope of that respective nuclide, or into another element altogether; it is always accompanied by the liberation of either particles or energy.*

Nuclear warhead: *A warhead that contains fissionable and fusionable material, the nuclear assembly, and nonnuclear components packaged as a deliverable weapon.*

Nuclear weapon: *The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.*

Nuclear Weapons Complex: *The sites supporting the research, development, design, manufacture, testing, assessment, certification and maintenance of the Nation's nuclear weapons and the subsequent dismantlement of retired weapons.*

Nuclide: *A species of atom characterized by the constitution of its nucleus and hence by the number of protons, the number of neutrons, and the energy content.*

Numerical simulation: *The use of mathematical algorithms and models of physical processes to calculationally simulate the behavior or performance of a device or complex system.*

Obsidian: *A black volcanic glass.*

Occupational Safety and Health Administration: *Oversees and regulates workplace health and safety, created by the Occupational Safety and Health Act of 1970.*

Offsite: *As used in this PEIS, the term denotes a location, facility, or activity occurring outside of the boundary of the entire DOE Complex site (ORR, SRS, Pantex, KCP, SNL, LANL, LLNL, or NTS). At sites which have detached remote locations (e.g., LLNL and Pantex) the term includes these boundaries or a part of the main site.*

Onsite: *As used in this PEIS, the term denotes a location or activity occurring somewhere within the boundary of the DOE Complex site (ORR, SRS, Pantex, KCP, SNL, LANL, LLNL, or NTS).*

Onsite population: *Department of Energy and contractor employees who are on duty, and badged onsite visitors.*

Operable unit: *A discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration or eliminates or mitigates a release, threat of release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units.*

Outfall: *The discharge point of a drain, sewer, or pipe as it empties into a body of water.*

Ozone: *The triatomic form of oxygen; in the stratosphere, ozone protects the Earth from the sun's ultraviolet rays, but in lower levels of the atmosphere ozone is considered an air pollutant.*

Packaging: *The assembly of components necessary to ensure compliance with Federal regulations. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shocks. The vehicle tie-down system and auxiliary equipment may be designated as part of the packaging.*

Paleontology: *The study of fossils.*

Paleozoic Era: *Geologic time dating from 570 million to 245 million years ago when seed-bearing plants, amphibians, and reptiles first appeared.*

Palustrine wetland: *Nontidal wetlands dominated by trees, shrubs, and emergent vegetation.*

Perched groundwater: *A body of groundwater of small lateral dimensions lying above a more extensive aquifer.*

Performance: The ability of a nuclear weapon or weapon system to operate in specified manner (e.g., yield, range, accuracy, radiation spectrum) under stated conditions. (Essentially equivalent to reliability.)

Permeability: geology, t *he ability of rock or soil to transmit a fluid.*

Person-rem: *The unit of collective radiation dose commitment to a given population; the sum of the individual doses received by a population segment.*

Physical setting: *The land and water form, vegetation, and structures that compose the landscape.*

Physics dealing with weapons primary: *Issues related to the reliability and safety of the primary*

high explosive and plutonium core, which is involved in the reaction up to the point where nuclear criticality is achieved. Without proper primary-stage function, the weapon secondary will not work.

Physics dealing with weapons secondary: *Issues related to the implosion of the secondary portion of uranium and lithium, a nuclear reaction that results in the thermonuclear explosion.*

Pit: *The central core of a nuclear weapon containing plutonium-239 and/or highly enriched uranium that undergoes fission when compressed by high explosives. The pit and the high explosive are known as the primary of a nuclear weapon.*

Plasma: *An electrically neutral, gaseous mixture of positive and negative ions, sometimes called a fourth state of matter since it behaves differently from solids, liquids, and gases. High-temperature, high-density plasmas are created in nuclear weapons and inertial confinement fusion (ICF) experiments.*

Playa: *A basin or a closed depression found within a dry environment that may contain water on a seasonal basis.*

Pleistocene Epoch: *Geologic time that occurred approximately 11,000 to 2 million years ago.*

Pliocene Epoch: *Geologic time between the Miocene and the Pleistocene epochs approximately 2 to 7 million years ago.*

Plume: *The elongated pattern of contaminated air or water originating at a point source, such as a smokestack or a hazardous waste disposal site.*

Plume immersion: *Occurs when an individual is enveloped by a cloud of radioactive gaseous effluent and receives an external radiation dose.*

Plutonium: *A heavy, radioactive, metallic element with the atomic number 94. It is produced artificially in a reactor by bombardment of uranium with neutrons and is used in the production of nuclear weapons.*

Potentiometric surface: *An imaginary surface defined by the level that water will rise to in a tightly-cased well.*

Pounds per square inch: *A measure of pressure; atmospheric pressure is about 14.7 pounds per square inch.*

Prehistoric: *Predating written history. In North America, also predating contact with Europeans.*

Prevention of Significant Deterioration: *Regulations established by the 1977 Clean Air Act Amendments to limit increases in criteria air pollutant concentrations above baseline.*

Prime farmland: *Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion, as determined by the Secretary of Agriculture (Farmland Protection Policy Act of 1981, 7 CFR 7, paragraph 658).*

Probable maximum flood: *Flood levels predicted for a scenario having hydrological conditions that maximize the flow of surface waters.*

Product realization: *The process that converts the nuclear assembly, nonnuclear components, subsystems, and system-level requirements into manufacturable designs and hardware.*

Production: Encompasses the fabrication, processing, assembly, and acceptance testing of nuclear weapons and nuclear weapon components, and is interchangeable with the term manufacturing.

Programmatic Environmental Impact Statement (PEIS): *A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of proposed Federal Actions that involve multiple decisions potentially affecting the environment at one or more sites.*

Project-specific EIS: *A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of a single action at a single site.*

Proliferation: *The spread of nuclear weapons and the materials and technologies used to produce them.*

Protected area: *An area encompassed by physical barriers, subject to access controls, surrounding material access areas, and meeting the standards of DOE Order 5632.1C, Protection and Control of Safeguards and Security Interests .*

Quality factor: *The principal modifying factor that is employed to derive dose equivalent from absorbed dose.*

Rad: *See "radiation absorbed dose."*

Radiation: *The particles or electromagnetic energy emitted from the nuclei of radioactive atoms. Some elements are naturally radioactive; others are induced to become radioactive by bombardment in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.*

Radiation absorbed dose: *The basic unit of absorbed dose equal to the absorption of 0.01 joule per kilogram of absorbing material.*

Radioactive waste: *Materials from nuclear operations that are radioactive or are contaminated with radioactive materials, and for which use, reuse, or recovery are impractical.*

Radioactivity: *The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation.*

Radioisotopes: *Radioactive nuclides of the same element (same number of protons in their nuclei) that differ in the number of neutrons.*

Radionuclide: *A radioactive element characterized according to its atomic mass and atomic number which can be man-made or naturally occurring. Radionuclides can have a long life as soil or water pollutants, and are believed to have potentially mutagenic or carcinogenic effects on the human*

body.

Radon: *Gaseous, radioactive element with the atomic number 86 resulting from the radioactive decay of radium. Radon occurs naturally in the environment, and can collect in unventilated enclosed areas, such as basements. Large concentrations of radon can cause lung cancer in humans.*

RADTRAN: *A computer code combining user-determined meteorological, demographic, transportation, packaging, and material factors with health physics data to calculate the expected radiological consequences and accident risk of transporting radioactive material.*

Reasonably Available Control Technology (RACT): *The lowest emissions limit that a particular source is capable of meeting by the application of control technology that is reasonably available as well as technologically and economically feasible.*

Receiving waters: *Rivers, lakes, oceans, or other bodies of water into which wastewaters are discharged.*

Recharge: *Replenishment of water to an aquifer.*

Record of Decision: *A document prepared in accordance with the requirements of 40 CFR 1505.2 that provides a concise public record of DOE's decision on a proposed action for which an EIS was prepared. A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by DOE in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not.*

Regional economic area*: A geographic area consisting of an economic node and the surrounding counties that are economically related and include the places of work and residences of the labor force. Each regional economic area is defined by the U.S. Bureau of Economic Analysis.*

Region of influence (ROI): *A site-specific geographic area that includes the counties where approximately 90 percent of the current DOE and/or contractor employees reside.*

Reliability: *The ability of a nuclear weapon, weapon system, or weapon component to perform its required function under stated conditions for a specified period of time. (Essentially equivalent to performance.)*

Rem: *See "roentgen equivalent man."*

Remediation: *The process, or a phase in the process, of rendering radioactive, hazardous, or mixed waste environmentally safe, whether through processing, entombment, or other methods.*

Replacement Pit Fabrication: *This function includes the fabrication, surveillance, and storage of the primary high explosive and plutonium core of a nuclear weapon.*

Replacement Secondary Fabrication: *This function includes the fabrication, surveillance, and storage of the secondary uranium and lithium portion of a nuclear weapon.*

Resource Conservation and Recovery Act, as amended: *The Act that provides "cradle to grave" regulatory program for hazardous waste which established, among other things, a system for*

managing hazardous waste from its generation until its ultimate disposal.

Retrofit: *To furnish (e.g., a weapon) with new parts, equipment, or features not available at the time of manufacture.*

Rhyolite: *A volcanic rock rich in silica; the volcanic equivalent of granite.*

Rightsizing: *Denotes the facility modification, rearrangement, and refurbishment necessary to size future weapon manufacturing facilities appropriately for the workload to be accomplished. In general, rightsizing involves reductions in the size of facilities, but not in their capabilities. Rightsizing is not driven by assumptions about future DOE budget levels, but rather is driven by the need to size facilities at the level necessary for long-term workload accomplishment.*

Riparian wetlands: *Wetlands on or around rivers and streams.*

Risk: *A quantitative or qualitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.*

Risk assessment (chemical or radiological): *The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or radiological materials.*

Roentgen: *A unit of exposure to ionizing X- or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air. It is approximately equal to 1 rad.*

Roentgen equivalent man: *The unit of radiation dose for biological absorption: equal to the product of the absorbed dose, in rads, a quality factor which accounts for the variation in biological effectiveness of different types of radiation. Also known as "rem".*

Runoff: *The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.*

Safe Drinking Water Act, as amended: *This Act protects the quality of public water supplies, water supply and distribution systems, and all sources of drinking water.*

Safe secure trailer: *A specially designed semitrailer, pulled by an armored tractor, which is used for the safe, secure transportation of cargo containing nuclear weapons or special nuclear material.*

Safety: *Minimizing the possibility that a nuclear weapon will be exposed to accidents and preventing the possibility of nuclear yield or plutonium dispersal should there be an accident involving a nuclear weapon.*

Safety Analysis Report: *A safety document providing a concise but complete description and safety evaluation of a site, design, normal and emergency operation, potential accidents, predicted consequences of such accidents, and the means proposed to prevent such accidents or mitigate their consequences. A safety analysis report is designated as final when it is based on final design information. Otherwise, it is designated as preliminary.*

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.

Sandstone: *A sedimentary rock predominantly containing individual mineral grains visible to the unaided eye.*

Sanitary wastes: *Wastes generated by normal housekeeping activities, liquid or solid (includes sludge), which are not hazardous or radioactive.*

Sanitization: *An irreversible modification or destruction of a component or part of a component to the extent required to prevent revealing classified or otherwise controlled information.*

Scope: *In a document prepared pursuant to the National Environmental Policy Act of 1969, the range of actions, alternatives, and impacts to be considered.*

Scoping: *Involves the solicitation of comments from interested persons, groups, and agencies at public meetings, public workshops, in writing, electronically, or via fax to assist DOE in defining the proposed action, identifying alternatives, and developing preliminary issues to be addressed in an EIS.*

Scrubber: *An air pollution control device that uses a spray of water or reactant or a dry process to trap pollutants in emissions.*

Sealed pit: *A nuclear weapon pit that is hermetically closed to protect nuclear materials from the environment. Note: This is the unclassified definition from the Weapons Program Classification Guide (CG-W-5). "Pit" is already defined in the glossary.*

Secondary: *See "weapon secondary."*

Security: *Minimizing the likelihood of unauthorized access to or loss of custody of a nuclear weapon or weapon system, and ensuring that the weapon can be recovered should unauthorized access or loss of custody occur.*

Sedimentation: *The settling out of soil and mineral solids from suspension in water.*

Seismic: *Pertaining to any earth vibration, especially an earthquake.*

Seismic zone: *An area defined by the Uniform Building Code (1991), designating the amount of damage to be expected as the result of earthquakes. The United States is divided into six zones: (1) Zone 0 - no damage; (2) Zone 1 - minor damage; corresponds to intensities V and VI of the modified Mercalli intensity scale; (3) Zone 2A - moderate damage; corresponds to intensity VII of the modified Mercalli intensity scale (eastern U.S.); (4) Zone 2B - slightly more damage than 2A (western U.S.); (5) Zone 3 - major damage; corresponds to intensity VII and higher of the modified Mercalli intensity scale; (6) Zone 4 - areas within Zone 3 determined by proximity to certain major fault systems.*

Seismicity: *The tendency for the occurrence of earthquakes.*

Self-aware weapon: *A stockpile weapon fitted with an integrated network of miniature "smart" sensors (sensing and measuring devices with built-in intelligence capabilities) and self-test features that monitor the weapon's environment (e.g., temperature, moisture, vibration), detect material*

decomposition products and corrosion, check cable continuity, determine the functionality of weapon subsystems, and alert a central location if any monitored parameters are outside the permitted range.

Severe accident: *An accident with a frequency rate of less than 10-6 per year that would have more severe consequences than a design-basis accident, in terms of damage to the facility, offsite consequences, or both.*

Sewage: *The total of organic waste and wastewater generated by an industrial establishment or a community.*

Shielding: *Any material of obstruction (bulkheads, walls, or other constructions) that absorbs radiation in order to protect personnel or equipment.*

Short-lived nuclides: *Radioactive isotopes with half-lives no greater than about 30 years (e.g., cesium-137 and strontium-90).*

Shrink-swell potential: *Refers to the potential for soils to contract while drying and expand after wetting.*

Silt: *A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.*

Siltstone: *A sedimentary rock composed of fine textured minerals.*

Simulant material: *Materials used to modify a weapon pit to prevent the device from becoming critical.*

Site-Wide EIS: *A legal document prepared in accordance with the requirements of 102(2)(C) of NEPA which evaluates the environmental impacts of many actions at one large, multiple-facility DOE site. Site-wide EISs are used to support specific decisions.*

Source term: *The estimated quantities of radionuclides or chemical pollutants released to the environment.*

Special nuclear materials: *As defined in Section 11 of the Atomic Energy Act of 1954, special nuclear material means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Nuclear Regulatory Commission determines to be special nuclear material or (2) any material artificially enriched by any of the foregoing.*

Standardization (Epidemiology): *Techniques used to control the effects of differences (e.g., age) between populations when comparing disease experience. The two main methods are:*

- *Direct method, in which specific disease rates in the study population are averaged, using as weights the distribution of the comparison population.*
- *Indirect method, in which the specific disease rates in the comparison population are averaged, using as weights the distribution of the study population.*

START I and II: *Terms which refer to negotiations between the U.S. and Russia (the former Soviet Union during START I negotiations) aimed at limiting and reducing nuclear arms. START I*

discussions began in 1982 and eventually led to a ratified treaty in 1988. The START II protocol, which has not been fully ratified, will attempt to further reduce the acceptable levels of nuclear weapons ratified in START I.

Steppe: *A semi-arid, grass-covered, and generally treeless plain.*

Stockpile assurance: *The umbrella term for stockpile management and stockpile stewardship; all the tasks required to ensure that the U.S. has a credible nuclear deterrent.*

Stockpile surveillance*: Routine and periodic examination, evaluation, and testing of stockpile weapons and weapon components to ensure that they conform to performance specifications and to identify and evaluate the effect of unexpected or age-related requirements.*

Strategic reserve: *That quantity of plutonium and highly enriched uranium reserved for future weapons use. For the purposes of this PEIS, strategic reserves of plutonium will be in the form of pits, and strategic reserves of highly enriched uranium will be in the form of canned secondary assemblies. Strategic reserves also include limited quantities of plutonium and highly enriched uranium metal maintained as working inventory at DOE laboratories.*

Stratigraphy: *Division of geology dealing with the definition and description of rocks and soils, especially sedimentary rocks.*

Strike: *The direction or trend that a structural surface (e.g., a bedding or fault plane) takes as it intersects the horizontal.*

Subcritical experiment: *A dynamic experiment that involves the use of special nuclear material and does not achieve a condition of criticality (i.e., no self-sustaining nuclear reaction).*

Superfund Amendments and Reauthorization Act of 1986: *Public Law 99-499 passed in 1986 which amends the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. SARA more stringently defines hazardous waste cleanup standards and emphasizes remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes. Title III of SARA, the Emergency Planning and Community Right-to-Know Act , mandates establishment of community emergency planning programs, emergency notification, reporting of chemicals, and emission inventories.*

Surface water: *Water on the Earth's surface, as distinguished from water in the ground (groundwater).*

System integration: *The process by which individual components are engineered into a system that meets performance requirements.*

Tertiary Period: *The first geologic period of the Cenozoic Era, dating from 66 million to about 3 million years ago. During this time, mammals became the dominant life form.*

Test readiness: *Maintaining the critical technologies, staff skills, and infrastructure to be able to resume nuclear testing if and when mandated by the President.*

Thermonuclear: *The process by which very high temperatures are used to bring about the fusion of*

light nuclei, such as deuterium and tritium, with the accompanying release of energy.

Third Thirds waste: The Environmental Protection Agency *proposed the Third Thirds Rule, as required by the Hazardous and Solid Waste Amendments of 1984, to establish treatment standards and effective dates for all wastes (including characteristic wastes) for which treatment standards had not yet been promulgated (40 CFR 268.12), including derived-from wastes (i.e., multi-source leachage), and for mixed radioactive/hazardous wastes.*

Threatened species: *Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.*

Threshold limit values: *The recommended concentrations of contaminants workers may be exposed to according to the American Council of Governmental Industrial Hygienists.*

Tokamak: *A toroidal (doughnut-shaped) chamber for electromagnetic confinement of plasmas, used in fusion-related experiments and research.*

Toxic Substances Control Act of 1976: *This Act authorizes the Environmental Protection Agency to secure information on all new and existing chemical substances and to control any of these substances determined to cause an unreasonable risk to public health or the environment. This law requires that the health and environmental effects of all new chemicals be reviewed by the Environmental Protection Agency before they are manufactured for commercial purposes.*

Transuranic waste: *Waste contaminated with alpha-emitting radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries/gram at time of assay.*

Tritium: *A radioactive isotope of the element hydrogen with two neutrons and one proton. Common symbols for the isotope are H-3 and T.*

Unconfined aquifer: *A permeable geological unit having the following properties: a water-filled pore space (saturated), the capability to transmit significant quantities of water under ordinary differences in pressure, and an upper water boundary that is at atmospheric pressure.*

Unreviewed safety question: *A proposed change, test, or experiment is considered to involve an unreviewed safety question if (1) the probability of occurrence or the consequences of an accident or malfunction of equipment important to safety evaluated previously by safety analyses will be significantly increased or (2) a possibility for an accident or malfunction of a different type than any evaluated previously by safety analyses will be created that will result in significant safety consequences.*

Unsaturated zone (vadose): *A region in a porous medium in which the pore space is not filled with water.*

Unusual occurrence: *Any unusual or unplanned event that adversely affects or potentially affects the performance, reliability, or safety of a facility.*

Uranium: *A naturally occuring heavy, silvery-white metallic element (atomic number 92) with many radioactive isotopes. Uranium-235 is most commonly used as a fuel for nuclear fission. Another isotope, uranium-238, can be transformed into fissionable plutonium-239 following its capture of a*

neutron in a nuclear reactor.

Vitrification: *A waste treatment process that uses glass (e.g., borosilicate glass) to encapsulate or immobilize radioactive wastes to prevent them from reacting with the surroundings in disposal sites.*

Volatile organic compounds: *A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures, such as benzene, chloroform, and methyl alcohol.*

War Reserve: *Operational weapons and materials designated as essential for national security needs.*

Warhead: *Collective term for the package of nuclear assembly and nonnuclear components that can be mated with a delivery vehicle or carrier to produce a deliverable nuclear weapon.*

Waste Isolation Pilot Plant: *A facility in southeastern New Mexico being developed as the disposal site for transuranic waste, not yet in operation.*

Waste minimization and pollution prevention: *An action that economically avoids or reduces the generation of waste and pollution by source reduction, reducing the toxicity of hazardous waste and pollution, improving energy use, or recycling. These actions will be consistent with the general goal of minimizing present and future threats to human health, safety, and the environment.*

Water table: *Water under the surface of the ground occurs in two zones, an upper unsaturated zone and the deeper saturated zone. The boundary between the two zones is the water table.*

Weaponization: *Converting the functional requirements for a weapon into integrated systems designs and prototype hardware.*

Weapon primary: *The crucial subsystem for weapon reliability and safety; the primary contains the main high explosive and the plutonium that comprise the principal safety concerns. Without proper primary-stage function, the secondary will not work.*

Weapon secondary: *Provides additional explosive energy release; composed of lithium deuteride and other materials. As the secondary implodes, the lithium in the isotopy form lithium-6. is converted to tritium by neutron interactions, and the tritium product in turn undergoes fusion with the deuterium to create the thermonuclear explosion.*

Weapons-grade: *Fissionable material in which the abundance of fissionable isotopes is high enough that the material is suitable for use in thermonuclear weapons.*

Weapons assembly/disassembly: *Assembly operations assembles piece parts into subassemblies using joining techniques such as welding, adhesive bonding, and mechanical joining. Disassembly takes retired weapons apart and recycles all materials of value.*

Weapons effects: *Deals with outputs of nuclear weapons and the associated effects on materials and the environment.*

Weapons laboratories: *Colloquial term for the three Department of Energy national laboratories--Los Alamos, Lawrence Livermore, and Sandia--that are responsible for the design, development, and*

stewardship of U.S. nuclear weapons.

Weapon system: *Collective term for the nuclear assembly and nonnuclear components, subsytems, and systems that comprise a nuclear weapon.*

Weighting factor: *Represents the fraction of the total health risk resulting from uniform whole-body irradiation that could be contributed to that particular tissue.*

Wetland: *Land or areas exhibiting hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions.*

Whole-body dose: *Dose resulting from the uniform exposure of all organs and tissues in a human body. (Also, see "effective dose equivalent.")*

Wind rose: *A depiction of wind speed and direction frequency for a given period of time.*

Worker year: *Measurement of labor requirement equal to 1 full time worker employed for 1 year.*

X/Q (Chi/Q): *The relative calculated air concentration due to a specific air release; units are* (sec/m^3). *For example,* $(Ci/m^3)/(Ci/sec)=(sec/m3)$ *or* $(g/m^3)/(g/sec)=(sec/m^3)$.

Yield: *The force in tons of TNT of a nuclear or thermonuclear explosion.*

Zero-based stockpile: *A nuclear weapons stockpile with zero nuclear weapons and therefore requiring no stockpile management effort.*

APPENDIX A: STOCKPILE STEWARDSHIP AND MANAGEMENT FACILITIES

The Nuclear Weapons Complex (Complex) comprises facilities located at eight major U.S. Department of Energy (DOE) sites, distributed over seven states. Summary descriptions of the Complex sites are presented in chapter 3. This appendix provides more detailed information.

The eight DOE sites described in appendix A include the Oak Ridge Reservation (ORR), the Savannah River Site (SRS), the Kansas City Plant (KCP), the Pantex Plant (Pantex), Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), and the Nevada Test Site (NTS). The first section of this appendix provides reference operating assumptions for each of these sites. Information provided includes specific site descriptions, current missions, and environmental regulatory compliance activities associated with ongoing DOE Office of the Assistant Secretary for Defense Programs (DP), and other DOE and non-DOE programs.

Detailed descriptions of the proposed stockpile stewardship projects can be found in the project-specific analyses contained in appendixes I, J, and K for the National Ignition Facility (NIF), Contained Firing Facility (CFF), and Atlas Facility, respectively.

The last section of this appendix provides detailed descriptions of the stockpile management alternatives. Each description includes specific information describing missions, assumptions, functional parameters, expected capabilities, process descriptions, special process requirements, utilities, chemicals used, operational resources, and transportation.

A.1 Reference Operating Assumptions

The reference base for this Programmatic Environmental Impact Statement (PEIS) is No Action, which is defined in chapter 3. Section 3.3 defines No Action for stewardship and section 3.4 defines No Action for management. No Action allows a comparison of stockpile stewardship and management alternatives for the candidate sites against the configuration as it would be expected to operate in 2005 and beyond, not against the current nuclear weapons facility configuration.

No Action assumes that all sites of the Complex would continue their current nuclear weapons-related missions with existing facilities that can comply with environment, safety, and health (ES&H) requirements, and at a production or research level that is consistent with current DOE guidance. The basic nuclear weapons missions assigned to the sites include researching, developing, and testing; maintaining nuclear weapons production and testing capability; processing and storing nuclear materials; operating an extensive transportation safeguards system to assure the safe, secure movement of weapons and strategic quantities of nuclear materials within the continental United States; and cooperating with the Department of Defense (DOD) in responding to nuclear accidents or incidents throughout the world.

Under No Action, the siting and construction of major new stockpile stewardship and management facilities would not occur, there would be no upgrades or modifications to existing facilities other than routine maintenance and repairs, no nuclear weapons missions would be transferred, and future support of the nuclear weapons stockpile would be provided within the confines of the existing

Complex capabilities. Some mission requirements for maintenance of the weapons stockpile in the future would not be met under No Action; however, No Action includes those mission requirements as a comparison for the stockpile stewardship and management alternatives. The No Action alternative assumes that weapons Complex sites would continue existing waste management programs which currently support weapons work to meet legal requirements and commitments in formal agreements and would proceed with ongoing cleanup activities related to past weapons work at these sites. Production facilities and support roles at specific sites, however, would be downsized or eliminated in accordance with the reduced workload projected for 2005 and beyond. Facilities that could not comply with requirements would no longer be used.

Detailed reference descriptions of the affected sites follow. These descriptions include discussions of the site location, missions, facility operations, and environmental regulatory compliance. Seismic zone locations of alternative sites are shown in figure A.1-1.

A.1.1 Oak Ridge Reservation

Site Description.ORR consists of approximately 13,980 hectares (ha) (34,545 acres) of Federal-owned lands located directly to the west and south, but within the incorporated city limits of Oak Ridge, TN. The residential section of Oak Ridge forms the northern boundary of the reservation. The Tennessee Valley Authority's Melton Hill and Watts Bar reservoirs on the Clinch and Tennessee Rivers form the eastern, southern, and western boundaries. The city of Oak Ridge and ORR are within the region known as the Great Valley of the Tennessee River, which lies between the Cumberland and Great Smoky Mountains. About 16 kilometers (km) (10 miles [mi]) to the northwest, the Cumberland Mountains rise to an elevation of 914 meters (m) (3,000 feet [ft]) or more, while the Great Smoky Mountains National Park reaches to heights over 2,000 m (6,600 ft) some 113 km (70 mi) to the southeast. The largest city in the area, Knoxville, is located approximately 48 km (30 mi) to the southeast. Land use in the five-county area surrounding ORR varies from the heavily populated and highly developed urban areas around Knoxville to the sparsely populated areas immediately surrounding ORR. The largest single land use for each of the five counties is forestry; the second most common land use is agriculture. The locations of ORR and its principal facilities are shown in figures A.1.1-1 and A.1.1-2.

ORR is a Government-owned, contractor-operated reservation. The prime contractor manages the Y-12 Plant (Y-12), the K-25 site (formerly the Oak Ridge Gaseous Diffusion Plant), the Oak Ridge National Laboratory (ORNL), and most other properties on the reservation. Originally built in the early 1940s for large-scale production of fissionable material for the world's first nuclear weapon, ORR continues to be used today as a research, development, and manufacturing institution.

Y-12 Plant. Y-12 is situated on 328 ha (811 acres), 225 ha (630 acres) of which are enclosed by perimeter security fencing, at the eastern end of ORR in the location known as Bear Creek Valley. The majority of DP activities at ORR are conducted at Y-12. Primary missions include dismantling nuclear weapons components returned from the national arsenal, maintaining nuclear production capability, and providing stockpile support and storage for special nuclear materials. Y-12 also supports other Federal agencies through a Work for Others program. In addition, a technology transfer program has been established to support the U.S. industrial base by applying Y-12 expertise to a wide range of manufacturing problems. All of the current nuclear weapons have components produced at Y-12. The plant itself consists of 494 buildings containing more than 650,000 square meters (m2) (7,000,000 square feet [ft2]) of floor space.

Y-12 also provides processing of radioactive source materials and support for other Government agencies. Some 47 buildings containing approximately 140,000 m2 (1,500,000 ft2) of floorspace located on Y-12 grounds are utilized by ORNL in support of non-DP missions. ORNL employs some 450 people at Y-12. Also located on the Y-12 site are approximately 20 buildings containing 28,000 m2 (300,000 ft2) that house the DOE construction manager, the water plant maintenance contractor for ORR, and several organizations of the Oak Ridge Operations Office. These activities employ 175 people in DOE and 550 people in construction manager organizations.

K-25 Site. K-25 consists of approximately 688 ha (1,700 acres) and is located about 9.6 km (6 mi) northwest of Y-12. The site consists of 250 buildings with approximately 1,130,000 m2 (12,200,000 ft2) of floor space. The primary mission of K-25 has been providing enriched uranium for U.S. nuclear weapons and, later, providing uranium toll enrichment services for use in power reactor facilities around the world. Because of a lack of weapons or commercial requirements, the gaseous diffusion process at K-25 was permanently shut down in 1987. Today, K-25 serves as the operations center for environmental restoration and waste management programs. K-25 is also the home of DOE's Center for Environmental Technology and Center for Waste Management. Missions and activities include technology development, technology transfer, engineering technology, uranium enrichment support, and the central functions of business management, engineering, computing, and telecommunications.

Oak Ridge National Laboratory. ORNL is a large multipurpose research institution that consists of approximately 1,174 ha (2,900 acres) located 6.5 km (4 mi) southwest of Y-12. The site has approximately 240 buildings containing 250,000 m2 (2,700,000 ft2) of floor space. Missions and activities include energy production and conservation technologies, physical and life sciences, scientific and technological user facilities, environmental protection and waste management, science and technology transfer, and education.

ORNL programs focus on basic and applied research, technology development, and technology that has been designated important to DOE and the Nation. It also performs work for non-DOE sponsors when such activities complement DOE missions and address significant national or international issues. ORNL facilities include a high-flux nuclear research reactor, chemical pilot plants, research laboratories, radioisotope production laboratories, accelerators, fusion test devices, and support facilities.

The onsite buildings and structures outside the major plant sites consist of the Scarboro Facility, the Central Training Facility, the Transportation Safeguards Division Maintenance Facility, and some ancillary structures. Most physical facilities used by the various plant protection and security groups are within the plant's fenced area; however, the target ranges are outside the fence but within the buffer zones of the main plant areas. Small-arms ranges are located on the eastern end of Y-12 and north of the western end of ORNL.

The offsite buildings and structures consist of the Oak Ridge Operations Office, the DOE Office of Scientific and Technical Information, the Oak Ridge Institute for Science and Education facilities, the American Museum of Science and Energy, the prime contractor's "Townsite" facilities, the National Oceanic and Atmospheric Administration's Atmospheric Turbulence and Diffusion Laboratory, and other buildings. With the exception of the Federal Office Building and space leased from the private sector, all buildings and structures used for DOE functions are situated on DOE-owned land.

The Oak Ridge National Environmental Research Park, established in 1980, consists of 5,500 ha (13,590 acres) on ORR. As one of seven DOE research parks, its purpose is to provide protected land areas for research and education in the environmental sciences and to demonstrate that energy technology development is compatible with a quality environment. There are 53 active environmental sciences research sites consisting of 1,442 ha (3,562 acres) on ORR. In addition, there are 15 inactive sites on 131 ha (323 acres).

The primary missions of the Oak Ridge Institute for Science and Education are to provide educational and research programs in the areas of health, environment, and energy for DOE, other Federal agencies, and private industry. The American Museum of Science and Energy is located at a site contiguous to the campus of Oak Ridge Institute for Science and Education. The museum contains historical displays and exhibits about energy in its various forms, as well as topical matter on the growth of the nuclear power industry.

The National Oceanic and Atmospheric Administration conducts meteorological and atmospheric diffusion research, that is supported by both itself and DOE, at the Atmospheric Turbulence and Diffusion Laboratory and field sites on ORR. This laboratory also provides services to DOE contractors and operates the weather instrument telemetering monitoring system for DOE.

Environmental Regulatory Setting. The policy of ORR is to conduct operations safely and to minimize any adverse impact of operations on the environment, ensuring incorporation of all local and national environmental-protection goals in the daily conduct of business. ORR consists of Y-12, ORNL, and K-25 and most permits and data on releases are reported by individual sites, with Y-12 being the most important site for making decisions in this PEIS. However, some environmental compliance agreements consider ORR to be a single Federal facility.

The Environmental Protection Agency (EPA) has delegated regulatory authority to the State of Tennessee for air, water, solid waste, hazardous waste, and mixed waste. The State of Tennessee and DOE have entered into a 5-year Oversight Agreement that was signed on May 13, 1991. That agreement has been extended for an additional 5 years until June 28, 2001. The purpose of this agreement is to assure Tennessee citizens that their health, safety, and the environment are being protected during ORR operations. The agreement reflects the obligations and agreements between DOE and the state regarding technical and financial support provided by DOE and the state for oversight of these activities. The agreement has provisions for modifications, as appropriate, to address community issues that may arise. The Tennessee Department of Environment and Conservation is the lead state agency for implementation of the agreement. This agency has established a DOE Oversight Division located in the city of Oak Ridge and is staffed with over 50 employees. The Oversight Division routinely visits the three ORR sites to attend formal meetings and briefings, to conduct walk throughs of buildings and grounds, or to conduct observations of site operations to ensure compliance with environmental regulations and DOE orders.

The remainder of this section summarizes the status of Y-12 compliance with the major environmental regulations.

National Environmental Policy Act. DOE finalized the environmental assessment (EA) for the *Proposed Interim Storage of Enriched Uranium Above the Maximum Historical Storage Level at the Y-12 Plant, Oak Ridge, Tennessee,* in September 1994, and issued a Finding of No Significant Impact (FONSI). This EA analyzed the storage of a larger quantity of enriched uranium than historically had

been stored at Y-12. In its FONSI, DOE decided to store no more than 500 metric tons (t) (550 short tons [tons]) of highly enriched uranium (HEU) and 7,105.9 t (7,833 tons) of low-enriched uranium at Y-12 on an interim basis until long-term storage and disposition decisions can be made and implemented.

Comprehensive Environmental Response, Compensation, and Liability Act. ORR was placed on the National Priorities List (NPL) on December 21, 1989, making the site subject to the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). As a result, DOE, EPA, and the state developed a Federal Facility Agreement for environmental restoration activities at ORR effective January 1, 1992, to serve as the interagency agreement in accordance with Section 120 of CERCLA. The agreement is intended to integrate the corrective action processes of the *Resource Conservation and Recovery Act* (RCRA) and CERCLA. EPA, DOE, and the state have negotiated the agreement to ensure that the environmental impacts associated with past and present activities at ORR are thoroughly investigated and that appropriate remedial actions or corrective measures are taken.

The Federal Facility Agreement establishes a procedural framework and schedule for developing, implementing, and monitoring response actions at ORR in accordance with CERCLA, RCRA, the National Environmental Policy Act (NEPA), and applicable state laws. Response actions under the agreement will achieve comprehensive remediation of releases or threatened releases of hazardous substances, hazardous wastes, pollutants, or contaminants at or from ORR. The agreement coordinates responses and remedial activities necessary to protect human health and the environment and reduces duplication of corrective actions or administrative requirements under CERCLA and RCRA. The three parties to the agreement intend to consolidate the DOE CERCLA response obligations with the corrective action measures required under RCRA permits. The agreement also addresses technical standards for new and existing liquid low-level radioactive waste storage tanks.

Emergency Planning and Community Right-To-Know Act. Sections 311 and 312 of the act require reporting to local officials the inventories of hazardous chemicals and extremely hazardous substances. Y-12 reported inventories in 1993, which included 42 hazardous chemicals and 5 extremely hazardous substances.

Resource Conservation and Recovery Act. The three ORR sites each generate both RCRA hazardous waste and mixed waste. Y-12 conducts storage, treatment, and disposal of hazardous waste under RCRA Part B Permits, and interim-status provisions. The Hazardous and Solid Waste Amendments permit requirements for corrective actions, effective since October 25, 1986, have now been integrated into the Federal Facility Agreement previously mentioned under CERCLA.

Effective June 12, 1992, DOE and EPA completed a Federal Facilities Compliance Agreement to resolve the compliance issue of storing land-banned waste for extended periods. The agreement acknowledges that ORR is currently storing, and will continue to store, mixed waste subject to land disposal restrictions. It contains a compliance schedule that dictates the steps required to bring ORR facilities into compliance with respect to the management of mixed wastes and includes the strategies and plans for treatment of the backlog of land-banned waste.

In May 1991, a moratorium on offsite shipment of hazardous waste to non-DOE sites was placed on DOE facilities, including those on ORR. The moratorium was established to prevent waste containing any radioactive material from being shipped to a facility that is not licensed to handle it. The moratorium essentially requires all RCRA hazardous waste generated at ORR to be managed as

mixed waste until appropriate procedures are developed and approved to ensure that waste streams are free of radioactivity above background levels. Such procedures have been prepared by each of the ORR sites. Y-12 received approval from DOE for four procedures certifying "No Rad Added" to allow offsite shipment of hazardous wastes.

Water quality data from the exit-pathway wells at the east end of Y-12 may indicate that the volatile organic compounds (VOCs) carbon tetrachloride and tetrachloroethane are being transported off ORR through the Maynardville Limestone at depths of 30 to 91 m (100 to 300 ft). The monitoring well is located in a general industrial area, and no drinking water wells have been identified in the area. Property owners in the area have been notified and provided with a status report.

The Federal Facility Compliance Act of 1992. This act is an amendment to RCRA. DOE published the Interim Mixed Waste Inventory Report in April 1993, annual updates, and periodic updates describing its inventory of mixed wastes and treatment capabilities. ORR prepared and submitted to the state in October 1993 a conceptual site treatment plan for ORR. In accordance with the *Federal Facility Compliance Act*, a Commissioner's Order issued on September 26, 1995, by the State of Tennessee, to become effective on October 2, 1995, included the Site-Specific Treatment Plan for Mixed Waste at ORR. This order allows ORR to store existing quantities of mixed waste and requires DOE to comply with a site treatment plan. The site treatment plan contains milestones and target dates for DOE to characterize and treat its inventory of mixed waste.

Clean Water Act. National Pollutant and Discharge Elimination System (NPDES) permits are required for each ORR facility. The Y-12 NPDES permit was issued April 28, 1995, and encompasses about 150 active point-source discharges requiring compliance monitoring. The new NPDES permit covers stormwater discharges, as well as point source discharges. The number of permitted-outfalls continues to decline as the outfalls are consolidated or eliminated, or as changes in implementation occur at the site. Through monitoring of discharges, DOE can demonstrate that Y-12 has achieved an NPDES permit compliance rate in 1993 of more than 99 percent.

Sanitary wastewater from Y-12 is discharged to the city of Oak Ridge under an industrial pretreatment permit. The Y-12 sanitary sewer upgrade project is an example of DOE corrective actions to achieve and maintain the Y-12 sanitary sewer collection system in regulatory compliance with the city of Oak Ridge sanitary sewer use ordinance and pretreatment permit. As part of the upgrade, a new monitoring station was completed in July 1994 and allows for more accurate monitoring of the sanitary sewage discharges by Y-12.

Activities are underway to reduce discharges of pollutants to surface waters of ORR. For example, two dechlorination systems were installed in late 1992 at key Y-12 outfalls on East Fork Poplar Creek to help control discharges of chlorine from noncontact cooling water systems and to help to eliminate chronic fish kills in the upper reaches of the creek. Additional efforts relating to reducing nonpoint-source pollutants to surface streams and cleaning up mercury pollution in the East Fork Poplar Creek are being implemented.

On January 17, 1992, Friends of the Earth, a nonprofit corporation, filed a lawsuit against DOE in Federal District Court in Knoxville, TN. The lawsuit alleged that DOE violated the NPDES permits because discharges of certain quantities of various pollutants into tributaries of the Clinch River exceeded the allowable discharge limits of the NPDES permits. Friends of the Earth filed a motion for summary judgment in October 1992, and DOE filed a cross-motion for denial of summary judgment in January 1993. Both motions are pending before the court. A second lawsuit was filed in

Federal District Court by the Friends of the Earth in October 1995, alleging NPDES monitoring and reporting violations. This lawsuit is also pending.

Safe Drinking Water Act. The systems that supply drinking water to ORR are DOE-owned; therefore, ORR must comply with all Federal, state, and local requirements regarding the provision of safe drinking water. Section 1447 of the act mandates such compliance for each Federal agency having jurisdiction over a Federal-owned or Federal-maintained public water system. Y-12 receives water from a DOE-owned water treatment facility located northeast of Y-12. The Y-12 system is designated as a "nontransient, noncommunity" water distribution system and is subject to the Tennessee Regulations for Public Water Systems and Drinking Water Quality. These regulations allow distribution systems that do not perform water treatment to use the records sent to the state by the water-treatment facility from which water is received to demonstrate compliance with requirements.

Clean Air Act. Authority for enforcement of the act is shared between the state, for nonradioactive emission sources, and EPA, for radioactive emission sources. *Clean Air Act* (CAA) compliance is an integral part of the state air permit program which has issued air permits for construction and operating sources to all three ORR sites. Each site complies with Federal clean air regulations in addition to the State of Tennessee air-permit conditions. Major sources are appropriately permitted, and documentation of compliance is developed. All major emission sources are permitted by the state and are operating in compliance with those permits as of December 31, 1993. Y-12 has 94 active air permits covering 400 air emission points, and currently has about 290 documented exempt minor sources and about 350 exempt minor emission points.

ORR is also in full compliance with the requirements as set forth in 40 Code of Federal Regulations (CFR) 61, Subpart H (National Emission Standards for Emissions of Radionuclides Other than Radon from DOE Facilities), for sampling significant radionuclide emission points. Continuous emissions monitoring is performed at the K-25 incinerator and at 74 potential radiological exhaust stacks serving uranium-processing areas at Y-12. The stacks are equipped with continuous stack samplers, because these stacks are judged to have the potential to emit uranium emissions that could contribute greater than 0.1 mrem per year effective dose equivalent to an offsite individual. EPA certified that ORR had completed all of the actions required by the *May 1992 Federal Facility Compliance Agreement for Clean Air Act* (ORR Rad-NESHAP) and was considered to be in compliance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations. A subsequent inspection in September 1993 confirmed such compliance.

Y-12 is also subject to an NESHAP rule for machining beryllium and currently monitors four stacks that serve beryllium machining and handling areas to demonstrate compliance with the 10 grams per day emission limit. The total beryllium emitted from Y-12 in 1993 was less than 1 gram.

Toxic Substances Control Act. The *Toxic Substances Control Act* (TSCA) requires polychlorinated biphenyl (PCB) wastes to be disposed of within 1 year from the date the PCBs are removed from service. Because of a lack of available disposal avenues, radioactive wastes contaminated with PCBs are stored at ORR sites for periods exceeding 1 year. Unauthorized uses and storage of PCBs are covered under the equipment-specific agreements with EPA or the Uranium-Enrichment PCB Federal Facilities Compliance Agreement, signed February 20, 1992. This agreement between DOE and EPA provides a vehicle for resolution of PCB issues only at K-25. The K-25 incinerator is the only facility in the Nation permitted to incinerate RCRA, PCB, and radioactive waste. This agreement allows K-25 to store such wastes generated by K-25 for periods exceeding one year.

Radioactive wastes contaminated with PCBs older than 1 year are generated by other ORR facilities, particularly Y-12, and also are stored at K-25. Several compliance issues exist at Y-12, because the Federal Facilities Compliance Agreement does not include PCB storage at Y-12. Therefore, discussions are continuing with EPA towards a new agreement that would include Y-12 and ORNL, as well as K-25. The new agreement is tentatively entitled the Oak Ridge Reservation PCB Federal Facilities Compliance Agreement. Storage concerns addressed under the existing agreement for K-25 would be included in the proposed Federal Facilities Compliance Agreement for the entire ORR. The earliest anticipated date for issuance of the PCB Federal Facility Compliance Agreement is in 1996.

Federal Insecticide, Fungicide, and Rodenticide Act. The three ORR sites maintain procedures for the storage and application of pesticides. Individuals responsible for the application of materials regulated by the *Federal Insecticide, Fungicide, and Rodenticide Act* are certified through the University of Tennessee Department of Agriculture. Safrotin®, used for the control of roaches, is the only restricted-use pesticide used at Y-12. No violations were identified during the 1993 *Federal Insecticide, Fungicide, and Rodenticide Act* inspection.

A.1.2 Savannah River Site

Site Description. SRS, 19 km (12 mi) south of Aiken, SC, and approximately 26 km (16 mi) southeast of Augusta, GA, occupies 80,130 ha (198,000 acres) of land. Established in 1950, SRS has been involved for more than 40 years in tritium operations and other nuclear material production. Today, the site contains 15 major production, service, research, and development areas, not all of which are in operation at this time. The locations of SRS and its principal facilities are shown in figures A.1.2-1 and A.1.2-2.

The developed areas of the site account for less than 5 percent of the land use and more than 99 percent of the total capital investment. There are more than 3,000 facilities at SRS, including 740 buildings, with approximately 511,000 m2 (5.5 million ft2) of floor area.

Major nuclear facilities at SRS include fuel and target fabrication facilities, nuclear material production reactors, chemical separations plants, a uranium fuel processing area, liquid high level waste (HLW) tank farms, a waste vitrification facility, and the Savannah River Technology Center. SRS is in the process of stabilizing and storing various forms of plutonium. This effort, supported by the F-Canyon Plutonium Solutions Environmental Impact Statement (DOE/EIS-0219) and the ROD (FR 9824), converts this material to plutonium metal. The process in FB-Line began in November 1995 and the conversion process in F-Canyon was completed in April 1996. The metal product will be stored temporarily in one of the F-Area vaults (FB-Line, 235-F or 247-F). Tritium recycling facilities at SRS empty tritium from expired reservoirs, purify it to eliminate the helium decay product, and fill replacement reservoirs with specification tritium for nuclear stockpile weapons. Filled reservoirs are delivered to Pantex for weapons assembly, or directly to DOD as replacements for expired reservoirs. Historically, DOE has produced tritium at SRS, but has not produced any since 1988.

Tritium recycling operations will continue with the replacement tritium facility conducting the majority of these operations. As part of the nonnuclear consolidation, SRS received some of the tritium processing functions formerly performed at the Mound Plant in Miamisburg, OH.

The current missions at SRS are shown in table 3.2.3-1. These activities can be categorized as DP,

Office of Environmental Management (EM), nuclear energy, and other activities.

Defense Program Activities. In the past, the SRS complex produced nuclear materials for DP. This complex consists of five reactors (the C-, K-, L-, P-, and R-Reactors) in addition to a fuel and target fabrication plant, two target and spent nuclear fuel chemical separations plants, a tritium-target processing facility, a heavy-water rework facility, and waste management facilities. The K-Reactor (the last operational reactor) was put into cold standby status in 1992 with no planned provision for restart. SRS is still conducting tritium recycling operations in support of stockpile requirements using tritium recovered from retired weapons as the tritium supply source. Based on the record of decision (ROD) for tritium supply and recycling, issued in December 1995, SRS will continue to perform tritium recycling operations and would be the site for accelerator production of tritium if that technology were selected in the future. In addition, SRS would be the site for a tritium extraction facility to support the commercial reactor option of supplying tritium.

Other Department of Energy Activities. EM is pursuing a 30-year plan to achieve full compliance with all applicable laws, regulations, and agreements; treat, store, and dispose of existing wastes; reduce generation of new wastes; cleanup inactive waste sites; remediate contaminated groundwater; and dispose of surplus facilities.

The Savannah River Technology Center provides technical support to all DOE operations at SRS. In this role, it provides process engineering development to reduce costs, waste generation, and radiation exposure. SRS continues to provide plutonium-238 required to support space programs and has an expanding mission to transfer unique technologies developed at the site to industry. SRS is also an active participant in the Strategic Environmental Research and Development Program formulated to develop technologies to mitigate environmental hazards at DOD and DOE sites.

Non-Department of Energy Activities. There are several facilities and operations at SRS that deal mainly with the ecological elements of the site. These are the Savannah River Forest Station, the Savannah River Ecology Laboratory, the South Carolina Wildlife and Marine Resources Department, the Institute of Archaeology and Anthropology, and the Soil Conservation Service.

Environmental Regulatory Setting. SRS had 544 construction and operating permits in 1993 that specified operating levels for each permitted source (WSRC 1994d:32). Completion of construction in progress and continued operation of permitted facilities are essential to overall SRS operations. Therefore, DOE emphasizes compliance with the terms of these permits as well as with applicable Federal and State of South Carolina environmental regulations and DOE orders related to environmental protection. SRS employed over 1,000 people devoted full-time to protecting the environment through environmental activities in 1993 while accomplishing SRS missions (WSRC 1994d:15). The remainder of this section summarizes the status of SRS compliance with the major environmental regulations.

National Environmental Policy Act. DOE has numerous NEPA documents affecting SRS proposed actions which are in various stages of completion as SRS complies with the requirements of NEPA and Council on Environmental Quality (CEQ) regulations. For example, DOE published the Savannah River Site Waste Management Final Environmental Impact Statement (DOE/EIS-0217) in July 1995, which recommended the moderate waste treatment configuration. This configuration would provide a balanced mix of technologies that includes extensive treatment of those waste types that have the greatest potential to adversely affect humans or the environment because of their mobility or toxicity if left untreated, or that would remain dangerously radioactive far into the future.

It would provide less extensive treatment of wastes that do not pose great threats to humans or the environment, or that will not remain dangerously radioactive far into the future.

Comprehensive Environmental Response, Compensation, and Liability Act. EPA placed SRS on the NPL effective December 21, 1989. DOE, the South Carolina Department of Health and Environmental Control, and EPA signed a Federal Facility Agreement effective August 16, 1993, to coordinate CERCLA cleanups at SRS, as required by Section 120 of CERCLA. Since the initial listing of the NPL in 1989, SRS has conducted both CERCLA and RCRA cleanup activities under the framework established in the draft Federal Facility Agreement. The comprehensive remediation of SRS will continue as directed by the Federal Facility Agreement currently in place.

Emergency Planning and Community Right-To-Know Act. Each year SRS completes a section 312 annual Tier II inventory report for all hazardous chemicals present at the site in excess of specified quantities and submits it to the South Carolina Department of Health and Environmental Control and to local emergency planning organizations in Aiken, Allendale, and Barnwell Counties, South Carolina. SRS also files an annual toxic release inventory report with EPA based on calculated chemical releases to the environment, which reports aggregate quantities for each regulated chemical that exceeds established threshold amounts. SRS reported eight chemicals to EPA in 1992, with releases totaling 34,820 kilograms (kg) (76,763 pounds [lb]) (WSRC 1994d:19). Changes in facility operating status will lead to changes in chemical inventories and uses of toxic chemicals; the hazardous chemical inventory and toxic release inventory reports will reflect these changes.

Resource Conservation and Recovery Act. The SRS hazardous waste permit was issued in 1987 and modified in 1992. The permit covers storage of wastes at four buildings, treatment at the Consolidated Incineration Facility, and maintenance and groundwater remediation at three closed waste units. Other waste management facilities at SRS are presently operating under interim status. SRS has submitted to the South Carolina Department of Health and Environmental Control a permit application covering the facilities' activities, under which they can continue to operate in conformance with regulatory requirements while applications are reviewed by the regulatory agencies and a final permit decision is issued.

The Federal Facility Compliance Act of 1992. This act is an amendment to RCRA. Westinghouse Savannah River Company submitted a mixed waste inventory report January 13, 1993, and DOE published the complex-wide report, US DOE Interim Mixed Waste Inventory Reports, on April 12, 1993. DOE provided this report, and annual and periodic updates since, to state governors and to regulatory agencies in states that host DOE sites, describing its inventory of mixed wastes and treatment capabilities. To meet requirements established by this act, SRS prepared and submitted a *Proposed Site Treatment Plan* (WSRC-TR-94-0608, May 1995) that sets forth options for treating mixed wastes currently in storage at SRS or that will be generated there over the next 5 years.

Clean Air Act. The air quality control construction permit for the Consolidated Incineration Facility was granted by the South Carolina Department of Health and Environmental Control on November 25, 1992. Emergency power diesel generators are covered under this permit. The M-Area Vendor Treatment facility emergency diesel generator is exempt from permitting requirements because of its limited capacity and expected use. A permitting exemption has been granted for the emergency diesel generator at the replacement HLW evaporator. The SRS NESHAP radionuclide program continues to change to incorporate sampling, monitoring, and dose assessment practices that meet or exceed the requirements of 40 CFR 61, Subpart H. SRS is currently in compliance with CAA requirements.

Clean Water Act. The South Carolina Department of Health and Environmental Control has issued Clean Water Act (CWA) permits for the F- and H-Area Tank Farms, Defense Waste Processing Facility, Z-Area Saltstone Facility, replacement HLW evaporator, F- and H-Area Effluent Treatment facilities, and M-Area Liquid Effluent Treatment Facility. Certain discharges from the outfalls at these facilities have been approved. DOE has submitted an industrial wastewater treatment permit application for the M-Area Vendor Treatment Facility. SRS is currently in compliance with CWA requirements.

Safe Drinking Water Act. SRS continues to work toward upgrading the 13 major treatment/distribution systems through which SRS provides drinking water to its employees. The State of South Carolina recommended that SRS consolidate 11 of the 13 major site drinking water systems into three systems. Work is in progress to implement this consolidation. Westinghouse Savannah River Company obtained a construction permit for the water line extension that will serve the Consolidated Incineration Facility.

Toxic Substances Control Act. Disposal of PCBs from SRS is conducted at EPA-approved disposal facilities within the regulatory timeframe. SRS has some PCBs which were radioactively contaminated during a spill in 1978. The act calls for annual disposal of PCB waste, but there is insufficient capacity for disposal of radioactive PCB waste offsite. These radioactive PCB materials are stored onsite in a facility that meets storage requirements for up to 1 year. SRS continues to seek disposal technologies and facilities that can handle radioactive PCB waste.

A.1.3 Kansas City Plant

Site Description. KCP is situated on approximately 57 ha (141 acres) of the 121-ha (300-acre) Bannister Federal Complex located within incorporated city limits 19 km (12 mi) south of the downtown center of Kansas City, MO. The plant shares the Bannister Federal Complex site with other Federal agencies: the General Services Administration, the Department of Defense Finance and Accounting Service, the Federal Aviation Administration, the National Archives and Records Center, and the Internal Revenue Service, among others. The locations of the Bannister Federal Complex and its major facilities are shown in figures A.1.3-1 and A.1.3-2.

KCP currently contains approximately 297,000 m2 (3.2 million ft2) of floor space with approximately 82 percent located within the large Federal office and industrial building that dominates the site. KCP and the rest of the Bannister Federal Complex are completely developed with limited open space. No residential structures are within the Bannister Federal Complex. Kansas City has zoned the Bannister Federal Complex, including KCP, as heavy industrial.

KCP is a Government-owned, contractor-operated facility that produces and procures nonnuclear electrical, electronic, electromechanical, mechanical, plastic, and nonfissionable metal components for the DOE nuclear weapons program. In 1992, there were 4,473 people employed at KCP. Site employment is expected to decrease to approximately 3,900 by the year 2000 (KCP 1995a:1). KCP's primary missions are shown in table 3.2.4-1.

DP activities comprise the vast majority of operations at KCP. The nuclear weapons-related operations at KCP are production and maintenance of electrical, mechanical, and plastic products. KCP does not process special nuclear materials but does have a health physics program consistent with industrial radiography and electrical manufacturing. The following is a brief description of KCP

mission activities.

Squib Valve Assembly. Pyrotechnic devices that provide valving functions for various nuclear weapons systems are manufactured. Their assembly requires handling Class 1.4 explosives in a static-free environment using fixture-assisted assembly techniques.

Hybrid Microcircuit Assembly. Hybrid microcircuit resistor/conductor networks using alumina oxide substrates with thin-film or thick-film technologies for radars, programmers, timers, and fire sets are manufactured. Their assembly includes attaching electrical components to these networks. This product's assembly requires a Class 10,000 clean room with temperature and humidity controls.

Hybrid Microcircuit Assembly for Joint Test Assemblies. Hybrid microcircuits that consist of an insulating substrate, such as alumina, that contains a thin or thick resistor/conductor network interconnected with active (transistors and integrated circuits) and passive (resistors and capacitors) components that are enclosed in a metal or ceramic package are manufactured.

Microminiature Electrical Assembly. Hybrid microcircuits (semi-conductors packaged in ceramic, leadless chip carriers, transistor outline headers, or kovar [alloy of nickel, cobalt, and iron] flatpacks) are constructed. These products perform several electronic functions in weapons systems such as switches, radars, programmers, fire sets, clocks, and telemetry.

Telemetry Assembly. Telemetry assemblies, neutron detectors, and test component firing systems are manufactured. The telemetry assemblies and neutron detectors provide warhead scoring data in flight tests as part of the joint test assembly. The test component firing systems are high energy transfer systems manufactured for use in underground testing at NTS.

Radar Assembly. Radars used in weapons fuzing systems for bombs and warheads are manufactured. Included in this product line are antenna assemblies that can be an integral part of a radar fuze assembly or a separate component used in the fuzing system. Facility requirements include controlled humidity environment, solvent cleaning stations, and electrostatic control.

Timers, Programmers, and Trajectory Sensing Signal Generators. Trajectory sensing signal generators (electronic assemblies that accept environmental data, verify correctness of that data, and produce predetermined and sequenced output functions for the weapon) are manufactured. The trajectory sensing signal generator product is part of the weapon's nuclear safety system. The primary function is to help ensure that accidental detonation caused by abnormal thermal and shock environments does not occur.

Test Equipment Design and Fabrication. Custom designed and fabricated test equipment able to accept products produced internally and by vendors is produced. This function is capable of performing electrical and mechanical design, producing definition drawings, developing computer software, and fabricating the necessary hardware.

Cellular Silicone and Filled Elastomers. Cellular silicone cushions that are used as filler to cushion components and to allow for thermal expansion are produced.

Foam Molding. Structural foam supports using urethane foam materials are produced.

Syntactic Foam Molding and Plastics Machining. Foam molding that is capable of withstanding

higher operating temperatures than conventional foam molding is produced. These products are made using high temperature resins and microspheres, which are sintered in a high temperature oven. Facility requirements include an environmentally controlled (temperature and moisture) plastics machining facility, because of the physical requirements of plastic products.

Laminates and Desiccants. Aluminum silicate desiccant powders and resins used to provide a dry environment in sealed nuclear assemblies and fiber-reinforced plastic laminates are produced.

Noncryptographic Coded Switch Assembly. Electronic devices using hybrid microcircuits and magnetic core memory used to permit the controlled use of nuclear weapons upon proper authorization and to prevent unauthorized use are manufactured.

Strong Link Switch Assembly. Complex electromechanical safety devices used in all modern weapons programs are manufactured. Facility requirements include clean rooms for switch assembly and testing.

Fire Set Assembly. High-voltage circuitry firing systems capable of supplying the energy required to initiate a weapon system are manufactured. Energy is derived from low-voltage battery power and is converted by this system to high voltage and stored until an initiating signal is received. Components include capacitors, inductors, hybrid microcircuits, flat cable and flex circuit technologies, and switches.

Composite Structures. Fiber-reinforced molding resins are manufactured.

Stockpile Support. Components and subsystems removed from the stockpile for reuse, systems testing, or component cycle testing are evaluated. No unique processes, materials, or technologies are used for stockpile support.

Category F Permissive Action Link Electronics Assembly. Electronic assemblies that are part of the nuclear surety system are manufactured.

Special Products-Special Electronics Assembly. This is a restricted access area where electronic products with special security requirements are manufactured.

Cryptographic Coded Switch Assembly. A Permissive Action Link Switch Adapter, an electronic device designed to provide an "electrical block" to the arming switch of the weapon, is assembled. The Permissive Action Link Switch Adapter utilizes both thin- and thick-film hybrid microcircuit technology and is packaged in a foam plastic housing.

T-Gear Containing Cryptographic Keying Material. Cryptographic keying material used to code and recode Permissive Action Link Switch Adapter devices in weapons is manufactured. The presence of these codes prevents unauthorized access to weapons.

MK5 Arming, Fuzing, and Firing Set Assembly. Arming, fuzing, and firing assemblies are assembled. This assembly incorporates a radar, a programmer, an accelerometer, a decelerometer, thermal batteries, a fire set, a contact fuze, and a force balance integrating accelerometer.

B83 Weapon Subassembly. Electronic and mechanical structures are assembled and placed in a case structure with environmental protection. Assemblies provide distance, timing, velocity sensing,

velocity control, and electrical power for weapon assemblies.

Machining Technology. This activity provides a wide variety of traditional and nontraditional metal-removing processes, including conventional and numerically controlled turning, milling, drilling, boring, and grinding processes.

Other Mechanical Technology. This activity provides support for mechanical product manufacturing including sheet metal hydroforming, fire edge blanking, punch pressing, riveting, laser marking, threaded insert installation, and manual assembly operations.

Plastics Technology. A wide range of polyurethane foam components, epoxy encapsulants, and modified commercial products for the Complex are manufactured.

Electrical/Electronic Fabrication and Assembly Technology. Printed wiring assemblies used in weapon timers, programmers, trajectory sensing devices, and various other electrical and electronic components are fabricated.

Secondary Support Areas. This activity provides support functions that service nearly all product lines, including a broad range of standard industrial processes (e.g., plating, painting, heat treating, and welding), some of which are uniquely tailored to meet special weapon requirements.

Environmental Regulatory Setting. KCP has a monitoring system in place to ensure continuity of operations and protection of the environment. Soil, surface and groundwater, and air media are regularly sampled and analyzed for various potential pollutants as a part of the ongoing environmental monitoring programs. The monitoring system includes over 163 monitoring wells, 5 sampling points at the ultraviolet/ozone system, 3 ambient air monitoring stations, and sampling results from 4 outfalls, 9 surface water sites, and 1 sanitary discharge. The remainder of this section summarizes the status of KCP's compliance with the major environmental regulations.

National Environmental Policy Act. There are no other major Federal actions under consideration that require NEPA studies and that would affect the plant.

Emergency Planning and Community Right-To-Know Act. The plant prepared and submitted to EPA an annual Toxic Chemical Release Inventory Form (EPA Form R) for 1993 as required under Section 313 of this act.

Resource Conservation and Recovery Act. DOE and EPA signed a Corrective Action Administrative Order on Consent under Section 3008(h) of RCRA on June 23, 1989. The intent of the order is to provide an agreed-upon method of effecting environmental remediation involving solid waste management units at the plant. While the consent order is with EPA, the Missouri Department of Natural Resources maintains RCRA authority over the KCP groundwater monitoring program. Groundwater monitoring has revealed chlorinated solvent contamination, particularly trichloroethylene, in at least three onsite plumes. The city of Kansas City, MO, regulates the discharge permit for the groundwater treatment unit, which is treating the groundwater plumes to preclude release of the contaminant into surface waters offsite.

Comprehensive Environmental Response, Compensation, and Liability Act. KCP is not regulated under this act for any required remediation. Remediation is presently regulated by the provisions of the RCRA Corrective Action Administrative Order on Consent.

Clean Air Act. Overall plant operations are regulated by an annual Air Operating Permit issued by Kansas City, MO. Results of radionuclide monitoring indicate that no radionuclides are present in quantities exceeding background levels. The plant is also in compliance with air pollution requirements for nonradiological air emissions. The plant is working proactively with the city to better define the requirements necessary to obtain the city's approval before constructing a new or modifying an existing source of air pollution, as well as to streamline reporting needs with respect to plant air emissions.

Clean Water Act. Sanitary and industrial wastewater discharges from the plant go into the Publicly Owned Treatment Works and are regulated by Discharge Permit #74; city ordinances administered by the Kansas City, MO, Water and Pollution Control Department; and EPA Pretreatment Standards for the Metal-Finishing Category (40 CFR 433.17). KCP stormwater effluents are regulated by NPDES Permit #MO 0004863, issued by the Missouri Department of Natural Resources.

Safe Drinking Water Act. The drinking water system at the plant meets all conditions for exclusion listed in 40 CFR 141.3, which implements this act. Therefore, the plant does not operate a public water system which is covered by this act.

Toxic Substances Control Act. KCP maintains compliance with the requirements of this act.

Federal Insecticide, Fungicide, and Rodenticide Act. The plant maintains compliance with this act and related state statutes concerning use of pesticides.

A.1.4 Pantex Plant

Site Description. Pantex is located in the panhandle of Texas, in Carson County. It is about 27 km (17 mi) northeast of downtown Amarillo and 64 km (40 mi) southwest of Pampa. The plant is located on a portion of the former Pantex Army Ordnance Plant. Pantex was constructed in the first half of the 1940s by the U.S. Army for the production of conventional ordnance. At the end of World War II, the plant was deactivated and the property eventually reverted to the War Assets Administration. In 1949, the entire installation was sold to Texas Technological College (now Texas Technological University, commonly called Texas Tech) for 1 dollar. The land was to be used for experimental farming, but was subject to recall under the National Security Clause. Following an extensive survey of World War II ordnance plants, Pantex was chosen in 1951 by the Atomic Energy Commission for expansion of its nuclear weapons assembly facilities. The Army Ordnance Corps reclaimed the site for the Atomic Energy Commission and contracted a civilian contractor to rehabilitate it.

DOE owns approximately 3,683 ha (9,100 acres) at Pantex. Just over 809 ha (2,000 acres) of the DOE-owned property are used for industrial operations at Pantex excluding the Burning Ground, firing sites, and other outlying areas. The Burning Ground and firing sites occupy approximately 198 ha (489 acres). Remaining DOE-owned land serves DOE safety and security purposes. DOE also owns a detached piece of property called Pantex Lake, approximately 4 km (2.5 mi) northeast of the main plant site. This property, comprising 436 ha (1,077 acres), includes the playa lake wetland itself which occupies approximately 138 ha (340 acres). Currently, no Government industrial operations are conducted at the Pantex Lake property. The location of Pantex is shown in figure A.1.4-1.

As of April 1995, approximately 2,599 ha (6,421 acres) of DOE-owned land were being used by Texas Tech for agricultural purposes through a service agreement. The DOE-owned acreage used for

agricultural purposes is variable and subject to periodic changes. Adjacent to the 3,683 ha (9,100 acres) owned by DOE, approximately 2,347 ha (5,800 acres) are leased from Texas Tech. DOE use of these lands is primarily for safety and security buffer areas. DOE also leases a small facility at the Amarillo International Airport for its own transportation use.

Pantex industrial operations are conducted for DOE by a management and operating contractor, the U.S. Army Corps of Engineers, and SNL. Seventy-six km (47 mi) of roads exist within Pantex boundaries. A spur of the Burlington Northern Santa Fe Railroad, formerly Atchison Topeka and Santa Fe Railroad, extends through the leased land into the DOE-owned property on the southwest area of the plant site. There are 27 km (17 mi) of railroad tracks within the site boundaries.

Historically, the Pantex site was divided into functional areas commonly called zones. Some maps may still show where the old functional areas were located. The main functional areas are Zone 12, which is the fabrication, assembly/disassembly (A/D), and technical/administrative support area; Zone 11, which is the high explosives (HE) development area; Zone 10, which is an excess property storage site; and Zone 4, which is the weapon/HE magazines and pit storage area. There are other supporting activities in other zones. The locations of Pantex zones are shown in figure A.1.4-2.

All the land within a 5-km (3-mi) radius of the plant site is used for agricultural purposes, either farming or grazing. Approximately 2,000 people live within 8 km (5 mi) of the outside boundary of Pantex. A significant population concentration occurs southwest of the Pantex facility near the Amarillo International Airport and includes the Texas State Technical Institute and the Highland Park Village. Highland Park Village consists of 500 single- and multi-family housing units (duplexes) with an occupancy rate averaging about 90 percent. Approximately 100 students are housed in a Texas State Technical Institute student dormitory.

Plant operation includes direct and support manufacturing operations, management and administrative services, protective services, and maintenance and utilities. Current missions at Pantex are shown in table 3.2.5-1.

Most operations at Pantex are DP activities. The plant's primary role today is the dismantlement, including removal of the fissile material, of retired U.S. nuclear weapons being returned to DOE from DOD. Other activities include certain maintenance and surveillance activities of the remaining nuclear weapons stockpile, modification and assembly of existing nuclear weapons systems, and production of HE components for nuclear weapons. DOE also conducts quality evaluation of weapons, quality assurance testing of weapons components, and research and development (R&D) activities supporting nuclear weapons at the plant. The principal operations performed at Pantex are the dismantlement of retired nuclear weapons; assembly of nuclear weapons from components received from other DOE facilities; fabrication of chemical HE components for nuclear weapons; operation of chemical HE synthesis, and characterization surveillance testing and disposal of chemical HE; and maintenance, modification, repair, and testing of nuclear weapons components. Weapons dismantlement, assembly, and stockpile surveillance activities involve handling significant quantities of sealed nuclear components, (pits, secondaries, tritium reservoirs), as well as a variety of nonradioactive toxic chemicals. Brief descriptions of the above mission activities follow.

New production is defined as the final assembly of a new nuclear weapon to be added to the stockpile. Pantex receives weapons components and other materials from throughout the Complex. The first step in the new production process is mating the HE main charge subassemblies with the special nuclear materials, which takes place within an assembly cell. Assembly bays house the

remainder of the assembly process. This is where the nuclear subassembly produced in the assembly cell is built into a complete weapon. After final assembly, weapons assembled at Pantex are shipped either to other facilities within the Complex or to military facilities. Dismantlement of retired weapons is basically a reversal of the assembly process. All parts must then be properly disposed or stored.

The tasks of modification, maintenance, and repair involve disassembly of a stockpiled nuclear weapon so that one or more components can be repaired, replaced, or modified. After replacing the components, the weapon is reassembled and returned to the stockpile.

HE component production includes manufacturing main charge subassemblies and mock components for use in weapon test assemblies, manufacturing small HE components, producing a variety of explosive materials from chemical reactants and commercially produced explosives, and evaluating explosive materials and components through a variety of analytical, mechanical, and explosive tests.

Pantex performs many quality assurance evaluation activities on both new and stockpiled nuclear weapons. These tests involve disassembly of weapons, laboratory testing of various components, and rebuilding weapons for shipment back to the stockpile. Five evaluations are performed at Pantex: new material laboratory testing, new material flight testing, stockpile laboratory testing, stockpile flight testing, and accelerated environmental aging and materials compatibility testing. These evaluations are outlined below:

- New Material Laboratory Testing--disassembly of a randomly selected, newly produced weapon before it is shipped to the stockpile. Various components are subjected to either destructive or nondestructive tests. After testing, the weapon is rebuilt and shipped to the stockpile.
- New Material Flight Testing--similar to new material laboratory testing. Weapons are selected at random before delivery to the stockpile and assembled into a nonnuclear, explosive joint test assembly for flight testing. These assemblies are tested by DOD aboard aircraft and missiles to verify the functioning of components under in-flight conditions. After the test flight, the joint test assembly is returned to Pantex for further examination when possible.
- Stockpile Laboratory Testing--similar to new material laboratory testing, but stockpile laboratory testing is performed on units randomly selected from the stockpile.
- Stockpile Flight Testing--similar to new material laboratory flight testing, but stockpile flight testing is performed on weapons randomly selected from the stockpile.
- Accelerated Environmental Aging and Materials Compatibility--determines the effects of aging on the integrity of weapons systems over time. These tests involve subjecting newly produced units to an artificial aging process or to environmental stresses to determine whether or not they retain their chemical and physical properties, and to ensure that they will react in a predictable manner after an extended period of time.

Also, some testing is performed at the Gas Analysis Laboratory, which evaluates samples taken from accelerated aging units, material compatibility tests, development activities, material certification tests, and production operations.

In addition to the principal efforts associated with weapons A/D, Pantex provides development support and services to the weapons laboratories and to other government entities.

Pantex contains a number of facilities that stage (temporarily store) weapons components that are

destined either for the assembly cells or for shipment to other DOE facilities. Staging procedures may involve the leak testing of staging containers, inventories to verify the number and contents of containers, and unpacking and repacking to physically verify and test contents.

Environmental Regulatory Setting. Pantex conducts operations in compliance with all applicable environmental regulations and statutes and with the requirements of the various permits issued to the plant. The Texas Natural Resources Conservation Commission has state authority for developing and enforcing regulations and standards for air, water, and waste management. EPA has delegated regulatory authority to the State of Texas for air and solid and hazardous waste. As of December 31, 1994, Pantex is in compliance with the major environmental laws and regulations, with no regulatory enforcement actions or lawsuits pending. The remainder of this section summarizes the status of Pantex compliance with the major environmental regulations.

National Environmental Policy Act. DOE finalized the EA for the Interim Storage of Plutonium Components and issued a FONSI in January 1994. This EA analyzed the storage of a larger number of pits for a longer interim period than previously stored. In its FONSI, DOE decided to store no more than 12,000 plutonium pits at Pantex. In May 1994, DOE published a Notice of Intent (NOI) to prepare a new site-wide environmental impact statement (EIS) for *The Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components.* This Site-Wide EIS incorporates several actions that were ongoing at the onset of this EIS. The draft EIS was issued in March 1996.

Comprehensive Environmental Response, Compensation, and Liability Act. On May 31, 1994, EPA placed Pantex on the NPL effective June 30, 1994 (59 FR 27989) as a Superfund site. As a result, Pantex is subject to the provisions of CERCLA enforcement and is required to develop a Federal Facility Agreement. In August 1994, DOE began discussions with EPA and the State of Texas on this agreement to perform response and remediation activities, pursuant to CERCLA and the National Contingency Plan requirements and consistent with corrective actions currently being performed under RCRA. On December 14, 1994, Pantex hosted a meeting of Federal and state trustees who are responsible for assessing damages for injury to, destruction of, and loss of natural resources. Trustees are continuing to participate in the Natural Resource Damage Assessment process under section 107 of CERCLA.

Emergency Planning and Community Right-To-Know Act. No Toxic Chemical Release Inventory Form (EPA Form R) for 1993 was required under Section 313 of this act, because no reportable substances were released at levels above threshold values. However, in accordance with the Agreement in Principle with the State of Texas that was effective July 31, 1990, DOE provides the state with a chemical and radiological contaminant inventory and assessment of the plant.

Resource Conservation and Recovery Act. Pantex is defined as a large-quantity generator and has both permitted and interim-status storage and treatment facilities. Pantex manages some solid wastes under Texas Solid Waste Disposal Act Hazardous Waste Permit Number HW-50284, which includes a corrective action section. Under interim permit status, Pantex also operates thermal treatment units for processing explosives. Hazardous wastes generated at Pantex include, but are not limited to, solvent-contaminated wastewater and spent organic solvents that are contaminated with explosives. These wastes are either managed onsite by storage and limited treatment or shipped offsite for treatment and disposal at permitted treatment, storage, and disposal facilities.

All of the routinely generated radioactive waste from Pantex operations is low-level radioactive

waste. This waste is generated in small quantities from weapons A/D and consists primarily of materials contaminated with depleted uranium or tritium. Low-level radioactive waste is temporarily stored onsite until it is shipped to NTS. Pantex manages mixed waste in accordance with the Pantex Plant*Federal Facility Compliance Act* Compliance Plan, while pursuing commercial treatment capability (see plan below).

The Federal Facility Compliance Act of 1992. This act is an amendment to RCRA. DOE published the Interim Mixed Waste Inventory Report in April 1993, annual updates, and periodic updates since, describing its inventory of mixed wastes and treatment capabilities. Pantex prepared and submitted the Pantex Plant*Federal Facility Compliance Act* Compliance Plan to provide mixed waste treatment capability for all mixed waste streams in accordance with the *Federal Facility Compliance Act*. This plan was approved by the Texas Natural Resources Conservation Commission and adopted through an Agreed Order on September 27, 1995. The Agreed Order, signed by the state on October 2, 1995, requires implementation of this plan.

Clean Water Act. EPA issued Pantex a draft wastewater NPDES permit on December 31, 1994. Actions to finalize the draft permit are progressing. Pantex has a stormwater NPDES permit pending, having resubmitted its permit application on August 24, 1994, and submitted NOI, on September 29, 1994. Pantex also has a wastewater no-discharge permit (Number 02296). On April 1, 1993, the state issued a draft permit based on DOE's May 1992 application to change the permit from a no-discharge to a discharge permit. Such a change requires public hearings and the process is continuing.

Safe Drinking Water Act. The plant water supply meets all required primary and secondary drinking water standards and operational and maintenance regulations. A state inspection on October 4, 1994, confirmed that the system is being operated and maintained in compliance with Texas statutes and regulations.

Clean Air Act. Most Federal requirements are implemented in Texas under the *Texas Clean Air Act*. Pantex Plant has permits and standard exemptions issued by EPA and the Texas Natural Resource Conservation Commission. In 1994, Pantex reviewed activities conducted in all buildings to determine their compliance with 40 CFR 61 Subpart A (General Provisions) and Subpart H (Emissions of Radionuclides Other than Radon from DOE Facilities). All buildings were in compliance. At the Burning Ground explosive weapons components, explosive contaminated materials, and explosive waste are thermally treated. The Burning Ground operates under a written Grant of Authority from the State of Texas for its air emissions and under RCRA interim status for its waste management activities. In 1990, Pantex applied to the state to modify its Permit for Industrial Solid Waste Management Site, to include the Burning Ground. The hearing process on the permit modification is continuing.

Toxic Substances Control Act. Pantex is managing PCBs, asbestos, and chemicals in compliance with applicable regulations. For example, waste materials contaminated with PCBs are shipped offsite to permitted facilities for treatment and disposal. As of December 3, 1994, all equipment and parts used at Pantex that contain PCBs have concentrations of less than 50 parts per million (ppm).

Federal Insecticide, Fungicide, and Rodenticide Act. Compliance with this act and several related state statutes, such as the *Texas Pesticide Control Act* , allows agricultural production on the arable land surrounding the plant. Pesticides are applied by state-licensed personnel who ensure the health and safety of workers and protect the integrity of the environment from potential adverse impacts of agricultural chemicals applications.

A.1.5 Los Alamos National Laboratory

Site Description. LANL is located in north-central New Mexico adjacent to the town of Los Alamos (see figure A.1.5-1). It is about 96 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe. The area is dominated by the Jemez Mountains to the west and the Sangre de Cristo Mountains to the east. These two ranges flank the Rio Grande Valley, which roughly bisects the state from north to south. LANL is located on the Pajarito Plateau, a volcanic shelf on the eastern slope of the Jemez Mountains, at an approximate elevation of 1,900 to 2,400 m (6,230 to 7,870 ft). Erosion has cut the Pajarito Plateau into a number of steeply sloped, deeply eroded drainage canyons and isolated finger-like mesas that fan out from the west to the east. The laboratory occupies approximately 11,300 ha (28,000 acres); 1,400 ha (3,500 acres) lie in Santa Fe County with the remainder in Los Alamos County.

LANL is divided into 74 Technical Areas (TAs) of which 30 are currently active (see figure A.1.5-2). TA-3 is located on South Mesa and is the main or core area where approximately half of the personnel are located. This area serves as the central technical, administrative, and physical support facility for LANL. It also provides space for experimental, theoretical, and computational sciences. From the core area, four roads connect to the other lab areas. The northern-most road crosses the Los Alamos Canyon and connects with the town of Los Alamos, the airport, medical center, and the Tritium System Test Assembly Facility. The road also provides access down the canyon to a nonoperating research reactor and to the facilities for engineering design of weapons components. The East Jemez Road runs east to the Los Alamos Meson physics facility, a general construction support area, a trailer park, a county landfill, and guard facilities, including a firing range.

From TA-3, Pajarito Road runs southeast to White Rock, the only other housing area near LANL. The TAs in this corridor are used predominantly for nuclear materials R&D, fusion and laser R&D, waste management, and other multiuse experimental sciences. The special nuclear materials, radiochemistry, plutonium processing, and waste management facilities are located in this corridor.

From the core area, West Jemez Road runs south along the western boundary of LANL. This West Jemez Corridor sits atop five mesas. TA-16, one of the larger areas, is dedicated to HE research and research, development, and testing (RD&T). Functions at this site include engineering design, prototype manufacturing, processing, and environmental testing of nuclear warhead systems. Ten other TAs located in this corridor are used extensively by the Dynamic Testing Division. The Aboveground Experiments Division and Design Engineering Divisions also have facilities at TAs within this corridor.

Developed land accounts for approximately 5 percent of the LANL area, 580 of 11,300 ha (1,440 of 28,000 acres). Within this developed area lie 2,318 buildings totaling 756,000 m2 (8.14 million ft2). The breakout of this space is as follows: 18 percent for offices, 12 percent for laboratories, 8 percent for heavy experimental facilities, 14 percent for storage, 33 percent for various service facilities, and the remainder for all other uses. Approximately 93 percent of the personnel and square footage are located within 38 of the TAs. About 415 buildings have floor space that exceeds 190 m2 (2,000 ft2) and they account for 89 percent of the lab's total floor space. Of these buildings, 152 exceed 930 m2 (10,000 ft2) and comprise 75 percent of the total space. The average size of the remaining (approximately 1,903) buildings is 60 m2 (650 ft2); half of these buildings are either temporary or transitional. Forty-one percent of all the buildings at LANL are permanent. Of the major buildings (larger than 190 m2), 73 percent of the total square footage was built prior to 1980.

Current missions at LANL are shown in table 3.2.6-1. A complete description of current facility operations can be found in the Los Alamos National Laboratory Institutional Plan. The major DP facilities located at LANL are shown in table A.1.5-1. In addition to the facilities included in this table, DOE operates various smaller facilities related to the ongoing Stockpile Stewardship and Management Program. Many of these have been subject to recent NEPA reviews, but are not included here because they would be considered minor facilities in relation to the entire Stockpile Stewardship and Management Program.

Environmental Regulatory Setting. It is the policy of LANL that operations be performed in a manner that protects the environment and addresses compliance with applicable Federal and state environmental protection regulations. The New Mexico Environment Department has state authority for developing regulations and standards for air, water, and hazardous and mixed waste management.

The remainder of this section summarizes the status of LANL compliance with the major environmental regulations.

National Environmental Policy Act. The current LANL Site-Wide EIS was published in 1979. Since the new LANL Site-Wide EIS is under preparation, any EA that proceeds ahead of the Site-Wide EIS was either identified in the NOI (60 FR 25697) of May 12, 1996, or must qualify as an interim action. The Site-Wide Draft EIS is expected to be released to the public in early February 1997 with the Site-Wide Final EIS to be issued in late August 1997.

Comprehensive Environmental Response, Compensation, and Liability Act. LANL is not on EPA's NPL; therefore, cleanup from past operations is covered not by CERCLA, but by other regulations, principally RCRA.

Resource Conservation and Recovery Act. The state was granted authorization by EPA to regulate control of hazardous waste under RCRA on January 25, 1985, and mixed waste on July 25, 1990. LANL is a large-quantity generator under RCRA and operates under both interim status provisions and a New Mexico Environment Department permit. Applications for mixed waste storage and treatment at LANL were submitted to the state prior to 1992 and are under interim status provisions.

Table A.1.5-1.-- Major Defense Program Facilities Located at Los Alamos National Laboratory

Facility	Function
Chemistry and Metallurgy Research (CMR) Building (TA-3)	Nuclear materials analytical chemistry, R&D, and storage, control and accountability
Main Shops Complex (TA-3)	Nonnuclear and uranium component manufacturing
Sigma Complex (TA-3)	Nonnuclear beryllium and pit support component fabrication, uranium process development and component production, and materials R&D
Nondestructive Testing Facilities Anchor Sites (TA-8)	Radiography, acoustics, and holography
High Explosives Operations, Anchor East (TA-9)	HE storage, characterization, safety and R&D, and pilot scale HE synthesis and formulation

Environmental Testing Facilities, K-Site (TA-11)	Vibration, impact, dynamic testing, and thermal testing
High Explosives Operations, Q-Site (TA-14)	HE testing and disposal
Hydrodynamic Testing Facilities, Pulsed High Energy Radiation Machine Emitting X-Rays (PHERMEX), Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, Firing Site R-306, and other facilities (TA-15)	Hydrodynamic testing, dynamic experiments, and HE testing
Weapons Engineering Tritium Facility (WETF), S-Site (TA-16)	Tritium processing and recovery, tritium R&D, tritium reservoir loading and surveillance, and fusion and neutron tube target loading
Explosives Facilities, S-Site (TA-16)	Large scale HE formulation, synthesis, casting, pressing, machining, assembly, inspection, packaging, treatment, storage, transportation, and disposal
Los Alamos Critical Experiment Facility (LACEF) (TA-18)	Nuclear criticality studies in design, construction, research, development, and application; nuclear material storage control and accountability
Tritium Operations (TA-21)	Neutron tube target loading and tritium R&D
Detonator Facility (TA-22)	Detonation R&D and high power detonator production
Target Fabrication Facility (TA-35)	Inertial confinement fusion target fabrication, physical and chemical vapor deposition component production and process development, material science R&D, and calorimetry
Trident Laser Facility and other facilities (TA-35)	Inertial confinement fusion experiments and high energy density weapons physics
Pegasus-II Facility and other facilities (TA-35)	Pulsed power capacitor bank, high energy density weapons physics experiments, hydrodynamic experiments, and dynamic material properties research, and pulsed power research
Kappa Site (TA-36)	HE and nonnuclear ordnance testing
Ancho Canyon (TA-39)	Explosively driven pulsed power experiments and development, dynamic experiments, and HE testing
DF Site (TA-40)	Detonation science and HE testing, and detonator development and surveillance
Radiochemistry (TA-48)	Radiochemistry, radiochemistry R&D, isotope production, waste management technology development, and isotope separation
Los Alamos Neutron Science Center (LANSCE) Complex (TA-53)	Neutron spallation sources; neutron research for materials science, stockpile stewardship research and development; nuclear and accelerator research and development; tritium production research and development; research on sub-atomic particles and particle physics, atomic physics, neutrinos, and the chemistry of sub-atomic interactions; isotope production; and radio frequency power sources, high-power microwaves, and free electron lasers studies

Plutonium Facilities (TA-55)	Nuclear material processing and recovery, plutonium R&D, plutonium component fabrication and surveillance, processing of plutonium-238 to produce heat sources, fabrication of ceramic-based and other reactor fuels, nuclear material R&D, and nuclear material storage, control, and accountability

Note: HE - high explosives; R&D - research and development; TA - technical area.

Source: LANL 1995t.

The state conducts annual RCRA audits of generator locations and treatment, storage, and disposal facilities throughout the LANL facilities. On January 28, 1993, the state issued two Compliance Orders listing a total of 24 alleged violations, including violations involving the management of mixed waste, deficiencies related to general waste management requirements, and deficiencies that could adversely affect human health and the environment if not addressed in a timely manner. Negotiations between DOE and the state resulted in a civil penalty of $700,000. All of the deficiencies relating to the general waste management requirements were corrected within 30 days.

The Environmental Restoration Project Office at LANL provides oversight for the closure of several solid waste management units which are subject to the corrective action requirements and closure provisions of the Hazardous and Solid Waste Amendments under RCRA. The state has regulatory authority for closure of these sites. During 1992, LANL and the state were in the process of developing a permit application to initiate the construction of a mixed waste storage and disposal facility for the disposal of mixed waste generated by the site remediation processes. LANL halted all construction efforts for the mixed waste storage and disposal facility in 1995.

LANL operates a controlled air incinerator that was permitted in November 1989 for the treatment of hazardous waste. The facility was placed on standby in 1992 for upgrades. The controlled air incinerator will be closed under RCRA and TSCA by the end of 1996.

The Federal Facility Compliance Act of 1992. This Act is an amendment to RCRA. DOE published the Interim Mixed Waste Inventory Report in April 1993 and has published annual updates and periodic updates since, describing its inventory of mixed wastes and treatment capabilities. The New Mexico Environment Department issued a Compliance Order in October 1995 directing DOE to implement the LANL Site Treatment Plan for Mixed Waste. This order terminates the Federal Facilities Compliance Agreement between DOE and EPA concerning land disposal restricted wastes.

Clean Water Act. The NPDES permit for LANL regulates discharges from 9 wastewater treatment facilities and 130 industrial outfalls. During 1992, compliance for sanitary and industrial discharges was 99.6 percent and 99.0 percent, respectively. Two NOIs for stormwater discharges were submitted on October 1, 1992, for the Lagoon Elimination Project and the Los Alamos Integrated Communication System. An additional NOI was submitted on September 29, 1992, for stormwater discharges associated with industrial activities.

Safe Drinking Water Act. LANL maintains compliance with Safe Drinking Water Act (SDWA) standards for its public water systems.

Clean Air Act. The New Mexico State Implementation Plan incorporates requirements of the act including the 1990 CAA Amendments, NESHAP, National Ambient Air Quality Standards, and New

Source Performance Standards. The state administers these Federal and state requirements through a series of Air Quality Control Regulations. During 1991, two open burn permits were issued to LANL for the burning of scrap wood from experiments and the burning of jet fuel for ordnance testing.

LANL operated 36 continuous emissions monitoring stations in 1992 to sample air discharges for radioactive releases. While no radionuclide concentrations were detected which would pose an environmental or health problem, EPA issued a Notice of Noncompliance on November 23, 1992, following an audit of LANL's NESHAP program in August 1992. The notice stated that LANL emissions exceeded the 10 mrem/yr effective dose equivalent standard during the 1990 reporting period. As a result of two Notices of Noncompliance issued to DOE by EPA Region 6 on November 27, 1991, and November 23, 1992, DOE and EPA entered into negotiations to achieve compliance with NESHAPs. The negotiations resulted in a Federal Facilities Compliance Agreement being signed on June 13, 1996, which requires that compliance with Subpart H be achieved by August 15, 1996.

Toxic Substances Control Act. This act regulates PCB use and storage at LANL. In compliance with TSCA regulations, equipment and materials containing PCBs greater than, or equal to, 50 ppm are removed and shipped offsite to permitted treatment and disposal facilities or disposed of at TA-54, Area G (only applied to solids containing 50 to 499 ppm of PCBs). No deficiencies were noted following an EPA inspection during the summer of 1993.

Federal Insecticide, Fungicide, and Rodenticide Act. In addition to this act, LANL is regulated by the New Mexico Pest Control Act which regulates pesticide use, storage, and certifications. Annual inspections to assess compliance with this act are conducted by the state.

A.1.6 Lawrence Livermore National Laboratory

Site Description. LLNL is located in southern Alameda County, CA, approximately 64 km (40 mi) east of San Francisco. The LLNL complex consists of a main site east of the city of Livermore (Livermore Site), several leased properties near the Livermore Site, and a more remote site (Site 300) in the Altamont Hills, 27 km (17 mi) southeast of the Livermore Site (see figures A.1.6-1 and A.1.6-2).

The Livermore Site occupies a 332-ha (821-acre) area in the southeast portion of the Livermore Valley. The valley is about 26-km (16-mi) long (east-west) and 11- to 16-km (7- to 10-mi) wide (north-south). Hills ranging in elevation from 300 to 600 m (1,000 to 2,000 ft) surround the Livermore Valley. These hills are predominantly open space devoted to agriculture and recreation uses.

Onsite land use includes offices, laboratory buildings, support facilities (e.g., cafeterias, storage areas, maintenance yards, facilities for waste treatment and groundwater treatment, security, and a fire station), roadways, parking areas, and landscaping. A 150 m (500 ft) wide security buffer zone lies along the northern and western borders of the site.

The Livermore Site has approximately 550,000 m2 (5.9 million ft2) of facilities that include existing space and areas under construction. This space is distributed among approximately 600 buildings, over 300 are temporary structures. Temporary facilities (trailers, modular buildings, and World War II buildings) constitute 30 percent of the occupied space and house approximately 51 percent of the total laboratory office population. Approximately 53 percent of the permanent facilities are more than

20 years old; 40 percent are more than 30 years old.

East of the laboratory is agricultural property with a few scattered rural residents. A branch of the California Aqueduct, the South Bay Aqueduct, traverses land east of the lab in a north-south direction. To the north lies a light industrial park, a line of the Union Pacific Railroad, and Interstate 580. Residential areas of low to medium density and the city of Livermore extend to the west. Immediately south of the Livermore site is the SNL site at Livermore. Farther south, and southwest, the land is cultivated for vineyards.

Site 300 is an HE test site occupying 2,800 ha (7,000 acres) of largely undeveloped steep ridges and canyons about 29 km (18 mi) southeast of Livermore in the sparsely populated Altamont Hills of the Diablo Range. Elevations vary from a low of 150 m (500 ft) along Corral Hollow Creek on the southern boundary to 520 m (1,700 ft) above mean sea level in the northwest portions of the site. Slopes range from 8 to greater than 45 degrees.

Site 300 consists of two remote firing areas supported by a chemistry processing area and an administrative support area at the site entrance. The site also includes a number of storage magazines. Major buildings include the firing complex, the advanced test accelerator, the dynamic test complex, disassembly complex, and drop tower test areas. Other facilities include police and fire department, badge office, HE storage, warehouse, medical, cafeteria, and other service facilities. There are approximately 31,700 m2 (341,000 ft2) of facilities, including four trailers.

While the majority of the land surrounding Site 300 is agricultural (primarily for grazing cattle and sheep), two other defense-related research and testing facilities are in the area. A facility adjacent to Site 300 on the east and a similar facility approximately 1 km (0.6 mi) to the south both conduct HE tests.

South of the western portion of Site 300 is the Carnegie State Vehicular Recreation Area which is for the exclusive use of off-highway vehicles. The nearest urban area is the city of Tracy, approximately 13 km (8 mi) northeast of Site 300. Several rural residences, however, are much closer to the site. Power-generating wind turbines occupy the land northwest of the site.

Current missions at LLNL are shown in table 3.2.7-1. A complete description of current facility operations can be found in the Lawrence Livermore National Laboratory Site Institutional Plan. The major DP facilities located at LLNL are shown in .

Environmental Regulatory Setting. It is the policy of LLNL to protect the environment and ensure that operations are conducted in accordance with applicable laws and regulations that have been enacted to protect the environment. With some minor exceptions, the State of California has regulatory authority for air, water, solid waste, hazardous waste, and mixed waste as administered through a variety of state and local agencies. The remainder of this appendix section summarizes the status of LLNL compliance with the major environmental regulations.

National Environmental Policy Act. During 1994, two EAs for proposed projects were initiated by LLNL. The Draft Environmental Assessment for the Mixed Waste Management Facility addressed the potential impacts from construction and operations of a facility that will demonstrate potential technologies for treating DOE mixed waste on a pilot scale. Based on the results of this research, certain technologies may be adopted later by DOE for treatment of mixed wastes throughout DOE's facilities. DOE is currently reviewing this Draft EA.

Table A.1.6-1.--Major Defense Program Facilities at Lawrence Livermore National Laboratory

Facility	Functions
Microfabrication Laboratory, Bldg. 153	Microelectronics fabrication
High Explosives Application Facility (HEAF), Bldg. 191	High explosives research with modern diagnostic and testing equipment
High Pressure - High Temperature Laboratory, Bldg. 232	High pressure - high temperature thermodynamic and materials properties experiments
Hydrogen Research Facility, Bldg. 331	Inertial confinement, fusion-directed, experimental work with isotopes of hydrogen gas, metal hydrides in contained beds, and small amounts of experimental metal hydrides and tritium-labeled compounds
Plutonium Facility, Bldg. 332	Testing plutonium-bearing engineering assemblies, developing and demonstrating improved plutonium fabrication techniques, and fundamental and applied research in plutonium metallurgy
High Pressure Laboratory, Bldg. 343	Tests and experiments with high pressure systems
Inertial Confinement Fusion Laser Facility, Bldg. 391	Nova laser, high-energy-density physics
Hydrodynamic Test Facilities with Flash X-Ray Facility at Site 300	Hydrodynamic and explosives testing with gamma-ray implosion imagery and other diagnostics

Source: LLNL 1995o.

The Draft EA for the Site 300 Explosives Waste Treatment Facility addressed the potential impacts of constructing and operating up-to-date replacement facilities for treating explosives wastes and explosives-contaminated wastes at Site 300. DOE is currently reviewing this Draft EA.

The California Environmental Quality Act (California Public Resources Code Sections 21000 et seq.) establishes state policy for protecting environmental quality. The goals of the California Environmental Quality Act are achieved by requiring local and state agencies to assess the potential environmental impacts of proposed actions for which they may have a decisionmaking role. This is done through the preparation of an initial study, which leads to issuance of a negative declaration or a requirement to prepare an Environmental Impact Report. An Environmental Impact Report may also be prepared directly for projects that may have significant environmental impacts. No Initial Study or Environmental Impact Report documents were prepared by the University of California in 1994 on proposed projects for which the university was the decisionmaking or lead agency.

Comprehensive Environmental Response, Compensation, and Liability Act. Both the Livermore Site and Site 300 are listed on the EPA's NPL. The Livermore site was placed on the NPL in 1987, and LLNL's groundwater project complies with provisions specified in a 1988 Federal Facility Compliance Agreement entered into by EPA, DOE, the California Department of Toxic Substances Control, and the San Francisco Bay Regional Water Quality Control Board. The ROD was issued by

EPA in 1992. Remedial investigations and treatment operations are ongoing.

Groundwater investigations began at Site 300 in 1981. The site was placed on the NPL in 1990. In June 1992, DOE negotiated a Federal Facility Agreement with EPA and the state that describes the groundwater and soil investigations to be conducted and specifies the reporting dates. Since June 1992, Site 300 investigations and remedial actions have been conducted under the joint oversight of EPA, Central Valley Regional Water Quality Control Board, and the Department of Toxic Substances Control under the authority of a Federal Facility Agreement.

Emergency Planning and Community Right-To-Know Act. In compliance with this act, LLNL implemented a computerized chemical tracking system called ChemTrack. The system allows for improved emergency response planning and complete inventory information, as well as improved overall chemical management.

Resource Conservation and Recovery Act. RCRA- regulated operations at LLNL's Livermore Site are managed under Interim Status Standards as administered by the California Department of Toxic Substances Control. A Part B Permit application has been submitted and describes storage and treatment operations at five facilities located in and near Buildings 233, 419, 514, 612, and 693. An additional new storage and treatment facility known as the Decontamination and Waste Treatment Facility would include construction of five new buildings for waste management operations to be located in the vicinity of Building 693. The Decontamination and Waste Treatment Facility would replace the majority of existing waste management facilities located in Areas 612 and 514.

At Site 300, LLNL operates a Part B-permitted container storage unit (Building 883) for management of hazardous waste. This facility permit is currently undergoing renewal. Explosives wastes are burned at an open burn facility near Building 829 under terms of a compliance order until a new thermal treatment unit can be designed, permitted, and constructed at which time the Building 829 facility will close. Part B Permit applications have all been submitted to the California Department of Toxic Substances Control for a new explosives storage facility and a new open burn/open detonation facility.

The Department of Toxic Substance Control conducted its annual audit of generator locations throughout the Livermore Site from June 22 to 25, 1993, and on July 14, 1993. Seventeen alleged violations were reported August 6, 1993. Site 300 was inspected February 16 and 17, 1993, and November 15 and 16, 1993. In each case, three violations were noted. Appropriate actions were taken at both sites to correct the violations.

The Building 829 Open Burn Facility thermally treats HE waste. The facility operates in accordance with interim status standard and the terms of a September 1993 compliance order. Design and permitting activities are currently in progress to build a new waste treatment facility at Building 845 to eliminate the need for the Building 829 Open Burn Facility. Another new facility has been proposed for Site 300, and a Part B Permit application has been submitted. The facility is an explosives waste storage facility that augments the storage capability at Building 883 by providing a separate dedicated facility to store explosives waste.

Federal Facility Compliance Act of 1992. Mixed wastes are generated and managed by LLNL operations in accordance with requirements of the *Federal Facility Compliance Act.* Existing and proposed management practices have been identified in the proposed site treatment plan submitted in April 1995. DOE is negotiating terms of a compliance agreement with the California Department of

Toxic Substances Control.

Clean Water Act. This act is administered by the California Resources Board and regional and local agencies. Routine discharges to ground and surface waters resulting from the groundwater investigation and remediation activities at the Livermore Site are subject to permits issued by the San Francisco Bay Regional Water Quality Control Board. Stormwater associated with industrial activities is discharged under a Wastewater Discharge Permit issued by the Livermore Water Reclamation Plant. Site 300 holds water discharge requirements and NPDES permits issued by the Central Valley Regional Water Quality Control Board. These pertain to discharges associated with cooling towers and groundwater remediation work. Site 300 permits are also in effect for closed landfills and operation of an explosives rinsewater surface impoundment system.

Safe Drinking Water Act. LLNL maintains compliance with *SDWA* standards for its public water systems.

Clean Air Act. This act is enforced by the California Air Resources Board and local districts. The Livermore Site complies with the Bay Area Air Quality Management District rules and regulations. Site 300 is subject to rules enforced by the San Joaquin Valley Unified Air Pollution Control District. LLNL holds over 200 permits for air pollution sources and control equipment that are renewed on an annual basis.

Radionuclide emissions are regulated under NESHAPs, which is administered by EPA. In April 1994, EPA notified DOE and LLNL that all requirements of the August 1993 Federal Facilities Compliance Agreement had been met and that LLNL had satisfactorily demonstrated compliance.

Toxic Substances Control Act. LLNL regulates PCBs and asbestos in compliance with TSCA regulations. LLNL submits annual PCB reports to EPA. Asbestos wastes are reported in the hazardous waste report.

A.1.7 Sandia National Laboratories

Site Description. SNL is headquartered in Bernalillo County at the foot of the Manzano Mountains adjacent to Albuquerque, NM. At their nearest points, SNL facilities are 4.0 km (2.5 mi) south of Interstate 40 and 10.5 km (6.5 mi) east of downtown Albuquerque. The facilities are surrounded by Kirtland Air Force Base, with co-use agreements on some U.S. Air Force property. An area of the Manzano Mountains east of Kirtland Air Force Base has been withdrawn from the U.S. Forest Service for the exclusive use of the Air Force and DOE. The location of SNL and its principal facilities are shown in figures A.1.7-1 and A.1.7-2.

The laboratory is situated on the 30,562-ha (75,520-acre) Kirtland Air Force Base military reservation. Kirtland Air Force Base is located on two broad mesas bisected by the Tijeras Arroyo, an east/west canyon. These mesas are bounded by the Manzano Mountains (Cibola National Forest) to the east and the Rio Grande to the west. Elevations range from 1,500 m (4,921 ft) at the Rio Grande to 3,255 m (10,680 ft) at Sandia Crest, which is in the Sandia Mountains adjacent to Albuquerque.

Albuquerque, the largest population center in Bernalillo County, and also the closest population center to Kirtland Air Force Base, is located slightly north of the base. The 1990 census figures show an Albuquerque population of 384,736. The Isleta Indian Pueblo, which borders Kirtland Air Force Base on the south, is the next nearest population center with a 1990 census of 2,953. An estimated

total population of 578,313 people live within an 80-km (50-mi) radius of Kirtland Air Force Base. This includes permanent residents of Kirtland Air Force Base living in the base housing areas. Current missions at SNL are shown in table 3.2.8-1. A description of facility operations can be found in the Sandia National Laboratories Site Institutional Plan. The major DP facilities located at SNL are shown in table A.1.7-1.

The majority of activities at SNL are DP activities. SNL facilities are located in five technical areas and several additional test areas. There are approximately 560 major buildings totaling over 370,000 m2 (4 million ft2) located in these areas. Each area has its own distinctive operations and is described in the following paragraphs.

Table A.1.7-1.-- Major Defense Program Facilities Located at Sandia National Laboratories

Facility	Function
Lurance Canyon Burn Site and Explosive, Electro-Explosive, and Aerial Cable Test Facilities (Coyote Test Field)	Weapons component testing in simulated accident scenarios and constrained rocket testing
Neutron Generator Facility, Wind Turbine, Environmental Test Laboratories, and Chemical, Ion, and Laser Physics Laboratories, Integrated Materials Research Laboratory, Micro Electronics Laboratory, Robotics, Manufacturing Science and Engineering Laboratory, Advanced Manufacturing Processes Laboratory, Primary Standards Laboratory, Lightning Test Laboratory, A/D Laboratory (Technical Area I)	Design, test, and manufacture of neutron generator components and weapon systems supporting R&D and production; structural analysis in high fatigue environments and material properties research
Explosives Component Facility, Device Development and Testing Facilities, and Environmental Testing Laboratories (Technical Area II)	Design, test, and manufacture of low power detonators, initiators, and timers for weapons subsystems
Dynamic Shock, Airgun Test and Reentry Burn-Up Test Facilities, Drop Tower, and Molten Core Laboratory (Technical Area III)	Extreme environmental testing, product acceptance qualification testing, material properties determination, and melting and casting process research
Particle Beam Fusion Accelerator (PBFA) High-Energy Radiation Megavolt Electron Source (HERMES) III Accelerator, Saturn Accelerator (Technical Area IV)	High energy gamma ray testing of electronic components for survivability; pulse power and weapon physics R&D; short pulse gamma and x-ray test facility for weapons component radiation testing
Hot Cell Facility, Annular Core Research Reactor, Sandia Pulse Reactor III, Gamma Irradiation Facility (Technical Area V)	Research and surveillance test facility for highly radioactive materials and products; high power pulse or steady state neutron and gamma ray radiation simulation environment for weapons component testing; steady state gamma ray testing of electronic systems and subsystems

SNL 1995i.

Technical Area I has the largest employee population (approximately 5,000) and is dedicated primarily to three activities: the design, research, and development of weapons systems; limited production of weapons system components; and energy programs. Technical Area I includes the main library, offices, laboratories, and shops used by administrative and technical staff; two small accelerators; a foundry; a steam plant; and an emergency diesel generator plant.

Technical Area II is a small area used for explosives testing. Techniques for measuring fractures in geologic strata are developed at this facility. Also located in Technical Area II are an inactive low-level radioactive waste disposal site, a small radioactive material decontamination and storage facility (Building 906), and a storage facility designed to temporarily hold PCB-contaminated materials to be transported to an EPA-licensed disposal facility. The inactive low-level waste (LLW) disposal site has not been used for over 20 years. Most Technical Area II activities have been transferred to the Explosive Components Facility, a new facility intended to replace Technical Area II. This facility will integrate many of the existing Technical Area II activities, as well as some remote testing activities currently performed in other test areas.

Technical Area III is located adjacent to and south of Technical Area V, 8 km (5 mi) south of Technical Area I. It comprises 20 test facilities that include extensive environmental test facilities (such as sled tracks, centrifuges, and a radiant heat facility). Other facilities in Technical Area III include a paper incinerator, an inactive LLW and mixed waste disposal site, and a melting and solidification laboratory. The inactive radioactive waste disposal site in Technical Area III consists of two adjoining fenced areas that occupy 0.6 ha (1.5 acres). One area was used for LLW disposal in seven shallow trenches. The second area was used for disposal of classified LLW in 37 pits. LLW consisted primarily of tritium-contaminated materials. Three additional pits located in the classified waste disposal area were used exclusively for natural and depleted uranium waste disposal. The site is currently used as an interim storage facility for radioactive and mixed wastes.

An inactive hazardous-waste disposal and storage site is also located near the southern boundary of Technical Area III. This facility has not been used for disposal of hazardous wastes since November 7, 1985. It was used as an interim hazardous waste storage area from 1985 to 1988. A closure plan and post-closure permit application were prepared in May 1988. The newer hazardous waste repackaging and storage building, located south of Technical Area I, has been in use since 1988.

Technical Area IV consists of several inertial-confinement fusion research and pulsed-power research facilities. One large accelerator, the Particle-Beam Fusion Accelerator-II, was completed in 1985. A large accelerator facility, the Simulation Technology Laboratory, houses seven pulsed-power accelerators. Several of these accelerators have been transferred from Technical Area V.

Technical Area V houses two research reactors in two reactor facilities, an intense gamma irradiation facility (using cobalt-60 and cesium-137), and a hot cell facility. The two research reactor facilities in Technical Area V are small and quite dissimilar: the Sandia Pulsed Reactor is an unreflected, unmoderated assembly of enriched uranium, and the Annular Core Research Reactor consists of an annular core of 226 fuel elements in an open water tank.

There are also test areas outside the five Technical Areas. These areas are located south of Technical Area III and in canyons on the west side of the Manzano Mountains. Coyote Canyon and Thunder Range are two examples of such areas.

Depleted uranium was used in the past for explosive testing in these remote areas. The test areas were surveyed following each test and contaminated materials were collected and disposed of in accordance with DOE requirements. Environmental monitoring is done as necessary. Operations in these areas are administratively controlled to avoid uranium contamination to public areas beyond the confines of Kirtland Air Force Base.

Electricity is supplied to SNL and much of southeast Albuquerque through the Public Service Company of New Mexico's switching station on Eubank Boulevard. Voltage is stepped down through transformers to 46 kilovolt (kV) for distribution through four feeders. Feeder 1 serves Technical Areas II through V and outlying areas, Feeder 2 serves the Radiant Heat Facility in Technical Area III, and Feeders 3 and 4 supply Technical Area I.

Kirtland Air Force Base is responsible for the overall natural gas system. The distribution system in technical areas I, II, and IV is owned by DOE and operated by SNL. Natural gas is purchased from Kirtland Air Force Base, which buys it commercially. Fuel is stored in Technical Area I for refueling remote-site tanks and for emergency supply to the steam plant. The steam plant in Technical Area I supplies steam both to that area and to Kirtland Air Force Base for space heating, hot water converters, absorption chillers, and processes.

Responsibility for water storage and transmission rests with Kirtland Air Force Base, with SNL handling distribution only to its own facilities. Remote test areas in Coyote Canyon have water trucked to them.

SNL is responsible for the sewage collection system in its technical areas and in Coyote Test Field, while Kirtland Air Force Base is responsible for the base-wide system. SNL contains over 24 km (15 mi) of sewer lines interconnected with Kirtland Air Force Base. Technical Areas I and IV are tied into the Kirtland Air Force Base system, while Technical Areas II, III, and V and Coyote Test Field have septic tanks and sewage lagoons independent of the main system.

Environmental Regulatory Setting. SNL strives to comply with environmental and other requirements established by Federal, state, and local statutes and regulations, executive orders, and DOE orders. The New Mexico Environment Department has state authority for developing regulations and standards for water, and hazardous and mixed waste management. The Albuquerque/Bernalillo County Air Quality Control Board has authority for developing regulations and standards for air. The remainder of this section summarizes the status of SNL compliance with the major environmental regulations.

National Environmental Policy Act. During 1994, SNL NEPA compliance activities focused on developing the SNL NEPA program and baseline information and fulfilling commitments made in the *Final Action Plan to Tiger Team.* SNL initiated the preparation of 15 EAs during 1994. FONSIs were issued for the neutron generator/switch tube prototyping relocation on April 8, 1994; general-purpose heat source safety verification testing on February 15, 1995; and the construction and occupancy of the Robotic Manufacturing Science and Engineering Laboratory on April 13, 1994.

Comprehensive Environmental Response, Compensation, and Liability Act. Based on the Preliminary Assessment/Site Inspection conducted in 1988, EPA concluded that none of SNL's inactive waste sites qualified for the EPA's list of high-priority cleanups. Therefore, this act does not govern waste site cleanup, but RCRA does. During 1994, SNL had two reportable quantity chemical releases. Lead

was released during a scheduled rocket motor firing and transformer oil leaked from an oil storage system and escaped from the system's secondary containment.

Resource Conservation and Recovery Act. The New Mexico Environment Department was granted authorization to regulate control of hazardous waste under RCRA by EPA on January 25, 1985, and mixed waste on July 25, 1990. SNL, which operates an onsite permitted treatment facility, is defined by RCRA as a large-quantity generator. During 1994, 86,369 kg (190,400 lb) of RCRA-regulated hazardous waste was managed by SNL. On May 12, 1994, DOE transmitted a Class I permit modification of the RCRA storage permit to the New Mexico Environment Department, allowing SNL to receive offsite generated wastes. SNL also operates a Thermal Treatment Facility that was permitted in November 1994 for the treatment of residual explosives.

The New Mexico Environment Department conducts annual RCRA audits of the SNL Hazardous Waste Management Facility and generator locations throughout SNL facilities. On October 7, 1994, the New Mexico Environment Department issued a Compliance Order listing 17 alleged violations, including open containers of hazardous waste, labeling errors, and incomplete training. Five of the violations were dropped following negotiations between SNL and the New Mexico Environment Department, and a civil penalty of $9,240,000 was proposed in January 1995. All of the remaining issues have been corrected.

As identified by the Environmental Restoration Project, potential release sites are being evaluated and corrected. At SNL's inactive Chemical Waste Landfill, concentrations of trichloroethylene slightly above the EPA's drinking water standards were discovered in groundwater 150 m (500 ft) beneath the site. A corrective action plan, entitled *The Chemical Waste Landfill Final Closure Plan and Postclosure Permit Application,* was approved by the New Mexico Environment Department in May 1993. Sites at which assessment efforts continued during 1994 include the Mixed Waste Landfill, Technical Area II, the Liquid Waste Disposal System, Tijeras Arroyo, and also at the Kauai Test Facility in Hawaii.

The Federal Facility Compliance Act of 1992. In accordance with the *Federal Facility Compliance Act* enacted in October 1992, SNL submitted a complete inventory of its mixed waste in November 1993 for the Final Mixed Waste Inventory Report. Additionally, SNL submitted the Conceptual Site Treatment Plan (Phase I) for SNL mixed waste issued in October 1993 and the Draft Site Treatment Plan (Phase II) issued in August 1994 to the New Mexico Environment Department. In December 1994, the Proposed Site Treatment Plan (Phase III), including a revised mixed waste inventory through September 1994 and preferred treatment options in accordance with the DOE/AL Mixed Waste Treatment Plan (April 1994), were submitted to the New Mexico Environment Department.

Clean Water Act. SNL submitted an NPDES permit application on October 1, 1992, for its industrial discharge. Two NOIs to discharge for construction of stormwater discharges were submitted on January 24, 1994, for construction of the Technology Support Center, and on September 19, 1994, for construction of the Robotic Manufacturing Science and Engineering Laboratory. SNL has six wastewater discharge permits from the city of Albuquerque.

Safe Drinking Water Act. SNL maintains compliance with *SDWA* standards for its public water systems.

Clean Air Act. SNL is regulated by the 1990 CAA amendments and by local regulations, including air quality control regulations, which are administered by the Albuquerque/Bernalillo County Air Quality

Control Board. In 1994, 15 open burn permits were issued to SNL by the city of Albuquerque. Permits were issued for operations at the Luance Canyon Burn Site, the Thermal Treatment Facility, the Coyote Test Field, and the Fire Extinguisher Training Site. All other existing permits were issued by either the city of Albuquerque or EPA. In early 1995, SNL conducted an inventory of hazardous chemical usage. The inventory included radionuclides, ozone-depleting substances, and chemicals listed in *Superfund Amendments and Reauthorization Act*, Section 313, Toxic Chemical List.

In January 1994, SNL began an ambient air surveillance program which included one criteria pollutant monitoring station, seven particulate matter monitoring stations, and four VOC monitoring locations. No exceedances or violations were detected in 1994.

Toxic Substances Control Act. SNL regulates PCBs and asbestos in compliance with TSCA regulations. Electrical distribution equipment containing greater than, or equal to, 50 ppm are being removed and shipped offsite to permitted treatment and disposal facilities. A total of 49 items, having PCB concentrations over 50 ppm, remained in service as of December 31, 1994. SNL operates two programs for the management of asbestos. The Facilities Asbestos Program manages the abatement of floor tiles and insulation. The Non-Facilities Asbestos Program handles nonfacilities items that may contain asbestos such as gloves, fume hoods, and ovens.

Federal Insecticide, Fungicide, and Rodenticide Act. EPA-registered pesticides are applied by EPA-certified applicators. Records including pesticide types and quantities and Material Safety Data Sheets are retained by SNL.

A.1.8 Nevada Test Site

Site Description. NTS is located in Nye County, NV, and encompasses approximately 351,000 ha (867,000 acres). It varies in width from 45 to 56 km (28 to 35 mi) east to west and in length from 64 to 88 km (40 to 55 mi) north to south. To the north, east, and west, the rugged, mountainous, and undeveloped Federal-owned land masses of the Nellis Air Force Range provide a buffer zone, varying from 24- to 104-km (15- to 65-mi) wide, between the test areas and public lands. The Bureau of Land Management manages the land that borders the southern and southwestern boundaries. U.S. Highway 95 and the town of Amargosa Valley are also to the south. The southeast corner of NTS is about 104 km (65 mi) northwest of Las Vegas. Locations of NTS and its principal facilities and testing areas are shown in figures A.1.8-1 and A.1.8-2.

NTS is unique in that it is a large open area with tightly controlled access and with adequate infrastructure to handle and run tests with hazardous or radioactive materials. Approximately 25 percent of NTS is undeveloped or provides buffer zones for ongoing programs and projects. Facility expansions are possible within all areas and encroachment from land development is not a concern.

NTS is divided into numbered test areas to simplify the distribution, use, and control of resources. The main entrance and the Desert Rock Airstrip are at the southeast corner of the site (Area 22). Mercury Base Camp is adjacent in Area 23 and provides administrative operations and general support. Offices for DOE, DOD, the Defense Nuclear Agency, LLNL, LANL, SNL, and all of the supporting contractors of these organizations are located in this area. Dormitory, cafeteria, recreation, and transportation facilities are located here.

North of Mercury is Frenchman Flat (Area 5), a historic area because of the atmospheric nuclear tests conducted there. Just north of Frenchman Flat is Area 6. The Control Point One Complex, which

provides control over and execution of nuclear detonations at NTS, is located here, as is a new work-camp for construction and craft support. A shallow, usually dry-lake bed, Yucca Lake, is also in this area. Farther north is the broad valley of Yucca Flat, site of many of the more recent nuclear tests (Areas 1, 2, 3, 4, 7, 9, and 10). At the northern edge of this flat at the base of Rainier Mesa is the center of DOD/Defense Nuclear Agency activities (Area 12). The Area 12 Camp, which is closed, provided logistic, service, and administration facilities that, in busier times, supported the northern part of NTS. The Area 12 Camp provided ready access to the Defense Nuclear Agency tunnels mined into the face of Rainier Mesa. In the northwest section of NTS is Pahute Mesa. Pahute Mesa's geology allows its use for testing nuclear devices with larger yields (Areas 19 and 20).

Due to its large size, the perimeter of NTS is not completely fenced; however, roving security guards patrol the test site. Security and hazardous areas are fenced and some areas are protected with armed guards and electronic security measures. Capital assets at NTS include about 1,200 buildings with 8,000 units of installed equipment, approximately 640 km (400 mi) of primary and secondary surfaced roads, and 480 km (300 mi) of unsurfaced roads.

The NTS water system consists of many wells, pumps, booster pumps, and many sumps, reservoirs, chlorinator water softeners, and 160 km (100 mi) of supply and distribution lines. This water system has an average weekly production of 40 million liters (L) (10.5 million gallons [gal]). Total well capacity is 21,670 liters per minute [lpm] (5,752 gallons per minute [gpm]). Twelve wells supply water for domestic use on NTS.

Electrical power to NTS is supplied by Nevada Power Company and Valley Electric Association transmission lines. Both transmission lines are rated at 138 kV. The Nevada Power Company line is approximately 96 km (60 mi) long and ties into the NTS transmission system near Mercury. The Valley Electric Association line is more than 160 km (100 mi) long. It runs from the Amargosa Valley substation and ties into the NTS transmission system at Jackass Flats substation. This system (the Nevada Power Company/Valley Electric Association transmission lines) is capable of providing 45 megawatt electric (MWe) based on a single contingency failure. NTS has over 1,120 km (700 mi) of overhead and underground transmission and distribution power lines. NTS also uses a small amount of liquid fuel. Table 4.9.2.2-1 shows the annual usage of resources. Current missions at NTS are shown in table 3.2.9-1. The major DP facilities located at NTS are shown in table A.1.8-1.

Table A.1.8-1.--Major Defense Program Facilities at Nevada Test Site

Facility	Functions
Device Assembly Facility (DAF)	Assembly of nuclear test devices
Lyner Facility	Underground subcritical testing, dynamic experiments with special nuclear materials
Area 27, Critical Assembly Facilities	Assembly bays, storage magazines, and radiography buildings maintained for use as an alternative to the Device Assembly Facility
Able Site	Maintained for resumption of testing pending Device Assembly Facility operations, and for operations involving HE and special nuclear materials
Baker Site	HE operations and staging

Big Explosive Experimental Facility (BEEF)	Conventional HE testing

Source: NT DOE 1996c; NTS 1996a:1.

In December 1950, President Truman established the Nevada Proving Grounds (forerunner to NTS) as the Nation's on-continent nuclear weapons testing area. The first nuclear test at NTS occurred on January 27, 1951. At that time, the nuclear weapons program was administered by the Atomic Energy Commission (AEC), Albuquerque Operations Office. AEC employees were sent to the Nevada Proving Grounds for the duration of a test series and then returned to Albuquerque. As tests became more frequent during the 1960s, the AEC created the Las Vegas-based Nevada Operations Office, which officially opened on March 6, 1962, and has since administered NTS operations. Approximately 40 percent of the total Nevada Operations Office budget for fiscal year 1992 was for DP activities.

Desert Rock Air Strip is located southwest of Mercury. The airstrip has, in busier times, provided scheduled air service by DOE aircraft between NTS and LLNL, LANL, and SNL, for access by researchers and testing personnel. Currently, it is used only for high priority shipments.

Construction of the only major new facility, the Device Assembly Facility, is essentially complete; however, existing facilities are modified on an as-needed basis. Drilled holes for groundwater monitoring are always in the process of being selected, designed, and developed. A waste management facility is being considered for handling transuranic (TRU) waste from DOE facilities; this and the Solar Power Production Facility are the only major non-DP facilities anticipated for NTS.

Defense Program Activities. Historically, most of the work carried out onsite has been related to DP activities. Since it was established in December 1950, NTS has been the principal testing location for the Nation's nuclear weapons program. As of September 30, 1992, the United States had conducted 1,054 nuclear tests, 928 of which were on NTS and 828 of which were underground. Underground testing was controlled at the Area 6 Control Point One. This facility contains the technical, managerial, and safety infrastructure to control the site.

As has previously been noted, since the *U.S. Nuclear Testing Moratorium Act* went into effect in early October 1992, no nuclear tests have been conducted by the United States. On the day immediately following China's October 4, 1993 nuclear test, President Clinton issued a directive to DOE to continue to maintain indefinitely a state of readiness for possible resumption of U.S. testing. Other aspects of stockpile stewardship activities at NTS include treaty-compliant and permitted HE tests, subcritical dynamic experiments, and hydrodynamic tests.

The Device Assembly Facility is the only new major facility for DP activities at NTS. This 9,290 m2 (100,000 ft2) facility was authorized in 1984. It is physically located just south of Control Point One. It will combine and centralize most functions and facilities of the existing device assembly area. The Device Assembly Facility will enable LLNL and LANL to conduct multiple operations with HE and nuclear devices simultaneously. All aspects of the operation will be handled in this one facility because its multiple processing areas include assembly cells, assembly bays, high bays, radiographic facilities, special nuclear materials laboratories, HE staging, special nuclear materials staging, shipping and receiving areas, and associated administrative and support areas. In addition, the facility will provide for increased overall security and permit easier entrance and exit for the workers during hazardous operations. Special nuclear materials will not be manufactured or machined at this facility;

only the device A/D and material storage/staging functions would be handled here.

The Nevada Operations Office has been delegated the lead Federal role in maintaining the capability to respond to certain kinds of national emergencies. It will provide the leadership when a Federal Radiological Monitoring and Assessment Center is established. Additionally, a team of highly trained DOE and contractor radiological specialists known as the Nuclear Emergency Search Team trains, tests equipment for search and detection, and stores equipment for rapid deployment under the auspices of the Nevada Operations Office. It can be mobilized in case of accidents involving radioactive materials or a terrorist threat involving nuclear weapons.

Other Department of Energy Activities . Although the principal activity at NTS is testing nuclear devices, DOE is also involved in a number of other activities. These activities include liquefied gaseous fuels spill testing, solar technology demonstration, radioactive and mixed waste disposal, and the Yucca Mountain characterization programs. NTS has also been designated a DOE National Environmental Research Park.

The Spill Test Facility in Area 5 was completed in 1986. It is operated on a fee basis for commercial users as a basic research tool for studying the dynamics of accidental releases of hazardous materials and to evaluate the effectiveness of various foams and fire retardants in accidents involving chemicals and hazardous materials. Test facility personnel discharge a measured volume of hazardous test fluid at a controlled rate onto a surface specially prepared to meet the test requirements and record close-in and downwind meteorological data and gaseous concentration levels.

NTS is a proposed site for a program sponsored by DOE for a Solar Enterprise Zone. As part of this program, a 100 MWe solar power plant is proposed to be built at NTS. The power from this plant would support Government needs in the area, and the remainder would be sold to the commercial grid. This size plant can be supported with the existing transmission lines at NTS. There is also potential to expand the solar power capability at NTS to approximately 500 MWe in the future; however, this expansion would require substantial infrastructure upgrades including new transmission lines. The first 100 MWe plant is expected to be in place and generating by the 2005 No Action timeframe.

NTS also operates radioactive waste disposal facilities. The Radioactive Waste Management Site, located in Area 5, accepts LLW materials that were generated in the Nation's DP activities. This 37-ha (92-acre) facility consists of trenches and pits for burying LLW and aboveground storage for TRU waste awaiting transfer to the Waste Isolation Pilot Plant (WIPP). Also located at the Area 5 Radioactive Waste Management Site are Greater Confinement Disposal Units, which consist of 3 m (10 ft) in diameter partially cased shafts that are 37 m (120 ft) deep. These units were used for disposing of waste not suited for shallow land burial because of high exposure and potential for migration into biopathways. Management in charge of Greater Confinement Disposal is considering using different disposal configurations (other than boreholes). Nonradioactive hazardous wastes are also accumulated at the Area 5 Radioactive Waste Management Site awaiting shipment to offsite treatment and disposal facilities. In Area 3, the Radioactive Waste Management Site uses surface subsidence craters (that were formed by underground nuclear tests) for the emplacing and burying of LLW in bulk form (such as debris collected from atmospheric nuclear test locations).

The Yucca Mountain Site is located along the western boundary of NTS. It is being considered by DOE for the disposal of spent power-reactor fuel and vitrified HLW, the latter resulting principally from DP activities. The Yucca Mountain Site Characterization Project staff reports directly to DOE's

Office of Civilian Radioactive Waste Management; however, because it has elements based on NTS, the Nevada Operations Office provides some administrative and operational support services to the project.

Recently, NTS has been designated as a DOE National Environmental Research Park with a purpose of consolidating previous ecological reports, filling in a significant gap in the existing DOE research park network, and providing a unique opportunity for research in the arid desert environment. This not only enables NTS scientists to link into the existing ParkNet computerized data system, but also makes the extensive accumulation of environmental research collected over the history of NTS available to students and scientists throughout the world. NTS's location in the transition zone between the Southern and Northern Basin and Range Ecological Regions, and its inclusion of vast undisturbed areas of mountain ridges, closed basins, and diverse ecological communities makes it particularly valuable.

Non-Department of Energy Activities. The most significant NTS activity involving non-DOE organizations has been the Defense Nuclear Agency's Nuclear Testing Facility. Congressional legislation (the *Hatfield Amendment*), however, limited nuclear testing to those tests that support the safety and reliability of the U.S. nuclear stockpile. This may preclude further Defense Nuclear Agency nuclear tests, which are done to support research into nuclear weapons effects.

Defense Nuclear Agency nuclear tests occurred in horizontal tunnels mined beneath Rainier Mesa. The nuclear devices for these tests were designed, built, funded, controlled, and executed by the Office of Defense Programs. The Defense Nuclear Agency's nuclear testing provided the database and design information for both nuclear effects and survivability. Nuclear weapons-effects were studied for all U.S. tactical and strategic weapons systems that were required to operate in a nuclear warfare environment. These tests played a major role in maintaining high confidence in the nuclear stockpile and nuclear-capable weapons systems. The weapons-effects tests were conducted to study a number of nuclear effects including x-ray, gamma-ray, neutron, stress (thermal, electrical, and mechanical), electromagnetic pulse, airblast, ground and water shock propagation, and temperature effects. These tests assessed both weapons effects and the survivability of military systems in a nuclear environment.

Area 25 has been used for a variety of purposes, including U.S. Army ballistic research using depleted uranium and transporter testing for the proposed mobile MX missile. Various military exercises and training activities are also conducted in and around Area 25.

The Desert Research Institute, EPA, the University of Utah, and the Nevada Operations Office operate the Community Radiation Monitoring Program. This program provides the community surrounding NTS with an increased understanding of its activities and the natural radiation environment.

Other activities have been and will likely continue to be carried out for other Federal departments and agencies. Representatives from EPA, the U.S. Geological Survey, and the National Oceanic and Atmospheric Administration are onsite to assist and monitor conditions.

Environmental Regulatory Setting. The State of Nevada has regulatory authority for air, water, solid waste, and hazardous waste. A Memorandum of Understanding between DOE and the state covers required notifications whenever there might be radiological releases from NTS. DOE and the state also signed an Agreement in Principle in October 1990 to provide DOE funding to Nevada for

oversight of environmental activities at NTS, including environmental restoration activities. The Agreement in Principle provides the understanding between and commitment of both parties regarding DOE's provision of technical and financial support to the state in return for environmental oversight and monitoring.

The remainder of this section summarizes the status of NTS compliance with the major environmental regulations.

National Environmental Policy Act. The site-wide EIS for NTS and offsite locations in the state of Nevada examines existing and potential impacts to the environment that have resulted, or could result, from current and future DOE operations in southern Nevada. The EIS analyzes the impacts from DOE programs at the following sites: NTS, the Tonopah Test Range, portions of the Nellis Air Force Range Complex, the Central Nevada Test Area, and the Project Shoal Area. These programs include ongoing activities for the stewardship of the national nuclear weapons stockpile, management of radioactive waste, and environmental restoration. Also examined in the EIS are newer programs, such as the proposed Solar Enterprise Zone sites at NTS, Dry Lake Valley, Eldorado Valley, and Coyote Spring Valley.

Comprehensive Environmental Response, Compensation, and Liability Act. NTS has soils contaminated by plutonium and other radioactive materials as a result of past testing operations. EPA is in the process of ranking NTS according to the Hazard Ranking System based on the preliminary assessment/site investigation reports prepared in 1988. Concurrently, the state is negotiating a Federal Facility Agreement with DOE for environmental restoration, including restoration mixed waste. Nevada has taken this action pursuant to the state's corrective actions regulations to negotiate a formal cleanup agreement with DOE rather than waiting for EPA to list NTS on the NPL under provisions of CERCLA. If an agreement between the state and DOE is signed, it is unlikely that EPA will further pursue ranking NTS.

Emergency Planning and Community Right-To-Know Act. The State of Nevada combines the reporting requirements of Section 312, Tier II Report with the information requirements for the Nevada State Fire Marshall Division Uniform Fire Code Materials Report. NTS reports to the State of Nevada information on 28 chemicals in 36 areas which were above the reporting threshold. In addition, the State of Nevada *Chemical Catastrophe Prevention Act* of 1992 requires the registration of highly hazardous substances above predetermined thresholds.

Resource Conservation and Recovery Act. DOE received a permit for the Explosive Ordnance Disposal Unit and the Hazardous Waste Storage Unit in May 1995. RCRA Corrective Action is included in the permit for these two facilities. The Environmental Restoration Program under Corrective Action activities will be the major contributor to the generation of mixed waste.

As provided in the June 23, 1992, Settlement Agreement for Mixed TRU waste, NTS is allowed to continue to operate the Area 5 Radioactive Waste Management Site TRU Waste Storage Pad in accordance with 40 CFR, Part 265, Subpart I. The agreement also requires that DOE submit a report documenting why the current inventory of mixed TRU cannot be removed until WIPP becomes operational and on the progress DOE is making to certify the stored TRU waste to WIPP Waste Acceptance Criteria. In January 1994, a Mutual Consent agreement was established between DOE and the state allowing DOE to use the available storage capacity on the TRU Waste Storage Pad for the storage of onsite generated low-level mixed waste that cannot be disposed because the waste does not meet the RCRA standards of treatment for land disposal. The Mutual Consent Agreement was

amended in June 1995 to allow for all mixed waste generated by DOE within the State of Nevada to be stored at the TRU waste storage pad.

NTS is registered as a hazardous waste generator (ID no. NV3890090001) and is routinely inspected by the Nevada Division of Environmental Protection. There were no Findings of Alleged Violation identified from the RCRA Annual Compliance Evaluation conducted at NTS near the end of 1993 because NTS is conducting RCRA operations in compliance and had corrected previous RCRA findings; unresolved findings have been incorporated as part of the enforceable agreements between DOE and the state.

The Federal Facility Compliance Act of 1992. This act is an amendment to RCRA. DOE published the Interim Mixed Waste Inventory Report in April 1993, annual updates, and periodic updates since, describing its inventory of mixed wastes and treatment capabilities. A Site Treatment Plan was issued in October 1995 and its provisions will be incorporated into the Consent Order being negotiated between the state and DOE.

Clean Air Act. There are no criteria pollutant or prevention of significant deterioration monitoring requirements for NTS operations. However, NTS does comply with other requirements established by the CAA, State of Nevada air quality controls, radionuclide monitoring, and air permit compliance. As of December 31, 1993, NTS operations are in full compliance with standards of 40 CFR 61, Subpart H (National Emissions Standards for Emissions of Radionuclides Other than Radon from DOE Facilities). NTS air quality permits limit particulate emissions to 20 percent opacity. Seven permitted equipment/processes, such as weapons event stemming operations, have been identified as routinely exceeding the 20 percent opacity requirement. NTS requested an independent study of fugitive dust emissions from permitted equipment and from surface disturbance operations to identify means of improving NTS air quality emissions. Recommendations were either instituted or equivalent changes were made to improve overall NTS air quality emissions. Chlorofluorocarbon recycling equipment is in place at all NTS service and maintenance centers. Freon is recovered and reused, eliminating ozone-depleting substance emissions into the atmosphere almost completely.

Clean Water Act. Wastewater discharges at NTS facilities are not regulated under NPDES permits because all such discharges are to onsite sewage lagoons. Discharges to these lagoons are permitted under the *Nevada Water Pollution Control Act.* Monitoring and reporting requirements are typically included under local permit requirements. Wastewater monitoring at NTS is required for sampling wastewater influents to sewage lagoons and containment ponds. The sewage lagoons are in compliance and are routinely inspected by State of Nevada personnel. DOE has requested a formal determination by the state concerning the regulatory situation of NTS reference stormwater requirements based on both Standard Industrial Code usage and whether waters of the United States exist on NTS. The Nevada Division of Environmental Protection must determine if requirements under Federal stormwater discharge regulations are relevant to NTS. This determination is still pending.

Safe Drinking Water Act. Compliance with this act primarily addresses the quality of potable water supplies at NTS as determined through the sampling and monitoring requirements for drinking water systems. The State of Nevada has enacted and enforces SDWA regulations and also regulates daily system operations. DOE developed an operations and maintenance plan to address standard operating procedures for water system operations at NTS. The State of Nevada classifies NTS water system as requiring a Grade II Water System Operator Certification. NTS provides such a certified operator. To meet requirements under the state health regulations, potable water distribution systems at NTS are

monitored for residual chlorine content, coliform bacteria, VOCs, inorganic compounds, and other water quality standards. Drinking water systems are in compliance with standards.

Toxic Substances Control Act. State of Nevada regulations that implement this act require submission of an annual report which describes the quantity and status of PCBs and PCB-contaminated equipments as well as shipments of PCBs and PCB-contaminated items from NTS to an EPA-approved disposal facility. NTS is managing PCBs, asbestos, and chemicals in compliance with applicable regulations.

Federal Insecticide, Fungicide, and Rodenticide Act. Pesticide usage includes insecticides, herbicides, and rodenticides. Records are maintained on all pesticides used for at least 3 years. All applicators are provided the opportunity to receive state-sponsored training materials.

North Las Vegas Facility. This is a 32-ha (80-acre) site within the Las Vegas urban area. The site is positioned along Losee Road which runs parallel to and is a short distance west of Interstate 15. It is a quarter mi (0.4 km) north of Carey Avenue and 1 mi (1.6 km) south of Cheyenne Avenue in the city of North Las Vegas. It is bordered on the north, south, and east by general industrial zoning. The western border is adjacent to Commerce Street, which separates the site from fully developed single-family residential zoned property. Electrical power is supplied to the site by the Nevada Power Company, and natural gas is supplied by Southwest Gas Corporation. The city of North Las Vegas supplies the water and sanitary sewer services. The site consists of office and warehouse buildings with one large high bay and a tower as well as a large paved area for trailers. Mechanical and technical support functions associated with the underground test program were performed at this site. LLNL, LANL, and SNL used the North Las Vegas Facility (NLVF) to prepare, assemble, and test the instrumentation rack and canister assembly prior to deployment to NTS for testing operations.

NLVF, although considered an adjunct to NTS, must independently comply with many of the basic environmental requirements just as NTS does. DOE operations at NLVF have environmental requirements similar to the requirements of other 32-ha (80-acre) sites in the city of North Las Vegas.

A.2 Stockpile Stewardship Project Descriptions

The stockpile stewardship projects considered in this PEIS are the proposed NIF, the proposed CFF, and the proposed Atlas Facility. Detailed project-specific analyses of these alternatives are contained in Appendix I, Appendix J, and Appendix K, respectively.

A.3 Stockpile Management Project Descriptions

A.3.1 Weapons Assembly/Disassembly

Weapons A/D is a key element of the DOE stockpile management responsibility. This function provides the capability to: dismantle retired weapons; assemble HE, nuclear components, and nonnuclear components into nuclear weapons; repair and modify weapons; perform weapons surveillance; and store strategic reserves of nuclear components (pits and secondaries).

Weapons A/D consists of five main functions:

- Weapon assembly
- Weapon disassembly
- Joint test assembly and post-mortem
- Test bed A/D
- Storage of plutonium and HEU strategic reserves

The functions, as described in the following subsections, would vary between weapon programs. The plant must have the capability to vary production operations and quality assurance tests to meet the special needs of each program.

Weapons contain special nuclear material. Operations involving special nuclear material must be conducted within a critical assembly area. Weapons, joint test assemblies, and test beds contain HE and explosive detonators; therefore, operations involving these must be conducted in facilities designed for explosives operations.

Weapon Assembly. Weapon assembly is performed to produce a new weapon, to rebuild a weapon that has been disassembled for surveillance, or for modification or replacement of components. The assembly steps for a rebuild are the same as for a new build, except that the starting point varies, depending on the extent of disassembly.

Weapon assembly requires approximately 2,000 steps to combine hundreds of parts and subassemblies to form a weapon. The process is labor-intensive and includes many verification and quality control steps. Prior to the start of the assembly process, several bays would be configured with special tooling required for the specific weapons operations. As the assembly progresses, partially assembled weapons may be moved in series from bay to bay. At several points during assembly, the weapon would be moved from assembly bays to special purpose bays. These special purpose bays would be permanently configured with nonprogram specific equipment for performing verification or inspection operations, such as radiography inspection, leak testing, and mass properties determination.

Complete weapon assembly would be accomplished in three stages: physics package (also known as nuclear explosive package) assembly, mechanical weapon assembly, and ultimate user package assembly. The weapon assembly function is shown in figure A.3.1-1, and each stage is described below. Weapon parts would be unpackaged, cleaned, verified and, in some cases, tested prior to assembly.

Physics package assembly entails bonding or mating the main charge subassemblies to a nuclear pit

and then enclosing this subassembly in a case along with other components. Prior to assembly, gamma spectrometry would be used to verify the authenticity of the nuclear components. The pit would also be leak-tested and weighed. After the physics package is cased, tests would be performed to ensure electrical continuity, and a radiographic inspection would be conducted to ensure that the internal subassemblies are correctly aligned.

When the main charge is made from conventional HE, the physics package assembly must be conducted in a specialized structure called an assembly cell. An assembly cell is designed to minimize the release of radioactive material in the event that the conventional HE detonates. After the physics package is cased, the potential for detonation is greatly reduced, and the physics package may be moved to an assembly bay. The physics package for a weapon using an insensitive HE main charge can be assembled in a bay. The completed physics package then continues to mechanical weapon assembly.

Mechanical weapon assembly entails placing the physics package in a warhead case and installing components for the arming, fuzing, and firing systems; the neutron generator; and the gas transfer system. At prescribed points during the assembly process, electrical testing and gas transfer system pressure testing would be conducted to verify proper installation. The completed mechanical package would be leak-tested, backfilled with a specified gas atmosphere, inspected with radiography, and subjected to mass properties testing. Leak-testing would ensure that the weapon case is properly sealed. Radiographic inspection would be used for verification of the weapon system. Mass properties testing measures the center of gravity and moments and products of inertia to ensure proper flying characteristics. The final stage of the mechanical weapon assembly is the user package assembly.

Ultimate user package assembly involves installing some additional components and packaging the weapon for shipment. This operation varies, depending on whether the mechanical assembly is used in a bomb or a warhead. For bombs, components such as the tail, nose, and/or preflight sections would be added. Tail and preflight sections would be preassembled prior to installation. The completed bomb would be loaded onto a trailer (roadable) for shipment. Warheads may have a separation subassembly installed and the completed warheads would be loaded into containers for shipment. The ultimate user assembly would be moved to the weapon staging area for shipment to DOD via safe secure trailer.

Weapon Disassembly. Weapon disassembly is performed to dismantle, modify, or evaluate a weapon. The operations conducted for each type of disassembly are similar, but the extent of the disassembly and procedures vary.

Dismantlement Disassembly . The weapon would be disassembled down to subassemblies and components that are suitable to be shipped to the originators, that facilitate recertification of usable parts, or that facilitate sanitization and demilitarization of unusable parts.

Modification (Retrofit) Disassembly. A weapon requiring modification would be disassembled to the extent necessary to gain access to the components requiring replacement. The disassembly procedures are intended to maximize reuse of parts.

Stockpile Evaluation Disassembly . The evaluations and tests required would be defined by the design laboratories. The extent of disassembly depends on which components require testing. Procedures include additional testing, and typically call for removing components in connected groups to

facilitate further testing in test beds or joint test assemblies.

The weapon disassembly process is similar to the reverse of the assembly process and would be accomplished in three stages: ultimate user package disassembly, mechanical weapon disassembly, and physics package disassembly. Many of the facilities used for various disassembly and testing operations are the same facilities used for weapon assembly. The weapon disassembly function is shown in figure A.3.1-2, and each stage is described below.

Ultimate user package disassembly begins by performing a series of verification steps to ensure that the weapon is in a safe condition and that internal components are intact. The steps include tritium monitoring, electrical safing system test, gamma spectrometry safeguards verification, and a radiographic safing system verification. Bombs would be removed from trailers, and mechanical assemblies would be separated from the tail and nose sections. Warheads would be removed from ultimate user containers and then mechanical assemblies would be separated, as required, from separation subassemblies.

Mechanical weapon disassembly also begins with a series of tests. These tests include an internal atmosphere test check, a radiographic inspection, and a tritium pressure leak test. Evaluation of disassemblies may also require vacuum chamber leak test and mass property testing. The mechanical weapon disassembly entails removing the components for arming, fuzing, and firing systems; neutron generators; the gas transfer system; and the outer weapon case. The remaining physics package is further disassembled. The physics package may require a radiographic inspection for an evaluation disassembly.

Physics package disassembly would be accomplished by opening the case, removing the HE/pit subassembly and other components, and then separating the HE main charge from the nuclear pit. As described for weapon assembly, the physics package disassembly must be performed in a cell if the main charge is conventional HE.

The balance of the weapon disassembly function involves processing various weapons parts. These parts may be disassembled further on site or left intact. Parts may be recertified and staged for reassembly, shipped to the originating site for evaluation or disposition, or processed as residual material in the waste management process. Selected components may be assembled in a test bed or the bulk of the components may be used in a joint test assembly.

Joint Test Assembly and Post Mortem. As part of the ongoing stockpile evaluation program, weapons are randomly selected from the stockpile or new production inventory for conversion to joint test assemblies. A joint test assembly is a nuclear explosive-like assembly (mock weapon) that will be test flown by DOD. A joint test assembly generally contains most of the original weapon parts, except for the nuclear components and main charge subassemblies. A joint test assembly also contains telemetry components to monitor joint test assembly performance during flight, mock materials to simulate the size and weight of missing components, and witness plates to verify that energetic actuators performed as expected.

A process flow diagram of the joint test assembly support function is shown in figure A.3.1-3. Assembly of a joint test assembly is similar to weapon assembly, but some components are different. The physics package equivalent for a joint test assembly is called joint test subassembly. A high degree of quality control is required due to the high cost of the complex test.

After the flight test, joint test assemblies for bomb programs are generally recovered and returned for post-mortem disassembly and evaluation. Joint test assemblies for warhead programs are recovered if possible and returned for evaluation. The parts obtained from disassembly are processed for disposal. The procedures for joint test assembly are similar to those for a weapon disassembly, except that additional measures are taken to contain residues produced by the energetic actuators. The parts obtained from disassembly may be recertified and staged for reassembly, shipped to the originating site for evaluation or disposition, or processed in the waste management facility.

Joint test A/D operations, as well as the special evaluations such as radiography gamma spectrometry and leak-testing required for joint test assemblies, are performed in the same bays and special purpose bays used to conduct weapon assembly and disassembly operations.

Test Bed for Assembly and Disassembly. A test bed is an apparatus used for bench testing weapon systems, subsystems, and components. It is composed of parts removed from a weapon in evaluation disassembly and an explosive box. The explosive box contains the blast and fragments from the small explosive charges which detonate as the weapons systems are tested. The weapon parts are generally from the arming, fuzing, and firing systems and include antennas, radio frequency lines, radar, programmers, fire sets, detonator cables, and permissive action links. Prior to testing, some test beds are exposed to temperature extremes in environmental conditioning ovens. The testing is conducted at fully instrumentated test stations that can simulate deployment temperatures.

The test bed support function is shown in figure A.3.1-4 and is described below. Test bed assembly entails constructing the explosive box and parent part assembly and mounting these items on the test fixture. The explosive box is manufactured by enclosing explosive or electro-explosive components in an explosive barricade containing a fill material to damp the detonations. The explosive box may also contain a fiber optic sensing system to monitor the actuation timing. The parent parts assembly is composed of the removed weapon parts. The explosive box may also contain parent parts.

Optional Storage of Plutonium and Highly Enriched Uranium Strategic Reserves. Storage of the plutonium strategic reserve could occur at the weapons A/D Facility (as shown in figure A.3.1-5). If Y-12 is selected as the site for the secondary fabrication mission, HEU strategic reserve storage would remain at ORR. If Y-12 is not selected, then the HEU strategic reserve could also be stored at the weapons A/D Facility. The strategic storage of plutonium and HEU provides cased pits and canned subassemblies for replacement in the enduring stockpile and for use as feedstock for nuclear fabrication. The quantities associated with the storage are identified in classified documents. If the responsibility for strategic storage is transferred to the Office of Materials Disposition, then consolidated storage could be at one of five sites being considered in the Storage and Disposition PEIS.

The weapons A/D process constructs a weapon from approximately 200 parts and subassemblies. Assembly feeds include main charge subassemblies from the HE fabrication plant, special nuclear material components, weapon parts and subassemblies, electrical components, and hardware. A joint test assembly has approximately the same number of parts as a weapon. Feeds include most of the weapon parts removed from an evaluation weapon disassembly, telemetry components, mock HE and special nuclear material components, and witness plates. Test bed feeds include selected weapon parts removed from an evaluation disassembly, small explosive parts, the explosive box, the test fixture, electrical components, and hardware. The feeds for disassembly operations include nuclear weapons, joint test assemblies, and test beds.

A.3.1.1 Downsize at Pantex Plant

Pantex is the existing A/D site for the U.S. nuclear weapons stockpile. To efficiently meet the workload established by DOE for fiscal year 2004 and beyond, operations would be consolidated into the facilities that exist at Pantex. No new facility construction is required to accomplish the consolidation of the A/D mission. Changes would only be required to allow the relocation and modification of some functions into the newer facilities and the upgrade of some infrastructure systems.

The five main functions for A/D operations discussed in section A.3.1 would be downsized and consolidated at Pantex. The site plans for the consolidated A/D operations at Pantex are shown in figures A.3.1.1-1 and A.3.1.1-2. The drawings depict the arrangement of plant buildings and site support areas for Pantex. Four types of security access areas exist at Pantex: material access area, protected area, limited area, and property protection area. Operations involving special nuclear material must be performed within a material access area. The material access area and some facilities supporting material access area operations are located in the protected area. The protected area is secured with a double fence and intruder detection systems. The protected area and operations involving classified materials and information are contained within a limited area. The property protection area surrounds the limited area and includes a buffer zone. Weapons A/D operations are performed within the material access area within Zone 12.

The downsizing and consolidation of A/D operations would enable Pantex to utilize existing structures. Consideration has been given to optimizing operations, as well as maximizing the use of facilities, in the downsizing analysis. No new construction would be required at Pantex to accomplish the reduced weapons A/D mission. Pantex has 59 A/D bays, of which only 31 bays are required to meet the A/D workload. Therefore, functions that reside in older facilities (not economically or technically feasible to upgrade) would be relocated to modern, heavy-type construction facilities.

All facilities at Pantex were built in compliance with design codes and standards in effect at the time of design and construction. At the time of any major modification, facilities were upgraded commensurate with codes and standards at the time of the modification. Where applicable, facilities were built to specific regional design criteria.

Structures containing explosives are generally constructed with steel-reinforced concrete and are designed to mitigate the effects of an accidental explosion. The resulting facility design typically consists of a number of separate operating bays that could vent to an unoccupied area should a detonation occur. Structures that do not require concrete construction due to the presence of special nuclear materials or HE are generally constructed of steel, although portions of these buildings may be concrete. Most facilities include support areas for offices; break rooms; rest rooms; electrical heating, ventilation, and air conditioning equipment; maintenance; and in-process staging of materials, components, tooling, and supplies. Many production and laboratory facilities also include vacuum systems.

Key facilities required to meet the mission of the A/D downsized and consolidated operations are listed in table A.3.1.1-1. A brief description of key facilities follows.

Assembly Bays. Assembly bays are used to manually assemble or disassemble nuclear weapons. Weapon assembly requires approximately 2,000 steps to combine hundreds of parts and

subassemblies to form a weapon. The process is labor-intensive and includes many verification and quality control steps. Prior to assembly, several bays are configured with special tooling required for assembly of a specific weapon. As assembly progresses, partially assembled weapons move in series from bay to bay. The physics package for a weapons program using a conventional HE main charge must be assembled in an assembly cell. The weapon disassembly process is conceptually the reverse of the assembly process, although tooling used and testing required will vary. High fidelity joint test assemblies (those containing explosives and/or special nuclear material) are also assembled and disassembled in bays.

Pantex has several A/D bay facilities; however, only 31 bays in Buildings 12-084, 12-099, and 12-104 are required. Each bay includes an area to perform assembly operations, staging areas for tooling and weapon parts, and a mechanical room for heating, ventilation, and air conditioning equipment and controls.

Assembly Cells. Assembly cells are designed to support the manual assembly or disassembly of a physics package for weapon programs using a conventional HE main charge. Physics package assembly involves mating explosive and nuclear components and sealing these components in a metal case. Assembly cells are designed to mitigate the release of radioactive material in the event that conventional HE detonates. After the physics package is cased, the potential for a detonation is greatly reduced and the physics package may be moved to an assembly bay. Assembly in a cell is not required for a physics package using an insensitive HE main charge.

Each cell includes an area to perform assembly operations; staging areas for special nuclear material, tooling, and weapon parts; and a mechanical room for heating, ventilation, and air conditioning equipment and controls. Prior to the start of the assembly process, an assembly cell is configured with special tooling to facilitate the assembly or disassembly of a specific weapon program. Pantex has 13 assembly cells; however, only 4 of the assembly cells (three in Building 12-098 and the 12-96 cell) are required.

Special Purpose Bays. Special purpose bays are similar to assembly bays, but special purpose bays are permanently configured with special equipment to perform general testing or assembly operations. As with assembly bays, special purpose bays are grouped and share some common support areas. The functions performed in these bays are described in the following sections.

Test Bed Assembly/Disassembly. Test beds and training units are assembled and disassembled in part of Building 12-086. Training units are nuclear-explosive-like assemblies that are used for training Pantex and DOE personnel to build, repair, maintain, and handle nuclear weapons. The facility contains a number of universal assembly bays which are configured with program-specific tooling. No modifications are required in this facility to support test bed functions.

Nondestructive Evaluation. Linear accelerator, computed tomography, and x-ray radiography are performed in part of Building 12-104A. These functions are used to inspect components, assemblies, and complete weapons to confirm proper configuration. Ultrasonic testing detects voids in the material used to bond close fitting parts. Acoustic emissions testing detects flaws in material. Radiometric inspection identifies the types of encased radioactive materials. No modifications are required in this facility to support the downsizing of Pantex.

Table A.3.1.1-1.-- Pantex Plant Downsized and Consolidated Weapons Assembly/Disassembly Facility Data

Building Number	Description	Type of Construction	Gross Area (m 2)	Footprint Area (m 2)	Security Access Area	Number of Levels	Special Material
12-008	Commercially procured weapon material	Steel	56	56	Limited area	1	None
12-042	Tester and tooling storage	Steel	4,404	4,404	Material access area	1	None
12-042 A/B/C/ D/F	Weapons evaluation testing	Steel/concrete	2,044	2,044	Material access area	1	HE
12-053/E	Metrology lab	Concrete	474	474	Material access area	1	None
12-058	HE component staging	Concrete	242	242	Material access area	1	HE
12-059/E	Commercially procured weapon material/chemical lab	Steel	771	771	Limited area	1	None
12-061	Component warehouse	Steel	2,230	2,230	Material access area	1	None
12-079	Component warehouse	Steel	2,666	2,666	Material access area		None
12-082	Special nuclear material container refurbishment/component tech acceptance	Concrete	632	632	Material access area	1	None

12-084	17 assembly/disassembly bays, 1 pit laser bay, 1 nondestructive evaluation environmental bay, metallurgical evaluation	Concrete	10,675	10,675	Material access area	1	HE/special nuclear material
12-086	Test bed assembly, electronic testing, gas lab, metrology lab	Concrete	4,479	3,627	Material access area	2	HE
12-092	Component packaging	Steel	88	88	Material access area	1	HE
12-095	Explosives Class C staging	Concrete	244	244	Material access area	1	HE
12-096	1 assembly/disassembly cell	Concrete	731	731	Material access area	1	HE/special nuclear material
12-098/E	3 assembly/disassembly bays, passive action link code activated process	Concrete	3,192	3,192	Material access area	1	HE/special nuclear material
12-099	3 assembly/disassembly bays, weapon staging	Concrete	5,639	5,639	Material access area	1	HE/special nuclear material
12-104	11 assembly/disassembly bays	Concrete	7,917	7,917	Material access area	1	HE/special nuclear material
12-104A	Paint, mass properties, separations testing, accelerated aging, 2 staging bays, 1 vacuum chamber and purge backfill bay, 1 x-ray bay, 1 computed tomography, 1 linear accelerator bay	Concrete	6,503	6,503	Material access area	1	HE/special nuclear material
12-104P	Generator buildings	Steel	NA	NA	Material access area	1	None

12-116	Special nuclear material component staging, AT-400A processing	Concrete	4,274	4,274	Material access area	1	Special nuclear material
12-117	Special nuclear material loading dock	Steel	576	576	Material access area	1	None
Total			63,233				
Note: NA - not applicable. Source: PX MH 1995a.							

Environmental/Physical Properties Testing. A portion of Building 12-084 is used to perform nondestructive testing of weapon components. Weapon components are subjected to mechanical and thermal shock to simulate deployment conditions. Mechanical conditioning tests include vibration, hostile shock, mini-air gun shock, and steady-state acceleration shock. Environmental chambers are used to simulate temperature extremes and thermal shock conditions. Equipment would be relocated from other areas of the plant into Building 12-084 to support this function.

Leak Detection and Backfill.

Leak rate tests are performed in one bay of Building 12-104A with vacuum chambers (or fixtures) on all outgoing nuclear weapons and on units returned from the field to ensure that the weapon case is properly sealed and correct internal atmosphere is maintained. Backfill involves filling the inside of the weapon case with a specific gas. This operation is performed following completion of a leak rate test and an evacuation step. No modifications are required in this facility to support the downsizing of Pantex.

Mass Properties Determination. Mass properties are critical for ensuring proper flight characteristics of a weapon. Products of inertia and lateral center of gravity are determined with remotely operated dynamic balancing machines. Center of gravity and moments of inertia are determined with a special machine. Modifications are required in one bay of Building 12-104A to allow existing equipment to be relocated to support this function.

Painting and Body Work. Weapons and weapon components, joint test assemblies, containers, and trailers are painted, repainted, or touched-up in a portion of Building 12-104A. Old paint is removed with sandblasting or chemical stripping. Minor dents in nonweapon components are straightened. No modifications are required to support this function.

Accelerated Aging. Accelerated environmental aging is conducted to simulate the aging process on newly produced weapons and weapon components in a portion of Building 12-104A. For these tests, weapons or materials are placed in an environmental chamber and subjected to thermal cycling above and below ambient temperatures for an extended period, typically from 1 to 2 years. Gas samples are taken from the weapon and analyzed in the gas laboratory. The accelerated aging chamber consumes

a significant amount of electrical power. After aging, weapons are disassembled and evaluated. No facility modifications are required to support this function.

Separations Systems Testing. Selected reentry body separation subassemblies are tested in a portion of Building 12-104A to provide data for evaluating release assembly hardware and associated installation procedures and for measuring service-related deterioration of the release assembly system. Facility modifications are required to allow the existing equipment to be relocated and operate in this area.

Special Nuclear Material Container Refurbishment. Containers used to ship radioactive components are reverified annually in a portion of Building 12-082. The structural integrity of containers is verified through leak tests, visual inspection, and maintenance. No modifications are required in Building 12-082 to support this function.

Pit Laser Sampling . A gas sample is taken for selected weapon system pits to determine the internal atmosphere type, percentage, and pressure. Pit laser sampling occurs in a bay in Building 12-084. No modifications are required in this facility.

AT-400A Processing. Pits are robotically packaged into the AT-400A, a hermetically sealed container. The AT-400A container meets requirements for long-term storage and shipping of pit items. This activity would occur in a portion of Building 12-116. The AT-400A robotics processing equipment and required modifications to Building 12-116 to accept this activity are included in the Pantex No Action alternative.

Component Packaging . Packaging of selected reaccepted weapon components occurs in Building 12-092, a special access area. No modifications are required in this facility.

Component Technical Acceptance . Components are reaccepted for assembly using a variety of inspection/verification techniques. This activity will occur in Building 12-082. No modifications are required to support this function.

Weapons Evaluation Testing Laboratory. Weapon system, subsystem, and component tests are conducted in Building 12-042 A/B/C/D/F by SNL personnel. Numerous fully instrumentated test stations are provided for heating, cooling, and test firing the tests beds. A cryogenic carbon dioxide system is used for cooling these units during testing. Environmental conditioning ovens and centrifuges are also provided for testing components under deployment conditions. No modifications are required in this facility.

Metrology Laboratory. Buildings 12-086 and 12-053 are used for metrology functions within the material access area. Instruments and testers for weapon assembly operations are calibrated here. Some areas within these facilities require tight heating, ventilation, and air conditioning temperature control to + 0.3 *o* C (+ 0.5 *o* F). Modifications are required in Building 12-086 to allow existing equipment to be relocated.

Gas Laboratory. Gas analyses are performed in Building 12-086 and are used to evaluate samples from accelerated aging tests and production operations. Information from these analyses provides data related to the internal atmosphere of weapons and effects of weapon material aging by measuring outgassing products. The three basic techniques used are gas fractionation, gas chromatography, and mass spectrometry. Facility modifications are required for this function which would relocate existing

equipment into Building 12-086.

Weapon Material Testing Laboratory. A laboratory for testing and accepting commercially procured weapon material is located in Buildings 12-008 and 12-059. No modifications are required for these facilities.

Tooling/Tester Storage. Precision tools, instruments, testers, and special equipment for A/D operations are stored in Building 12-042. Generic assembly bays and cells are configured with program-specific tooling at the beginning of a production run. Tooling storage would contain tools for assembly, disassembly, and evaluation operations for all the weapon programs in the enduring stockpile. This function would be relocated from another facility into Building 12-042.

Weapon Staging. A portion of Building 12-099 is used for staging nuclear weapons awaiting transportation to and from DOD facilities. No facility modifications are required to accommodate weapons staging.

Special Nuclear Material Component Staging. The special nuclear material staging facilities, Buildings 12-116 and a loading area 12-117, are designed to ship, receive, and stage special nuclear material. The facilities include segregated staging bays and inspection equipment.

Inert Component/Container Warehouses . Buildings 12-058, 12-061, 12-079, and 12-095 are used for storing, repackaging, and distributing inert weapon components, materials, and containers for Pantex. HE components to support A/D are staged in Building 12-058. Weapons and special nuclear material are staged in other buildings. These facilities include storage racks, a loading dock, and areas designed for packaging and unpackaging and shipping and receiving. No modifications are required in these facilities.

Strategic Reserves Storage . The plutonium and HEU strategic reserves would be stored in Area 12.

Requirements for Construction and Operation. Downsizing and consolidating A/D operations at Pantex would require approximately 0.2 ha (0.4 acres) of land for construction material laydown. There would be no associated disturbed land area involved with downsizing of operations at Pantex. Materials and resources consumed during the 3-year construction period are listed in table A.3.1.1-2. The principal source of air emissions during construction would be fugitive dust from site preparation and construction activities and exhaust from construction equipment and vehicles. Annual emissions during a peak construction year are presented in table A.3.1.1-3.

The number of workers required during each construction year is presented in table A.3.1.1-4.

The weapon A/D process requires the following utilities: electricity, plant air for operating pneumatic tools and hoists, instrument air for radiation monitors, steam for heating test beds in environmental conditioning ovens, cryogenic carbon dioxide for cooling test bed test stations, and water for operating vacuum pumps. Utilities consumed during surge operation can be found in table A.3.1.1-5.

Table A.3.1.1-2.--Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Construction Materials/Resources

Material/Resource	Total Consumption	Peak Demand 1
Electricity	609 MWh	4 MWe
Water (L)	1,400,000	
Concrete (m^3)	840	
Steel (t)	15	
Liquid fuel and lube oil (L)	28,800	
Industrial gases (m^3) 2	600	

Table A.3.1.1-3.-- Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Construction Emissions

Pollutant	Quantity (t)
Sulfur dioxide	0.04
Nitrogen oxides	0.46
Volatile organic compounds	0.23
Carbon monoxide	1.26
Particulate matter	0.19
Total suspended particulates	0.46
PX MH 1995a.	

Chemicals consumed during operation primarily include water treatment chemicals, materials for facility equipment and vehicle maintenance, and bottled gases. Annual estimated chemical use during surge operations is listed in table A.3.1.1-6.

Emissions. Emissions result from plant boiler operation and cleaning operations that use solvents. Releases would be limited to what is possible, using best available control technology. Emissions for the downsizing and consolidating alternative A/D surge operations are shown in table A.3.1.1-7.

Radiological release for A/D operations are limited to uranium isotopes and tritium. These releases are the result of assembly and disassembly operations, as well as waste operations. Extremely small releases of plutonium (near background) are possible.

Table A.3.1.1-4.-- Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Construction Workers

Employees	Year 1	Year 2	Year 3	Total
Craftworkers				
Carpenter	1	7	2	10
Concrete mason	1	5	1	7
Electrician	0	6	5	11
Iron worker	1	8	1	10
Laborer	2	6	2	10
Millwright	0	2	1	3

Operator	0	3	1	4
Sheet metal worker	0	7	2	9
Pipe fitter	0	5	3	8
Sprinkler fitter	0	5	1	6
Teamster	1	3	1	5
Other craftworkers	0	4	3	7
Total Craftworkers	6	61	23	90
Construction management and support staff	1	6	2	9
Total Employment	7	67	25	99
PX MH 1995a.				

Table A.3.1.1-5.-- Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand
Electricity	43,000 MWh	10 MWe
Liquid fuel (L)	740,000	
Natural gas (m^3)	7,150,000	
Water (L)	196,000,000	
PX MH 1995a.		

Table A.3.1.1-6.-- Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Acetone	227
Argon	8,165
Carbon dioxide	49,896

Circlene FG 20	635
Clepox 143	635
Degreaser	680
Desiccants	454
Dispersant	290
Dry air	771
Eco-Star	2,858
Ethyl acetate	544
Ethyl alcohol	227
Fixer and replenisher	1,497
Glass beads	408

Glass cleaner	1,452
Helium	1,769
Heptane	318
Hydraulic/lubricating oil	29,030
Inorganic proprietary	2,722
Joint compound	1,179
Micro liquid lab cleaner	363
Mild steel metal	5,897
Molecular sieve	1,043
Neutrasorb acid neutralizer	272
Nitrogen	3,629

Paint	16,330
Planisol-M concentrate	363
Polyalkylene and ethylene glycol	240
Potassium hydroxide	408
Siliconized ammonium phosphate base	590
Sodium chloride	34,020
Solksorb solvent absorbent	1,769
Specialty gas mixtures	1,542
Stainless steel metal	2,268
Sulfuric acid	363
TISAB with CDTA	862

Water treatment chemicals 3	11,340

Table A.3.1.1-7.-- Pantex Plant Downsizing and Consolidating Weapons Assembly/Disassembly Surge Operation Annual Emissions

Pollutant	Quantity (t)
Ammonia	<0.001
Carbon monoxide	5.4
1,2-Dichloroethane	<0.001
Nitrogen oxides	21.3
Particulate matter	0.8
Sulfur dioxide	<0.001
1,1,1-Trichloroethane	0.44
2,2,4-Trimethyl-1,3-Pentane diolbutyrate	<0.001

Volatile organic compounds	11.3
PX MH 1995a; PX 1996e:1.	

Weapons Assembly Transportation. As illustrated in figure A.3.1.1-3, the two major types of radiological hazardous materials that would be transported to Pantex include special nuclear material components and HE components. Special nuclear material would be shipped in safe secure trailers. Upon arrival at the site, a safe secure trailer would proceed directly to the weapon staging facility. Movement of explosive components would be performed by trucks and battery-powered vehicles specifically designed for this purpose. The quantity of HE (conventional and insensitive) transported onsite by these trucks would be strictly limited.

All major weapon assembly work would be performed in assembly bays and cells. Special nuclear material would be transferred from staging areas by battery-powered vehicles travelling on ramps. After final assembly and inspection, weapons would be transferred to the weapon staging facility on ramps. Weapons would then be shipped offsite by safe secure trailer.

Small quantities of low-level, mixed, and hazardous wastes generated during assembly of nuclear weapons would be collected, packaged, and transported by electric car to local accumulation sites and then by truck to a low-level staging area near the waste management facility. The wastes would be transferred by truck for offsite disposal.

Weapons Disassembly Transportation. As illustrated in figure A.3.1.1-4, returning weapons would be delivered in safe secure trailers. After a security inspection, weapons would be unloaded and temporarily stored in the same weapons staging area used for outgoing assembled weapons. Individual weapons would be transported to an assembly bay or cell by a battery-powered vehicle travelling on a ramp. After disassembly, the various special nuclear material components would be transported by battery-powered vehicles to staging areas for subsequent shipment offsite. HE components would be transported by electric vehicle to the HE staging area for subsequent transportation to the HE fabrication plant. Waste would be collected, transported, and disposed of in a manner similar to that described for weapons assembly.

Waste Management. Pantex waste management is described in detail in appendix section H.2.4. The liquid and solid nonhazardous wastes generated over a 3-year period would include concrete and steel construction waste materials and sanitary wastewater. The steel construction waste would be recycled as scrap material before completing construction. The remaining nonhazardous wastes generated during construction would be disposed of as part of the construction project by the contractor. Wastewater would be used for soil compaction and dust control or processed through the Pantex sanitary wastewater system. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous wastes generated during construction would consist of such materials as waste adhesives, oils, cleaning fluids, solvents, and coatings. Hazardous waste would be packaged in Department of Transportation (DOT)-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. No radioactive waste would be generated during construction.

Table A.3.1.1-8.-- Pantex Plant Weapons Assembly/Disassembly Waste Volumes

Category	Annual Average Volume Generated from Construction (m 3)	Annual Volume Generated from Surge Operations (m 3)	Annual Volume Effluent from Surge Operations (m 3)
Low-Level			
Liquid	None	0.06	None
Solid	None	21 4	10 5
Mixed Low-Level			
Liquid	None	0.06	0.06
Solid	None	Minimal	Minimal
Hazardous			
Liquid	None	2	2
Solid	0.25	0.05	0.05
Nonhazardous (Sanitary)			

Liquid	315	141,000	141,000
Solid	5 6	340	170 7
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	Included in sanitary	Included in sanitary

The project design incorporates waste minimization and pollution prevention. Segregation of activities that generate radioactive and hazardous wastes would be employed, where possible, to avoid the generation of mixed wastes. Where applicable, treatment to separate radioactive and nonradioactive components would be performed to reduce the volume of mixed wastes and provide for cost-effective disposal or recycle. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials that contribute to the generation of hazardous or mixed waste. Production processes would be configured, with minimization of waste production given high priority. Material from the waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. Future D&D considerations have also been incorporated into the design.

Table A.3.1.1-8 presents the estimated annual waste volumes from the A/D and pit recertification, requalification, and reuse facility during construction and surge operations. Solid and liquid waste streams are routed to the waste management system. Figure A.3.1.1-5 depicts the waste management system. Solid wastes would be characterized and segregated into LLW, hazardous, and mixed wastes, then treated to a form suitable for disposal or storage within the facility. Liquid wastes would be treated onsite to reduce hazardous and toxic elements before discharge or transport. All fire-sprinkler water discharged in process areas is contained and treated as process wastewater, when required.

Low-Level Waste. LLW generated from the recertification, requalification, and reuse operations would consist of tubes removed from the pits, personnel protective equipment, glove box gloves, filters, cleaning materials, and disposal supplies. Small amounts of LLW would be generated by A/D operations and would consist primarily of sanitized and demilitarized weapon parts, test residue, compacted wipes, rubber gloves, and vacuum filters. Compactible LLW would be processed at the solid waste compaction facility. Compactible and noncompactible waste would then be shipped to NTS or a commercial vendor for disposal. Liquid LLW, consisting of solvents used in cleaning operations, would be solidified prior to packaging.

Mixed Low-Level Waste. Pit recertification, requalification, and reuse operations would not generate any mixed LLW. Small amounts of mixed LLW would be generated from operation of the A/D facility and would consist primarily of sanitized and demilitarized weapons parts, test residue, compacted wipes, rubber gloves, and vacuum filters. Mixed waste would be stored onsite in RCRA-permitted facilities and shipped to an offsite commercial facility for processing. Liquid mixed waste would be managed in accordance with the Pantex Site Treatment Plan.

Hazardous Waste. Liquid hazardous wastes would be generated from solvents from cleaning

operations and residue from painting and bonding operations, as well as sanitized and demilitarized parts. The cleaning solvents selected would be from a list of nonhalogenated solvents. Hazardous liquids would be sent to one of three onsite wastewater treatment facilities. The treated nonhazardous effluent would be discharged in accordance with NPDES permits. Hazardous effluents would be packaged and shipped offsite to a RCRA-permitted treatment, storage, and disposal facility.

Solid hazardous wastes would be generated from nonradioactive materials such as wipes contaminated with oils, lubricants, and cleaning solvents that are used for equipment outside the main processing units. All HE and HE-contaminated substances would be returned to the HE fabrication site. All hazardous solid waste would be shipped to a RCRA-permitted facility for disposal.

Nonhazardous (Sanitary) Waste. Sewage wastewater and process wastewater would be treated in the sanitary wastewater treatment facility. Most of the treated effluent would be recycled for use in the cooling tower and other processes. Excess effluent would flow into a lagoon which then either evaporates or leaches into the ground. The sludge and other nonrecyclable, nonhazardous solid sanitary and industrial wastes would be compacted and shipped to the city of Amarillo landfill for disposal.

Nonhazardous (Other) Waste. Small amounts of classified nonhazardous waste would be generated from operation of the A/D facility. This waste would be demilitarized and sanitized before disposal in a permitted landfill.

A.3.1.2 Relocate to Nevada Test Site

All functions described in section A.3.1 would be relocated to NTS in this alternative. Figure A.3.1.2-1 shows the location of NTS facilities. The proposed A/D plant site plan is shown in figures A.3.1.2-2 and A.3.1.2-3. The size, number, and arrangement of the plant building and support areas are conceptual and may change significantly as design progresses. The site plans are included to convey general layout information only.

The existing Device Assembly Facility would form the cornerstone of the A/D plant. All plant facilities located within the material access area either occupy existing buildings inside the Device Assembly Facility or are located in hardened new construction connected to the Device Assembly Facility. All plant facilities located within the limited area at the plant site (adjacent to the Device Assembly Facility) would be new construction.

Key facilities required to meet the mission of the A/D operations at NTS are listed in table A.3.1.2-1. The following sections describe the key facilities in more detail.

Table A.3.1.2-1.-- Nevada Test Site Weapons Assembly/Disassembly Facility Data

Building Number	Function	New or Existing	Location	Gross Area (m 2)	Construction Type	Number of Floors
Assembly/Disassembly						

DAF 301-304	Physics package cells	Existing	Material access area	1,732	Hardened concrete	1
DAF 341, 343, 345	Mechanical bays	Existing	Material access area	624	Hardened concrete	2
M01-M24	Mechanical bays	New	Material access area	6,044	Hardened concrete	2
L01	Test bed	New	Limited area	186	Steel	1
Laboratories						
23-700	Gas analysis lab	Existing	Area 23	828	Steel	1
L02	Weapons evaluation testing lab	New	Limited area	2,415	Steel	1
23-725	Metrology lab	Existing	Area 23	1,353	Steel	1
M51	Metrology lab	New	Material access area	557	Hardened concrete	1
23-190	Commercially procured material testing/staging	Existing	Area 23	701	Concrete	1
Warehousing/Staging						

L03	HE components	New	Limited area	279	Hardened concrete	1
23-160	Inert components/containers	New	Area 23	4,682	Steel	1
L04	Tooling/testers	New	Limited area	2,323	Steel	1
M26-M31	Weapons staging	New	Material access area	836	Hardened concrete	1
Special Purpose						
M32	Pit laser sampling	New	Material access area	46	Hardened concrete	1
M33	Accelerated aging	New	Material access area	372	Hardened concrete	1
L05	Special nuclear material container refurbishment/verification	New	Limited area	139	Steel	1
DAF 351, 353	AT-400 processing	Existing	Material access area	426	Hardened concrete	1
DAF 494	Mass properties	Existing	Material access area	118	Hardened concrete	1
DAF 492	Separations testing	Existing	Material access area	118	Hardened concrete	1

DAF 310	Vacuum chambers	Existing	Material access area	215	Hardened concrete	1
L06	Paint	New	Limited area	111	Steel	1
DAF 491	Permissive action link capability	Existing	Material access area	213	Hardened concrete	1
M34	Purge/backfill	New	Material access area	46	Hardened concrete	1
DAF 493	Component packaging	Existing	Material access area	118	Hardened concrete	1
Special Purpose (Continued)						
DAF 495	Component technical acceptance	Existing	Material access area	118	Hardened concrete	1
DAF 331, 332	Nondestructive evaluation	Existing	Material access area	744	Hardened concrete	1
M35	Nondestructive evaluation	New	Material access area	325	Hardened concrete	1
M52	Electronic testing	New	Material access area	325	Hardened concrete	1
NT DOE 1995b.						

Assembly Cells. Four existing assembly cells in the Device Assembly Facility would support the manual A/D of a physics package. A fifth available cell would be held in reserve for test devices or

expanded use if necessary. Each cell (standard Pantex design) includes an area to perform assembly operations, staging areas for special nuclear materials and weapon parts, and a mechanical room for heating, ventilation, and air conditioning equipment controls.

Assembly Bays. A new assembly bay facility would be constructed adjacent and connected to the Device Assembly Facility. This facility would contain 24 assembly bays; 20 of standard Pantex design and four with extended operational areas. Three additional bays of standard Pantex design are provided in the existing Device Assembly Facility. All assembly bays would be separated by a minimum of 4.1 m (13.6 ft) of earth fill for explosive blast shock mitigation. Each bay would include an area or areas to perform assembly operations, staging areas for tooling and weapon parts, and a second floor mechanical room for heating, ventilation, and air conditioning equipment and controls. Two additional assembly bays are held in reserve within the existing Device Assembly Facility for device assembly operations or expanded use, if required.

Test Bed . A new nonhardened facility would be constructed within the limited area, adjacent to the Device Assembly Facility for test bed fabrication. This facility would contain universal assembly bays configured with program-specific tooling.

Laboratories

Gas Analysis . Gas analysis would be performed in an existing nonhardened building in Area 23. This building would be configured with laboratory facilities equipped to provide analysis by gas fractionation, gas chromatography, and mass spectrometry.

Weapons Evaluation Testing. A new nonhardened facility would be constructed within the limited area, adjacent to the Device Assembly Facility for weapons evaluation testing. This facility would contain a number of fully instrumented test stations to provide for heating, cooling, and test firing the test beds. A cryogenic system would be used for the cooling of these units during testing. Environmental conditioning ovens and centrifuges would be provided for the testing of components under deployment conditions.

Metrology. Metrology laboratory facilities would be located in an existing nonhardened building in Area 23 and in a new hardened building within the material access area, connected to the existing Device Assembly Facility. These facilities would be equipped to calibrate instruments and testers used in weapon assembly operations. A class 1000 clean room with heating, ventilation, and air conditioning temperature control to + 2.8 *o* C (+ 5 *o* F) would be added to these buildings.

Commercially Procured Material Testing/Staging . An existing building located in Area 23 would be used to test and stage commercially procured materials used in the assembly process. This building would have both receiving and staging areas and a room equipped for performing standard material tests.

Special Purpose Bays

Pit Laser Sampling . A new hardened building would be constructed within the material access area, connected to the Device Assembly Facility, to perform laser sampling of pits.

Accelerated Aging. A new hardened building would be constructed within the material access area, connected to the Device Assembly Facility, to simulate accelerated environmental aging of newly

produced weapons and weapon components. This building would contain five environmental chambers to provide thermal cycling above and below ambient temperatures for an extended period of time.

Special Nuclear Materials Container Refurbishment/Verification . A new building would be constructed within the limited area, adjacent to the Device Assembly Facility, to refurbish and verify processing of special nuclear material containers.

AT-400A Processing. Two existing hardened bays within the Device Assembly Facility would be used for AT-400A processing.

Mass Properties . Mass properties determination would be performed in an existing hardened bay within the Device Assembly Facility. This building would be equipped with remotely operated dynamic balancing machines to determine products of inertia and lateral center of gravity and a center of gravity and moments of inertia machine.

Separations Testing. An existing hardened bay in the Device Assembly Facility would be used for separations testing. This bay would be equipped to test selected reentry body subassemblies, measurements of service-related deterioration of the release assembly system, and for acquisition of data associated with the evaluation of release assembly hardware.

Vacuum Chambers. Two vacuum chambers would be installed in an existing hardened building in the Device Assembly Facility to perform leak rates on all outgoing weapons or on weapons returned from the field.

Paint . A new nonhardened building would be constructed within the limited area, adjacent to the Device Assembly Facility, to paint, repaint, or touch-up weapons, weapon components, and containers.

Purge/Backfill. A new hardened building would be constructed within the material access area, connected to the Device Assembly Facility, to conduct purge and backfill operations. This building would be equipped to either purge or fill the inside of the weapon case with a specific gas.

Component Packaging/Technical Acceptance. Component packaging and technical acceptance operations would be conducted in two existing hardened Device Assembly Facilities.

Nondestructive Evaluation. Explosive components would be inspected by linear accelerator, medium x ray, and computed tomography within the existing two radiography buildings in the Device Assembly Facility. Other weapon and component testing would be conducted in a new hardened building located within the material access area, connected to the Device Assembly Facility. This building would contain equipment to support mechanical conditioning tests including vibration, hostile shock, mini air-gun shock, and steady-state acceleration shock.

Electronic Testing. Electronic testing of weapon components would be conducted in a new hardened building located within the material access area, connected to the Device Assembly Facility.

Warehousing/Staging

High Explosives Components. Three new hardened bunkers would be constructed within the limited

area, adjacent to the Device Assembly Facility, for the storage of HE components. These bunkers would be bermed and would provide a safe separation distance to all other occupied facilities at the plant site.

Special Nuclear Materials Components. A new hardened building would be constructed within the material access area, connected to the Device Assembly Facility, to stage and store special nuclear material components. This building would contain segregated staging bays and inspection equipment and would utilize the existing safe secure trailer loading dock within the Device Assembly Facility for secure receiving of special nuclear material components.

Inert Components/Containers Shipping and Receiving. An existing building located in Area 23 would be used to ship, receive, and store inert weapon components. This facility would include storage racks, a loading dock, and areas designed for packaging and unpackaging.

Tooling/Testers . A new nonhardened building would be constructed within the limited area, adjacent to the existing Device Assembly Facility, to control the storage of precision tools, instruments, testers, and special equipment used in A/D operations. Segregated storage areas would be provided for all specific tooling requirements supporting weapons programs in the enduring stockpile.

Weapons. Six new hardened bays would be constructed within the material access area, connected to the Device Assembly Facility, for the interim staging of a maximum of 100 weapon units. This facility would have a dedicated safe secure trailer dock for shipping and receiving weapons.

Strategic Plutonium/Canned Subassembly Storage . The strategic Plutonium/Canned Subassembly Storage Facility would consist of new hardened construction within the material access area connected to the existing Device Assembly Facility.

Weapons A/D facilities construction would take 6 years to complete. Materials and resources consumed during the entire construction period are listed in table A.3.1.2-2.

The principal sources of air emissions during A/D facility construction would be fugitive dust from land clearing, site preparation, excavation, and other construction activities, and exhaust from construction equipment and vehicles. The annual emissions generated during a 1-year period with peak construction activity are shown in table A.3.1.2-3.

Table A.3.1.2-2.-Nevada Test Site Weapons Assembly/Disassembly Construction Materials/Resources Requirements

Material/Resource	Total Consumption	Peak Demand 8
Electricity	38,000 MWh	5 MWe
Water	98,400,000 L	94,600 L/day

Concrete (m^3)	75,000	
Steel (t)	16,300	
Liquid fuel and lube oil (L)	3,030,000	
Industrial gases (m^3) 9	65,100	

Table A.3.1.2-3.-- Nevada Test Site Weapons Assembly/Disassembly Construction Emissions

Pollutant	Quantity (t)
Sulfur dioxide	1.8
Nitrogen dioxide	24
Volatile organic compounds	7.3
Carbon monoxide	36
Particulate matter	13.6

Total suspended particulates	31
NT DOE 1995b.	

The number of craftworkers, as well as construction management and support staff, required during each year of construction, are presented in table A.3.1.2-4.

The utilities consumed during operation include electric power, liquid fuels, and water. Annual utility consumption rates and peak electric power rates for surge operation are shown in table A.3.1.2-5.

The chemicals and materials consumed during operation primarily include water treating chemicals, reactants and solvents for explosives formulation and synthesis, explosive powders, materials for facility equipment and vehicle maintenance, metals for manufacturing tooling, and bottled gases. Annual surge operation material consumption is listed in table A.3.1.2-6.

Emissions. Gaseous environmental releases result from operation of the thermal treatment unit for nonradioactive HE contaminated waste and mixed HE contaminated waste. Emissions will also result from plant boiler operation, cleaning operations using solvents, and small scale synthesis operations. The thermal treatment units would be designed and operated to attain and maintain temperatures that result in the destruction of hazardous constituents and hazardous particulates that will be trapped in filters. The releases will be limited to what is possible using the best available control technology. The annual emissions for the A/D facility surge operations are shown in table A.3.1.2-7.

Waste Management. NTS waste management is described in detail in appendix section H.2.8. The liquid and solid nonhazardous wastes generated during the 6-year construction period would include concrete and steel construction waste materials and sanitary wastewater. The steel construction waste would be recycled as scrap material before completing construction. The remaining nonhazardous wastes generated during construction would be disposed of as part of the construction project by the contractor. Uncontaminated wastewater would be used for soil compaction and dust control, and excavated soil would be used for grading and site preparation. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous wastes generated during construction would consist of such materials as waste adhesives, oils, cleaning fluids, solvents, and coatings. Hazardous waste would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. No radioactive waste would be generated during construction.

Table A.3.1.2-4.-- Nevada Test Site Weapons Assembly/Disassembly Construction Workers

Employees	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Craftworkers							

Carpenter	61	117	115	63	41	36	433
Concrete mason	8	15	10	2	2	4	41
Electrician	24	27	53	90	96	55	345
Iron worker	30	75	67	23	16	16	227
Laborer	38	62	52	20	17	20	209
Millwright	3	7	10	20	19	7	66
Operator	10	23	29	22	18	9	111
Sheet metal worker	5	14	29	29	14	5	96
Pipe fitter	15	32	75	82	78	32	314
Sprinkler fitter	3	8	16	16	7	3	53
Teamster	3	6	7	7	6	3	32

Other craftworkers	4	8	15	24	20	6	77
Total Craftworkers	204	394	478	398	334	196	2,004
Construction staff 10	29	59	73	61	51	30	302
Management and support staff 11	44	91	111	92	78	46	462
Total Employment	277	544	662	550	463	272	2,768

Table A.3.1.2-5.-Nevada Test Site Weapons Assembly/Disassembly Facility Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 12
Electricity	45,000 MWh	7 MWe
Liquid fuel (L)	432,000	
Natural gas (m^3)	3,680,000	
Water (L)	98,400,000	

Table A.3.1.2-6.-- Nevada Test Site Weapons Assembly/Disassembly Facility Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Acetone	64
Acetonitrile	64
Aluminum metal	499
Argon	8,165
Brass metal	50
Carbon dioxide	49,896
Circlene FG 20	227
Clepox 143	227
Copper/copper oxide wire	295

Copper metal	136
Degreaser	227
Dispersant	68
Dry air	771
Eco-Star	726
Electrode/probe solutions	59
Ethyl alcohol	59
Fixer/replenisher	454
Glass cleaner	454
Glass beads	136
Helium	1,769

Heptane	113
Hydraulic/lubricating oil	8,165
Hydrochloric acid	68
Joint compound	363
Kimwipes	1,134
Lead metal	136
Micro liquid lab cleaner	113
Mild steel metal	1,814
Molecular sieve	295
Neutrasorb acid neutralizer	68
Nitrogen	3,629

Paint	4,536
Planisol-M concentrate	113
Polyalkylene and ethylene glycol	68
Potassium hydroxide	113
Siliconized ammonium phosphate base	181
Sodium hydroxide	113
Solksorb solvent absorbent	499
Specialty gas mixtures	1,542
Stainless steel metal	612
Sulfuric acid	113
Tetrahydrofuran	4,990

TISAB and CDTA	250
Toluene	68
Water treating chemicals	2,268
NT DOE 1995b; NTS 1995a:3.	

Table A.3.1.2-7.-- Nevada Test Site Weapons Assembly/Disassembly Facility Surge Operation Annual Emissions

Pollutant	Quantity (t)
Carbon monoxide	0.007
Nitrogen dioxide	0.907
Particulate matter	0.00227
Sulfur dioxide	0.907
NT DOE 1995b; NTS 1995a:3.	

The project design incorporates waste minimization and pollution prevention. Segregation of activities that generate radioactive and hazardous wastes would be employed, where possible, to

avoid the generation of mixed wastes. Where applicable, treatment to separate radioactive and nonradioactive components would be performed to reduce the volume of mixed wastes and provide for cost effective disposal or recycle. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials which contribute to the generation of hazardous or mixed waste. Production processes would be configured with minimization of waste production given high priority. Material from the waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. Future D&D considerations have also been incorporated into the design.

Table A.3.1.2-8 presents the estimated annual waste volumes from the A/D and pit reuse facility during construction and surge operations. Liquid and solid waste streams are routed to the waste management system. Solid wastes would be characterized and segregated into LLW, hazardous and mixed wastes, then treated to a form suitable for disposal or storage within the facility. Liquid wastes would be treated onsite to reduce hazardous and toxic and radioactive elements before discharge or transport. All fire-sprinkler water discharged in process areas is contained and treated as process wastewater, when required.

Low-Level Waste. LLW generated from reuse operations would consist of tubes removed from the pits, personnel protective equipment, glove boxes, filters, cleaning materials, and disposal supplies. Small amounts of LLW would be generated by A/D operations and would consist primarily of sanitized and demilitarized weapon parts, test residue, compacted wipes, rubber gloves, and vacuum filters. Bulk waste would be disposed of in Area 3, and packaged waste would be disposed of in Area 5, employing standard shallow land burial techniques.

Mixed Low-Level Waste. Pit reuse operations would not generate any mixed LLW. Small amounts of mixed LLW would be generated from operation of the A/D facility and would consist primarily of sanitized and demilitarized weapon parts, test residue, compacted wipes, rubber gloves, and vacuum filters. Mixed LLW would be stored in an onsite RCRA-permitted storage facility until treatment in accordance with the site treatment plan that was developed to comply with the Federal Facility Compliance Act of 1992.

Table A.3.1.2-8.-- Nevada Test Site Weapons Assembly/Disassembly Facility Waste Volumes

Category	Annual Average Volume Generated from Construction (m^3)	Annual Volume Generated from Surge Operations (m^3)	Annual Volume Effluent from Surge Operations (m^3)
Low-Level			
Liquid	None	0.06	None

Solid	None	30 13	15 14
Mixed Low-Level			
Liquid	None	None	None
Solid	None	2	2
Hazardous			
Liquid	None	6	6
Solid	5	0.05	0.05
Nonhazardous (Sanitary)			
Liquid	6,670	53,000	53,000
Solid	260 15	100	50 16
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	Included in sanitary	Included in sanitary	Included in sanitary

Hazardous Waste. Liquid hazardous wastes would be generated from solvents from cleaning operations and residue from painting and bonding operations. The cleaning solvents selected would be from a list of nonhalogenated solvents. Solid hazardous wastes would be generated from nonradioactive materials, such as wipes contaminated with oils, lubricants, and cleaning solvents that are used for equipment outside the main processing units. Hazardous wastes would be collected in DOT-approved containers and sent to an onsite hazardous waste storage area. The hazardous waste storage area would provide a 90-day staging capacity prior to shipment to an offsite commercial RCRA-permitted treatment, storage, and disposal facility, using DOT-certified transporters.

Nonhazardous (Sanitary) Waste. Sewage wastewater and process wastewater would be treated using

a series of facultative lagoons and evaporation ponds and disposed of in septic tanks, sumps, or ponds. Solid wastes are disposed of in landfills at various locations on the site.

Nonhazardous (Other) Waste. Small amounts of classified nonhazardous waste would be generated from operation of the A/D facility. These wastes would be sanitized and disposed of per site practice.

1

Peak demand for electricity is the maximum rate. Peak demand for water is the average daily consumption during a 1-year period with construction activity.

2

Cubic meters measured at standard temperature and pressure.

PX MH 1995a.

3

Chlorine, sodium sulfite, sodium sulfate, sulfuric acid, poly electroly, and phosphoric acid.

PX MH 1995a.

4

Includes 9.2 m *3* generated from A/D operations and 11.3 m *3* generated from pit reuse operations.

5

Assumes 2/3 of solid LLW is compactible by a factor of 4:1 and the liquid LLW is solidified by a factor of 2:1.

6

Includes 4.6 m3 of concrete and 0.6 t (0.7 tons) of steel. Volume estimate made by using 0.127 m3/t for density of steel.

7

Assumes 2/3 of solid is compactible by a factor of 4:1.

PX 1995a:6; PX DOE 1995k; PX MH 1995a.

8

Peak demand for electricity is the maximum rate. Peak demand for water is the average daily consumption during a 1-year period with peak construction activity.

9

Cubic meters measured at standard temperature and pressure.

NT DOE 1995b.

10

Construction staff includes temporary construction facilities, construction services, and field staff.

11

Management and support staff include all construction personnel and an allowance for DOE site personnel, field and vendor inspection services, construction management, and engineering support during construction.

NT DOE 1995b .

12

Peak demand is the maximum rate expected during any time.

NT DOE 1995b; NTS 1995a:2.

13

Includes 18.3 m *3* generated from A/D operations and 11.3 m *3* generated from pit reuse operations.

14

Assumes 2/3 of solid LLW is compactible by a factor of 4:1 and the liquid LLW is solidified by a factor of 2:1.

15

Includes 255 m *3* of concrete and 39 t (43 tons) of steel. Volume estimate made by using 0.127 m *3* /t for density of steel.

16

Assumes 2/3 of solid is compactible by a factor of 4:1.

NT DOE 1995b; NT DOE 1995f; NTS 1995a:2; NTS 1995a:3; PX DOE 1995k.

A.3.2 Secondary and Case Fabrication

This alternative involves those activities required to support the production and maintenance of the secondaries and case components of the nuclear weapons physics package as follows:

- Providing secondary materials
- Processing materials
- Fabricating parts and components
- Assembling and disassembling secondary components
- Performing quality evaluations of secondary assemblies
- Providing safe secure storage of secondary material and products

Functional capabilities required to perform these activities include operations to physically and chemically process, machine, inspect, assemble, certify, disassemble, and store secondary materials. Management of wastes generated from these operations is also required. The fabrication of secondaries and cases can be subdivided into the following major material production processes: uranium, lithium, and nonnuclear/special materials. The following typical process descriptions are provided to illustrate the functional activities and operations associated with each of the major production processes. These processes are based on traditional secondary and case fabrication methods and represent upper bounds to the types and number of processes that would be continued in the downsized and reconfigured Complex. Alternative sites for performing secondary and case fabrication are Y-12, LANL, and LLNL. The site-specific descriptions provided in sections A.3.2.1 to A.3.2.3 are based on more streamlined and less unit operations than described in this section. When comparing data between site alternatives, it is important to note that there are differences in the facility designs. The Y-12 alternative considers all the necessary support facilities to conduct the missions, not just the production and storage facilities. The LANL and LLNL alternatives only consider the incremental changes for operating the production facilities. The actual production footprint size of each alternative is almost identical; however, the production capacities vary between site alternatives. For example, base case, multiple-shift capacities at Y-12 and LANL are about 150 units, whereas at LLNL the equivalent production capability would be about 50 units. This creates significant differences in some of the data.

Process Descriptions

Uranium. The uranium process provides finished uranium parts and products. The operations are capable of all uranium handling and processing functions, from raw materials handling to finished parts manufacturing. In addition, uranium storage areas need to be provided for storage of in-process uranium materials and, at ORR only, for the HEU strategic reserve. In the event secondary and case fabrication is phased out at ORR and performed at LANL or LLNL, the storage of the HEU strategic reserve would be addressed at the weapons A/D site (i.e., Pantex or NTS).

The production of uranium parts and products involves casting or wrought processing; metal-working; machining, inspection, and certification; chemical recovery; assembly, disassembly, and quality evaluation; and in-process storage. The products from casting or wrought processing are billets and cast parts that feed directly to machining and metalworking. Billets are cropped and cast parts are delugged before they are sent to the next operation. The input to casting consists of retired weapons parts, metal buttons from storage, and recycled scrap metal from metalworking and machining. A casting charge is made up and processed in a critically safe configuration in a vacuum

induction furnace. Scrap metal and machine turnings are degreased, cleaned, and briquetted before direct recycle.

Metalworking prepares a wrought product as feed for machining. Cropped billets from casting are preheated in a salt bath, rolled into a sheet, annealed in a salt bath, blanked, and pressed. The blanking operations are a major source of recycled metal for casting. Formed parts are cleaned, debrimmed, and machined.

Both formed and cast blanks are machined to finished dimensions and inspected. Scrap metal and machine turnings are returned to casting for cleanup and reuse. Miscellaneous solids are sent to the chemical recovery systems for treatment to recycle the material back to metal buttons. Product inspections and certification is accomplished with coordinate measuring machines, optical gaging, high-energy x-ray radiography, ultrasonic and dye penetrant flaw-inspection methodology, plating thickness gaging, and mechanical properties testing.

Uranium chemical recovery receives feed from virtually all areas in the process. The major feeds are residuals from casting, impure metal chips from machining, and a miscellaneous array of combustibles from all areas. The feeds are incinerated and processed in a head-end treatment consisting of acid dissolution, leaching, and feed preparation for solvent extraction. The feed solution is processed through primary extraction by which it is purified, concentrated by evaporation, and purified further by secondary extraction. The resulting solution is converted to oxide, then to uranium tetrafluoride, and then to uranium metal buttons. Secondary residues are returned to the head-end treatment. Finished metal is returned to casting for reuse.

Assembly operations assemble piece parts into subassemblies using joining techniques such as welding, adhesive bonding, and mechanical joining. Disassembly takes retired weapons apart and recycles all materials of value. The quality evaluation function receives weapons from the stockpile for disassembly, evaluation, and lifecycle testing. Shipping containers for weapons parts and subassemblies are certified and refurbished as part of the A/D process.

Uranium storage includes storage vaults for in-process uranium materials, which includes buttons and other scrap materials directly recycled, as well as semi-finished and finished components. The vaults at ORR are also for the strategic reserve, which includes assembled secondaries and HEU metal castings.

Lithium. The lithium process provides finished lithium hydride and deuteride parts. Primary functional elements of this process include powder production and forming, finishing and inspection, and deuterium production. These systems are briefly described below.

The lithium hydride and deuteride from storage, recycled weapons parts, and manufacturing scrap are broken, crushed, and ground to produce powder. The powder is loaded into molds and cold isostatically pressed to form solid blanks.

The blanks are unloaded from the molds and placed into vacuum furnaces where they are outgassed by heating under vacuum. After cooling, the outgassed blanks are loaded into form-fitting bags, heated, and then warm pressed. After being warm pressed, the blanks are cooled to room temperature and removed from the bags. The fully dense machining blanks that result from forming operations are radiographed to detect any high-density inclusions. Powder production, mold loading, and radiography are all performed in dry glove boxes to minimize reaction of the lithium hydride and deuteride with moisture in the atmosphere. Mold unloading, furnace loading and unloading, and bag

loading and unloading are all conducted in an inert glove box. The lithium hydride or deuteride is handled outside inert-atmosphere glove boxes only when it is sealed in a mold or bag.

The blanks from forming operations are machined to final shapes and dimensions on lathes using single-point machining methods in finishing operations. Most machine dust is collected for direct recycle salvage operations. The finished part weight and dimensions are inspected using certified balances and contour measuring machines. All machining and inspection activities are conducted in dry glove boxes to minimize any reaction with moisture in the atmosphere. Certified parts receive a final vacuum outgassing treatment before final assembly.

Deuterium is required for many of the products and will be stored for future use. Deuterium oxide, or heavy water, is electrolytically reduced. The resulting deuterium is compressed and stored for use. The compressed deuterium gas is used to reconvert the lithium metal to deuteride in the final step of wet chemistry if needed.

Lithium wet chemistry can be used to pre-produce lithium hydride and deuteride to meet production requirements for many decades. The principal function of wet chemistry is to purify lithium hydride and deuteride by removing oxygen and other trace elements. The principal feeds to this system are retired weapon components from the disassembly operation, machine dust, powder, and killed parts from other operations. Purification is accomplished by transforming the lithium hydride and deuteride through a chemical dissolution process; then the solution is evaporated and crystallized. The crystals are then reduced to lithium metal and impurities are removed. The lithium metal is then reconverted to lithium hydride and deuteride by combining it with hydrogen or deuterium gas. The resulting lithium hydride and deuteride billet, sealed in a thin stainless-steel can, is transferred to lithium storage.

The production of lithium hydride and deuteride components creates a considerable amount of scrap that must be recycled to recover the lithium and deuterium. Much of the machine dust, unacceptable formed parts, machined parts that fail inspection, and stockpile returned parts are directly recycled. Salvage operations typically process material that is too impure to be recycled. Salvage operations primarily involve washing and chemical recovery. Items that require washing include machining tools and fixtures, filters used throughout the processes, and sample bottles. Oil-soaked lithium hydride and deuteride blanks from the powder-forming operations are also prepared for storage. Solutions from the purification and wash operations, including mop and dike water streams, are neutralized, filtered, crystallized, and sent to storage or waste disposal.

Long-term storage is required for chemicals and pre-produced lithium hydride and deuteride billets. Interim storage is to be provided for lithium hydride and deuteride components from disassembly or retired weapons and rejected components from forming and finishing operations.

Special Materials. Special materials such as diallyl-phthalate are required to support the lithium processes. Diallyl-phthalate based molding compound is formed into near-net-shape blanks that are later machined to finished parts. The primary forming operation is compression or transfer molding, which is followed by a drying and final curing step.

Nonnuclear. The nonnuclear process is responsible for producing certain weapon components composed of nonnuclear materials and for providing the uranium and lithium processes with specialized material and support services. Many types of materials are processed to provide a diverse product line consisting of both nonnuclear metal components and tooling and a variety of polymer-based items. The principal manufacturing technologies employed are hydroforming, hydrostatic

forming, rolling, forging, heat treating, welding, machining, cold/hot isostatic pressing, grinding, winding, casting, plating, molding, and coating.

The nonnuclear process handles several product streams, which are described briefly in the following paragraphs.

Several types of urethane foams are required to be produced. The urethane components and blowing agents are pumped into molds and allowed to expand to fill the mold. After curing, the foam moldings are ejected and trimmed to final shape.

Steel and aluminum are construction materials for both components and support tooling, making this a relatively high throughput product line. The usual fabrication route for both materials is rough machining, heat treatment, and finish machining.

Operations to produce stainless steel cans consist of blanking, followed by hydroforming and hydrostatic forming with subsequent machining and heat treatment. Ultrasonic cleaning is required before heat treatment to ensure cleanliness for welding, which completes the assembly.

Ceramic finished parts are finished from blanks or procured. Procured parts are inspected and certified prior to final assembly.

Polyvinyl chloride is formed into bags and castings and also applied as a coating. Items to be coated are dipped into a tank of curable, plasticized polyvinyl chloride formulation, whereas castings are produced by transferring the polyvinyl chloride liquid into a mold. All items are heat cured.

A.3.2.1 Downsize at Oak Ridge Reservation

Y-12 has performed the secondary and case fabrication mission in the Complex for over 40 years. This mission includes the production of materials and components for thermonuclear weapons secondary assemblies and the associated functions such as depleted uranium for radiation cases and other miscellaneous materials for other applications. Figure A.3.2.1-1 shows the location of Y-12 at ORR.

The Y-12 secondary and case fabrication mission requires approximately 30 ha (75 acres) of the existing 328-ha (811-acre) Y-12 site. This, unlike the LANL and LLNL alternatives, includes significant area for support facilities. There would be no new developed land outside the currently existing Y-12 boundary. Land for construction laydown and warehousing would be minimal and would use existing Y-12 developed areas; construction parking requirements, about 0.8 ha (2 acres), can be satisfied by existing unused parking facilities.

The Y-12 complex consists of an array of production and support facilities. The physical configuration for the Y-12 secondary and case fabrication mission consists of five main production buildings, one shared production facility, and a number of office, utility, and changehouse facilities.

During the past 12 years, major restoration projects (such as Production Capability Restoration, Utility System Restoration, and the Capability Assurance Program) have brought the infrastructure supporting this facility up to current standards and should allow the use of these facilities for up to an additional 40 years. Figure A.3.2.1-2 is a plot plan of Y-12 showing these main and shared facilities.

The secondary and case fabrication mission would be located in the following Y-12 production buildings: 9996, 9212, 9215, 9201-5N, 9204-2E, 9204-2 (isostatic press), 9720-19, and 9998. The secondary and case fabrication mission footprint comprises *61,800* m *2* (665,000 ft *2*) of total DP area including a production footprint of *21,840* m *2* (235,000 ft *2*). The total proposed footprint includes all DP functions: production, storage, maintenance, dedicated utilities, and administration. Buildings 9204-2 and 9201-5W would be placed in cold standby to enable reactivation in the event of unforeseen additional capacity demands. Activation of these buildings would require separate NEPA evaluation.

The following production buildings would be used to support the Stockpile Stewardship and Management Program.

Building 9212

- E-wing--Enriched uranium casting and storage would continue in this area. All but two of the west line casters would be placed in standby as would one auxiliary caster. Adjacent to E-wing is the process area for enriched uranium metal recovery, which would be operated by programs other than DP or placed in cold standby.
- A2-wing--This wing would be used as now configured for depleted uranium and binary operations.
- Equipment for metal production from uranium oxide would be held in cold standby.

Building 9998

- Foundry--The staging area and six furnaces would be used.
- H2-Area--This area would contain all of the enriched uranium machining and the associated dimensional inspection. The existing storage area would remain, and G3-Area would be used for ceramic machining and other special materials.
- F-Area--This area would be used in its current configuration for depleted uranium binary and nonnuclear metalworking with the *3,175* t (3,500 ton) press added.

Building 9215

- M-wing--This area would be used for enriched uranium storage.
- O-wing--Enriched uranium rolling and forming would be performed in this area.
- P-wing--This area would continue to be used for hydroforming and would house the can shop, relocated from Building 9210-1.
- N-wing--The third mill area would continue to function as the depleted and alloyed uranium rolling and blanking operation.

Building 9996

- This building would be used as a laydown and tool storage area for the equipment now in service in the Building 9212-A2 Area and the F-Area of Building 9998.

Building 9204-2

- The largest isostatic press would continue to be used for the lithium forming operation. This press is in a self-contained small section of Building 9204-2 that would be sealed. The

remainder of Building 9204-2 would be placed in cold standby.

Building 9201-5N

- This building houses machine tools and other preparation and plating equipment dedicated to the production of depleted uranium/binary alloy/nonnuclear components.

Building 9201-5W

- This building would be placed in cold standby.

Building 9720-19

- The rubber curing shop is located in this facility. This area would not be modified or its function altered.

Building 9204-2E

- This building would be modified to be used for lithium forming and machining. It would continue to function as the assembly facility, a testing (nondestructive testing) facility, and for storage.

No new facilities are required at Y-12 to support the secondary and case fabrication mission. Table A.3.2.1-1 summarizes key facility data, such as plant functions, nuclear materials present, building square footage, number of floors in the building, and type of construction.

Construction. Modification of Y-12 facilities to support the secondary and case fabrication mission would require 6 years to complete. The materials and resources that would be consumed during this period are summarized in table A.3.2.1-2. Emissions generated during construction are provided in table A.3.2.1-3. The principal sources of airborne emissions from construction are fugitive dust, construction activities, and exhaust from construction equipment and vehicles. Construction employment for the Y-12 Secondary and Case Fabrication Facility modification is shown in table A.3.2.1-4.

Operations. The secondary and case fabrication mission processes require the following utilities during operations: electricity, diesel fuel, natural gas, coal, air (compressed, dehumidified, and breathing), water (demineralized, fire, potable, plant, and cooling tower), and steam. Table A.3.2.1-5 presents the estimated utilities consumed during surge operation of the Y-12 secondary and case fabrication facilities. Chemicals consumed during secondary and case fabrication surge operations are summarized in table A.3.2.1-6.

Emissions. The contaminated and potentially contaminated zones within the plant facilities that handle uranium materials have high efficiency particulate air (HEPA) filtered ventilation systems that exhaust to the atmosphere. Some exhausts are provided with liquid scrubbing prior to HEPA filtration to remove chemical vapors such as nitric acid. The annual emissions for surge operation of the Y-12 secondary and case fabrication mission are shown in table A.3.2.1-7.

Table A.3.2.1-1.-- Y-12 Plant Secondary and Case Fabrication Facility Data

Building Number	Upgraded Uranium/Lithium Plant Function	Upgraded Uranium/Lithium Facility Usage (percent)	Nuclear Materials Present	Total Size (m 2)	Number of Floors	Type of Construction 1
9103	Communication/support	10		6,780	3	B-1
9117	Communication/support	10		1,810	1	A-5
9119	Administration/support	100		6,660	4	B-5
9201-5N	Uranium/nonnuclear	85	Uranium	7,480	2	B-2
9204-2E	Uranium	85	Uranium	14,050	3	B-1
	Lithium	10	Lithium			
	Maintenance/support	5				
9212 2	Uranium	40	Uranium	28,930	3	B-2
9215	Uranium	90	Uranium	14,590	3	B-2
	Nonnuclear	10				
9401-3	Steam plant support	10		3,130	3	B-4
9404-2	Compressed air/support	40		430	1	B-2
9706-2	Emergency Operations Center	20		2,040	2	A-2
	Medical/support	20				
9710-2	Fire station	10		1,760	1	B-2
9710-3	Security/support	60		3,820	4	B-3
9711-5	Cafeteria/support	10		5,360	2	B-1
9723-31	Changehouse/support	50		2,710	2	B-3
9995	Plant laboratory			7,810	2	B-3
	Uranium	6	Uranium			
	Lithium	3	Lithium			
	Nonnuclear	1				
9996	Uranium	100	Uranium	3,110	2	B-3
9998	Uranium	70	Uranium	12,740	2	B-3
	Nonnuclear	20				

Table A.3.2.1-2.-- Y-12 Plant Secondary and Case Fabrication Construction Materials/Resources Requirements

Material/Resource	Total Consumption	Peak Demand 3
Concrete (m3)	100	
Electricity (MWh)	2.7	0.2 MWe
Industrial gases 4 (m 3)	300	
Liquid petrochemicals (L)	10,000	
Steel (t)	20	
Water (L)	2,000,000	

Table A.3.2.1-3.-- Y-12 Plant Secondary and Case Fabrication Construction Emissions

Pollutant	Quantity (t)
Carbon monoxide	2.4
Nitrogen oxides	0.8
Particulate matter	0.6
Sulfur dioxide	0.1
Total suspended particles	1.0
Volatile organic compounds	1.2
OR MMES 1996j .	

Table A.3.2.1-4.-- Y-12 Plant Secondary and Case Fabrication Construction Workers

Employees	97	98	99	00	01	02	Total 5
Craftworkers							
Carpenter	0.4	0.4	0.4	0.4	0.4	0	2
Concrete mason	0.2	0.2	0.2	0.2	0.2	0	1
Electrician	1	1	1	1	0.5	0.5	5
Iron worker	2	2	2	2	2	2	12
Laborer	1	1	2	1	1	1	7
Millwright		0.5	0.5	0.5	0.5		2
Operator	0.5	0.5	0.5	0.5	0.5	0.5	3
Other craftworkers	0.2	0.2	0.2	0.2	0.2		1

Pipe fitter	0.5	0.5	0.5	0.5	0.5	0.5	3
Sheet metal worker	0.4	0.4	0.4	0.4	0.4		2
Sprinkler fitter							0
Teamster	0.3	0.3	0.3	0.4	0.4	0.3	2
Total Craftworkers	6.5	7.0	8.0	7.1	6.6	4.8	*40*
Construction management and support staff	5.2	5.6	6.4	5.7	5.3	3.8	32
Total Employment	11.7	12.6	14.4	12.8	11.9	8.6	*72*

Table A.3.2.1-5.-- Y-12 Plant Secondary and Case Fabrication Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 6
Coal (t)	500	
Diesel fuel (L)	250,000	
Electricity	118,000 MWh	19.0 MWe
Natural gas 7 (m^3)	17,000,000	
Raw water (L)	1,510,000,000	

Table A.3.2.1-6.-- Y-12 Plant Secondary and Case Fabrication Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Solid Chemicals	
Aluminum trihydride	3,000
Barium nitrate	15
Borax	15
Calcium hydroxide	30,000
Calcium nitrate	150
Calcium oxide	150
Curing agent	4
Diatomaceous earth	2,500

Epoxy resin	10
Erbium oxide	75
Ferric sulfate	7,500
Graphite	2,000
Lithium carbonate	1,200
Magnesium sulfate	100
Methylene diphenyl diisocyanate	100
Nickel compounds	75
Polycure	75
Potassium carbonate	3,000
PVC plastisol	1,500
Silicon carbide	40
Sodium bicarbonate	75
Sodium carbonate	450
Sodium molybdate dihydrate	5
Sodium nitrate	1,500
Sodium potassium	3
Trisodium phosphate	250
Tungsten carbide	1
Yttria	150
Zirconium oxide	180
Liquid Chemicals	
Acetic acid	15
Acetone	8
Acetonitrile	150
Anisol	200
Corrosion inhibitor	800
Diamond paste	1
Diesel fuel	75,000
Ethanol	1,000
Gasoline	110,000
Hydraulic oil	3,000
Hydrogen peroxide	750
M-pyrol	50
Methanol	2,500
Micro/oakite detergent	12
Mineral oil	1,500

Mold release	7.5
Nitric acid	1,000
Nitrogen tetroxide	150
Oxalic acid	2
Petroleum oils (lubricants)	1,500
Potassium chloride	15
Propylene glycol	150
Pump oil	3
PVC primer	2
Solvent 140	750
Toluene 2,4-diisocyanate	100
1,1,1-Trichloroethane	800
Gaseous Chemicals	
Ammonia, anhydrous	*7.5*
Argon	*1,400,000*
Carbon dioxide	*30,000*
Chlorine	*75*
Freon or equal (cleaning)	*750*
Helium	*6,000*
Hydrogen	*1,500*
Nitrogen	*5,000,000*
Oxygen	*50,000*
Note: PVC- polyvinyl chloride. Source: OR MMES 1996j; ORR 1995a:4 .	

Employment. Y-12 generally operates with one shift per day, 5 days per week, except for some utility systems and security functions that operate continuously. Surge capacity would be accommodated by operating multiple shifts. The employment during surge operation for the secondary and case fabrication mission is summarized in table A.3.2.1-8. The data presented includes employees from the management and operating contractor, support organizations, and DOE.

Table A.3.2.1-7.-- Y-12 Plant Secondary and Case Fabrication Surge Operation Annual Emissions

Pollutant	Quantity (t)
Carbon monoxide	7.4
Chlorine	0.15

Hydrogen chloride	4.8
Methyl alcohol	14
Nitric acid	7.1
Nitrogen oxides	195
Ozone	0.07
Particulate matter	0.5
Pressing lubricant	0.3
Sulfuric acid	1.8
Sulfur dioxide	80
Total suspended particles	10
Volatile organic compounds	1.2
Radiological Isotope	**Estimated Release**
Uranium-235 (microcuries)	420
Uranium-238 (microcuries)	1,490
OR MMES 1996j; ORR 1995a:4.	

Approximately 20 percent of the dosimeter badged population at Y-12 routinely work inside the radiological area (uranium handling areas). Based on current design definition, 20 percent is also assumed for the Y-12 secondary and case fabrication mission. Therefore, it is estimated that 174 of the badged employees would be at risk of radiological exposure as shown in table A.3.2.1-8. In addition, on a nonroutine basis, a small fraction of badged visitors may enter the radiological area.

Table A.3.2.1-8.-- Y-12 Plant Secondary and Case Fabrication Surge Operation Workers

Labor Category	Number of Employees	Risk of Radiological Exposure
Craftworkers	131	61
Laborers	8	--
Officials and managers	88	7
Office and clerical	95	--
Operatives	93	43
Professionals	284	35
Service workers	584	--
Technicians	93	28
Total Employees	*1,376*	174
OR MMES 1996j; ORR 1995a:4.		

Waste Management. The solid and liquid nonhazardous wastes generated during modification activities would include concrete and steel construction waste materials and sanitary wastewater. The steel waste would be recycled as scrap material before completing construction. The remaining nonhazardous wastes generated during construction would be disposed of by the construction contractor. Uncontaminated wastewater would be managed per site practice. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous wastes would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. A small amount of solid LLW consisting of contaminated steel and concrete would be generated. This waste would be placed in an appropriate container and shipped to an approved LLW disposal facility.

The project design considers and incorporates waste minimization and pollution prevention. Production processes would be configured with minimization of waste production given high priority. Future D&D considerations have also been incorporated into the design.

Table A.3.2.1-9 presents the estimated annual waste volumes from the secondary and case fabrication facilities during modifications and surge operations. Solid and liquid waste streams are routed to the waste management system. Figures A.3.2.1-3 through A.3.2.1-6 [figure A.3.2.1-4] [figure A.3.2.1-5] depict the waste management system. Solid wastes would be characterized and segregated into low-level, hazardous, and mixed wastes, then treated to a form suitable for disposal or storage within the facility. Liquid wastes would be treated onsite to reduce hazardous/toxic and radioactive elements before discharge or transport. All fire-sprinkler water discharged in process areas would be contained and treated as process wastewater, when required.

Table A.3.2.1-9.-- Y-12 Plant Secondary and Case Fabrication Waste Volumes

Category	Annual Average Volume Generated from Construction (m *3*)	Annual Volume Generated from Surge Operations (m *3*)	Annual Volume Effluent from Surge Operations (m *3*)
Low-Level			
Liquid	None	320	None
Solid	8	1,120 8	570 9
Mixed Low-Level			
Liquid	None	3,400	3,400
Solid	1	92 10	92
Hazardous			
Liquid	None	Included in mixed	Included in mixed
Solid	2	Included in mixed	Included in mixed
Nonhazardous (Sanitary)			
Liquid	27	320,000	319,400 11
Solid	30 12	13,500 13	7,670 14

Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	2	10,000 15	Included in sanitary

Spent Nuclear Fuel. The Secondary and Case Fabrication Facility would not generate any spent nuclear fuel.

Transuranic Waste. The Secondary and Case Fabrication Facility would not generate any TRU wastes.

Low-Level Waste. LLW would be generated by operation of the Secondary and Case Fabrication Facility and would consist primarily of depleted uranium oxide in drums and contaminated scrap metal, air filters, and HEPA filters. Approximately 10 percent of all LLW generated would currently be suitable for disposal onsite. The remaining waste would be packaged for offsite treatment and disposal at the waste feed preparation facility and stored at K-25, pending disposal at an approved disposal facility. Scrap metal would be sent offsite for smelting into shielding blocks for DOE use.

Mixed Low-Level Waste. Mixed LLW would be generated from operation of the Secondary and Case Fabrication Facility and would consist primarily of ash and sludge immobilized in grout, compacted gloves, and wipes. Mixed LLW would be collected in DOT-approved containers and sent to an onsite hazardous waste accumulation area. Waste suitable for incineration would be sent to the K-25 TSCA incinerator. After compaction, if appropriate, the remaining solid wastes would be packaged and stored onsite awaiting disposal by an offsite commercial vendor.

Hazardous Waste. These materials are included in the mixed LLW.

Nonhazardous (Sanitary) Waste. Sewage wastewater would be discharged directly to the Oak Ridge Municipal Wastewater Treatment System sewer system. Process wastewater would be treated in the sanitary wastewater treatment facilities and discharged through permitted NPDES outfalls. Sludge would be stored onsite, pending treatment by a commercial vendor. Nonhazardous solid wastes including small amounts of classified nonhazardous waste would be generated from operation of the Secondary and Case Fabrication Facility and disposed of in a State of Tennessee permitted Class II landfill.

Nonhazardous (Other) Waste. Nonrecyclable (other) wastes would be disposed of in a permitted landfill or discharged through permitted NPDES outfalls.

A.3.2.2 Relocate to Los Alamos National Laboratory

LANL secondary and case fabrication facilities would include all of the functional operations required to physically and chemically process, machine, inspect, assemble, certify, and disassemble secondary materials to produce canned subassemblies and radiation case components for the nuclear weapons physics package.

The secondary and case fabrication facilities would occupy 21,739 m2 (234,000 ft2) of floor space inside existing structures within their current footprint of 1.1 ha (2.7 acres). Additional land area for the construction of new buildings would not be required. A nominal area would be required for equipment staging, material laydown, and parking during the modifications of these facilities.

Facility Description. Secondary and case fabrication would utilize existing facilities within the boundaries of TAs -3, -8, -50, -54, and -55 (figure A.3.2.2-1). Facilities within each of these technical areas include the TA-3 Sigma Complex (SM-35, SM-66, and SM-141), the TA-3 Chemistry and Metallurgy Research building (SM-29), the TA-3 main machine shop (SM-39 and SM-102), the TA-8 Nondestructive Evaluation Facility (Buildings 22 and 23), the TA-55 Nuclear Material Storage Facility for overflow capacity, the TA-50 Liquid Radioactive Waste Treatment Facility, and the TA-54 Solid Radioactive Waste Treatment Area.

The flow of fissile material would be contained within the Chemistry and Metallurgy Research building (SM-29). Manufacturing operations would take their feeds from both incoming stockpile returns and the chemical recovery process. Components from manufacturing would be sent back out for assembly. Low-equity waste (graphite, booties, and machining fluids) would be sent back to waste management for processing, storage, and disposal. Recoverable quantities of fissile material would be reprocessed in chemical recovery and returned as feed stock to manufacturing.

Figure A.3.2.2-2 shows the major structures located in TA-3. The buildings shown on this plot plan for use in stockpile stewardship and management operations are SM-29, SM-35, SM-39, SM-66, SM-102, and SM-141. Modifications are required for the following facilities:

- Renovations to Chemistry and Metallurgy Research building Wings 2, 4, and 9
- SM-102 change room and ventilation upgrades
- SM-66-D103 lithium forming, machining, and inspection
- SM-35 lithium purification, salvage, and storage

Table A.3.2.2-1 summarizes key facility data for the building and support structures to be utilized in secondary and case fabrication.

The Chemistry and Metallurgy Research building is a large reinforced concrete building with a basement, a first floor, and an attic floor. This building has been classified as a Performance Category PC-3 Nuclear Facility (per DOE-STD-3009-94). The administration wing and Wing 1 contain second-floor office areas. The plan of the building is centered on a spinal corridor oriented in a north-south direction with an administration wing and seven laboratory wings (Wings 1, 2, 3, 4, 5, 7, and 9) that extend from the corridor. Wings 2, 3, 4, 5, and 7 have equipment/change rooms located at the front of each wing and filter towers located at the end of the wings, which house the filter plenum and other large mechanical equipment for the exhaust ventilation system. The building also contains a waste assay facility located at the loading dock between Wings 1 and 4 and a Category I special nuclear material vault. The Chemistry and Metallurgy Research building replaced the World War II "D" building and was designed to house analytical chemistry facilities, plutonium metallurgy, uranium chemistry, engineering design and drafting, electronics, and other support functions. At the time it was built, the Chemistry and Metallurgy Research building represented the state-of-the-art instrumentation and safety controls for a modern chemistry laboratory.

Table A.3.2.2-1.-- Los Alamos National Laboratory Secondary and Case Fabrication Facility Data

Building	Footprint (m2)	Number of Levels	Special Materials	Construction Type
SM-29 Chemistry and Metallurgy Research	51,097	3	Special nuclear materials	Concrete post and beam with concrete masonry unit in-fill walls
SM-66 Sigma	15,794	3	NA	Concrete post and beam with concrete masonry unit in-fill walls
SM-39 Nonnuclear Shops	14,202	3	NA	Concrete post and beam with concrete masonry unit in-fill walls
SM-102 Uranium Shops	2,090	3	NA	Concrete post and beam with concrete masonry unit in-fill walls
SM-141 Rolling Mill	1,858	2	NA	Concrete post and beam with concrete masonry unit in-fill walls
SM-35 Press	929	2	NA	Concrete foundation with steel pillars and sheet metal walls
SM-67 Guard Station Sigma	22.9			
SM-127 Cooling Tower	138			
SM-145 Switchgear Station	39			
SM-147 Air Plenum and Fan	15.2			
SM-154 Chemistry and Metallurgy Research Cooling Tower	37.2			
SM-159 Forming	14.9			
SM-161 Magazine	1.5			

SM-169 Warehouse	581			
SM-187 Cooling Tower	37.2			
SM-317 Graphite Flour Storage	140.5			
SM-451 Micro Machining	160			
TA-8-22 Nondestructive Evaluation Lab	843			
TA-8-23 Nondestructive Evaluation Support	316			
NA - not applicable. **LANL 1995e.**				

The Sigma Complex comprises three main processing buildings located in TA-3 just east of the Chemistry and Metallurgy Research building. The fenced area encompassing the Sigma Facility contains a total of 16 buildings. The three buildings designated as SM-66, SM-141, and SM-35 contain the majority of laboratory space. Other structures house utilities, support functions, and storage areas. The Sigma Complex has been classified as a low-hazard chemical (PC-1), nonnuclear facility.

The Press building (SM-35) is the oldest building in this complex. Construction was completed in 1953. The building was originally designed to house the 4,536-t (5,000-ton) press for the Materials Technology Group. Building construction consists of a concrete foundation and supporting steel pillars with insulated double sheet metal walls outside. Inside walls (separating various work areas and offices) are similar or made of concrete block.

The Rolling Mill building (SM-141) has reinforced concrete foundations, floors, support columns, and beams with concrete block exterior walls. Interior walls separating various work areas and offices are made of concrete block and/or metal studs with gypsum board. The roof is built of tar and gravel over rigid insulation and is supported by steel joists. The building was designed to house areas for powder metallurgy and fabrication. Today the Rolling Mill building continues to house these activities in addition to work areas for ceramics research, beryllium technology, and development and rapid solidification research.

The Sigma building (SM-66) was constructed in 1959 and was originally designed to house activities in physical metallurgy, ceramics, powder metallurgy, plastics, a metal foundry, electrochemistry, fabrication, and other support functions. Today the Sigma building continues to house all these functions except plastics. The building is built on a reinforced concrete foundation using reinforced concrete post and beam construction techniques. The exterior walls are constructed of concrete block

fill between the supporting posts and beams. The mezzanine spaces are constructed of supported metal decking. Interior walls separating various work areas and offices are also concrete block or metal studs and gypsum board. The roof is built of tar and gravel over rigid insulation and metal decking supported by steel joists. The building has a basement, a first floor, and a small second floor. The plan of the building is on a spinal corridor oriented in a north-south direction. SM-66 has 11 major work areas that extend from the corridor.

Building SM-102 is connected to the Main Shops building, SM-39, by a 38-m (125-ft) long corridor. Constructed in the late 1950s, it originally housed a foundry, a heat-treating operation, a graphite machining shop, and a radioactive materials machine shop. Since that time, the northeast corner of the building, which provided programmatic support to the Rover Project, has been decommissioned and now is dedicated to the support of Engineering, Sciences, and Applications division operations. Currently, the southern half of the building is occupied primarily by Shop 13, the uranium and lithium machine shops. The building is constructed of cinder block and has a concrete floor. Shop 13 contains machines that are used for machining operations on uranium. The majority of the building houses pyrophoric, toxic, and radioactive material machining and a dimensional inspection area. SM-102 has been classified as a low-hazard chemical (PC-1), nonnuclear facility.

Building SM-39 is of concrete and cinder block construction. The main bay is aligned from north to south and is 183 m (600 ft) in length by 37 m (120 ft) in width. Three wings extend eastward from the north and south ends of the bay, as well as the middle of the main bay. The south main (high) bay section, the middle wing, and the south wing contain metal and machining shops owned by the Mechanical Fabrication Group. SM-39 has been classified as a low-hazard chemical (PC-1), nonnuclear facility.

The north wing contains offices occupied by the Materials Technology Polymers & Coatings Group (MST-7) and the Standard and Calibration Group (ESH-9). It also contains Mechanical Fabrication Group beryllium machining and inspection, a glass shop operated by MST-7, and a Standards and Calibration Laboratory operated by ESH-9. Three transportable equipment storage trailers are located on the south side of the north wing.

Construction. Modification to the LANL facilities to perform the stockpile management secondary and case fabrication mission would require approximately 7 years for design, construction, mission transfer, and operational startup. With conceptual design beginning in 1997, operational startup could commence in 2004. The materials and resources consumed during modification activities are provided in table A.3.2.2-2.

Emissions generated during modification activities are provided in table A.3.2.2-3. The principal sources of airborne emissions during modification are fugitive dust, construction debris, and exhaust from construction equipment and vehicles.

Table A.3.2.2-2.-- Los Alamos National Laboratory Secondary and Case Fabrication Construction Materials/Resources Requirements

Material/Resource	Total Consumption	Peak Demand 16
Concrete (m 3)	245	
Electricity	4,130 MWh	0.75 MWe
Industrial gases 17 (m 3)	11,500	
Liquid fuel (L)	22,700	
Steel (t)	54	
Water (L)	4,160,000	

Table A.3.2.2-3.-- Los Alamos National Laboratory Secondary and Case Fabrication Construction Emissions

Pollutant	Quantity (t)
Carbon monoxide	<1 *18*
Lead	0
Nitrogen dioxide	<1 *18*
Particulate matter	<1 *18*
Sulfur dioxide	<118
Volatile organic compounds	0

Employment needs during the modification phase are presented in table A.3.2.2-4.

Operation. The secondary and case fabrication processes require the following utilities during operation: electricity, natural gas, diesel fuel, air, water, and steam. Table A.3.2.2-5 presents a listing of the utilities consumed during Secondary and Case *Fabrication Facility surge operations.* Chemicals consumed during operation are summarized in table A.3.2.2-6.

The annual emissions from surge operation required in the Secondary and Case Fabrication Facility are based on historical emissions and amounts of materials to be processed as shown in table A.3.2.2-7.

Employment. The employment needs in support of secondary and case fabrication surge operation activities at LANL are summarized in table A.3.2.2-8.

Table A.3.2.2-4.-- Los Alamos National Laboratory Secondary and Case Fabrication Construction Workers by Year

Labor Category	Year 1	Year 2	Year 3	Year 4	Total
Total craftworkers	34	45	45	45	169
Construction management and support staff	6	10	10	10	36
Total Employment	40	55	55	55	205
LANL 1995e.					

Table A.3.2.2-5.-- Los Alamos National Laboratory Secondary and Case Fabrication Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 19
Diesel fuel (L)	100,000	
Electricity	36,000 MWh	5 MWe
Natural gas 20 (m^3)	0	
Water (L)	55,000,000	

Table A.3.2.2-6.-- Los Alamos National Laboratory Secondary and Case Fabrication Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Solid Chemicals	
Aluminum nitrate	75
Aluminum trihydride	3,000
Barium nitrate	15
Borax	15
Calcium hydroxide	30,000
Calcium nitrate	150
Curing agent	4
Epoxy resin	10
Ferric sulfate	7,500

Graphite	2,000
Lithium chloride	6,000
Magnesium sulfate	100
Methylene diphenyl diisocyanate	100
Nickel compounds	75
Polycure	75
Potassium carbonate	3,000
PVC plastisol	1,500
Silicon carbide	40
Sodium bicarbonate	75
Sodium carbonate	450
Sodium molybdate dihydrate	5
Sodium nitrate	1,500
Trisodium phosphate	250
Tungsten carbide	1
Yttria	300
Liquid Chemicals	
Acetic acid	15
Acetone	20
Acetonitrile	150
Anisol	200
Corrosion inhibitor	800
Diamond paste	1
Dibutyl carbitol	1,000
Ethanol	1,000
Gasoline and diesel	100,000
Hydraulic oil	3,000
Hydrogen peroxide	750
Kerosene, high grade	150
M-pyrol	50
Methanol	2,500
Micro/oakite detergent	12
Mineral oil	1,500
Mold release	7.5
Nitric acid	1,000
Nitrogen tetroxide	150
Oxalic acid	2

Petroleum oils (lubricants)	1,500
Potassium chloride	15
Propylene glycol	150
Pump oil	3
PVC primer	2
Solvent 140	750
Toluene 2,4 diisocyanate	100
Gaseous Chemicals	
Ammonia, anhydrous	*7.5*
Argon	*1,000,000*
Carbon dioxide	*10,000*
Chlorine	*75*
Freon or equal (cleaning)	*750*
Helium	*6,000*
Hydrogen	*1,500*
Nitrogen	*500,000*
Oxygen	*50,000*
Note: PVC- polyvinyl chloride. Source: LANL 1995b:4; LANL 1996e:1.	

Table A.3.2.2-7.-- Los Alamos National Laboratory Secondary and Case Fabrication Surge Operation Annual Emissions

Pollutant	Quantity (t)
Carbon monoxide	4.5
Lead	0.1
Nitrogen dioxide	117
Particulate matter	0.3
Sulfur dioxide	48
Volatile organic compounds	0.6
Radiological Isotope	*Estimated Release*
Uranium 235 (microcuries)	486
Uranium 238 (microcuries)	1776
LANL 1995b:4.	

Table A.3.2.2-8.-- Los Alamos National Laboratory Secondary and Case Fabrication Surge Operation Workers

Labor Category	Number of Employees	Employees at Risk of Radiological Exposure
Office and clerical	26	0
Officials and managers	34	4
Professionals	37	13
Service workers	244	61
Technicians	182	73
Total Employees	523 21	151

Nearly all of the personnel performing operations in the secondary fabrication facilities would be dosimeter-badged. As shown in table A.3.2.2-8, it is estimated that approximately 151 workers would be at risk of radiological exposure. In addition, a small fraction of badged visitors may nonroutinely enter radiological areas.

Waste Management. Wastes generated during secondary and case fabrication operations include radioactive, mixed, hazardous, and nonhazardous byproducts. Secondary and case fabrication operations would not generate any high-level or TRU wastes. Low-level radioactive waste would consist primarily of depleted uranium oxide chips, contaminated scrap metal, and filter media. Mixed and hazardous wastes would consist of ash, sludges, filters, rags, and wipes. Liquid radioactive and inorganic chemical wastes that meet the LANL waste acceptance criteria are sent either by truck or industrial drain to be processed at TA-50, Building 1. Mixed wastes are currently stored at TA-54; liquids in Area L and solids in Area G. Hazardous and organic chemical (RCRA) wastes are packaged and shipped to TA-54, Area G, for interim storage and subsequently shipped offsite. Nonhazardous solid waste is collected in dumpsters and taken to the landfill operated by Los Alamos County. Sanitary liquids are disposed of by either sanitary drain or permitted outfall. Sanitary process and support liquids are sent by drain to the sanitary wastewater treatment plant, TA-46, and treated similarly to municipal sewage. Table A.3.2.2-9 provides an estimate of the annual quantities of these waste categories for Secondary and Case Fabrication Facility surge operation.

Table A.3.2.2-9.-- Los Alamos National Laboratory Secondary and Case Fabrication Waste Volumes

Category	Annual Average Volume Generated from Construction (m^3)	Annual Volume Generated from Surge Operations (m^3)	Annual Volume Effluent from Surge Operations (m^3)
Low-Level			
Liquid	None	192	None
Solid	134	690	349 22

Mixed Low-Level			
Liquid	None	30	30
Solid	10	108	108
Hazardous			
Liquid	None	60	60
Solid	37	216	216
Nonhazardous (Sanitary)			
Liquid	890	20,240	20,370
Solid	120	1,160	639 23
Nonhazardous (Other)			
Liquid	Included in sanitary	None	None
Solid	10 24	3,000	3,000

A.3.2.3 Relocate to Lawrence Livermore National Laboratory

The LLNL secondary and case fabrication facilities would be housed within existing buildings at the Livermore Site (figure A.3.2.3-1). All of the structures required to house the secondary and case fabrication functions are in place; finalizing the capability would require installing some new equipment, moving existing equipment to other locations, and modifying some facilities to meet production requirements. A new structure, a 167-m2 (1800-ft2) steel framed, Butler-type building would be required to provide covered space within the Superblock protected area in which to house the enriched uranium inventory. At the Livermore Site, the existing security system for the fenced Superblock could be used with minor modifications to include Building 239, the radiographic facility for enriched uranium fabrication, assembly, disassembly, storage, and surveillance operations.

Manufacturing and assembly of the canned secondary assemblies would take place in the buildings indicated on the Livermore Site plan, figure A.3.2.3-2. The overall site occupies approximately 332 ha (821 acres) and is surrounded by security fencing. The individual facilities to be used for secondary and case fabrication are within protected areas, limited areas, or exclusion areas as required for security and safeguards. Support facilities are located both inside and outside the security areas but inside the overall site perimeter fence, which is controlled at the entrances to the perimeter fenced area. The required facilities comprise approximately 19,500 m2 (210,000 ft2) and cover approximately 2 ha (5 acres). The Livermore Site has sufficient yard area and warehousing space to accommodate required laydown areas for receipt and staging of equipment and construction materials. In addition, parking for construction workers is available onsite.

Facility Description. Uranium parts are fabricated within a high-security, fenced area of the Livermore Site Superblock. Building 332 would house casting, machining, chemical recovery, destructive testing, nondestructive testing, dimensional inspection, storage, and A/D/surveillance operations. LLNL would use Building 334 as an additional site for A/D/surveillance operations and for metalworking of uranium parts.

The uranium processing facility is divided into three heating ventilation and air conditioning zones for radioactive contamination confinement. Zone 1 comprises areas where radioactive materials are

handled and processed and includes enriched uranium receiving, processing, and storage areas. Zone 2 consists of areas where there is normally no radioactive contamination, but where there is the possibility of contamination. This zone includes the rooms containing glove boxes, process operating areas, and service corridors surrounding Zone 1 areas. Building 332 is a reinforced-concrete structure meeting the requirements of DOE 430.1, Life-Cycle Asset Management. The existing fire protection; radiation monitoring; heating, ventilation, and air conditioning; and emergency power facilities in Building 332 would be used. Building 239 would be used for radiography. Other buildings used in enriched uranium operations would include Building 177 for mass spectroscopy and Buildings 222, 235, and 251. These buildings are existing facilities that are adequate for this mission, and only minor modifications and upgrades would be needed.

As in the uranium parts manufacture, Building 239 is used for radiography, Building 177 for mass spectroscopy, and Buildings 222 and 251 for chemical laboratory analysis. The existing facilities in Building 235 are used for chemical laboratory analysis and nondestructive testing. Additional non-destructive testing functions take place in Building 327. Building 322 is used for some uranium part plating operations. The existing facilities in Buildings 322 and 327 are adequate for this mission. All of these facilities have been reviewed and approved for adequacy of building construction in accordance with applicable design codes and standards for the planned mission to be performed.

The special materials fabrication operations are performed in Buildings 231 and 241. Mass spectroscopy will be done in the existing facilities in Building 177, and chemical laboratory analysis in Buildings 222 and 235. Dimensional inspection is done in Building 321. Special materials would be fabricated in existing facilities in Building 231, with finishing operations to take place in Building 241. Again, all of these facilities have been reviewed and, with the exception of Building 241, approved for adequacy of building construction in accordance with applicable design codes and standards for the planned mission to be performed. Building 241 would require some minor, additional seismic retrofits before operations could commence.

The nonnuclear component fabrication capabilities would be housed in the extended Building 321 area complex at the Livermore Site. This includes the major Buildings 321 (with Wings A, B, C), 327, 329, and 322. Mechanical specimen testing would be performed in Building 231.

Table A.3.2.3-1 summarizes key facility data for the buildings and support structure to be utilized in secondary and case fabrication. While table A.3.2.3-1 summarizes all the facilities that are proposed for the canned secondary assemblies mission at LLNL, many of the facilities are used only for sample tests and are existing facilities that would be used as is and shared with other LLNL programs. Buildings 177, 222, 235, 251, 322, 327, and 329 fit into this category. The remaining facilities are discussed because they are the main processing facilities for the canned secondary assemblies mission.

Table A.3.2.3-1.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Facility Data

Building Name	Footprint (m2)	Number of Levels	Special Materials	Construction Type
B-175	734	1	None	Reinforced concrete

B-177	28	1	SNM	Steel frame
B-222	113	1	SNM	Steel frame
B-231	1,661	1	None	Steel frame
B-235	140	2	SNM	Steel frame
B-239, Radiography	136	2 + basement	SNM	Reinforced concrete
B-241	620	1	None	Steel frame
B-251	19	1	SNM	Steel frame
B-321	13,945	2	None	Steel frame
B-322	149	1	None	Steel frame
B-327	143	1	None	Steel frame
B-329	484	1	None	Steel frame
B-332	738	2	SNM	Reinforced concrete
B-334	438	3	SNM	Reinforced concrete
New, Butler storage building	167	1	SNM	Steel frame
SNM - special nuclear materials. **LLNL 1995e.**				

Construction. Modification to the Livermore Site facilities, as discussed above, to perform the secondary and case fabrication mission would require approximately 3 years based on a fiscal year 1998 start date, with the first production unit scheduled for the beginning of 2004. To meet this milestone, facilities would have to be in place several years before that date to provide for certification of equipment and processes and for training and certification of personnel. It is anticipated that facilities would be required to be in place for this activity no later than 2001.

The materials and resources consumed during the modification phase are provided in table A.3.2.3-2. Information is based on a 3-year construction schedule.

Table A.3.2.3-2.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Construction Materials/Resources Requirements

Material/ Resource	Total Consumption	Peak Demand
Concrete (m3)	612	
Electricity	3,500 MWh	400 kW 25
Gasoline, diesel fuel, and lube oil (L)	908,000	

Industrial gases 26 (m3)	142	
Steel (t)	73	
Water (L)	8,710,000	

Estimated emissions generated during modification activities for the secondary and case fabrication mission at LLNL are provided in table A.3.2.3-3. The principal sources of airborne emissions during facility modification would be fugitive dust, construction debris, and exhaust from construction equipment and vehicles. The peak year is defined as the year when modification activities would be the highest and equipment is anticipated to be arriving for installation.

Table A.3.2.3-3.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Construction Emissions

Pollutant	**Quantity (t)**
Carbon monoxide	635
Oxides of nitrogen	63.5
Particulate matter	544
Sulfur dioxide	5.44
Volatile organic compound	6.53
LLNL 1995e.	

Employment needs during the modification period are presented in table A.3.2.3-4. The modification activities would include some site work on the secondary fence enclosure of Building 239; seismic upgrades to Buildings 231 and 242; upgrades to building utilities such as electrical distribution systems, heating, ventilation and air conditioning, and security systems; and installation and checkout of equipment.

Table A.3.2.3-4.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Construction Workers

Employees	**Year 1**	**Year 2**	**Year 3**	**Total**
Construction management and support staff	15	15	10	40
Craftworkers	115	115	60	290
Total Employment	130	130	70	330
LLNL 1995e.				

During modification activities, some support personnel and crafts would be at risk of radiological exposure. Approximately 20 personnel involved in decontamination of the 5 rooms in Building 332 would be at risk during the first year of construction. However, since the building is a certified plutonium handling facility, all construction personnel working in this building during the modification phase would be at some risk of radiological exposure.

Operations. The secondary and case fabrication processes would require consumable materials and resources to maintain facility operations. Annual utility consumption for surge operations secondary and case fabrication at the Livermore Site is presented in table A.3.2.3-5.

Table A.3.2.3-5.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 27
Electricity	15,000 MWh	2 MWe
Liquid fuel (L)	85,200	
Natural gas 28 (m3)	566,000	
Raw water (L)	194,000,000	

Table A.3.2.3-6 lists the estimated annual chemicals consumed during surge operation of the secondary and case fabrication mission at LLNL.

Table A.3.2.3-6.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Mission Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Solid Chemicals	
Aluminum trihydride	875
Barium nitrate	4
Borax	4
Calcium hydroxide	8,730
Calcium nitrate	45
Calcium oxide	45
Curing agent	1
Diatomaceous earth	730
Epoxy resin	3
Erbium oxide	25
Ferric sulfate	2,200

Graphite	590
Lithium carbonate	350
Magnesium sulfate	30
Methylene diphenyl diisocyanate	30
Nickel compounds	25
Polycure	25
Potassium carbonate	875
PVC plastisol	450
Silicon carbide	15
Sodium bicarbonate	25
Sodium carbonate	135
Sodium molybdate dihydrate	1
Sodium nitrate	440
Sodium potassium	1
Trisodium phosphate	75
Tungsten carbide	0.3
Yttria	45
Zirconium oxide	55
Liquid Chemicals	
Acetic acid	4
Acetone	2
Acetonitrile	45
Anisol	60
Corrosion inhibitor	240
Diamond paste	0.3
Diesel fuel	21,850
Ethanol	300
Gasoline	32,000
Hydraulic oil	875
Hydrogen peroxide	220
M-pyrol	15
Methanol	730
Micro/oakite detergent	3
Mineral oil	440
Mold release	2
Nitric acid	300
Nitrogen tetroxide	45

Oxalic acid	0.1
Petroleum oils (lubricants)	440
Potassium chloride	4
Propylene glycol	45
Pump oil	1
PVC primer	1
Solvent 140	220
Toluene 2,4-diisocyanate	30
1,1,1-Trichloroethane	235
Gaseous Chemicals	
Ammonia, anhydrous	*2*
Argon	*407,300*
Carbon dioxide	*8,750*
Chlorine	*25*
Freon or equal (cleaning)	*220*
Helium	*1,750*
Hydrogen	*440*
Nitrogen	*1,450,000*
Oxygen	*14,550*
Note: PVC- polyvinyl chloride. **LLNL 1995e; LLNL 1995i:3.**	

The estimated annual emissions from surge operation of the Secondary and Case Fabrication Facility are based on historical emissions and amounts of materials to be processed and are shown in table A.3.2.3-7.

Table A.3.2.3-7.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Surge Operation
Annual Emissions

Pollutant	Quantity (t)
Carbon dioxide	3,100
Carbon monoxide	1.0
Chloride	1.6
Chlorine	0.05
Methyl alcohol	4.5

Nitric acid	2.3
Nitrogen dioxide	1.9
Ozone	0.03
Particulate matter	0.1
Pressing lubricant	0.1
Sulfur dioxide	0.02
Sulfuric acid	0.6
Total suspended particulates	3.2
Volatile organic compounds	0
Water vapor	1,040
Radiological Isotope	Estimated Release
Uranium-235 (microcuries)	135
Uranium-238 (microcuries)	480
LLNL 1995e; LLNL 1995i:3.	

Employment. The additional employment needs in support of secondary fabrication surge activities at LLNL are summarized in table A.3.2.3-8.

Approximately 250 (33 percent) badged employees would work inside radiological areas and are considered to be at risk for radiological exposure. In addition, a small fraction of badged visitors may nonroutinely enter radiological areas. Table A.3.2.3-8 provides a breakdown of those employees who may be at risk of radiological exposure.

Table A.3.2.3-8.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Surge Operation Workers

Labor Category	Number of Employees	Employees at Risk of Radiological Exposure
Office and clerical	120	0
Officials and managers	45	10
Operatives	330	150
Professionals	120	50
Technicians	145	40
Total Employees	760 29	250

Waste Management. Radioactive wastes generated from construction activities would be from the five rooms in Building 332 which must be decontaminated before the installation of new equipment. Included in this waste is some ducting, flooring, equipment that would need to be disposed of, and building partitioning materials. Hazardous waste would consist primarily of lubricants and coolants

that would be recycled or disposed of in accordance with RCRA guidelines. Nonhazardous solids include construction debris, metal, containers, and packaging materials. Liquid nonhazardous wastes would be treated locally and discharged to the sanitary sewer or hauled to an offsite facility for treatment and disposal. Wastes generated during replacement secondary fabrication operations include radioactive, mixed, hazardous, and nonhazardous byproducts. Table A.3.2.3-9 provides an estimate of the quantities of these waste categories effluent volumes as a result of secondary fabrication construction and surge operations. Secondary and case fabrication operations would not generate any spent nuclear fuel, HLW, or TRU wastes.

LLW generated from fabrication activities includes protective clothing, abrasive materials, cutting tools, filters, small equipment, and mop water contaminated with uranium. This waste would be treated by sorting, separation, concentration, and size reduction processes. Processed LLW would be surveyed and shipped to an offsite facility for land disposal.

Mixed wastes would consist of analytical solutions, wipes and rags with acetronitrile and acetone, and organic wastes contaminated with uranium. These wastes would be packaged and shipped to a DOE waste management facility for temporary storage pending treatment and disposal.

Hazardous wastes would include analytical solutions, rags with acetonitrile and acetone, coolants, hydraulic fluid, curing agents, epoxy resins, and plastics. These wastes would be managed and shipped to a commercial waste facility for treatment and disposal.

Nonhazardous (sanitary) wastes would consist of such solid items as office waste, paper, spent tools, and scrap materials. These materials would be hauled to an offsite sanitary landfill for disposal. Sanitary liquids would include sewage waste, uncontaminated process fluids, and mop water. These wastes would be discharged to the local municipal sewage system.

Table A.3.2.3-9.-- Lawrence Livermore National Laboratory Secondary and Case Fabrication Waste Volumes

Category	**Annual Average Volume Generated from Construction (m3)**	**Annual Volume Generated from Surge Operations (m 3)**	**Annual Volume Effluent from Surge Operations (m 3)**
Low-Level			
Liquid	None	105	None
Solid	5	370	304
Mixed Low-Level			
Liquid	None	550	550
Solid	None	12	12
Hazardous			
Liquid	11	540	540
Solid	41	18	18

Nonhazardous (Sanitary)			
Liquid	5,050	102,000	102,000
Solid	2,820	4,320	4,320
Nonhazardous (Other)			
Liquid	Included in sanitary	Included in sanitary	Included in sanitary
Solid	255	3,200 30	None

Nonhazardous (other) wastes would be collected and examined before being reclaimed for other recycled use or release to the environment. Examples of this type of waste are paper, glass, and recyclable metals.

1

Building construction key:

Single story building with: A-1 wood frame, A-2 masonry bearing walls with wood roof framing, A-3 masonry bearing walls with structural steel roof stem, A-4 masonry bearing walls with precast concrete roof system, and A-5 prefabricated metal building with metal wall panels.

Multistory building with: B-1 reinforced concrete structure with masonry walls, B-2 reinforced concrete and structural steel with masonry walls, B-3 structural steel skeleton with masonry walls, B-4 structural steel skeleton with cement-asbestos wall panels, and B-5 structural steel skeleton with metal wall panels.

2
Not all of Building 9212 is within the DP footprint.

OR MMES 1996j; ORR 1995a:4.

3
Peak demand is the maximum rate expected.

4
Cubic meters measured at standard temperature and pressure.

OR MMES 1996j; ORR 1995a:3; ORR 1995a:4 .

5

Full-time equivalent.

Source: OR MMES 1996j; ORR 1995a:3; ORR 1995a:4.

6

Peak demand is the maximum rate expected during any hour.

7

Cubic meters measured at standard temperature and pressure.

OR MMES 1996j; ORR 1995a:3; ORR 1995a:4.

8

Includes 10 m^3 of classified waste, 40 drums depleted uranium ash from chip oxidation (one 55 gal drum = 0.2 m^3), and 1,100 m^3 of unclassified waste.

9

Assumes 100:1 wastewater to sludge ratio for the treatment of liquid LLW followed by 2:1 for solidification. Assumes 2/3 of LLW is compactible by a factor of 4:1. LLW in drums is not compactible.

10

Includes 2 m^3 of classified waste and 90 m^3 of unclassified waste.

11

Y-12 only pretreats industrial wastewater prior to discharge to the city of Oak Ridge Municipal Sanitary Sewer System.

12

Includes 3.4 m^3 of concrete and 4.1 t of steel.

13

Includes 5 m^3 of classified waste.

14

Assumes 2/3 of solid is compactible by a factor of 4:1.

15

Recyclable wastes.

OR MMES 1996j; ORR 1995a:4.

16

Peak demand is the maximum rate expected.

17

Cubic meters measured at standard temperature and pressure.

LANL 1995b:4; LANL 1995e.

18

The total of all criteria pollutants is estimated to be less than 1 metric ton.

LANL 1995b:4; LANL 1995e.

19

Peak demand is the maximum rate expected during any hour.

20

Cubic meters measured at standard temperature and pressure.

Source: LANL 1995b:4; LANL 1995e.

21

Total surge employment. Increment to current employment would be 321.

Source: LANL 1995b:4.

22

Assumes 2/3 of the solid LLW is compactible by a factor of 4:1. The wastewater to sludge ratio for liquid LLW treatment is 100:1, followed by 2:1 solidification ratio.

23

Assumes 2/3 of the solid waste is compactible by a factor of 4:1. The wastewater to sludge ratio for liquid sanitary treatment is 350:1.

24

Includes 300 t of recyclable steel and 18 t of recyclable copper.

LANL 1995b:4; LANL 1995e.

25

Peak demand is the maximum rate expected.

26

Cubic meters measured at standard temperature and pressure.

LLNL 1995e.

27

Peak demand is the maximum rate expected during any hour.

28

Cubic meters measured at standard temperature and pressure.

LLNL 1995e; LLNL 1995i:3; LLNL 1996i:2.

29

Total surge employment. Increase to current employment would be 290.

Source: LLNL 1995e.

30

Recyclable wastes.

LLNL 1995e; LLNL 1995i:3.

A.3.3 Pit Fabrication and Intrusive Modification Pit Reuse

A nuclear weapon has a primary assembly that contains a pit subassembly surrounded by HE. The nuclear material in a pit, typically plutonium, is encased in a shell of nonnuclear metal such as stainless steel. Fabricating and processing the plutonium, and assembling the pit components, is the task that LANL or SRS would perform under this option. For both pit fabrication and intrusive modification, plutonium would be supplied from existing pits that have been retrieved and disassembled.

In order to fabricate replacement pits, the plutonium from disassembled pits first would be processed (dissolution, purification, reduction to metal). Processing also provides means to convert manufacturing scrap and residue (oxides) to metal usable in fabrication operations. Plutonium fabrication involves foundry and mechanical operations, including casting, shaping, machining, bonding, assembly, inspection, and packaging. Intrusive modification would disassemble an existing pit, keeping the plutonium component intact. Modification would be made external to the plutonium and a new outer shell applied. These operations are similar to the assembly and inspection functions for replacement pit fabrication.

Waste management and analytical chemistry activities would also be required for all of the plutonium operations. The block flow diagram of pit fabrication is shown in figure A.3.3-1. In addition to the actual operational aspects of plutonium fabrication, several other important processing functions are required. For example, the plutonium metal is under strict accountability for security and safeguard reasons. These security and safeguard requirements influence some of the facility and personnel needs at LANL or SRS to accomplish this task. Also, the nuclear weapons design/production process includes pit certification and qualification, which influences the facility and personnel needs.

Process Descriptions

Pit Fabrication. Pit fabrication involves preparation of plutonium components (casting, machining, inspecting, and cleaning), assembly of the pits (assembling the plutonium and nonnuclear components then hermetically sealing the pit with a weld), and post-assembly processing of the pits to the stockpile configuration.

Plutonium Processing. Plutonium processing consists of disassembly and metal preparation (obtaining stockpile pits, extracting the plutonium, and purifying the plutonium metal to a reusable form) and chloride and nitrate processing (recovering plutonium from residues generated by the manufacturing processes by using either the chloride or nitrate plutonium recovery processes).

Waste Management. Waste management includes taking waste generated by the manufacturing processes and placing it in a form suitable for final disposal. Wastes to be managed would consist of liquid or solid, TRU or LLW, and may include hazardous or mixed waste.

Analytical Chemistry. Analytical chemistry consists of all analytical measurements required to support pit manufacturing. These chemical evaluations include metal samples from the metal preparation area, plutonium components, samples from the plutonium processing unit processes, all samples that support the disposition of waste, and samples required to maintain physical and administrative control of special nuclear material. Samples supporting waste disposition must meet standards set by the RCRA and EPA.

Storage. Storage would include interim storage of retired stockpile pits awaiting disassembly and new pits awaiting shipment to the nuclear weapons assembly facility, as well as long-term storage of plutonium and oxide.

A.3.3.1 Reestablish at Los Alamos National Laboratory

Currently, LANL processes plutonium for RD&T and stockpile support purposes on site. Reconfiguring and upgrading these existing plutonium laboratory facilities in TA-55 is the proposed approach to provide a Pit Fabrication and Intrusive Modification Pit Reuse Facility. Other nuclear facilities to be used for this effort are located in TAs -3, -8, -35, -50, and -54 (as shown in figure A.3.3.1-1). Within TA-55 is the Plutonium Facility (PF-4), which includes a Pit Fabrication Facility in the 300 Area and facilities for plutonium and waste processing in the 400 Area (as shown in figure A.3.3.1-2). TA-3 is a key area; it contains the Sigma Complex, Chemistry and Metallurgy Research building, and main machine shop. Another key area, TA-35, has the physical vapor deposition coating building. Nondestructive evaluation is carried out in a facility in TA-8. Radioactive waste is treated in TA-50 (liquid) and TA-54 (solid). The facilities that are currently used by stockpile surveillance activities would be shared with the pit fabrication group until dedicated facilities become available. The current stockpile Pit Rebuild Program at LANL would be absorbed within the pit fabrication effort as the activity is the same; only the number of pits produced would change. The number of pits fabricated annually is projected to be from 20 to 50 (depending on equipment availability), but could be about 80 if surge mode (multiple shifts, personnel overtime, and use of equipment to full capacity) were exercised. The key building descriptions for the Pit Fabrication and Intrusive Modification Pit Reuse Facility at LANL are shown in table A.3.3.1-1.

Table A.3.3.1-1.-- Los Alamos National Laboratory Pit Fabrication Facility Data

Building	Footprint (m2)	Number of Levels	Special Nuclear Material Permitted	Construction
TA-55, PF-4 Plutonium Facility	14,000	2	Yes	Concrete post and beam with concrete masonry unit in-fill walls
TA-55, PF-4 Nuclear Material Storage Facility			Yes	Concrete post and beam with concrete masonry unit in-fill walls
TA-3, SM-29 Chemistry and Metallurgy Research Building	51,100	3	Yes	Concrete post and beam with concrete masonry unit in-fill walls
TA-3, SM-141 Nonnuclear Component Fabrication	1,860	1	No	Concrete post and beam with concrete masonry unit in-fill walls

TA-3, SM-66 Sigma Building	15,800	1	No	Concrete post and beam with concrete masonry unit in-fill walls
TA-3, SM-39 Nonnuclear Shops Building	7,660	1	No	Concrete post and beam with concrete masonry unit in-fill walls
LANL 1995g.				

The pit fabrication process flow at LANL would begin with old pits from the weapons retirement process being routed to a disassembly area. The plutonium metal from disassembled pits would be purified before transfer to the fabrication area. Residues generated in the disassembly/metal purification areas are primarily chloride salts, crucibles, and chloride-contaminated scrap. The bulk of the residual plutonium would be purified and converted to plutonium metal in the chloride recovery area. Recovered plutonium metal would also be sent to the fabrication area. During fabrication, plutonium metal would be cast into the desired near-net-shape and machined to the final shape with desired tolerances. The finished components would then be assembled with other nonplutonium materials into the new weapon pit component.These new pits would then be sent to the weapon assembly facility. During the casting and machining operations, a number of residues would be generated that require processing and would subsequently undergo nitrate recovery operations. In nitrate recovery, the residues are purified and converted to oxide for return to the reduction operations. Solid and liquid wastes from processing areas would be routed to waste management facilities for processing into a disposable waste form. Analytical laboratories provide chemical analyses of plutonium metal, oxides, solutions, and wastes.

Tables A.3.3.1-2 and A.3.3.1-3 summarize resource requirements for facility modification and operation of the Pit Fabrication Facility. Table A.3.3.1-4 summarizes the bulk quantities of chemicals that would be used in the pit fabrication processes. These quantities assume the surge mode of 80 new pits per year.

Table A.3.3.1-2.-- Los Alamos National Laboratory Pit Fabrication Construction Requirements

Requirement	Consumption
Material/Resource	
Electrical energy (MWh)	Minimal
Peak electrical demand (MWe)	Minimal
Concrete (m ^{3})	Minimal
Steel (t)	Minimal
Gasoline, diesel, and lube oil (L)	Minimal
Industrial gases 1 (m ^{3})	Minimal
Water (L)	Minimal

Land (ha)	None
Employment	
Total employment (worker years)	216
Peak employment (workers)	138
Construction period (years)	3

Table A.3.3.1-3.-- Los Alamos National Laboratory Pit Fabrication Surge Operation Annual Requirements

Requirement	Consumption
Resource	
Electrical energy (MWh)	5,480
Peak electrical demand (MWe)	0.7
Liquid fuel 2 (L)	None
Natural gas 3 (m *3*)	30,900
Water (L)	30,200,000
Plant Footprint (ha)	NA 4
Employment* 5 *(Workers)	628

Table A.3.3.1-4.-- Los Alamos National Laboratory Pit Fabrication Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Solid Chemicals	
Aluminum nitrate	2,041

Aluminum sulfate	2,041
Bentonite	1,021
Calcium fluoride	62
Calcium carbonate	1,021
Calcium chloride	227
Diatomaceous earth	45,360
Ferrous ammonium sulfate	5
Hydroxylamine hydrochloride	23
Iron, magnesium, calcium	11
Magnesium hydroxide	340
Oxalic acid	748
Portland cement	45,360
Resins	23
Sodium carbonate	57
Sodium hydroxide	28
Sodium nitrite	96
Sodium sulfite	794
Urea	20
Liquid Chemicals	
Carbon dioxide	17
Film developer, fixer, toner	1,043
Hydrochloric acid	1,497
Hydrofluoric acid	340
Hydrogen peroxide	1,996
Hydroxylamine nitrate	658
Nitric acid 6	3,420
Nitrogen	57
Potassium hydroxide	17,010
Sodium hydroxide	2,268
Gaseous Chemicals	
Argon	170,100
Chlorine	340
Helium	23
Hydrogen chloride	11
Nitrogen	1,360,800
Oxygen	1,814

Waste Management. The liquid and solid hazardous and nonhazardous wastes generated during

building modification would include concrete and steel construction waste materials. The steel waste would be recycled as scrap material before completing construction. The remaining nonhazardous wastes generated during construction would be disposed of by the construction contractor. Wood, paper, and metal wastes would be shipped offsite to a commercial contractor for recycling. Hazardous wastes generated during construction would consist of such materials as waste adhesives, oils, cleaning fluids, solvents, and coatings. Hazardous waste would be packaged in DOT-approved containers and shipped offsite to commercial RCRA-permitted treatment, storage, and disposal facilities. Small amounts of radioactive waste would be generated during construction.

The project design considers and incorporates waste minimization and pollution prevention. Segregation of activities that generate radioactive and hazardous wastes would be employed, where possible, to avoid the generation of mixed wastes. Where applicable, treatment to separate radioactive and nonradioactive components would be performed to reduce the volume of mixed wastes and to provide for cost-effective disposal for recycling. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials which contribute to the generation of hazardous or mixed waste. Production processes would be configured with minimization of waste production given high priority. Material from the waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. Future D&D considerations have also been incorporated into the design.

Table A.3.3.1-5 presents the estimated annual waste volumes from the Pit Fabrication and Reuse Facility during modification activities and Solid and liquid waste streams are routed to the waste management system. Figures A.3.3.1-3 through A.3.3.1-5 depict the waste management system. Solid wastes would be characterized and segregated into TRU, LLW, hazardous, and mixed wastes, then treated to a form suitable for disposal or storage within the facility. [figure A.3.3.1-4] Liquid wastes would be treated onsite to reduce hazardous/toxic and radioactive elements before discharge or transport. All fire-sprinkler water discharged in process areas is contained and treated as process wastewater, when required.

Spent Nuclear Fuel. The Pit Fabrication and Reuse Facility would not generate any spent nuclear fuel.

Transuranic Waste. TRU waste would be generated from operation of the Pit Fabrication and Reuse Facility and would consist of glass, leaded gloves, plastics, equipment, metals, and heater elements. These wastes would be shipped to WIPP for disposal.

Low-Level Waste. LLW would be generated from operation of the Pit Fabrication and Reuse Facility and would consist primarily of plastics, metal, cement sludge, and vacuum filters. Liquid LLW would be sent either by truck or industrial drain to TA-50 for processing. The liquid LLW treatment facilities include a chemical treatment and ion-exchange plant at the radioactive liquid waste treatment facility and a chemical treatment plant. The waste would be processed, with radioactive constituents removed, in accordance with the NPDES permit. Low-level solids would be disposed of in 0.1-m *3* (2-ft *3*) boxes at TA-54, Area

Mixed Low-Level Waste. No mixed LLW is expected to be generated. If any were to be generated, it would be managed in accordance with LANL Site Treatment Plan.

Hazardous Waste. Liquid hazardous wastes would be generated from solvents from cleaning operations and residue from painting and bonding operations. The cleaning solvents selected would be from a list of nonhalogenated solvents. Hazardous chemical wastes would be treated at

commercial offsite RCRA-permitted facilities until completion of the Hazardous Waste Treatment Facility. The remaining liquid waste would be treated by gravity settling and discharged through an NPDES-permitted outfall. No solid hazardous wastes are expected to be generated.

Table A.3.3.1-5.-- Los Alamos National Laboratory Pit Fabrication Waste Volumes (80 Pits Per Year)

Waste Category	Annual Volume Generated from Construction (m3)	Annual Volume Generated from Surge Operations (m3)	Annual Volume Effluent from Surge Operations (m3)
Transuranic			
Liquid	None	5	None
Solid	6 7	43	60
Mixed Transuranic			
Liquid	None	None	None
Solid	None	2	2
Low-Level			
Liquid	None	15	None
Solid	12 8	386	393
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	0.06	2	2
Solid	51	None	None
Nonhazardous (Sanitary)			
Liquid	None	12,300 9	12,300
Solid	None	552 10	552
Nonhazardous (Other)			
Liquid	None	Included in sanitary	Included in sanitary
Solid	26 11	Included in sanitary	Included in sanitary

Nonhazardous (Sanitary) Waste. Sewage wastewater and process wastewater would be sent by drain to the sanitary wastewater treatment plant (TA-46). Treated effluents would be disposed of by either sanitary drains or through permitted NPDES outfalls. Cooling tower blowdown and overflow would be discharged through outfalls permitted by the State of New Mexico. Sludge and other solid sanitary

waste would be disposed onsite at the Sandia Canyon site (TA-61).

Nonhazardous (Other) Waste. Nonhazardous (other) wastes would be disposed of in a permitted landfill or discharged through permitted NPDES outfalls.

A.3.3.2 Reestablish at Savannah River Site

The Pit Fabrication and Intrusive Modification Pit Reuse Facility at SRS would use existing hardened facilities but with all new equipment. The facilities available for this mission include the Separations Areas, F-Area, and H-Area (figure A.3.3.2-1). All aspects of pit component fabrication would be included: pit fabrication, plutonium processing, and waste management. Pit fabrication could be located in the 232-H Building or the F-Canyon. Plutonium processing would be in the F-Canyon facilities. The intrasite transfers of plutonium between areas would be in the form of metal ingots, buttons, and scrap as well as small quantities of oxide. Any liquid transfers would be performed through vessels and piping with secondary and tertiary containment systems. The nonnuclear portions of the pit component would be fabricated and manufactured elsewhere, then shipped to SRS as finished parts. Potentially tritium contaminated pits would not be handled at SRS; rather, they would be sent to LANL. The total number of pits fabricated annually is projected to be in the range of 20 (normal operations), 50 (design capacity, normal operations), or 120 in the surge mode (multiple shifts, personnel overtime, and use of equipment to full capacity).

Currently, Building 232-H is being used for tritium processing and handling operations. These missions are being moved to the Replacement Tritium Facility. The building would be refurbished, leaving adequate space for pit fabrication. The space would be in a hardened facility and essentially free of tritium contamination. Those areas with high levels of tritium contamination would be isolated from the pit fabrication areas. Adjacent nonhardened areas would be used for receiving and handling nonnuclear components or direct service support to the pit fabrication process. Figure A.3.3.2-2 shows the H-Area proposed pit fabrication facilities.

The F-Canyon facilities have adequate noncontaminated hardened areas that can house the plutonium processing functions. The canyon includes the new, never operated, plutonium storage facility, the new special recovery facility, and a vacant production space that was previously decontaminated. Only minor modifications would be required to the glove boxes and equipment in the two new facilities. The plutonium processing operations would also handle the receiving, handling, and disposition of surplus plutonium. The existing waste management systems and laboratory facilities can be used to support the process.

The infrastructure at SRS includes liquid and solid waste management; analytical laboratories; security systems; ES&H systems; training facilities; and research, development, and demonstration facilities. The waste management operations are collocated with the plutonium processing facilities. This allows for the expedient transfer of byproducts from the plutonium purification process to the liquid waste stream, which is subsequently vitrified with high-level waste in the existing Defense Waste Processing Facility.

SRS has the existing support infrastructure to handle plutonium processing. Feedstock for the pit fabrication process would be plutonium metal. Plutonium would be received from offsite via safe secure trailer, unloaded into a staging area, then moved to the plutonium storage facility until needed. Once the retired pit is determined not to be contaminated, it would enter the disassembly process where the nonnuclear and other nuclear components would be removed from the plutonium. The

plutonium would be collected and purified while the nonnuclear parts would be declassified and sent to solid waste treatment, and the other nuclear parts would be cleaned and sent to staging to await offsite transport. The purified plutonium would be converted back to metal and would enter the pit fabrication process. The listing of the major support facilities for the Pit Fabrication and Intrusive Modification Pit Reuse Facility is shown in table A.3.3.2-1.

The plutonium fabrication process is an abbreviated version used by the Rocky Flats Environmental Technology Site. Though there are several pit types, the process is basically the same. The process consists of casting parts to the near net-shape, machining the surfaces of the casting to achieve the final shape, and performing tests on the completed parts to assure suitability. After this inspection, the plutonium components are cleaned and assembled with the nonnuclear components to form a pit that is then welded together. Once the plutonium is encapsulated, it may then be safely removed from the glove box, certified, and stored or shipped offsite as needed.

Nonnuclear components used in the new pits would be received from offsite. After inspection these parts would be stored in Building 704-55H until needed for either newly fabricated or reused pits. Some nonnuclear parts require a vapor deposition coating of material be applied. Generally all of these coatings would be produced in a vacuum environment using either a thermal evaporation or plasma sputtering process. Tables A.3.3.2-2 and A.3.3.2-3 show resource requirements for facility modification and surge operation of the Pit Fabrication Facility. Table A.3.3.2-4 shows annual chemical usage for surge operation.

Table A.3.3.2-1.-- Savannah River Site Pit Fabrication Facility Data

Building	Facility Type	Footprint (m2)	Number of Levels	Construction
211-F	Supply tanks	NA	NA	Outside/metal frame
221-F	Feed preparation	4,060	6	Concrete/metal frame
292-F	Canyon exhaust fan house	1,160	1	Concrete
294-F	Sand filters	2,230	NA	Concrete
294-1F	Sand filters	3,340	NA	Concrete
703-F	Administration building	1,860	1	Metal frame

704-F	Administration building	1,130	1	Metal frame
707-F	Administration building	1,490	1	Metal frame
707-7F	Administration building	1,490	1	Metal frame
717-F	Mock-up/maintenance shops	1,170	2	Metal frame
723-F	Laundry	1,060	1	Metal frame
772-F	Laboratory	3,850	2	Concrete/metal frame
772-1F	Laboratory	280	1	Concrete/metal frame
232-H	Manufacturing	4,840	3	Concrete
232-1H	Shop and storage	1,210	1	Metal frame
235-H	Tritium facility office	780	1	Metal frame
703-H	Administration building	1,860	1	Metal frame
704-H	Administration building	1,390	1	Metal frame
704-2H	Administration building	4,670	1	Metal frame
704-55H	Administration building	1,230	1	Metal frame

707-H	Administration building	1,770	1	Metal frame
766-H	Training facility	7,620	2	Metal frame
NA - not applicable. **WSRC 1995c.**				

Table A.3.3.2-2.-- Savannah River Site Pit Fabrication Construction Requirements

Requirement	Consumption
Material/Resource	
Electrical energy (MWh)	15
Peak electrical demand (MWe)	0.37
Concrete (m ^{3})	1,600
Steel (t)	249
Gasoline, diesel, and lube oil (L)	175,000
Industrial gases (m ^{3}) 12	3,780
Water (L)	30,000,000
Land (ha)	2
Employment	

Total employment (worker years)	801
Peak employment (workers)	288
Construction period (years)	5

Table A.3.3.2-3.-- Savannah River Site Pit Fabrication Surge Operation Annual Requirements

Requirement	Consumption
Resource	
Electrical energy (MWh)	9,700
Peak electrical demand (MWe)	1.6
Liquid fuel (L)	28,400
Natural gas (m *3*) 13	None
Water (L)	46,200,000
Coal (t)	1,090
Plant Footprint (ha)	NA 14
Employment (Workers)	813

Table A.3.3.2-4.-- Savannah River Site Pit Fabrication Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)
Solid Chemicals	
Calcium carbonate	642
Calcium metal	227
Hydroxylamine nitrate	633
Magnesium oxide	383
Sodium hydroxide	4,983
Sodium nitrite	206
Water treatment chemicals	64
Liquid Chemicals	
Betz 25k series corrosion inhibitor	200
Betz Slimcide (CE-77 PE)	34
Cleaning/developing fluids	340

Hydrofluoric acid	10
Nitric acid 15	3,420
Liquid nitrogen	4,000
Polyphosphate	191
Sodium hypochlorite	96
Gaseous Chemicals	
Argon	3,924
Carbon dioxide	45,360
Hydrogen	6
Hydrogen fluoride	442
Nitrogen	2,790

Waste Management. The solid and liquid nonhazardous wastes generated during modification activities would include concrete and steel construction waste materials and sanitary wastewater. The steel waste would be recycled as scrap material before completing construction. Liquid waste which is primarily sanitary water would be treated as sanitary plant waste. Solid nonhazardous waste would consist primarily of office trash and sludge from sanitary wastewater treatment. Nonrecyclable portions of this waste would be sent to a permitted landfill after volume reduction practices such as compacting and shredding had been performed. No liquid hazardous waste would be generated other than the lubrication oils and coolants needed to maintain the construction equipment. Solid hazardous waste would consist primarily of solvent rags and empty containers of hazardous materials. Hazardous waste would be packaged in DOT approved containers and shipped offsite to commercial RCRA-permitted treatment,storage, and disposal facilities. No radioactive waste would be generated

during construction.

The Pit Fabrication Facility considers and incorporates waste minimization and pollution prevention. Segregation of activities that generate radioactive and hazardous wastes would be employed, where possible, to avoid the generation of mixed wastes. Where applicable, treatment to separate radioactive and nonradioactive components would be performed to reduce the volume of mixed wastes and provide for cost-effective disposal or recycle. To facilitate waste minimization, where possible, nonhazardous materials would be substituted for those materials which contribute to the generation of hazardous or mixed waste. Production processes would be configured with minimization of waste production given high priority. Material from the waste streams would be treated to facilitate disposal as nonhazardous wastes, where possible. Future D&D considerations have also been incorporated into the design.

Table A.3.3.2-5 presents the estimated annual waste volumes from the Pit Fabrication Facility during modification activities and operation for the base case surge. Solid and liquid waste streams would be routed to the waste management system.

Figure A.3.3.2-3 depicts the overall waste management system at SRS. Additional figures by waste category are available in appendix section H.2.2. Solid wastes would be characterized and segregated into TRU, low-level, mixed, hazardous, and nonhazardous, then treated to a form suitable for disposal or storage. Liquid wastes would be treated onsite to reduce hazardous/toxic and radioactive elements before discharge or transport. All fire sprinkler water discharged in process areas would be contained and treated as process wastewater, when required.

Spent Nuclear Fuel. The Pit Fabrication Facility would not generate any spent nuclear fuel.

High-Level Waste. The Pit Fabrication Facility would not generate any operational HLW. However, as a result of the plutonium recovery and purification processes, plutonium processing would generate a liquid TRU waste that would be managed as a high specific activity waste at SRS. As shown in figure A.3.3.2-3, one of the final waste products from the treatment of this waste is a glass log composed of comingled TRU waste from pit fabrication and legacy HLW.

Transuranic Waste. As noted above, plutonium processing would generate a liquid TRU waste as a result of the plutonium recovery and purification processes. This waste would have a high specific activity and would be managed in accordance with the SRS High-Level Waste Management Plan as outlined in appendix H.2.2. Solutions from both processes would be transferred to F-Canyon, evaporated, and the resulting evaporator bottoms neutralized with sodium hydroxide and transferred to the F-Area Tank Farm. Excess oxalic acid in the precipitation filtrates would be destroyed during filtrate evaporation. The residual sludge consisting primarily of americium and plutonium would be fed to the Defense Waste Processing Facility for conversion to a HLW form using borosilicate glass. The waste would then be immobilized by melting and poured into stainless steel cylinders which would be stored until a repository is available.

Table A.3.3.2-5.-- Savannah River Site Pit Fabrication Waste Volumes (120 Pits Per Year)

Category	Annual Average Volume Generated from Construction (m3)	Annual Volume Generated from Surge Operations (m3)	Annual Volume Effluent from Surge Operations (m3)
Transuranic			
Liquid	None	28 [16]	None
Solid	None	129 [17]	129 [17]
Mixed Transuranic			
Liquid	None	None	None
Solid	None	11	11
Low-Level			
Liquid	None	80 [18]	None
Solid	None	88 [19]	34
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	<0.01	<1	None
Solid	8 [20]	None	<0.01 [21]
Nonhazardous (Sanitary)			
Liquid	3,020	46,160	46,140 [22]
Solid	23	1,450	1,580
Nonhazardous (Other)			
Liquid	None	None	None
Solid	500 [23]	1,450 [24]	None

The solid TRU waste would consist primarily of graphite molds, crucibles, failed equipment, leaded gloves, filters, and combustible materials such as plastics and rags used during glove box operations. Approximately one-half of the volume of waste reported as TRU is considered as intermediate-level waste at SRS and would be disposed of in the intermediate-level waste vaults in E-Area. Intermediate-level waste is managed as TRU waste at SRS because it contains beta or gamma emitters that produce a dose equal to or greater than 200 mrem/hr at 5 centimeters (cm) (2 inches [in]) from an unshielded container. TRU waste destined for disposal in a Federal repository would be certified to meet the WIPP waste acceptance criteria and packaged in drums at the Pit Fabrication Facility then placed in interim storage. Disposal is planned for WIPP, once it has been determined to be a suitable repository for TRU wastes, pursuant to the requirements of 40 CFR 191 and 40 CFR 268. Noncertifiable drums would be repackaged and certified for shipment to WIPP in the future TRU waste facility.

Mixed TRU waste consisting of leaded gloves and TRU waste contaminated with organics such as solvents would be managed in accordance with the SRS site treatment plan. Current plans call for disposal at WIPP.

Low-Level Waste. Solid LLW would consist primarily of failed equipment and combustible plastics and cellulose-based products used in maintaining and cleaning the facilities. Combustible LLW may be incinerated using the consolidated incineration facility. Solid LLW would be packaged in B-25 (90 ft 3) metal boxes and transported to the LLW disposal facility for disposal in concrete vaults. Evaporator overheads from the evaporation of the high-specific liquid waste described above and other liquid LLW would be sent to the F/H-Area Effluent Treatment Facility where radionuclide contaminants are removed using filtration, ion exchange, and reverse osmosis. The decontaminated effluent would be discharged through a permitted NPDES outfall. Concentrate from the F/H-Area Effluent Treatment Facility is transferred through the H-Area Tank Farm to Z-Area for solidification and final disposal in onsite vaults in Z-Area as a cement-based waste form called saltstone.

Mixed Low-Level Waste. The Pit Fabrication Facility is not expected to generate any mixed LLW. In the event any mixed LLW is generated, it would be managed in accordance with the SRS site treatment plan.

Hazardous Waste. Liquid hazardous wastes would be generated from solvents from cleaning operations and residue from painting and bonding operations. The cleaning solvents selected would be from a list of nonhalogenated solvents. Hazardous wastes would be collected in DOT-approved containers and sent to onsite hazardous waste accumulation areas (B-, M-and N-Areas). The hazardous waste accumulation area would provide a 90-day staging capacity. Incinerable waste would be shipped to an offsite vendor for treatment and disposal. Waste that cannot be incinerated would be placed in storage until the hazardous/mixed waste disposal facility and consolidated incineration facility are operational.

Nonhazardous (Sanitary) Waste. Sewage wastewater would be treated in the new central sanitary wastewater treatment facility prior to discharge through permitted NPDES outfalls. The sludge would be disposed of in a permitted landfill. Other nonrecyclable, nonhazardous, solid sanitary, and industrial wastes would be compacted and disposed of in a permitted landfill.

A.3.4 Nonintrusive Modification Pit Reuse

Unlike the pit fabrication and intrusive modification pit reuse function, the nonintrusive modification pit reuse function does not disassemble the pit. The entire pit is received through the weapons retirement/disassembly process. The pit is then cleaned and inspected, and, if necessary, the exterior of the pit is modified. No plutonium would be exposed in the nonintrusive modification pit reuse function. Since the intrusive modification pit reuse mission described in section A.3.3.1 for LANL and section A.3.3.2 for SRS inherently includes the nonintrusive modification pit reuse capability, a full discussion of the facilities and processes for conducting nonintrusive modification pit reuse activities at LANL and SRS is not included in this section. The nonintrusive modification pit reuse mission at Pantex and NTS are described in sections A.3.4.3 and A.3.4.4.

A.3.4.1 Los Alamos National Laboratory

The facilities necessary to accomplish these functions at LANL are a subset of those used in the

intrusive modification pit reuse function and are discussed in section A.3.3.1.

A.3.4.2 Savannah River Site

The facilities necessary to accomplish these functions at SRS are a subset of those used in the intrusive modification pit reuse function and are discussed in section A.3.3.2.

A.3.4.3 Pantex Plant

Pits that are to be reused would be obtained from the weapons A/D Facility that is currently located at Pantex. Pits would be transferred from one facility to another on the same site, and all infrastructure would be shared. Since the plutonium is encapsulated and any modification is made to the outside of the pit, the entire nonintrusive modification pit reuse process can be conducted in an area that will remain free of radioactive contamination. Three classes of nonintrusive modification pit reuse are proposed at Pantex: recertification (minimum requirement for those pits still within their original design life), requalification (more extensive requirement for those pits that have exceeded their original design life), and nonintrusive modification reuse (modifications imposed upon the pit due to design changes). Pantex would have the capability to recertify 120 pits per year with an annual surge, multi-shift capacity of 200 pits. The combined capability for requalified and modified reused pits would be 150 annually, with a surge annual capacity of 250 pits; of these numbers, approximately 20 pits would be modified. Normal operation is considered to be four 10-hour work days per week, 52 weeks per year.

The facilities that would be used to support the pit recertification, requalification, and nonintrusive modification reuse mission include the weapons assembly bays in Buildings 12-64, 12-84, 12-104, and 12-104A and the current support areas in Zone 12 North along with the special nuclear material facility, Building 12-116. Four existing A/D bays in Building 12-104 would be modified to meet the nonreactor nuclear facility requirements. These four bays, along with an area for control, decontamination, and access control portals, would become the Nonintrusive Modification Pit Reuse Facility. The Nonintrusive Modification Pit Reuse Facility and special nuclear materials facility would be used to consolidate the interim storage, staging, and operations that would be necessary to support recertification, requalification, and nonintrusive modification pit reuse activities.

The Nonintrusive Modification Pit Reuse Facility would make extensive use of robotics. The first area would be used for unpacking and receiving to prepare the pit for the reuse process. As the process starts, the pit would enter the qualification bay and an automated processing line. This line would clean, inspect, and verify tolerances and performance to the specified requirements. The pit would then enter the assembly and welding bay, which includes a glove box line for any needed pit modification. After inspection, the pit would go to the purge and backfill bay to be leak tested and cleaned.

The recertification, requalification, and nonintrusive modification reuse processes would generate LLW, hazardous, industrial, and potentially mixed wastes. The operating areas would have accumulation sites and would perform the onsite characterization. The Waste Operations Group would be responsible for establishing the waste streams, scheduling the waste movement from the accumulation sites to the waste packaging areas, and disposing of the wastes. These processes are not intended to generate radioactive contamination and would not generate TRU or mixed waste under normal operations.

A.3.4.4 Nevada Test Site

NTS is an alternative site for the proposed Nonintrusive Modification Pit Reuse Facility. This facility would require a new building, but it would be adjacent and connected to the Device Assembly Facility. It would be within the secure area of the Device Assembly Facility and would be considered a nonreactor nuclear facility handling special nuclear materials. Though new construction would be required, the existing NTS infrastructure would be sufficient to support the facility. The pits to be reused in this facility would come from the weapons A/D Facility. Locating the Nonintrusive Modification Pit Reuse Facility at NTS assumes that the new weapons A/D Facility would also be at NTS. The A/D Facility mission would be performed within the Device Assembly Facility (originally designed to support assembly of test devices) and the pits would be transferred through corridors between these facilities. Since the plutonium would be encapsulated and any modification would be made to the outside of the pit, the entire process can be conducted in an area which will remain free of radioactive contamination. Three classes of pit reuse are proposed at NTS: recertification (minimum requirement for those pits still within their original design life), requalification (more extensive requirement for those pits that have exceeded their original design life), and nonintrusive modification reuse (modifications imposed upon the pit due to design changes). The total nonintrusive modification pit reuse capability at NTS for these three classes is 50 pits per year, which is based upon one full shift per day (maintenance and training included in the same shift).

The new Nonintrusive Modification Pit Reuse Facility would use the same processes as proposed for use at Pantex. The basic services required would include radiography, interim storage, gas analysis, gas preparation, and security. Radiography would be accomplished by a linear accelerator that is a shared resource with the A/D Facility. An interim storage area for 50 pits would be planned for within the 2,230 m2 (24,000 ft2) new Nonintrusive Modification Pit Reuse Facility. Both the gas analysis and preparation services would be incorporated within the facility. Gas analyses would be used to evaluate samples from accelerated aging tests, material compatibility tests, development activities, material certification tests, and production operations. Security in and around the Device Assembly Facility is sufficient (though it would be expanded) for the new facility, and the shipping and receiving functions would be handled through the Device Assembly Facility. The waste streams and utility requirements would be considered a part of the A/D process and are included with that estimate (see section A.3.1.2). The processes would include a waste management facility, waste storage facility, mixed waste storage and LLW disposal facility, sanitary wastewater treatment unit, sanitary and industrial landfill, and stormwater ponds.

1

Cubic meters at standard temperature and pressure.

LANL 1995g.

2

Used only for utility backup.

3

Cubic meters at standard temperature and pressure.

4

Within existing facilities.

5

Total full time equivalent employment. Increment from current employment would be 260.

NA - not applicable.

LANL 1995b:4; LANL 1995g.

6

Annual makeup requirement with recycling. Total first year requirement is 32,886 kgs.

LANL 1995b:4.

7

Over a 3-year construction period a total of 27 t (30 tons) of associated piping and ventilation ductwork from glove boxes would be generated. For volume conversion, 1,500 kg/m3 was assumed.

8

Over a 3-year construction period a total of 41 t (45 tons) of glove boxes and 14 t (15 tons) of associated piping and ventilation ductwork would be generated. For volume conversion, 1,500 kg/m3 was assumed.

9

Assumes 50 gal/day/person/shift, with parameters of 250 days/yr, and 260 total additional employees for three shifts.

10

Assumes 0.3 ft *3* /day/person/shift, with parameters of 250 days/yr, 3 shifts/day, and 260 total additional employees for three shifts.

11

Includes 0.15 t (0.175 tons) of steel assuming a density of 0.127 t/m3.

LANL 1995g; LANL 1996e:1.

12

Cubic meters at standard temperature and pressure.

WSRC 1995c .

13

Cubic meters at standard temperature and pressure.

14

Contained within existing facilities.

NA - not applicable.

WSRC 1995c.

15

Annual makeup requirement with recycling.

WSRC 1995c.

16

At SRS, this would be managed as high specific activity liquid waste which would be combined with HLW at the Tank Farm and then processed in accordance with the High-Level Waste Management Plan as depicted in appendix section H.2.2. The resultant waste forms include 0.61 glass logs composed of comingled TRU waste from pit fabrication and legacy HLW, and LLW saltstone. Based on aqueous alternative process for Complex 21; denitrated water=49.3 L/kg Pu metal processed and discarded filtrates=6.9 L/kg plutonium metal. Neutralized with 0.2 L of 50 percent caustic per kg of waste.

17

One-half of this volume is considered intermediate-level waste at SRS and would be disposed of in the intermediate-level waste vaults in E-Area. It is managed as TRU waste because it contains beta or gamma emitters that produce a dose equal to or greater than 200 millirem/hr at 5 cm (2 in) from an unshielded container.

18

Based on aqueous alternative process for Complex 21; 166 L of recycle water per kg of Pu metal processed. Assume "recycle" water sent to Effluent Treatment Facility; recovered acid is recycled.

19

Incinerable=58 m3, nonincinerable=30 m3.

20

Includes 7.6 m *3* (9.9 yd *3*) of D&D wastes such as wall material contaminated with asbestos.

21

Treatment of liquid hazardous wastes results in solid hazardous ash. Volume reduction is 200:1.

22

Assumes 350:1 wastewater to sludge ratio for treatment of liquid sanitary waste.

23

Includes 1.5 m *3* (2 yd *3*) of concrete and 0.8 t (0.2 tons) of steel. Includes 498 m *3* (651 yd *3*) of D&D wastes such as ductwork, concrete, electrical wiring, and equipment.

24

Recyclable wastes.

SRS 1996a:2; WSRC 1995c.

A.3.5 High Explosives Fabrication

The HE fabrication mission requires explosives synthesis, formulation, pressing, machining, testing, evaluation, and component manufacturing. In addition to these fundamental capabilities, a variety of support activities is required.

The explosives fabrication activity is important to the overall mission of the future DOE Complex. Over the past several years, economic trends have dictated a significant reduction in the domestic commercial support for this technology. In today's marketplace it is difficult to secure the small quantities of products necessary to sustain the reduced workload from commercial sources. The meticulous quality required of the explosives and components placed in nuclear weapons also disqualifies most commercial vendors.

Assumptions. In addition to the general assumptions used in preparing this PEIS, the following assumptions apply specifically to the HE fabrication mission:

- Baseline technologies will be used except where alternatives can be shown to meet requirements and be more cost effective.
- All production operations can be housed in existing facilities.
- Raw materials required to manufacture explosive charges are available either from within DOE or from commercial manufacturers.

General Functions and Layout. The general functions of HE fabrication are HE main charge manufacturing, small HE component manufacturing, HE formulation and synthesis, and HE testing and characterization. Production support functions include storage of raw materials and staging, packaging, and shipping of the intermediate and final product. These functions convert commercially available raw materials into HE and related components for weapons. These general functions also provide for testing and safe handling and storage of both raw materials and in-process and finished products.

The facilities required to perform HE fabrication functions can be arranged in a variety of layouts to accommodate existing structures. Structures containing explosives operations are generally constructed with steel-reinforced concrete and are designed to mitigate the effects of an accidental explosion. Although insensitive HE materials can generally be processed in conventional steel structures, concrete construction is typically used to maintain the flexibility to process conventional explosives. The resulting facility design typically consists of a number of separate operating bays that could vent to an unoccupied area should a detonation occur. Structures that do not require concrete construction due to a lack of HE presence are generally constructed of steel, although portions of these buildings may be concrete. Most facilities include support areas for offices, break rooms, rest rooms, electrical equipment, heating, ventilation, and air conditioning equipment, maintenance, and in-process staging of materials, components, tooling, and supplies. Many production and laboratory facilities also include vacuum systems. Utilities required include water, steam, compressed air, and electricity.

High Explosives Main Charge Manufacturing. This function manufactures main charge explosive subassemblies, main charge mock explosive assemblies, and explosive test specimens. An area must also be provided for conducting physical property testing on explosive components and materials. Each subfunction is described below.

High Explosives Pressings . Rough shapes for HE main charge subassemblies and material test billets are manufactured by pressing. These presses also produce rough shapes for mock components from nonexplosive materials. Sufficient area is needed to include presses, ovens, powder inspection tables, loading tables, and shadowgraph equipment.

Explosives Machining. The rough pressings are machined into hemispherical shapes or test elements using a combination of mills and lathes. HE machining is conducted wet, and a recirculating water treatment system is provided. Mock components may be machined in the same area or in the machine shop. Sufficient area is needed to include equipment for conducting density measurements, dye penetrant testing, and dimensional inspection.

Main Charge Subassembly. The explosive hemispheres are assembled with electrical parts and hardware to produce main charge subassemblies. This is a manual operation that generally involves potting and bonding.

Mechanical Properties Testing. The physical properties of explosive components and materials are tested to support War Reserve lot certification for materials and components and to support production development. The test configurations are assembled and tensile, torsion, and compression tests are conducted.

Small High Explosives Component Fabrication. This process fabricates small HE weapon components and test assemblies. Various small components are fabricated from HE powders and binders, metal or plastic components, electrical components, hardware, and assembly materials. The fabrication process requires equipment for explosive powder heating, pellet pressing, laser welding, ultrasonic cleaning, extrusion loading, density testing, and mechanical assembly. Functions are described below.

Pellet Pressing. Small pellets are pressed to density specifications from small energetic components assemblies.

Extrusion Loading. Extrudable (paste) explosive is loaded onto small fixtures for small component assemblies.

Small Component Assembly. Small HE pellets and/or fixtures containing extrudable paste explosives are assembled with inert parts to make small components.

High Explosives Formulation and Synthesis. This process produces a variety of explosive materials from chemical reactants and commercially produced explosives.

High Explosives Formulation. This function produces a variety of explosive materials from chemical reactants and commercially produced explosives. Material lots up to about 91 kg (200 lb) are produced through a series of batch operations. Some products are used to make small HE weapon components, while other products support the development of new explosives or explosives manufacturing processes.

High Explosives Synthesis. The synthesis process integrates a variety of vessels, filters, and transfer pumps which are used to synthesize, recrystallize, blend, and wash explosive powders. The facility includes bays for mixing/milling, particle-size reduction, drying/weighing/packaging, solvent storage, and refrigerated storage for explosives and chemicals.

High Explosives Testing and Characterization. Explosives test configurations are assembled and then detonated. The test data characterize the explosives performance and are required for the qualification of raw materials and production lots. Testing requires explosives containment chambers and an array of special instrumentation including streak cameras, rotating mirror framing cameras, an air image converter system, oscilloscopes and digitizers, flash x-ray systems, and velocity interferometers.

High Explosives Test Firing. Energetic materials components are test fired at a remote firing facility which includes an outdoor firing capability to conduct large-scale explosives tests that cannot be performed in a test chamber, such as main charges for explosives lot certification.

Nondestructive Evaluation. Explosive components are inspected using neutron radiography, x-ray, magnetic particle, and eddy current equipment to detect flaws, cracks, and voids in explosive and inert components.

Mechanical Properties Testing. The mechanical properties of explosive components and materials are tested to support lot certification for materials and components and to support fabrication development. The test configurations are assembled and tensile and comprehensive tests are conducted.

Analytical Laboratory. Chemical analyses are performed on explosive and nonexplosive materials to determine or verify their characteristics. The data obtained yield valuable information about the condition and composition of the material. This information is used to assure reliability of components and to statistically evaluate performance with material characteristics. The methods used include gas chromatography, liquid chromatography, size exclusion chromatography, infrared spectroscopy, thermal analysis, particle characterization, atomic spectroscopy, and emission spectroscopy. Surface chemistry, metallography, optical and scanning electron microscopy, and wet chemistry are also performed.

Material Compatibility Testing. Test coupons are assembled such that the subject materials are in direct contact with each other. These coupons are then placed in environmental ovens to accelerate the aging process. Gas samples are periodically taken from the coupon containers and analyzed by the gas laboratory. Compatibility testing is required to certify new materials for weapon use.

Production Support. The following functions and facilities are needed to support the HE fabrication missions.

Bulk Explosives Storage. This function requires facilities to store collectively 31,800 kg (70,000 lb) of conventional HE powders awaiting transfer to/from the HE staging facility and offsite explosives vendors. These materials are typically received in 4,500 to 9,000 kg (10,000 to 20,000 lb) lots. Storage facilities also are needed for storing 182,000 kg (400,000 lb) of insensitive HE that is awaiting transfer to and from the explosive staging facilities. The bulk explosives facilities would be designed to provide separation between incompatible explosives types and would be remotely located from the production operations.

Explosives Staging/Packaging/Shipping. This function would require staging a variety of explosive powders, components, and assemblies for supporting HE operations. These explosive materials include plastic bonded explosives for main charge manufacturing, completed main charges, small HE components, energetic feeds and products for HE formulation and synthesis, and explosive residues for disposal or recycling. The staging facilities would be designed to provide separation between

incompatible explosives types.

Process Support Systems. Process support for the HE manufacturing operation would include a machine shop and ES&H laboratory as well as other plant general services facilities. These facilities would directly support the HE fabrication mission as well as RD&T and other activities.

Facility Utilities . HE fabrication utility requirements are a function of the size, condition, and location of the facilities as well as the production requirements. Therefore, the utility requirements vary at each of the three candidate sites. Utilities are described in subsequent sections for each candidate site. A typical water balance for HE fabrication is shown in figure A.3.5-1.

Chemicals Required. The chemicals and materials consumed during operation primarily include water treating chemicals, reactants and solvents for explosives formulation and synthesis, explosives powders, materials for facility equipment and vehicle maintenance, and bottled gases. Specific lists of chemicals used by each site are provided under the site alternative description.

The HE fabrication process also requires the following chemical support materials:

- Solvents and wipes for manual cleaning operations
- Adhesives and bonding agents for manual assembly operations
- Glycerin fluid for preparing the isostatic pressing fluid
- Release agents for coating the inside of mechanical die sets used in pressing operations
- Dye for the penetrant test
- Shipping and packaging materials
- X-ray film
- Bottled nitrogen for extrusion loading
- Bottled argon for laser welding
- Solvents and feedstocks for the synthesis of hexanitrostilbene and triaminotrinitrobenzene powders
- Other miscellaneous materials required for routine operations

Transportation

Intersite Transportation. The HE shipping/receiving facility would be designed to ship and receive bulk HE materials to and from the HE plant. These materials typically would be received in 4,500 to 9,000 kg (10,000 to 20,000 lb) lots.

Shipping of completed charges would follow appropriate HE shipping regulations. All hazardous chemicals would be shipped using appropriate DOT requirements. The major type of hazardous material that would be transported to the plant would be HE materials. Bulk explosives powders would be delivered to the site by DOT-approved bulk commercial carriers. The powder would be unloaded at the bulk explosives storage facilities, which would isolate it from other facilities on the site.

Intrasite Transportation. All intrasite transportation required for manufacture would occur within existing site boundaries and would not require use of public roads. Appropriate HE shipping regulations as defined by DOE and DOT would be followed. Shipment of HE components for testing may require the use of public roads. After testing and manufacturing, subsequent movements of HE and explosive components would be performed by trucks and battery-powered vehicles specifically

designed for this purpose. The quantity of HE (conventional and insensitive) transported onsite by these trucks would be strictly limited.

Explosives main charges and components would be transferred to staging areas while awaiting transfer to the A/D plant. In a similar manner, explosive components from the A/D plant would be transferred to the explosives production plant for demilitarization, sanitization, and disposition. Small quantities of hazardous wastes generated during operations would be collected, packaged, and transported by electric car to local accumulation sites and then by truck to a staging area. The waste would be transferred by truck for offsite disposal.

Waste Management. The HE fabrication process generates the following waste and residual materials:

- Bulk HE machining scrap
- Off-specification HE components
- HE-contaminated materials, such as gloves and wipes, from manual cleaning operations
- Glycerin pressing fluid
- Developing materials from x-ray and neutron radiography film processing
- Hazardous contaminated materials from chemical bonding operations, packaging/

  repackaging, storage/staging, and shipment for ultimate disposal

The waste management process for HE fabrication at the alternative sites follows in sections A.3.5.1 through A.3.5.3.

A.3.5.1 Downsize at Pantex Plant

Pantex is the current DOE site for HE main charge manufacturing, small HE component manufacturing, HE formulation and synthesis, and HE testing and characterization. To efficiently meet the expected Complex workload, Pantex can downsize current HE fabrication operations. The following description assumes a downsized HE production mission at Pantex along with the A/D functions.

Significant downsizing actions at Pantex focus on functional consolidation. This can be achieved by reducing the number of facilities operating in the explosives area to 11 or 12 and decreasing the direct, direct support, and direct operations support personnel to about 50. There are no processes to be transferred from offsite. All facilities identified under this plan meet Federal regulations and DOE orders as they pertain to explosives manufacturing. Table A.3.5.1-1 indicates specific products and capabilities that comprise the HE fabrication mission at Pantex.

Table A.3.5.1-1.-- Pantex Plant High Explosives Fabrication Products and Capabilities

Products	Capabilities
High Explosives	*Manufacturing Process Development*
	Stockpile stewardship support

	Formulation
	Synthesis
	Surveillance
Binders	*Main Charge Manufacturing*
	Pressing
	Machining
	Subassembly
	Receiving/storage
	QA-mechanical/chemical/test fire
	Disposition
Main Charge Formulations	*Energetic Component Manufacturing*
	Pressing
	Machining
	Subassembly
	Receiving/storage
	QA-mechanical/chemical/test fire
Initiation High Explosives	Detonators
Mock High Explosives Formulations	Testing

Note: QA - quality assurance.
Source: PX DOE 1995e.

Assumptions. Requirements are based on an annual production rate of 150 replacements or retrofits. The 150 replacements or retrofits consist of 100 warheads and 50 bombs. The capability of providing explosives for two weapons systems in any given year is maintained. The Stockpile Evaluation Program consists of 120 disassemblies and inspections, 110 rebuilds, and additional joint test assemblies, joint test assembly post mortems, and test beds consistent with current guidance and stockpile levels. Some existing programs in the enduring stockpile use main charges made from conventional HE. Insensitive HE machining and storage continue to be explosive hazard Class IV operations. All hexanitrostilbene-based explosives and micronized-triaminotrinitrobenzene materials required would be produced at the HE production plant. Spare equipment and facilities are not included in the minimum facility requirements.

Facility and equipment maintenance would occur on the off-shift and the nonwork days when feasible. The Complex would be capable of producing materials and assembling replacement components and units for two weapon systems in any given year. This capability would be achieved by either simultaneous or sequential campaigns, as long as the sum of the product shipments for the year meets the annual production goals. The stockpile stewardship and management alternatives would not impact the ongoing plant missions, either during construction or during the life of the upgraded plant. Ongoing plant missions are defined as those functions performed today.

Strategic reserve requirements for explosives would be stored at the HE production site. The selected site for the HE production mission would be operational within 2 years after the ROD for this PEIS. The baseline technology for HE production comprises the present techniques utilized at Pantex. If transferred, prebuilds at the donor site would fill any production capability gap between the donor

and receiver site for the HE operations. If HE production missions are transferred, a 5-year period is required to accomplish the D&D activities at Pantex.

Facility Description. As stated previously, there would be no product or process transfers; however, there would be substantial functional consolidation. For example, Pantex currently has seven functional test fire sites. All test activities identified as required to support the enduring stockpile can be consolidated into two sites: a fully contained indoor test chamber and an outdoor site to accommodate large charges. Explosives components fabrication would be reduced from four buildings to two. Chemical characterization, nondestructive evaluation, and mechanical testing would be consolidated from the current five facilities to two, as well. A comprehensive listing of the planned consolidations can be found in table A.3.5.1-2. Figures A.3.5.1-1, A.3.5.1-2, and A.3.5.1-3 show the locations of the zones and the facilities within these zones.

Table A.3.5.1-2.-- Pantex Plant Functional Consolidation of Explosives Operations

Capabilities	Current Facilities	Consolidated Facilities (Projected)
Synthesis	11-36	11-55
Formulation	12-19E, 12-62	11-50, 12-62
Isostatic pressing	12-63	12-63
Explosives machining	11-50, 12-121	12-121
Explosives subassembly	12-31	12-121
Explosives components	11-20, 12-17, 12-62, 12-63	12-62, 12-63
Evaluation/characterization	11-5, 11-17, 11-51, 12-21, 12-59	11-51, 12-104A
Test fire	11-18, 11-38, FS-10, FS-11, FS-21, FS-22, FS-24	FS-11, FS-22, FS-24
Explosives storage	11-42, 12-65, 12-83, Zone 4 (8 magazines)	12-65, Zone 4 (4 magazines)
Explosives disposal	Burning Ground	Burning Ground

Source: PX DOE 1995e.

Pantex consists of 425 buildings containing approximately 232,300 m 2 (2.5 million ft 2) of floor space of which explosives operations occupy 37,200 m 2 (400,000 ft 2). Within 4,119 ha (10,177 acres), approximately 809 ha (2,000 acres) are dedicated to active facility operations. Approximately 3,270 ha (8,080 acres) are devoted to storage, disposal, and miscellaneous activities in support of plant operations.

Pantex structures containing explosives operations comply with the *DOE Explosives Safety Manual,* DOE/EV/06194 and are generally constructed with steel-reinforced concrete and designed to mitigate the effects of an accidental explosion. Although insensitive HE materials can generally be processed in conventional steel structures, concrete construction is typically used to maintain the flexibility to process conventional explosives. The resulting facility design typically consists of a number of separate operating bays with remote and/or contact operating capability that are fully contained or could vent to an unoccupied area should a detonation occur. Most facilities include support areas for

offices, break rooms, rest rooms, electrical equipment, heating, ventilation, and air conditioning equipment, maintenance, and in-process staging of materials, components, tooling, and supplies. Many production and laboratory facilities also include vacuum systems. Utilities required include steam, compressed air, and electricity.

The HE facilities are primarily within the Applied Technology Division. These facilities would support main charge manufacturing, small component manufacturing, formulation and synthesis, and explosives testing and characterization, as well as HE storage and disposition.

Design Safety. The following sections identify important safety considerations incorporated in the design of explosives facilities. Performance goals commensurate with the associated hazard are selected for all structures, systems, and components. The term "hazard" is defined as a source of danger, whether external or internal. Natural phenomena such as earthquakes, extreme winds, tornadoes, and floods are external hazards to structures, systems, and components; whereas toxic, reactive, explosive, or radioactive materials contained within the facilities are internal hazards. Usage category is established by DOE management. Guidelines for usage category (performance category) and the corresponding performance goals are given in *Design and Evaluation Guidelines for DOE Facilities Subjected to Natural Phenomena Hazards* (UCRL-15910).

Earthquakes. All existing facilities meet the standards as cited below. Structures, systems, and components are designed for earthquake-generated ground accelerations in accordance with University of California Research Laboratory (UCRL)-15910. The applicable seismic hazard exceedance probability is 2x10 *-3* for general use (performance category 1), 1x10 *-3* for low and moderate hazard (performance categories 2 and 3), and 2x10 *-4* for high hazard (performance category 4) for structures, systems, and components.

Seismic design considerations for performance category 3 and 4 structures, systems, and components include provisions for such structures, systems, and components to function as hazardous materials confinement barriers and for adequate anchorage of building contents to prevent loss of critical function during an earthquake. In essence, design considerations are to avoid premature, unexpected loss of function, and to maintain ductile behavior during earthquakes.

The fire protection system, emergency power, water supplies, and controls for the safety class equipment are some of the necessary emergency items that must be available following an earthquake. As stated in UCRL-15910, earthquake-resistant design considerations extend beyond the dynamic response of structures and equipment to include survival of systems that prevent facility damage or destruction due to fires or explosions.

Wind. All existing plant structures, systems, and components at Pantex meet the wind or tornado load criteria and the corresponding facility usage and performance goals. Wind design criteria are based on annual probability of exceedance, importance factor, missile criteria, and atmospheric pressure changes as applicable to each performance (usage) category as specified in UCRL-15910. Wind loads are based on the annual probability of exceedance of 2x10 *-2* for the general and low hazard (performance categories 1 and 2), 1x10 *-3* for the moderate hazard (performance category 3), and 1x10 *-4* for the high hazard (performance category 4) structures, systems, and components. Since tornadoes are the viable wind hazards, structures are designed for the annual probability of exceedance of 2x10 *-5* as defined in UCRL-15910.

Floods. All facilities required for the HE operations at Pantex are located above the critical flood evaluation. The extent of the flood hazard is determined using the appropriate usage (performance)

category for determining the "Annual Hazard Probability of Exceedance": $2x10^{-3}$ for the general use (performance category 1), $5x10^{-4}$ for the important or low hazard (performance category 2), $1x10^{-4}$ for the moderate hazard (performance category 3), and $1x10^{-5}$ for the high hazard (performance category 4) facility as defined in UCRL-15910.

Whenever possible, all facilities in performance categories above the general use category (performance category 1) are constructed with the lowest floor of the structure, including subsurface floors, above the level of the 500-year flood. This requirement can be met by siting and/or flood protection. Whenever possible, all facilities, including their basements, in all performance categories are sited above the 100-year floodplain.

Fire Protection . The fire protection features for the plant and its associated support buildings are in accordance with DOE orders and the National Fire Prevention Association Fire Codes and Standards. Redundant firewater supplies and pumping capabilities are installed to supply the automatic and manual fire protection systems located throughout the site. Appropriate types of fire protection systems are installed to provide life safety, prevent large-loss fires, prevent production delay, ensure that fire does not cause an unacceptable onsite or offsite release of hazardous material that will threaten the public health and safety of the environment, and minimize the potential for the occurrence of a fire and related perils. Specific production areas and/or equipment are provided with the appropriate fire detection and suppression features, as required, with respect to the unique hazard characteristics of the product process.

Safety Class Instrumentation and Contro l. The safety classification of instrumentation and controls are derived from the safety functions which they perform. The safety classification is based on appropriate DOE orders. Existing facilities at Pantex meet all safety class requirements. Safety instrumentation is designed to monitor identified safety-related variables in safety class systems and equipment over expected ranges for normal operation, accident conditions, and safe shutdown. Safety class controls are provided when required to control these variables. Safety class instrumentation is designed to fail in a safe mode following a component or channel failure. Safety class Uninterruptable Power Supply power is provided when appropriate.

Ventilation . The heating, ventilation, and air conditioning system design of existing facilities meets all general design requirements in accordance with DOE orders, and American Society of Heating, Refrigerating, and Air Conditioning Engineers guides. The design includes engineered safety features to prevent or mitigate the potential consequences of postulated design basis accident events.

Internal Explosion . Buildings containing HE are designed to mitigate the effects of accidental explosion within a bay or cell. The design is in accordance with the *DOE Explosive Safety Manual* , DOE/EV/06194, including the quantity-distance and the level-of-protection criteria for each class of explosives activities.

Overall Facility Layouts and Design Description. Pantex facilities proposed for the HE fabrication mission are listed in table A.3.5.1-3 and described in this section. The table summarizes key facility data for existing buildings and support areas. Data for the facilities include building number, description, construction type (concrete or steel), gross square meters, number of levels in the structure, and explosives present.

Structures containing explosives operations are generally constructed with steel-reinforced concrete and are designed to mitigate the effects of an accidental explosion. Although insensitive HE materials can generally be processed in conventional steel structures, concrete construction is typically used to

maintain the flexibility to process conventional explosives.

Table A.3.5.1-3.-- Pantex Plant High Explosives Fabrication Facility Data

Facility Function	Building Number	Construction Type	Gross Area (m^2)	Number of Levels	*Special Materials*
Bulk explosives storage	04-101 - 04-104	Concrete	441	1	HE
Synthesis	11-55	Concrete	279	1	HE
HE formulation	11-50	Concrete	2,062	2	HE
Chemical testing/evaluation	11-51	Concrete	1,078	1	None
HE main charge pressing	12-63	Concrete	223	1	HE
Explosives staging/packaging/shipping	12-65	Concrete	753	1	HE
Fabrication/assembly	12-62, 12-63	Concrete	548	1	HE
Explosives machining/gaging/subassembly/ safety testing/physical testing/ nondestructive evaluation	12-121	Concrete	4,562	1	HE
Test fire assembly	FS-11	Steel	190	1	HE
Outdoor firing site	FS-22	Concrete	167	1	HE
Contained firing site	FS-24	Concrete	701	1	HE
HE disposal	Burning Ground	Concrete	56	1	HE

Source: PX DOE 1995e.

The resulting facility design typically consists of a number of separate operating bays that could vent to an unoccupied area should a detonation occur. Structures that do not require concrete construction due to the presence of HE are generally constructed of steel, although portions of these buildings may be concrete. Most facilities include support areas for offices, break rooms, rest rooms, electrical equipment, heating, ventilation, and air conditioning equipment, maintenance, and in-process staging of materials, components, tooling, and supplies. Many production and laboratory facilities also include vacuum systems. Utilities required include water, steam, compressed air, and electricity.

High Explosives Main-Charge Manufacturing. These facilities manufacture explosive subassemblies, main charge mock explosive hemispheres, and explosive test specimens. An area is also provided for conducting physical property testing on explosive components and materials. Each functional area is described below.

Isostatic Pressing (Building 12-63). Rough pressings for HE main charge subassemblies and material test billets are manufactured in Building 12-63.

Explosives Machining (Building 12-121). The rough pressings are machined in Building 12-121.

Main Charge Subassembly (Building 12-121). The explosives hemispheres are assembled in Building 12-121.

Mechanical Properties Testing (Building 12-121). The physical properties of explosive components and materials are tested in a portion of Building 12-121.

Small High Explosives Component Manufacturing (Buildings 12-63, 12-121) . Various small components are manufactured from HE powders and binders, metal or plastic components, electrical components, hardware, and assembly materials. The manufacturing process requires equipment for explosive powder heating, pellet processing, laser welding, ultrasonic cleaning, extrusion loading, density testing, inspection, and mechanical and electrical assembly.

Test Firing (Buildings FS-11, FS-22, FS-24). Explosives test configurations are assembled and tested at Buildings FS-11, FS-22, and FS-24. The test data characterize the explosives performance and are required for the qualification of raw materials and production lots. Testing requires explosives containment chambers and an array of special instrumentation including streak cameras, rotating mirror framing cameras, digitizers, flash x-ray systems, and velocity interferometers. Outdoor firing sites are used to conduct explosives tests (e.g., skid and hydrodynamic tests greater than 1 kg [2.2 lb]) that cannot be performed in a test chamber. These facilities are remotely located from production operations.

Nondestructive Evaluation (Building 12-121). Explosive components are inspected using neutron radiography, x-ray, magnetic particle, and eddy current equipment to detect flaws, cracks, and voids in explosives and inert components. Nondestructive evaluation also supports the A/D mission.

High Explosives Formulation (Buildings 11-50 and 12-62) and Synthesis (Building 11-55). These facilities have the capability to produce a variety of explosives materials from chemical reactants and commercially produced explosives. Material lots up to about 91 kg (200 lbs) are produced through a series of batch operations. Some products are used to make small HE weapon components, while other products support the development of new explosives or explosives manufacturing processes.

The HE formulation and synthesis facilities include several flexible processing bays that contain a variety of vessels, filters, and transfer pumps used to synthesize, recrystallize, blend, and wash explosive powders. The facilities also include bays for mixing/milling, reducing particle size, drying/weighing/packaging, storing solvent, and refrigerated storing of explosives and chemicals. Building 11-55 replaces the existing synthesis facility (Building 11-36), which is in deteriorating condition. Building 11-50 replaces an existing formulation capability in Building 12-19E.

Production Support. The production support facilities house an analytical laboratory and material compatibility testing.

Analytical Laboratory (Building 11-51). Chemical analyses are performed on explosive and nonexplosive materials in Building 11-51 to determine or verify their characteristics. The data obtained yield valuable information about the condition and composition of the material. This information is used to ensure components' reliability and to statistically evaluate performance with

material characteristics. The methods used include gas chromatography, liquid chromatography, size exclusion chromatography, infrared spectroscopy, thermal analysis, particle characterization, atomic spectroscopy, and emission spectroscopy. Surface chemistry, metallography, optical and scanning electron microscopy, and wet chemistry are also performed.

Material Compatibility Testing (Building 11-51). Test coupons are assembled such that the subject materials are in direct contact with each other. These coupons are then placed in environmental ovens to accelerate the aging process. Gas samples are periodically taken from the coupon containers and analyzed by the gas laboratory. Compatibility testing is accomplished in Building 11-51 and is required to certify new materials for weapon use.

Bulk Explosives Storage (Buildings 4-101 through 4-104). These facilities are designed to store collectively 31,800 kg (70,000 lb) of conventional HE powders while awaiting transfer to or from the HE staging facility and offsite explosives vendors. These materials are typically received in 4,500 to 9,000 kg (10,000 to 20,000 lb) lots. These facilities also are used for storing 182,000 kg (400,000 lb) of HE awaiting transfer to or from the explosives staging facilities. The bulk explosives facilities would be designed to provide separation between incompatible explosives types and would be located remotely from the production operations.

Explosive Staging/Packaging/Shipping (Building 12-65). These facilities are designed to stage a variety of explosives powders, components, and assemblies for supporting HE operations. These explosives materials include plastic bonded explosives for main charge manufacturing, completed main charges, small HE components, energetic feeds and products for HE formulation and synthesis, and explosives residues for disposal or recycling. These facilities are designed to provide separation between incompatible explosives types.

Resource Requirements During Construction/Modification. Requirements during construction and modification to implement the downsized configuration for HE fabrication at Pantex are described below.

Land Area Requirements During Modification. Downsizing in place of the explosives production operations at Pantex requires approximately 0.*12* ha (0.3 acres) of land for construction laydown and warehousing and an additional *0.04* ha (0.1 acres) to accommodate construction parking. These activities would occur in previously developed land areas.

Materials and Resources Consumed During Modification. The materials and resources consumed during downsizing of the explosives production operation at Pantex are shown in table A.3.5.1-4. These resources include utilities, construction materials, liquid fuels, and industrial gases.

Table A.3.5.1-4.-- Pantex Plant High Explosives Downsizing Materials/Resources Requirements

Material/Resource	Total Consumption	Peak Demand 1
Electricity	257 MWh	2 MWe
Water (L)	644,000	

Concrete (m^3)	356	
Steel (t)	6	
Liquid fuel (L)	12,200	
Industrial gases 2 (m^3)	258	

Emissions During Modification. Air pollutants are emitted during modification activities required for the downsizing of the explosives production operations. The principal sources of such emissions are fugitive dust from site preparation for material laydown areas, other construction activities, and exhaust from construction equipment and vehicles. The estimated annual emissions generated during a 1-year period with peak construction activity are shown in table A.3.5.1-5.

Employment During Modification. The number of workers required during each year of construction at Pantex for the HE downsizing alternative is presented in table A.3.5.1-6.

Table A.3.5.1-5.-- Pantex Plant High Explosives Downsizing Construction Emissions

Pollutant	Quantity (t)
Carbon monoxide	0.54
Nitrogen oxides	0.19
Particulate matter	0.08
Sulfur dioxide	0.02
Total suspended particles	0.19
Volatile organic oxides	0.09

PX DOE 1995e.

Table A.3.5.1-6.-- Pantex Plant High Explosives Downsizing Construction Workers

Employees	Year 1	Year 2	Year 3	Total
Craftworkers				
Carpenter	1	3	1	5
Construction management and support staff	0	3	1	4
Concrete mason	1	2	1	4
Electrician	0	3	2	5
Iron worker	1	3	1	5
Laborer	1	3	1	5
Millwright	0	1	1	2
Operator	0	1	0	1

Other craftworkers	0	2	1	3
Pipe fitter	0	2	1	3
Sheet metal worker	0	3	1	4
Sprinkler fitter	0	2	1	3
Teamsters	0	1	1	2
Total Employment	4	29	13	46

Source: PX DOE 1995e.

Resource Requirements During Operations--High Explosives Fabrication Mission. No additional land is required to operate the HE downsizing alternative at Pantex.

The utilities consumed during operation include electric power, liquid fuels, natural gas, and water. Annual utility consumption rates and peak electric power rates for surge operation are shown in table A.3.5.1-7 and are incremental to the A/D mission at Pantex.

All activities would be accomplished on a single, 40 hours-a-week shift. Any surge production would be achieved by increasing personnel and adding shifts (1-year lead time). The facilities would be operated under existing site labor agreements. Surge operation of the HE Fabrication Facility would require 37 direct workers (PX 1996e:1). Support workers for the A/D mission would provide sufficient support for the HE fabrication mission.

Table A.3.5.1-7.-- Pantex Plant High Explosives Downsizing Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 3
Electricity	3,250 MWh	1 MWe
Liquid fuel (L)	55,600	
Natural gas 4 (m^3)	500,000	
Water (L)	12,500,000	

Chemicals Consumed During Operation. The chemicals and materials consumed during operations primarily include water treating chemicals, reactants and solvents for explosives formulation and synthesis, explosive powders, materials for facility equipment and vehicle maintenance, and bottled gases. No radioactive materials are required for explosives production. Materials with annual consumption in excess of 227 kg (500 lb) during surge operations are listed in table A.3.5.1-8.

Table A.3.5.1-8.-- Pantex Plant High Explosives Downsizing Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)

Calcium chloride	4,080
Ethyl acetate	1,360
HE powders, insensitive	31,600
HE powders, conventional	15,800
Hydraulic/lubricating oil	4,310
Nitrogen	1,810
Paint	2,380
Source: PX 1995a:6; PX DOE 1995e.	

Emissions During Operation. Gaseous environmental releases would result from operation of the thermal treatment units for bulk HE waste and nonradioactive HE-contaminated waste generated by Pantex for the explosives production operations. Emissions would also result from plant boiler operation, cleaning operations using solvents, and formulation and synthesis operations. The thermal treatment units would be designed and operated to attain and maintain temperatures which result in the destruction of hazardous constituents. Hazardous particulates would be trapped in filters. The releases would be limited to what is possible, using the best available control technology. The annual chemical emissions for the explosives production surge operations are shown in table A.3.5.1-9.

Table A.3.5.1-9.-- Pantex Plant High Explosives Downsizing Surge Operation Annual Emissions

	Quantity (kg)
Pollutant	**Incremental with Assembly/ Disassembly**
Criteria Pollutant	
Carbon monoxide	413
Nitrogen oxides	1,560
Particulate matter	68
Sulfur dioxide	0.01
Volatile organic compounds	122
Hazardous and Other Toxic Compounds	
Acetonitrile	0.45
Aldehydes	2.04
Ammonia	0.02
Benzene	3.00
Cresylic acid	0.0014
Cyclohexane	1.70
1,2-Dichloroethane	0.03
Dimethyl formamide	0.01

Dioxane	0.04
Hexane	0.09
Hydrogen chloride	3.20
Hydrogen fluoride	4.50
Mercury	2x10 -*8*
Methanol	2.7
Methyl ethyl ketone	349
Toluene	9.5
1,1,1-Trichloroethane	0.54
Trichloroethylene	0.45
Xylene	8
PX DOE 1995e.	

Waste Management

Wastes Generated During Construction. The liquid and solid wastes generated during construction would include concrete and steel waste construction materials, hazardous wastes, and sanitary wastewater. The steel construction waste material would be recycled as scrap metal. No radioactive or mixed wastes would be generated during construction.

The liquid and solid wastes generated during HE downsized fabrication functions are discussed in the subsections below. The annual quantity of solid and liquid waste generated by the explosives production operations at Pantex during surge operation is shown in table A.3.5.1-10.

Hazardous toxic wastes would consist of solid residue (ash) from thermal treatment units, solvents from operations, wash water and residual reactants from explosives formulation and synthesis, and residue from painting and bonding operations. This waste would be stabilized and sent to an approved permitted RCRA disposal site.

Solid nonhazardous, nonradioactive wastes generated by the explosives production operations would consist primarily of solid sanitary waste, residue from facility and vehicle maintenance, spent desiccants, and sanitized and demilitarized paper and parts. Nonrecyclable portions of this waste would be sent to an offsite landfill. Liquid sanitary wastewater and process wastewater would be treated and discharged to a permitted drainage channel.

Transportation. The major type of hazardous material that would be transported to Pantex would be HE materials. Bulk explosives powders would be delivered to the site by DOT-approved bulk commercial carriers. The powder would be unloaded at the bulk explosives storage facilities, isolated from other facilities on the site. Subsequent movements of HE and explosives components would be performed by trucks and battery powered vehicles specifically designed for this purpose. The quantity of HE (conventional and insensitive) transported onsite by these trucks would be strictly limited.

Explosives main charges and components would be transferred to staging areas for transfer to the A/D plant. In a similar manner, explosives components from the A/D plant would be transferred to the explosives production plant for demilitarization, sanitization, and disposition. Small quantities of hazardous waste generated during operations would be collected, packaged, and transported by

electric car to local accumulation sites and then by truck to a staging area. The waste would be transferred by truck for offsite disposal.

Table A.3.5.1-10.-- Pantex Plant High Explosives Fabrication Facility Waste Volumes

Category	Annual Average Volume Generated from Construction (m^3)	Annual Volume Generated from Surge Operations (m^3)	Annual Volume Effluent from Surge Operations (m^3)
Low-Level			
Liquid	None	None	None
Solid	None	Minimal	Minimal
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	None	0.23	0.23
Solid	0.06	30	30
Nonhazardous (Sanitary)			
Liquid	146	7,120	7,120
Solid	None	17	8 5
Nonhazardous (Other)			
Liquid	Included in sanitary	None	None
Solid	2 6	Included in sanitary	Included in sanitary

A.3.5.2 Relocate to Los Alamos National Laboratory

The HE processing facilities at LANL (figures A.3.5.2-1 and A.3.5.2-2) were designed and built for production scale operations and were operated as production facilities supplying nuclear weapons HE components for many years. LANL has continued to upgrade and modernize processing equipment in these existing facilities to provide prototype HE components to meet hydrodynamic and NTS program requirements. Using the existing HE manufacturing infrastructure along with state-of-the-art processing equipment, LANL produces high-quality complex HE components to meet one-of-a-kind prototype requirements or limited production runs of HE components used in test programs. Typically, LANL fabricates an average of 1,200 to 1,500 HE parts per year. Surveillance (returned stockpile) HE components are also processed for weapon aging studies.

LANL's full range of HE-processing capabilities includes HE storage magazines, HE synthesis, HE formulation, pressing, machining, assembly, and subassembly of HE devices, proven quality assurance processes, and stringent disposal requirements. In addition, LANL has facilities for

environmental, safety, and performance testing of HE and HE assemblies. In all, the inherent capacity of the LANL HE plant exceeds weapons R&D testing program requirements. Furthermore, expanding workloads at LANL to support the projected production would not tax or require full capacity of LANL's existing infrastructure.

LANL would assume the responsibility for providing all HE feedstock, main charge, and component procurement, and fabrication as required by the HE fabrication mission. The products and capabilities for which LANL would be responsible are shown in table A.3.5.2-1.

Table A.3.5.2-1.-- Los Alamos National Laboratory High Explosives Fabrication Products and Capabilities

Products	Capabilities
High Explosives	*Manufacturing Process Development*
	Stockpile stewardship support
	Formulation
	Surveillance
	Synthesis
Binders	*Main Charge Manufacturing*
	Pressing
	Machining
	Subassembly
	Receiving/storage
	Quality assurance-mechanical/chemical/test fire
	Disposition
Main Charge Formulations	*Energetic Component Manufacturing*
	Pressing
	Machining
	Subassembly
	Receiving/storage
	Quality assurance-mechanical/chemical/test fire
	Disposition
Initiation High Explosives	Detonators
Mock High Explosives Formulations	Testing
LANL 1995d.	

Assumptions. The general and facility assumptions on which the data in this section are based

follow.

General Assumptions

- LANL currently has adequate infrastructure in place to meet all ES&H safeguards and security and waste management requirements for the HE fabrication mission.
- Additional staff would be required to support new HE production.
- Transition from Pantex and qualification and process prove-in will take approximately 2 years, beginning in fiscal year 1997 after the ROD.
- Steady state operations begin at LANL in fiscal year 1999.
- Steady state operations include manufacturing, testing, and quality assurance evaluation of parts and returned stockpile surveillance components (approximately 10 percent of the production rate).

Facility Capacity/Capabilities Assumptions

- The capacity is defined as 150 sets of explosives components for new builds and 110 sets of explosives components for rebuilds.
- All products and capabilities defined by the HE manufacturing block flow diagrams will be supported.
- Some existing programs in the enduring stockpile use main charges made from conventional HE. All new weapon programs will use main charges made from insensitive HE. Insensitive HE machining and storage continue to be explosive hazard Class IV operations.
- Appropriate portions of the existing storage facilities will be upgraded and reserved to provide adequate storage for the HE fabrication mission, estimated as 182,000 kg (400,000 lb) of insensitive HE and 31,750 kg (70,000 lb) of conventional HE.
- Existing S-Site facilities will be operated according to the current shift system (four 10-hour days per week) to meet normal production requirements. The facilities will be operated under existing labor agreements.
- No new facility construction will be needed.

Facility Description. LANL has all the facilities and equipment needed to carry out the HE fabrication mission. These HE processing facilities are located primarily in TAs -9 and -16. The synthesis, analytical laboratory, and pilot scale formulation activities are located at TA-9. These facilities, including administrative support and HE storage, comprise 39 buildings with over 3,700 m *2* (40,000 ft *2*) of floor space. Formulation, pressing, machining, receiving, storage, subassembly, radiography, and disposal processes are carried out at TA-16, which houses 65 buildings covering over 8,900 m *2* (96,000 ft *2*). Testing and nondestructive evaluation would be carried out in a variety of other TAs. TA-37 would provide storage of HE parts and components. All LANL facilities are designed to meet the requirements of the *DOD Ammunition and Explosive Safety Standards* (DOD 6055.9) and the *DOE Explosives Safety Manual* (DOE/EV/06194) for quantity-distance and operational criteria. The HE safety requirements applicable to operations involving the development, testing, handling, and processing of explosives or assemblies containing explosives are identified in DOE/EV/06194. This manual reflects the state of the art in HE safety. Again, no new construction or major equipment transfers from Pantex are required to support the HE fabrication mission at LANL.

State- and Federal-permitted waste disposal facilities are located at TA-54 for hazardous materials (non-HE contaminated) and at TA-16 for HE and HE-contaminated waste. LANL operates in compliance with all state and Federal requirements and regulations, applying a process of continuous

process improvements to drive an effective "best practices" program in waste minimization.

Currently, processing routing flow sheets accompany HE components as they are moved through each processing step. Operators sign off as each process is completed. When the processing is completed, the flow sheets are sent to production control where the processing and inspection data are entered into databases and then filed in production control files. Database inventories and task order files are kept on all components, assemblies, and raw materials used in the HE Fabrication Facility.

Although the facilities are in remote locations, they are well integrated into the infrastructure of LANL. They all have intrasite transportation connections so that transportation of explosives and components on public roads is not of concern for operations. Because of their location, HE facilities are well buffered and are not subject to population pressures.

The HE facilities are primarily centralized in the Dynamic Experimentation and Engineering Sciences and Application Divisions and are used in support of DOE and DOD programs. These facilities will be used for the HE fabrication processes including synthesis and formulation, main-charge manufacturing, testing and characterization, small component manufacturing, HE storage, and disposition. The TAs used to support the production include TAs -8, -9, -11, -14, -15, -16, -21, -22, -28, -36, -37, -39, and -40. The majority of the HE processing operations are located at TAs -9, -16, -28, and -37.

HE performance testing and characterization can be conducted at any of several firing sites operated by DX Division. TAs include TAs -14, -15, -16, -21, -22, -36, -39, and -40. Hazardous waste treatment and disposal facilities are located at TA-54, while HE disposal facilities are located at TA-16.

Design Safety. Important safety considerations are incorporated into the design of DOE facilities. Performance goals commensurate with the associated hazard are selected for all structures, systems, and components. The term "hazard" is defined as a source of danger, whether external or internal. Natural phenomena such as earthquakes, extreme winds, tornadoes, and floods are external hazards to structures, systems, and components; whereas, toxic, reactive, explosive, or radioactive materials contained within the facilities are internal hazards. Usage category is as established by DOE management. Guidelines for usage category (performance category) and the corresponding performance goals are given in UCRL-15910.

Earthquake. All existing HE fabrication structures located in Dynamic Experimentation and Engineering Sciences and Application Divisions meet all current applicable standards. An engineering study showed that the reinforced concrete structures used for HE processing buildings used for blast loading requirements exceed the seismic loading for structural capacity. New structures, systems, and components, when required, shall be designed for earthquake-generated ground accelerations in accordance with UCRL-15910, with applicable seismic hazard exceedance probability of 2x10 *-3* for general use (performance category 1), 1x10 *-3* for low and moderate hazard (performance category 2 and 3), and 2x10 *-4* for high hazard (performance category 4) structures, systems, and components.

Wind. All existing HE fabrication structures at TA-9 and TA-16 meet the wind criteria as discussed below. All new structures, systems, and components would be designed for wind or tornado load criteria when required in accordance with UCRL-15910 and the corresponding facility usage and performance goals. Wind loads shall be based on the annual probability of exceedance of 2x10 *-2* for the general and low hazard (performance categories 1 and 2), 1x10 *-3* for the moderate hazard

(performance category 3), and 1x10 *-4* for the high hazard (performance category 4) structures, systems, and components. Wind design criteria is based on annual probability of exceedance, importance factor, missile criteria, and atmospheric pressure change, as applicable, to each performance (usage) category as specified in UCRL-15910.

Floods. All HE facilities and buildings at the LANL HE Fabrication Facility are located above the critical flood elevation from the potential flood source (river, dam, levee, precipitation, etc.). The extent of the flood hazard is determined using the appropriate usage (performance) category for determining the annual hazard probability of exceedance: 2x10 *-3* for general use (performance category 1), 5x10 *-4* for important or low hazard (performance category 2), 1x10 *-4* for moderate hazard (performance category 3), and 1x10 *-5* for high hazard (performance category 4) facilities as defined in UCRL-15910.

The critical flood elevation is determined by obtaining the design basis flood level. The design basis flood level is the peak hazard level (flow rate, depth of water, etc.) corresponding to the mean annual hazard probability of exceedance or combinations of flood hazards (river flooding, wind-wave action, etc.) and corresponding loads associated with the peak hazard level and applicable load combination (hydrostatic and/or hydrodynamic forces, debris loads, etc.). LANL run-off site drainage conforms to the State of New Mexico and NPDES requirements. The minimum design level for the stormwater management system is the 25-year, 6-hour storm, but potential effects of larger storms up to the 100-year 6 hour storm are also considered.

Fire Protection. The fire protection features for the existing HE Fabrication Facility and its associated support buildings are in accordance with DOE orders and the National Fire Prevention Association Fire Codes and Standards.

Redundant firewater supplies and pumping capabilities (electric motor drivers with diesel generator backup) would be installed to supply the automatic and manual fire protections systems located throughout the site. One tank and one set of pumps would be designed to meet design basis event requirements. Appropriate types of fire protections systems would be installed to provide life safety, to prevent large-loss fires, to prevent production delay, to ensure that fire does not cause an unacceptable onsite or offsite release of hazardous material that would threaten the public health and safety or the environment, and minimize the potential for the occurrence of a fire and related perils. Specific production areas and/or equipment would be provided with the appropriate fire detection and suppression features, as required, with respect to the unique hazard characteristics of the product or process.

A fire hazards analysis would be performed to assess the risk from fire within the individual fire areas of the facility. All fire sprinkler water that has been discharged during and after a fire would be collected in building sump systems, monitored, sampled, and, if required, retained until it could be disposed of.

Safeguards and Security Systems Description. The HE fabrication facilities located at TA-9 and TA-16 are located within a security parameter with multiple fences surrounding the areas. The main large scale HE processing buildings, assembly area, and magazine storage areas at TA-16 and TA-37 are located within a separate fenced HE exclusion area.

Safety Class Instrumentation and Control. The safety classification of instrumentation and controls is derived from the safety function each performs. This safety classification is based on appropriate DOE orders. HE facilities at LANL that utilize instrumentation for explosives operations currently

meet all the safety class requirements.

Ventilation. The heating, ventilation, and air conditioning system provides environmental conditions for the health and comfort of personnel and for equipment protection.

Internal Explosion. New and existing buildings are designed for the effects of accidental explosion within a bay or cell. The design is in accordance with the *DOE Explosives Safety Manual* (DOE/EV/06194), including the quantity-distance and the level of protection criteria for each class of explosives activities.

Overall Facility Layouts and Design Descriptions. The existing HE fabrication facilities at LANL would be used to support the production mission for HE fabrication. These facilities were designed to meet the *DOD Ammunition and Explosives Safety Standards* (DOD 6055.9) and DOE/EV/06194. Operations are segregated by hazard class: Class I processes, the most hazardous processes, were designed for remote operations with an accidental detonation venting the process bay via a frangible (blow-out) wall away from inhabited areas. Fragment distances and blast overpressure (interline distance) set the criteria for locating operating buildings.

All LANL HE processing facilities are designed for Class I (remote) and Class II (operated attended) operations as defined by DOD 6055.9. While some processing operations require some minimal changes for processing conventional HE, there are no major differences in equipment or facilities. The just-in-time flexible manufacturing approach allows the facilities to alternately process both insensitive HE and conventional HE in the same equipment and facilities. This operational philosophy allows optimized fabrication of all HE and gives the flexibility to make production lots of materials, as required (i.e., plane wave lenses), as well as to manufacture a single quantity of weapon HE components for local hydrodynamic tests and custom HE part requirements.

Structures containing HE and those in which HE operations are conducted are constructed with thick (0.6-m [2-ft]) thick, steel-reinforced, concrete walls designed to mitigate the effects of an accidental explosion. These facilities contain protective berms and are located to meet quantity-distance criteria. Most facilities include support areas for offices; break rooms; restrooms; electrical equipment; heating, ventilation, and air conditioning equipment; maintenance; and in-process staging of materials, components, tooling, and supplies. Table A.3.5.2-2 lists functional HE processing technology, building numbers, and working floor space. No new facilities or structures are required to support the HE manufacturing production mission.

High Explosive Main-Charge Manufacturing. The HE processing facility is used to manufacture main charge subassemblies, mock main charge hemispheres, and explosive test specimens. An area is also provided for conducting physical property testing on explosives components and materials. Each functional area is described below:

Isostatic Pressing. Rough pressings for HE main charge subassemblies, material test billets, and pellets for small components and boosters are fabricated in TA-16-430.

Explosives Machining. Rough pressings are radiographed, inspected, and machined into hemispherical shapes or test charges in TA-16-260.

Inspection. HE components are inspected in TA-16-260.

Main Charge Subassembly. The explosives hemispheres are assembled in TA-16-410.

Table A.3.5.2-2.-- Los Alamos National Laboratory High Explosives Fabrication Facility Data

Functional Area	**Existing Facilities**	
High Explosives Technology	**Gross Area (m 2)**	***Building Number***
Main Charge Fabrication		
HE pressing	740	TA-16-430
HE machining, inspection	930	TA-16-260
HE subassembly	370	TA-16-410
Physical property testing	185	TA-11, All
High Explosives Staging, Insensitive High Explosives, and Conventional High Explosives	280	TA-16-261 TYPICAL
Main Charge Test Fire	93	TA-15, TA-40
Energetic Components		
Small component fabrication	700	TA-16-340
Test fire	93	TA-15, TA-40
Component nondestructive evaluation	560	TA-8-22, -23
Formulation and Synthesis		
HE synthesis	460	TA-9-45, -46
HE formulation	700	TA-16-340
Chemical storage	47	TA-16-344
HE staging	47	TA-16-341, -343, -345
Production Support		
Analytic/environmental lab	460	TA-9-21 and -32
Metrology	185	TA-16-260, -410
Materials compatibility testing	280	TA-9-21, -40, -42
Machine shop	185	TA-16-370
High Explosives Shipping/Receiving	230	TA-16-280
Outdoor Test Fire	93	TA-15, TA-11
High Speed Test Machining	18	TA-16-340, -476
High Explosives Storage, Insensitive High Explosives, and Conventional High Explosives	930	TA-37-1 through -37
High Explosives Tech Ramps	2,790	TA-16-413, -332
Component Warehouse	280	

Total	10,655	
LANL 1995d.		

Small High Explosives Component Manufacturing. This facility manufactures small HE weapon components and test assemblies and conducts qualification and development testing for explosives components and materials. Various small components are manufactured in TAs-16-340, -430, -260, and -410 from HE powders and binders, metal or plastic components, electrical components, hardware, and assembly materials. The manufacturing process requires equipment for explosives powder heating, pellet pressing, laser welding, ultrasonic cleaning, extrusion loading, density testing, and mechanical assembly.

Inert Machining. Small components are manufactured in TA-16-370 and TA-3-39. Additional facilities at the central shop (TA-13-39) include full service, high precision metal manufacturing capability.

Synthesis (Technical Areas 9-45, -46) and Formulation (Technical Area 16-340). These facilities have the capability to produce a variety of explosives materials from chemical reactants or to formulate HE composites from commercially produced explosives. Material lots up to about 91 kg (200 lb) are produced through a series of batch operations. Some products are used to make small HE weapons components, while other products support the development of new explosives or explosives manufacturing processes. Blending capabilities for producing uniform blends up to 454 kg (1,000 lb) to minimize batch-to-batch variations are available at the TA-16-340 complex. The HE formulation and synthesis facility includes several flexible processing bays that contain a variety of vessels, filters, and transfer pumps which are used to synthesize, recrystallize, blend, and wash explosive powders. The facility also includes six bays for mixing/milling, particle size reduction (micronization), drying/weighing/packaging, solvent storage, and refrigerated storage for explosives and chemicals.

High Explosives Shipping and Storage. The HE shipping/receiving facility in TA-16-280 and TA-37-1 through TA-37-26 is designed to ship and receive bulk HE materials to and from the HE Fabrication Facility. These materials are typically received in 4,500 to 9,000 kg (10,000 to 20,000 lb) lots. Parts would be shipped out as needed in small lots to the A/D Facility.

High Explosives Disposal (Technical Area 16-389). LANL disposal facilities is in place and permitted by the State of New Mexico for disposal of HE waste and HE-contaminated materials. There is a large flash pad that thermally decontaminates items subject to trace HE contamination prior to burial. Two aboveground burning trays are used to destroy HE scrap and residue, and two sand filters are used to remove HE-contaminated water from sump sludge for drying and burning. One aboveground tray burns contaminated oil. An incinerator burns room trash from the HE area (potential contamination due to association only). All water is filtered to remove HE; treated with activated carbon for solvent removal; and measured for chemical oxygen demand, suspended solids, and acidity prior to release to the environment.

Explosives Testing and Characterization. HE testing and characterization cover a wide range of activities and processes and provide quality assurance data that can be used to certify a HE lot for production use or to provide test firing information to qualify small HE component lots for use in production assemblies. LANL has facilities, instrumentation, and test equipment to support the certification of HEs and HE components that would be used for production. These facilities can be

used for analytical chemistry evaluation, physical testing, nondestructive evaluation, materials compatibility testing, and firing sites for performance and safety evaluations of HEs and HE assemblies. The full complement of testing and characterization activities is used for surveillance evaluation of returned stockpile HEs.

Analytical Laboratory. Chemical analyses are performed in TA-9-21 on explosives and on explosives materials to determine or verify their characteristics. Analysis methods include gas chromatography, liquid chromatography, ion chromatography, size exclusion chromatography, infrared spectroscopy, thermal analysis, particle characterization, mass spectroscopy, atomic spectroscopy, and emission spectroscopy. Small-scale safety tests required for evaluation of HEs are conducted in this facility. Tests include drop weight impact, friction, electrostatic discharge, and thermal tests.

Material Compatibility Testing. Test coupons are assembled in TA-9-40, TA-9-21, and TA-9-42 so that the subject materials are in direct contact with each other. These coupons are then placed in environmental chambers to accelerate the aging process. Temperatures can be cycled between -55 °C (-67 °F) and +75 °C (+167 °F) in the chambers. Gas samples are periodically taken from the coupon containers and analyzed. Compatibility testing is required to certify new materials for weapon use and HE compatibility. Two large environmental chambers that can be used for cycling full scale weapons systems are located in TA-9-42.

Physical Properties Testing. The physical properties of explosives components and materials are tested in TA-16-340 and TA-9-37 to support lot certification for materials and components and to support production development. The test configurations are assembled, and tensile, torsion, and compression tests are conducted.

Nondestructive Evaluation. Explosives and nonexplosives components are inspected in TAs-8-22, -23, -70 and TA-16-260 with neutron, x-ray, magnetic particle, and eddy current equipment to detect flaws, cracks, voids, and foreign materials.

Test Firing. LANL assembles and detonates explosive test configurations in TA-15, TA-40, and TA-11-25. Tests require explosive containment chambers and an array of special instrumentation including streak cameras, rotating mirror framing cameras, an air image converter system, digital oscilloscopes, flash x-ray systems, and velocity interferometers. LANL conducts large-scale safety tests such as skid tests and spigots at the TA-11 drop tower facility. Vibration test capabilities are also located in this area and can be used for full scale weapons tests as well as components tests.

High Explosives Staging Areas and Corridors. In-process storage in TA-16 is required for a variety of HE powders, components, and assemblies for supporting the HE fabrication operations. These explosives materials include PBXs for main charge manufacturing, completed main charges, small HE components, energetic feed materials and products for HE formulation and synthesis, and explosives residues for disposal or recycle. Staging magazines exist in conjunction with each operational building. The staging magazines are connected with the operational buildings with enclosed corridors. These corridors are used for equipment and material transfers only. Major process buildings are not interconnected.

Resource Requirements During Construction/Modification/Transition. Since only minimal new equipment is needed at LANL, there are no facility construction or modification requirements to conduct the HE fabrication mission at LANL. LANL already has all the technologies needed to provide HE materials, component fabrication, characterization, surveillance, and quality assurance for the future nuclear weapons requirement. The capacity of LANL HE fabrication facilities exceeds

R&D mission requirements and can easily accommodate the required production load.

LANL has a full spectrum of HE research, development, fabrication, and test capabilities managed by the Dynamic Experimentation and Engineering Sciences and Applications Divisions. The existing facilities, equipment, and infrastructure would be used to satisfy future production requirements for the HE fabrication mission. The existing capabilities are used to manufacture prototype weapon components for full scale testing that provide the basis for production specifications. Additionally, LANL has demonstrated the capability to manufacture limited production quantities of HE components. Typically, LANL produces 1,200 to 1,500 HE parts per year for use in the weapons research development and testing programs, which include requirements for small production lots (~500) of HE components. These components are manufactured to strict quality assurance requirements and are used in complex hydrodynamic and NTS program requirements.

The equipment and processes used in the HE fabrication processes are very similar and in some cases identical to those used at Pantex for production. By using the same equipment and processing technologies, both LANL and Pantex manufacture parts by the same methods. The processes used by Pantex for HE component production would be used by LANL, except in rare cases where process and/or product improvements can be demonstrated to be cost effective and still meet production requirements. Transition of the HE fabrication processes from Pantex to LANL would require very little press development since equipment and processes are almost identical.

The transition period for transferring the HE fabrication mission to LANL is estimated to take 2 years after the ROD of this PEIS. HE main-charge components may exhibit dimensional instabilities (material creep) when stored for periods of time in excess of 6 to 8 months. Production scheduling plans for "just-in-time" manufacturing of HE components to be used in weapon assemblies. Additionally, extrudable HE used in weapons application, must be stored at -30 °C (-22 °F), and have a 24-hour room temperature working life before the materials cure and setup. The shelf life of the extrudables, when stored at -30 °C (-22 °F), is typically on the order of 6 to 8 months. Because of these concerns, it is not feasible to prebuild HE components during the transition period. It will be necessary for Pantex to remain operational for producing HE components until the receiver site becomes operational. For LANL, this transition period would require 2 years, with steady state operations beginning in fiscal year 1999.

Resource Requirements During Operations-High Explosives Fabrication Mission. HE operations are conducted within the existing LANL boundaries and occupy approximately 5,180 ha (12,800 acres). Table A.3.5.2-2 lists all the required facilities for HE fabrication operations at LANL and the footprint or area on the ground required for each facility.

General utilities and resource requirements including electric power, steam, natural gas, liquid fuels, and water would be supplied by existing LANL infrastructure. Capacity of the general utilities support is sufficient to meet the current requirements of the HE Fabrication Facility for R&D operations and an increase in capacity to meet production requirements is not needed. The utilities and resources consumed during operations include electric power, liquid fuels, natural gas, and water. Annual utility resource consumption rates and peak electric power rates for surge operation are estimated in table A.3.5.2-3.

Table A.3.5.2-3.-- Los Alamos National Laboratory High Explosives Fabrication Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 7
Electricity	5,600 MWh	1.0 MWe
Liquid fuel (L)	94,600	
Natural gas 8 (m^3)	3,650,000	
Coal (t)	0	
Water (L)	13,000,000	

LANL's HE fabrication processing facilities currently operate on a 4-day week, 10 hours per day, for 50 weeks per year. Maintenance personnel that support the HE processing equipment work a 5-day week, 8 hours per day. Routine and preventive maintenance is conducted on Fridays, as scheduling permits. Actual operational schedules will be dependent on workload and scheduling requirements.

Table A.3.5.2-4 provides the estimated number of additional direct operating and direct support personnel required at LANL to meet the HE fabrication requirements under base case surge (three shifts per day) operation. The DOE production control documents for the enduring stockpile systems would be used for planning and scheduling of the HE components needed to meet the production requirements. In addition, manpower estimates for manufacturing quality assurance parts and preparing surveillance samples for testing and evaluation have been included.

Table A.3.5.2-4.-- Los Alamos National Laboratory High Explosives Fabrication Surge Operation Workers

Labor Category	Number of Workers
Direct workers	35
Direct support workers	30
Operations support workers	40
Indirect support workers	95
Total	200 9

Chemicals Consumed During Operation. The chemicals consumed during all HE fabrication operations are shown in table A.3.5.2-5.

Emissions During Operations. The HE fabrication operations at LANL do not require radiological materials. Under normal operations, no workers could be exposed to radiation. Emissions during operation are listed in table A.3.5.2-6. Gaseous environmental releases would result from operation of the thermal treatment units (incinerator baseline) for bulk HE waste and nonradioactive HE-contaminated waste. Emissions would also result from plant boiler operation, cleaning operations

using solvents, and small scale synthesis operations, although the incremental amount of emissions over current operations would be very small. The thermal treatment units would be designed and operated to attain and maintain temperatures which would result in the destruction of hazardous constituents. Hazardous particulates would be trapped in filters. The releases would be limited to as low as achievable using the best available control technology.

Waste Management. Liquid and solid waste streams generated by the HE fabrication operations are processed to meet state, Federal, and DOE requirements for the various types of nonhazardous, hazardous, radioactive, and mixed wastes. LANL waste management facilities would be used to receive, track, characterize, treat, package, store, and ship wastes generated by HE plant operations. These facilities include a waste management operation, waste storage facility, sanitary wastewater treatment unit, and a sanitary and industrial landfill.

Table A.3.5.2-5.-- Los Alamos National Laboratory High Explosives Fabrication Surge Operation Annual Chemical Requirements

Chemical	**Quantity (kg)**	**Chemical**	**Quantity (kg)**
Acetone	2,722	Ethylene glycol	227
Acetonitrile	1,814	X-Ray film developer, fixer, and toners	227
Acid neutralizers/spill kits	272	HE powders	45,360
Adiprene polyurethane composition	45	Hydrochloric acid	45
Activated carbon	454	Hydraulic lube oils	2,268
Aluminum metal	454	Mild steel	454
Argon	907	Nitrogen	227
Carbon dioxide	227	Silicone elastomer	91
Cyanuric acid	454	Sodium hydroxide	227
Degreaser	45	Stainless steel	454
Desiccants/molecular sieves	136	Talc	454
Elastomer binders	227	Tetrahydrofuran	113
Ethanol	272	Toluene	680
Ethyl acetate	454	**Water chemicals**	91
LANL 1995b:4; LANL 1995d.			

Table A.3.5.2-6.-- Los Alamos National Laboratory High Explosives Fabrication Surge Operation Annual Emissions

Pollutant	Quantity (kg)
Criteria Pollutants	
Carbon monoxide	4,540
Nitrogen oxides	22,700
Particulate matter	227
Volatile organics	4,540
Hazardous and Other Toxic Compounds	
Ammonia	454
Acetonitrile	4.5
Cyclohexane	2.3
Dioxane	2.3
Hydrogen chloride	113
Hydrogen fluoride	45.4
Methyl ethyl ketone	22.7
Toluene	22.7
LANL 1995d.	

Nonhazardous wastes generated at the HE Fabrication Facility would primarily consist of solid sanitary waste, sludge from sanitary wastewater treatment, maintenance residues, and scrap parts. Materials unsuitable for recycle would be appropriately disposed of in an approved landfill. Liquid sanitary wastewater will be discharged to the environment after treatment, subject to the NPDES requirements.

Hazardous wastes generated by the HE Fabrication Facility would consist of solid residue from thermal treatment of scrap explosives and explosive-contaminated combustible materials, spent carbon from HE- and solvent-contaminated water treatment, and waste oils and paint residues from routine maintenance operations. LANL would stabilize all hazardous materials for disposal/treatment at an approved RCRA disposal site.

Low-level radioactive waste would only be generated from A/D operations involving depleted uranium parts, or from processing of surveillance materials or other HE charges returned from stockpile with slight contamination. There would be no radioactive wastes associated with HE fabrication. In all cases, compliance with all appropriate regulations and standards concerning all wastes, including mixed waste, would be met.

HE residual materials, such as bulk HE machining scrap, off-specification HE components, HE-contaminated materials (including gloves, wipes, and rags) and process water generated during HE

fabrication operations are the source of most of the waste material that must be processed. LANL uses waste minimization and recycle processes to reduce the amounts of material that ultimately must be subjected to waste treatment processes. Recycled scrap HE and HE-contaminated process water are not considered waste and are handled as in-plant operations.

Currently, thermal treatment of HE and HE-contaminated materials (open air burning and incinerators) are the preferred permitted techniques used to dispose of and decontaminate solid materials. LANL is looking at several alternative processes in the event state and Federal agencies do not approve permit applications. Some of these processes include base-hydrolysis decomposition of HE, followed by supercritical water oxidation, molten salt destruction, and bioremediation techniques. The open burning and incineration techniques at LANL are subject to environmental monitoring, and emissions must meet permit requirements.

HE-contaminated process water generated by synthesis and formulation processes, vacuum pump seal water, and HE machining processes, would be collected in tanks and then treated with activated carbon filters to remove residual HEs and solvents. The water would then be recycled or discharged to the environment subject to NPDES permit requirements. LANL collects sanitary wastewater in a separate system and routes it to septic tanks or sanitary waste water treatment facilities. Stormwater is collected separately, and a stormwater pollution prevention plan is in place.

The thermal treatment of HE scrap and HE-contaminated materials would result in emission of decomposition gases. Typical decomposition gases include carbon monoxide, oxide of nitrogen, volatile organics, hydrogen chloride, hydrogen fluoride, and ammonia. Small amounts of organic solvent vapors from materials such as toluene, acetone, methyl ethyl ketone, and ethyl acetate can also be generated during treatment processes as well as normal plant operations.

All LANL operations involving HE, including waste disposal, must comply with DOE/EV/106194 and meet explosives safety requirements. Buildings meet blast-resistant building construction standards and quantity distance criteria. Remote operations capabilities exist for disposal processes.

The HE fabrication process would generate the following waste and residual materials:

- Bulk HE machining scrap
- Off-specification HE components
- HE-contaminated materials, such as gloves and wipes, from manual cleaning operations
- Glycerin pressing fluid
- Developing materials from x-ray and n-ray film processing
- Hazardous contaminated materials from chemical bonding operations, packaging/repackaging, storing/staging, and shipping for ultimate disposal.

Several facilities exist within LANL's waste management infrastructure that process the plant non-HE wastes. These facilities are used to receive, track, characterize, treat, package, store, and ship wastes generated by HE fabrication operations. Included are a waste storage facility, a sanitary wastewater treatment unit, a sanitary and industrial landfill, and stormwater ponds. Hazardous waste that has been HE decontaminated would be handled through the LANL waste management operations at TA-54. The increased loading on the LANL infrastructure which handles these types of wastes would be minimal, requiring no additional capacity or facilities. The radioactive wastes, mixed wastes, hazardous wastes, and nonhazardous wastes generated during the surge operations are quantified in table A.3.5.2-7.

Transportation. All intrasite transportation required for manufacturing is done within existing site boundaries and does not require use of public roads. Appropriate HE shipping regulations as defined by DOE and DOT are followed.

The HE shipping and receiving facility is designed to ship and receive bulk HE materials to and from the HE Fabrication Facility. These materials are typically received in 4,500 to 9,000 kg (10,000 to 20,000 lb) lots. All completed charges are shipped following appropriate HE shipping regulations. All hazardous chemicals are shipped using appropriate DOT requirements.

Table A.3.5.2-7.-- Los Alamos National Laboratory High Explosives Fabrication Waste Volumes

Category	Annual Average Volume Generated from Construction (m3)	Annual Volume Generated from Surge Operations (m3)	Annual Volume Effluent from Surge Operations (m3)
Low-Level			
Liquid	None	None	None
Solid	None	Minimal	Minimal
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	None	4 10	4
Solid	None	13	13
Nonhazardous (Sanitary)			
Liquid	None	5,900	5,880 11
Solid	None	Included in liquid	17
Nonhazardous (Other)			
Liquid	None	6,930 12	6,930
Solid	None	28	• 28

A.3.5.3 Relocate to Lawrence Livermore National Laboratory

LLNL maintains self-contained HE RD&T, and fabrication capabilities at the remote explosives testing area, Site 300, and at the HE Applications Facility at the Livermore Site. LLNL has the

facilities, equipment, and infrastructure to satisfy the current production requirements for the HE fabrication mission for all weapon systems in the enduring stockpile. The health and safety, materials management, and materials characterization (nondestructive examination, test fire, and chemical analysis) infrastructures are already in place and available to support the production function as well as the R&D function. No significant HE Applications Facility or Site 300 upgrades are anticipated to receive the mission for HE fabrication in the Complex. No deviations from the current baseline technologies at Pantex are anticipated.

Site 300 is dedicated to all aspects of HE RD&T and is remotely situated on 2,800 ha (7,000 acres) in California's Central Valley, 24 km (15 mi) east of the Livermore Site (figure A.3.5.3-1). Large-scale synthesis, formulation, and test firing is done at Site 300. The HE Applications Facility staff administers the technical work from the Livermore Site. Small-scale process development/prove-in would be done in the HE Applications Facility. The HE Applications Facility meets or exceeds all the applicable ES&H requirements for explosives R&D and production support. Synthesis and formulation would be performed in this building and would be locally supported by the theory and modeling efforts in the HE Applications Facility. A full spectrum of other HE activities take place at this facility, ranging from detonator development to experiments involving 10-kg (22-lb) detonations.

Table A.3.5.3-1.-- Lawrence Livermore National Laboratory High Explosives Fabrication Products and Capabilities

Products	Capabilities
High Explosives	*Manufacturing Process Development*
	Support stockpile stewardship
	Formulation
	Synthesis
	Surveillance
	Main charge manufacturing
Binders	Pressing
	Machining
	Subassembly
	Receiving/storage
	Quality assurance-mechanical/chemical/test fire
	Disposition
Main Charge Formulations	*Energetic Component Manufacturing*
	Pressing
	Machining
	Subassembly
	Quality assurance-mechanical/chemical/test fire
Initiation High Explosives	*Detonators*

Mock High Explosives Formulations	*Testing*
LLNL 1995j.	

No significant upgrades to the HE Applications Facility would be required. Larger-scale work at Site 300 is done in parallel with the HE Applications Facility's small-scale process development. Both sites are fully self-contained installations. Site 300's synthesis and formulation complex provides the capability to conduct both remote and contact HE operations in facilities that meet current DOE design levels of environment, safety, and health protection criteria, as well as the current regulatory requirements of applicable Government agencies. LLNL would assume responsibility for providing all HE feedstock, main charge and component procurement, and fabrication as required by the production mission. The products and capabilities for which LLNL would be responsible are shown in table A.3.5.3-1.

Assumptions. The specific assumptions for the HE fabrication mission at LLNL are as follows:

- All production operations can be housed within existing buildings with one exception: modifications would be undertaken only when necessary or where it could be shown to be cost-effective. Modifications include moving, adding or subtracting walls, relocating existing equipment, purchasing new equipment and all associated costs.
- DOE R&D funding for present HE activities would continue at the current level in fiscal year 1995 dollars, adjusted for inflation. This includes mutually dependent R&D missions and interfacing activities. The Work for Others category of activities in energetic materials would remain at least at constant fiscal year 1995 levels and would likely increase.
- Baseline technologies would be employed except where alternatives could be shown to meet requirements and be more cost effective (i.e., faster, better, and/or cheaper). Technical shortfalls identified in the current baseline technology would be addressed with alternative technology.
- The LLNL health and safety structure is adequate to support production needs. Additional staff would be added, if required.
- The LLNL materials management infrastructure could fulfill all material, control, and accountability plus shipping and receiving requirements for the production operation. Additional staff would be added, if required.
- The LLNL waste management infrastructure is adequate to deal with any new or additional waste streams. Additional staff would be added, if required.
- LLNL has adequate safeguards and security infrastructure to deal with the production mission. Additional staff would be added, if required.
- LLNL would not store excessive quantities of conventional HE or insensitive HE. In certain cases, there would be room to expand existing storage capacities by moderate amounts, as necessary, to accommodate production throughput requirements.
- A separate management structure, capable of implementing the production operation and fulfilling all quality assurance and certification requirements, would be put in place if LLNL is selected for the HE production mission.
- A site-specific EIS would most likely not be needed to fulfill NEPA requirements for the overall production mission. The need for further NEPA documents would be assessed, as appropriate.
- The first production unit for new HE production would be October 1, 1998.
- A 27-month period, commencing July 1, 1996, would be an adequate transition time with the only exception being Pantex D&D overhead costs and safe shutdown costs.

- Dismantlement schedules would not affect first production unit for HE production.

Transition of High Explosives Fabrication Mission to Lawrence Livermore National Laboratory. LLNL maintains a full-spectrum HE RD&T and fabrication capability. The energetic materials program is conducted at Site 300 and in the HE Applications Facility at the Livermore Site. LLNL has maintained the ability to fabricate sizable numbers of HE components on an annual as-needed basis in support of the nuclear test schedule and in support of DOD projects and missions. Assumption of the production and fabrication of HE components and materials mission would be a readily accommodated incremental increase to the workload currently supported by the HE technology at LLNL.

Small-scale process development/prove-in would be done at the HE Applications Facility, which meets or exceeds all applicable ES&H requirements for explosives R&D and production support. Synthesis and formulation would be performed in this building. The full spectrum of other HE-required activities takes place here, ranging from detonator development to experiments involving 10-kg (22-lb) detonations. No significant upgrades to the HE Applications Facility would be required.

Large-scale synthesis and formulation is currently done at Site 300. The HE Applications Facility staff administers the technical work performed at Site 300 to ensure full program synergy. Thus the larger scale work at Site 300 is done in parallel with the HE Applications Facility's small-scale process development. It is not necessary to ship significant quantities of HE (>10 g) between the locations: Site 300, like the HE Applications Facility, is a fully self-contained installation. There are no public roads at the site, and population encroachment is not an issue. LLNL would be able to perform synthesis and formulation manufacturing of required energetic materials and main charge fabrication at Site 300 for the foreseeable future. Site 300 facilities contain the necessary equipment for fabrication work. Specialized equipment needed for R&D of new processes and of the next generation of explosives, which may be required by the enduring stockpile, are currently available at Site 300. For example, three deaerator loaders for injection loading of explosives that range in capacity from 50 g to 23 kg (1 ounce to 50 lb) are fully operational.

Both the HE Applications Facility and the synthesis, formulation, and production area at Site 300 have local analytical capability. To enhance capabilities in a cost-effective fashion, the HE program also extensively utilizes LLNL's main analytical laboratories. The Site 300 synthesis and formulation complex is located near the associated HE activities (e.g., the processing area, the engineering area, the radiography laboratory, the environmental test facilities, and the hydrodynamic test bunkers). LLNL analytical capabilities are such that no problems are anticipated in developing the appropriate characterization infrastructure to support the new mission. Test fire capabilities at many levels of charge size exist at Site 300 and in the HE Applications Facility.

LLNL synthesis and formulation staff with present facilities can produce plastic bonded explosives fabrication levels of 450 kg/week (1,000 lb/week) which would be sufficient to meet anticipated production requirements. There would be no facility capacity restrictions for the envisioned material quantities.

The LLNL waste minimization program has reduced the waste associated with HE manufacturing. The HE fabrication mission quantities would involve levels of HE waste generation that are well within disposal capability limits and NEPA/CEQ requirements.

Facility Description. The facility at LLNL would consist of a fabrication facility consisting of one main functional area; HE technology with four main functions: HE main-charge fabrication, small HE formulation and synthesis; and HE testing and characterization. LLNL has the facility infrastructure shown in table A.3.5.3-2 available to support the HE fabrication mission.

Table A.3.5.3-2.-- Lawrence Livermore National Laboratory High Explosives Fabrication Facility Infrastructure

23 buildings (Site 300 and Livermore Site)
66 magazines (200,000 lb limit)
Working space (68,000 ft2)
Waste tanks for all buildings
Backup power for all buildings and equipment
Independent boilers for all buildings
Independent compressors for all buildings
Air exchange cycle rate of 4 per hour per laboratory
Facilities meet all DOE explosives safety requirements
Operations are fully permitted
Open burning for disposal of minimized HE waste permitted
LLNL 1995j.

In addition to the facilities listed in table A.3.5.3-3 that are to be used directly in support of HE fabrication, 11,000 m *2* (119,000 ft *2*) of other support facilities at Site 300 and at the Livermore Site would be available for support of HE fabrication efforts. There are also 8,600 m *2* (92,935 ft *2*) of support facilities at Site 300 and at the Livermore Site. The nondestructive evaluation, chemical analysis, or characterization areas that directly support the HE effort are critically important support facilities for other LLNL missions and would remain whether or not HE fabrication is carried out as a LLNL mission.

Design Safety. The following sections identify important safety considerations incorporated in the design of DOE facilities. Performance goals commensurate with the associated hazard are selected for all structures, systems, and components. The term "hazard" is defined as a source of danger, whether external or internal. Natural phenomena such as earthquakes, extreme winds, tornadoes, and floods are external hazards to structures, systems, and components; whereas, toxic, reactive, explosive, or radioactive materials contained within the facilities are internal hazards. The usage category is established by DOE management.

Earthquake. All existing HE plant structures at Site 300 meet all current applicable standards. New plant structures, systems, and components, when required, shall be designed for earthquake-generated ground accelerations in accordance with *Design and Evaluation Guidelines for DOE Facilities Subjected to Natural Phenomena Hazards* (UCRL-15910), with applicable seismic hazard exceedance probabilities of 2x10 *-3* for general use (performance category 1), 1x10 *-3* for low and moderate hazard (performance categories 2 and 3), and 2x10 *-4* for high hazard (performance

category 4) structures, systems, and components.

Wind. All existing HE plant structures at Site 300 meet the wind criteria as discussed below. All new plant structures, systems, and components would be designed for wind or tornado load criteria when required in accordance with UCRL-15910 and the corresponding facility usage and performance goals. Wind loads shall be based on the annual probabilities of exceedance of 2x10 *-2* for the general and low hazard (performance category 1 and 2), 1x10 *-3* for the moderate hazard (performance category 3), and 1x10 *-4* for the high hazard (performance category 4) structures, systems, and components. Wind design criteria is based on annual probability of exceedance, importance factor, missile criteria, and atmospheric pressure change as applicable to each performance (usage) category as specified in UCRL-15910.

Floods. All HE facilities and buildings at Site 300 are located above the critical flood elevation from the potential flood source (river, dam, levee, and precipitation). The extent of the flood hazard is determined, using the appropriate usage (performance) category for determining the Annual Hazard Probability of Exceedance: 2x10 *-3* for general use (performance category 1), 5x10 *-4* for important or low hazard (performance category 2), 1x10 *-4* for moderate hazard (performance category 3), and 1x10 *-5* for high hazard (performance category 4) facilities as defined in UCRL-15910.

The critical flood elevation is determined by obtaining the appropriate design basics flood level. The design basics flood level is the peak hazard level (flow rate and depth of water) corresponding to the mean Annual Hazard Probability of Exceedance or combinations of flood hazards (river flooding and wind-wave action), and corresponding loads associated with peak hazard level and applicable load combinations (hydrostatic and/or hydrodynamic forces and debris loads). LLNL site drainage conforms to the governing local agency regulations. The minimum design level for the stormwater management system is the 25-year 6-hour storm, but potential effects of larger storms up to the 100-year 6-hour storm are also considered.

Fire Protection. The fire protection features for the existing plant and its associated support buildings are in accordance with DOE orders and the National Fire Protection Association Fire Codes and Standards. A fire hazards analysis would be performed to assess the risk from fire to the HE Fabrication Facility within the individual fire areas of the facility. All fire sprinkler water that has been discharged during and after a fire would be contained, monitored, sampled and, if required, retained until it could be disposed.

Safety Class Instrumentation and Control. The safety classification of instrumentation and controls is derived from the safety functions each performs. This safety classification is based on appropriate DOE orders. HE facilities at Site 300 that utilize instrumentation for explosives operations currently meet safety class requirements.

Ventilation. The heating ventilation and air conditioning system provides environmental conditions for the health and comfort of personnel and for equipment protection.

Internal Explosion. New and existing buildings are designed for the effects of accidental explosions within a bay or cell. The design is in accordance with DOE/EV/06194, including the quantity-distance and the level-of-protection criteria for each class of explosives activities. Additional resource documents for the siting and design of explosives facilities listed in the above-referenced manual are utilized to provide a safe design where applicable.

Safeguards and Security System Description. Site 300 is surrounded by multiple fences for security.

Although not indicated on the plot plan, there are two security access areas within which various components of the HE Fabrication Facility are located: the limited area and the property protection area. The property protection area surrounds the limited area. Main-charge pressing, machining, and inspection; HE and conventional explosives shipping and receiving; and explosives storage would be performed within a limited area. Synthesis and formulation and test firing would also be performed within a limited area. Most other support facilities would be in a property protection area. All security access areas meet DOE safeguards and securities standards for the proscribed activities associated with HE main-charge fabrication and associated activities for nuclear weapons applications.

Table A.3.5.3-3.-- Lawrence Livermore National Laboratory High Explosives Fabrication Facility Data

Facility Function	**Building 13**	**Construction Type**	**Footprint (m2)**	**Number of Levels**	**Special Materials**	**Access Area**
Main Charge Fabrication						LA
Pressing		Concrete		1	HE	
Machining	817		300			
	806		600			
	809		150			
Subassembly						
Physical prop	810		500			
	HEAF		66			
Small High Explosives Components	HEAF	Concrete	30	1	HE	LA
	826		160			
Main Charge Test Fire	851	Concrete	1,000	1	HE	LA
High Explosives Formulation and Synthesis	826		160			LA
	827A		155			
	827C		168			
	827D		168			
	827E		168			
Conventional High Explosives Storage	New	Concrete	116	1	HE	LA
Explosives Storage	854J	Concrete	500	1	HE	LA
Explosives Shipping, Receiving, and Inspection	805	Concrete	636	1	HE	LA

High Explosives Test Firing and Characterization	HEAF	Concrete	28	2	HE	LA
	222		28	1	non-HE	LA
	235		28	2	non-HE	LA
	241		9	2	non-HE	PPA
Nondestructive Evaluation	823	Steel	255	1	HE	LA
Metrology	806 (room 105)	Concrete	90	1	HE	LA

Table A.3.5.3-4.-- Lawrence Livermore National Laboratory Support Facilities Description

Facility Name	Building	Construction Type	Footprint (m2)	Number of Levels	Special Materials	Access Area
Central shipping and receiving warehouse	875	Steel	1,380	2	None	PPA
Effluent monitoring/ meteorological tower						PPA
Facility maintenance shops	873	Steel	1,400	2	None	PPA
Vehicle maintenance facility	879	Steel	255	1	None	PPA
Fire station and security	870 and 882	Steel	557	1	None	PPA/LA
Medical center	877	Steel	310	1	None	PPA
Administration	871	Steel	930	1	None	PPA
Change house/laundry	813	Steel	262	1	None	PPA
Cafeteria	880	Steel	218	1	None	PPA
ES&H lab	222					LA
Helicopter pad						PPA
Storage yard			1,860			PPA
Parking						PPA

LA - limited area; PPA - property protection area.

LLNL 1995j.

Table A.3.5.3-5.-- Lawrence Livermore National Laboratory Support Function Facilities Description

Facility Name	Building	Construction Type	Footprint (m2)	Special Materials	Access Area
Plant Utilities					
Utility building	All located in General Services Area	Steel	670	None	PPA
Water storage tanks			76		PPA
Raw water supply			186		PPA
Plant water treatment			427		PPA
Tower cooling water facility			560		PPA
Firewater storage tank and pumphouse			370		PPA
Switchyard			186		PPA
Emergency generator		Steel	130	None	PPA
Diesel fuel storage			93		PPA
Nitrogen tanks			200		PPA
Waste Management		Concrete		HE	
Explosives waste management, handling, storage, and treatment	816, M1 through M5		96		PPA
			129		
			827		
Sanitary wastewater treatment	845		4,645	non-HE	PPA
PPA - property protection area. **LLNL 1995j.**					

Overall Facility Layouts and Design Descriptions. The HE fabrication facilities are described in tables A.3.5.3-3, A.3.5.3-4, and A.3.5.3-5, which summarize facility data for buildings and support areas including the structure footprint area, construction material, and the security area. Structures containing explosives are generally constructed from steel-reinforced concrete and are designed to mitigate the efforts of a potential accidental explosion. Although insensitive HE materials can generally be processed in conventional steel structures, concrete construction is typically used in current facilities to maintain the flexibility to process conventional explosives. The resulting facility design typically consists of a number of separate operating bays that could vent to an unoccupied area should a detonation occur. This is true for existing buildings which meet current and anticipated explosives safety requirements. Structures that do not require concrete construction due to the

presence of HE are generally constructed of steel, although portions of these buildings may be concrete. One-half of Building 875 would be used for inert storage for this mission.

High Explosives Main-Charge Manufacturing. These buildings compose the facility that fabricates main-charge hemispheres, mock main-charge hemispheres, and explosive test specimens. The various functional areas are described below:

Isostatic Pressing. Rough pressings for HE main-charge hemispheres and material test billets would be fabricated in Buildings 817A, B, C, D, E, and F, which are moderate hazard (performance category 2) facilities.

Explosives Machining. The rough pressings are machined into hemispherical shapes or test elements in Buildings 806 and 809.

High Explosives Main-Charge Subassembly. The explosive hemisphere assembly would be done in Buildings 810A and 810B.

High Explosives Shipping and Receiving. Building 805 is designed to ship, receive, and inspect HE bulk and parts (both conventional and insensitive HE).

High Explosives Storage. Building 854J comprises 378 m *2* (4,068 ft *2*) and has more than adequate space available for bulk and parts storage and staging.

Conventional High Explosives Storage. A facility would be constructed at the HE storage area near M30 and M34. This 116-m *2* (1,250-ft *2*) facility would have a 11,350-kg (25,000-lb) conventional HE bulk and parts storage and staging capacity.

Small High Explosives Component Fabrication. This activity fabricates small HE weapon components and test assemblies. Various small components are fabricated from HE powders and binders, metal or plastic components, electrical components, hardware, and assembly materials. The fabrication process requires equipment for explosive powder heating, pellet pressing, laser welding, ultrasonic cleaning, extrusion loading, density testing, and mechanical assembly. Functions are described below.

Pellet Pressing. Small pellets are pressed to density specifications for small energetic component assemblies in Building 191 (HE Applications Facility).

Extrusion Loading. Extrudable (paste) explosive is loaded onto small fixtures for small component assemblies in Building 826.

Small Component Assembly. Small HE pellets and/or fixtures containing extrudable paste explosive are assembled with inert parts to make small components in Building 810A.

High Explosives Formulation and Synthesis. This activity has the capability to produce a variety of explosive materials from chemical reactants and commercially produced explosives.

High Explosives Formulation. For purposes of this analysis, material lots up to about 90 kg (200 lb) are assumed to be produced through a series of batch operations in Buildings 826 and 827C, D, and E. Some products are used to make small HE weapon components while other products support the development of new explosives or explosives fabrication processes.

High Explosives Synthesis. Buildings 827C, D, and E contain a variety of vessels, filters, and transfer pumps which are used to synthesize, recrystallize, blend, and wash explosive powders. The facility also includes bays for mixing/milling, particle-size reduction, drying/weighing/packaging, solvent storage, and refrigerated storage for explosives and chemicals.

High Explosives Testing and Characterization. Explosives test configurations are assembled and detonated. The test data characterizes the explosives performance and are required for the qualification of raw materials and production lots. Testing requires explosives containment chambers and an array of special instrumentation, including streak cameras, rotating mirror framing cameras, an air image converter system, oscilloscopes and digitizers, flash x-ray systems, and velocity interferometers.

High Explosives Test Firing. Energetic materials components are test fired at the HE Applications Facility, Building 191, at the Livermore Site. This facility has a considerable gas gun capability with 10-kg (22-lb) (trinitrotoluene [TNT]-equivalent) rated contained-firing tank. This facility has a total of six contained firing chambers which range in HE capacity from a few grams to 10 kg (22 lb) (TNT-equivalent).

The remote firing facility, Building 851 at Site 300, is remotely located from HE fabrication operations and includes an outdoor firing capability to conduct large-scale explosives tests that cannot be performed in a test chamber, such as main charges for explosives lot certification.

Nondestructive Evaluation. Building 823 is an area where explosive and inert components are inspected with radiography equipment to detect flaws, cracks, and voids.

Mechanical Properties Testing. The mechanical properties of explosive components and materials are tested in Building 191 (Livermore Site) to support lot certification for materials and components and to support fabrication development. The test configurations are assembled, and tensile and compressive tests are conducted.

Analytical and Materials Characterization Laboratories. Chemical analyses are performed on explosive and nonexplosive materials in Buildings 191, 222, 235, and 241 (Livermore Site) to determine or verify their characteristics. The data obtained yield valuable information about the condition and composition of the material. The methods used include gas chromatography, liquid chromatography, size exclusion chromatography, infrared spectroscopy (Building 222), particle characterization (Building 241), atomic spectroscopy, emission spectroscopy (Building 235), and thermal analysis (Building 191).

Material Compatibility Testing. Test coupons are assembled such that the subject materials are in direct contact with each other in Building 810A. These coupons are then placed in environmental ovens to accelerate the aging process. Gas samples are periodically taken from the coupon containers and analyzed. Compatibility testing is required to certify new materials for weapon use.

Process Support Systems. Process support for the HE fabrication operation includes a machine shop and ES&H laboratory, as well as other plant general services facilities. These facilities directly support the HE fabrication mission, as well as existing, ongoing missions such as RD&T and other activities at LLNL.

Resource Requirements During Construction. All HE fabrication operations can be housed within

existing buildings except for the conventional HE storage building. This building would have 11,350 kg (25,000 lb) conventional HE bulk and parts storage capacity and a 116 m2 (1,250 ft2) staging capacity. The total construction requirements for materials and utilities are shown in table A.3.5.3-6. Peak construction year emissions and construction worker requirements are shown in tables A.3.5.3-7 and A.3.5.3-8, respectively.

Table A.3.5.3-6.-- Lawrence Livermore National Laboratory High Explosives Fabrication Construction Materials/Resources Requirements

Material/Resource	Total Consumption 14	Peak Demand
Electricity (MWe)	15MWh	0.2 MWe
Water (L)	1,230,000	
Concrete (m3)	190	
Steel (t)	15	
Liquid fuel, and lube oil (L)	9,500	
Industrial gases 15 (m3)	3	

Table A.3.5.3-7.-- Lawrence Livermore National Laboratory High Explosives Fabrication Construction Emissions

Pollutant	Quantity (kg)
Carbon monoxide	7.3
Oxides of nitrogen	2.7
Particulate matter	0.9
Sulfur dioxide	0.23
Volatile organic compounds	1.4
LLNL 1995i:3; LLNL 1995j.	

Table A.3.5.3-8.-- Lawrence Livermore National Laboratory High Explosives Fabrication Construction Workers

Employees	Year 1
Craftworkers	

Carpenter	3
Concrete mason	1
Electrician	1
Iron worker	1
Laborer	1
Millwright	1
Operator	1
Other craftworkers	1
Pipe fitter	1
Sheet metal worker	1
Sprinkler fitter	1
Teamster	1
Construction management and support staff	5
Total Employment	19
LLNL 1995i:3; LLNL 1995j.	

Table A.3.5.3-9.-- Lawrence Livermore National Laboratory High Explosives Fabrication Surge Operation Annual Utility Requirements

Utility	Consumption	Peak Demand 16
Electricity	4,300 MWh	1 MWe
Liquid fuel (L)	53,100	
Natural gas 17 (m^3)	None	
Water (L)	58,200,000	

Table A.3.5.3-10.-- Lawrence Livermore National Laboratory High Explosives Fabrication Surge Operation Workers

Labor Category	Number of Employees
Direct workers	52.5
Direct support workers	42
Operations support workers	17
Facilities support workers	8.9

Indirect support workers	112
Total	232 18

Resource Requirements During -High Explosive Fabrication Mission. Table A.3.5.3-3 lists all the required facilities for HE fabrication operations at LLNL and the footprint or area on the ground required for each facility. Requirements to operate the LLNL HE fabrication facilities are shown in tables A.3.5.3-9, A.3.5.3-10, and A.3.5.3-11. The HE Fabrication Facility is located on approximately 2,800 ha (7,000 acres) of land at Site 300. The additional utilities and fuel required for conducting the HE fabrication mission at LLNL are shown in table A.3.5.3-9.

The facility operations required to meet the HE fabrication mission at LLNL are based on a single shift per day, 50 weeks per year, 40 hours per week, for 250 days of operational time annually. Maintenance time and scheduling for manufacturing operations would be based on equipment and facility-specific requirements and, as such, routine maintenance would be performed as needed and scheduled such that there is minimal impact to operation schedules by correlating equipment maintenance with maintenance schedules for plant activities.

The number of workers required at LLNL to accomplish the HE fabrication mission at LLNL are shown in table A.3.5.3-10.

Chemicals Consumed During Operations. The chemicals consumed during all HE fabrication operations at LLNL are shown in table A.3.5.3-11. The HE fabrication operations do not require radiological materials and no workers would be exposed to radiation under normal operations.

Emissions During Operations. The additional emissions that would result from accomplishing the HE fabrication mission are shown in table A.3.5.3-12.

Table A.3.5.3-11.-- Lawrence Livermore National Laboratory High Explosives Fabrication Surge Operation Annual Chemical Requirements

Chemical	Quantity (kg)	Chemical	Quantity (kg)
Acetone	227	Helium	45
Acetonitrile	91	Heptane	45
Activated charcoal	45	Hydraulic/lubricating oil	908
Adiprene polyurethane composition	45	Hydrochloric acid	68
Aluminum metal	454	Joint compound	45
Ammonia	454	Kimwipes	908
Aqueous film forming foam	91	Micro liquid lab cleaner	5
Circlene Fg 20	91	Mild steel metal	454
CLEPOX 143	91	Molecular sieve	45
Copper/CuO wire	9	Neutrasorb acid neutralizer	45

Copper metal	23	Nitrogen	227
Cyanuric acid	45	Paint	454
Degreaser	5	PLANISOL-M concentrate	23
Desiccants	91	Polyalkylene and ethylene glycol	14
Dispersant	23	Potassium hydroxide	45
Dry air	136	Silicone elastomer	91
DUST-OFF	23	Siliconized ammonium phosphate base	5
ECO-STAR	23	Sodium hydroxide	45
Electrode/probe solutions	23	Solksorb solvent absorbent	227
Ethyl alcohol	91	Sulfuric acid	23
Ethyl acetate	136	TALC	5
Fixer and replenisher	91	Tetrahydrofuran	227
Glass cleaner	45	TISAB with CDTA	14
Glass beads	145	Toluene	227
Glycerine	68	Toner	23
HE powders, insensitive	54,432	Trichlorotrinitobenzene	23
HE powders, conventional	18,144	Water treating chemicals	91
LLNL 1995i:3; LLNL 1995j.			

Waste Management. The liquid and solid waste streams generated by the HE fabrication mission would be processed to meet Federal, state, and DOE requirements for the various types of nonhazardous, hazardous, and radioactive wastes. Waste management facilities and assets would be used to receive, track, characterize, treat, package, store, and ship wastes generated by HE fabrication. Facilities would include a waste management operation, waste storage facility, sanitary wastewater treatment unit, and a sanitary and industrial landfill.

Nonhazardous waste generated at the HE Fabrication Facility would consist primarily of solid sanitary waste, sludge from sanitary wastewater treatment, maintenance residues, and scrap parts. Materials unsuitable for recycling would be disposed of appropriately. Liquid sanitary wastes would be collected by independent underground septic tanks at HE fabrication buildings and by sewer pipe systems from most of the support buildings in the General Services Administration area and routed to the domestic sewage lagoon for evaporation and percolation. Excess water would be discharged to a natural drainage channel. Sewage sludge would be disposed of in offsite sanitary and industrial landfills. Process wastewater would be sent to holding tanks for treatment and recycling, where appropriate. Stormwater from all areas of Site 300 would go into natural drainage channels. Nonhazardous rinsewater from HE formulation and machining operations is discharged to a surface impoundment for evaporation.

Table A.3.5.3-12.-- Lawrence Livermore National Laboratory Incremental Annual Emissions During Operations

Pollutant	Quantity (kg)
Criteria Pollutant	
Carbon monoxide	1,315
Nitrogen oxides	349
Ozone (as VOC)	45
Particulate matter	27
Sulfur dioxide	24
Hazardous and Other Toxic Compounds	
Ammonia	4.5
Acetonitrile	14
Bisphenol alpha epichlorohydrin	0.5
Benzene	0.2
Chloroform	0.5
Cresylic acid	0
Cyclohexane	0.5
Dibutyl phthalate	0.05
1,2-Dichloroethane	0.9
Dimethyl formamide	0.5
Dioxane	0.5
Ferric ferrocyanide	0
Hexane	0.5
Hydrogen chloride	11.3
Hydrogen fluoride	22.7
Hydrogen sulfide	0.2
Mercury	0
Methanol	4.5
Methyl ethyl ketone	22.7
n-Butyl glycidyl ether	0.2
Propylglycol methyl ether	0.5
Toluene	2.3
Trichloroethylene	0.2

Triethylamine	0.2
2,2,4-Trimethyl-1, 3-pentane-diol isobutyrate	0.5
Xylene	2.3
LLNL 1995i:3; LLNL 1995j.	

Hazardous wastes generated by the HE fabrication mission would consist of solid residue from thermal treatment (open burning) of scrap explosives and explosives-contaminated combustible materials. This residue and other hazardous wastes, such as waste oils and paint residues, would be properly packaged and managed for offsite treatment and disposal at RCRA-permitted facilities.

HE residual materials such as bulk HE machining scrap and off-specification HE components and HE-contaminated materials, including gloves, wipes, rags, and process water generated during HE fabrication operations, would be the source of most of the waste material that would be processed. Waste minimization and recycle processes would be used to reduce the amounts of material that ultimately must be subjected to waste treatment processes. Scrap HE and HE-contaminated process water that are recycled are not considered waste and would be handled as in plant operations.

Currently, thermal treatment of HE and HE-contaminated materials (open air burning) is the preferred permitted technique used to dispose of and decontaminate solid materials. Next generation, more environmentally benign destruction technologies are being developed and would be incorporated when available and appropriate.

HE-contaminated process water generated by synthesis and formulation processes, and vacuum pump seal water would be collected in tanks and analyzed for appropriate waste classification and then disposed of as appropriate. Water from HE machine processes would be filtered through a weir and clarifier system and then discharged to holding ponds. Sanitary wastewater would be collected in a separate system and routed to septic tanks or sanitary wastewater treatment facilities. Stormwater would go into natural drainage channels at Site 300.

The utilities required for operation of waste treatment functions associated with the HE fabrication processes would include water, electric power, liquid fuels, steam, compressed air, and propane gas. These utilities are also used in normal HE plant operations and would not pose any significant increase in consumption nor any unique requirements.

The wastes and emissions generated during HE fabrication waste treatment operations would include gaseous decomposition products of combustible materials, hazardous solid waste, and nonhazardous solid and liquid wastes. Hazardous wastes consisting of solid residue (ash) from the thermal treatment process would be characterized, packaged, and sent to an approved RCRA-permitted disposal site. Nonhazardous wastes generated by HE fabrication would consist of solid sanitary waste, sludge from sanitary wastewater treatment, and other noncombustible parts. Materials that cannot be recycled would be sent to an approved landfill.

All operations involving HE must comply with DOE/EV.106194 and meet explosives safety requirements. Buildings must meet blast-resistant building construction standards and quantity-distance criteria. A capability for remote operations would also be necessary for disposal processes. The design would incorporate spill-prevention control and countermeasure elements.

The Livermore Site and Site 300 waste management facilities to support the HE fabrication mission

include:

- The waste management facility, which provides space and equipment for receiving, tracking, packaging/repackaging, and shipping of solid and liquid wastes. Areas are segregated by waste type. Operating areas are provided for waste staging and container storage.
- The waste storage facility, which stores hazardous waste for up to 1 year of operation prior to offsite treatment/disposal. An explosive waste storage facility is currently being constructed and permitted to manage explosive wastes. Storage and staging areas are segregated by waste type. Equipment and design features are provided for handling drums, controlling spills, and monitoring.
- The open burn facility, which treats scrap explosives and explosive-contaminated combustible material. Plans and permits are being pursued for a new open burn and open detonation facility to treat high explosives.
- The Livermore Site, which has the ability to handle and store mixed and LLW wastes, and the HE Fabrication Facility would have the ability to handle these types of wastes if required.
- The HE fabrication facilities, all of which have a septic tank system. Industrial wastewater would be placed in holding tanks for chemical analysis to determine proper disposal method. Nonhazardous HE rinsewater is disposed of onsite in a permitted surface impoundment. Other liquid industrial wastes are shipped offsite for disposal.

Table A.3.5.3-13 lists the incremental quantities of the types of wastes that would be generated at LLNL to accomplish the HE fabrication mission.

Transportation. Transportation requirements exist at both the Livermore Site and Site 300 (intrasite) and between the HE Fabrication Facility and the A/D site (intersite).

Intrasite Transportation. Transportation of products within the HE Fabrication Facility would be performed by LLNL transportation, meeting all applicable DOT and DOE criteria for transportation of the energetic materials. Transportation of classified products within the HE Fabrication Facility would be performed by LLNL transportation which meets DOE safeguards and security criteria for transporting classified products. Subsequent movements of HE and explosive products would be performed by vehicles specifically designed for this purpose. The quantity of HE (conventional and insensitive) transported onsite by these trucks would be strictly limited. HE products would be transported by appropriate vehicle to an HE staging area for eventual recycle or disposal onsite. HE waste would be collected, transported, and disposed of, as appropriate, for explosives materials.

Intersite Transportation. Transportation of the products from the HE Fabrication Facility would be performed by commercial vendors that meet all applicable DOT and DOE criteria for transportation of the specified materials. Transportation of classified products from the HE Fabrication Facility to the A/D plant would be performed by commercial vendors that meet DOE safeguards and security criteria for transporting these classified products, as well as DOT requirements for safe packaging and shipping of HE products. Other inert or ancillary materials that would require transportation would also be transported by qualified commercial vendors.

Table A.3.5.3-13.-- Lawrence Livermore National Laboratory High Explosives Fabrication Waste Volumes

Category	Annual Average Volume Generated from Construction (m3)	Annual Volume Generated from Surge Operations (m3)	Annual Volume Effluent from Surge Operations (m3)
Low-Level			
Liquid	None	None	None
Solid	None	Minimal	Minimal
Mixed Low-Level			
Liquid	None	None	None
Solid	None	None	None
Hazardous			
Liquid	1	3	3
Solid	2	54	54
Nonhazardous (Sanitary)			
Liquid	454	7,270	7,250 19
Solid	11	69	55 20
Nonhazardous (Other)			
Liquid	946	568	566
Solid	8 21	36	20

1

Peak demand for electricity is the maximum rate. Peak demand for water is the average daily consumption during a 1-year period with peak construction activity.
2

Cubic meters measured at standard temperature and pressure.

PX 1995a:6; PX DOE 1995e.

3

Peak demand is the maximum rate expected during any time.

4

Cubic meters measured at standard temperature and pressure.

PX 1995a:5; ***PX 1995a:6; PX DOE 1995e.***

5

Assumes 2/3 of solid sanitary waste is compactible by a factor of 4:1.

6

Includes 2 m^3 of concrete and 0.25 t (0.28 tons) of recycled steel. Density of steel was assumed to be 0.127 m^3 /t for volume conversion.

PX 1995a:5; PX 1995a:6; PX DOE 1995e.

7

Peak demand is the maximum rate expected during any time.

8

Standard cubic meters standard temperature and pressure.

LANL 1995b:4; LANL 1995d.

9

Total surge employment. Increase to current employment would be 67.

Source: LANL 1995b:4; LANL 1995d.

10

Includes HE process solvents and contaminated oils.

11

Assumes 350:1 wastewater to sludge ratio in treatment of liquid sanitary waste.

12

Treated process water to NPDES permitted outfalls.

LANL 1995b:3; LANL 1995b:4; LANL 1995d.

13

High Explosives Applications Facility (HEAF) is Building 191 on the Livermore Site; all other buildings are at Site 300.

LA - limited area; PPA - property protection area.

LLNL 1995j.

14

Total construction period is 1 year.
15

Cubic meters at standard temperature and pressure.

Source: LLNL 1995i:3; LLNL 1995j.
16

Peak demand is the maximum rate expected during any time.
17

Cubic meters measured at standard temperature and pressure.

Source: LLNL 1995i:3; LLNL 1995j.
18

Total surge employment. Increase to current employment would be 100.

Source: LLNL 1995i:2; LLNL 1995i:3; LLNL 1995j.
19

Assumes 350:1 wastewater to sludge ratio for treatment of liquid sanitary waste.
20

Assume 2/3 of solid is compactible by a factor of 4:1.
21

Includes 7.6 m^3 (9.9 yd3) of concrete and 3 t (3.3 tons) of steel which is recycled.

LLNL 1995i:3; LLNL 1995j.