APPENDIX A - ACRONYMS

AB	Authorization Basis Document
ACGIH	American Conference of Governmental Industrial Hygienists
ACLs	Administrative Control Levels
AED	Aerodynamic Equivalent Diameter
AGL	Above Ground Level
AIHA	American Industrial Hygiene Association
ALARA	As Low as Reasonably Achievable
ALOHA	Areal Locations of Hazardous Atmospheres
ANS	American Nuclear Society
ANSI	American National Standards Institute
APC	Atmospheric Pressure Change
ARAC	Atmospheric Release Advisory Capability
ARCHIE	Automated Resource for Chemical Hazard Incident Evaluation
ARF	Airborne Release Fraction
ASA	Auditable Safety Analysis
ASCE	American Society of Civil Engineers
BCF	Billion Cubic Feet
BEST	Building Emergency Support Team
BFO	Basis for Operation
BLEVE	Boiling Liquid Expanding Vapor Explosion
BIO	Basis for Interim Operation
BOCA	Building Officials and Code Administrators
BR	Breathing Rate
BST	Building Source Term

CAS	Chemical Abstract Service
CCCP	Configuration Change Control Program
CCR	Colorado Code of Regulations
CDH	Colorado Department of Health
CDPHE	Colorado Department of Public Health and the Environment
CEDE	Committed Effective Dose Equivalent
CEPC	Configuration, Engineering, Project, and Construction
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CID	Cumulative Impacts Documents
CL	Confidence Limits
CM	Crisis Manager
CMCAP	Commitment Management and Corrective Action Process
CNG	Compressed Natural Gas
CNHP	Colorado Natural Heritage Program
COEM	Conduct of Engineering Manual
COOP	Rocky Flats Environmental Technology Site Conduct Of Operations Manual
CSM	Criticality Safety Manual
D&D	Decontamination, and Decommissioning
DAPPLE	Damage Area Per Path Length
DCF	Dose Conversion Factor
DCI	Dyn-Corp Inc.
DD&D	Deactivation, Decontamination, and Decommissioning
DIA	Denver International Airport
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy

DOT	Department of Transportation
DR	Damage Ratio
EDE	Effective Dose Equivalent
EEGL	Emergency Exposure Guidance Level
EMO	Emergency Management Organization
EOC	Emergency Operations Center
EOCNO	Emergency Operations Center Notification Officer
EOE	Engineering Operability Evaluation
EP	Emergency Preparedness
EPA	Environmental Protection Agency
EPHA	Emergency Preparedness Hazard Assessment
EPLAN	Rocky Flats Environmental Technology Site Emergency Plan
EPSCREEN	Emergency Preparedness Screening
EPST	Emergency Preparedness Screening Threshold
EPZ	Emergency Planning Zone
ER/WM	Environmental Restoration and Waste Management
ERO	Site Emergency Response Organization
ERPG	Emergency Response Planning Guidelines
ES&H	Environmental Safety and Health
ESA	Endangered Species Act
ESHC	Environmental, Safety, and Health Council
EWP	Emergency Work Package
FBI	Federal Bureau of Investigation
FCA	Federal Facilities Compliance Act
FEMA	Federal Emergency Management Agency
FHA	Fire Hazards Analysis

FSA	Facility Safety Analysis
FSAR	Final Safety Analysis Report
GCR	Geologic Characterization Report
HAZMAT	Hazardous Materials
HEPA	High Efficiency Particulate Air
HEUN	Highly Enriched Uranyl Nitrate
HQ	Head Quarters
HSP	Health and Safety Program
HSP	Health Safety Program
HVAC	Heating, Ventilation and Air Conditioning
IA	Industrial Area
IC	Intra-cloud
IC	Incident Commander
ICMS	Integrated Chemical Management System
ICP	Incident Command Post
IDC	Item Description Code
IDLH	Immediately Dangerous to Life and Health
IMC	Integrating Management Contractor
ISM	Integrated Safety Management
IST	Initial Source Term
ISV	Interim Storage Vault
IWCP	Integrated Work Control Program
JCO	Justification for Continued Operation
JPIC	Joint Public Information Center
K-H	Kaiser-Hill
LCF	Latent Cancer Fatality

LCO	Limiting Condition for Operation
LCS	Limited Control Settings
LGS	Lightning Grounding System
LLMW	Low Level Mixed Waste
LLW	Low Level Waste
LO/TO	Lock Out/Tag Out
LOC	Level of Concern
LPF	Leakpath Factor
LPS	Lightning Protection System
LS/DW	Life Safety/Disaster Warning
LSS	Lightning Safety System
LSSC	Lightning Safety System Certification Plan
LTWS	Lightning Threat Warning System
LUM	Land Use Manual
LWRP	Lightning Warning Response Plan
MACCS	MELCOR Accident Consequence Code System
MAL	Master Activity List
MAR	Material-at-Risk
MBC	Media Briefing Center
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MMD	Mass Median Diameter
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
MT	Metric Tons
NAS	National Academy of Sciences

NCAR	National Center for Atmospheric Research
NCSC	Nuclear Criticality Safety Committee
NCPP	National Conversion Pilot Project
NEPA	National Environmental Policy Act
NESHAP	Radiological National Emissions Standard for Hazardous Air Pollution
NFPA	National Fire Protection Association
NFRAG	Rocky Flats Risk Assessment Guide
NIOSH	National Institute for Occupational Safety and Health
NMC	Nuclear Materials Control
NMSL	Nuclear Material Safety Limit
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPH	Natural Phenomena Hazards
NRC	Nuclear Regulatory Commission
NREL	National Renewable Energy Laboratory
NRPCP	Natural Resource Protection and Compliance Program
NSB	Nearest Site Boundary
NSM	Nuclear Safety Manual
NSSFC	National Severe Storms Forecast Center
NSTR	Nuclear Safety Technical Report
ORC	Operations Review Committee
OSHA	Occupational Safety and Health
OSR	Operational Safety Requirement
OU	Operable Unit
PA	Protected Area
PACS	Personnel Access Control System

PARs	Protective Action Recommendations
PAs	Protective Actions
PATS	Plant Action Tracking System
PC	Performance Category
PCB	Polychlorinated Biphenol
PEL	Permissible Exposure Level
PEL-C	Permissible Exposure Level-Ceiling
PEL-TWA	Permissible Exposure Level-Time Weighted Average
PHA	Preliminary Hazard Analysis
PMT	Post-Maintenance Test
PROFS	Prototype Regional Observing and Forecasting System
PSC	Public Service Company of Colorado
PSZ	Perimeter Security Zone
QA	Quality Assurance
QAP	Quality Assurance Plan
QSI	Quality Systems Integration
RCM	Radiological Control Manual
RCO	Radiological Control Organization
RCP	Radiological Control Program
RCRA	Resource Conservation and Recovery Act
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
RFP	Rocky Flats Plant
RFPEMP	Rocky Flats Plant Environmental Monitoring Plan
RMA	Rocky Mountain Arsenal
RMIR	Radioactive Materials Incident Report

RMRS	Rocky Mountain Remediation Service
RPPM	Radiation Protection Programs Manager
RQ	Reportable Quantity
RSPA	Research and Special Programs Administration
S/R	Shipping and Receiving
SAND	Corrugated Metal Crate for TRU Waste
SAR	Safety Analysis Report
SARA	Superfund Amendment and Reauthorization Act
SARAH	Safety Analysis and Risk Assessment Handbook
SCP	Systems and Components Protection
SDWA	Safe Drinking Water Act
SEAC	Structural Engineers Association of Colorado
SEOC	State Emergency Operations Center
SES	Safety Evaluation Screen
SL	Safety Limits
SNM	Special Nuclear Material
SR	Surveillance Requirements
SS	Shift Supervisor
SSC	Structures, Systems, and Components
SST	Safe Secure Transport
SWB	Standard Waste Box
TLV/PEL	Threshold Limit Value/Permissible Exposure Limit
TLV	Threshold Limit Values
TLV-C	Threshold Limit Value-Ceiling
TLV-TWA	Threshold Limit Value-Time Weighted Average
TPQ	Threshold Planning Quantities

TQ	Threshold Quantities
TQM	Total Quality Management
TRAC	Terrain Responsive Atmospheric Code
TRM	Transuranic Mixed Waste
TRU	Transuranic or transuranic waste
TSCA	Toxic Substance Control Act
TSD	Treatment, Storage, and Disposal
TSO	Transportation Security Officer
TSR	Technical Safety Requirement
TWAs	Time Weighted Averages
TYP	Ten Year Plan
UBC	Uniform Building Code
UDFCD	Urban Drainage and Flood Control District
UPS	Uninterruptible Power Supply
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WEMS	Waste and Environmental Management System
WGPu	Weapons Grade Plutonium
WIPP	Waste Isolation Pilot Plant
WSI	Wackenhut Services Inc.
WSRIC	Waste Stream and Residual Identification and Characterization
WWTP	Water Waste Treatment Plant

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APPENDIX B - GLOSSARY

Accident. An unplanned event or sequence of events that results in undesirable consequences. [DOE-STD-3009-94]

Accident Analysis. Accident analysis consists of the formal development of estimates of the expected consequence and probability of potential accidents associated with a facility. Consequences are compared with offsite evaluation guidelines to identify safety-class structures, systems and components. [DOE Order 5480.21]

Accident Severity Category. Categories developed in NUREG-0170 identifying expected damage to contents of a transfer vehicle in the event of an accident based on the velocity of the impact.

Activity. An all-inclusive term describing a specific set of operations or related tasks to be performed serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication) that result in a product or service.

Administrative Controls. Provisions relating to organization and management, procedures, recordkeeping, assessment, and reporting necessary to ensure the safe operation of a facility. [DOE Order 5480.23]

ALOHA (Areal Locations of Hazardous Atmospheres). A computer model which estimates pollutant concentrations downwind from the source of a spill, taking into consideration the toxicological and physical characteristics of the spilled material.

Anticipated Event. Events with an estimated probability of occurrence greater than 10^{-2}/year. Incidents that may occur several times during the lifetime of the facility. [DOE-STD-3009-94]

Approved Packaging. Approved means:

1. Approval issued or recognized by the U. S. Department of Transportation; or
2. A Department of Transportation specification or exemption container; or
3. A Certificate of Compliance for packaging approved by the U. S. Department of Energy or the Nuclear Regulatory Commission; or
4. Off-Site Transportation Certificate (OTC) packaging approved by DOE/AL; or
5. For transportation within Rocky Flats, a packaging shown in the *On-Site Transportation of Hazardous and Radioactive Materials Manual*, *On-Site Transportation of Non-Hazardous Materials Manual*, or approved by the On-Site Transportation Safety Committee.

ARCHIE (Automated Resource for Chemical Hazard Incident Evaluation). A computer model developed to assist emergency preparedness personnel in estimating the vapor dispersion, fire, and explosion impacts associated with episodic discharges of hazardous materials into the terrestrial environment.

As Low as Reasonably Achievable (ALARA). A philosophy of protection that controls and maintains radiation, radioactive contamination and hazardous material exposures to individuals and to the work force and general public as low as technically and economically feasible below the regulatory limits. [10 CFR 835]

ATMX. Atomic Munition Explosive Rail Transport Car used in the past to transport TRU waste to Idaho.

Auditable Safety Analysis. A defendable safety analysis (similar to a SAR but with much reduced content and requirements) which is developed for a radiological facility. An auditable safety analysis:

a. Provides systematic identification of hazards within a given DOE operation; and
b. Describes and analyzes the adequacy of measures taken to eliminate, control or mitigate identified hazards. [DOE-EM-STD-5502-94]

Average residue. For this evaluation, a package of average residue is assumed to contain 1,000 grams of aged weapons grade plutonium in non-oxide form.

Authorization Basis. Those aspects of the facility design basis and operational requirements relied on by DOE to authorize operation. These aspects are considered to be important to the safety of facility operations. The authorization basis is described in documents such as the facility SAR and other safety analyses, Hazard Classification Documents, the Technical Safety Requirements (TSRs), and documents such as DOE-issued safety evaluation reports, and facility-specific commitments made in order to comply with DOE Orders or policies. [DOE Order 5480.23]

Bases. Summary statements of the reasons for the administrative and engineered controls, the administrative control programs and their associated surveillance requirements. The Bases relate the credited assumptions made in the accident analysis to the requirements for safe operation.

Becquerel (Bq). The System International (SI) equivalent of the curie for measurement of activity. One Bq is defined as one disintegration per second. Thus 1 Bq = 2.703×10^{-11} Ci.

Beyond Design Basis Accident. An accident of the same type as a design basis accident (e.g., fire, earthquake, spill, explosion, etc.), but defined by parameters that exceed in severity the parameters defined for the design basis accident. [DOE-STD-3009-94]

Beyond Extremely Unlikely Event. Events with an annual likelihood of occurrence less than or equal to 10^{-6}. [DOE-STD-3009-94]

Buffer Zone. A protected environmental preserve for plant and animal life lying within the site boundary but outside the industrialized area of the Site and from which the public is normally excluded by security control. The current buffer zone area is 6265.85 acres (including industrial area).

Bulk Chemical. A chemical which is transported in tank trucks or railcar quantities or stored in tanks.

Certificate of Compliance (C-of-C). A DOE or NRC document that provides certification that a specific packaging for specified quantities and types of radioactive materials meets the applicable regulatory requirements.

Collocated Worker. The worker whose dose is calculated at 100 meters and who is considered representative of all on-site workers who are not immediate workers.

Commercial Carrier. A for-hire carrier, common or contract, interstate or intrastate (Air, rail, motor, or water). A contract carrier's services are not extended to the general public.

Committed Dose Equivalent (CDE). The dose equivalent calculated to be received by a tissue or organ over a 50-year period after the intake of a radionuclide into the body. It does not include contributions from radiation sources external to the body. Committed dose equivalent is expressed in units of rem (or sievert).

Committed Effective Dose Equivalent (CEDE). The sum of the committed dose equivalents to various tissues in the body, each multiplied by its appropriate weighting factor. It does not include contributions from external dose. Committed dose equivalent is expressed in units of rem (or sievert).

Compensatory Actions. Temporary actions planned and implemented to provide an acceptable alternative means to meet the intent of the functional requirements afforded by the normal structure, system, component (SSC) configuration and operation. When normal system operation has failed and compensatory measures are justified by an approved Engineering Operability Evaluation (EOE), implementation of those specified compensatory measures is required to maintain the SSC status as conditionally operable. Compensatory measures are not corrective actions (actions required to return the SSC to an operable status). Compensatory measures are implemented by existing work processes, such as CCCP for temporary modifications.

Conservatism. Simplifying approximations and assumptions in safety analyses and evaluations and their applications that increase the safety margin above the required minimum.

Container. The inner item that holds the material.

Contamination. Deposition of unwanted chemicals or radioactive material on any object, surface, or in the atmosphere. When not specifically preceded by a descriptive word, i.e., plutonium, beryllium, etc., implies contamination with one or more of the radioactive or hazardous materials present at Rocky Flats.

Contamination Area. Any area where contamination levels are greater than the values specified in Appendix D of 10 CFR 835 but less than or equal to 100 times those levels.

Controlled Area. Any area to which access is managed in order to protect individuals from exposure to radiation and/or radioactive material. Individuals who enter only the controlled area without entering radiological areas are not expected to receive a total effective dose equivalent of more than 100 mrem (0.001 sievert) in a year.

Credible Accident. Offering reasonable grounds for being believed on the basis of commonly accepted engineering judgment. Those accidents with an estimated probability of occurrence greater than 10^{-6} per year, conservatively calculated, or 10^{-7}, realistically calculated. Separate probability criteria are used for natural phenomena as stated in DOE-STD-1020-94. [DOE-STD-3009-94]

Critical. Fulfilling the condition that a medium capable of sustaining a nuclear fission chain reaction has an effective multiplication factor, k_{eff}, greater than or equal to unity.

Criticality Accident. The release of energy as a result of the unintentional production of a self-sustaining or divergent nuclear fission chain reaction.

Criticality Safety Evaluation. The documented rationale demonstrating the nuclear criticality safety of a facility or operation that contains fissionable material. The analysis is developed by the facility management, engineering design personnel, facility operations supervision, and nuclear criticality safety personnel. It provides sufficient descriptions of the facility equipment, fissionable material processes, and operational controls to identify the normal and contingent abnormal operating conditions of the facility.

Curie (Ci). A curie is a measure of activity (i.e., rate of decay) of a radioactive sample. One curie is defined as an activity of 3.7×10^{10} disintegrations per seconds (sec^{-1}). 1 Ci = 3.7×10^{10} Bq.

Damage Ratio. The fraction of the material at risk actually impacted by the accident-generated conditions. The release fraction is applied to this impacted fraction. [DOE-HDBK-3010-94]

Decommissioning. The process of closing and securing a nuclear facility or nuclear materials storage facility so as to provide adequate protection from radiation exposure and to isolate radioactive contamination from the human environment. [DOE Order 5480.30]

Decontamination. The act of removing a chemical, biological, or radiological contaminant from, or neutralizing its potential effect on, a person, object or environment by washing, chemical action, mechanizal cleaning or other techniques. [DOE Order 5480.30]

Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and can be accelerated without input of heat from another source. Deflagration is a surface phenomenon, with the reaction products flowing away from the unreached material along the surface at subsonic velocity.

Depleted Uranium. The substance remaining after part of the fissile uranium has been removed; having a percentage of uranium-235 smaller than the 0.72 percent found in natural uranium.

Design Basis. The set of requirements that bound the design of systems, structures, and components within the facility. These design requirements include consideration of safety, plant availability, efficiency, reliability, and maintainability. Some aspects of the design basis are important to safety, although others are not. [DOE Order 5480.23]

Design Basis Accidents (DBAs). Postulated accidents, or natural forces, and resulting conditions for which the confinement structure, systems, components and equipment must meet their functional goals. These safety class items are those necessary to assure the capability; to safety shut down operations, maintain the plant in a safe shutdown condition, and maintain integrity of the final confinement barrier of radioactive or other hazardous materials; to prevent or mitigate the consequences of accidents; or to monitor releases that could result in potential offsite exposures. [DOE Order 5480.23]

Detonation. A violent chemical reaction within a chemical compound or mechanical mixture evolving heat and pressure. It is a reaction that proceeds through the reacted material toward the unreached material at a supersonic velocity. The result of the chemical reaction is the exertion of extremely high pressure on the surrounding medium, forming a propagating shock wave of supersonic velocity.

Dose Assessment. Process of determining radiological dose and uncertainty included in the dose estimate, through the use of exposure scenarios, bioassay results, monitoring data, source term information and pathway analysis.

Emergency Preparedness Screening Threshold Quantity. The amount of a material on the composite screening list used by Emergency Preparedness to screen chemicals based on hazard.

Emergency Response Planning Guidelines-1 (ERPG-1). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing anything other than mild transient health effects or perceiving a clearly defined objectionable odor. [AIHA]

Emergency Response Planning Guidelines-2 (ERPG-2). The maximum airborne concentration, below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action. These are guidelines for community exposure to accidental releases and are produced by a consortium of 25 chemical firms in conjunction with the American Industrial Hygiene Association (AIHA). These limits are for offsite, short-term, accidental exposures. [AIHA]

Emergency Response Planning Guidelines-3 (ERPG-3). The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects. These are guidelines for community exposure to accidental releases and are produced by a consortium of 25 chemical firms in conjunction with the American Industrial Hygiene Association (AIHA). These limits are for on-site, short-term, accidental exposures. [AIHA]

Engineered Controls. Use of components and systems to reduce airborne radioactivity or hazardous chemical releases by using piping, containments, ventilation, filtration or shielding.

Engineered Safety Feature. Systems, components or structures that prevent and/or mitigate the consequences of all potential accidents, including the bounding design basis accidents. [DOE Order 5480.23]

Equivalent Level of Safety (for Transportation purposes). Those positive measures that will assure a level of protection to the public safety, health, and the environment which meet or exceed those specified in applicable regulations. [AL 5610.1]

Evaluation Guidelines. Hazardous material dose/exposure values that the safety analysis evaluates against. [DOE-STD-3009-94]

Extremely Unlikely Event. Events with an estimated annual likelihood of occurrence of less than or equal to 10^{-4} but greater than 10^{-6}. Accidents that will probably not occur during the life cycle of the facility. This class includes the design basis accidents. [DOE-STD-3009-94]

Facility. Any equipment, structure, system, process, or activity that fulfills a specific purpose. [DOE Order 5000.3B] The definition most often refers to buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed therein to delineate a facility. However, specific operations and processes independent of buildings or other structures (e.g., waste retrieval and processing, waste burial, remediation, groundwater or soil decontamination, decommissioning) are also encompassed by this definition. [DOE-STD-3009-94]

Fissile Materials. A nuclide capable of undergoing fission by interaction with slow neutrons provided the effective thermal neutron production cross section exceeds the effective thermal neutron absorption cross section. [DOE Order 6430.1A]

Fissionable Material. A material of any nuclides capable of sustaining a nuclear fission chain reaction. For nuclear criticality safety purposes, such materials are composed of fissionable nuclides but may include nonfissionable nuclides.

Frequency of Exceedance. The annual probability that a particular amplitude of ground motion will be exceeded at the Site. The exceedance probabilities at a variety of peak ground accelerations (maximum amplitudes) constitute the Total Hazard Curve. This term is also used for other natural phenomena hazards in ways specific to those events.

Frequency of Occurrence. The number of occurrences in an interval of time during which an event is expected to occur as a result of a specific hazard; the inverse of the return period.

Graded Approach. A process by which the level of analysis, documentation, and actions necessary to comply with a requirement are commensurate with:

1. The relative importance to safety, safeguards, and security;
2. The magnitude of any hazard involved;
3. The life cycle stage of a facility;
4. The programmatic mission of a facility;
5. The particular characteristics of a facility;
6. Any other relevant factor. [10 CFR 830.3]

Groundwater. Water in a saturated zone or stratum beneath the surface of land or water. The supply of fresh water found beneath the Earth's surface, usually in aquifers, that supplies wells and springs.

Hazard. A source of danger (i.e., material, energy source or operation) with the potential to cause illness, injury, or death to personnel or damage to facility or to the environment (without regard for the likelihood or credibility of accident scenarios or consequence mitigation). [10 CFR 830.3]]

Hazard Analysis. The determination of material, system, process, and facility characteristics that can produce undersirable consequences, followed by the assessment of hazardous situations associated with a process or activity. Largely qualitative techniques are used to pinpoint weaknesses in design or operation of the facility that could lead to accidents. [DOE-STD-3009-94]

Hazard Class (for transportation purposes). The category of hazard assigned to a hazardous material under the criteria of 49 CFR 173 and the provisions of 172.102.

Hazard Categories. The consequences of unmitigated releases of radioactive and/or hazardous material shall be evaluated and classified by the following hazard categories:

Hazard Category 1:	The hazard analysis shows the potential for significant offsite consequences.
Hazard Category 2:	The hazard analysis shows the potential for significant onsite consequences.
Hazard Category 3:	The hazard analysis shows the potential for only significant localized consequences. [DOE Order 5480.23]

Hazard Classes. Non-nuclear facilities will be categorized based on the following:

High	hazards with a potential for onsite and offsite impacts to large numbers of persons or for major impacts to the environment;
Moderate	hazards which present considerable potential for onsite impacts to people or the environment, but at most only minor offsite impacts; and
Low	hazards which present minor onsite and negligible offsite impacts to people and the environment. [DOE Order 5481.1B]

Hazard Communication Program. A requirement under 29 CFR 1910.1200 which obligates employers who may expose their employees to hazardous chemicals to develop a formal hazard communication program which includes training, labels and other forms of warning, including Material Safety Data Sheets.

Hazardous Material. Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Oil is excluded from this definition. [DOE Order 5480.23] Candidate hazards include radioactive materials, hazardous chemicals as defined by OSHA in 29 CFR 1910.1200 and 29 CFR 1910.1450; any material assigned a reportable quantity value in 40 CFR 302, Table 302.4; threshold planning quantities in 40 CFR 355, Appendix A; threshold planning quantities in 29 CFR 1910.119; level of concern quantities in EPA's "Technical Guidance for Hazard Analysis--Emergency Planning for Extremely Hazardous Substances;" or materials rated as 3 or 4 in National Fire Protection Association 704, "Identification of the Fire Hazards of Materials." [DOE-STD-3009-94]

Hazardous Waste. Any material containing hazardous materials. Hazardous wastes are subject to the Uniform Hazardous Waste Manifest Requirements of the U. S. EPA specified in 40 CFR 262. [49 CFR 171.8]

HEPA Filter. High Efficiency Particulate Air filter that removes minute particles from the air stream; used to filter exhaust air from buildings where radioactive or toxic material is present. HEPA filters are commonly used in industry and capable of particulate removal efficiency of no less than 99.97 percent.

Highly Enriched Uranium (HEU). Uranium having isotopic contents of U-235 or U-233 greater than or equal to 20 weight percent. HEU generally refers to 93 weight percent U-235.

Holdup. The amount of nuclear material remaining in process equipment and facilities after the in-process material, stored materials, and product have been removed. Estimates or measured values of materials in holdup may be reflected in the facility's inventory records.

Immediate Worker. Those workers in close proximity to operations who are the population principally at risk from potential consequences from accidents. [DOE-STD-3009-94]

Incredible. Those accidents with an estimated probability of occurrence less than or equal to 10^{-6} per year calculated conservatively or 10^{-7} per year calculated realistically.

Individual Hazardous Substance Site (IHSS). A chemically- or radiologically-contaminated area of the Site.

Industrial Area. That portion of the site containing the majority of the structures and processes.

Initiating Event. The event that is the beginning of an accident (initiator for accident scenarios) and its associated frequency of occurrence.

Integrated Chemical Management System. A computer database for tracking chemicals on Site.

Item Description Code (IDC). A three-character code that identifies the type of nuclear material (e.g., ingot, part, oxide, combustible waste).

Justification for Continued Operation (JCO). A technical evaluation performed to assess the safety significance of continued operation outside of conditions defined by the OSRs or TSRs.

Lab Pack. A package consisting of individual waste items that are packed into a DOT-approved container and prepared to DOT specifications (hazard class, description, labels and markings) for off-site shipment, as specified in 49 CFR 173.12.

Limiting Condition for Operation (LCO). The lowest functional capability or performance levels of safety-related structures, systems components, and their support systems required for normal, safe operation of the facility. [DOE Order 5480.22]

Low-Level Waste. Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel or byproduct material as defined in Section 11e(2) of the Atomic Energy Act, as amended. Material having no economic value and contaminated with transuranic elements (e.g., americium and plutonium) at a specific activity less than or equal to 100 nCi per gram of waste material, or wastes contaminated with uranium. [DOE Order 5820.2A]

Low-Level Mixed Waste. Waste that is regulated under the Atomic Energy Act as low-level waste and also regulated by the EPA as hazardous waste.

Material Access Area. A subdivision of the Protected Area within which material is tracked for accountability purposes.

Material at Risk. The amount of each radionuclide or chemical component of the total inventory that is available for release in a given scenario.

Material Safety Data Sheets (MSDS). A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health, and physical hazards, exposure limits, and precautions.

Maximum Credible Accident (MCA). A hypothetical accident which leads to the most severe consequences within the range of credibility (probability greater than 10^{-6}/year, calculated conservatively, or greater than 10^{-7}/year, calculated realistically).

Maximum Off-Site Individual (MOI). A hypothetical member of the public whose air, food, and water consumption takes place 100% of the time at a location at the site boundary (or greater distance), which maximizes the radiological dose received as a result of accidental releases or routine emissions from the site.

Member of the Public. An individual who is not occupationally exposed to radiation or radioactive material. An individual is not a "member of the public" during any period in which the individual receives occupational exposure.

Mitigating Systems. Safety/Support systems, administrative controls, and/or emergency responses, that modify the frequency of accident sequences and, if they function as intended (succeed), mitigate the consequences of initiating events.

Mitigative Feature. Any structure, system, or component that serves to mitigate the consequences of a release of hazardous materials in an accident scenario. [DOE-STD-1027-92]

Mixed Waste. Waste containing both radioactive and hazardous components as defined by the Atomic Energy Act of 1954 and the Resources Conservation and Recovery Act, respectively. Mixed waste may be low-level or TRU waste.

Moderator. A material used to reduce neutron energy by scattering neutrons without appreciable neutron capture.

Movement. Used in transportation to refer to the relocation of material within a building or between buildings via a tunnel or overpass.

National Conversion Pilot Plant Project. A project designed to explore and demonstrate the feasibility of economic conversion of facilities and equipment owned by the Federal government to production of goods by private firms for profit.

Natural Phenomena. Natural events of concern for design or accident analyses purposes such as earthquakes, tornadoes, extreme winds, floods, snow loadings, and lightning strikes.

Nonreactor Nuclear Facility. Those activities or operations (at DOE facilities which are not reactors) that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. [DOE Order 5480.23]

Nuclear Material. All materials so designated by the Secretary of Energy. Presently, these materials are: depleted uranium, enriched uranium, americium-241, americium-243, curium, berkelium, californium, plutonium 238 through 242, lithium-6, uranium-233, normal uranium, neptunium-237, deuterium, tritium, thorium.

Nuclear Material Safeguards Category. Classification of nuclear material form, quantity, and attractiveness level that determines safeguards and security requirements. Specific criteria for determining Nuclear Material Safeguards Categories are given in DOE Order 5633.3B.

Occurrence. Is defined in the DOE's Occurrence Reporting and Processing System (ORPS) as (1) an emergency that requires an increased alert status for on-site personnel and perhaps off-site authorities; or (2) an unusual event, not an emergency, that has an impact or a potential impact on safety, environment, health, security or operations; or (3) an off-normal event (abnormal or unplanned) that affects, or could indicate a degradation in the safety, security, environmental, or health protection performance or operation of a facility.

Off-Site. Any area beyond access-controlled DOE property to which the public has free and unlimited access.

On-Site. Any area that is fenced or otherwise access-controlled DOE property (suitable access control includes physical barricades, staffed gate houses, or manned temporary positions).

Operable Unit. The designation used for a grouping of Individual Hazardous Substance Sites by geographical proximity or chemical similarity.

Operational Controls. Controls placed on the facility to ensure safe operation. They include safety limits, operating limits, surveillance requirements, administrative controls, their bases, and other restrictions placed on operation of the facility to maintain the safety envelope. [DOE-STD-3011-94]

Operational Safety Requirement (OSR). Those requirements that define the conditions, the safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality.

Package/packaging. The outer item with the contents (containers and packaging components).

Personal Protective Equipment. Equipment such as protective clothing, plastic gloves, lead aprons, face shields, respirators and supplied air suits, which are worn on the body to protect the individual from inhalation, irradiation, or direct contact with radioactive or other hazardous materials.

Pondcrete. A mixed waste composed of evaporative solar pond sludge and water that have been mixed with Portland cement.

Preliminary Hazard Analysis (PHA). The PHA is the initial step in the development of the accident analysis in which hazards are identified and assessed without mitigation. The analyst formulates a list of hazards and generic hazardous situations by considering facility or activity equipment; layout; raw materials; intermediate and final products and their reactivities; operating environment; operational activities; and interfaces among components. Standard industrial hazards are identified only to the degree that they are initiators and contributors to accidents in main processes and activities. [DOE-STD-3009-94]

Preventive Feature. Any structure, system, or component that serves to prevent the release of hazardous material in an accident scenario. [DOE-STD-1027-92]

Probability of Exceedance. The annual probabilities that various amplitudes of ground motion will be exceeded at the Site. A similar term is used for other natural phenomena events.

Process Safety Management. A process or activity involving the application of management principles as defined in 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals.* [DOE-STD-3009-94]

Product. Material manufactured at Rocky Flats, not meeting the definitions of waste, scrap or residue.

Property Protection Area (PPA). A type of security area having boundaries identified with barriers and access controls for the protection of DOE property. The Property Protection Area at Rocky Flats is that portion of the site inside the perimeter cattle fence, but excluding all security areas.

Protected Area (PA). An area encompassed by physical barriers (e.g., walls or fences), subject to access controls, surrounding a Material Access Area, and meeting the standards of DOE Order 5632.2A. The area of Rocky Flats which is locked within several physical security boundaries and in which most of the SNM is used, processed and stored.

Public. All individuals outside the DOE site boundary. [DOE-STD-3009-94]

Pyrophoric. Spontaneously igniting in air; producing sparks by friction.

Quality. The condition achieved when an item, service, or process meets or exceeds the user's requirements or expectations. [10 CFR 830.3]

Quality Assurance. All those actions that provide confidence that quality is achieved. [10 CFR 830.3]

Quality Control. The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality.

RADIDOSE. Spreadsheet calculation used to determine the consequences (doses) to the MOI and collocated worker for a postulated accident scenario.

Radioactive Material. Any materials having a specific activity greater than 0.002 microcuries/gram. [49 CFR 173.403] For on-site transfers, materials with less than a 0.0002 microcuries/gram value may be considered radioactive for the purpose of local radioactive contamination control.

Radioactive Material Area. An area where radioactive material is used, handled or stored.

Radioactive Waste. Solid, liquid or gaseous material that contains radionuclides regulated under the Atomic Energy Act, as amended, and is of negligible economic value considering the cost of recovery.

Radioactivity. A natural and spontaneous process by which the unstable atoms of an element emit or radiate excess energy from their nuclei and, thus, change (or decay) to atoms of a different element or to a lower energy state of the same element.

Radiological Area. Any area within a controlled area which must be posted as a Radiation Area, High Radiation Area, Very High Radiation Area, Contamination Area, High Contamination Area, or Airborne Radioactivity Area in accordance with 10 CFR 835.603, as presented in the *Radiological Control Manual.*

Radiological Buffer Area (RBA). An intermediate area established to prevent the spread of radioactive contamination and to protect personnel from radiation exposure. The area surrounds or is contiguous with Contamination Areas, High Contamination Areas, Airborne Radioactivity Areas, Radiation Areas or High Radiation Areas. [10 CFR 835.603]

Radiological Facilities. Those facilities that do not meet or exceed the hazard category e threshold quantity values published in DOE-STD-1027-92 but still contain some quantity of radioactive material (above those discussed in Appendix B to 4- CFR 302). [DOE-EM-STD-5502-94]

RCRA Unit. A storage area for RCRA waste which is permitted by the Colorado Department of Public Health and Environment.

Receptor. The public, maximum off-site individual, collocated worker, immediate worker, or other group for which postulated accident dose consequences are calculated.

Reportable Quantity. The quantity of any CERCLA regulated hazardous substance regulated under Table 302.4 of 40 CFR 302.

Residues. Plutonium-contaminated wastes which contain plutonium in sufficient quantities to warrant treatment for recovery of nuclear material. Now treated as TRU waste.

Resource Conservation and Recovery Act (RCRA) Regulated. Waste materials which contain hazardous constituents regulated by the Colorado Department of Public Health and Environment (CDPHE) pursuant to 6 CCR 1007-3, Part 261, and the EPA's 40 CFR Part 261.

Return Period. The average time between consecutive events of the same or greater severity. It should not be construed as the *actual* time between occurrences, which would be highly variable. [DOE-STD-1020-94]

Risk. The quantitative or qualitative expression of possible loss that considers both the probability that an event will occur and the consequence of that event. [DOE Order 5481.1B]

Risk Class. Classification of accident scenario consequence and frequency. The Risk Class matrix used in this evaluation is based on guidance given in DOE-STD-3011-94, Table B.I.

Safeguards. Precautionary accounting and control measures to prevent the unauthorized diversion or theft of special nuclear material.

Safety Analysis. A documented process to provide systematic identification of hazards within a given DOE operation; to describe and analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards; and to analyze and evaluate potential accidents and their associated risks. [DOE Order 5480.23]

Safety Analysis Report. A report that documents the adequacy of safety analysis to ensure that a facility can be constructed, operated, maintained, shut down and decommissioned safely and in compliance with applicable laws and regulations. [DOE Order 5480.23]

Safety Analysis Report for Packaging (SARP). A comprehensive technical evaluation and review of the design, testing, and operational and maintenance procedures of a particular package that documents compliance of the package with regulatory requirements.

Safety Basis. The combination of information relating to the control of hazards at a facility (including design, engineering analyses, and administrative controls) upon which DOE depends for its conclusion that activities at the facility can be conducted safely. [DOE Order 5480.23]

Safety-Class Structures, Systems, and Components. Systems, structures, or components including primary environmental monitors and portions of process systems, whose failure could adversely affect the environment, or safety and health of the public as identified by safety analyses. Safety-class SSCs are systems, structures, or components whose preventive or mitigative function is necessary to keep hazardous material exposure to the public below the offsite Evaluation Guidelines. [DOE-STD-3009-94]

Safety Evaluation. The record required by DOE Order 5480.21 to document the review of a "change." The Safety Evaluation records the scope of the evaluation and the logic for determining whether or not an Unreviewed Safety Question exists. [DOE Order 5480.21]

Safety Limits. Limits on process variables associated with those physical barriers, generally passive, that are necessary for the intended facility functions and which are found to be required to guard against the uncontrolled release of radioactivity and other hazardous materials. [DOE Order 5480.22]

Safety-Significant Structures, Systems, and Components (Safety-Significant SSCs). Structures, systems, and components not designated as safety-class SSCs but whose preventive or mitigative function is a major contributor to defense in depth (i.e., prevention of uncontrolled material releases) and/or worker safety as determined from hazard analysis. Safety-significant SSC designations based on worker safety are limited to those systems, structures, or components whose failure is estimated to result in an acute worker fatality or serious injuries to workers. It specifically excludes potential latent effects (e.g., potential carcinogenic effects of radiological exposure or uptake). [DOE-STD-3009-94] It should not be confused with the generic modifier "safety significant" used in DOE orders (e.g., DOE Order 5480.23). [DOE-STD-3009-94]

Saltcrete. Salt from liquid plutonium recovery processes which has been stabilized with Portland cement.

Screening. A process of applying criteria to identify those accident initiators which are recognized to be unimportant contributors to risk, leaving those accident initiators that are potentially important risk contributors.

Send, sender. Terms used for the transportation of materials on site.

Ship, shipment, shipper. Terms used by transportation related to off-site movement/transportation of materials that is regulated by DOT.

Shipping Paper. A shipping order, bill of lading, manifest or other shipping document serving a similar purpose and, for hazardous materials, containing the information required by 49 CFR 172.202, 172.203 and 172.204.

Siftproof Packaging. A packaging impermeable to dry contents, including fine solid material produced during transportation.

Site. An area of land that contains a DOE facility or facilities or is either owned or leased by DOE or the Federal government. A DOE site and facility may or may not have the same boundaries. The general public may or may not have access. In this document *Site* refers to the Rocky Flats Environmental Technology Site.

Site Boundary. A well-marked boundary of the property over which the owner and operator can exercise strict control without the aid of outside authorities. [DOE Order 6430.1A] The DOE boundary is a geographic boundary within which public access is controlled and activities are governed by DOE and its contractors, and not by local authorities. A public road traversing a DOE site is considered to be within the DOE site boundary if, when necessary, DOE or the site contractor has the capability to control the road during accident or emergency conditions.

Solid Waste Management Unit. Former name for an Individual Hazardous Substance Site.

Source term. The estimate of the amount of material, usually plutonium, made airborne and available to a receptor (worker or member of the public). The source term is converted to a concentration in air to which an individual could be exposed.

Special Nuclear Material (SNM). Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material which has been determined to be special nuclear material under the Atomic Energy Act of 1954 (68 Stat 919, section 51), or any material artificially enriched by any of the foregoing.

Specification Packaging. A packaging conforming to one of the specifications or standards for packaging in 49 CFR 178 or 179.

Stakeholder. Parties interested in the future of the Rocky Flats Environmental Technology Site. Includes workers and persons in the community.

Standard Industrial Hazard. Hazards that are routinely encountered in general industry and construction, and for which national consensus codes and/or standards (e.g., OSHA, transportation safety) exist to guide safe design and operation without the need for special analysis to define safe and/or operational parameters. [DOE-STD-3009-94]

Surface Water. All water which is open to the surface and subject to surface runoff; all water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

Surveillance. The act of monitoring or observing to verify whether an item or activity conforms to specified requirements.

Technical Safety Requirements (TSRs). Those requirements that define the conditions, the safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. [DOE Order 5480.22] The administrative equivalent of TSRs are also assigned for the conditions, the safe boundaries, and the management or administrative controls necessary to ensure the safe operation of the facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of nonradiological hazardous materials or energy. [DOE-STD-3009-94]

Threshold Planning Quantity (TPQ). The quantity of an extremely hazardous substance which is regulated under Appendices A and B of 40 CFR 355, *Emergency Planning and Notification.*

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

Toxic Substance Control Act (TSCA) Regulated. Waste materials which contain hazardous constituents regulated by EPA pursuant to 40 CFR, Parts 702-799.

Transfer. Any on-site transportation of materials between buildings on site within Rocky Flats. Between buildings refers to movements exterior to the building structure. It involves such activities as packaging, loading, marking and labeling, cargo security, placarding, and preparation of shipping/transfer documents as appropriate in addition to the actual transportation of the material via the transport vehicle. [DOE Order 1540.1A]

Transuranic (TRU) Waste. Waste that results primarily from plutonium recovery, fabrication, and research and development activities at DOE defense facilities. TRU waste is contaminated with alpha-emitting radionuclides that are heavier than uranium with half-lives greater than 20 years and in concentrations greater than 100 nanocuries per gram. [DOE Order 5820.2A]

TRU Mixed Waste. Waste that contains both radioactive and RCRA-regulated constituents. The wastes exceed 100 nanocuries per gram of alpha-emitting radionuclides heavier than uranium with half-lives greater than 20 years.

TRUPACT II. An NRC certified Type B package designed to transport contact-handled TRU waste to the WIPP site.

Type A Package. A Type A packaging together with its limited radioactive contents. It may not contain greater than a Type A quantity as described in 49 CFR 173.435.

Type B Package. A Type B packaging together with its radioactive contents which are greater than a Type A quantity as described in 49 CFR 173.435 (e. g., 0.002 Ci or 0.03 g of Pu-239).

Unlikely Event. Events with an estimated annual probability of occurrence less than or equal to 10^{-2} but greater than 10^{-4}. These accidents are not anticipated to occur during the lifetime of the facility. Natural phenomena of this probability class include Uniform Building Code-level earthquake, 100-year flood and maximum wind gust. [DOE-STD-3009-94]

Waste Isolation Pilot Plant (WIPP). The WIPP is a DOE facility near Carlsbad, New Mexico, which has been designated to be an experimental and operational site for evaluating the disposal capabilities of a deep underground salt bed for transuranic waste generated by DOE defense facilities.

WSRIC. The Waste Stream and Residue Identification and Characterization program is responsible for documenting the identification and characterization information provided by waste generators for all waste streams. Backlog waste is outside the scope of the WSRIC program.

APPENDIX C - FACILITIES LISTING

The purpose of Appendix C is to provide the hazard classifications of facilities on the Rocky Flats Environmental Technology Site (RFETS). These hazard classifications are based on hazards identified in the facilities. Hazard identification is determined using facility walkdowns for facilities expected to contain hazards that may not be routinely accepted by the public. For office buildings and other entities that also exist in the public domain the hazard classification was determined based upon the intended use of the facility (i.e., office buildings and trailers). These facilities are referred to as "industrial" facilities per DOE-EM-STD-5502-94 (DOE, 1994). Facility hazard classifications are the basis for the type of safety documentation required to ensure safe operations in a facility, with facilities with quantities of radioactive material requiring the most rigorous documentation. Facilities with less hazards have auditable safety analyses and industrial facilities do not require an authorization basis document, but are required to follow the appropriate programs to ensure safe operations in the facility.

A numbering system has been used to assign identifiers to all of the various RFETS entities such as buildings, systems, tanks, fences, and roads. These entities form the basis for a database of site facilities that provides information on the operations contractor, the facility manager, building coordinator, principle tenant and maintenance coordinator. This database is maintained by Facility Utilization and Planning and was used to generate the listing in this appendix.

Not all numbered entities require a hazard classification. Such entities as fences and roads do not require hazard classification because of their passive existence and non-hazardous conditions. The list maintained by Facility Utilization and Planning contains tanks that do not appear on the list in this appendix because they are associated with a facility or process and do not require a separate hazard classification. Not all RCRA Units are included in this facility list because they are integral with a facility. Also, this list does not include the 90-day RCRA storage units or the environmental restoration projects (formerly identified as Operable Units (OUs).

A.1 Table Information

The column headings and terms used in the following table are defined as follows:

Number

This is the number assigned to the structure. Alpha characters are added to numbers to identify a type of structure, e.g., "T" identifies a trailer or modular building, "S" identifies sheds or shelters, etc. Multiple facilities with the same number will be differentiated using letters. Due to inconsistency in how facilities have been numbered over the years, some tanks appear with facility numbers. Hazard classifications are assigned to these tanks as appropriate based on the past or present use of the tank.

Description

The description is essentially the name of the building or facility and/or describes the use of the edifice. Additional descriptive information may appear in the Comments column.

Classification

The column headed "Classification" identifies the classification for the facility based on the inventory of hazardous materials (radiological or chemicals) in the facility. Not all the facilities on the following list are buildings, rather they are enumerated structures which appear on the listing of site facilities. The following terms are used to classify the facilities. The nuclear and non-nuclear designations are further refined using the terms described below the classification.

Nuclear - Facilities that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public (DOE, 1994). DOE-STD-1027-92 identifies three categories of nuclear facilities, Category 1, 2, and 3 (DOE, 1992). RFETS does not have any Category 1 nuclear facilities.

Category 2 - Facilities with quantities of hazardous radioactive materials which meet or exceed the Category 2 values in Table A.1 of DOE STD-1027-92.

Category 3 - Facilities with quantities of hazardous radioactive materials which meet or exceed the Category 3 values in Table A.1 of DOE STD-1027-92, but are less than the Category 2 values.

Radiological - Radiological facilities are those with an inventory of radiological materials below the levels defined in DOE-STD-1027-92 for nuclear hazard Category 3 facilities, but above the reportable quantity (RQ) value listed in Appendix B to Table 302.4 (per 40 CFR 302). (DOE, 1994)

Non-nuclear - A facility is classified as "non-nuclear" if the amount of radioactive material potentially releasable from a facility is less than the RQ value listed in Appendix B to Table 302.4 of 40 CFR 302 and the amount of potentially releasable hazardous material exceeds the RQ values listed in Table 302.4 to 40 CFR 302 (DOE, 1994). The facilities on the site fall into two non-nuclear categories, moderate and low. There are no high hazard non-nuclear facilities.

moderate - Facilities with hazards which present considerable potential on-site impacts to people or the environment, but at most only minor off-site impacts. These facilities tend to have chemical inventories at or above 29 CFR 1910.119 thresholds or the levels specified in 40 CFR 355 (if the chemicals are not listed in 29 CFR 1910.119).
low - Facilities with hazards which present minor on-site and negligible off-site impacts to people and the environment. These facilities are those with chemical inventories

below 29 CFR 1910.119 thresholds or the levels specified in 40 CFR 355 (if the chemicals are not listed in 29 CFR 1910.119).

Industrial Facilities - Industrial facilities are those facilities with hazards which present negligible on-site and off-site impact on people or the environment. (Based on definition in DOE-STD-3009-94 for accidents with no consequences.) Consequences of an accident in these facilities would be localized and, therefore, involve no or only minor quantities of hazardous material. As guidance, the quantity of hazardous materials can be equated to being less than the RQ values reported in 40 CFR 302 Table 302.4 for hazardous materials or Appendix A to Table 302.4 for radionuclides. The industrial facility classification was determined based on the title (description) of the facility or a walkdown of the facility.

Many facilities are identified as part of a complex surrounding a nuclear facility and are not explicitly classified as "industrial". If a facility is not classified as one of the above classifications, or NA, it will, by default, be classified as industrial in the following list.

NA - Facilities or entities for which a classification is not feasible. This includes facilities external to the plant site and facilities which have been removed or were never constructed. This also includes entities such as roadways, lighting, etc. which do not have the ability to contain material or perform an activity that may involve hazardous materials. Bus stops and car pool structures are also included.

Comments

The comments column provides information about the facility, such as additional description, the location of the facility and if the facility has been removed or relocated. An External Facility is a facility included in the Rocky Flats numbering system, but not located on the site property or not associated with activities at the site.

Facilities that are not present on the site due to removal, demolition, or were never constructed are identified with shading.

A.2 References

DOE, 1992 *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, DOE-STD-1027-92, Change 1, U. S. Department of Energy, Washington, D. C., September 1997.

DOE, 1994 *Hazard Baseline Documentation*, DOE-EM-STD-5502-94, U. S. Department of Energy, Washington, D. C., August 1994.

CFR 302 *EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Substances Under CERCLA*, 40 CFR 302, Code of Federal Regulations, Office of the Federal Register.

CFR 355 *EPA Regulations for Emergency Planning and Notification Under CERCLA*, 40 CFR 355, Code of Federal Regulations, Office of the Federal Register.

CFR 1910 *Process Safety Management of Highly Hazardous Chemicals*, 29 CFR 1910.119, Code of Federal Regulations, Office of the Federal Register.

Table C-1. Facilities List

Number	Description	Classification	Comments
60	Information and Access Center	NA	External Facility, RAC Corp.
61	PU&D Warehouse	NA	External Facility, RAC Corp.
62	Fire Water Pump House	NA	External Facility, RAC Corp.
100	Guard Post (West Gate)	NA	Demolished 7/95.
111	Office Space (Administration)	Industrial Facility	
T111A	Office Trailer/Storage	Industrial Facility	
111B	Guard Post (west of T111A) closed	Industrial Facility	
112	External Dosimetery	Industrial Facility	
T112A	Office Trailer	NA	Removed.
T112B	Trailer/Storage	NA	Removed to PU&D yard.
T112C	Office Trailer	NA	Removed.
113	Office Space	NA	Removed 5/98.
114	Bus Stop/Car Pool Shelter	NA	Removed.
115	Office Building & EOC	Industrial Facility	
T115A	Office Trailer	Industrial Facility	
T115B	Office Trailer	Industrial Facility	
T115C	Office Trailer	Industrial Facility	
116	Office Building	Industrial Facility	
T117A	Office Trailer	Industrial Facility	
119	WSLLC Fitness Center	Industrial Facility	
T119A	Office Trailer	Industrial Facility	
T119B	Office Trailer & Radio Maintenance	Industrial Facility	
119H	Heliport Pad	NA	
120	West Access Guard Post	Industrial Facility	
T120A	Office Trailer (Security Badging)	NA	Relocated to firing range and renumbered T303D, 4/99.
S120	Bus Stop/Car Pool Shelter	NA	
121	Plant Protection	Industrial Facility	
T121A	Office Trailer	Industrial Facility	
122	Occupational Health (Medical)	Industrial Facility	
122S	Emerg Power Switchgear & Transformer	Industrial Facility	Emergency Power described in Vol I, Chapt 3.
T122A	Decontamination System Trailer	Industrial Facility	Associated with Building 122 (Medical)
123	Health Physics/Analytical Laboratories	NA	Removed, 5/98.
123S	Hazardous Waste Storage	NA	Removed, 5/98.
124	Water Treatment Plant	Industrial Facility	Reclassified due to removal of chlorine.
T124A	Office Trailer	Industrial Facility	
125	Standards Laboratory	Non-nuclear low	
S125	Storage Shed (south of 125)	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
126	Source Calibration and Storage	Radiological	
127	Emergency Generator Building	Industrial Facility	
128	Vehicle Shelter (Plant Protection)	Industrial Facility	
129	Raw Water Strainer	Non-nuclear low	Reclassified due to addition of chemical.
130	Office/Warehouse/Cafeteria	Industrial Facility	Includes Shipping/Receiving and Cafeteria.
C130	130 Yard Maint. Cargo Container	Industrial Facility	
T130A	Office Trailer	Industrial Facility	
T130B	Office Trailer	Industrial Facility	
T130C	Office Trailer	Industrial Facility	
T130D	Office Trailer	Industrial Facility	
T130E	Office Trailer	Industrial Facility	
T130F	Office Trailer	Industrial Facility	
T130G	Office Trailer	Industrial Facility	
T130H	Office Trailer	Industrial Facility	
T130I	Office Trailer	Industrial Facility	
T130J	Office Trailer	Industrial Facility	
131	Training Building	Industrial Facility	
T131A	Office Trailer	Industrial Facility	
132	Electrical Substation No. 9	Industrial Facility	Electric power described in Vol I, Chapt 3.
133	130 Guard Post	NA	Removed, July, 1995.
134	C-2 Recycled Water Pumphouse	NA	Removed.
180	Meteorological Towers & Support Building	Industrial Facility	
181	Meteorological Tower	NA	Abandoned before 1992.
200	Site Topographic & Preliminary Work	NA	
201	Railroad	NA	
202	Roads	NA	
203	Buffer Zone, Cattle & Limited Area Fences	NA	
204	Walkways	NA	
205	Parking Areas & Access Roads	NA	
206	Domestic Water (On Site)	Industrial Facility	
207	Industrial Waste Storage	Industrial Facility	Out of service.
207A	Solar Evaporation Pond	Industrial Facility	Empty.
207B	Solar Evaporation Pond	Industrial Facility	Empty. Includes North, Central & South Sections.
207C	Solar Evaporation Pond	Industrial Facility	Empty.
208	Sanitary Sewer Piping & Lift Stations	Industrial Facility	
209	Storm Drains	Industrial Facility	
210	Natural Gas Distribution	Non-nuclear moderate	
211	Steam Distribution	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
212	Electrical Distribution	Industrial Facility	Electric power described in Vol I, Chapt 3.
213	Protection Alarm & Communication System	Industrial Facility	Alarms and comm. systems described in Vol I, Chapt 3.
214	Fence & Street Lighting	Industrial Facility	
215A	Domestic Water Storage Tower	Industrial Facility	
215B	Domestic Water Storage (Tank)	Industrial Facility	
215C	Domestic Fire Water Storage (Tank)	Industrial Facility	
215D	Evaporation Distillate Storage	Industrial Facility	
216	Raw Water Supply Pump House	Industrial Facility	
217	Solid Wastes Landfill (New)	Industrial Facility	New facility is not operational.
218	Nitric Acid Tank Farm	NA	Removed, 9/96.
219	Solid Wastes Landfill	Industrial Facility	
220	Telephone & Communication System	Industrial Facility	Alarms and comm. systems described in Vol I, Chapt 3.
221	Central Fuel Oil Storage Tank	NA	Removed, 9/96.
222	Data Line	Industrial Facility	Alarms and comm. systems described in Vol I, Chapt 3.
223	Nitrogen Supply Facility	Industrial Facility	
223A	Environmental Restoration Storage Facility	Industrial Facility	
224	Central Fuel Oil Storage Tank	NA	Removed, 9/96.
226	Brine Tank, Building 910 (Underground)	Industrial Facility	Out of service.
227	Nitric Acid Tank, Building 910	Industrial Facility	Out of service.
228A	Drying Bed (Sanitary Sewer)	Industrial Facility	
228B	Drying Bed (Sanitary Sewer)	Industrial Facility	
229	Portable Irrigation System	Industrial Facility	
T230	Cargo Container Storage Complex (Building 771)	Industrial Facility	
231	Low Level Process Waste Pumphouse - LL	Radiological	
231A	Low Level Process Waste Tank (250,000 gal)	Radiological	
231B	Low Level Process Waste Tank (950,000 gal)	Radiological	
240	Steam Condensate Storage Tank	Industrial Facility	
250	Wind Systems Test Center	NA	External Facility - NREL, Wind Site.
251	Wind Systems Test Center Building	NA	External Facility - NREL, Wind Site.
C251A	Truck Trailer - UPS	NA	External Facility - NREL, Wind Site. Removed.
C251B	Cargo Container - UPS	NA	External Facility - NREL, Wind Site. Removed.
252	Dynamometer Building	NA	External Facility - NREL, Wind Site.
253	Switchgear Building	NA	External Facility - NREL, Wind Site.
254	Fire Pump House	NA	External Facility - NREL, Wind Site.
255	Emergency Generator Bldg	NA	External Facility - NREL, Wind Site.
256	Domestic Water Well Pump House	NA	External Facility - NREL, Wind Site.

Table C-1. Facilities List

Number	Description	Classification	Comments
257	Fuel Storage Tanks	NA	External Facility - NREL, Wind Site.
260	Perimeter Security Zone	NA	
262	No. 2 Diesel Fuel Tank	NA	Deactivated. Abandoned in place.
262A	Diesel Storage Tank	Industrial Facility	
270	Ground Wave Emergency Network (GWEN)	NA	Removed.
280	Landfill Support Facility	Industrial Facility	
281	Landfill Leachate Valve Bldg	Industrial Facility	Part of Building 280 Facility
282	Landfill Support Facility	Industrial Facility	Fire Protection building and 120,000 gallon water tank.
283	Landfill Evaporation Pond	Industrial Facility	Part of Building 280 Facility
284	Landfill Leachate Collection/Storage	Industrial Facility	Part of Building 280 Facility
301	Field Station and Air Sampling Stations	Industrial Facility	
302	Shoot House	Industrial Facility	302 was the East Pistol Range which was abandoned.
303	North Firing Range	Industrial Facility	303 was the East Rifle Range, which was abandoned.
T303D	Trailer at Firing Range	Industrial Facility	Was T120A
T303E	Trailer	Industrial Facility	
304	Fire Patrol Crossings	Industrial Facility	
305	Erosion Control and/or Graveling	Industrial Facility	
306	Water Sampling Station (Walnut Cr.)	Industrial Facility	
308	Compressor Bldg (shooting range)	Industrial Facility	
308A	Solar Pond Pump House	NA	Removed 1999
308B	Modular Storage Tank Pump House	Industrial Facility	
308D	Central Sump Pump House	Industrial Facility	
308BA	Modular Storage Tank	Industrial Facility	
308BB	Modular Storage Tank	Industrial Facility	
308BC	Modular Storage Tank	Industrial Facility	
331	Garage & Fire Station	Industrial Facility	Also designated as 331G, garage, and 331F, fire station.
C331	Cargo Container Shed	Industrial Facility	
331A	Fire Station Storage (Behind 335)	Industrial Facility	
331S	Storage Shed (Garage)	Industrial Facility	
T331A	Office Trailer	Industrial Facility	
333	Paint Shop & Sand Blast Facility	Industrial Facility	
334	General Offices & Maintenance Shop	Industrial Facility	
T334A	Office Trailer	NA	Removed before 7/95.
T334B	Office Trailer	Industrial Facility	
T334C	Office Trailer	Industrial Facility	
T334D	Office Trailer	Industrial Facility	
335	Fire Training Building	Industrial Facility	
367	Equipment Storage Shed	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
371	Plutonium Storage and Handling	Nuclear Category 2	
T371A	Office Trailer	Industrial Facility	
T371B	Office Trailer	NA	Removed before 7/95.
T371C	Office Trailer	Industrial Facility	
T371D	Office Trailer	Industrial Facility	
T371E	Restroom Trailer	Industrial Facility	
T371F	Office Trailer	Industrial Facility	
T371G	Office Trailer	NA	Removed 9/97.
T371H	Office Trailer	Industrial Facility	
T371J	Office Trailer	Industrial Facility	
T371K	Office Trailer	Industrial Facility	
372	Guard Post (Portal 2)	Industrial Facility	
372A	Personnel Access Control, Portal 2 (371)	Industrial Facility	
S372	Bus Stop/Car Pool Shelter	NA	
373	Cooling Tower (Building 374)	NA	
374	Liquid Process Waste Treatment	Nuclear Category 2	
374A	Carpenter Shop (south of 374)	Industrial Facility	
S374	Building 374 Storage	Industrial Facility	
375	Guard Tower	Industrial Facility	
376	Office Building	Industrial Facility	
T376A	Office Trailer	Industrial Facility	
377	Air Compressor Building	NA	
378	Waste Collection Pumphouse	NA	
381	Fluorine Building	Industrial Facility	
427	Emergency Generator Building (444)	Industrial Facility	
427A	Diesel Storage Tank	Industrial Facility	
428	Waste Collection Pump House - LL	Radiological	
T428B	Tool Shed	Industrial Facility	
429	Process Waste Pit (Bldg.441)	Industrial Facility	Not in use.
439	Excess Property Processing	Industrial Facility	
T439A	Office Trailer	Industrial Facility	
T439B	Office Trailer	NA	Removed before 7/95.
T439C	Office Trailer	NA	Removed before 7/95.
T439D	Office Trailer	Industrial Facility	
440	Waste Storage/Shipping & LLW Repackaging Facility	Nuclear Category 2	
441	Production Support Building	Industrial Facility	
T441A	Office Trailer	Industrial Facility	
442	Rad Ops/GB Center; HEPA Warehouse	Industrial Facility	442L and 442W

Table C-1. Facilities List

Number	Description	Classification	Comments
T442A	Office Trailer	Industrial Facility	
443	Heating Plant (Steam Plant)	Non-nuclear low	
S443	443 Steam Shed (Eight Street)	Industrial Facility	
444	Manufacturing Building - Depleted U Operations	Radiological	
T444A	Trailer - Shower/locker	NA	Removed.
S444	Bus Stop/Car Pool Shelter	NA	
445	Carbon Storage	Industrial Facility	
446	Guard Post	NA	Removed 9/96.
447	Depleted U Manufacturing Bldg	Radiological	Integral w/ Building 444.
448	Shipping & U Material Storage	Radiological	Integral w/ Building 444.
449	Oil & Paint Storage	Industrial Facility	
S449	Maintenance Storage	Industrial Facility	
450	Filter Plenum Building (S of 444)	Radiological	Integral w/ Building 444.
451	Filter Plenum Building (S of 447)	Radiological	Integral w/ Building 444.
452	Office Building	Industrial Facility	
T452A	Office Trailer	Industrial Facility	
T452B	Office Trailer	Industrial Facility	
T452C	Office Trailer	Industrial Facility	
T452D	Office Trailer	Industrial Facility	
T452E	Restrooms	Industrial Facility	
T452F	Applied Tech. Lab.	Industrial Facility	
T452G	Respirator Fit Facility	Industrial Facility	
S452	Storage (west of 452)	Industrial Facility	
453	Maintenance Storage	Industrial Facility	
454	Cooling Tower (Building 444)	Industrial Facility	
455	Filter Plenum (444 Plating Lab)	Radiological	Integral w/ Building 444.
457	Cooling Tower (447)	Industrial Facility	
460	DOE Administration Offices	Industrial Facility	
S460	Bus Stop/Car Pool Shelter	NA	
461	Guard Post	NA	Removed, Sept. 1996.
462	Cooling Tower (Building 460)	Industrial Facility	Reclassified due to removal of chemical.
515	Electrical Substation No. 5	Industrial Facility	Electric power described in Vol I, Chapt 3.
516	Electrical Substation No. 6	Industrial Facility	Electric power described in Vol I, Chapt 3.
517	Electrical Substation No. 7	Industrial Facility	Electric power described in Vol I, Chapt 3.
518	Electrical Substation No. 8	Industrial Facility	Electric power described in Vol I, Chapt 3.
519	Alarm Systems Storage (NW of 566)	Industrial Facility	
520	517-518 Switchgear Building	Industrial Facility	Electric power described in Vol I, Chapt 3.
528	Process Waste Pit (Building 559)	NA	

Table C-1. Facilities List

Number	Description	Classification	Comments
549	Alarm Systems Offices	Industrial Facility	
T549A	Contractor Storage Building	NA	Removed 5/94.
T549B	Contractor Storage Building	NA	Removed 5/94.
550	Guard Tower	Industrial Facility	
551	General Warehouse & Contractor Shop	Industrial Facility	Reclassified due to removal of hazardous materials
T551A	Office Trailer	Industrial Facility	
T551B	Office Trailer	NA	Removed before 7/95.
552	Industrial Gas Storage	Industrial Facility	Reclassified due to removal of hazardous gases.
553	Welding Shop	Industrial Facility	
554	Warehouse Storage & Shipping Dock	Industrial Facility	
555	Electrical Substation No. 2	NA	Removed 3/96.
556	Site Maintenance	Industrial Facility	
557	Guard Post	Industrial Facility	
558	Electrical Substation No. 4	NA	Removed 3/96.
559	Plutonium Analytical Laboratory	Nuclear Category 2	
560	Cooling Tower (Building 559)	Industrial Facility	
561	Filter Plenum (Building 559)	Industrial Facility	
562	Emergency Generator Building (Building 561)	Industrial Facility	
563	Cooling Tower (Building 559)	Industrial Facility	
564	Office Building	Industrial Facility	
566	CSS Alarms	Industrial Facility	Characterization in NSTR-009-92.
566A	Protective Clothing Decon Facility Plenum	Industrial Facility	Characterization in NSTR-009-92.
566B	Carpenter Shop Cargo Container Shed	Industrial Facility	
569	Crate Counter Facility	Nuclear Category 2	
570	Filter Plenum (Building 569)	Industrial Facility	
575	515-516 Switchgear Building, Power Station	Industrial Facility	
661	Electrical Substation No. 1	NA	Removed 3/96.
662	Plant Power Storage Building	Industrial Facility	
663	Contractor Storage & Shipping Building	Industrial Facility	Vacant.
663C	Contractor Storage Container	NA	Removed.
664	Waste Storage & Shipping Facility	Nuclear Category 2	
C664	Storage Area (B664)	Nuclear Category 2	Part of 664 complex
T664A	Office Trailer	Industrial Facility	
666	TSCA Waste Storage	N/A	Demolished 2002
668	Drum Certification Building	Industrial Facility	
T668B	Storage Shed (Asbestos sheets/paint)	NA	Removed before 7/95.
675	Electrical Substation No. 3	NA	Removed 3/96.
679	Electrical Substation	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
680	Electrical Substation	Industrial Facility	
681	679/680 Switchgear Building	Industrial Facility	
T690A	Office Trailer	NA	Removed 9/97.
T690B	Office Trailer	NA	Removed 9/97.
T690C	Office Trailer	NA	Removed 9/97.
T690D	Office Trailer	NA	Removed 9/97.
T690E	Office Trailer	NA	Removed 9/97.
T690F	Office Trailer	NA	Removed 9/97.
T690G	Office Trailer	NA	Removed 9/97.
T690H	Office Trailer	NA	Removed 9/97.
T690J	Office Trailer and Lab	NA	Relocated to T891V, 6/98.
T690K	Office Trailer	NA	Removed 9/97.
T690L	Office Trailer	NA	Removed 9/97.
T690M	Office Trailer	NA	Removed 9/97.
T690N	Office Trailer	Industrial Facility	
701	Research Building	Industrial Facility	
702	Pump House for Cooling Tower 712	Industrial Facility	
703	Pump House for Cooling Tower 713	Industrial Facility	
705	Coatings Laboratory	Industrial Facility	
705T	Temporary Guard Post	NA	Removed 1999
706	Office Space	Industrial Facility	
T706A	Office Space	Industrial Facility	
706T	Temporary Guard Post	NA	Removed 1999
707	Plutonium Operations	Nuclear Category 2	
T707B	Office Trailer	Industrial Facility	
707S	Oil Storage Shed	Industrial Facility	
708	Compressor Building	Industrial Facility	
709	Cooling Tower (707)	NA	Out of service.
709A	Emergency Diesel Generator	NA	Out of service.
710	Steam Valve House	Industrial Facility	
711	Cooling Tower (Building 707)	Industrial Facility	
711A	Emergency Diesel Pump (Cooling Tower 711)	Industrial Facility	
712	Cooling Tower (Buildings 776, 777, 779A)	Industrial Facility	
712A	Propane Mix Shed (W of 712)	Industrial Facility	
713	Cooling Tower (Buildings 776, 777, 779A)	Industrial Facility	
713A	Valve Pit (N of 713)	Industrial Facility	
714	HF Storage Building	Industrial Facility	No longer used for HF.
714A	HF Storage Shed	Industrial Facility	No longer used for HF.

Table C-1. Facilities List

Number	Description	Classification	Comments
714B	Emergency Breathing Air Building	Industrial Facility	
715	Emergency Generator #1 (Building 771/774)	Industrial Facility	
716	Emergency Generator #2 (Building 771/774)	Industrial Facility	
717	Magnehelic Gauge Building	Industrial Facility	
718	Pump House, Cooling Tower 711	Industrial Facility	
727	Emergency Generator (Building 782)	NA	Removed 1999
728	Process Waste Pit (Building 771)	NA	
729	Filter Plenum Building (Building 779)	NA	Removed 1999
730	Process Waste Pit (Building 776)	NA	
731	Process Waste Pit (Building 707)	NA	
732	Laundry Waste Pit (Building 778)	NA	No longer used.
750	Offices and Cafeteria	Industrial Facility	
750 PAD	Storage Pad - Pondcrete (Tents 2-6, 12)	Nuclear Category 2	Cat. 2 due to storage of TRU wastes in POCs.
K750	PACS 1 Kiosk	Industrial Facility	Food service trailer.
750P	Propane Tank Farm	Non-nuclear moderate	
S750	Custodial Storage	Industrial Facility	East of T750B.
T750A	Office Trailer	Industrial Facility	
T750B	Office Trailer	Industrial Facility	
T750C	Office Trailer	Industrial Facility	
T750D	Office Trailer	Industrial Facility	
T750E	Restrooms	NA	Removed.
T750F	Locker/Shower Trailer	Industrial Facility	
T750G	Break Trailer	Industrial Facility	
T760A	Locker/Shower Trailer (Pondcrete)	Industrial Facility	
760B	Carpool Shelter/Bus Stop	NA	
761	Guard Tower	Industrial Facility	
762	Guard Post Portal 1 (Central & 9th)	Industrial Facility	
762A	Personnel Access Control (Building 707) (PACS 1)	Industrial Facility	
763	South Breezeway	Industrial Facility	
764	PIDAS Data Collection Building	Industrial Facility	
T764A	Office Trailer	NA	Removed 1/98.
T764B	Office Trailer	NA	Removed 1/98.
765	Secondary Alarm Center	Industrial Facility	
765-A	Radio Tower (N of 765)	Industrial Facility	
765A	Emergency Pump	Industrial Facility	
770	Offices and Maintenance Shops	Industrial Facility	
771	Pu Recovery Facility	Nuclear Category 2	Includes 771 stack and tunnel connecting to 776.
771B	Carpenter Shop	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
771C	Nuclear Waste Packaging Facility - Drum Counting	Industrial Facility	
T771A	Modular Building	Industrial Facility	
T771B	Office Trailer	Industrial Facility	
T771C	Shower/Locker Trailer	Industrial Facility	
T771D	Vacant Trailer	Industrial Facility	Removed 1999
T771E	Office Trailer	Industrial Facility	
T771F	Office Trailer	Industrial Facility	
T771G	Locker/Shower Trailer	Industrial Facility	
T771H	Office Trailer	Industrial Facility	
T771J	Office Trailer	Industrial Facility	
T771K	Office Trailer	Industrial Facility	
T771L	Restroom Trailer	Industrial Facility	
771MB	Mobile Break Room	Industrial Facility	Previously numbered T788A and then T910
772	HF Acid Storage Building	Industrial Facility	
772A	Acid Storage, SE of 771	NA	Facility does not exist.
773	Incident Command Center	Industrial Facility	
774	Liquid Waste Treatment	Nuclear Category 2	
774A	Tank (NE of Building 774)	NA	Out of service.
774B	Tank (NE of Building 774)	NA	Out of service.
775	Sewage Lift Station	Industrial Facility	
776	Manufacturing Building - LL & TRU Waste	Nuclear Category 2	
777	Manufacturing Building - Assembly	Nuclear Category 2	
778	Service Building, Contaminated Clothing Laundry	Industrial Facility	
779	Plutonium Development Building	NA	Removed 1999
T779A	Office Trailer	Industrial Facility	
T779B	Construction Trailer (Foster Wheeler)	NA	Removed 1999
T779C	Trailer (Break Room - RMRS)	NA	Removed 1999
T779D	Trailer (Asbestos & Lockers)	NA	Removed 1999
T779E	Trailer (Offices)	NA	Removed 1999
T779F	Trailer (Lockers)	NA	Removed 1999
780	Flammable Storage	NA	Removed 1999
780A	Metal Storage	NA	Removed 1999
780B	Electrical Maintenance Storage	NA	Removed 1999
781	Compressor Building (Building 777)	Industrial Facility	
782	Filter Plenum (Building 779)	NA	Removed 1999
783	Pump House, Tower Water (Building 779)	NA	Removed 1999
S783	Paint Supplies Storage	NA	Removed 1999
784	Cooling Tower (Standby)	NA	Removed 1999

Table C-1. Facilities List

Number	Description	Classification	Comments
785	Cooling Tower (Process Water)	NA	Removed 1999
786	Cooling Tower (West Chiller)	NA	Removed 1999
787	Cooling Tower (East Chiller)	NA	Removed 1999
788	Cementation Process Building - Ponderete Ops.	NA	Removed 1999
T788A	Breakroom Trailer	NA	Now T910, relocated to B910
790	Radiation Calibration Laboratory	Radiological	
792	Guard Post - (Portal 3 North of 771)	Industrial Facility	
792A	Personnel Access Control, Building 771 (PACS 3)	Industrial Facility	
827	Emergency Generator (Bldgs. 865, 875, 883, 886)	Industrial Facility	Removed 2002
828	Process Waste Pit (Building 886)	Nuclear Category 3	Removed 2002
830	Storage	Industrial Facility	No hazardous materials.
850	Office Space	Industrial Facility	
863	Electrical Transformer (Switchgear)	Industrial Facility	Electrical power system is discussed in Vol I, Chapt 3.
864	Guard Union Office	Industrial Facility	Former Guard Post.
865	Material & Process Develop. Lab. - Depleted U	Industrial Facility	Hazardous material quantities have been reduced.
865A	Utilities Maint./Carpenter Shop	Industrial Facility	Removed 1999
C865	Cooling Tower	Industrial Facility	
866	Process Waste Transfer Building	Industrial Facility	
867	Filter Plenum (West of Building 865)	Industrial Facility	Integral w/ Building 865.
868	Filter Plenum (East of Building 865)	Industrial Facility	Integral w/ Building 865.
869	Gas Meter House	Industrial Facility	
875	Filter Plenum Building (Building 886)	Nuclear Category 3	Integral w/Building 886. Removed 2002
879	Filter Plenum (Building 883)	Industrial Facility	Integral w/ Building 883.
880	Storage Building	Industrial Facility	Removed 2002
881	Manufacturing & General Support	Nuclear Category 3	
881C	Cooling Tower for B881	Industrial Facility	
881F	Filter Plenum (Building 881 Roof)	Nuclear Category 3	Integral w/ Building 881.
881G	Emergency Generator Building	Industrial Facility	
881H	Electrical Equipment	Industrial Facility	Electrical power system is discussed in Vol I, Chapt 3.
T881A	Office Trailer	Industrial Facility	
T881B	Office Trailer	Industrial Facility	
T881C	Offices	NA	Removed.
882	Gas Cylinders Storage Shed	NA	Removed.
883	Uranium Rolling & Forming Facility	Industrial Facility	Hazardous material quantities have been reduced.
883C	Cooling Tower for B883	Industrial Facility	
T883A	Office Trailer	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
T883B	Office Trailer	Industrial Facility	
T883C	Office Trailer	Industrial Facility	
T883D	Restrooms	Industrial Facility	
T883E	Office Trailer	NA	Removed 1992.
884	Warehouse - LL Waste RCRA Unit 13	Nuclear Category 3	
885	Paint & Oil Storage	Industrial Facility	Previously non-nuclear low hazard.
886	Critical Mass Laboratory	Nuclear Category 2	Removed 2002
T886A	Office Trailer	Industrial Facility	Removed 2002
T886B	Office Trailer	Industrial Facility	Removed 2002
T886C	Office Trailer	Industrial Facility	Removed 2002
T886D	Modular Analytical Lab - Thermo Nu Tech	Radiological	
S886	Bus Stop/Carpool Shelter	NA	
887	Sewage & Process Waste Lift Station	Radiological	
888	Guard Post	Industrial Facility	
888A	Secondary Substation (SW of 888)	Industrial Facility	Electric power described in Vol I, Chapt 3.
889	Equipment Decontamination Facility	NA	And 889 sump removed 6/96.
T889A	Locker Room/Shower Trailer	NA	Removed to PU&D.
890	Cooling Tower (881,883)	Industrial Facility	
890 PAD	Cooling Tower Equipment Storage	Industrial Facility	
891	Consolidated Water Treatment Facility	Non-nuclear low	
T891	Propane Tank Farm	NA	Removed.
T891A	Office Trailer	NA	Removed.
T891B	Office Trailer	Industrial Facility	
T891C	Office Trailer	Industrial Facility	
T891D	Office Trailer	Industrial Facility	
T891E	Office Trailer	Industrial Facility	
T891F	Office Trailer	Industrial Facility	
T891G	Office Trailer	Industrial Facility	
T891H	Office Trailer	NA	Removed 9/96.
T891I	Office Trailer	NA	Removed 9/96.
T891J	Office Trailer	NA	Removed 9/96.
T891K	Office Trailer	NA	Removed 9/96.
T891L	Office Trailer	NA	Removed 5/96.
T891M	Office Trailer	NA	Removed 5/96.
T891N	Office Trailer	NA	Removed 5/96.
T891O	Office Trailer	Industrial Facility	
T891P	Office Trailer	Industrial Facility	
T891Q	Office Trailer	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
T891R	Office Trailer	Industrial Facility	
T891V	Office Trailer	Industrial Facility	Originally T690J.
892	Storage facility	NA	Facility was never built.
893	Treatment Facility	NA	Future facility.
T893A	Office Trailer	Industrial Facility	
T893B	Office Trailer	Industrial Facility	
900	Guard Post (East Gate)	NA	Removed 7-95.
T900A	Microfiltration Water Treatment Facility	Non-nuclear low	Classification based on association with Building 891.
T900B	Precipitation Trailer Water Treatment Facility	Non-nuclear low	Classification based on association with Building 891.
T900C	Field Trailer	Industrial Facility	Semi located by east gate.
T900D	Field Trailer	Industrial Facility	Located by east gate.
T900E	Trailer at Mound Site	NA	Original T900E moved 6/98. Removed 4/99.
T900F	Trailer at Mound Site	NA	Removed 4/99.
T900G	Trailer at Mound Site	NA	Removed 4/99.
901	Guard Tower	Industrial Facility	
902 PAD	Sludge Waste Storage Pad (Tent 7)	Nuclear Category 3	Classification based on tent classifications.
903 PAD	Radiological Pad	Radiological	
903A	Main Decontamination Facility	Radiological	
903A2	Storage (9 x 12)	Industrial Facility	
903B	Decontamination Support Facility	Industrial Facility	
T903A	Trailer at Mound Site	NA	Original trailer numbered T903A removed, 12/97.
T903B	Trailer at Mound Site	NA	Removed 1999
T903G	Trailer at Mound Site	NA	Removed 1999
904 PAD	LL Mixed Waste Storage Pad (Tents 8-11)	Nuclear Category 3	Collective classification for the tents 8, 9 , 10, 11 on the pad.
P904	Propane Tank Farm	Non-nuclear moderate	
T904A	Break Trailer (Pondcrete)	Industrial Facility	
T904B	Pondcrete Personnel	NA	Removed.
905 PAD	Field Ops Yard Area	Industrial Facility	
906	Centralized Waste Storage	Nuclear Category 2	RCRA Unit 14.
910	Evaporator Building	Industrial Facility	Out of service.
920	Guard Post (East Access)	Industrial Facility	
928	Fire Water Pump House	Non-nuclear low	
930	Effluent Monitor Station (Building 990)	Industrial Facility	
931	Effluent Monitor Station (Building 995)	Industrial Facility	
932	Effluent Monitor Station (Pond A-1)	Industrial Facility	
933	Effluent Monitor Station (Indiana, Walnut Cr.)	Industrial Facility	

Table C-1. Facilities List

Number	Description	Classification	Comments
934	Effluent Monitor Station (Woman Creek)	Industrial Facility	
944	Building on B-4 Dam	NA	Removed 1999.
952	Isolated Gas Storage Building	Industrial Facility	Formerly RCRA Unit 23. Unit closed and building empty.
960	Contractor Storage	Industrial Facility	
964	RCRA Unit 24, LL Hazardous Waste Storage	Nuclear Category 3	
965	Carpentry Shop	NA	Removed 9/97.
966	Protected Area Decontamination Facility	Radiological	
968	Contractor Warehouse/ Storage	NA	Removed 9/97.
971	Sludge Bed #1 (Sewage Treatment Facility)	Industrial Facility	
972	Sludge Bed #2 (Sewage Treatment Facility)	Industrial Facility	
973	Sludge Bed #3 (Sewage Treatment Facility)	Industrial Facility	
974	Sludge Bed #4 (Sewage Treatment Facility)	Industrial Facility	
T974A	Treatment Unit (Sewage Treatment Facility)	Industrial Facility	
975	Sludge Bed #5 (Sewage Treatment Facility)	Industrial Facility	
976	Sludge Bed #6 (Sewage Treatment Facility)	Industrial Facility	
977	Sludge Bed #7 (Sewage Treatment Facility)	Industrial Facility	
980	Contractor Metal Shop	NA	Removed 9/97.
984	Shipping Container Storage Facility	Industrial Facility	
985	Filter Plenum (Buildings 996,997,999)	NA	
987	Storage Vault - Plant Protection	Industrial Facility	
988	Tertiary Treatment Pump House	Industrial Facility	
988A	UV Disinfectant System Building	Industrial Facility	
989	Emergency Generator (Building 991)	NA	
990	Pre-aeration Building	Industrial Facility	
990A	Waste Water Treatment	Industrial Facility	
991	Product Warehouse	Nuclear Category 2	
992	Guard Post	Industrial Facility	
993	Security Storage Vault	Industrial Facility	
993A	Waste Drum Storage, RCRA Unit 993.1	NA	Classification to be determined.
994	Effluent Measuring Station (Pond B-4)	NA	
995	Sewage Treatment Plant	Industrial Facility	Reclassified due to removal of chlorine and sulfur dioxide.
T995A	Office/Locker Room	NA	Facility was never built.
996	Storage Vault (Building 991)	Nuclear Category 2	
997	Storage Vault (Building 991)	Nuclear Category 2	
998	Storage Vault (Building 991)	Nuclear Category 2	
999	Storage Vault (Building 991)	Nuclear Category 2	
Tent 01	Formerly part of RCRA Unit 18.03	NA	Tent 1 has been removed.

Table C-1. Facilities List

Number	Description	Classification	Comments
Tent 02	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 03	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 04	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 05	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 06	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 07	Waste (Sludge) Storage, 902 Pad	Nuclear Category 3	Part of RCRA Unit 15B.
Tent 08	Pondcrete Stg. Tent (904 Pad)	Nuclear Category 3	Classification of 904 Pad
Tent 09	Pondcrete Stg. Tent (904 Pad)	Nuclear Category 3	Classification of 904 Pad
Tent 10	Pondcrete Stg. Tent (904 Pad)	Nuclear Category 3	Classification of 904 Pad
Tent 11	Pondcrete Stg. Tent (904 Pad)	Nuclear Category 3	Classification of 904 Pad
Tent 12	Pondcrete/Saltcrete Storage Tent (750 Pad)	Nuclear Category 2	Classification of 750 Pad
Tent 14	A-4 Pond Storage Tent	Industrial Facility	
RCRA Unit 1	Non Radiological Waste Storage	Nuclear Category 3	
RCRA Unit 10	Liquid Mixed Waste Storage	Nuclear Category 3	
RCRA Unit 15A	Mixed Waste Storage	Nuclear Category 3	Cargo containers & crates.
RCRA Unit 15B	Tents 7-11 on 902 & 904 Pads	Nuclear Category 3	
RCRA Unit 18.03	RCRA Storage Unit	Nuclear Category 3	
RCRA Unit 18.04	RCRA Storage Unit	Nuclear Category 3	
	Mound Plume	Industrial Facility	
	East Trenches Plume	Industrial Facility	
VVS	Valve Vaults	Radiological	Part of the Process Waste Collection system

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APPENDIX D - FUEL GAS SYSTEMS

CONTENTS

TABLES

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D.1 INTRODUCTION

The Fuel Gas Systems consist of the underground and overhead natural gas pipelines fed from a Public Service of Colorado (PSCo) supply, two propane tank farms, and propane tanks located throughout the site. Natural gas and propane are used primarily for building heat, either in the form of fuel for the site steam plant or for gas space heaters, and as a fuel supply for internal combustion engines. Flammable gases in cylinders, e.g., propane and acetylene, are not considered as part of the fuel gas system.

Natural gas is the primary fuel source to the steam plant and accounts for approximately 80 percent of the site's natural gas consumption. The natural gas system includes the distribution system (identified on the facility list as 210) and the gas meter house (Building 869).

The propane systems supply fuel gas to provide heat in facilities, such as the waste storage tents, the PACs, and various trailers, and to heat water for locker trailers. The propane systems include tank farms P750 and P904 and piping to the tents and trailers. Each tank farm consists of eight 1,000-gallon storage tanks. Individual, facility specific, propane tanks, range in size from 250 to1,179 gallons.

The chemical inventory associated with this system includes propane and natural gas (methane). Each propane tank farm has a capacity in excess of 10,000 pounds, the 40 CFR 68 (CFR, 1993) threshold quantity (TQ) and the natural gas system has virtually an unlimited volume which could exceed the 10,000 pound TQ for methane. Therefore, the Fuel Gas Systems are classified as moderate hazard, non-nuclear. Propane and natural gas are not considered to be toxic, but can produce central nervous system damage to humans at high concentrations. The principal hazard associated with propane is its flammability and explosive potential in air. Accidents involving propane (flash fires, fireballs or BLEVEs) could seriously affect the immediate and collocated worker, but have negligible impacts to confinement of hazardous materials. Explosions associated with natural gas pose similar risk to the workers, but only incidental risk to facility structures, except for the case of gas jet explosions.

This appendix identifies the facilities associated with the Fuel Gas Systems and provides an evaluation of the consequences based on the hazard identification and hazard inventory. The hazard evaluation 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 can be postulated to initiate a release of hazardous materials or increase the risk associated with a postulated hazardous material release.

D.2 FACILITY DESCRIPTION

The Fuel Gas System includes the natural gas distribution system (210); the Public Service of Colorado (PSCo) and K and N Energy (formerly known as the Coors Pipeline) natural gas transmission pipelines; the natural gas meter and pressure-reducing station (Building 869); all stationary propane tanks located outdoors; two propane tank farms (Facilities P750 and P904); and the out-of-service propane mixing facility (Building 712A). The natural gas system and the propane system on the site are described in Chapter 3, Section 3.3.3.

Gaseous propane is piped from the tank farms through vaporizers to space heaters inside the 750 Pad tents and 904 Pad tents, which store radioactive wastes. Individual tanks are piped directly to the facility they serve. A list of the facilities served by propane from storage tanks (not cylinders) is given in Table 3-4 in Chapter 3, Section 3.3.3.

Natural gas is delivered in pipes to non-nuclear, radiological, and nuclear facilities, mainly for use as a fuel for space heating. The facilities with natural gas service are given in Table 3-2 in Chapter 3, Section 3.3.3.

D.3 HAZARDS IDENTIFICATION AND ACCIDENT ANALYSIS

Hazards associated with the fuel gas systems include the inventory of hazardous materials associated with natural gas and propane. In addition, industrial hazards inherent with the systems are identified and the preventative and mitigative features discussed.

D.3.1 Facility Inventory and Classification

Methane is the main constituent in natural gas and has a 40 CFR 68 threshold quantity (TQ) of 10,000 pounds (CFR, 1993). The quantity of methane that could be released in the event of a pipe break is limited only by the time required to locate and shut down the leaking connection. No allowance is made in the postulated accident scenarios for mitigative actions, therefore it can be assumed that more than 10,000 pounds of methane gas could be discharged at the site. A similar assumption is made for the K and N Energy gas pipeline that crosses the site.

Propane storage tanks (not cylinders) range from 250-gallons to 1,179-gallon capacity. The tank farms, P750 and P904, each have eight 1,000-gallon tanks. A full 1,000-gallon tank holds approximately 4,100 pounds of liquified propane, a 500-gallon tank = 2,050 pounds and a 250-gallon tank = 1,025 pounds. When full, each of the propane tank farms contains 32,800 pounds which is greater than the 10,000 pound 40 CFR 68 TQ for propane. Single tanks with capacities of 250, 500 and 1,000 gallons are considered to be filled to these respective capacities.

At ambient conditions, propane is a colorless, odorless (may have odor added), and tasteless gas. At ambient temperature it is a saturated mixture of liquid and vapor at moderate pressure. Propane is not toxic but can produce central nervous system effects at the immediately dangerous to life and health (IDLH) level of 20,000 parts per million. It is an asphyxiant. The principal hazard associated with propane is its moderate flammability and explosive potential when in a wide range of concentration in air. The vapor is ignitable with a small ignition source. It is explosive as a vapor when exposed to heat or flame. The Occupational Safety and Health Act (OSHA) (CFR, 1992) permissible exposure limit (PEL) is a time-weighted average (TWA) of 1,000 ppm. Propane is stored as a saturated liquid and vapor mixture under a pressure of 175 psi at 100 degrees Fahrenheit and 35 psi at 0 degrees.

The Fuel Gas Systems are classified as a non-nuclear moderate hazard based on the inventory of propane on site and the potential leaks which may involve large quantities of natural gas. The potential accidents involving natural gas leaks consider toxic exposure and vapor cloud and jet explosions. The accidents involving propane were identified as vapor cloud explosions (VCE), jet explosions, fireballs and possible boiling liquid expanding vapor explosions (BLEVE).

D.3.2 Hazard Identification

The hazards analysis 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 and health standards and are not evaluated further unless they initiate a release of hazardous materials, or worsen the consequences of a hazardous materials release.

All hazards listed in Table D-1 were screened to identify those associated with the Fuel Gas Systems. These hazards are identified and are described in Table D-2 which provides information on quantity, form, packaging, and location of the hazards. As indicated in the remarks column of Table D-2 most of the hazards are considered standard industrial hazards, including the flammability/explosivity of propane and natural gas.

Table D-1. Fuel Gas Hazard Identification Checklist

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

D.3.3 Hazard Evaluation

The preventive and mitigative features used to control the effects of the hazards are listed in Table D-2. Because the hazards are primarily standard industrial hazards, using administrative controls and procedures, following manufacturers' recommendations, and employing industrial safety and hygiene practices are considered to be adequate measures to control the hazards.

Table D-2. Fuel Gas Hazards Description

Hazard/ Energy Source	Form/ Description	Preventive & Mitigative Features	Remarks
4. INERT AND LOW OXYGEN ATMOSPHERE			
Valve and heater vaults	Four below grade covered pits for valves and a pipeline heater for the natural gas system located inside and outside Bldg 869.	- Operating procedures including confined space entry program - Training - Personal protective equipment - Two-man rule	Standard industrial hazard.
8. FLAMMABLE GASES, LIQUIDS, AND DUSTS			
Natural gas	Natural gas transmission and distribution systems throughout site.	- Standard design - Maintenance - Shutoff capability - Fire suppression - Emergency Preparedness Program	Standard industrial hazard. Methane has a 40 CFR 68 TQ of 10,000 pounds, based on flammability.
Propane	32,800 lbs. of liquid stored in eight 1,000-gallon tanks at P750 and at P904.	- Standard design - Maintenance - Shutoff capability - Fire suppression - Emergency Preparedness Program	Standard industrial hazard Propane has a 40 CFR 68 TQ of 10,000 pounds, based on flammability.
16. TOXIC HAZARDOUS, OR NOXIOUS MATERIALS			
Natural gas	Natural gas transmission and distribution systems throughout Site.	- Standard design - Maintenance - Shutoff capability - Fire suppression - Emergency Preparedness Program	Standard industrial hazard. Methane has a 40 CFR 68 TQ of 10,000 pounds, based on flammability.
Propane	32,800 lbs. of liquid stored in eight 1,000-gallon tanks at P750 and at P904.	- Standard design - Maintenance - Shutoff capability - Fire suppression - Emergency Preparedness Program	Standard industrial hazard. Propane has a 40 CFR 68 TQ of 10,000 pounds, based on flammability.

D.3.3.1 Analysis of Natural Gas and Propane Accident Scenarios

The information presented in the following paragraph is based on conclusions reached from review of collected experimental work and presented in "Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs" prepared by the Center for Chemical Process Safety of the American Institute of Chemical Engineers (CCPS, 1994). Natural gas, which is principally methane, is classified as a low reactivity fuel, and propane is classified as a medium reactivity hydrocarbon fuel. Their vapors mixed with air may be ignited as deflagrations with minimum ignition energies on the order of 0.25 milliJoules (mJ). Totally unconfined explosions of these fuels exhibit flame speeds of about 13 meters/second (m/sec) for methane and 28 m/sec for propane in a very quiescent atmosphere. These are relatively slow flame front velocities which indicate propane and methane are among the least explosively reactive hydrocarbon fuels, and consequently exhibit small overpressures in unconfined fuel/air explosions. Direct initiation of detonation in stoichiometric fuel/air mixtures requires a minimum ignition energy of 2.5E+09 mJ (about 1 lb of TNT) for propane and 2.3E+11 mJ (about 100 lb of TNT) for methane

or natural gas. Considering the high energy required for direct initiation of detonation, it is an *extremely unlikely* occurrence. On the other hand, the presence of small ignition sources must always be expected. It has also been observed that transition to detonation is very difficult to achieve in propane or methane vapor cloud explosions (VCEs). Where explosions occur in areas with significant confinement or with repeated obstructions to flame front flow and gas expansion, flame acceleration and accompanying pressure rise will occur among the obstacles or in the confined area. It has also been observed that propane and methane explosions among obstacles experience rapid reduction in flame speeds and overpressure once the flames leave the obstructed area. Since this phenomenon is quite dependent on the nature and extent of flow obstacles, and other uncontrolled conditions, it was not credited in the analysis of overpressures expected at surfaces of vulnerable buildings. A final observation concerning the explosion hazard posed by releases of propane or methane is that they both have relatively narrow ranges of concentration in air in which they are flammable. Propane is flammable in air between 2.1% and 9.5%, by volume, and methane has a range of flammable concentrations from 5% to 15% (CCPS, 1994). It is therefore expected that dispersion of a release results in only a small fraction of released fuel being within the flammable range at any time. The methodology for assessing the damage done by particular vapor cloud explosions that might occur outside on the RFETS site is summarized in the next section

Natural gas and propane explosions can impact the immediate and collocated worker. The principal hazard associated with these gases is their flammability and explosive potential when mixed with air. Both are asphyxiants. Accidental propane release was postulated from one 1,000 gallon tank from tank farm P750 or P904. An evaluation was performed on these potentialities to identify potential vapor cloud explosion affects, including potential obstructions to flame front propagation resulting in elevated blast pressures.

Methodology and Assumptions

It has been stated in the previous section that completely unconfined explosions of natural gas or propane vapor clouds will not generate damaging blast pressures. Explosions must take place in congested areas where flame expansion is met with resistance and coincident turbulent flow in order to develop significant blast front overpressure. Therefore, the magnitude of explosion energy in any event is not dependent on the total amount of flammable vapor released, but rather on the fraction of the release that occupies areas congested by parked cars, by storage containers with spaces between them or by other relatively large and continuous set of flow blocking elements. An overpressure calculation strategy called the multienergy method has been developed (CCPS, 1994, Chapter 4), that allows analysts to determine the effects of vapor explosions originating in obstructed areas. Application of the method is straightforward, and when properly applied, yields realistic results that are not as overly conservative as the TNT equivalent method applied to VCE deflagrations. The multienergy method is applied to several explosion scenarios that lead to significant blast wave peak overpressure in the supporting calculation (RFETS,1998).

The following paragraphs discuss the propane tank locations and the surrounding configuration. The expected scenarios for these configurations are described in the supporting calculation (RFETS, 1998).

P750 - Eight 1,000-gallon tanks connected to a common manifold serve the tent heater/vaporizer units for the storage tents on the 750 Pad. The tents contain waste and are classified as a nuclear hazard Category 2 and 3 facility. No significant obstructions to flame expansion are placed in the vicinity of the tanks, although there is an expanse of open space near the tanks that should be discouraged as a loose material, storage location.

B762A - A 1,000-gallon tank is placed adjacent to the west wall of the PACS 1 entry, Building 762A. The vehicles in the parking lot immediately west of the tank provide significant potential for overpressure in an explosion.

B372A - This situation is identical to B762A above, except Building 371 is about 280 feet to the north of the parking lot outside Building 372A, at PACS 2.

B792A - This situation is identical to B762A above. Building 771 is about 320 feet to the south of the parking lot outside Building 792A, at PACS 3.

T771B - A 500 gallon tank is placed about 30 feet southwest of Trailer 771B. Plywood storage boxes have been stored a few feet west of the tank. Continued storage of boxes in this area would provide enough flame front blockage volume and density that significant overpressure is expected in an explosion.

T771G - A 1,000-gallon tank is placed about 100 feet east-northeast of the northeast corner of Building 774. However the only confined space near the tank is the open plywood enclosed porch of Trailer T77lG.

T760A - A 500-gallon tank is placed adjacent to the west end of Trailer 760A, and about 150 feet east of B762A (PACS 1) and about 330 feet from Building 707. The parking lot to the north of the tank provides the same blockage density as described for B762A.

P904 - Eight 1,000-gallon tanks connected to a common manifold serve the tent heater/vaporizer units for the storage tents on the 904 Pad. The tents are jointly classified as a radiological facility. The tents are about 100 feet north of the tanks. The southeast corner of Building 906, a nuclear Hazard Category 3 facility, is about 150 feet from the propane storage. Fifty-five-gallon drums have been stored in the yard in the vicinity of these tanks and would become flame front obstacles if stored there.

T891G - A 250-gallon tank is placed at the west end of Trailer 891G, which is about 300 feet southwest of Building 906. There are scattered vehicles around several trailers that are skirted to the ground. These do not constitute sufficient blockage for concern in an explosion.

A4 Pond - There are basically no structural, or other, inhibitors to flame front travel at these locations, so no significant overpressures would result from a vapor cloud explosion of the contents of either, or both, of the two large (1000 gallon and 1179 gallon) tanks at the A4 Ponds.

B549 - A 1000 gallon tank is placed near the west wall of Building 549 and about 40 feet east of Building 553. Except for sparse vehicle parking in the vicinity, there are no blockages to flame travel in the area.

903 Pad - The 500 gallon tank placed at the 903 decontamination pad is not close to significant flame front obstacles, nor is it close to any nuclear or radiological facility.

Removed from regions of obstructed flame front travel, propane and methane would burn in a rapid, but nonexplosive manner with insignificant overpressure, known as a flash fire. Burning is rapid, normally complete in less than a second. This would be the form the combustion of spilled and rapidly evaporating propane would take. A methane leak that had the opportunity to form a flammable gas cloud before ignition would also be evidenced as a flash fire. Radiological or nuclear facility structural damage, including storage tents, would be insignificant in a flash fire, but thermal radiation flux to humans could be lethal.

Propane BLEVE/fireball accidents have occurred as a result of external heating of the pressure vessel storage tank. A BLEVE will result if the propane inside the vessel is above its superheated liquid limit temperature at the pressure inside the tank. This minimum temperature to produce explosive boiling in propane is about 120°F at atmospheric pressure. Higher temperature than this indicates that the vessel has significantly increased in pressure during the heating process, and has increased potential for expelling a large fraction of the liquid contents of the tank in the forms of vapor and atomized liquid. This energetic mass expulsion from the tank and the presence of an ignition source leads to a fireball. These typically huge balls of flame burn longer and with much higher thermal radiation dose than flash fires because of increased fuel mass due to the presence of atomized liquid.

When pressurized propane or natural gas exits a pressure vessel through an open relief valve or break in a pipe, the resulting jet usually exhibits sonic velocity at the exit plane, and forms a highly turbulent fuel/air plume as long as the fuel source continues. The mass of the fuel/air mixture within the flammable range, and the distance from the fuel source to the location along the plume axis where the mixture is stoichiometric (assumed to be the center of the flammable plume or ensuing explosion) can be predicted (Epstein,1993). A turbulent jet explosion exhibits blast wave characteristics that are very similar to a detonation, so it is treated as a vapor cloud explosion with

maximum energy, using the multienergy method. Also, since the duration of a typical jet explosion is so short the impulsive force developed at a building surface must be evaluated; the multienergy approach may also be applied for determining impulse. This method is applied specifically to the natural gas jet explosion because gas pipelines that are attached to buildings can exhibit high peak overpressure at the building surface, which is only a few feet away from the center of the exploding jet.

Using the Britter-McQuaid dense gas model (JBF, 1996) an analysis was done to determine reduction in vapor cloud fuel/air concentration downstream of a spilled mass of propane. The location of the P750 tank farm was used as a source location and Building 991 was selected as a potential receiver of propane gas and air mixture.

Hazard Analysis

Natural Gas Accidents

Only one release type that could lead to a damaging explosion has been identified. This is a turbulent gas jet due to a break in a distribution line attached to the outer wall of a building. The theoretical development in (Epstein, 1993) is used to evaluate (1) the amount of flammable gas present in a postulated natural gas jet explosion, and (2) the distance from the source to the location of a stoichiometric mixture in the plume. A jet explosion due to ignition of the plume from a broken elevated natural gas line is considered to be an *extremely unlikely* event.

Natural gas toxic exposure and explosion scenarios are addressed based on a gas release from the natural gas pipeline. The analysis is qualitative based on uncertainties in quantities of gas released and possible accident locations.

Two types of scenarios are postulated for an underground natural gas leak. The most probable scenario involves a release when a digging operation inadvertently breaches an underground portion of the gas line. Though a toxic exposure is possible, this exposure is realistically estimated to be of low consequence because of the noticeable odor associated with natural gas coupled with the ventilation provided with the outdoor environment.

A variation of this accident involves sparks generated by the digging tool resulting in an explosion. High worker consequences are expected from the blast or fireball effects in the immediate vicinity of the explosion.

Two types of scenarios are postulated for the overhead portion of the natural gas pipeline. The first involves a release caused by the impact from an automobile that strikes a overhead pipeline support. This release has the potential for a toxic exposure, but this exposure is realistically estimated to be of low consequence because: (1) there is a noticeable odor from the natural gas, (2) there would be a high probability that personnel would be aware of the leak (i.e., damaged pipeline would be noticeable), (3) if the leak were to occur during worst case meteorological conditions (i.e., low wind speeds), the gas cloud, primarily composed of methane, would stay above the ground, and

(4) if the leak were to occur during windy conditions that might cause the gas cloud to hug the ground, the resulting cloud concentrations would be low.

A variation of an overhead line release resulting in an explosion is possible. A natural phenomena event such as a severe storm, lightning strike, or earthquake has the potential to cause this event by damaging both the overhead pipeline and nearby electrical lines. High worker consequences could occur from the blast effects of the explosion. Though not expected, an explosion near a facility involving a sufficient amount of natural gas could result in damage to the facility.

Propane Accidents

The propane tanks and their immediate vicinities, located across the site, were inspected to determine the likelihood that a sustained leak from a stuck open relief valve or a spill caused by major rupture in a tank could create conditions that, upon ignition, lead to peak overpressure that could structurally damage nearby radiological or nuclear facilities. In order to develop flame front speeds that would lead to a significant pressure wave, combustible vapor and air must occupy obstructed areas that impede, and/or change direction of, the flow of a flame front in an explosion. Turbulence resulting from expanding gases flowing around corners or even along solid boundaries in confined spaces causes acceleration of burning and a pressure front. The amount of pressure increase depends on the density of flow blockages or degree of confinement, the amount and reactivity of the fuel, and the degrees of freedom available for gas expansion (CCPS, 1994). For propane release scenarios, peak VCE overpressures were determined at the distance from the location of an array of obstacles near a leaking propane tank to the nearest facilities potentially impacted.

In the BLEVE analysis performed it was postulated that a propane delivery truck tank is punctured, the leaking propane is ignited and the flame (likely a jet) is directed at the storage tank on the ground. The flame heats the propane in the storage tank, and also weakens the tank wall. The tank wall eventually would fissure under the increase in tank pressure. This can even occurred after the tank relief valve has opened; the relief valve being unable to cope with the large heat flux on the outside wall. It was conservatively assumed that the source of the BLEVE and fireball is the contents of a full storage tank. The analytical process detailed in RFETS, 1998 considered 250, 500 and 1,000 gallon propane sources. CCPS, 1994 contains the basis of BLEVE analysis. The consequences to immediate and collocated workers due to a flash fire is analyzed as a fireball accompanying a BLEVE because the thermal radiation dose consequences of a fireball bound those of a comparable flash fire.

Each of the outdoor propane storage tank locations was inspected with intent to locate obstructed areas nearby that could, in an explosion, lead to sufficient overpressure that could cause structural damage to radiological or nuclear facilities. Findings of these walkdowns are summarized in the referenced calculation (RFETS, 1998). Scenario references in the following discussion are those contained in the Calculation.

D.3.3.2 Accident Analysis Results

Propane vapor cloud explosions are only expected to occur following storage tank rupture and spill of the liquid contents on the ground. Evaporation of the liquid pool would result in formation of a vapor cloud, a portion of which would be flammable. Propane tanks are typically located close to buildings (except for the 750 and 904 pads), but not within 50 feet of nuclear or radiological facilities. All propane tankage has been assessed with emphasis on (1) potential for flammable concentrations of vapor to collect in regions of obstructed flame front flow and (2) proximity to nuclear or radiological facilities. RFETS, 1998, gives the qualitative results of a walkdown survey, from which the evaluated explosion scenarios were selected. The supporting calculation assumes the cloud formed occupies the volume with identified obstacles to flame travel and is all assumed to be at stoichiometric conditions. This is a conservative assumption because it gives the maximum possible peak overpressure at any distance from the center of an explosion.

The locations and summary descriptions of conditions near propane storage tanks that have been selected for evaluation of blast wave peak overpressure from ignition of a flammable vapor cloud are given here.

1) Four locations were identified that could be analyzed using the same obstacle blockage density and vapor cloud volume. These are the propane tank locations that are contiguous to vehicle parking lots. The flame front expansion would be sufficiently impeded by the parked vehicles to cause a blast wave with significant increase in peak overpressure. The tank locations are: (a) next to the west wall of Building 762A (PACS 1), (b) next to the west wall of Building 372A, (PACS 2), (c) next to the west wall of Building 792A (PACS 3) and d) next to the west end of Trailer 760A. These propane storage locations have either 500 gallon or 1,000-gallon tanks present. It is assumed that the 500-gallon spills result in a vapor cloud half the size of the 1,000 gallon spills. The geometry of the obstructed vapor cloud among vehicles is described in RFETS, 1998.

2) The propane storage tank located a few feet south of Trailer 771B and about 100 feet from the dock at the northwest corner of Building 771 was analyzed because eight plywood storage boxes with about 2 feet of spacing between them are on the ground close to the tank. A flammable vapor cloud existing between these boxes would generate an energetic blast wave if ignited.

3) The propane tank located next to Trailer 891G would, if its contents were spilled, tend to drift downhill and toward Building 906. Three trailers without skirts located close to

Building 906 have significant volume under them that would serve to confine an explosion and create some blast wave overpressure.

The results of the vapor cloud explosion scenarios give the distance from the center of an explosion to 1 psi peak overpressure, which is taken as the threshold of damage to wood frame buildings and provides a conservative value for assessing threshold of damage to RFETS facilities. The results of the parking lot explosion scenario calculations are presented in Table D-3 below.

Table D-3. Potential Vapor Cloud Explosion Effects on Nuclear/Radiological Facilities

Storage Tank Location	Tank Volume	Distance from Explosion to 1 psig Overpressure	Nearest Potentially Affected Nuclear/Rad Facility	
			Facility	Distance
West Wall of Bldg 762A	1,000 gallon	280 ft	707	360 ft
West Wall of Bldg 372A	500 gallon	220 ft	371	330 ft
West Wall of Building 792A	1,000 gallon	280 ft	771	420 ft
West end of Trailer T760A	1,000 gallon	220 ft	707	330 ft
South of Trailer T771B	500 gallon	75 ft	771	100 ft*
Next to Trailer T891G	250 gallon	<< 100 ft	906	100 ft
* Pressure less than 1 psig may have effect if dock doors open or if transport truck is at dock.				

Propane: Vapor Jet Explosions

A relief valve on any of the propane storage tanks on site might release saturated vapor propane as a turbulent jet essentially until tank pressure is atmospheric. At any instant the jet would contain a predictable, and relatively small, amount of flammable air/fuel mixture. An explosion of a jet would behave as a detonation because of the turbulent flow and is predicted to exhibit a peak overpressure of 0.8 psi at 100 feet from the center of the propane vapor jet. This exceeds the predicted overpressure at the dock of Building 771 from the T771B vapor cloud explosion scenario in the previous section, but is still not a threat to the structural integrity of Building 771. All other facilities are predicted to experience smaller overpressures from jet explosion at any of the storage tanks on site.

Propane: BLEVE/Fireball Events

A BLEVE initiated by collision of a propane tanker truck as previously described could occur at any of the propane storage tanks. Any of these potential BLEVEs could be accompanied by a fireball. Calculations were performed to predict the distance to 1 psi peak overpressure for BLEVEs involving the contents of 1,000, 500, and 250-gallon tanks. The results are 126 feet, 100 feet and 79 feet for these cases, respectively. None of these distances is large enough to threaten the integrity of any nuclear facility. Radiological facilities, such as the 904 Pad and 750 Pad should be assessed to determine the extent of damage that might be done in a BLEVE.

Fireballs that could accompany BLEVEs were evaluated to determine the distance from the center and edge of a spherical fireball the would lead to death of 99% of workers. The first fireball investigated involved 2,750 gallons of fuel in a delivery truck and 1,000 gallons of fuel in a storage tank. The distance for which 99% of workers are predicted to suffer fatality in this case is about 70 meters (230 feet) from the edge of a 132 meter (433 foot) diameter fireball. The second case involves only the stored 1000 gallons of propane. The predicted distance for 99% fatalities is 26 meters (85 feet) from the edge of a 73 meter (240 foot) fireball. It should be noted that the probit method is conservative when compared to other predictors.

Propane Vapor Cloud Dispersion

A tank spill at the P750 tank farm was analyzed to determine whether a flammable cloud could exist at Building 991 as a result of vapor cloud drift and dispersion. Under conservative atmospheric conditions of a 1 m/sec wind speed 2 m above the ground and stability class C, the propane concentration is expected to reach the lower flammability limit about 70 meters (230 feet) from the source. Since Building 991 is about 175 meters (574 feet) from the ruptured tank, it is not possible for propane vapor released at the P750 tank farm to be flammable at the surface of Building 991.

Natural Gas Explosions

No areas of significant flame front blockage or confinement were located near the overhead gas transmission pipelines on site. Without obstacles to flame travel, no significant blast wave overpressure is expected in an ignition of a flammable from a natural gas line leak. Confinement exists around an underground leak, but insufficient mass would be available underground to cause building damage.

The only natural gas explosion identified that could cause structural damage to a radiological or nuclear facility is a jet explosion caused by a ruptured gas line that is attached to a building. Several of the nuclear facilities have natural gas lines close enough that this type of explosion is analyzed in this evaluation. The analytical model assumes the jet plume axis is oriented perpendicular to the building. As in the case of the propane jet, these explosions must be modeled as detonations. It was determined that for a 3 inch diameter break, the distance along the plume to a stoichiometric mixture is about 10 feet from the pipe rupture or origin of the jet. This is treated as the center of the explosion. It was also calculated that the peak overpressure, accounting for the approximate doubling due to the shock wave reflection at the building wall, is 22.8 psi. This is a large pressure, but the duration of the shock wave pressure excursion is predicted to be only 2.6 msec, so the damage to a building wall is expected to be impulse dependent instead of pressure dependent. Assuming the shock wave is seen as a triangular pulse at the wall, the impulse is calculated to be 32 psi-msec. This impulse is small, but the damage it would cause is dependent on the structural details of each individual building. It is not expected that masonry or reinforced concrete buildings would be threatened by this explosion.

D.3.3.3 Worker Safety Evaluation

As identified above, several facility specific considerations may be required as a result of the accidents associated with potential BLEVEs, fireball and propane jet explosions. However, the non-facility specific hazards associated with the fuel gas system are considered to have been adequately addressed.

The other hazards identified for the Fuel Gas Systems are standard industrial hazards and the following measures are adequate to control these hazards:

- administrative controls and procedures,
- following manufacturers' recommendations,
- using Personal Protective Equipment (PPE), and
- following industrial health and safety practices.

D.3.4 Final Hazard Classification

There is no radioactive material present in the Fuel Gas Systems. The quantity of hazardous materials inherent to the system exceed the 40 CFR 68 TQs and present potential high impacts to on-site personnel but low consequences to the public. Therefore, the Fuel Gas Systems are classified as a non-nuclear moderate hazard.

No hazards have been identified in Building 712A or other parts of the system. The propane storage tank associated with this building has been drained. Residual propane is minimal. Building 712A is classified as an industrial facility.

D.4 OPERATIONAL CONTROLS

The controls defined here are forms of administrative controls (ACs). They consist of programmatic elements of the site programs and specific controls and requirements.

D.4.1 Fuel Gas System Controls

The operational controls consist of administrative controls designed to protect the worker, public and environment from potential accidents involving the natural gas and propane systems on the site.

The RFETS safety management infrastructure consists of the programs summarized in Chapter 6 of this Site SAR and are required and implemented on a site-wide basis to assure the protection of workers, the public and the environment. The safety management programs address three major areas:

- 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.

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.

D.4.1.1 Requirements for Fuel Gas System Controls

The operational controls for the fuel gas systems maintain the validity of the hazard analysis and assure the continued safe operations of the systems. Based on the inventory of hazardous materials, the natural gas system and the propane tank farms are classified as non-nuclear moderate.

D.4.1.2 Credited Programmatic Elements

No specific programmatic elements of the safety management programs are identified for controlling the fuel gas systems.

D.4.1.3 Specific Controls or Restrictions

Specific controls or restrictions are for the propane storage and distribution system are identified in Chapter 7, Site Controls, SEC 7.

D.4.2 Bases for Fuel Gas System Controls

D.4.2.1 Bases for Requirements for Fuel Gas System Controls

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

D.4.2.2 Bases for Credited Programmatic Elements

No programmatic elements are credited.

D.4.2.3 Bases for Specific Controls or Restrictions

The bases for the controls identified in SEC 7 are described in Chapter 7, Section 7.7.3.

D.5 REFERENCES

CCPS, 1994 *Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs*, Center for Chemical Process Safety of the American Institute of Chemical Engineers, 345 East 47th Street, New York, NY 10017, 1994.

CFR, 1992 *Occupational Safety and Health Standards*, 29 CFR 1910, Code of Federal Regulations, Office of the Federal Register National, Washington, D.C., 1992.

CFR, 1993 *Risk Management Programs for Chemical Accidental Release Prevention,* 40 CFR 68, Code of Federal Regulations, Office of the Federal Register National, 1993.

DOE, 1992 *Technical Safety Requirements*, DOE Order 5480.22, Change 1, U.S. Department of Energy, Washington, D.C., September 15, 1992.

DOE, 1994a *Hazard Baseline Documentation*, DOE-EM-STD-5502-94, DOE Limited Standard, U.S. Department of Energy, Washington, D.C., August 1994.

DOE, 1994b *Nuclear Safety Analysis Reports*, DOE Order 5480.23, Change 1, U.S. Department of Energy, Washington, D.C., March 10, 1994.

Epstein, 1993 *Evaluation of the Explosion Hazards Associated with a Leaking 0.45 kg Cylinder of Liquid Propane*, M. Epstein and H.A. Fauske, Report FAI/93-85, submitted to Westinghouse Hanford Company, Richland, Washington, September, 1993.

JBF, 1996 *Hazard Evaluation: Consequence Analysis Methods*, JBF Associates, Inc, 1000 Technology Drive, Knoxville, TN 37932.

RFETS, 1997 *Safety Analysis and Risk Assessment Handbook*, RFP-5098, Revision 1, Kaiser-Hill. L.L.C., Golden, CO, November 25, 1997.

RFETS, 1998 *Site Fuel Gas Systems Hazards Analysis*, Calculation No. CALC-RFP-98.0555-RGC, Nuclear Safety Department, Kaiser-Hill, L.L.C., April 1998.

APPENDIX E - STEAM AND CONDENSATE SYSTEM

CONTENTS

TABLES

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E.1 INTRODUCTION

This appendix presents the hazard evaluation for the steam and condensate system at the Rocky Flats Environmental Technology Site (RFETS) and identifies controls for maintaining the facility classification of the system. Sodium hydroxide is the only chemical stored in Building 443 that may exceed reportable quantities (RQ). There are no chemicals in the building that exceed threshold quantities. The storage limit for sodium hydroxide equals the RQ of 1,000 pounds per 40 CFR 302 (CFR, 1985), although current practice is to maintain significantly less than this amount in storage. Sodium hydroxide is a corrosive and caustic chemical used in boiler feedwater treatment. The principal receptors at risk to exposure to sodium hydroxide are the immediate workers. Other major risks to the immediate workers are the standard industrial hazards that are addressed by DOE-prescribed occupational safety and health standards. No potential public risk was identified. There are no significant radioactive materials in the facility. Therefore, the final hazard classification, per DOE-EM-STD-5502-94 (DOE, 1994b), is non-nuclear low hazard for Building 443. Facilities 211, 240 and 710 have been classified as industrial facilities based on the absence of hazardous materials. The significant industrial hazards represented by the presence of high pressure steam and high voltage electricity in the facility do not affect the hazard classification as defined in the DOE Standard.

E.2 FACILITY DESCRIPTION

The Steam and Condensate System consists of the following facilities: Building 443, the Central Steam Plant; the steam distribution system, identified as Facility 211; the condensate storage tank, Facility 240; and Building 710, an isolation valve and pressure reducing station. Building 443, the primary source of steam at RFETS, is located on Fifth Street between Central Avenue and Cottonwood Avenue. The steam and condensate system components and operation are described in Chapter 3, Section 3.3.5.

E.3 HAZARDS EVALUATION

Hazards associated with the steam and condensate system include the inventory of hazardous material associated with the operation of the steam plant. In addition, industrial hazards inherent with the systems are evaluated and the preventative and mitigative features identified.

E.3.1 Facility Inventory and Classification

There is no significant radiological source in the Steam Plant. The condensate is monitored for radioactivity prior to acceptance by the steam plant. If any activity is detected, the condensate is not returned.

The chemical inventory for Building 443 contains several non-hazardous chemicals that are used to treat the boiler feedwater. The inventory also includes sodium hydroxide at a maximum amount that may equals the reportable quantity (RQ) of 1,000 pounds per 40 CFR 302 (CFR, 1985). The facility inventory is provided in Table E-1.

Sodium Hydroxide - A maximum of 1,000 pounds of sodium hydroxide (the RQ amount) in solid, flaked form, may be present in two 55-gallon drums in Building 443 for treating the boiler feedwater. Current practice is to keep less than 1,000 pounds in storage at any time. There is no threshold quantity (TQ) or threshold planning quantity (TPQ) for sodium hydroxide.

Natural Gas - Natural gas is predominantly methane. Methane is an asphyxiant, but not toxic. It is highly flammable and explosive in air. The characteristic of flammability is the reason for its hazardous classification per 40 CFR 68 (CFR, 1994), with a 10,000-pound threshold quantity (TQ). Natural gas is available on demand from the plant distribution system and is not stored in the facility. Therefore, the 10,000-pound threshold would only be exceeded if there was an undiscovered leak or other unanticipated accident.

Propane - Propane is used on an as-needed basis as fuel to the pilot flame when fuel oil is used to fuel the boilers. A 100-pound propane gas cylinder for this purpose is kept at the Gashouse, Building 552 until needed. It is moved into the facility and connected to the pilot piping with a quick disconnect coupling when needed. Although the propane cylinder is not stored in Building 443 it would be inside during use, therefore, it is included in the inventory for inside the building.

Table E-1. Chemicals Associated with Steam and Condensate System

Material	Maximum Inventory	Comments
Outside Building 443		
Fuel Oil - No. 6	40,000 gal.	Stored in two aboveground tanks
Water-Contaminated Fuel Oil	20,000 gal.	Stored in three out-of-service underground tanks
Diesel Fuel - No. 2	3,100 gal.	Stored in two aboveground tanks
Inside Building 443		
Sodium Hydroxide	1,000 lbs.	RQ = 1,000 lbs.
Mercury	< 1 lb. in ~4 switch gages	RQ = 1 lbs.
$CO\text{-}N\text{-}O_2$	4 cylinders	Non-hazardous
$O_2\text{-}N_2$	5 cylinders	Non-hazardous
CO	1 cylinder	Non-hazardous
Betz Entec 720	14 at 210 lbs. each	Non-hazardous
Betz Entec OptiSperse 10	12 at 280 lbs. each	Non-hazardous
Betz Entec 840	12 at 240 lbs. each	Non-hazardous
Betz Entec 733	4 at 210 lbs. each	Non-hazardous
Sodium Chloride	7,500 lbs. In 50-lb. bags	Non-hazardous
Lab Chemicals	Numerous at <1 gal. each	Non-hazardous
Oil, Grease, Lubricants	Several hundred gal.	Non-hazardous
Propane	1-100 lb. cylinder	TQ = 10,000 lbs., flammable
Natural gas	Unlimited supply	TQ = 10,000 lbs., flammable

E.3.2 Hazards Identification

This hazard analysis 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. The methodology contained in the *Safety Analysis and Risk Assessment Handbook (SARAH)* (RFETS, 1997a) was used for this hazard assessment. The inventory identified in Section E.3.1 was evaluated.

All hazards listed in Table E-2 were evaluated to identify those associated with the steam and condensate facilities and system. These hazards are indicated with a "yes" and are described in more detail in Table E-3 which provides information on quantity, form, packaging, and location of the hazards. As indicated in the remarks column of Table E-3, most of the hazards are considered standard industrial hazards.

Table E-2. Building 443 Facility 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	No	16. Toxic, Hazardous, or Noxious Material	Yes
4. Inert and Low-Oxygen Atmospheres	No	17. Inadequate Ventilation	No
5. Direct Radiation Sources	No	18. Material Handling	Yes
6. Radioactive Materials	No	19. Ambient Temperature Extremes	Yes
7. High Noise Levels	Yes	20. Working at Heights	Yes
8. Flammable Gases, Liquids, & Dusts	Yes	21. Pesticide Use	No
9. Compressed Gases	Yes	22. Lasers	No
10. High Temperature & Pressure Sys.	Yes	23. Inadequate Illumination	No
11. Kinetic Energy	Yes	24. Biohazard	No
12. Potential Energy	No	25. Unknown or Unmarked Materials	No
13. Non-Ionizing Radiation Sources	No	26. Other Hazards	No

E.3.3 Hazard Evaluation

The energy sources described in Table E-3 are standard industrial energy sources and represent energy sources capable of initiating or enabling accidents involving personnel injury. The preventive and mitigative features used to control the effects of the hazards are also listed in Table E-3. Boiler safety programs are in effect, which would reduce risks involved with the operation of the steam plant. Building 443 Annual Boiler Test Procedure, PRO-511-CSS (RFETS, 1999a), requires a certified inspector to test pressure relief equipment and boiler controls. Boiler operator training and qualification is also required. Non-destructive testing is performed on the boilers to verify acceptable tube condition and retubing is done as needed.

Table E-3. Steam and Condensate System Hazard Description

Hazard/ Energy Source	Description	Preventive & Mitigative Features	Remarks
1. HIGH VOLTAGE			
13.8-kV service	13.8-kV/480-V transformer located outside Building 443, 480-V switchgear and MCCs in standard metal case enclosures.	- Transformer in exterior metal enclosure has controlled access. - 13.8-kV lines enter ground in fenced, controlled enclosure.	Standard industrial hazard.
7. HIGH NOISE LEVELS			
Steam plant	Equipment and steam in Building 443 that can produce high noise levels potentially in excess of 85 db.	- Use of Personal Protective Equipment (PPE), such as hearing protection - Administrative controls, such as posting and training.	Standard industrial hazard.
Steam lines	Steam lines vented at various locations along distribution lines.	- Administrative controls, such as posting and training.	Standard industrial hazard.
8. FLAMMABLE GASES, LIQUIDS AND DUSTS			
Natural gas	8-inch natural gas line at 50 to 60 psi, reduced to 17 to 30 psi at Building 443.	All: - Steel piping - Systems per ASME and NFPA - Automatic shutdown - Venting - Administrative controls, such as posting, emergency response, and training.	All: Standard industrial hazard.
Fuel Oil - No. 6	40,000 gallons of fuel oil, stored above-ground outside Building 443 in two 20,000-gallon tanks.	- Insulation for fuel oil lines	
Diesel Fuel - No. 2	3,100 gallons of No. 2 diesel fuel , stored above-ground outside Building 443 in two 1,550-gallon tanks.		
Propane	1 - 100 pound propane cylinder, normally stored at the Gashouse, Building 552.		Propane is used as a pilot flame back-up when fuel oil is used.
9. COMPRESSED GASES			
Gas cylinders	- Four cylinders of CO-N-O_2 - Five cylinders of O_2-N_2 - One cylinder of CO All cylinders are located in Building 443.	All: - DOT steel cylinders - Cylinders restrained and capped when not in use - Administrative controls such as procedures, HAZCOM Program, and training	Compressed gases are used as necessary to calibrate equipment measuring stack air emissions. These are standard industrial hazards.
10. HIGH TEMPERATURE AND PRESSURE SYSTEMS			
Steam plant	Four boilers in Building 443 with superheated steam at 300 psi, 480°F.	- ASME design and construction - Redundant pressure relief - Automatic shutdown - Insulation - Qualified operators - Pressure reduced at steam plant - Annual safety testing	Standard industrial hazard.

Table E-3. Steam and Condensate System Hazard Description (Continued)

Hazard/ Energy Source	Description	Preventive & Mitigative Features	Remarks
10. HIGH TEMPERATURE AND PRESSURE SYSTEMS (continued)			
Steam distribution	Superheated and saturated steam, 140 to 125 psi, in carbon steel piping throughout site.	- ASME design and construction - Redundant pressure relief at steam plant - Insulation	Standard industrial hazard.
11. KINETIC ENERGY			
Rotating equipment	Pumps, turbines, and fans in Building 443.	- Metallic casings - Maintenance - Vibration instrumentation - Operating procedures	Standard industrial hazard.
Vehicular traffic	Movement of equipment and vehicles throughout facility as needed	- Licensing, regulation, enforcement, training, markings and signage	Standard industrial hazard.
15. CHEMICAL EXPOSURES			
General industrial chemicals	Fuel, water treatment products, lab chemicals, and maintenance products in tanks, drums, bags, buckets, cans, bottles; primarily manufacturers' packaging. Laboratory chemicals for water testing exist in quantities of <1 gallon each. All chemicals are in Building 443.	- Procedures, - Chemical tracking - Warning labels, - Ventilation - Packaging - Administrative controls such as procedures, HAZCOM Program, and training.	Standard industrial hazard. Quantities in excess of Appendix B RQs, TQs, or TPQs are covered in Item 16.
16. TOXIC, HAZARDOUS, OR NOXIOUS MATERIALS			
Sodium hydroxide	Up to 1,000 pounds of solid, flaked sodium hydroxide in two 55-gallon drums stored inside Building 443.	- Only small amounts are used at a time in chemical feed mixing - Administrative controls such as procedures, HAZCOM Program, PPE, and training.	Equals 40 CFR 302 1,000-pound RQ.
Mercury	<1 pound of mercury, a liquid metal, is located in four fully-enclosed switch gages associated with the boilers in Building 443.	- Gages are fully-enclosed - Administrative controls such as procedures, HAZCOM Program, PPE, and training.	40 CFR 302 RQ is 1 pound
18. MATERIAL HANDLING			
Material movement and handling of chemicals	Chemicals, pipes, equipment, waste, etc. that are located throughout the facility as needed.	- Administrative controls - Use of PPE - Use of safety equipment	Standard industrial hazards.
19. AMBIENT TEMPERATURE EXTREMES			
Steam plant	High ambient temperatures (greater than 90E°F) around steam generation equipment can exist in Building 443, operations floor and mezzanine.	- Ventilation - Training - Procedures.	Standard industrial hazard.
20. WORKING AT HEIGHTS			
Maintenance	Maintenance activities for Building 443 and the distribution system can involve elevated work.	- Training and procedures - Approved work plans - Safety equipment.	Standard industrial hazard.

E.3.3.1 Evaluation of Releases

No radioactive materials are associated with the steam and condensate system and the associated facilities.

Dispersion of hazardous (chemical) materials present in Building 443, will have little on-site impact, and will not disperse to the collocated worker or the public, due to the quantities or characteristics of the materials available for release. There are no chemicals in storage at Building 443 that exceed threshold or reportable quantities. Only one chemical, sodium hydroxide, is stored at a maximum amount that may equals a reportable quantity (RQ) of 1,000 pounds per 40 CFR 302. This white, solid, flake is stored in two 55-gallon drums weighing 500 pounds each when full. However, current practice would not have two full drums in storage concurrently.

E.3.3.2 Worker Safety Evaluation

Sodium hydroxide is a strong caustic that is corrosive to all body tissues, particularly skin, eyes, and mucous membranes. Sodium hydroxide reacts violently or explosively with acid and a number of organic compounds. Contact with moisture may generate sufficient heat to ignite surrounding combustible material. The hazard from sodium hydroxide is to the immediate worker. Other risks to the immediate workers are standard industrial hazards, such as steam explosions, fuel gas explosions, fuel oil fires, etc., that are addressed by DOE-prescribed occupational safety and health standards. No potential public consequences were identified.

The other hazards identified are standard industrial hazards and the following measures are adequate to control the hazards:

- administrative controls and procedures,
- following manufacturers' recommendations,
- using Personal Protective Equipment (PPE), and
- following industrial health and safety practices.

E.3.4 Final Hazard Classification

There are no significant radioactive materials in the Central Steam Plant facility. Therefore, the facility is not considered to be radiological or nuclear, per the definitions found in DOE-EM-STD-5502-94 (DOE, 1994b). Building 443 has one chemically hazardous material (sodium hydroxide) which may be present at the reportable quantity level (RQ), per 40 CFR 302, Appendix B (CFR, 1985), although current practice is to have less than the RQ amount in storage. Since the possibility exists to have the RQ amount present, this places the facility in the non-nuclear EM class. Based on the potential impact on the immediate worker from chemical hazards, Building 443, the Central Steam Plant, is classified as a non-nuclear low hazard facility. A low hazard (non-nuclear) facility is defined as one which has a hazardous chemical inventory which exceeds the RQ limit, but does not exceed the threshold quantity (TQ) in either 29 CFR 1910.119 (CFR, 1992) or 40 CFR 68 (CFR, 1994), or threshold planning quantity (TPQ) limits in 40 CFR 355 (CFR, 1987).

There is also the potential for significant on-site worker impact due to steam explosion, fuel explosion/fire, and high voltage electricity, however, these are industrial hazards and are not considered in the definition of the hazard classification. Facilities 211, 240, and 710, associated with the Steam and Condensate Systems, are classified as industrial facilities based on the absence of hazardous materials.

E.4 OPERATIONAL CONTROLS

The controls defined here are administrative controls (ACs) consisting of programmatic elements of the site programs and specific controls to maintain steam to facilities when needed. These controls are implemented to assure the continued safe operations of Building 443.

The RFETS safety management infrastructure consists of the programs summarized in Chapter 6 of the Site SAR and is required and implemented on a site-wide basis to assure protection of workers, the public, and the environment. Safety management programs address these areas:

- 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.

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.

E.4.1 Steam and Condensate System Controls

E.4.1.1 Requirements for Steam and Condensate System Controls

The operational controls maintain the validity of this hazard analysis and assure the continued safe operation of the steam and condensate system. The inventory limitations maintain the documented hazard classification of non-nuclear low for the steam plant, Building 443.

E.4.1.2 Credited Programmatic Elements

The following programmatic elements shall be maintained to ensure the hazard classification of the facility is maintained and that the on-site and off-site impacts from a release of hazardous materials are not increased from that evaluated:

- The Chemical Management Program shall be followed for the procurement of chemicals.

- Introduction of radioactive materials into a facility associated with the steam and condensate system shall be in accordance with the Radiological Control Manual.

- Pressure systems and pressure relief devices will be maintained and tested as required by the appropriate program or requirements.

E.4.1.3 Specific Controls or Restrictions

No specific controls or restrictions are identified for controlling the steam and condensate system.

E.4.2 Bases for Steam and Condensate System Controls

Controls are placed on hazardous materials inventory to prevent the introduction of materials into the facility that would invalidate the safety analysis basis of the facility as documented in this appendix. The hazard classification of non-nuclear low hazard for Building 443 is based on the materials currently present or maximum inventories possible in the facility.

E.4.2.1 Bases for Requirements for Steam and Condensate System Controls

The hazard classification of non-nuclear low hazard facility for Building 443 is based on the radiological materials not exceeding the RQs in 40 CFR 302, Appendix B to Section 302.4 and the hazardous chemicals not exceeding the TQs in 29 CFR 1910.119 or 40 CFR 68, the TPQs in 40 CFR 355, or the EPST developed by RFETS Emergency Preparedness.

The hazard classification of industrial facility is based on the radioactive materials in these buildings not exceeding the RQs in 40 CFR 302, Appendix B to Section 302.4 and the hazardous chemicals in these buildings not exceeding the RQs in 40 CFR 302, Table 302.4 in Section 302.4. Following the requirements for the introduction of radioactive materials into a facility identified in the Radiological Control Manual ensures these levels are not exceeded.

E.4.2.2 Bases for Credited Programmatic Elements

Controlling the quantities of radiological materials and hazardous chemicals limits the potential release of these materials in the event of an accidental release. The programmatic controls for chemical and radioactive material assure that Building 443 operates within the bounds of this safety analyses.

Boiler safety programs provide assurance of the safety of equipment associated with the production of steam in Building 443. The Building 443 Annual Boiler Test Procedure (RFETS, 1999a) requires a certified inspector to test pressure relief equipment and boiler controls. Boiler operator training and qualification is also required.

There is an Unreviewed Safety Question (USQ) for non-compliance with Pressure Safety Program requirements (USQD-RFP-97.0106-CAS, Rev. 1), with an associated Justification for Continued Operation (JCO-RFP-98.0288-KGH), and an Exemption Request (RFPE-DOE-5483.1A-EX-040). An audit of the program showed that the pressure safety relief valves reviewed had not been tested and calibrated or replaced as required in Standard SM-137, Inspection of Tanks or Piping Systems, Pressure Vessels and Safety/Relief Devices or in Occupational Health and Industrial Safety Manual, MAN-072-OS&IH PM, Section 15, Pressure Systems (RFETS, 1999b). However, the above-referenced Annual Boiler Test Procedure has been complied with and the pressure relief valves in the Central Steam Plant have been tested and calibrated on an annual basis. Therefore, the safety relief devices in Building 443 are in compliance with the applicable standards.

E.4.2.3 Bases for Specific Controls or Restrictions

No specific controls or restrictions apply to the steam and condensate system.

E.5 REFERENCES

CFR 1985 *EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Chemicals*, 40 CFR 302, Code of Federal Regulations, Office of Federal Register, April, 1985.

CFR 1987 *EPA Designation, Reportable Quantities, and Notification Requirements for Hazardous Chemicals*, 40 CFR 355, Appendix B, Code of Federal Regulations, Office of Federal Register, April, 1987.

CFR 1992 *Process Safety Management of Highly Hazardous Chemicals*, 29 CFR 1910.119, Code of Federal Regulations, Office of Federal Register, March, 1992.

CFR 1994 *Chemical Accident Prevention Provision*, 40 CFR 68, Code of Federal Regulations, Office of Federal Register, January, 1994.

DOE 1992 *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,* DOE-STD-1027-92, U.S. Department of Energy, Washington, D.C., April 30, 1992.

DOE, 1994a *Nuclear Safety Analysis Reports*, DOE Order 5480.23, Change 1, U.S. Department of Energy, Washington, D.C., March 10, 1994.

DOE, 1994b *Hazard Baseline Documentation*, DOE-EM-STD-5502-94, Environmental Management Limited Standard, U.S. Department of Energy, Washington, D.C., August 1994.

APPENDIX F - DOMESTIC WATER SYSTEM

CONTENTS

TABLES

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F.1 INTRODUCTION

This appendix presents the hazard evaluation for the domestic water system at the Rocky Flats Environmental Technology Site (RFETS) and identifies controls for maintaining the facility classification of the system. Calcium hypochlorite is the only chemical stored in the facilities in quantities that exceeds the reportable quantity (RQ). Building 129 can store up to 750 pounds of calcium hypochlorite and Building 928 can store up to 110 pounds. The quantities stored exceed the 10 pound RQ for calcium hypochlorite. The principal receptors at risk to exposure to calcium hypochlorite are the immediate workers. Other risks to the immediate workers are the standard industrial hazards that are addressed by occupational safety and health standards. No potential public risk is identified. There are no radioactive materials in the facilities or components that comprise the domestic cold and raw water system. As a result, the system is considered to be non-nuclear in accordance with DOE-EM-STD-5502-94, *Hazard Baseline Documentation* (DOE, 1994b). Facilities 124, 206, 216, 215A, 215B, and 215C are classified as industrial facilities because they do not contain chemicals or radioactive materials above reportable quantities (RQs) listed in 40 CFR 302, *Designation, Reportable Quantities, and Notification*. Building 129, part of the water treatment facility, and Building 928, the fire water pumphouse, are classified as a non-nuclear low hazard facilities because of the presence 65% calcium hypochlorite in tablet form.

F.2 FACILITY DESCRIPTION

The domestic cold and raw water system includes the water treatment plant, Building 124; the raw water strainer and chemical mixing, Building 129; the domestic water distribution system, 206; the raw water pumphouse, supply pipeline, storage and distribution systems, 216; domestic water storage tanks, 215A, 215B, and 215C; and the firewater pumphouse, Building 928. The domestic water system services the water needs for the Rocky Flats' site. The system's raw water piping and routing provides raw water for process support as well as feed to the water treatment plant. Effluent from the treatment plant is the source for domestic water for general potable water use and the water based fire suppression systems throughout the site. Domestic water is required to meet Primary Drinking Water Regulations is monitored by the Colorado Department of Health and the Environment (CDPHE). Raw water is used mainly for open-loop cooling system make-up. The components and operation of the domestic water system are described in Chapter 3, Section 3.3.6.

F.3 HAZARDS EVALUATION

Hazards associated with the domestic water system include the inventory of hazardous material associated with the treatment of water for domestic use. In addition, industrial hazards inherent with the system is evaluated and the preventative and mitigative features identified.

F.3.1 Facility Inventory and Classification

There are no radioactive materials associated with the Water Treatment Plant and the associated distribution systems. The chemical hazards associated with the water treatment plant are typical of any similar, publicly owned water treatment plant. Miscellaneous laboratory chemicals and

cleaning products are routinely used. The laboratory chemicals are stored in labeled containers of ≤1 gallon each and the cleaning products are commercial brands. Chemical hazards associated with the domestic cold and raw water system are listed in Table F-1.

Table F-1. Domestic Water System Chemicals

Location	Material	Maximum Inventory	Applicable Regulatory Thresholds
Building 124	Diesel fuel	530 gallons	None
	Mercury	~ 3 milliliters	40 CFR 302 RQ = 1 pound
	Sodium Hydroxide	Normally 450 pounds	40 CFR 302 RQ = 1,000 pounds
Building 129	65% calcium hypochlorite	750 pounds in 55-pound containers	40 CFR 302 RQ = 10 pounds
	Nalco Ultraion 8157 Clarifier	220 gal	Non-hazardous
	Nalcolyte 8102 Coagulant	110 gal	Non-hazardous
Building 928	65 % calcium hypochlorite	110 pounds in 55-pound containers	40 CFR 302 RQ = 10 pounds
	Diesel fuel	500 gallons	None

Calcium Hypochlorite - Tablets containing 65 percent calcium hypochlorite are used in Buildings 129 and 928 for water purification. Typically a maximum of 750 pounds of calcium hypochlorite used in the water treatment process is stored in Room 100 of Building 129. The chemical is packaged in 55 pound drums with 800 to 1,000 pounds ordered every two to three months, depending on usage. The calcium hypochlorite in Building 928 is used to maintain adequate chlorine concentration, per CDPHE requirement, in the domestic firewater storage tank (215C). Approximately two 55-pound drums of tablets are stored in Building 928. Fifty-five pounds of 65% calcium hypochlorite equates to 36 pounds of calcium hypochlorite, therefore, the quantities in both facilities exceed the 40 CFR 302 RQ for calcium hypochlorite of 10 pounds. There is no TQ or TPQ for calcium hypochlorite.

Sodium Hydroxide - Typically one 450-pound container of sodium hydroxide flakes are stored in Building 124, which is less than the 40 CFR 302 RQ for sodium hydroxide of 1,000 pounds. There is no TQ or TPQ for sodium hydroxide.

Mercury - Approximately 3 milliliters of mercury, less than 0.1 pound, is equally divided among three water pumps. The mercury is used in sealed level indicators that trigger automatic switches to turn the water pumps on and off. The 40 CFR 302 RQ is 1 pound. There is no TQ or TPQ for mercury.

Based upon the inventory identified above, facilities 124, 206, 216, 215A, 215B, and 215C are classified as industrial facilities because they do not contain chemicals or radioactive materials above the RQs listed in 40 CFR 302 and operations associated with these facilities will have negligible on-site and off-site impact on people or the environment.

Buildings 129 and 928 are low hazard facilities because the maximum inventory of calcium hypochlorite exceeds the 40 CFR 302 RQ limit, however, the hazards present minor on-site and negligible off-site impacts to people and the environment. The chemical does not have a threshold quantity (TQ) or threshold planning quantity (TPQ).

F.3.2 Hazard Identification

The hazards analyses use a comprehensive checklist of typical hazards found in the nuclear industry as well as many other industries. The checklist includes radiological, hazardous material, and occupational hazards. 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. The methodology contained in the *Safety Analysis and Risk Assessment Handbook (SARAH)* (RFETS, 1997) was used for these hazard assessments.

All hazards listed in Table F-2 were evaluated to identify those associated with the domestic water system. These hazards are indicated with a "yes" and are described in more detail in Table F-3 which provides information on quantity, form, packaging, and location of the hazards. As indicated in the remarks column of Table F-3, most of the hazards are considered standard industrial hazards.

Table F-2. Domestic Water System 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	No	16. Toxic, Hazardous, or Noxious Material	Yes
4. Inert and Low-Oxygen Atmospheres	No	17. Inadequate Ventilation	Yes
5. Direct Radiation Sources	No	18. Material Handling	Yes
6. Radioactive Materials	No	19. Ambient Temperature Extremes	No
7. High Noise Levels)	Yes	20. Working at Heights	Yes
8. Flammable Gases, Liquids, and Dusts	Yes	21. Pesticide Use	No
9. Compressed Gases	No	22. Lasers	No
10. High Temperature and Pressure Sys	Yes	23. Inadequate Illumination	No
11. Kinetic Energy	Yes	24. Biohazard	No
12. Potential Energy	Yes	25. Unknown or Unmarked Materials	No
13. Non-Ionizing Radiation Sources	No	26. Other Hazards	No

F.3.3 Hazard Evaluation

The energy sources described in Table F-3 are standard industrial energy sources and represent energy sources capable of initiating or enabling accidents involving personnel injury. The preventive and mitigative features used to control the effects of these hazards are also listed in Table F-3.

Table F-3. Domestic Water System Hazard Description

Hazard/ Energy Source	Description	Preventive & Mitigative Features	Remarks
1. HIGH VOLTAGE			
13.8-kV power distribution lines and 115-kV transmission lines	High voltage 13.8-kV AC power distribution lines and 115-kV transmission lines extend from the transformer, located approximately 15 feet from the south wall of the building, to the Water Treatment Plant and to the rest of the site power grid. The lines are constructed following ANSI C2. Overhead lines are isolated by height. Underground lines are isolated by burial. Power to fire water pumps in Bldg 928.	- Lines are constructed per ANSI C2 - Overhead lines isolated by height - Underground lines isolated by burial - Procedures - Training - Protective equipment for maintenance - Fuses and breakers - Switch out capability	Standard industrial hazard.
7. HIGH NOISE LEVELS			
Diesel generator and diesel pump	One standby generator in Building 124 (Room 002). One diesel pump in Building 928.	- Standard industrial design and housings - Basement of Bldg. 124 normally unoccupied - Building 928 is normally unoccupied - Buildings posted for hearing protection	Standard industrial hazard.
8. FLAMMABLE GASES, LIQUIDS AND DUSTS			
Diesel fuel	30-gallon day tank for generator Bldg 124, outside 500-gallon concrete fuel tank. 500 gals diesel fuel stored above ground on the west side of Bldg. 928.	- Administrative controls - Standard industrial design and housings - Venting - Steel piping - Systems per ASME and NFPA	Standard industrial hazard.
Hydrogen	Small quantities generated from batteries, Bldg. 928.	- Procedures for charging - Standard battery and charger design - Ventilation	Standard industrial hazard.
10. HIGH TEMPERATURE AND PRESSURE SYSTEMS			
Electric water heater Heat Exchanger Plant steam distribution piping Pump discharge	Building 124 Building 124 Superheated and saturated steam and condensate, 125- and 140-psi systems located through site and Building 124 Discharge of high pressure water from distribution pumps in Building 928.	Carbon steel piping - Insulation - ASME design and construction - Pressure relief at steam plant	Standard industrial hazard.

Table F-3. Domestic Water System Hazard Description (Continued)

Hazard/ Energy Source	Description	Preventive & Mitigative Features	Remarks
11. KINETIC ENERGY			
Vehicular traffic	Movement of equipment and vehicles throughout facility as needed	- Licensing, regulation, enforcement, training, markings, and signage. - Standard industrial design and housings	Standard industrial hazard.
Rotating equipment	Pumps in Building 928	- Metal casings - Maintenance - Operating procedures	Standard industrial hazard.
12. POTENTIAL ENERGY			
Elevated tank	One steel elevated tank, 155 feet in height, 300,000 gallons water located North of Building 124.	- Steel shell - Structural support of six tubular steel cross-braced legs	Tank was not seismically designed, only for 100-mph wind.
15. CHEMICAL EXPOSURES			
General industrial chemicals	Water treatment products, laboratory chemicals, maintenance products.	- Procedures - Chemical tracking - Warning labels - Ventilation - Packaging - HAZCOM Program.	Standard industrial hazard.
16. TOXIC, HAZARDOUS, OR NOXIOUS MATERIALS			
65% calcium hypochlorite	Greater than RQ quantities in tablet form located in Room 100 of Building 129 and in Building 928.	- Tablets in solid form - Use of PPE - Training - Procedures - HAZMAT - HAZCOM	Exceeds 40 CFR 302 10-pound RQ, no TPQ.
Sodium hydroxide	Approximately 450 pounds as flakes in Building 124.	- Solid form - Protective packaging - Use of PPE - Training - HAZCOM - HAZMAT	Exceeds 40 CFR 302 1,000-pound RQ, no TPQ.
Mercury	~3 ml of liquid in fully-enclosed mercury level indicators set to automatically turn on pumps in Building 124.	- Administrative controls - HAZMAT - HAZCOM - Crew with specialized training maintains equipment	40 CFR 302 RQ is 1 pound, no TPQ.
17. INADEQUATE VENTILATION			
Water tanks	Two north of Building 124, one (tank 215C) located next to Building 928.	- Warning signs - Confined space entry program - Access controlled	Standard industrial hazard.
Basins	Clear well (Bldg 124), treatment tank and filter beds (Bldg 124), microstrainer basin (Bldg 129), backwash basins and pumping station. All are concrete basins, covered and uncovered located in the water treatment area of Bldg 124.	- Administrative controls - Confined space entry program	Standard industrial hazard.

Table F-3. Domestic Water System Hazard Description (Continued)

Hazard/ Energy Source	Description	Preventive & Mitigative Features	Remarks
18. MATERIAL HANDLING			
Material movement and handling of chemicals	Chemicals, pipes, equipment, waste, etc. that are located throughout the facility, as needed.	- Administrative controls - Use of PPE - Use of safety equipment - Warning devices	Standard industrial hazard.
20. WORKING AT HEIGHTS			
Elevated tanks	Tank 215A, one elevated water tank with enclosed ladder located north of Building 124. Water level in tank 215C is monitored from the top.	- Access controls - Training - Procedures - Approved work plans - Standard industrial design and housings - Safety equipment	Standard industrial hazard.
Metal ladder	Ladder stairs with railing on outside of ground storage tank.		
Outside stairs, catwalks, and platforms	Tank 215B and north of Bldg 124. One set of stairs divided by 3 platforms. Open metal weave grating on stairs and platforms outside Bldgs 124 and 129.		

F.3.3.1 Evaluation of Releases

No radioactive materials are associated with the domestic water system facilities and operations.

Dispersion of the chemicals present in Buildings 129 and 928 will have little on-site impact, and will not disperse to the collocated worker or public due to quantities per package or characteristics of the material. Chemical quantities, except for calcium hypochlorite are below the reportable thresholds (RQs) listed in 40 CFR 302. There are no hazardous materials present in quantities greater than the safety regulated thresholds (TQs or TPQs). Because storage is a passive process, the time when the chemical is at risk is during material handling which entails receiving containers, moving containers to and from storage, and the addition of the chemical to the water treatment process.

The calcium hypochlorite in Buildings 129 and 928 is 65% calcium hypochlorite in tablet form packaged in 55-pound drums. Fifty-five pounds of tablets is equivalent to 36 pounds of pure calcium hypochlorite. The 40 CFR 302 RQ for calcium hypochlorite is 10 pounds. This material has no 29 CFR 1910.119 threshold quantity or 40 CFR 355 threshold planning quantity. Therefore, it is assumed that dispersion of 65% calcium hypochlorite will not impact collocated workers or the public. Immediate workers may be impacted as discussed in Section F.3.3.2.

Calcium hypochlorite is highly corrosive. It is not combustible, but is incompatible with strong acids (e.g., sulfuric, phosphoric, nitric, hydrochloric, chromic, sulfonic) which can cause violent spontaneous combustion. It is also incompatible with organic materials (e.g., rags, sawdust, hydrocarbon oils or solvents) and reducing agents (e.g., hydrazine, sulfites, sulfides, aluminum or

The sodium hydroxide in Building 124 is in flake form, packaged in 450 pound containers. Typically, a maximum of 500 pounds will be in the building at one time which does not exceed the 40 CFR 302 RQ of 1,000 pounds. This material has no 29 CFR 1910.119 threshold quantity or 40 CFR 355 threshold planning quantity. Therefore, it is assumed that dispersion of sodium hydroxide will not impact collocated workers or the public.

Sodium hydroxide is a strong caustic and extremely reactive. Sodium hydroxide absorbs carbon dioxide from the air, and may react violently or explosively with acid and a number of organic compounds. Contact with moisture may generate sufficient heat to ignite surrounding combustible material. Sodium hydroxide can react with some metals (e.g., aluminum, zinc, magnesium, copper, etc.) to release explosive hydrogen gas (EM Science, n..d.; Sax, 1992).

In addition to calcium hypochlorite and sodium hydroxide, the chemicals used in Building 124 during the water treatment process include Nalco Polymers #8102 and #8157. These chemicals are stored and used in accordance with occupational, safety and health requirements by Colorado State-certified operators. None of these chemicals have designated TPQs. Nalco Ultraion and Nalcolyte coagulant are liquid polymers that are not hazardous as defined by OSHA regulations. Effects to the operator may include slight irritation to the skin, moderate irritation to the eyes, and irritation to the upper respiratory tract from mists and aerosols (Betz, n.d.).

F.3.3.2 Worker Safety Evaluation

Calcium hypochlorite is a strong oxidizer. Contact with combustible metals, flammable materials, or powdered metals can cause fire or explosion with an accompanying release of toxic hydrochloric acid fumes. Closed containers exposed to heat may explode. Fires can be extinguished with water spray. Water can be used to keep fire-exposed containers cool. Firefighters or those responding to a spill or discharge should wear proper protective equipment and self-contained breathing apparatus. All combustibles and ignition sources should be removed and the area should be well ventilated. The health effects associated with acute overexposure range from moderately toxic to severe irritation of skin and mucous membranes, depending upon exposure route.

The other hazards identified for Buildings 124, 129 and 928 are standard industrial hazards and the following measures are adequate to control these hazards:

- administrative controls and procedures
- following manufacturers' recommendations
- using personal protective equipment (PPE), and
- following industrial health and safety practices.

F.3.3.4 Final Hazard Classification

There is no radioactive material present in the domestic water system. Therefore, the system and associated facilities are not considered to be radiological or nuclear, per the definitions found in DOE-EM-STD-5502-94 (DOE, 1994). The only hazardous material in the facilities (Buildings 129

and 928) is 65% calcium hypochlorite which is above the 40 CFR 302 RQs. However, there is no corresponding 29 CFR 1910.119 threshold quantity or 40 CFR 355 threshold planning quantity. Therefore, consequences associated with 65% calcium hypochlorite will only impact the immediate worker and Buildings 129 and 928 are classified as a non-nuclear low hazard facilities. All other facilities associated with the domestic water system are classified as industrial based on the absence of hazardous materials.

F.4 OPERATIONAL CONTROLS

The controls defined here are forms of administrative controls (ACs). They consist of programmatic elements of the site programs and specific controls based on inventory control.

The controls defined here are administrative controls (ACs) consisting of programmatic elements of the site programs and specific controls to maintain steam to facilities when needed. These controls are implemented to assure the continued safe operations of the domestic water system, specifically Buildings 129 and 928.

The RFETS safety management infrastructure consists of the programs summarized in Chapter 6 of the Site SAR and are required and implemented on a site-wide basis to assure the protection of workers, the public, and the environment. Safety management programs address three major areas:

- 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.

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.

F.4.1 Domestic Water System Controls

F.4.1.1 Requirements for Domestic Water System Controls

The operational controls maintain the validity of this authorization basis and assure the continued safe operations of the domestic water system. Buildings 129 and 928 have been classified as non-nuclear low hazard facilities and Buildings 124, 206, and 216, and Tanks 215A, 215B, and 215C are classified as industrial facilities, based on the guidance provided in DOE-EM-STD-5502-94.

F.4.1.2 Credited Programmatic Elements

The following programmatic elements shall be maintained to ensure the hazard classification of the facility is maintained and that the on-site and off-site impacts from a release of hazardous materials are not increased from that evaluated.

- The Chemical Management Program shall be followed for the procurement of hazardous chemicals.

- Introduction of radioactive materials into a facility associated with the Domestic Water System shall be accordance with the Radiological Control Manual.

- Pressure systems and pressure relief devices will be maintained and tested as required by the appropriate program or requirements.

F.4.1.3 Specific Controls or Restrictions

Specific controls and restrictions for the domestic water system are identified in Chapter 7, Site Controls, SEC 1. This control ensures the fire protection water system is capable of supplying firewater to facility fire suppression systems and to fire hydrants.

F.4.2. Bases for Domestic Water System Controls

Controls are placed on hazardous materials inventory to prevent the introduction of materials into the facility that would invalidate the safety analysis basis of the facility as documented in this appendix. The hazard classification of non-nuclear low hazard for Buildings 129 and 928 is based on the materials currently present or maximum inventories possible in the facility.

F.4.2.1 Bases for Requirements for Domestic Water System Controls

The hazard classification of non-nuclear low hazard facility for Buildings 129 and 928 is based on the absence of radioactive and the hazardous chemicals not exceeding the TQs in 29 CFR 1910.119 or 40 CFR 68, the TPQs in 40 CFR 355, or the EPST developed by RFETS Emergency Preparedness.

The hazard classification of industrial facility is based on the radioactive materials in these buildings not exceeding the RQs in 40 CFR 302, Appendix B to Section 302.4 and the hazardous chemicals in these buildings not exceeding the RQs in 40 CFR 302, Table 302.4 in Section 302.4. Following the requirements for the introduction of radioactive materials into a facility identified in the Radiological Control Manual ensures these levels are not exceeded.

F.4.2.2 Bases for Credited Programmatic Elements

Controlling the quantities of radiological materials and hazardous chemicals limits the potential release of these materials in the event of an accidental release. The programmatic controls for chemical and radioactive material assure that Buildings 129 and 928 operate within the bounds of

this safety analyses.

F.4.2.3 Bases for Specific Controls or Restrictions

The bases for the specific control or restriction presented in Chapter 7 is found in Section 7.7.3.3.

F.5 REFERENCES

ALOHA, 1992 — Areal Locations of Hazardous Atmospheres (ALOHA) User's Manual, U.S. Environmental Protection Agency and National Oceanic and Atmospheric Administration, October 1992.

Betz, n.d. — Polymer 1192P Material Safety Data Sheet, Betz Laboratories.

Cal State, 1993 — Water Treatment Plant Operation, Volume 2, Second Edition, California State University, Sacramento, 1993.

DOE, 1994a — Nuclear Safety Analysis Reports, DOE Order 5480.23, Change 1, U.S. Department of Energy, Washington, D.C., March 10, 1994.

DOE, 1994b — DOE Environmental Management Limited Standard "Hazard Baseline Documentation", DOE-EM-STD-5502-94, U.S. Department of Energy, Washington, D.C., August 1994.

EM Science, n.d. — Sodium Hydroxide Material Safety Data Sheet, E M Science.

NALCO, n.d. — NALCO 2590 Microbiocide Material Safety Data Sheet, NALCO Chemical Company.

RFETS, 1994 — Fire Protection Assessment: Buildings 124 and 129, Rocky Flats Environmental Technology Site, FPA-124/129-001, Rev. 0, May 23, 1994.

RFETS, 1993 — Rocky Flats Plant 1-62300-HSP-11.01, Health and Safety Practice (HSP) 11.01, Compressed Gas Cylinders, March 23, 1993, with applicable DMRs.

RFETS, 1997 — *Safety Analysis and Risk Assessment Handbook (SARAH)*, RFP-5098, Revision 1, Kaiser-Hill Company, L.L.C., Golden, CO, November 25, 1997.

RFETS, 1998 — Site SAR Accident Analysis for *FSAs*, CALC-RFP-98.0558-KKK, Revision 0, Kaiser-Hill Company, L.L.C., Golden, CO, June 1998.

Sax, 1992 — Sax's Dangerous Properties of Industrial Materials, Eight Ed., Vol. II, Richard J. Lewis, Sr. Van Nostrand Reinhold: New York, 1992.

Stauffer, n.d. Aluminum Sulfate Material Safety Data Sheet, Stauffer Chemical Company.

Webb, 1996 Personal conversation between Dave Webb, DynCorp, and Georgene Porter, MACTEC, on June 25, 1996.

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COMPANY

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

SAFETY ANALYSIS REPORT

APPENDIX G

SAFETY ANALYSIS
for
BUILDING 666
TSCA Waste Storage Facility

This Safety Analysis has been canceled due to the demolition of the facility.

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