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Revision Number 0
Date April 1997

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

FACILITY SAFETY ANALYSIS

BUILDING 123
Radiological Health/Analytical Laboratories

REVIEWED FOR CLASSIFICATION
By [signature]
Date 3/31/97

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EXECUTIVE SUMMARY

This facility safety analysis (FSA) provides final hazard classification and authorization basis documentation for Building 123 based on the hazards associated with the facility This FSA meets requirements for an auditable safety analysis as referenced in Department of Energy (DOE) Environmental Management (EM) limited standard, DOE-EM-STD-5502-94, *Hazard Baseline Documentation*

Building 123 houses the Radiological Health and Analytical Laboratories Water, urine, soil, air, vegetation, nose swipes, fecal material, tissue, and filter samples are analyzed in the Analytical Laboratories for the presence of plutonium, americium, uranium, alpha, beta, and gamma radiation, tritium, beryllium, and organics Personnel thermoluminescent dosimeters (TLDs) are counted, calibrated, and repaired in the Radiological Health Laboratories Occupational radiation exposure and dose records for radiation workers are also stored in the facility Portable radiation survey instruments are calibrated and repaired in the facility

Most of the hazards associated with Building 123 are standard industrial hazards which, by using administrative controls and procedures, following manufacturer's recommendations, using personal protective equipment, and following industrial safety and hygiene practices are adequate measures to control the hazards

The inventory of potentially releasable radiological material in the facility does not and shall not exceed the reportable quantities (RQs) listed in Appendix B of 40 CFR 302, *EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Chemicals* Therefore the facility is not considered to be radiological or nuclear The facility does have potentially releasable hazardous chemicals which exceed the designated threshold quantities (TQs), threshold planning quantities (TPQs), or emergency preparedness screening threshold quantities (EPSTs) The hazardous chemicals are concentrated solutions of hydrochloric acid, hydrofluoric acid, and nitric acid located in the outside storage units and inside Building 123 in Room 103 According to the guidance in DOE-EM-STD-5502-94, *Hazard Baseline Documentation*, Building 123 is classified as a non-nuclear moderate hazard facility due to the presence of these hazardous materials

Risk dominant accident scenarios are defined as those that result in a Risk Class I or II based upon the estimated scenario frequency and postulated consequences For Building 123, there are no risk dominant accident scenarios Therefore, no additional controls are warranted to prevent or mitigate the hazardous chemicals associated with Building 123

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1 INTRODUCTION

This facility safety analysis (FSA) is a part of the Rocky Flats Environmental Technology Site Safety Analysis Report (Site SAR) It addresses the final hazard classification and documents the authorization basis, including operational controls, for Building 123, Radiological Health and Analytical Laboratories Building 123 is classified as a non-nuclear moderate hazard facility Upon approval of the Site SAR, this FSA will replace any previous safety basis documents

Department of Energy (DOE) documents (DOE, 1994a, DOE, 1994b) mandate that safety evaluations be performed for both nuclear and non-nuclear facilities within the DOE nuclear complex that have the potential to adversely affect the health and safety of the workers and the public or the environment The Site SAR meets these requirement and provides safety documentation for facilities classified as nuclear hazard Category 3, radiological, non-nuclear, and industrial The Site SAR is separated into two volumes, the first contains information which is germane to the site as a whole, and may be referenced by all authorization basis documents including the FSAs in Volume II The site-wide information contained in Volume I includes

- descriptions of the site and site-wide utilities,
- authorization basis safety analysis methodology,
- information concerning site-wide hazards, such as natural phenomena events and external man-made threats,
- summaries of the Rocky Flats Environmental Technology Site (RFETS) Safety Management Programs,
- site-wide operational controls, and
- facility summaries and interactions

This FSA provides specific information on the activities performed in the Building 123, a general description of the facility, and develops the source term from the inventory information The hazard assessment uses a hazard identification checklist and description table to provide the framework for the hazard assessment Standard industrial hazards noted on the table are not analyzed in detail unless they initiate a release of hazardous materials or worsen the consequences of a hazardous material release

2 FACILITY DESCRIPTION AND ACTIVITY CHARACTERIZATION

This section provides a brief description of Building 123, the Radiological Health/Analytical Laboratories facility Section 2 1 describes the facility mission and activities Section 2 2 describes the facility systems, as well as interfaces with other buildings and operations at the site Because of the relatively low hazards associated with this facility, it has no safety class systems that are depended upon to mitigate the consequences of an accident The structural, operational, and system descriptions provided in this FSA are for descriptive purposes only

2.1 FACILITY MISSION

Building 123 houses the Analytical Laboratories which analyze water, urine, soil, air, vegetation, nose swipes, fecal material, and filter samples for the presence of plutonium, americium, uranium, alpha, beta, and gamma radiation, tritium, beryllium, and organics Personnel thermoluminescent dosimeters (TLDs) are counted, calibrated, and repaired in the Radiological Health Laboratories Occupational radiation exposure and dose records for radiation workers are also stored in the facility

2.1.1 Analytical Laboratory Activities

The analytical procedures used in the Analytical Laboratories involve preparing samples for analysis by purifying and concentrating the plutonium, americium, uranium, and tritium that may be present The original samples are various forms of liquids and solids that are administratively controlled by chain-of-custody procedures All chemicals identified in the process descriptions below are used in small quantities during sample preparation and analysis The samples and filters handled in Building 123 may contain trace quantities of radioactive materials The quantities of radioactive materials are well below the reportable quantities (RQs) established in 40 CFR 302 (CFR, 1993a) as listed in Volume I, Appendix E of the Site SAR As a result of the low levels, the radionuclides will not be considered a hazard except for the potential of contamination of localized areas

The sample preparation operations generate much of the process wastes for the building Kimwipes, rubber gloves, and broken glass generated in the Radiological Material Management Area (RMMA) are placed in accumulation areas for eventual handling as low-level wastes Some sample wastes and rinse solutions are washed down the process drain for subsequent treatment in Building 374 Liquid organic wastes are placed in special bottles and sorted in satellite accumulation areas prior to transfer to the 90-day storage building and eventual shipment to Liquid Waste Operations

A listing of the chemicals used in all of the building processes is listed in the RFETS Chemical Management Tracking System database (RFETS, 1996) All of the processes use a variety of chemicals (acids, bases, solvents, etc) which are described further in Section 2 2 3

2 1 1 1 Sample Digestion

The sample digestion process prepares a variety of samples for plutonium, americium, and uranium analysis, resulting in a wet ash sample to be taken to the electrodeposition process or the neodymium fluoride precipitation process Samples include vegetation, soil, nose swipes, fecal material, stack filters, ambient air filters, and urine The process uses fume hoods, muffle furnaces, ion exchange resins, and hot plates

Different methods are used to prepare the samples for further processing Vegetation, nose swipes, and soil are heated in a muffle furnace to drive off organics and create an ash prior to dissolution Vegetation and nose swipes are mixed with nitric acid, soil samples are mixed with nitric and hydrofluoric acids, fecal material is dried in a muffle furnace and then mixed with nitric and hydrofluoric acids After mixing, the samples are dried in a muffle furnace The resulting ash from soil and nose swipes is solubilized with nitric acid Ash from vegetation and fecal material is solubilized with hydrochloric acid

The urine samples are mixed with internal standards, nitric acid, phosphoric acid, ammonium hydroxide, and calcium nitrate (for samples containing very low levels of calcium) The prepared solution is stirred and allowed to settle The liquid supernate is decanted to the process drain Nitric acid is added, and the sample is allowed to evaporate on a hot plate through the fume hood Hydrochloric acid is added to solubilize the constituents in the sample

Stack filters and ambient air filters are mixed with internal standards and put into a muffle furnace to evaporate the liquid, drive off the organics and create an ash prior to dissolution Nitric and hydrofluoric acids are added to the evaporated sample, and a drop of perchloric acid is added to the stack filter samples The solution is then dried on a hot plate Sodium bisulfate is added to the ambient air filters to change the valence of the plutonium Boric acid is added to complex the hydrofluoric acid Hydrochloric acid is added to solubilize the constituents in the sample

The solubilized samples are ready for americium, uranium, and plutonium purification This part of the process uses a series of ion exchange resins in ion exchange columns to purify and concentrate the constituents The ion exchange resins are conditioned with hydrochloric or nitric acid Some samples are mixed with sodium nitrate, or sodium nitrite and nitric acid, to change the valence of the plutonium prior to addition to the column Uranium is stripped from the solution and loads on the resin A hydrochloric/hydroiodic acid solution is passed through the column to strip iron Uranium is unloaded by elution with hydrochloric acid The first phase off the column is the americium phase The plutonium and uranium phases follow The uranium eluant is evaporated on a hot plate to form a wet ash sample

Ammonium iodide and hydrochloric acid are used to elute plutonium The eluant is mixed with nitric acid and allowed to evaporate under a fume hood using a hot plate Concentrated nitric acid is added to the wet ash sample

The americium eluant is mixed with nitric acid and DDCP (Dibutyl-N,N-Diethylcarbomolyphosphonate) in a separatory funnel and shaken Americium is stripped from the sample to the DDCP The mixture is allowed to settle into two phases, an acid phase and the DDCP phase The heavier, acid phase is discharged to the process drain Two more rinses with nitric acid are done and the same procedure followed Toluene and hydrochloric acid are added to the DDCP-phase funnel, and the americium is exchanged to the acid phase After settling, the heavier, acid phase is collected in a beaker, and after two subsequent washes with hydrochloric acid, the DDCP/toluene phase is collected in a satellite accumulation area Prior to the americium cation exchange, the resin is conditioned with hydrochloric acid The acid phase from the DDCP/americium exchange is added to the column, the americium loads onto the resin, and the stripped acid is discharged down the process drain Ammonium thiocyanate is used to elute iron, and hydrochloric acid is used to elute calcium and magnesium from the resin The iron eluant and the calcium/magnesium eluant is evaporated on a hot plate to form a wet ash Concentrated nitric acid is mixed with the ash to form the americium sample The wet ash samples are taken to the electrodeposition process or the neodymium fluoride precipitation process

2 1 1 2 Electrodeposition

The electrodeposition process, located in Room 124, involves plating trace quantities of purified plutonium, americium, and uranium samples onto a planchet The samples are received from the sample digestion process, which uses an electroplating cell, a hot plate, and a fume hood The hood exhaust is vented to the building's plenum system Samples from the purification processes are first dissolved in a solution of 17 molar sulfuric acid, zirconium chloride, and 10 percent sodium bisulfate The solution is then evaporated to dryness The samples are re-dissolved using 6 normal hydrochloric acid, 0 3 normal sulfuric acid, and are again evaporated to dryness Puphal or ammonium sulfate electrolyte solution is added to the electroplating cell Thymol blue is added to the cell as a pH indicator, 6 normal hydrochloric acid and ammonia hydroxide are applied to adjust the pH to approximately 1 8 Oakite rinse solution, mariko, 8 normal nitric acid and methanol are used to degrease metal planchets prior to electroplating The raw planchets are then added to the cell as the anode After plating, the planchets are washed with an ammonium nitrate/ammonium hydroxide solution in the cell After removal from the cell, the planchets are rinsed with methanol The plated planchets are placed in marked envelopes Kimwipes, isopropyl alcohol or methanol, rubber gloves, and glassware are used during general purpose sample preparation and cleanup Nitric acid is used to clean anodes after plating Plated planchets are taken for alpha counting Waste plating and rinse solutions are washed down the process drain for eventual treatment in Building 374 Waste isopropanol or methanol are collected in a waste alcohol bottle

2 1 1 3 Low-Level Alpha, Beta, and Gamma Counting

The counting process, located in Room 135, involves counting plated planchets from the electrodeposition process or the neodymium process for alpha emissions The low-level alpha, beta, and gamma counting process, located in Room 149, involves counting air head and smear samples from various buildings for alpha, beta, and gamma emissions

2 1 1 4 Gamma Counting Process

The gamma counting process, located in Room 149, electronically measures soil and water samples from the RFETS for gamma radiation The process uses electrical gamma-counting equipment (liquid nitrogen cooled scintillation crystal based detectors) Environmental samples in 1-liter bottles, such as soil and water collected on site, are brought to Room 149 Following analysis, the water samples are washed down the process drain for eventual treatment in Building 374 Soil samples are returned to the customer

2 1 1 5 Tritium Analysis Process

The tritium analysis process in the Room 125 is a chemical process used to determine tritium content in various sample types The sample types include urine, effluent stack, and water This process uses heating mantles, tritium-counting equipment, Kimwipes, isopropyl alcohol, glassware, and rubber gloves The samples are mixed and distilled with potassium permanganate and sodium hydroxide A condenser, using domestic water as the cooling media, condenses the vapor and collects the condensate The condensate is drained into scintillation vials and Ultima Gold XR cocktail is added The vials are sent for counting Cooling water and excess urine are discharged down the process drain Scintillation cocktail and discarded samples are collected in a white 55-gallon drum

2 1 1 6 Beryllium Analysis

The beryllium analysis process, located in Rooms 111 and 112, analyzes air filters and smear samples for beryllium content The process uses an atomic absorption spectrophotometer and a fume hood Each filter is treated with a solution of nitric and perchloric acid to dissolve the beryllium The solution is evaporated to dryness and reconstituted with 1 molar nitric acid The reconstituted sample is analyzed in the spectrophotometer Acetylene, nitrous oxide, and compressed air are also used in operation of the spectrophotometer Atomic-absorption waste and spent beryllium standards are discharged to the process drain for eventual treatment in Building 374 Hood exhaust is vented to the building plenum Perchloric acid hood wash water is discharged to the sumps

2 1 1 7 Gross Alpha and Beta Counting

The gross alpha and beta counting process, located in Room 163, measures the levels of alpha and beta radiation in brass-ring-mounted paper air filters collected from throughout the plant The process uses a counter for counting alpha and beta emissions After counting, the filters are disassembled, and the brass rings are separated from the paper

2 1 1 8 Pipette Maintenance

The pipette maintenance and calibration process is in Room 127 Pipettes are received from various labs throughout the building The process ensures that pipettes are maintained and calibrated within operational standards There are no hazardous chemicals, cleaning agents, etc , used or generated from this process

2 1 1 9 Neodymium Fluoride Precipitation

The neodymium fluoride precipitation process in Room 127 is a process used to prepare sample mounts for alpha spectroscopy and is an alternative technique for the electroplating process The samples for this process originate in the actinides-separations labs as dried residue in a beaker The residue is dissolved in approximately 5 milliliters (ml) of 1 molar hydrochloric acid Titanous chloride solution is added To precipitate neodymium fluoride and carry the actinides, 5 ml of 48 percent hydrofluoric acid is added The samples are filtered and washed with dilute hydrofluoric acid followed by a wash with 80 percent ethanol Equipment in this process includes laboratory glassware, a centrifuge, and sample filtration equipment

2.1.2 Radiological Health Laboratory Activities

2 1 2 1 Dosimetry

The dosimetry process, located in Room 133, evaluates site personnel TLD badges for radioactive exposure levels Body TLD badges are worn by contractor, DOE, and subcontractor personnel The whole body Panasonic system uses a UD-802AS and UD-809AS dosimeter The dosimeters are process using the Panasonic UD-710A readers which are located in Room 133C The extremity system is made up of the Panasonic UD-813 dosimeter which is also processed on the Panasonic UD-710A readers Dosimeters are exchanged on a quarterly basis, with a monthly exchange for individuals who require monitoring more often

2 1 2 2 Instrumentation Servicing

The Radiological Health instrumentation servicing process (located in Rooms 131 and 155) maintains, calibrates, repairs, and certifies portable radiation instrumentation The equipment is received from off-site vendors and nonprotected area buildings The equipment is first inspected and cleaned with various cleaning agents, as required Repair may include the fabrication and construction of new electrical components Depleted Gel-Cel and alkaline batteries are removed from the equipment and replaced The serviced electrical equipment is calibrated and certified

2 1 2 3 Radiological Records

Radiological records for all employees, contractors, subcontractors, and visitors are stored in Building 123 Records are stored in both hard copy paper form and electronic form Storage containers include Lektrievers and fire-proof file cabinets There are no hazardous chemicals used or generated

2.2 FACILITY DESCRIPTION

2.2.1 General Description

The facility is located between Third and Fourth Streets to the west and east, and between Central and Cottonwood Avenues to the north and south The 19,298-square-foot building is configured in a U-type layout with the sides of the U being unequal in length The dimensions are approximately 150 feet exterior along the north corridor (the base of the U), 144 feet exterior along the west corridor (the west side of the U) and 197 feet exterior along the east corridor (the east side of the U)

The building was originally constructed in 1953 Additions were made in 1971, 1973, and 1975 The west wing of the building was added later, and other major modifications include the addition of the laboratory hood scrubber systems to reduce hazardous chemical releases to the environment and the discontinuance of the use of natural gas at the laboratory benches and as a facility utility system

The facility houses approximately 28 offices, 17 laboratory rooms, two laboratory support areas (instrument repair, diagnostic and calibration, etc), one computer room (raised floor type), one utility room, separate men's and women's change/locker rooms with showers, one men's rest room and two utility corridors

The facility is built on a concrete slab on grade and is one story high Exterior walls are constructed of concrete block (used in the original construction, north and east corridors) and cast-in-place concrete sections (used in the west wing addition) The facility has a flat roof covered by neoprene-hypalon and butyl rubber over plastic foam insulation The roof structure is cast-in-place concrete over corrugated metal deck/bar joists The roof supports the HVAC exhaust systems for the laboratories Roof drains (for rainwater and snowmelt runoff) are directed to ground level splash blocks Lightning rods and ground cables are positioned around the edge of the roof Floor coverings are either predominantly 12-inch vinyl asbestos floor tile or short pile industrial type carpet Suspended ceilings with integral fluorescent lighting fixtures are used throughout the facility

The facility boundaries can be defined principally by a 2-foot zone from the exterior walls of the building with the exception of interfaces with the following services

- Three domestic water cutoff valves are located at about 20 feet west and 20 feet south of the northwest corner, and two valves 50 feet north of the north wall of the building, near the midsection

- The fire water isolation post indicator valve is located just off the site fire water main about 30 feet south and 20 feet west of the southwest corner of the building

- The 13 8-kilovolt (kV) to 480-volt (V) transformer at the low voltage (480 V) terminals of the electrical service is located on the east side of the building

- The 13 8-kV to 480-V transformer at the low voltage terminals are located southwest of the building

- The natural gas supply isolation valve is located about 10 feet east of the east wall of the building

- The steam system and steam condensate isolation valves are located about 10 feet east of the east wall of the building

- Two liquid nitrogen tanks are located adjacent to the building on separate concrete pads

- A 2-foot zone just downstream of the process liquid waste sump discharge lines for the sumps that are located outside of the facility footprint The Building 123 floor plan is presented in Figure 1

2.2.2 Facility Systems and Utilities

2 2 2 1 Heating, Ventilation and Air Conditioning (HVAC)

Heating is supplied to all occupied areas by steam radiators The building has a central air conditioning system Air handling equipment is located in the utility room (132) Air conditioning compressors are located outside the southeast and northwest portions of the building Many of the offices and labs are also equipped with window air conditioners Much of the air flows one time through the facility from offices and corridors into the laboratory rooms and out through the laboratory hoods located in the lab rooms The exhaust air from the hoods is collected in an exhaust plenum on the roof of the facility Flows from hoods that use and produce hazardous vapors (mainly acids) are routed through a ground-mounted caustic-based scrubber system up to exhausters and short roof-mounted stacks Periodically, the vent lines servicing the fume hoods are washed by spraying water into the vent line to condense the remaining acid The wash water is routed through the process drain system to Building 374 via Valve Vault 18 (approximately 15,600 gallons per year)

2 2 2 2 Electrical Service

Two pad-mounted transformers located east and southwest of the building reduce the 13 8-kV service to 480 V The 480-V feeds are routed underground into the electrical distribution and control panels in the utility room (132) The 480-V three-phase is also split in the utility room into 208-V three-phase, and 240-V/120-V single-phase for distribution

2 2 2 3 Fire Suppression

The building is protected by a wet pipe sprinkler system The sprinkler riser is located in Room 123A Portable fire extinguishers are also located throughout the corridors of the building The building is further protected by fire hydrants located outside of the building and is in close proximity to the RFETS Fire Station (Building 331), which is located across the street on the adjacent block east of the building

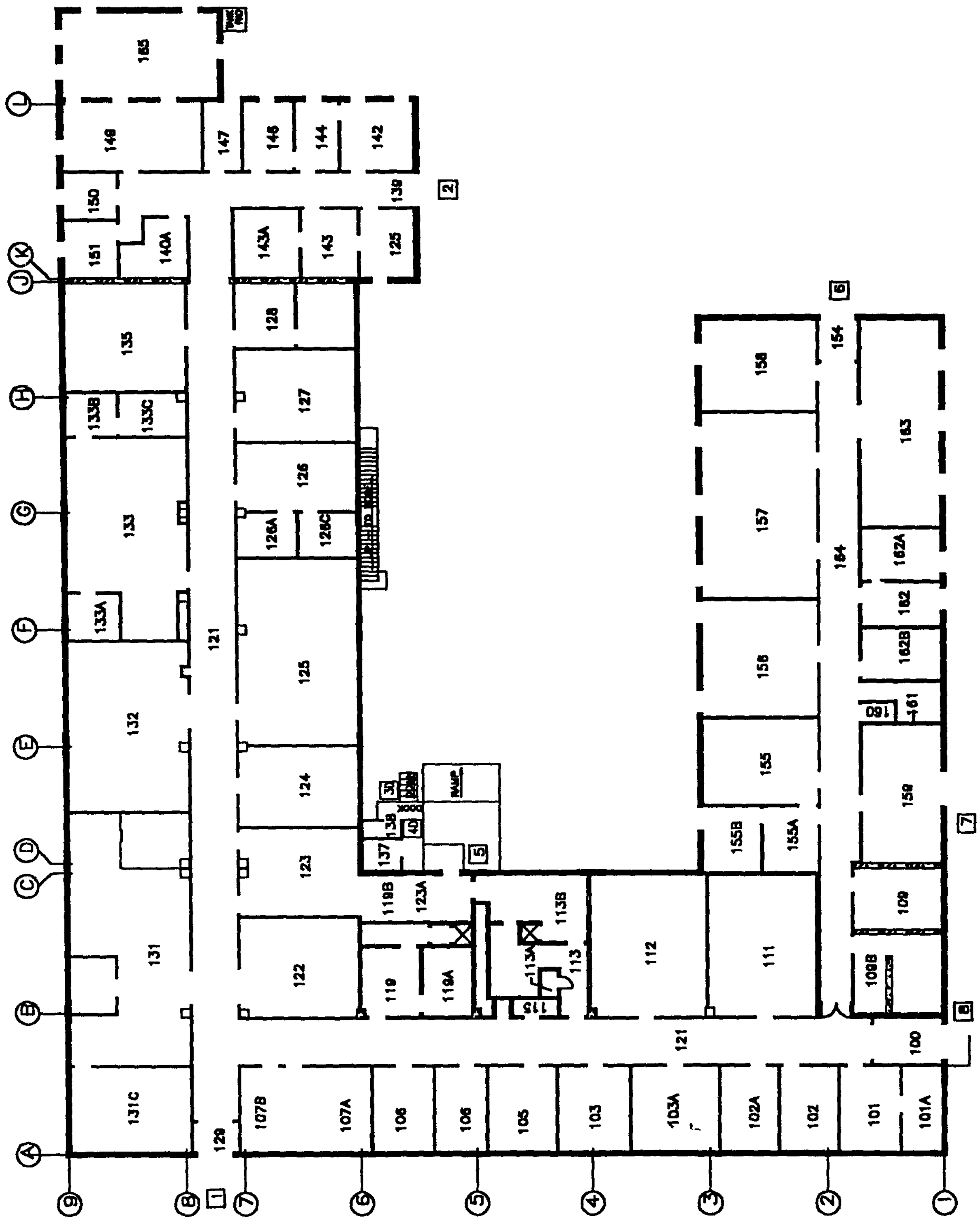

Figure 1. Building 123 Floor Plan

2 2 2 4 Steam

Steam from the plant steam distribution system is mainly used for building heating Steam radiators are used throughout the building for heating occupied areas

2 2 2 5 Domestic Cold Water

Sanitary water is present throughout the building for drinking, break room, change rooms, laboratory supply, and fire suppression

2 2 2 6 Domestic Cold Water - Fire

Fire water is supplied by the domestic water system main, but through a separate post indicator valve (PIV) and branch line from the sanitary domestic cold water supply

2 2 2 7 Distilled and Deionized Water

Distilled and deionized waters are produced through different systems Distilled water is prepared by heating domestic cold water in a still Overflow of the make-up water flushes salts from the still The remaining water is distilled by heating with steam from the steam plant Water vapor from the still is condensed and then collected for use in non-analytical procedures

Deionized water is produced by reverse osmosis and ion-exchange Domestic cold water is first passed through a reverse-osmosis membrane to filter out small impurities The filtered water is then held in a storage tank Upon demand for the purified water, it is treated using an ion-exchange unit, a carbon filter, and an organic-resin filter Purified water is used for preparing chemical reagents used in analytical procedures

2 2 2 8 Sanitary Sewer

All of the sanitary drains from Building 123 are collected and routed to the sanitary sewer Many of the sinks located in the laboratory areas are also routed to the sanitary drains These are administratively posted to prevent the introduction of process wastes into the sanitary drain system Some of these drains are sealed Likewise, all of the floor drains are routed to the sanitary drain All of the floor drains observed were sealed Three sanitary sewer lines exit at the east (4-inch), west (3-inch), and north (4-inch) sides of the building

2 2 2 9 Process Waste

All of the process drains (mainly from the laboratories) are collected and routed to collection sumps The sumps are equipped with integral pumps that pump the collected liquids through overhead process waste mains, with the exception of several gravity lines All of the process liquid waste lines combine and go to Valve Vault No 18 by gravity flow

2 2 2 10 Natural Gas

The natural gas service to the building is no longer in service The service is located outside at the east side of the east wing The supply line branch to the building contains a valve that is administratively and physically controlled by lock-out/tag-out to isolate the supply The valve is chained, locked and tagged with "Danger, Do Not Operate " The service condition was confirmed during conversations with Conrad Trice, Facility Manager of Building 123, and Ken Shirk of the RFETS Utilities Group

2.2.3 Facility Interfaces

Building 123 has several interfaces with other areas, facilities, systems, processes and operations Utilities (steam, sanitary water, fire water, electrical, telecommunications, alarm systems, sanitary drains, and process drains to Valve Vault 18) are shared with other areas Utilities interfaces are identified above in Section 2 1 2 Material deliveries (supplies, chemicals, gas bottles, etc) are shared with other areas by use of common carriers (internal and third party) Material shipments (waste containers, empty gas bottles, un-repairable equipment, etc) may be shared with other areas by use of common carriers

Interfaces with other facilities are in the form of incoming shipments of samples for analysis (with appropriate transfer and tracking of the chain of custody) and liquid process drain transfers to Building 374 via Valve Vault 18

2.2.4 Facility Inventory and Source Term Development

2 2 4 1 Chemical Inventory

There are three sources for chemical inventory at Building 123 Process and bulk chemicals used and stored for Building 123 processes, and the chemicals contained in the waste streams Potentially hazardous chemicals are defined as those having a TPQ, TQ, or EPST value The weights, in pounds, of chemicals in this FSA represent weights of pure chemical content within the solution

2 2 4 1 1 Process and Bulk Chemicals

Acids and bases are stored in separate storage areas throughout the facility in cabinets labeled either "acids" or "bases " Much of the process and bulk chemical inventory of Building 123 is comprised of very small quantities of general use chemicals which are below the reportable quantities (RQs) However, there are chemicals stored in various locations throughout the facility that do have TQs, TPQs, or EPSTs associated with them A list of these chemicals are presented in Table 1 The volumes provided in the table represent actual volume, but the weights (pounds) represent the quantity of pure chemical in the solutions The quantities of these chemicals also represent the maximum allowable for Building 123 Buffer solutions, alcohols, reference electrode filling solutions, and various other laboratory solutions, also stored in Building 123, are considered to be general industrial chemicals and are neither included in Table 1 nor analyzed further

Table 1 Process and Bulk Chemical Inventory in Building 123

Chemical	Quantity (weights of solutions represent pure chemical content)	Location	TPQ, TQ, or EPST
Ammonium Hydroxide (14 Molar/26% Solution)	60 gal (117 lb)	Outside storage unit	TQ = 10,000 lb TPQ = 500 lb (for conc >20% NH_3 in solution)
Hydrochloric Acid (12 Molar/37% Solution)	90 gal (326 lb)	Outside storage unit (different storage unit than used for ammonium hydroxide)	TQ = 5,000 lb EPST = 10 lb (for conc >38%)
Hydrochloric Acid (12 Molar/37% Solution)	30 gal (110 lb)	Room 103	TQ = 5,000 lb EPST = 10 lb (for conc >38%)
Hydrofluoric Acid (48% Solution)	32 gal (154 lb)	Outside storage unit (different storage unit than used for ammonium hydroxide)	TQ = 1,000 lb TPQ = 100 lb EPST = 53 lb
Hydrofluoric Acid (48% Solution)	4 8 gal (22 lb)	Room 103	TQ = 1,000 lb TPQ = 100 lb EPST = 53 lb
Nitric Acid (16 Molar/70% Solution)	160 gal (1,310 lb)	Outside storage unit (different storage unit than used for ammonium hydroxide)	TPQ = 1,000 lb (for conc <80%)
Nitric Acid (16 Molar/70% Solution)	20 gal (165 lb)	Room 103	TPQ = 1,000 lb (for conc <80%)
Nitric Acid (< 8 Molar Avg = 5 Molar/27% Solution)	30 gal (81 lb)	Various rooms	TPQ = 1,000 lb (Conc <80%)
Sulfuric Acid (18 Molar/96% Solution)	18 gal (266 lb)	Outside Storage unit (different storage unit than used for ammonium hydroxide)	TPQ = 1,000 lb
Sulfuric Acid (18 Molar/96% Solution)	6 gal (89 lb)	Room 103	TPQ = 1,000 lb
Sulfuric Acid (< 9 Molar Avg = 5 Molar/38% Solution)	20 gal (82 lb)	Various rooms	TPQ = 1,000 lb

2 2 4 1 2 Chemicals in Waste Streams

Chemicals are entrained in waste streams associated with the laboratory processes in Building 123 and are managed in accordance with the Waste Management Program Several of the analytical procedures use strong acids that are evaporated under fume hoods routed to the Building 123 plenum system The bulk of the wastes generated are produced during the sample digestion and purification phase of the analysis Wastes generated in radiologically controlled areas may also be disposed of as sanitary landfill debris or recycled through the site recycling programs following approval by an Radiation Control Technician Some sample waste and rinse solutions are washed down the process drain for eventual treatment in Building 374

Hazardous wastes, except those disposed into the process waste system, are collected, packaged and temporarily stored in satellite accumulation areas When the package is filled in the satellite accumulation area, it is sealed and transferred to the 90-day accumulation area The waste package is then transferred from the 90-day accumulation area to a storage facility The Waste Management Units (WMU) in Building 123 are described in Table 2 Waste materials associated with Building 123 are described in detail in the Waste Stream and Residue Identification and Characterization document for Building 123 (RFETS, 1993)

The chemical inventory associated with the waste streams are below the TQ, TPQ, and EPST values and are not analyzed further

Table 2. Building 123 Waste Management Units

WMU No.	WMU Type	Location	Wastes
313	Satellite	Room 112	Combustible wastes contaminated with toluene, isopropanol, toluene/DDCP
314	Satellite	Room 156	Combustible wastes contaminated with toluene, isopropanol, toluene/DDCP
315	Satellite	Room 157	Combustible wastes contaminated with toluene, isopropanol, toluene/DDCP
1061	Satellite	Room 125	Isopropanol, toluene, trimethyl benzene, combustibles contaminated with toluene, urinalysis wastes in 4-liter bottles, scintillation cocktail waste
1063	Satellite	Room 103A	Combustibles contaminated with toluene, isopropanol, toluene/DDCP
1518	Satellite	Room 124	Methanol, isopropanol
1843	Satellite	Room 133	Broken badge parts including cadmium and lead
1867	Satellite	Room 125	Toluene-contaminated Kimwipes and gloves, isopropyl alcohol, toluene/DDCP
1886	Satellite	Room 131	Used components containing lead or silver
1907	Satellite	Room 127	Toluene-contaminated Kimwipes and gloves, isopropyl alcohol, toluene/DDCP

2 2 4 2 Radiological Inventory

2 2 4 2 1 Sealed Radioactive Sources

The only significant radioactive materials in Building 123 are contained in sealed sources Sealed sources are nuclear material which is generally used for testing and calibration and are packaged to be environmentally and critically safe Certified sealed sources are not included in the radioactive material inventory for facility classification

Certification documentation for Source 547 (Cesium-137) is not available at the plant This 2-Curie source (now 1 6 Curies) was fabricated in 1986, and is located in the dosimeter irradiator in Room 155A. The source was fabricated by Amersham (708-593-6300), Product Code CDC 3822 The radiological material is in a nondispersible form, encapsulated in stainless steel Therefore, the source inventory is not evaluated further

2 2 4 2 2 Other Radioactive Sources

There are six sources that are not sealed and are of a granular nature including soil and sand samples These sources are have total activities which are orders of magnitude below the established RQs and are not evaluated further

2 2 4 2 3 Air Monitoring Samples and Filters

The samples and filters handled in Building 123 may contain trace quantities of radioactive materials The quantities of radioactive materials are well below the established RQs Routine air monitoring filters transferred to Building 123 for analysis have a survey instrument reading of less than 2500 counts per minute (cpm) This equates to approximately 9 2E-08 grams per filter assuming a twenty percent instrument efficiency More than ten million filters would have to be collected to approach the RQ for plutonium These materials are not evaluated further

3 HAZARDS AND ACCIDENT ANALYSIS

The hazards assessment uses a comprehensive checklist of typical hazards found in the nuclear industry as well as many other industries This checklist includes radiological, hazardous material, and occupational hazards Routine occupational hazards are regulated by DOE-prescribed occupational safety and health standards and are not evaluated further unless they initiate a release of hazardous materials or worsen the consequences of a hazardous material release This section determines the final hazard classification from which the operational controls are derived The methodology contained in Volume I, Chapter 4 of the Site SAR was followed for this hazard assessment

3.1 HAZARD IDENTIFICATION

Hazards associated with the processes in Building 123 are summarized in Tables 3 and 4 Table 3 is a checklist of existing facility hazards All hazards listed in Table 3 were evaluated to identify those associated with Building 123 These hazards are indicated with a "yes" and are described in more detail in Table 4 which provides information on quantity, form, packaging, and location of the hazards

Table 3. Building 123 Hazard Identification Checklist

HAZARD	Yes/No	HAZARD	Yes/No
1 High Voltage	Yes	14 High Intensity Magnetic Fields	No
2 Explosive Substances	No	15 Effects of Chemical Exposures	Yes
3 Cryogenic Systems	Yes	16 Toxic, Hazardous, or Noxious Material	Yes
4 Inert and Low-Oxygen Atmospheres	No	17 Inadequate Ventilation	Yes
5 Direct Radiation Sources	Yes	18 Material Handling	No
6 Radioactive Materials	Yes	19 Ambient Temperature Extremes	No
7 High Noise Levels	No	20 Working at Heights	Yes
8 Flammable Gases, Liquids, and Dusts	Yes	21 Pesticide Use	No
9 Compressed Gases	Yes	22 Lasers	No
10 High Temperature and Pressure Sys	Yes	23 Inadequate Illumination	No
11 Kinetic Energy	Yes	24 Biohazard	Yes
12 Potential Energy	Yes	25 Unknown or Unmarked Materials	No
13 Non-Ionizing Radiation Sources	No	26 Any Other Hazards	No

Table 4. Building 123 Hazard Description

Hazard/ Energy Source	Description	Preventative and Mitigative Features	Remarks
1 HIGH VOLTAGE			
Instrumentation	Several mass spectrometer/gas chromatograph, radiation detection equipment that require high voltage located in Room 126, Room 127, and Room 163 Packaged in manufacturer's standard instrument cases	- Proper use of instruments - Signs indicating hazard	Standard industrial hazard
13 8-kV substation	Two 13 8-kV substations with standard transformer enclosure located outside to the east and southwest of Building 123	- Restricted access - Signage - Qualified service personnel	Standard industrial hazard.
13 8-kV power lines	Two, site power aboveground lines located north and west exterior	- Lines are constructed per ANSI C2	Standard industrial hazard.
3 CRYOGENIC SYSTEMS			
Liquid nitrogen tanks and manifolds	Two 350-gal vertical storage tanks with vaporizer coils and control cabinet Standard dewar, double shell tanks located outside, adjacent to the facility, one at the southeast corner of the east wing and in the northwest area of the courtyard Manifold in Room 165	- Relief valves - PPE - Building ventilation - Shut-off capability	The storage tanks are not guarded to protect against vehicular incidents Allowing employees to park their private vehicles further inhibits safe access for delivery tanker trucks
5 DIRECT RADIATION SOURCES			
Sealed sources	303 sealed sources stored in labeled storage cabinets in various labs, Rooms 133, 149, 155A	- Certified sources - Administrative controls - Accountability	The activities associated with these sources (except Source No 547) are orders of magnitude below the RQs
Other sources	6 sand, soil, and granular sources stored in labeled storage cabinets in Room 149	- Encapsulated	Source No 547 (Cesium-137), located in Building 155A, is sealed and has an activity of 1 6 Curies The source is not certified, but the radiological material is in a nondispersible form, encapsulated in stainless steel

Table 4. Building 123 Hazard Description (continued)

Hazard/ Energy Source	Description	Preventative and Mitigative Features	Remarks
6 RADIOACTIVE MATERIALS			
Samples for analysis	Trace amounts, less than 2500 cpm on filter paper samples from stack samplers, bioassay samples Stored in sealed containers Located in all labs that store, process, and count physical samples which may contain radioactive materials	- Radiation detectors - RMMA postings - Physical containers - Administrative controls - Radiation Protection Program	Possible contamination
8 FLAMMABLE GASES, LIQUIDS, AND DUSTS			
Acetylene gas	5 tanks (500 lb total) Compressed gas cylinders Acetylene Dock area and in Room 111	- DOT cylinders - Secured in racks - Caps on when not in use - Inspection and testing	Standard industrial hazard
Various solvents for cleaning	Various quantities Alcohols, cleaning agents, etc Plastic, glass chemical containers	- Administrative control for handling chemicals - Hood exhaust system for vapor dilution	Standard industrial hazard
Natural gas	As required Natural gas lines from plant services Steel piping Approximately 20 feet east of building, above ground	- Standard design - Maintenance - Shutoff capability - Locked out from bldg	Standard industrial hazard, all exterior of building
9 COMPRESSED GASES			
Various bottled gases	Minimum two standard compressed gas cylinders each of anhydrous ammonia and nitrous oxide located in various labs	- Procedures per HSP - DOT cylinders - Secured in racks - Caps on when not in use - Inspection and testing	Standard industrial hazard
10 HIGH PRESSURE AND HIGH TEMPERATURE SYSTEMS			
Hydraulic pressure systems	Two hydraulic press systems with pressures up to 10,000 psi Standard hydraulic press configuration Located in various labs	- Administrative controls - PPE	Commercially available equipment, standard industrial hazard
Muffle type furnaces	Various muffle type furnaces in standard equipment cabinet Located on various lab benches	- Furnace insulation - Signs indicating high temperature - PPE	Commercially available equipment, standard industrial hazard
Steam supply	70 psi steam from site utilities in insulated iron pipe Distributed throughout building for steam heat	- Standard design - Insulation	Standard industrial hazard

Table 4. Building 123 Hazard Description (continued)

Hazard/ Energy Source	Description	Preventative and Mitigative Features	Remarks
11 KINETIC ENERGY			
High speed machinery	Various HVAC fans, air exchanges, rotary pumps for vacuum systems in standard housings in various locations	- Standard design equipment - Procedures - Maintenance	Standard industrial hazard.
Vehicular traffic	Transportation and delivery vehicles exterior to building on Third Street, Fourth Street, Central Avenue, Cottonwood Avenue, parking areas all around	- KE barriers	Standard industrial hazard
12 POTENTIAL ENERGY			
Compressed gases	See Item 9		
High pressure systems	See Item 10		
15. EFFECTS OF CHEMICAL EXPOSURES			
Chemical inventory	Various chemicals in plastic and glass sealed bottles located in various labs	- Physical containers - Engineered systems (lab hoods, PPE requirements, etc) - Administrative controls - HAZCOM Program (see Section 3)	Those chemicals with no TPQ, TQ, or EPST values are considered to be standard industrial hazards Those chemicals present in quantities greater than TPQ, TQ, or EPST values are analyzed further in Section 3
16 TOXIC, HAZARDOUS, OR NOXIOUS MATERIAL		The quantities (volumes) are the maximum allowable in the facility The weights are of pure material in solution	
Ammonium Hydroxide (14 Molar Solution)	60-gal (117-lb) aqueous solution packaged in cases of four 1-gal bottles Kept in storage unit outside Bldg 123	- PPE	Less than the 500-lb TPQ and is not evaluated further
Hydrochloric Acid (12 Molar/37% Solution)	- 90-gal (326-lb) aqueous solution packaged in cases of 1-gal bottles Stored in storage unit outside Bldg 123 - 30-gal (109-lb) stored in Rm 103	- See Section 3 3	An EPST of 10-lb exists for solutions with a concentration of 38% or greater 37% is sufficiently close to 38% to warrant additional evaluation
Hydrochloric Acid (9 molar or less)	Stored and used in various rooms in Bldg 123	- PPE	Concentration is sufficiently less than 38% and will not be evaluated further

Table 4. Building 123 Hazard Description (continued)

Hazard/ Energy Source	Description	Preventative and Mitigative Features	Remarks
Hydrofluoric Acid (48% Solution)	- 32-gal (154-lb) packaged in cases which hold 0 5 liter plastic bottles, kept in storage unit outside Bldg 123 - Max 4 8-gal (23-lb) aqueous solution in plastic stored in Rm 103	- See Section 3 3	Quantity exceeds the TPQ value of 100-lb and is further evaluated
Nitric Acid (16 Molar/ 70% Solution)	- Max. 160-gal (1310-lb) in cases of 4 1-gal bottles, kept in storage unit outside Bldg 123 - Max 20-gal (164-lb) stored in Rm 103	- PPE recommended	Total inventory exceeds the 1000-lb TPQ and is further evaluated
Nitric Acid (<8 Molar/avg 27% Solution)	Max. 30-gal diluted to <8 M or less stored and used in various labs within the facility Equals approx 81-lb pure chemical	- PPE	Dilute solutions will be bounded by accidents involving the concentrated solutions and will not be further analyzed.
Sulfuric Acid (18 Molar/ 96% Solution)	18-gal (266-lb) packaged in cases of 6 0 5-l bottles kept in storage unit outside Bldg 123	- No more than 6 cases in building at one time - PPE	Total inventory does not exceed the 1000-lb TQ and is not evaluated further
Sulfuric Acid (<9 Molar/ avg 38% Solution)	20-gal dilute solns <9 M or less in various locations within the building Equals approx 82-lb pure chemical	- PPE	Total inventory does not exceed the 1000-lb TQ and is not evaluated further
17 INADEQUATE VENTILATION			
Areas where anhydrous ammonia is used	Ammonia in tubing and bottles used in Room 137 (exterior storage) and Room 124	- Room 124 alarmed for ammonia - Warning signs - Administrative controls - Ventilation system	Standard industrial hazard
Areas where nitrous oxide is stored	Room 138, an exterior block wall storage area Nitrogen-oxide is stored in bottles	- Signs - Administrative controls	Standard industrial hazard
20 WORKING AT HEIGHTS			
Roof access	Infrequent maintenance on the building roof Access via stairs in east courtyard	- Controlled access - Approved work plans - OSHA compliant stairs and rails	Standard industrial hazard
24 BIOHAZARD			
Fecal and urine samples	Hundreds of solid and liquid physical samples in plastic and glass sealed bottles stored in refrigerators in various labs	- Signs indicating sample storage only No food storage allowed	Standard industrial hazard A refrigerator for employee use is located in the break room

3.3 ACCIDENT EVALUATION

Accident scenarios are developed to evaluate the risk to workers and the public from identified hazards that are not considered standard industrial hazards Based upon the screening criteria provided in Volume I, Chapter 4 of the Site SAR, the only hazards requiring scenario development for Building 123 are the chemicals listed in the Toxic, Hazardous, or Noxious Materials category Hydrochloric acid is analyzed further because a RFETS emergency planning screening threshold (EPST) of 10 pounds exits for a 38% solution The 37% solution used in Building 123 is sufficiently close to the 38% used in the EPST that an evaluation is warranted Accident scenarios are developed for hydrofluoric acid and nitric acid because the inventory exceeds the 40 (CFR, 1993b) 355 TPQ of 100 pounds and TPQ of 1000 lbs, respectively

3.3.1 Methodology

Accidental releases of chemicals can result from natural phenomena, external events, or internal events Natural phenomena of concern at RFETS are earthquakes, high winds and tornados, flooding, heavy rain and snow, and lightning External events include aircraft crashes, range fires, on-site and off-site transportation incidents, and impacts from other facilities in the vicinity Internal events are those activities and operations that take place in the facility There are three basic accident types that may result from these particular initiating events spills, explosions, and fires

Accident scenario frequencies are estimated by multiplying the occurrence frequency of the initiating event and the probabilities of failure or success of each mitigative measure associated with the accident scenario The initiating event occurrence frequencies may be either quantitative or qualitative based upon the data available The failure and success probabilities are qualitative in nature because exact facility-specific data are not available Thus, the overall accident scenario frequency is considered qualitative The accident scenario frequencies are classified into four bins anticipated, unlikely, extremely unlikely, and incredible or beyond extremely unlikely (refer to Volume I, Chapter 4 of the Site SAR for more detail) The three bins of anticipated, unlikely, and extremely unlikely are used for risk evaluations Accident scenarios with occurrence frequencies in the incredible or beyond extremely unlikely bin do not require further evaluation

Consequence evaluations use the comparison criteria shown in Volume I, Chapter 4 Chemical consequences are evaluated against Emergency Response Planning Guidelines (ERPG)-2 and ERPG-3 values Chemical releases are evaluated using the Areal Locations Of Hazardous Atmospheres (ALOHA) model Median and site-specific weather data are used because the results are realistic, yet conservative The median weather parameters include wind speed of 4 5 meters/second, stability class D, cloud cover of 0 tenth, and no inversion Site-specific weather data include the relative humidity of 43%, which is the average annual relative humidity, air temperature of 50°F, which is based upon the average daily temperature, and ground roughness, which is open country for RFETS

Additional parameters include distances to the maximum off-site individual (MOI) and collocated worker, location of the release, and wind direction The distance to the MOI for Building 123 is 1210 meters The collocated worker distance is considered 100 meters for all RFETS buildings The wind direction for Building 123 that will result in the maximum exposure to the MOI is 66 degrees

The evaluation of risk considers two factors occurrence frequency of the postulated scenario and potential consequences resulting from the postulated scenario Risk is qualitatively estimated by using the risk matrix presented in Volume I, Chapter 4 of the Site SAR. The risk matrix classifies risk into four categories (I, II, III, and IV) with Risk Class I representing the highest risk and Risk Class IV representing the lowest risk For example, anticipated or unlikely accidents with high consequences are considered in Risk Class I An extremely unlikely event with low consequences is considered in Risk Class IV

3.3.2 Assumptions

The following assumptions were used in the development of the various postulated accident scenarios for Building 123

1 This analysis does not cover interaction between chemicals

2 The evaporation rate for chemical solution spills was modeled using parameters of vapor pressure, puddle size, and temperature The calculated evaporation rate was input into the ALOHA model as a direct release of pure chemical See RFETS, 1997 for specific calculations inputs

3 Accident scenarios involving the chemicals stored in the outside storage units were not analyzed because the chemicals are stored in nine storage units (cargo containers) sitting side by side located outside of Building 123 These units are constructed of heavy-duty steel and are structurally robust This physical arrangement would mitigate any postulated damage

4 For the hazardous chemicals of concern (hydrochloric acid, hydrofluoric acid, and nitric acid) the maximum permissible amount is in storage when the postulated accidents occur

5 Combustible loading in Building 123 and in the vicinity of the cargo containers used for storage of the hazardous chemicals is maintained extremely low

6 The packaging (e g , a case of hydrochloric acid solution contains six 1-gallon glass bottles with the bottles partitioned and shock-protected by form-fitting inserts, a case of hydrofluoric acid solution contains six 0 5-liter plastic bottles with the bottles separated and shock-protected by cardboard partitions, and a case of nitric acid solution contains four 1-gallon glass bottles with the bottles partitioned and shock-protected by form-fitting inserts) of the chemical cases is credited for mitigating breakage of bottles upon impact in the spill scenarios

7 The acid solutions in Room 103 are stored in their original packaging or in acid storage cabinets

8 The design-basis earthquake will result in the collapse of Building 123 The occurrence of an earthquake at RFETS is considered unlikely based upon the estimated occurrence frequency of 1 2E-03/yr (see Volume I, Chapter 5 of the Site SAR) and is considered as a potential initiator of a spill scenario at Building 123

9 In the event of a design-basis earthquake, a higher percentage of glass bottles containing hydrochloric acid solution would break than the plastic bottles containing hydrofluoric acid solution

10 The occurrence of high winds at RFETS is considered anticipated (see Volume I, Chapter 5 of the Site SAR) and is not considered as a potential initiator of a spill scenario at Building 123 because the chemicals are located inside the building or cargo containers and therefore are protected from high winds

11 The occurrence of damaging tornadoes at RFETS is considered incredible or beyond extremely unlikely (see Volume I, Chapter 5 of the Site SAR) and is not analyzed for Building 123

12 Flooding from extreme precipitation (rain and melting snow) is not evaluated for Building 123 because of its location in relation to site grading and drainage systems

13 Structural damage from heavy snow is bounded by the collapse of Building 123 assumed for the occurrence of an earthquake

14 A lightning-initiated fire scenario is considered impossible for Building 123 because lightning rods and ground cables are positioned around the edge of the roof A lightning-initiated fire scenario is considered beyond extremely unlikely or incredible for the cargo containers used to store hazardous chemicals because of the low combustible loading in the area of the containers

15 The potential of a range fire impacting Building 123 is not evaluated based upon the range fire analysis conclusions presented in Volume I, Chapter 5 of the Site SAR

3.3.3 Evaluations

There are three potential accident scenario types evaluated in hazards analyses They are explosion, fire, and spill

3 3 3 1 Explosions

Based upon Assumption 3, no explosion scenario involving the chemicals stored outside of Building 123 was developed The only potential explosion initiator for the chemicals inside of

Building 123 is the ignition of the acetylene stored in Room 111 The occurrence frequency of an acetylene explosion is also considered to be extremely unlikely and is assessed to be 4 6E-04 per year (S&W, 1991)

The maximum inventory of acid solutions stored in Room 103 are 30 gallons (296 lb) of 12 Molar hydrochloric acid solution, 4 8 gallons (46 lb) of 48% hydrofluoric acid solution, and 20 gallons (236 lb) of 16 Molar nitric acid solution The equivalent amounts of pure chemical for the maximum inventory are 110 pounds of hydrochloric acid, 22 pounds of hydrofluoric acid, and 165 pounds of nitric acid Based upon the location of Room 111 in respect to Room 103 and the packaging and storage requirements (Assumptions 6 and 7) for the acid solutions, it is conservatively assumed that 20% of the total inventory may be impacted by the acetylene explosion Therefore, the material at risk for this scenario is 22 pounds of hydrochloric acid, 4 4 pounds of hydrofluoric acid, and 33 pounds of nitric acid Table 5 summarizes the consequences and risk for an acetylene explosion impacting Room 103 in Building 123 As indicated, the consequences to immediate workers, collocated workers, and the public are low Therefore, this accident scenario results in a Risk Class IV to all receptors based upon an occurrence frequency of extremely unlikely with low consequences

Table 5. Hazard Evaluation Summary for Explosions

Hazards	(a) Hydrochloric Acid (b) Hydrofluoric Acid (c) Nitric Acid		
Accident Type	Acetylene Explosion in Room 111		
MAR	(a) 22 lb of hydrochloric acid (HCl) (b) 4 4 lb of hydrofluoric acid (HF) (c) 33 lb of nitric acid (HNO_3)		
Scenario Frequency[1]	Extremely unlikely		
Receptor	**Consequence**[2]	**Risk Class**[3]	**Specific Credited Features**
Public	(a) Low (HCl = 0 05 ppm < ERPG-2 of 20 ppm) (b) Low (HF = no significant concentration ERPG-2 is 20 ppm) (c) Low (HNO_3 = no significant concentration ERPG-2 is 15 ppm)	IV IV IV	- Inventory controls
Collocated Worker	(a) Low (HCl = 4 2 ppm < ERPG-3 of 100 ppm) (b) Low (HF = 0 3 < ERPG-3 of 50 ppm) (c) Low (HNO_3 = 0 06 < ERPG-3 of 30 ppm)	IV IV IV	- Same as Public
Immediate Worker	(a) Low (b) Low (c) Low	IV IV IV	- Same as Public
1 - With Prevention 2 - With Mitigation 3 - With Prevention & Mitigation			

3 3 3 2 Fires

Potential fire initiators include lightning strikes, aircraft crash, range fire, and ignition of combustibles in the vicinity of the hazardous chemicals Based upon Assumption 4, lightning fires are not evaluated for the hazardous chemicals associated with Building 123

An aircraft crash is considered as a potential initiator for fire scenarios at RFETS based upon the area of the impacted building (refer to Volume I, Chapter 5 of the Site SAR) Building 123 covers 19,298 square feet, which is higher than the 16,642 square feet credibility limit for an aircraft crash at RFETS However, the hazardous chemicals in Building 123 are located only in Room 103 Since the chemicals are so localized, the actual area of impact is reduced to an extremely small area Therefore, the occurrence frequency of a small aircraft impacting Room 103 is considered to be beyond extremely unlikely or incredible

Based upon Assumption 3, an aircraft crash would not result in a release of the chemicals stored in the nine cargo containers located outside of Building 123 These units are constructed of heavy-duty steel and are structurally robust This physical arrangement would mitigate the damage to the cases of chemcials in the event of an aircraft crash

Based upon Assumption 15, range fires are not evaluated for Building 123 Based upon Assumption 5, the low combustibility of the structure of Building 123, and the wet pipe sprinkler system in Building 123, fires initiated by ignition of combustible loading is not evaluated

3 3 3 3 Spills

Spill scenarios are the most common accident type for any containerized material Initiating events for spill scenarios fall into all three initiator types natural phenomena, external events, and internal events

Based upon Assumptions 8 through 15, an earthquake is the only potential natural phenomena initiators for a spill scenario The occurrence of an earthquake at RFETS is considered unlikely based upon the estimated occurrence frequency of 1 2E-3/yr (see Volume I, Chapter 5 of the Site SAR) Based upon Assumption 6 and 9, the assumed source term for the earthquake-initiated accident scenario is 20 gallons of hydrochloric acid solution, 2 4 gallons for hydrofluoric acid solution, and 15 gallons of nitric acid solution A higher percentage was used for hydrochloric acid solution (68%) and nitric solution (75%) than hydrofluoric acid (50%) is because the hydrochloric and nitric acid solutions are in glass bottles and the hydrofluoric acid solution is in plastic bottles The equivalent amounts of pure chemical for the assumed inventory are 73 pounds of hydrochloric acid, 11 pounds of hydrofluoric acid, and 123 pounds of nitric acid

There are no external event initiators applicable to the hazardous chemicals associated with Building 123 The hazardous chemicals are stored in cargo containers or in Room 103 Based upon Assumption 3, the cargo containers are sturdy enough to withstand a vehicle crash

Table 6. Hazard Evaluation Summary for Spill due to Earthquake

Hazards	(a) Hydrochloric Acid (b) Hydrofluoric Acid (c) Nitric Acid		
Accident Type	Spill due to Earthquake		
MAR	(a) 73 lb of hydrochloric acid (HCl) (b) 11 lb of hydrofluoric acid (HF) (c) 123 lb of nitric acid (HNO_3)		
Scenario Frequency[1]	Unlikely		
Receptor	**Consequence**[2]	**Risk Class**[3]	**Specific Credited Features**
Public	(a) Low (HCl = 0.15 ppm < ERPG-2 of 20 ppm) (b) Low (HF = no significant concentration ERPG-2 is 20 ppm) (c) Low (HNO_3 = no significant concentration ERPG-2 is 15 ppm)	IV IV IV	- Inventory controls
Collocated Worker	(a) Low (HCl = 13.1 ppm < ERPG-3 of 100 ppm) (b) Low (HF = 0.64 < ERPG-3 of 50 ppm) (c) Low (HNO_3 = 0.21 < ERPG-3 of 30 ppm)	IV IV IV	- Same as Public
Immediate Worker	(a) Low (b) Low (c) Low	IV IV IV	- Same as Public

1 - With Prevention 2 - With Mitigation 3 - With Prevention & Mitigation

Internal events are those activities and operations that take place in the facility. For Building 123, material handling entails moving cases of hazardous chemicals to and from their storage positions, and using individual bottles of the hazardous chemicals. The occurrence frequency for material handling accidents is anticipated. Movement of the cases of hazardous chemicals would bound the consequences.

Therefore, the second spill scenario has as an initiator a mishap during transfer of the chemical solutions by hand truck. No more than two cases of chemical solution are transferred by hand truck at any one time. Each case of 12 Molar (37% by weight) hydrochloric acid solution contains six 1-gallon glass bottles with the bottles partitioned and shock-protected by form-fitting inserts. Each case of 48% by weight hydrofluoric acid solution contains six 0.5-liter, plastic bottles with the bottles separated and shock-protected by cardboard partitions. Each case of 16 Molar (70% by weight) nitric acid solution contains four 1-gallon glass bottles with the bottles partitioned and shock-protected by form-fitting inserts. In this scenario, one of the cases falls to the ground and breaks some of the bottles in the case. Either two 1-gallon bottles of hydrochloric acid, one 0.5 liter bottle of hydrofluoric acid, or two bottles of nitric acid are assumed to break and release their contents onto the ground. The packaging of the chemical cases is credited for mitigating breakage of bottles upon impact in the spill scenarios.

Table 7 Hazard Evaluation Summary for Spill due to Material Handling

Hazards	(a) Hydrochloric Acid (b) Hydrofluoric Acid (c) Nitric Acid		
Accident Type	Spill due to Material Handling		
MAR	(a) 7 3 lb of hydrochloric acid (HCl) (b) 0 6 lb of hydrofluoric acid (HF) (c) 16 5 lb of nitric acid (HNO_3)		
Scenario Frequency[1]	Anticipated		
Receptor	**Consequence**[2]	**Risk Class**[3]	**Specific Credited Features**
Public	(a) Low (HCl = 0 02 ppm < ERPG-2 of 20 ppm) (b) Low (HF = no significant concentration ERPG-2 is 20 ppm) (c) Low (HNO_3 = no significant concentration ERPG-2 is 15 ppm)	III III III	- Inventory controls
Collocated Worker	(a) Low (HCl = 1 49 ppm < ERPG-3 of 100 ppm) (b) Low (HF = 0 04 < ERPG-3 of 50 ppm) (c) Low (HNO_3 = 0 03 < ERPG-3 of 30 ppm)	III III III	- Same as Public
Immediate Worker	(a) Low (b) Low (c) Low	III III III	- Same as Public

1 - With Prevention 2 - With Mitigation 3 - With Prevention & Mitigation

3 3 3 4 Building 123 Risk Dominant Scenarios

Risk dominant accident scenarios are defined as those that result in a Risk Class I or II based upon the estimated scenario frequency and postulated consequences For Building 123, there are no risk dominant accident scenarios Therefore, no additional controls are warranted to prevent or mitigate the hazardous chemicals associated with Building 123

3.4 BUILDING 123 FINAL HAZARD CLASSIFICATION

The inventory of potentially releasable radiological material in the facility does not and shall not exceed the reportable quantities (RQs) listed in Appendix B of 40 CFR 302 4 (CFR, 1993a) Therefore the facility is not considered to be radiological or nuclear The facility does have potentially releasable hazardous chemicals which exceed the designated threshold quantities (TQs), threshold planning quantities (TPQs), or emergency preparedness screening threshold quantities (EPSTs) The hazardous chemicals are concentrated solutions of hydrochloric acid, hydrofluoric acid, and nitric acid located in the outside storage units and in Building 123, Room 103 According to the guidance in DOE-EM-STD-5502-94 (DOE, 1994b), Building 123 is classified as a non-nuclear moderate hazard facility because of the presence of these hazardous chemicals

4 OPERATIONAL CONTROLS

The following operational controls maintain the validity of this authorization basis and assure the continued safe operations of Building 123, which has been classified as a non-nuclear moderate hazard facility, based on the guidance provided in DOE-EM-STD-5502-94

4.1 DERIVATION OF OPERATIONAL CONTROLS

The operational controls derived for Building 123 consist of administrative controls addressing inventory constraints for hazardous materials, specific credited controls, and the RFETS safety management infrastructure This set of administrative controls for Building 123 provide (a) protection to the collocated worker, the public, and the environment by preserving assumptions made in analyzed accident scenarios, (b) worker safety based on standard industrial hazards, and (c) defense-in-depth

Inventory constraints are based upon the hazardous materials identified in Section 3 These limitations maintain the documented hazard classification, as defined in DOE-EM-STD-5502-94, and the specific amounts that are analyzed in this FSA.

Credited controls are those specifically identified and credited during evaluation of identified accident scenarios These controls reduce the risk associated with the facility by providing direct prevention or mitigation features for the postulated accident scenarios Credited controls include engineered or physical features and administrative procedures or policies

The RFETS safety management infrastructure consists of the 22 programs summarized in Volume I, Chapter 6 of the Site SAR Safety management programs address three major area

- adequate control of radiological material and hazardous chemical hazards,
- regulatory compliance with federal and state requirements, applicable codes and standards, and standard industrial health and safety practices, and
- good engineering and management practices

These programs are required and implemented on a site-wide basis to assure the protection of workers, the public, and the environment Facility implementation is based upon a graded approach as dictated by individual facility hazard analysis and site-wide infrastructure requirements The graded-approach is based upon the magnitude of hazards in the facility and the control's relative importance to safety

4.2 ADMINISTRATIVE CONTROLS FOR BUILDING 123

The following administrative controls and bases address inventory limitations, credited controls, and the RFETS safety management infrastructure associated with the hazards identified in Section 3 of this FSA

4.2.1 Hazardous Material Inventory

Controlling the quantities of radiological materials and hazardous chemicals limits the potential release of these materials in the event of a spill The following inventory controls assure that Building 123 operates within the bounds of the safety analyses performed in this FSA

Table 8. Hazardous Material Inventory Controls for Building 123

Control	Surveillance Requirement	Required Action
• The facility inventory of **radioactive materials** shall not exceed RQs in 40 CFR 302 • The facility inventory of **hazardous chemicals** shall not exceed the TQs in 40 CFR 68 or 29 CFR 1910 119, TPQs in 40 CFR 355, or the EPST developed by RFETS Emergency Preparedness except as follows • Hazardous chemicals ordered for or stored in the outside storage units at any one time shall not exceed the following • Hazardous chemicals stored inside at any one time shall not exceed the following	All Controls • Verify prior to receipt that inventory controls will not be exceeded • Surveillance of inventory is conducted in accordance with contractor policies and procedures	All Controls • Remove materials from the facility to below Inventory Control thresholds

Quantity limits of hazardous chemicals

Chemical	Ordered or stored outside	Stored inside
HCl (37%)	90 gallons	30 gallons
HF (48%)	30 gallons	30 gallons
HNO_3 (96%)	160 gallons	20 gallons

Bases:

Controls are placed on hazardous material inventories to prevent the introduction of materials into the facility that would invalidate the safety analysis basis of the facility as documented in this FSA The hazard classification of non-nuclear moderate hazard for Building 123 in this FSA is based on the materials currently present or maximum inventories possible in the facility Therefore, the inventory of hazardous materials may not exceed the quantities identified in the hazards analysis in Chapter 3 of this FSA

No radiological materials are currently present in Building 123, therefore the introduction of radiological materials to Building 123, must be compared to the RQs listed in 40 CFR 302, Appendix B to Section 302 4 If they exceed any of these reportable quantities, a USQD must be performed

For those hazardous chemicals not specifically evaluated in Chapter 3, the inventory in Building 123 shall not exceed the TQs listed in 29 CFR 1910 119 and 40 CFR 68, or the TPQs listed in 40 CFR 355, or the EPST developed by RFETS Emergency Preparedness

The introduction of new chemicals to Building 123 must be compared to the 40 CFR 302 RQs to determine if the chemical is hazardous Hazardous chemicals must be compared to the TQs listed in 29 CFR 1910 119 and 40 CFR 68, the TPQs listed in 40 CFR 355, or the EPST developed by RFETS Emergency Preparedness If they exceed any of these threshold quantities, a USQD must be performed

4.2.2 Specific Credited Controls

Table 9 presents the specific credited controls used in the development and disposition of accident scenarios for Building 123 These controls must be maintained to ensure the validity of the accident evaluation documented in this FSA

Table 9. Specific Credited Controls for Building 123

	Control	Surveillance Requirements	Required Action
1	Transitory combustible loading in Room 103 and in the vicinity of the cargo containers storing hazardous chemicals shall be controlled	Functional performance expectations and periodic surveillance for combustible loading shall be established by contractor procedures	Remove combustibles from building or vicinity of cargo containers
2	The hazardous chemicals in the cargo containers and Room 103 shall be stored in their original packaging unless they are in a acid storage cabinet	Functional performance expectations and periodic surveillance for storage configuration shall be established by contractor procedures	Move hazardous chemicals into original packaging or acid storage cabinet.
3	Outside storage of hazardous chemicals shall be inside of cargo containers	Functional performance expectations and periodic surveillance for storage configuration shall be established by contractor procedures	Move hazardous chemicals into cargo containers
4	Fire suppression system shall be maintained operable	Functional performance expectations and periodic surveillance for fire suppression system shall be established by contractor procedures	Establish continuously monitoring fire watch and initiate maintenance work order to repair
5	No more than 2 cases of hydrochloric acid, hydrofluoric acid, or nitric acid shall be transferred at a time	Functional performance expectations and periodic surveillance for material handling shall be established by contractor procedures	Reduce transfer load to 2 cases

Bases.

1 Extremely low transitory combustible loading was credited in the disposition of fire scenarios in that a fire would not be sustained long enough to impact the hazardous chemicals in Room 103 or the cargo containers

2 The original packaging of the hazardous chemicals was credited in the spill scenarios to reduce the source term released during the postulated scenarios

3 The structure of the cargo containers was credited in the disposition of explosion and spill scenarios because it was assumed that the robust construction would protect the hazardous chemicals

4 The fire suppression system was credited in the disposition of fires impacting the hazardous chemicals in Room 103

5 A limit of 2 cases was credited in the material handling scenarios

4.2.3 Safety Management Infrastructure

Facility management shall assure that all identified hazards are adequately addressed The application of Safety Management Infrastructure Programs to this facility shall be based on (a) hazard identification and (b) accident evaluation Implementation of the appropriate RFETS Safety Management Programs or specific aspects of the RFETS Safety Management Programs shall be performed in accordance with approved contractor policies and procedures

Surveillance Requirement

Application of the Safety Management Programs for this facility shall be assessed annually in conjunction with the annual update of this FSA

Basis

Each facility shall implement Safety Management Programs or program aspects that aid in the identification, assessment, and control of hazards recognized as being present in the facility The hazards are documented in the FSA Hazard Description Table "Standard industrial hazards" do not require further analysis based on the assumption that the facility will implement Safety Management Programs necessary to control these hazards Examples of standard industrial hazards include high voltage sources and the storage and use of hazardous chemicals Standard industrial hazards, simply by their existence in the facility, may necessitate the need to implement certain aspects of a specific Safety Management Program or possibly the entire program For example, the presence of high voltage and hazardous chemicals may necessitate a graded application of the Industrial Hygiene and Safety Program

Some of the identified hazards in the FSA Hazard Description Table may have warranted additional accident evaluation based on potential impacts to collocated workers and/or the public The implementation of Safety Management Programs or program aspects for a this facility must take into consideration the hazards (radiological and chemical) analyzed in Section 3 As a minimum, Safety Management Programs or program aspects that define, implement, and assure continued compliance with inventory constraints and credited controls shall be implemented using a graded approach For example, combustible loading requirements are typically defined and implemented via aspects of the Site Fire Protection Program Implementation of the entire program would not typically be required to assure control of combustibles Using a graded approach, facility management shall define, implement, and maintain Safety Management Programs that assure compliance with each inventory control and credited control

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