International Isotopes Fluorine Products, Inc. (IIFP)
A Wholly Owned Subsidiary of
International Isotopes, Inc. (INIS)

Fluorine Extraction Process & Depleted Uranium De-conversion (FEP/DUP) Plant

Integrated Safety Analysis (ISA) Summary

Revision B
December 28, 2011

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

ACRONYMS and ABBREVIATIONS

AC	Administrative Control
ACEC	Area of Critical Environmental Concern
AEA	Atomic Energy Act
AEC	Active Engineered Control
AEGL	Acute Exposure Guideline Levels
AHF	Anhydrous Hydrogen Fluoride/Anhydrous Hydrofluoric Acid
AHJ	Authority Having Jurisdiction
ALARA	As Low As Reasonably Achievable
ALI	Annual limit intake
ANSI	American National Standards Institute
APE	Area of Potential Effect
APF	Assigned protection factor
APTS	Advanced Process Technology Systems
ARI	Average Recurrence Interval
ARTCC	Air Route Traffic Control Center
ASL	Approved Suppliers List
ASCE	American Society of Civil Engineers
ASME	American Society for Mechanical Engineers
ASTM	American Society for Testing and Materials
ATIS	Automated Radar Terminal System
BDC	Baseline design criteria
BMP	Best Management Practice
Bq	Becquerel
BTU	British Thermal Unit
CA	Controlled Area
CDE	Committed dose equivalent
CEDE	Committed effective dose equivalent
CEO	Chief Executive Officer
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Ci	Curie(s)
cm	Centimeter
CM	Configuration Management
CMM	Configuration Management Manager
CMO	Communication Officer
COO	Chief Operations Officer
CPR	Cardiopulmonary Resuscitation
CPS	Chemical Process Safety
CY	Calendar Year
D&D	Decontamination and decommissioning

DAC	Derived air concentration
DB	Design and Build
dBA	Decibels acoustic
DBE	Design Basis Earthquake or Design Basis Event
DBF	Design Basis Fire
DBFL	Design Basis Flood Level
DCS	Distributed Control System
DEM	Design Engineering Manager
DFP	Decommissioning Funding Plan
DHSEM	U.S. Department of Homeland Security and Emergency Management
DOC	Decommissioning Operations Contractor
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DUP	Depleted Uranium De-conversion Process
DTGW	Depth To Groundwater
E	East
EAC	Enhanced Administrative Control
EAL	Environmental Assessment Lead
EIS	Environmental Impact Statement
EMD	Emergency Director
EMP	Effluent Monitoring Program
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EOC	Emergency Operations Center
EMP	Emergency Management Plan
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act (1986)
EPIP	Emergency Plan Implementation Procedure
EPP	Environmental Protection Process
ER	Environmental Report
ERPGs	Emergency Response Planning Guidelines
ERO	Emergency Response Organization
ERT	Emergency Response Team
ERTL	Emergency Response Team Leader
ESH	Environmental, Safety and Health
FAA	Functional Allocation Analysis
FEMA	U.S. Federal Emergency Management Agency
FEP	Fluorine Extraction Process
FEP/DUP	Fluorine Extraction Process & Depleted Uranium De-conversion Plant
FF	Failure Frequency
FHA	Fire Hazards Analysis
FIC	Field Incident Commander

FLM	Front Line Manager
FP	Failure Probability
FPE	Fire Protection Engineer
FSE	Facility Safety Engineer
FSRC	Facility Safety Review Committee
ft	Foot/feet
ft2	Square foot/feet
ft3	Cubic/feet
GET	General Employee Training
gpm	Gallons per minute
GUIs	Graphical User Interface
ha	Hectacres
HAZCOM	Hazardous Communication Program
HAZWOPER	Hazardous Operations and Emergency Response
HEPA	High Efficiency Particulate Air
HFE	Human Factors Engineering
HSI	Human System Interface
HUD	U.S. Housing and Urban Development
HVAC	Heating Ventilation Air Conditioning System
IBC	International Building Code
ICRP	International Commission on Radiological Protection
IECC	International Energy Conservation Code
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
IFR	Instrustment Flight Rules
IIFP	International Isotopes Fluorine Products, Inc.
INIS	International Isotopes, Inc.
IP	Industrial Package
IROFS	Items Relied on for Safety
ISA	Integrated Safety Analysis
ISAL	ISA Lead
ISO	International Organization for Standardization
JHA	Job Hazards Analysis
kg	Kilograms
kgU	Kilograms of depleted uranium
LA	License Application
lbs	Pounds
Ldn	Day-Night Average Sound Level
LLW	Low-Level Waste
LPG	Liquefied petroleum gas
LSC	Life Safety Code
M	Meters

M&TE	Measuring and Test Equipment
MCC	Motor Control Center
mCi	Millicuries
Md	Modified Mercalli (scale)
MDC	Minimum detectable concentration
mg	Milligram
mi	Miles
ml	Milliliters
MHAP	Mean Hazard Annual Probability
MOAs	Military Operation Areas
MOU	Memorandum of Understanding
MPFL	Maximum Possible Fire Loss
mrem	Millirems
MSDS	Material Data Safety Sheets
msl	Mean sea level
mSv	Milli-Sieverts
mw	Megawatt
N	North
NCDC	National Climate Data Center
NCR	Nonconforming Report
NEF	obsolete use URENCO USA* (formerly National Enrichment Facility)
NDA	Non-destructive Assay
NELAC	National Environmental Laboratory Accreditation Conference
NEPA	National Environmental Policy Act of 1969
NESHAP	National Environmental Standards for Hazardous Air Pollutants
NFPA	National Fire Protection AssociationNatural Gas
NG	Natural Gas
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NM 483	New Mexico Highway 483
NMAC	New Mexico Administrative Code
NMCBC	New Mexico Commercial Building Code
NMDGF	New Mexico Department of Game and Fish
NMDHSEM	New Mexico Department of Homeland Security and Emergency Management
NMDOT	New Mexico Department of Transportation
NMEC	New Mexico Electrical Code
NMED	New Mexico Environment Department
NMED/AQB	New Mexico Environment Department /Air Quality Bureau
NMED/HWB	New Mexico Environment Department/Hazardous Waste Bureau
NMED/RCB	New Mexico Environment Department/Radiological Control Bureau
NMED/GWQB	New Mexico Environment Department/Groundwater Water Quality Bureau
NMED/SWQB	New Mexico Environment Department/Surface Water Quality Bureau

NMPC	New Mexico Plumbing Code
NMMSS	Nuclear Materials Management and Safeguards System
NMSA	New Mexico Statutes Annotated
NMSHPO	New Mexico State Historic Preservation Office
NMSLO	New Mexico State Land Office
NMRL/CID	New Mexico Regulation and Licensing/Construction Industries Division
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPH	Natural Phenomena Hazards
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NUREG	U.S. Nuclear Regulatory Commission Regulatory Guides
NWS	National Weather Service
OEM	Office of Emergency Management
OJT	On-the-Job Training
OER	Operating Experience Review
OSHA	U.S. Occupational Safety and Health Administration
P&E	Purge and Evacuation
P&IDs	Piping and Instrumentation Diagrams
PCS	Plant Control Systems
PEC	Passive Engineered Control
PFDs	Process Flow Diagrams
pga	Peak Horizontal Ground Acceleration
PHA	Process Hazard Analysis
PHMSA	Pipeline Hazardous Material Safety Administration
PLC	Project Logic Controller
PM	Plant Manager
PM	Preventive Maintenance
PM	Particulate Matter
PPE	Personal Protective Equipment
ppm	Parts per million
PO	Procurement Officer
POTW	Publicly Owned Treatment Works
PMT	Post-Maintenance Testing
PSA	Pressure Swing Absorption
psia	Pounds per square inch absolute
psig	Pounds-force per square inch gauge
PSM	Process Safety Management
PSP	Physical Security Plan
QL-1	Quality Level 1
QL-2	Quality Level 2

QA	Quality Assurance
QAPD	Quality Assurance Program Description
QC	Quality Control
QMS	Quality Management System
RAIs	Requests for Additional Information
RAQD	Regulatory Affairs and Quality Assurance Director
RCAs	Radiological Controlled Areas
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent in man
REMP	Radiological Environmental Monitoring Program
RP	Radiation Protection
RPM	Radiation Protection Manager
RPP	Radiation Protection Program
RWP	Radiation Work Permits
S	South
SCBA	Self-contained breathing apparatus
scfm	Standard cubic feet per minute
SFC	Sequoyah Fuels Corporation
SFPE	Society of Fire Protection Engineers
SHPO	State Historic Preservation Office
SIH	Standard Industrial Hazards
SNM	Special Nuclear Material
SPCC	Spill Prevention Control and Countermeasure
SRC	Silicon Controlled Rectifier
SRP	Standard Review Plan
SSCs	Systems, structures and components
SSP	Shift Superintendent
SUM	Startup Manager
Sv	Sievert
SWPPP	Storm Water Pollution Prevention Plan
TAC	Tactical Teams
TA	Task Analysis
TEDE	Total effective dose equivalent
TLD	Thermo-luminescent Dosimeter
TPSL	Training /Procedures Support Lead
UL	Underwriters Laboratories
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPS	Uninterruptible Power Supply
U.S. 62/180	U.S. Highways 62 and 180
USGS	United States Geological Survey
USFWS	U.S. Fish and Wildlife Service

UV	Ultraviolet
V&V	Verification and Validation
VFR	Visual Flight Rules
VOC	Volatile organic compound
W	West
WINK	Winkler County Airport
WIP	Work-in-progress
WIPP	Waste Isolation Pilot Plant
WRCC	Western Regional Climate Center

ISA SUMMARY AND ISA DOCUMENTATION

International Isotopes Fluorine Products, Inc. (IIFP), a wholly owned subsidiary of International Isotopes, Inc. (INIS), will build and operate a depleted uranium processing facility in Lea County, New Mexico. The IIFP Facility is being licensed under the Code of Federal Regulations (CFR) Title 10 Part 40 (CFR, 2009e). A License Application (LA) has been submitted to the U. S. Nuclear Regulatory Commission (NRC). IIFP will provide services to the uranium enrichment industry for converting (de-conversion) depleted uranium hexafluoride (DUF_6) into uranium oxides for long-term stable disposal at an offsite licensed disposal facility. IIFP will utilize the extracted fluorine derived from the de-conversion process to manufacture high purity fluorine products for sale in electronic, energy storage, solar panel, semi-conductor and other markets. Descriptions of the Facility site and discussions of the facilities and operation processes are provided in Sections 1, 2 and 3 of this Integrated Safety Analysis (ISA) Summary. The IIFP Facility is also referred to throughout the LA and this ISA Summary as the Fluorine Extraction and Depleted Uranium De-conversion (FEP/DUP) Plant.

The purpose of this document, the IIFP Integrated Safety Analysis (ISA) Summary, is to provide a synopsis of the results of the IIFP ISA including the information specified in 10 (CFR) 70.65(b) (CFR, 2009a). An ISA identifies potential accident sequences in facility operations, designates Items Relied on for Safety (IROFS) to either prevent such accidents or mitigate their consequences to an acceptable level and describes management measures to provide reasonable assurance of the availability and reliability of IROFS. The IIFP ISA Summary principally differs from the ISA by describing and focusing on risk accident sequences with consequences that could exceed the performance criteria of 10 CFR 70.61 (CFR, 2009b).

The following information, as a minimum, is included in the ISA Summary:

1. A general description of the site with emphasis on those factors that could affect safety (e.g., meteorology, seismology)

2. A general description of the facility with emphasis on those areas that could affect safety, including an identification of the controlled area boundaries

3. A description of each process system analyzed in the ISA in sufficient detail to understand the theory of operation, and for each process, the hazards that were identified in the ISA and descriptions of the accident sequences

4. Information that demonstrates compliance with the performance requirements of 10 CFR 70.61, including brief descriptions of the management measures and the requirements of 10 CFR 70.64 (CFR, 2009c)

5. A description of the team, qualifications and the methods used to perform the ISA

6. A list briefly describing each IROFS in sufficient detail to understand its function in relation to the performance requirements of 10 CFR 70.61

7. A description of the quantitative standards used to assess the consequences to an individual from acute chemical exposure to licensed materials, or chemicals produced from licensed materials before those product chemicals are separated from the licensed materials

8. A descriptive list that identifies all IROFS that are the sole item preventing or mitigating an accident sequence that exceeds the performance requirements of 10 CFR 70.61

9. A description of the definitions of unlikely, highly unlikely and credible as used in the evaluations in the ISA

The ISA was performed by establishing a logical relationship between hazards and the related potential risk associated with the hazards. The activities associated with this task were: 1) review of the operation, 2) identification of the hazards, 3) hazards evaluation and estimation of the potential risk and 4) the establishment of safety controls to reduce or eliminate the risk, if needed. This ISA activity was an iterative process that depended on the level completeness of the design and as such, the tasks were not necessarily performed in any order or performed only once.

The review phase defined the scope of the ISA. Regulatory guidance and requirements such as NUREG 1520 (NRC, 2002), the NUREG 1520 Revision 1 (NRC, 2010) and 10 CFR Part 70 Subpart H (CFR, 2009d) were followed for format and content and to ensure that performance requirements specified in 10 CFR 70.61 were met. Information was obtained from project documentation including, but not limited to, conceptual design Piping and Instrumentation Diagrams (P&IDs), Process Flow Diagrams (PFDs), mass balance equations and various engineering design information based on the current level of design. Material Safety Data Sheets (MSDSs) were reviewed for all chemicals/commodities specified in the process as a feed, intermediate reaction product or final product, by-product and/or waste. Design criteria were reviewed for other energy sources including electrical, mechanical, heat and pressure. Natural phenomena events such as earthquake, flood, (external) fire and wind were evaluated for impact on plant hazards, particularly the hazardous materials inventory. Interviews with system and process designers provided clarification of design intent and projected operational requirements. A broad group of these technical specialists were active members of the ISA process and contributed to the development and/or review of all the safety basis documentation.

This ISA is based on the existing level of design detail, much of which is developed from engineering calculations and estimates, known physical and chemical data derived from literature and the plant equipment and system concepts obtained from knowledge of other similar processes and from some pilot plant tests. The design and process parameter data are subject to changes as design detail progresses. The Process Hazard Analysis (PHA) and risk-based ISA reflect the safety design features and the prevention and mitigation measures developed and evaluated using the existing level of design. The ISA process provides the method for continuing review and analysis of design as it develops, becomes more detailed or changes and requires updating of the ISA, where applicable.

The IIFP Facility will not be licensed to possess special nuclear material and therefore will be licensed under Title 10 CFR Part 40. While the current regulations do not require applications submitted under Title 10 CFR Part 40 to include an ISA, NRC staff has been directed to use 10 CFR Part 70 Subpart H performance requirements as part of the licensing basis. The Subpart H requirements are being included for the application review of certain new source material facilities as an interim measure pending the completion of 10 CFR Part 40 rulemaking (NRC, 2007).

A meeting conducted on May 7, 2009 between the IIFP licensing team and the NRC concluded that the ISA requirements will be imposed through orders and that these orders would require an ISA similar to that required by 10 CFR Part 70 Subpart H. This ISA has been developed and is being submitted in anticipation of orders and subsequent rulemaking requiring that an ISA for the IIFP Facility meet requirements similar to those stipulated in 10 CFR Part 70 Subpart H.

Consistent with the 10 CFR Part 70.4 (CFR, 2009f) definition of hazardous chemical produced from licensed materials, the safety controls associated with those activities that involve the processing, collection, storage and transfer of hazardous chemicals that have been separated from licensed material are governed by the U.S. Occupational Safety and Health Administration (OSHA) regulations (CFR, 2009g). Risk Management Programs for Chemical Accidental Release Prevention regulations, developed by U.S. Environmental Protection Agency (EPA, 1994) are followed for the chemicals separated from licensed materials as long as a release of these chemicals would not adversely affect licensed materials or radiological safety.

For the purposes of the ISA and subsequent licensed operations, hazardous chemicals are considered "separated from licensed materials" if the source material in any chemical mixture, compound or solution is less than one-twentieth of 1 percent (0.05 %) of the total weight of the chemical mixture, compound or solution, consistent with the criteria specified in 10 CFR 40.13, "Unimportant quantities of source material." The environmental health and safety controls and regulations associated with the storage, handling, transportation and disposal of the hazardous chemicals associated with the IIFP licensed operations is more restrictive than those controls that would be necessary to protect the worker, public and environment from the radiological hazard justification to utilize the 10 CFR 40.13(a) criteria (CFR, 2009h).

References to Introduction Section

CFR, 2009a 10 CFR 70.65(b). Title 10, Code of Federal Regulations, Section 70.65, “Additional Content of Application,” 2009.

CFR, 2009b 10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, “Domestic Licensing of Special Nuclear Material, Section 61, Performance Requirements,” 2009.

CFR, 2009c Title 10, Code of Federal Regulations, Section 70.64, “Requirements for New Facilities or New Processes at Existing Facilities,” US Nuclear Regulatory Commission, 2009.

CFR, 2009d Title 10, Code of Federal Regulations, Part 70, “Domestic Licensing of Special Nuclear Material, Section 61, Performance Requirements,Subpart H, Additional Requirements for Certain Licensees Authorized to Possess a Crtical Mass of Special Nuclear Material” 2009.

CFR, 2009e Title 10, Code of Federal Regulations, Part 40, “Domestic Licensing of Source Material,” 2009.

CFR, 2009f Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials," Section 4, Definitions, 2009.

CFR, 2009g 29, Code of Federal Regulations, Part 1910, "Occupational Safety and Health Standards, Section 119, Process Safety Management of Highly Hazardous Chemicals ," 2009.

CFR, 2009h Title 10, Code of Federal Regulations, Part 40, "Domestic Licensing of Source Material, Section 13, Unimportant Quantities of Source Material," 2009.

EPA, 1994 "Risk Management Programs for Chemical Accidental Release Prevention, U.S. Environmental Protection Agency,"1994.

NRC, 2002 U.S. Nuclear Regulatory Commission Regulation NUREG-1520. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," 2002

NRC, 2007 U.S. Nuclear Regulatory Commission, SECY-07-0146, "Staff Requirements Memorandum, Regulatory Options for Licensing New Uranium Conversion and Depleted Uranium Deconversion Facilities," 2007.

NRC, 2010 U.S. Nuclear Regulatory Commission Regulation NUREG-1520, Revision 1. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility ," 2010.

1 SITE DESCRIPTION

This section contains a summary description of the New Mexico site selected for the IIFP Facility and surrounding areas. The IIFP Environmental Report (ER), Revision B contains additional information regarding the site and its environs.

1.1 Site Geography

This section contains information regarding the site location, including nearby highways, bodies of water and other geographical features.

1.1.1 Site Location Specifics

The IIFP Site is located in Southeast New Mexico, approximately 19 km (12 mi) west of Hobbs, New Mexico (population 28,657). The site is located in Lea County, approximately 26 km (16 mi) west of the Texas state border, 87 km (54 mi) northwest of Andrews, Texas (population 10,182) and 362 km (225 mi) southeast of Albuquerque, New Mexico (population 712,728). The nearest large population center (>100,000 population) and commercial airport is the Midland-Odessa, Texas area which is approximately 142 km (89 mi) to the southeast. See Figure 1-1 for a depiction of the site location. The approximate center of the IIFP Site is located at latitude 32 degrees, 43 min North and 103 degrees, 20 min West longitude.

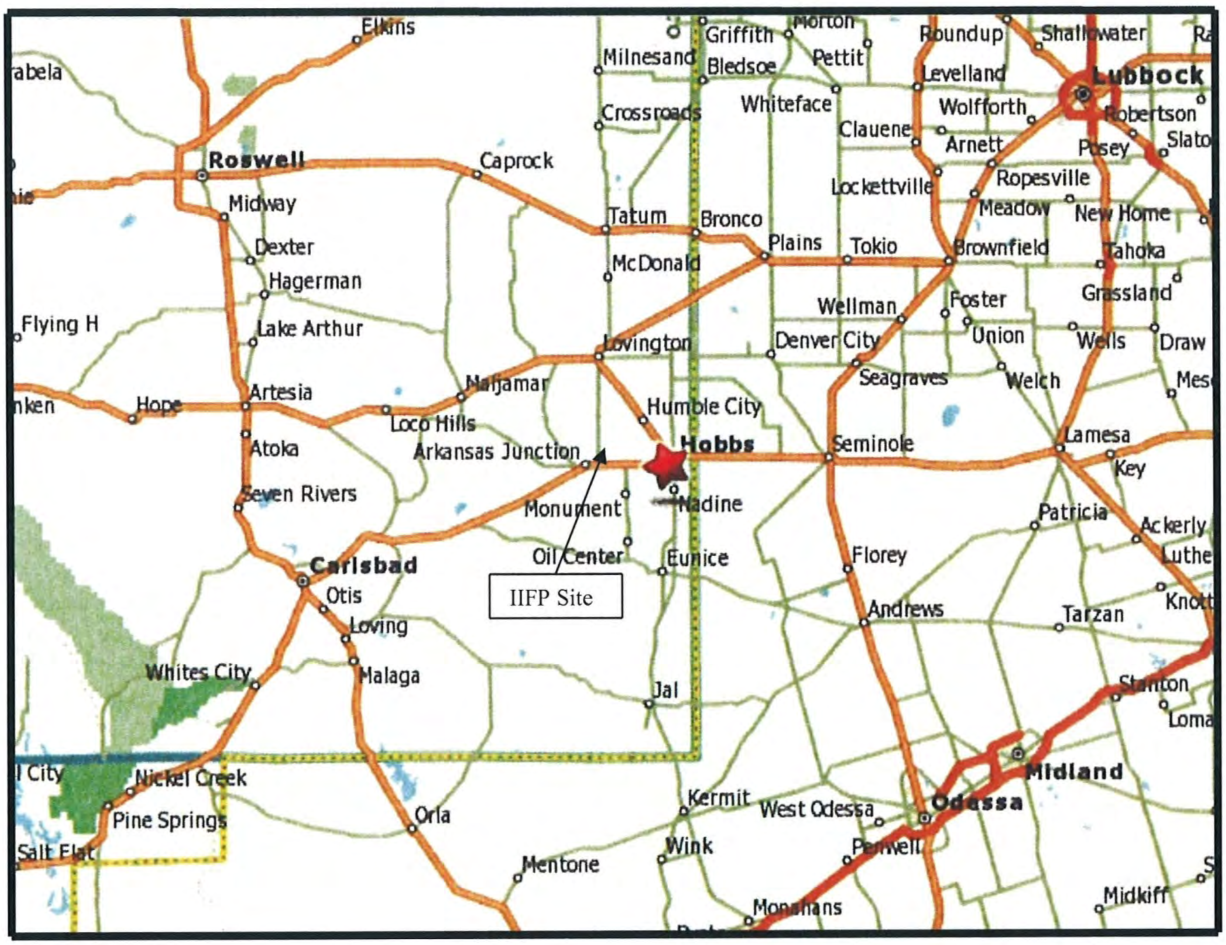


Figure 1-1 Location of IIFP Site

Lea County is situated at an average elevation of 1,220 m (4,000 ft) above mean sea level (msl) and is characterized by its flat topography. Lea County covers 11,381 km^2 (4,393 mi^2) or approximately 1,142,235 hectares (ha) (2,822,522 acres) which is three times the size of Rhode Island and only slightly smaller than Connecticut. From north to south, Lea County spans 173 km (108 mi); the county spans 70 km (44 mi) from east to west at its widest point.

The IIFP Site location was chosen out of 958.7 ha (2,369 acres) in Township 18S, Range 36E, Sections 26, 27, 34 and 35. The 259 ha (640-acre) Section 27 was selected for location of the 16.2 ha (40-acre) facility site and lies approximately one (1) mile north of U.S. Highways 62/180 and along the east side of New Mexico Highway 483. U.S. Highway 62/180 intersects New Mexico Highway 209 providing access from the city of Hobbs south to Eunice and Jal. New Mexico Highway 132 runs north from Hobbs at the intersection with U.S Highways 62/180 to Knowles and Denver City. U.S. Highways 62/180 runs southwest to Carlsbad, New Mexico, approximately 56 miles from the site. U.S. Highways 62/180 runs east through Seminole, Texas, 41 miles from Hobbs to Fort Worth, Texas, 340 miles from the site.

1.1.2 Features of Potential Impact to Accident Analysis

The landscape of the site and vicinity is typical of a semi-arid climate and consists of sandy soils with desert-like vegetation such as mesquite bushes, shinnery oak shrubs and native grasses. The IIFP Site is open, vacant land. Except for man-made structures associated with the neighboring industrial properties and the local oil and gas industry, nearby landscapes are similar in appearance. The only agricultural activity in the site vicinity is domestic livestock ranching.

The site is within the southern part of the Llano Estacado or Staked Plains, which is a remnant of the southern extension of the Southern High Plains. The Southern High Plains are remnants of a vast debris apron spread along the eastern front of the mountains of Central New Mexico by streams flowing eastward and southeastward during the Tertiary period. The site and surrounding area has a nearly flat surface. Natural drainage is northwest to southeast. Surface drainage is into numerous un-drained depressions as well as a small intermittent water tributary running from the northwestern boundary to the southeast.

The site area overlies prolific oil and gas geologic formations of the Pennsylvanian and Permian age. Other common features of the Southern High Plains are un-drained depressions called "buffalo wallows” which are believed to have formed by leaching of the caliche cap and the calcareous cement of the underlying sandstone and subsequent removal of the loosened material by wind.

There is no mountain range in the site vicinity. Several “produced water" lagoons are located on the property. "Produced water" is water that has been injected into oil wells to facilitate the extraction of oil. As oil wells mature, the ratio of water to oil in each well increases. This is because the formation of “waters out” due to the water injection process. Water becomes a significant by-product of oil and gas production. There are two (2) playas on the site but no significant bodies of water such as rivers or lakes. There is no park, wilderness area or other recreational area located within or immediately adjacent to the IIFP Site. In addition, there is no architectural or aesthetic feature that would attract tourists to the area.

1.2 Demographics

This section provides the current census results (calendar year [CY] 2010) for the area surrounding the IIFP Site, to include specific information about populations, public facilities and industrial facilities. Land use and nearby bodies of water are also described.

1.2.1 Latest Census Results

According to the U. S. Census Bureau, the population of Lea County was 55,508 in 2000 and 67,727 in 2010. Andrews County, Texas had a population of 13,004 in 2000 and 14,786 in 2010 and the population of Gaines County, Texas was 14,467 in 2000 and 17,526 in 2010. Demographic, site and climate data used throughout the ISA Summary are taken from the IIFP ER, Revision B. The population increases for these three (3) counties over the most recent decade were 22.0%, 13.7% and 21.1% respectively. The total population of the three principal counties in the region of influence was approximately 100,000 in 2010 compared to 83,000 in 2000 representing a 20.6% increase for the three-county area. (http://quickfacts.census.gov/qfd/states/48/48165.html)

1.2.2 Description, Distance and Direction to Nearby Population Areas

The IIFP Site is in Lea County, New Mexico. Figure 1-1 also shows the city of Hobbs, New Mexico, the closest population center to the site, at a distance of about 12 miles. Other population centers are at distances from the site as follows:

- Eunice, Lea County, New Mexico: 35 km (22 mi) southeast
- Jal, Lea County, New Mexico: 69 km (43 mi) southeast
- Lovington, Lea County, New Mexico: 24 km (15 mi) north-northwest
- Seminole, Gaines County, Texas: 66 km (41 mi) east
- Denver City, Gaines County, Texas: 55 km (34 mi) north-northeast
- Andrews, Andrews County, Texas: 87 km (54 mi) southeast

Aside from these communities, the population density around the site region is extremely low. Other communities in Lea County include Buckeye, Caprock, Humble City, Knowles, McDonald, Maljamar, Monument, Oil Center and Tatum.

Surrounding property consists of vacant land and the industrial facilities described in Section 1.2.4 below. Cattle grazing on nearby sites occur throughout the year. Land around the site has been mostly developed by the oil and gas industry. The nearest residence is situated approximately 2.6 km (1.6 mi) northwest of IIFP structures and 1.21 km (0.75 mi) from the site's western boundary.

1.2.3 Proximity to Public Facilities

Urban development is relatively sparse in the vicinity of the IIFP Site. The nearest city, Hobbs, New Mexico is approximately 19m (12 mi) to the east. Within Hobbs, New Mexico, several educational institutions are available for the education of personnel in the local community. There are two (2) colleges, a high school and an alternative high school, three (3) middle schools and twelve (12) elementary schools as well as two (2) private schools.

There is no known public recreational area or hospital within five (5) miles of the site.

1.2.4 Potential Nearby Events

Land around the site has been mostly developed by the oil and gas industry. Three (3) gas-fueled electric-generating plants and a gas-processing facility are located nearby including the Xcel Energy Cunningham Station, 1.6 km (1.0 mi) from the site on the west boundary (New Mexico Highway 483); Xcel Energy Maddox Station located 3.5 km (2.2 mi) east-southeast of the site; and the Colorado Energy Hobbs Generating Station 3.1 km (1.9 mi) east-northeast of the site. The DCP Midstream Linam Ranch Plant, a natural gas (NG) processing facility, is located 5.8 km (3.6 mi) southeast of the IIFP Site.

Hazard Energy Sources as listed in Table 5-3, "IIFP Facility Hazard Identification Checklist," include: 1) non-facility events such as explosions, fires and power outages and 2) vehicles in motion, e.g. airplanes, cranes/hoists, forklifts, helicopters, trains or trucks/cars.

An explosion analysis determined that a natural gas explosion at the nearest industrial facility, Excel Energy Cunningham Power Station located 1.6 km from the nearest IIFP Process Building, will not impose a blast wave greater than (or equal to) 6.9 kPa (1 psi) on any of the IIFP Process Buildings. The structures of the IIFP Facility are to be designed to withstand a 6.9 kPa (1 psi) overpressure. Thus, a natural gas explosion from nearby industrial facilities poses no credible danger to the IIFP safety system IROFS. The explosion analysis and results for nearby gas pipelines are discussed in subsection 1.2.4.2.

Other hazard energy sources from other industrial facilities to the IIFP Facility are fires and power outages. Chapter 7 of the IIFP LA, Revision B addresses "Fire Safety." The Fire Safety Program is intended to reduce the risk of fires and explosions at the IIFP Facility and documents how the facility administrates the Fire Safety Program at the IIFP Facility. Fires at adjacent industrial facilities could lead to power outages or potential explosions at those facilities. Should a fire at an adjacent industrial facility not be contained and spread toward the facility, administrative controls are maintained for vegetation control and limitations on combustible loads. These administrative controls reduce the potential for a fire to be initiated or sustained at the IIFP Facility.

A non-facility event at a nearby industrial facility could result in a power outage at the IIFP Facility. In the event of a power outage, the IIFP Facility has a diesel powered emergency generator located outside the Main Switchgear Building. The facility also possesses an Uninterruptable Power Supply (UPS) system that provides power to all critical loads during the interim period between power failure and the generator coming up to full speed to supply the site. All buildings are provided with emergency lighting for the illumination of the primary exit paths and critical operation areas where personnel are required to operate valves, dampers and other controls in an emergency. Thus, fires and power outages at nearby industrial facilities do not pose a credible risk to the safe operation of the IIFP Facility.

An aircraft crash into the IIFP Facility is an incredible event because all three proximity criteria from Section 3.5.1.6 of Standard Review Plan (SRP) NUREG 0800 were met (See Section 1.2.4.3 below). Similarly, an aircraft crash into a nearby industrial facility would be a highly unlikely event. Should an aircraft crash into a nearby facility, the consequences to the IIFP Facility would be similar to that of an explosion potentially caused by the aircraft accident. The process building structures of the facility are to be designed to withstand a 6.9 kilopascals (kPa) (1 psi) overpressure per the Regulatory Guide 1.91 (NRC, 1978).

There is no military facility within twenty (20) miles of the site. The closest military installation is Cannon Air Force Base which is 129 miles from the IIFP Facility. Thus, there is no need to further assess effects of non-facility events such as explosions, fires or power outages from military facilities on the IIFP Site.

See Subsection 1.2.4.3 below for the analysis discussion of impact to the IIFP Facility from vehicles in motion hazards (aircraft and helicopters) at these nearby facilities and from military operations.

1.2.4.1 Potential Explosion Hazards from Nearby Highways

The IIFP Site is situated within Lea County approximately one (1) mile north of U.S. 62/180 and on the east side of NM Highway 483. U.S Highways 62/180 is of four-lane construction and is a well-established radioactive waste transportation corridor established for shipping transuranic and mixed waste. U.S 62/180 runs southwest toward Carlsbad, NM, approximately fifty-six (56) miles (90.1 km) from the proposed site. NM 483 runs from intersection of U.S. 62/180 (Arkansas Junction) to Lovington, NM, approximately 15.4 miles (24.1km) from the IIFP Site.

Regulatory Guide 1.91 provides guidance to address transportation explosion hazards near nuclear power plants. The potential hazard has been considered and evaluated in reference to the Regulatory Guide 1.91 and the NRC Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico, Louisiana Energy Services, NUREG-1827 (NRC, 2005.)

In NUREG-1827, the potential hazard of a highway propane explosion was evaluated for likelihood of occurrence because the postulated accident was in the approximate safe-separation distance from a proposed safety-significant structure.

In the case of the IIFP Facility, the structures of the facility are to be designed to withstand a 6.9 kPa (1 psi) overpressure in accordance with Regulatory Guide 1.91.
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

The nearest IIFP safety structure is greater than 0.58 miles (0.94 km) from the nearest highway transportation route (Highway 483). No further analysis is needed for nearby highway transportation routes due to the conservative safe distance of more than 0.42 miles (0.68 km). Likewise, there is no rail transportation route within five (5) miles of the IIFP Facility and no further analysis is needed for nearby rail transportation routes due to the conservative safe distance of more than 0.58 miles (0.94 km).

1.2.4.2 Potential Hazards from Nearby Gas Pipelines

A New Mexico licensed engineering company performed a survey of the site to identify nearby underground fossil fuel pipelines. Based on easement records filed with Lea County, several underground fossil fuel pipelines are located within one (1) mile of the site (one petroleum gas pipeline and several natural gas pipelines). An engineering drawing (number 100-C-0004 Revision B) shows the gas pipeline locations in reference to the IIFP Facility Site Plan. This drawing is available as part of the IIFP License Application Engineering Drawing Package submitted to the NRC. As part of the land survey, each pipeline was assigned a designation (i.e., Pipeline 45a). The survey successfully identified the diameter and pressure for the liquefied petroleum gas (LPG) pipeline and all but two (2) of the natural gas (NG) pipelines. The pressure is unknown for one (1) NG pipeline and the diameter is unknown for the other NG pipeline. Based on the available data for pipelines located near the IIFP Site, the largest NG pipeline diameter is twelve (12) inches and the largest NG pipeline pressure is 1500 psi. These values are conservatively selected to characterize the two (2) pipelines for which diameter and pressure are unknown.

The leak or rupture of a nearby, underground, fossil fuel pipeline could form an explosive cloud of gaseous fuel in the atmosphere. Detonation of the explosive cloud would generate a blast pressure wave. The magnitude of the blast pressure wave would depend primarily on fuel type, pipe diameter and pressure. Atmospheric conditions (stability class, wind speed and wind direction) would influence the transport and dispersion of the gaseous fuel and therefore influence the size of the explosive cloud and the magnitude of the blast. The magnitude of a blast pressure wave attenuates rapidly with distance. A blast pressure wave less than one (1) psi is considered conservatively safe for industrial structures per NRC Regulatory Guide 1.91.

An evaluation was performed to determine the annual probability that the rupture of a nearby fossil fuel pipeline (followed by detonation) could generate a blast pressure wave greater than one (1) psi at a process building. Major calculation steps and key analytic assumptions for the pipeline explosion probability evaluation are listed below.

[Step 01] Based on twenty-four (24) years of fossil fuel gas pipeline safety data obtained from the U.S. Department of Transportation (DOT) Pipeline Hazardous Material Safety Administration (PHMSA) website, an explosion per year per pipeline mile rate is developed for NG pipelines (a separate rate is developed for LPG pipelines).

[Step 02] Guillotine pipeline rupture is assumed to occur; a steady gas release ensues; and detonation of the gas plume occurs as much as one hour after the pipeline rupture.

[Step 03] Blast radii are determined by the EPA approved ALOHA computer code for every set of wind speed and stability class that occurs in the Lea County region (there are 43 sets of atmospheric conditions identified). Site specific meteorological data was provided by the State of New Mexico. Blast radii are determined for a range of average pipeline release rates and a power series curve fit is developed for each set of atmospheric conditions (k = 1 to 43):

$$BlastRadius_k = W_k T^{Z_k}$$

Where Blast Radius$_k$ is the blast radius (meters); W_k is the mantissa of the power series curve fit; T is the average release rate from the pipeline (kg/sec); and Z_k is the exponent of the power series curve fit. The subscript “k” represents each of the 43 sets of atmospheric conditions. Power series curve fits provide an excellent fit to all of the results generated by ALOHA.

[Step 04] For each pipeline, the initial release rate $Q_{initial}$ is calculated based on choked flow conditions from the end for the broken pipe. Equal flow from both ends of the ruptured pipeline is conservatively assumed. Based on empirical data from a year 2000 report published by the Gas Research Institute (GRI-00/0189, “A Model for Sizing High Consequence Areas Associated with Natural Gas Pipelines”), a release rate decay factor (λ) is calculated based on the first five (5) minutes of the release (λ=0.16). An average pipeline release rate, $\lambda \times Q_{initial}$, is conservatively assumed to persist for as much as one (1) hour before detonation occurs. Although the soil cover would likely attenuate the release rate via diffusion and absorption, the analysis assumes no credit for the presence of the soil cover.

[Step 05] Based on the curve fits in Step 04, for each pipeline, a blast radius is calculated for each set of atmospheric conditions (k = 1 to 43). Then, consistent with the method illustrated in Figure 2 of NRC Regulatory Guide 1.91 for each blast radius, calculations are performed to determine the pipeline exposure distance. Pipeline exposure distance is the span of nearby pipeline with potential to produce a blast pressure wave greater than one (1) psi at a process building. It is conservatively assumed that the wind always travels directly toward the nearest process building.

[Step 06] Each pipeline exposure distance calculated in Step 05 is weighted based on the annual frequency of the atmospheric conditions.

$$WeightedExposureDistance_k = ExposureDistance_k \times Freq_k$$

For example, if the calculations reveal that a nearby pipeline has a 287 foot exposure distance based on D stability and 4 m/s wind conditions (D04) and the annual frequency of D04 conditions is 2.3 percent, then the weighted exposure distance is 2.3% x 287 feet = 6.6 feet.

[Step 07] Based on the equation below, a total, annual, weighted average exposure distance (S_{TOT}) is calculated for each pipeline. The use of a weighted average ensures that redundant exposure distances are not double-counted.

$$S_{TOT} = \frac{1}{43}\sum_{k=1}^{43} ExposureDistance_k \times Freq_k$$

[Step 08] Steps 04 through 07 are performed for each nearby fossil fuel pipeline. The combined exposure distance for all the NG pipelines is determined separately from the exposure distance for the LPG pipeline. The weighted exposure distance results for the NG pipelines are summed.

$$NG\ Exposure\ Distance = \sum S_{TOT,NG}$$

$$PG\ Exposure\ Distance = S_{TOT,LPG}$$

[Step 09] Each result from Step 08 (one result to represent the LPG pipeline and one result to represent the NG pipelines) is then multiplied by the appropriate annual pipeline explosion rate developed in Step 01. The sum of these products represents the total annual probability that a nearby, fossil fuel pipeline could rupture, detonate and cause a one (1) psi (or larger) blast pressure wave at a process building.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1.2.4.3 Potential Aircraft Accidents from Nearby Air Transportation Corridors

An aircraft hazard risk determination has been conducted. This analysis follows the methodology as described in Standard Review Plan (SRP) NUREG 0800 Section 3.5.1.6 for aircraft hazards evaluation (NRC, 2010a). SRP 3.5.1.6 methodology is accepted by the U.S. Nuclear Regulatory Commission to assess the probability of hazards due to airport operations and aircraft transits near nuclear facilities. Resource references for data used in the analysis are included in the analysis documentation.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Using the method provided in Section 3.5.1.6 of NUREG 0800, the probability of an aircraft on the V68 airway crashing onto the facility was estimated to be 2.7 x 10^{-8} for CFR Part121 operations. This probability makes the aircraft crash an incredible event and thus requires no further consideration in either design or integrated safety analysis.

The U.S. Department of Energy (DOE) Standard 3014-2006 (DOE, 2006) offers an alternative analytic method to evaluate external risk from aircraft operations. To establish additional confirmation of the results obtained by the NRC method, the DOE method was also applied. Since the DOE method applies a different analytic approach, the results obtained via the DOE method are only relevant in comparison to the DOE threshold risk metric, which is not the same as the NRC risk metric. Based on the results from the DOE evaluation, the calculated probability of 3.3 x 10^{-7} crashes per year at the site is less than the DOE evaluation guideline of 1.0 x10^{-6}.Therefore, the DOE method also demonstrates that the crash of an aircraft into the target areas is an incredible event and thus requires no further consideration in the integrated safety analysis.

All three (3) proximity criteria of Section 3.5.1.6 have been met. Additional calculations estimate that the probability per year of an aircraft crashing into the plant from the closest Federal airway (V68) is less than the NRC acceptance criteria. Calculations also estimate the annual probability of an aircraft crashing into the plant from the same airway is less than the DOE acceptance criteria. This probability is well below the NRC threshold metric of 1 x 10^{-7} which means an aircraft crash into the target area is an incredible event and thus requires no further consideration in the integrated safety analysis.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1.2.5 Land Use within One Mile of Facility

As described above, very little land use occurs nearby the IIFP Site. Land use within one (1) mile of the facility is essentially the same as that within five (5) miles of the facility.

1.2.6 Uses of Nearby Bodies of Water

Water resources at the site are minimal. There are two (2) local playas on the site with a small stream that runs from northwest to southeast across the property that is predominantly dry during the year. The site is above the Ogallala Aquifer that is discussed below in Section 1.4. The site region has semi-arid climate, with low precipitation rates and minimal surface water occurrence. Thus, the potential for negative impacts on those water resources are very low due to lack of water presence and formidable natural barriers to any surface or subsurface water occurrences. Groundwater at the site would not likely be impacted by any potential releases, but a groundwater permit application will be filed with the State of New Mexico for review and approval.

1.3 Meteorology

1.3.1 Primary Wind Direction and Wind Speeds

Spring is the windy season. Winds of fifteen (15) mph or more occur from February through May. Blowing dust and serious soil erosion of unprotected fields may be a problem during dry spells. Winds are generally stronger in the eastern plains than in other parts of the State. Winds generally predominate from the southeast in summer and from the west in winter, but local surface wind directions will vary greatly because of local topography and mountain and valley breezes. Average wind speed and direction from four (4) regional locations are shown below in Figure 1-2.

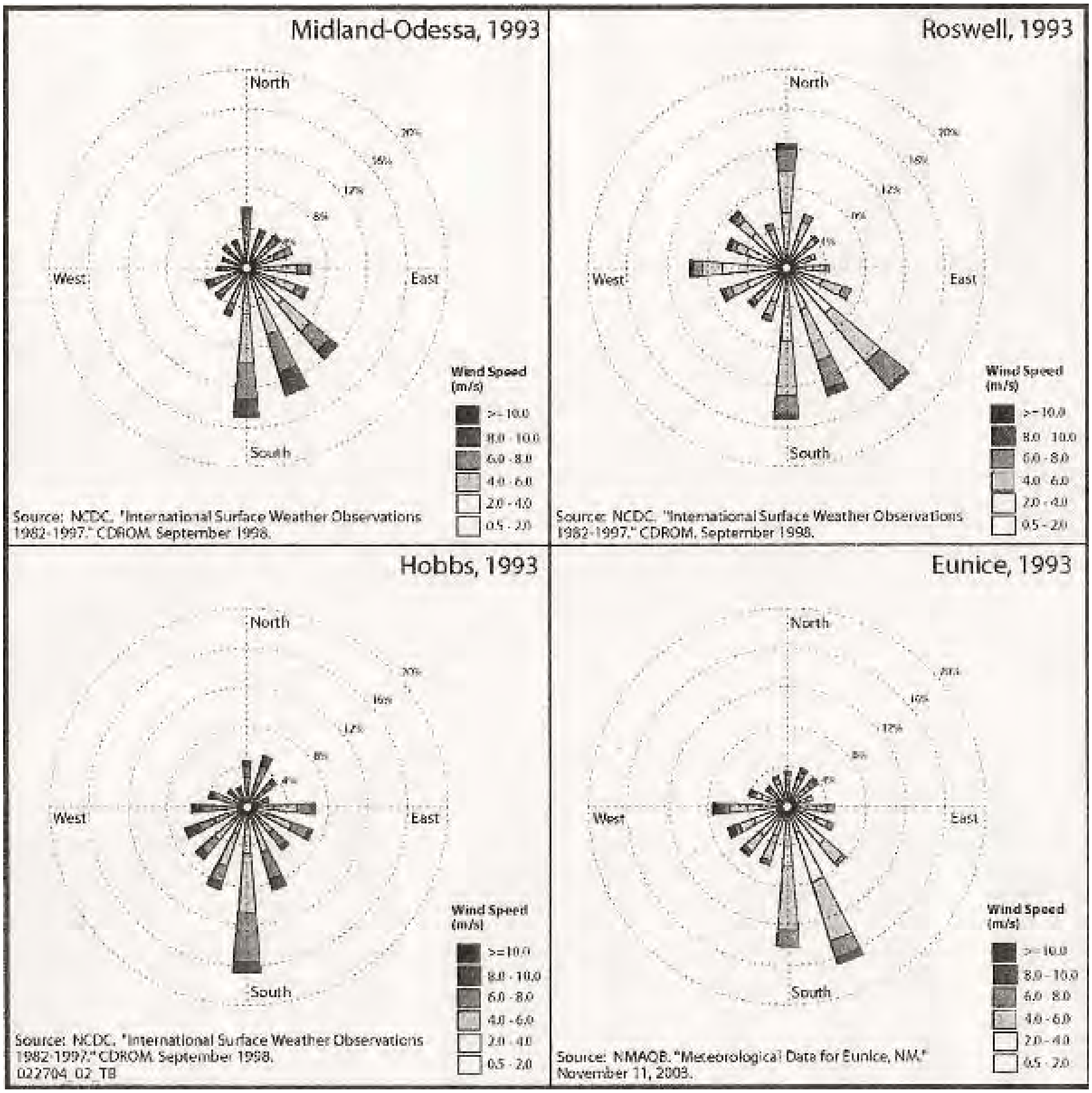


Figure 1-2 Wind Rose for Midland-Odessa, Roswell, Hobbs and Eunice for 1993

Table 1-1 Summary of Monthly Precipitation at Hobbs, New Mexico, from 1914 to 2006

	Rainfall							Total Snowfall		
Month	**Mean**	**High**	**Year**	**Low**	**Year**	**1-Day Maximum**		**Mean**	**High**	**Year**
January	1.14 cm (0.45 in)	7.52 cm (2.96 in)	1949	0.00	1924	3.07 cm (1.21 in)	01/11/1949	3.30 cm (1.3 in)	31.75 cm (12.5 in)	1983
February	1.14 cm (0.45 in)	6.20 cm (2.44 in)	1923	0.00	1917	3.53 cm (1.39 in)	02/05/1988	2.79 cm (1.1 in)	36.32 cm (14.3 in)	1973
March	1.40 cm (0.55 in)	7.57 cm (2.98 in)	2000	0.00	1918	5.08 cm (2.00 in)	03/20/2002	1.27 cm (0.5 in)	25.40 cm (10.0 in)	1958
April	2.03 cm (0.80 in)	13.13 cm (5.17 in)	1922	0.00	1917	4.75 cm (1.87 in)	04/20/1926	0.51 cm (0.2 in)	22.86 cm (9.0 in)	1983
May	5.16 cm (2.03 in)	35.13 cm (13.83 in)	1992	0.00	1938	13.21 cm (5.20 in)	05/22/1992	0.0	0.0	1948
June	4.80 cm (1.87 in)	23.62 cm (9.30 in)	1921	0.00	1924	11.23 cm (4.42 in)	06/07/1918	0.0	0.0	1948
July	5.33 cm (2.10 in)	23.90 cm (9.41 in)	1988	0.00	1954	11.35 cm (4.47 in)	07/19/1988	0.0	0.0	1948
August	6.02 cm (2.37 in)	23.29 cm (9.17 in)	1920	0.10 cm (0.04 in)	1938	11.30 cm (4.45 in)	08/09/1984	0.0	0.0	1948
September	6.68 cm (2.60 in)	32.99 cm (12.99 in)	1995	0.00	1939	19.05 cm (7.50 in)	09/15/1995	0.0	0.0	1948
October	4.04cm (1.59 in)	20.70 cm (8.15 in)	1985	0.00	1917	14.22 cm (5.60 in)	10/09/1985	.25 cm (0.1 in)	11.43 cm (4.5 in)	1976
November	1.45 cm (0.57 in)	11.00 cm (4.33 in)	1978	0.00	1915	9.65 cm (3.80 in)	11/04/1978	1.52 cm (0.6 in)	41.91 cm (16.5 in)	1980
December	1.42 cm (0.56 in)	12.90 cm (5.08 in)	1986	0.00	1917	4.72 cm (1.86 in)	12/21/1942	2.29 cm (0.9 in)	24.13 cm (9.5 in)	1986
Annual	40.49 cm (15.94 in)	81.76 cm (32.19 in)	1941	13.41 cm (5.28 in)	1917	19.05 cm (7.50 in)	09/15/1995	11.93 cm (4.7 in)	68.83 cm (27.1 in)	1980

cm – centimeter.
In – inch.
Source: WRCC, 2006.

As described in the IIFP ER, Revision B the normal annual total rainfall as measured in Hobbs, New Mexico is sixteen (16) inches. Precipitation amounts range from an average 0.45 inch in January to 2.63 inches in September. Maximum and minimum monthly totals are 13.8 inches and zero. Table 1-1 above presents a summary of precipitation in the Hobbs area for monthly and annual means from the Hobbs weather station with monitoring data from 1914 to 2006. Total snowfall is also shown in Table 1-1. The mean snowfall is 5.1 inches with a high of 27.1 inches at this monitoring location. The mean snowfall is 5.1 inches with a high of 27.1 inches at this monitoring location.

1.3.2 Severe Weather

1.3.2.1 Extreme Temperature

Table 1-2 shows the highest and lowest recorded temperatures in the IIFP Site area.

Table 1-2 Temperature Extremes at Hobbs, New Mexico

Station	Temperature Extremes [^{0}C (^{0}F)]			
	High	Date	Low	Date
Hobbs	45.6 (114)	June 27, 1998	-21.7 (-7.1)	January 11, 1962
Hobbs FAA Airport	42.2 (108)	July 14, 1958	-23.9 (-11)	February 1, 1951
Hobbs 13 W	41.7 (107)	June 25, 1998	-16.1 (3)	December 8, 2005

1.3.2.2 Extreme Precipitation

Summer rains fall almost entirely during brief, but frequently intense thunderstorms. Frequent rain showers and thunderstorms from June through September account for over half the annual precipitation. The general southeasterly circulation from the Gulf of Mexico brings moisture from the storms into the State of New Mexico and strong surface heating combined with orographic lifting as the air moves over higher terrain causes air currents and condensation. Orographic lifting occurs when air is intercepted by a mountain and is forcefully raised up over the mountain, cooling as it rises. If the air cools to its saturation point, the water vapor condenses and a cloud forms. The rainiest months are August and September when 30 to 40 percent of the year’s total moisture falls.

1.3.2.3 Extreme Winds

This section describes the basis for evaluation of wind loading on the structures at the IIFP Facility in Lea County, New Mexico. Three sources of wind loading are evaluated; wind loading from a hurricane, straight wind loading and wind loading from a tornado.

<u>Hurricanes</u>

The IIFP Facility site is located in the extreme southeastern portion of New Mexico and over 500 miles inland from the Gulf of Mexico. Hurricane winds dissipate over Louisiana and Texas enough to prevent a wind damage threat to the IIFP Facility site as evidenced by the following information provided by National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center (NCDC).

According to NOAA/NCDC, of the 155 thunderstorm events recorded between 01/01/59 and 02/28/10, the maximum thunderstorm wind speed recorded for Lea County was eighty (80) knots (92.1 mph) on 07/14/89. Some of these thunderstorm events likely would have been the result of dissipated hurricanes.

<u>Tornadoes and Straight Winds</u>

NOAA/NCDC Storm Events includes information for 527 tornado events reported for the state of New Mexico for the period 1950-2010 for an average of 8.78 events per year. Lea County reported 92 tornadoes for the same period for an average of 1.53 tornadoes per year. Of these 92 tornado events for Lea County between January 1, 1950 and January 31, 2010, 63 Category F0, 20 Category F1, 8 Category F2 and 1 Category F3 tornadoes were reported. During this same sixty-year period, no Category F4 or F5 tornado was reported.

The evaluation of tornadoes and straight winds was made based on NUREG/CR-4461, Revision 2 (NRC, 2007b) including data in Appendices A, B and C of the NUREG, DOE-1020-2002 (DOE, 2002) and DOE-STD-1022-2002 (DOE, 2002a) including Appendix D. It was determined from this evaluation that straight gust wind speeds will be used as the design basis for buildings and structures at the IIFP Facility. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Design wind speeds for all buildings and structures containing licensed material or buildings and structures containing chemicals or processes affecting licensed material are determined in accordance with NUREG-1520, Revision 1 (NRC, 2010) and by reference to DOE-STD-1020-2002 which, in Table 3-2, lists recommended peak gust wind speeds for Category C exposure and for tornadoes at 10m (33 ft) above the ground versus “Performance Category and Annual Probability of Exceedance” for twenty-three (23) DOE sites across the United States.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

As mentioned above, those structures will meet the performance category of $1x10^{-4}$ and be designed to withstand a $1x10^{-4}$ probability per year occurrence straight-line wind event. Hence, based on the order of magnitude scale for determining event likelihood using the ISA methodology in NUREG-1520, Rev. 1, the collapse or loss of the building integrity is considered to be highly unlikely and meets the qualitative frequency scale of $1x10^{-5}$ per year or less. Events that occur at a highly unlikely frequency meet the performance criteria for acceptable risk without the need to further reduce the likelihood of hazardous release or mitigate its consequences. Therefore, designing the IIFP applicable facilities to withstand straight-line wind events with an occurrence frequency of $1x10^{-4}$ per year meets ISA risk acceptance levels regardless of the hazardous material inventories within the facilities and without consideration to mitigation of any hazardous release.

Sandstorms

Blowing sand and dust may occur occasionally. Large dust storms with the potential of covering a large region are rare (DOE, 2003).

1.3.2.4 Thunderstorms

Thunderstorms occur during every month but are most common in the spring and summer months. Thunderstorms occur on an average of 36.4 days/yr in Midland-Odessa. The seasonal average are: 11 days in the spring (March through May) and 17.4 days in the summer (June through August); 6.7 days in the fall (September through November); and 1.3 days in winter (December through February). Occasionally, thunderstorms are accompanied by hail.

1.3.2.5 Lightning

Only two (2) lightning events having sufficient intensity to cause loss of life, injury, significant property damage and/or disruption to commerce were reported in Lea County, New Mexico, between January 1, 1950 and April 30, 2004 (see IIFP ER, Revision B). The closest lightning event occurred in Hobbs with minor property damage of $3,000 on August 12, 1997. The second occurred in Lovington on August 8, 1996, causing two (2) deaths.

The NOAA database indicates that Lea County is in a region that has an average flash density of 4 to 5 flashes/km^2/yr. The conversion of this flash density to a 40-acre basis for the IIFP fenced area indicates that the site could expect 0.65 to 0.81 flashes per year (equivalently less than one (1) flash per year). IIFP structures, equipment and associated power systems will be designed and built with heavy grounding and/or lightning protection to handle lightning strikes.

1.3.2.6 Floods

The site is located in an area which does not fall within a mapped 100 year or 500 year flood plain and has a semi-arid climate with an average rainfall of twelve (12) to slightly less than sixteen (16) inches per year as recorded for Hobbs city (15.93 in/yr), Hobbs airport (12.35 in/yr), Pearl, NM (13.91 in/yr) and Roswell, NM (14.66 in/yr). This information was obtained from the Western Regional Climate Center (WRCC) website.

Since there is no significant body of water or river within several miles of the site, it is expected that any flooding would be due to extreme short-term precipitation which could result in flash flooding (See assessment discussion below). According to information obtained from NOAA National Climate Data Center Storm Events, there have been sixty-eight (68) flood events in Lea County, New Mexico between 1/1/1950 and 2/28/2010, an average of approximately one per year. Of these sixty-eight (68) events, there were no deaths reported, and property damage was reported for only fourteen (14) of the events, all of which occurred in the cities and towns of Lea County. Twenty-nine (29) of the sixty-eight (68) events were reported for Hobbs which is located at an elevation from 125 to 170 feet lower than the site and approximately 11.4 miles to the east. The Hobbs airport is at an elevation of about 125 feet lower and some 6.9 miles southeast of the site, and it is also in Federal Emergency Management Agency (FEMA) Zone D and unmapped.

The IIFP property would likely receive some drainage from New Mexico Highway 483 on the west and possibly from the north as parts of these areas are at slightly higher elevations than the facility location. However, site topography indicates that water would naturally drain away from the property toward the east and south as gradual but significant elevation declines occur in those directions for several miles.

A preliminary flood hazard assessment for the IIFP Facility was performed using DOE documents DOE-STD-1020-2002, DOE-STD-1022-2002 and DOE-STD-1023-95 (DOE, 2002b). For the IIFP Facility, a Performance Category-3 (PC-3) facility classification, as defined by the referenced DOE documents, was used. From that assessment, IIFP determined that a comprehensive flood hazard assessment is not required. Preliminary screening indicates that flooding is not a design basis event other than in consideration of storm water runoff. A summary of the preliminary flood hazard assessment is discussed below.

In accordance with DOE-1020-2002 Table 4-1 "Flood Criteria Summary", the Mean Hazard Annual Probability (MHAP) for Performance Category PC-3 is 1×10^{-4}. The preliminary screening analysis was performed with a MHAP of 1×10^{-4} as a minimum.

A. A preliminary screening for the potential of river flooding of the IIFP Facility site reveals that the nearest river (Pecos River) is approximately fifty (50) miles south and southwest from and 700 feet in elevation below the IIFP Facility site at its nearest point. Based upon this information, the potential for river flooding is screened out as a potential source of flooding of the IIFP Facility site.

B. A preliminary screening for the potential of flooding of the IIFP Facility site from a dam failure reveals that the nearest dam is Brantley Dam forming Brantley Lake and Lake McMillan.

Brantley Dam is located on the Pecos River approximately sixty-one (61) miles northeast and approximately 550 ft below the elevation of the IIFP Facility site. Avalon Dam forming a smaller Lake Avalon is located on the Pecos River approximately 66 miles east of and 630 feet in elevation below the IIFP Facility site. No other dams or significant bodies of water are located within approximately 300 miles of the IIFP Facility site. Therefore, flooding from lakes (storm surge, wave action seiche) or from the breaching of dams is screened out as a potential source of flooding of the IIFP Facility site.

C. The IIFP Facility site is approximately 500 miles north of and 3800 feet in elevation above the Gulf of Mexico; therefore, storm surges, wave action, seiche or tide effects from hurricanes or squall lines from ocean waters is screened out as a source of flooding of the IIFP Facility site.

D. The IIFP Facility site, being approximately 500 miles north of and 3,800 feet in elevation above the Gulf of Mexico, is not subject to Tsunami or tide effects.

E. As a result of the preliminary screening analysis detailed above, it is determined that the only flooding hazard applicable to the IIFP Facility site is storm water runoff from a design basis rain event.

All-season precipitation estimates for the IIFP Site are provided by the National Weather Service (NWS) and the NOAA in the “Point Precipitation Frequency Atlas of the United States, NOAA Atlas 14 (Bonnin, 2011) and its associated database. Using a linear least-squares regression procedure to extrapolate NOAA’s precipitation estimates to an average recurrence interval of 100,000 years, it was determined that the 1-hour, 24-hour and 48-hour all-season precipitation estimates for 1.0×10^{-5} annual probability are 7.2 inches, 14.4 inches and 17.0 inches respectively.

The 40-acre IIFP Facility site is within a 640-acre section of land adjacent to and just east of NM Highway 483 and about one (1) mile north of U.S. Highway 62/180. The general slope of the terrain in this area is from northwest to southeast. The natural lie of the terrain allows only limited rainwater from the northwest (approximately 16.1 acres) to flow over the site in the vicinity of the process buildings. Most rainwater is naturally diverted via low areas to the southwest and to the northeast around the 40-acre site.

The slope of run-on to the 40-acre site from the northwest is approximately 0.21%. The slope of the run-off to the northeast is approximately 0.46%, to the southeast is approximately 0.35% and to the southwest is approximately 0.38%. Thus the site is naturally self-draining thereby preventing “ponding” or accumulation of water except in two small playas (depressions) located near the west boundary.

According to drainage evaluations (GL, 2010), once drainage is diverted around the IIFP Facility site, the terrain tends to drain toward the southeast to a collection playa approximately eight (8) miles away at an elevation approximately 225 feet lower than the site of the IIFP Facility. Detailed civil engineering design and surveys have not yet been performed. However, the drainage for the area surrounding the 40-acre conceptual design IIFP Facility was evaluated using general contours of the area. The contours show that the natural drainage in the area promotes constant flow across the site with highly unlikely potential for accumulated flooding. Using the general contours evaluation for the conceptual design facility land area and assuming no credit for site grading or storm water sewer installation, a maximum design basis flood level (DBFL) affecting the process buildings is estimated to be 4.8 inches from a 7.2 inch/hour 1.0×10^{-5} precipitation event (Bonnin, 2011). This evaluation considered the 1-hour, 24-hour and 48-hour all-season precipitation estimates for 1.0×10^{-5} annual probability (7.2 inches, 14.4 inches and 17.0 inches, respectively) using the probable maximum area of 16.1 acres of rainfall that might affect the process buildings and a slope of run-on (.00207 ft/ft) to the site from the 16.1 acres. The DBFL will be verified after the IIFP Facility site detailed civil engineering survey is completed and prior to determination of site drainage grade requirements and design of building, roads and infrastructure.

Due to the natural drainage of the area and the planned site grading and drainage system, it is reasonable to predict that rainwater from a design basis rain event will not flood the IIFP Facility site but that any rainwater entering the site and that does not percolate into the soil will flow over and off the site.

Based upon the above precipitation estimates for the site and preliminary calculations performed as part of the prescreening flood hazard assessment, the effect of extreme precipitation of short duration on process buildings and IROFS structures, systems and components (SSCs) at the IIFP Facility is minimal. In the area north and northwest of the developed site, the terrain will be contoured to divert run-on around the site so that only the precipitation that falls on the developed portion of the site will affect facility design. The site storm sewer system will be designed for a 4-inch, 1 hour maximum rain event slightly above the 3.2 inch, one (1) hour rain event with a 1.0×10^{-2} annual probability as published in NOAA Atlas 14, however the storm sewer system will not be relied on or credited for protection against a design basis flood event. Buildings and structures containing IROFS structures, systems and components will be constructed a minimum of six inches above grade level and above the level of plant roadways in order to physically remove (elevate) them from potential floodwater. Process buildings and structures will be provided with curbing a minimum of twelve (12) inches in height in order to prevent internal spills (in such an event) from leaving the structure, and this curbing although not credited in the DBFL analysis also serves as flood barriers for those structures.

1.3.2.7 Snow

The mean annual snowfall is 5.1 inches as recorded at the Hobbs weather station with a high annual total of 27.1 inches. The historical maximum snow depth for Hobbs, NM is 12.2 inches, and it occurred during the month of November. The 2-day 100-year snowfall is 12.1 inches which also occurred in November.

The design basis extreme environmental “ground” snow load for the IIFP Site is 96.7 lb/ft^2 or 472.5 kg/m^2. This design basis ground snow load is calculated as the sum of the 100-year return period snowpack and the load corresponding to the 48-hour all-season precipitation and an annual probability of 1.0×10^{-5} for the facility site. The method of determination follows acceptable methodology discussed in NRC NUREG-1951(NRC, 2010b). The roofs of all process buildings (involving or affecting licensed materials) at the IIFP Facility site will be sloped at a minimum of 5/12 or 22.6 degrees. Using the method described in American Society of Civil Engineers Standard 7-05 “Minimum Design Loads for Buildings and Other Structures” (ASCE 7-05) to convert the ground snow load into a “roof” snow load, the design basis extreme environmental “roof” snow load for the buildings on the IIFP Facility is 81.2 lb/ft^2 (396.8 kg/m^2). This calculation assumes no runoff of snow or rain notwithstanding that roofs of IIFP process buildings (involving or affecting licensed materials) are sloped. This load represents the extreme roof snow load for the purpose of building design.

IIFP used the data collected by the WRCC for the Hobbs, New Mexico area to determine that the 100-year snowpack was 12.2 inches resulting in a normal (severe) design basis ground snow load of 8.4 lb/ft^2 (41.0 kg/m^2) (NRC, 2010b). Since essentially 100 years of snowpack data was available for the area, no calculation or extrapolation of the data was necessary.

All-season precipitation estimates for the IIFP Site are provided by the National Weather Service and the NOAA in the “Point Precipitation Frequency Atlas of the United States, NOAA Atlas 14 (Bonnin, 2011) and supersedes the “Two-to-Ten Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States”, 1964 and its associated data base.
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

1.4 Hydrology

This section describes the IIFP Site's surface water and groundwater resources. Data are provided for the IIFP Site and its general area and the regional associations of those natural water systems are described. This information provides the basis for evaluation of any potential facility impacts on surface water, groundwater, aquifers, use of water and water quality. Subsections address surface hydrology, water quality, preexisting environmental conditions, water rights and resources, water use, contamination sources and groundwater characteristics.

1.4.1 Characteristics of Nearby Rivers, Streams and Other Bodies of Water

Surface drainage at the site is contained within two local playas that have no external drainage. There is also a small stream that runs from northwest to southeast across the property that would be predominantly dry during the year. Essentially all the precipitation that occurs at the site is subject to infiltration and/or evapotranspiration. More information on the movement and fate of surface water and groundwater at the site is provided in the IIFP ER, Revision B. There are also several intermittent surface features in the vicinity of the IIFP Site that may collect water for short periods of times following heavy rainfall events.

The climate in southeast New Mexico is semi-arid. Precipitation in the IIFP area averages only 30 to 40 cm/yr (12 to 16 in/yr). Evaporation and transpiration rates are high which results in minimal, if any, surface water occurrence or groundwater recharge.

Runoff does not drain to one of the state’s major rivers. Surface water is lost through evaporation, resulting in high salinity conditions in the waters and soils associated with the playas. These conditions are not favorable for the development of viable aquatic or riparian habitats. There is no designated FEMA Zone A area for the IIFP Site. The site is located in an area which does not fall within a mapped 100 year or 500 year flood plain.

1.4.2 Depth to the Groundwater Table

The Ogallala Aquifer underground reservoir system depth varies from actual surface discharge to over 150 meters (500 feet). Generally the Aquifer is found from fifteen (15) to ninety (90) meters (50 to 300 feet) below the land surface (WE, 2012). More specifically for the IIFP Site, a drill log of an Xcel Energy, Maddox Facility water supply well (M3) located in Section 27 indicates the Ogallala Formation was encountered from 30 to 155 feet below the ground surface (bgs). Initial depth to groundwater in M3 was 55 feet when completed in 1965. Three (3) Xcel Energy, Cunningham Facility monitoring wells are located along a north-south axis close to the western boundary of Section 27 and have been monitored for depth to groundwater (DTGW) as recently as November of 2009. DWGT within these wells ranges from 59 feet to 67 feet bgs. (GL, 2010) The site region has semi-arid climate with low precipitation rates and minimal surface water occurrence. Thus, the potential for negative impacts on those water resources are very low due to lack of water presence and formidable natural barriers to any surface or subsurface water occurrences. It is highly unlikely that groundwater at the site would be impacted by any potential releases because of the dikes, curbs, collection basins, spill controls and water discharge controls provided in the process areas.

1.4.3 Groundwater Hydrology

The IIFP Site is located west of the Llano Estacado caprock and east of the Pecos River in southeastern New Mexico. The Llano Estacado surface is underlain by the Ogallala Formation, which is composed of fluvial gravels exposed at the base with thicker eolian fine sand above. It is capped by the Caprock, a 3-m (9-ft) thick calcrete that is the resistant layer upon which the Llano Estacado if formed.

The surface geology is dominated by erosion that has exposed the upper weathered surface of the Caprock. Bioturbation of site sediments by rodents and insects may be severe. In some places, young deposits are present that include slope-wash sediments along the margins of playas and eolian sand deposits on the leeward (east) side of playas. Thin eolian deposits also occur along the northern edge of the southern lobe of the Llano, the sand derived from the Mescalero Plain. The draws across some areas of the Llano are old drainages filled with Holocene-age sediment.

Most precipitation is contained onsite due to infiltration and/or evapotranspiration. The vegetation on the site is primarily shrubs and native grasses. The surface soils are predominantly of an alluvial or eolian origin. The texture of the surface soils is generally silt or silt-like sands. Therefore, the surface soils are relatively low in permeability, and would tend to hold moisture in storage rather than allow rapid infiltration to depth. Water held in storage in the soil is subsequently subject to evapotranspiration. Evapotranspiration processes are significant enough to short-circuit any potential groundwater recharge.

1.4.4 Characteristics of the Uppermost Aquifer

The Ogallala Aquifer, also known as the High Plains Aquifer, is a huge underground reservoir created millions of years ago that supplies water to the region which includes the IIFP Site. The aquifer extends under the High Plains from west of the Mississippi River to the east of the Rocky Mountains. The aquifer system underlies 174,000 square miles in parts of eight States (Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming).

1.4.5 Design Basis Flood Events Used for Accident Analysis

The IIFP Site has not been mapped and does not lie within areas that have been mapped and that are in the 100-year or 500-yer flood-plain in and around Hobbs, New Mexico according to information provided in the FEMA Mapping Information Platform. A detailed discussion of the IIFP flood hazard assessment is provided above in Subsection 1.3.2.6. The likelihood of any major flood at the plant site is determined to be low and the consequences are limited (due to no fissile material existing at the site). Thus, flood type accidents are not a significant risk for facility operations.

1.5 Geology and Seismology

This section describes the geology and seismology at the New Mexico site, including soil characteristics, earthquake magnitudes and return periods and other geologic hazards.

1.5.1 Characteristics of Soil Types and Bedrock

The IIFP Site is located west of the Llano Estacado caprock and east of the Pecos River in southeastern New Mexico. Pecos Plains section is characterized by its more irregular erosion topographic expression. The boundary between the two (2) sections is locally referred to as Mescalero Ridge. In southern Lea County, Mescalero Ridge is an irregular erosion topographic feature with a relief of about 9.1 to 15.2 m (30 to 50 ft) compared with a nearly vertical cliff and relief of approximately 45.7 m (150 ft) in Northwestern Lea County. The lower relief of the ridge in the southeastern part of the county is due to partial cover by wind-deposited sand. The dominant geologic feature of this region is the Permian Basin. The Permian Basin is a massive subsurface bedrock structure that has a downward flexure of a large thickness of originally flat-lying, bedded, sedimentary rock. The Permian Basin extends to 4,880 m (16,000 ft) below mean sea level. The IIFP Site is located within the Central Basin Platform area. The Central Basin Platform divides the Permian Basin into the Midland and Delaware sub-basins. The top of the Permian deposits are approximately 434 m (1425 ft) below ground surface at the proposed IIFP Site. Overlying the Permian are the sedimentary rocks of the Triassic Age Dockum Group.

The upper formation of the Dockum Group is the Chinle Formation, a tight claystone and silty clay layer. The Chinle Formation is regionally extensive with outcrops as far away as the Grand Canyon region in Arizona. In the vicinity of the site, the Chinle Formation consists of red, purple and greenish micaceous claystone and siltstone with interbedded fine-grained sandstone. The Chinle (also known as Red Bed) Formation is overlain by Tertiary Ogallala, Gatuna, or Antlers Formations (alluvial deposits). Caliche is a partly indurate zone of calcium carbonate deposits accumulation formed in the upper layer of surficial deposits. Soft caliche is interbedded with the alluvial deposits near the surface.

1.5.2 Earthquake Magnitudes and Return Periods

Seismic activity in southeastern New Mexico is uncommon; however one of the most recent major earthquakes (moment magnitude of > 4.5 on the Modified Mercalli-Revised 1931 scale) in New Mexico occurred south of Eunice in January, 1992. The earthquake was 5.0 on the Modified Mercalli (Md) scale with its epicenter at 32.3 degrees North and 103.2 degrees West (Sanford, 2002). The Hobbs Site is in a seismically quiet region, with nearby earthquakes being of relatively small (< 2.0 Md) magnitude. No Quaternary fault or fold, thought to be associated with most earthquakes of moment magnitude 6 or greater over the last 1.6 million years, exists in the southeast New Mexico/west Texas region (Yarger, 2009). The nearest recent faulting is situated more than 161 km (100 mi) west of the site.

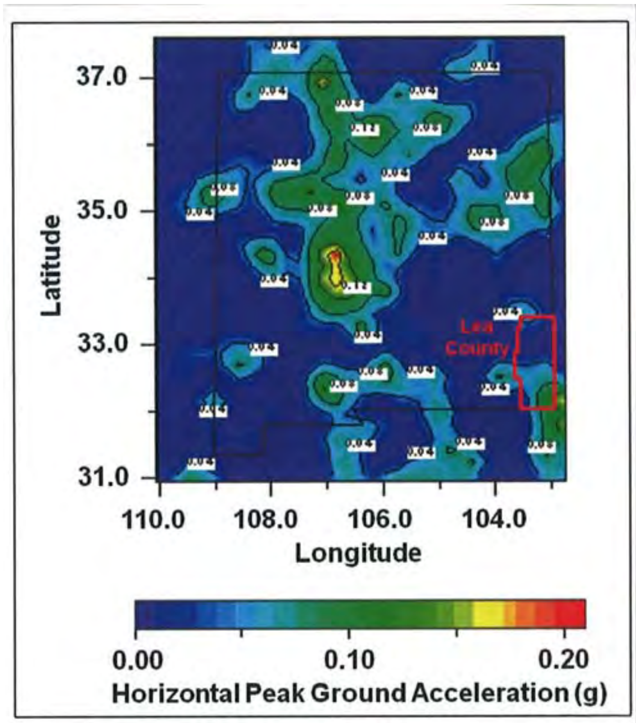
The New Mexico Institute of Mining and Technology has generated probabilistic seismic hazard estimates for different magnitude of earthquakes. Figure 1-3 and Figure 1-4 show horizontal peak ground acceleration (g) for an earthquake (Md) of 6 in New Mexico (10% probability of exceedance in a 50-year period) (Yarger, 2009).

Probabilistic ground motion for the site area is shown in Table 1-3. Seismic activity is well documented as the result of licensing activities of the uranium enrichment facility located near Eunice, New Mexico and the extensive network of seismometers established for the Waste Isolation Pilot Plant (WIPP) facility near Carlsbad, New Mexico. The Peak Horizontal Ground Acceleration (pga) for a 1,000 and 2,500 year return is 0.05g and 0.1g respectively (USGS, 2002), as shown in Table 1-3.

Seismic activity in southeastern New Mexico is typically of small magnitude and generally caused by oil field injection activities. However, one of the most recent major earthquakes (moment magnitude of > 4.5 on the Modified Mercalli-Revised 1931 scale) in New Mexico occurred south of Eunice in January 1992. The earthquake was 5.0 on the Modified Mercalli (Md) scale with its epicenter at 32.3 degrees North and 103.2 degrees West (Yarger, 2009).

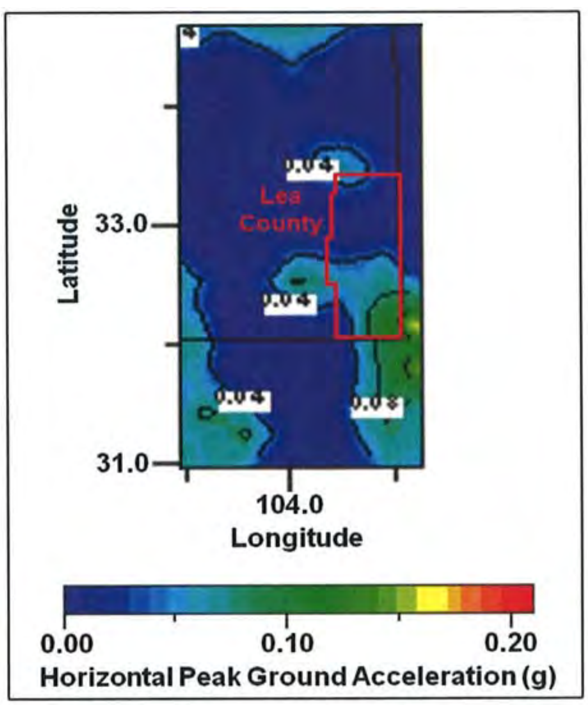
1.5.3 Other Geologic Hazards

No other geological hazards are known to exist at the IIFP Plant site. There are no known abandoned oil or gas wells on the 40-acre plant site, but as part of the civil engineering work for the facility reviews with the State will be conducted for the entire 640-acre Section of property to ensure such wells have been plugged or closed in accordance with State of New Mexico requirements.



Source: Adapted from (Lin, 1996)

Figure 1-3 New Mexico Seismic Hazard for a Moment Magnitude (Md) 6 Earthquake



Source: (Yarger, 2009)

Figure 1-4 Lea County Seismic Hazard for a Moment Magnitude (Md) 6 Earthquake

Table 1-3 Seismic Criteria for IIFP Site

Parameter	Return Period, T		
	500 years	**1000 years**	**2500 years**
P*	0.002 (0.2%)	0.001 (0.1%)	0.0004 (0.04%)
EP**	0.1 (10%)	0.05 (5%)	0.02 (2%)
n***	50 years	50 years	50 years
Peak Ground Acceleration	0.03g (Weber, 2008)	0.05g (USGS, 2002)	0.11g (USGS, 2002)

*P=1/T, **EP=1-(1-P)^n, ***n=50 years

1.5.4 Geotechnical and Geophysical Investigation and Analysis

A preliminary geotechnical and geophysical investigation and analysis plan has been developed to determine the site class, seismic site response, liquefaction potential, soil settlement potential and allowable bearing capacity of the soil for the IIFP Facility site. Details of the analysis plan and the codes and standards to be followed are provided below.

The proposed scope of the IIFP Facility geotechnical investigation, including the planned tests and their use for determining soil parameters, is as follows:

- Perform pathfinder surveys for determination of essential settlement parameters with dilatometer soundings to 150 feet of depth or blade thrust refusal load of 25 tons
- Perform pathfinder surveys for determination of approximate small strain seismic data and large strain shear strength data with Seismic Cone Penetration Test soundings to 150 feet of depth or cone thrust refusal load of 25 tons
- Perform critical determination of small strain seismic shear modulus and Poisson Ratio data with Cross-hole Seismic Tests to depths of 150 feet or so depending on the requirements as defined by the Engineering use of the individual buildings and geology determined by the dilatometer and seismic cone penetration test soundings
- Perform drilling and borings in select locations, based on data from dilatometer and Seismic Cone Penetration Test soundings, including Standard Penetration Test borings, to 150 feet of depth
- Perform soil sampling in Standard Penetration boreholes to obtain disturbed and undisturbed soil samples
- Perform auger borings to 15 feet of depth and obtain bulk disturbed soil samples

The proposed drilling and boring location guidelines are as follows:

- Structures: 1 boring for every 2500 square feet
- Pier foundations: 1 boring for every pier
- Roads: 1 boring for every 500 feet

Geotechnical Standards under which activities and tests will be performed in accordance with American Society for Testing and Materials (ASTM) standards. See LA, Revision B Chapter 3 “Integrated Safety Analysis” Section 3.1.5.3 “Geotechnical and Geophysical Codes and Standards” for applicable ASTM Standards.

1.6 References

ASCE, 2006 — American Society of Civil Engineers, ASCE 7-05, “Minimum Design Loads for Buildings and Other Structures: SEI/ASCE 7-05 (ASCE Standard),” 2006

GL, 2010 — GL Environmental, “Existing Groundwater Conditions in Section 27, Township 18 South, Range 36 East,” 2010.

DOE, 2002 — U.S. Department of Energy, DOE STD-1020-2002, “Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities,” Washington, D.C., 2002. DOE, 2002a Standard 1022-94, reaffirmed 2002, “Natural Phenonema Hazards Site Characterization Criteria,” 2002.

DOE, 2002b — Standard 1023-95, “Natural Phenomena Hazards Assesssments Criteria,” reaffirmed, 2002.

DOE, 2003 — DOE/WIPP-95-2065, Revision 7, “Waste Isolation Pilot Plant Contact-Handled (CH) Waste Safety Analysis Report,” 2003.

Lin, K. W., 1996 — "Probabilistic Seismic Hazard of the Socorro, New Mexico Area of the Rio Grande Rift." Geophysics Open-File Report 82 . Socorro, NM: Geophysical Research Center and Earth and Environmental Science Department, New Mexico Institute of Mining and Technology, 1996.

NMCBC, 2009 — New Mexico Commercial Building Code, Chapter 7, Part 2, 2009.

NRC, 1978 — Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants," Revision 1, 1978.

NRC, 2005 — "Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico," Louisiana Energy Services, NUREG-1827, 2005.

NRC, 2007b — NUREG/CR 4461, Revision 2, "Tornado Climatology of the Continguous United States, 2007.

NRC, 2010 — US Nuclear Regulatory Commission Regulation NUREG-1520, Revision 1. "Standard Plan for the Review of a License Application for a Fuel Cycle Facility," 2010.

NRC, 2010a — U.S. Nuclear Regulatory Commission, Standard Review Plan (SRP) NUREG-0800 Section 3.5.1.6, “Aircraft Hazards,” Washington, DC, 2010

NRC, 2010b — U.S. Nuclear Regulatory Commission, NUREG-1951 “Safety Evaluation Report for the Eagle Rock Enrichment Facility in Bonneville County, Idaho, AREVA Enrichment Services LLC”, Pages 1-23 to 1-25, Washington, DC, 2010.

Sanford, A. R., — Earthquake Catalogs for New Mexico and Bordering Areas: 1869-1998. Circular 2002, 210. Socorro, NM: New Mexico Bureau of Geology and Mineral Resources, 2002.

USGS, 2002 U.S. Geological Survey, U.S. Department of the Interior "National Seismic Hazard Mapping Project," Washington, DC, 2002.

WE, 2012 Water Encyclopedia Science and Issues website, "Ogallala Aquifer, " 2012.

Weber, 2008 Neil Weber & Associates, "Regional Seismological Evaluation," Hobbs, New Mexico, 2008.

Yarger, F., 2009 "Seismic Probability in Lea County, NM: A Brief Analysis," New Mexico Institute of Mining and Technology, New Mexico Center for Energy Policy, 2009.

2 FACILITY DESCRIPTION

The IIFP Plant is an integrated facility consisting of multiple chemical processes. There are two (2) main chemical process buildings: the Depleted Uranium Tetrafluoride (DUF_4) Process Building and the Fluorine Extraction Process (FEP) Building. Three (3) other process buildings support the main processes.

In the DUF_4 Process Building, depleted uranium hexafluoride is reacted with relatively small amounts of gaseous hydrogen and converted to DUF_4 powder and gaseous anhydrous hydrogen fluoride (AHF) that is then condensed and collected as a liquid. The DUF_6, in solid form, is received from suppliers (customers) in cylinders; temporarily stored; and transported to the DUF_6 Autoclave Building where the cylinder contents are vaporized in a containment-type autoclave and fed into the DUF_4 reaction vessel to be reacted with gaseous hydrogen. The resulting intermediate product DUF_4 is sent to the FEP Process Building for use as a raw material in making high purity fluoride gas products, such as silicon tetrafluoride (SiF_4) and boron trifluoride (BF_3). The by-product AHF, generated in the DUF_4 Building, is temporarily stored and sold to customers.

In the FEP Process Building, DUF_4 is reacted with diboron trioxide, also referred to as boric oxide (B_2O_3), or with silicon dioxide (SiO_2) to produce the products BF_3 or SiF_4, respectively. The products are collected, packaged and sold as high-purity compressed gases.

The remainder of the IIFP Facility supports the two (2) main processes, including functions of: 1) rendering materials suitable for reaction in the processes, 2) storing, transferring, packaging, performing analyses, and shipping, 3) treating waste effluents, 4) ensuring safe operations, 5) providing utilities, 6) maintaining the facility and equipment and 7) accommodating plant staff.

The facility is to be built on an approximate 40-acre tract located within a 640-acre square area as shown in Figure 2-1. A larger and more legible engineering drawing (number 100-C-0001 Revision F) showing Figure 2-1 is available in the IIFP License Application “Engineering Drawing Package” that is part of the license application documentation submitted to the NRC. This 640-acre area is located in Township 185, Range 36E Section 27 in Lea County, New Mexico. The southwest corner of Section 27 is located about one mile north of the intersection of Highway 62 and Highway 483. The 40-acre site is strategically located inside the 640-acre area to avoid existing underground electric and utility lines.

The entire 40-acre site Controlled Area (CA) as defined in the IIFP LA, Revision B Chapter 1 “General Information” is surrounded by a security fence with a surveillance road just inside the fence. Pole mounted security lighting is installed around the entire perimeter of the security fence.

2.1 Overview of Facility Site

The entrance to the facility is from the west via a paved road (approximately 3/4 mile) that intersects with Highway 483. The entrance road terminates at the main security gate of the facility just outside the 40-acre site.

Just outside the main gate and to the north is the paved and striped parking lot. The lot provides parking for employees and visitors and has marked handicap spaces.

Figure 2-1 IIFP Facility 40-acre Site Plan

~~**Security Related Information – Withhold From Public Disclosure In Accordance With 10 CFR §2.390**~~

Located just inside the main security gate is the Guard Station from which the main security gate and the entrance road inside the gate are controlled to prevent unauthorized entry. Concrete filled pipe bollards are anchored several feet into the ground and are located for a distance from the main gate entrance to provide a vehicle control barrier just inside the plant fence to prevent the diversion of vehicles around this barrier. This arrangement provides a corridor for vehicle control and inspection. The main entrance road is configured such that vehicles are hindered from high speed acceleration upon approach to the gate area. All vehicles entering the plant require authorization by the guard staff prior to entry. Trucks and other vehicles that require entrance to the facility beyond the Administrative Building are checked and logged at the Guard House and need-of-entry is verified in accordance with plant access and security procedures. Upon leaving the plant, trucks and other vehicles are visually checked and logged at the Guard House prior to exiting the main gate.

The inside-plant road begins at the main security gate and continues in an easterly direction where it divides into an intersection with two (2) access roads, one (1) heading north and the other heading south. These roads surround the process areas of the facility and eventually meet to form a loop, thereby allowing access around the facility in either direction. The loop formed by the road is approximately 700 feet long (north to south) by 400 feet wide (east to west). For descriptive purposes, the four (4) sections of the road loop are designated as the North, South, East and West Roads, so named by their proximities to the North, South, East and West boundaries of the 40-acre Facility site. Beyond the main gate, a vehicle control barrier is installed coupled with bollards along each side of the inside-plant road extending from the main gate to the vehicle control barrier. This barrier is controlled by the guard staff to prevent vehicle movement inside the facility pending inspection and authorization by the guard staff.

The Administrative Building with a change/locker area is located just inside the security fence north of the Guard House and east of the parking lot. An access-control station at the security fence allows entrance into the plant area leading to the Administrative Building or the change/locker entrance. The exit door from the change/locker area and Administrative Building connects with a concrete walkway leading to the process area of the facility. The visitor control area at the Guard House can be accessed directly from the parking lot. Upon authorization, visitors may then enter the facility via the Administrative Building and associated walkways.

Just south of the intersection of the West and South Roads is the reinforced concrete Full DUF_6 Cylinder Storage Pad. This pad is used to stage full DUF_6 cylinders until moved to the DUF_6 Autoclave Building for processing. The full cylinder pad is further described in Section 2.4.14 below.

Approximately 150 ft east of the intersection of the East and South Roads is the Empty DUF_6 Cylinder Storage Pad. This pad is used to contain empty DUF_6 cylinders for cool down and staging in preparation for shipment from the facility. An access security fence is installed around the entire perimeter of the empty cylinder pad with one entrance opening with clearance for the cylinder hauler to maneuver. The pad is described in more detail in Section 2.4.15 below.

Full DUF_6 cylinders are unloaded from trucks and moved as needed into and out of the full cylinder storage pad area using a cylinder hauler vehicle. The same hauler is used to move full cylinders from the storage pad to just outside the DUF_6 Autoclave Building. Emptied cylinders are loaded onto trucks using the cylinder hauler. The hauler may also be used to move empty cylinders that are outside the DUF_6 Autoclave Building to the Empty DUF_6 Cylinder Storage Pad.

The cylinder hauler is a diesel-powered vehicle with several features that reduce the risk of a diesel-fuel fire. Instead of a conventional fuel tank, a safety fuel cell tank configuration will be provided for the hauler vehicle diesel fuel storage. The safety diesel fuel cell tank will be designed with a robust steel outer layer and an impact resistant inner container filled with foam-cell baffling. The puncture and impact resistant inner layer provides primary containment for the fuel. The outer (secondary) container minimizes the risk of fuel leaking and forming a pool of combustible fuel in the event the inner containment device fails. Finally, the combined onboard storage capacity of the safety fuel cell tank(s) will be limited to less than seventy-four (74) gallons.

The cylinder hauler will also be equipped with a fire suppression system that includes multiple sensors and discharge heads strategically located at positions where fire ignition is more likely to occur (motor, muffler, battery, etc). The onboard fire suppression system will reduce the potential for a cylinder hauler fuel fire.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Centered inside the paved road loop are the main process related buildings and equipment including the DUF_6 Autoclave Building, DUF_4 Process Building, DUF_4 Container Staging Building, Decontamination Building, FEP Process Building, FEP Oxide Staging Building, DUF_4 Container Storage Building, FEP Product Storage and Packaging Building, AHF Staging Containment Building, Fluoride Products Trailer Loading Building, B_2O_3 Storage Silo, the Potassium Hydroxide (KOH) Scrubbing System including the storage tank, process off-gas scrubbers and scrubber containment pads. All the building area aprons and areas around the outside equipment, such as the scrubber systems, have concrete curbing or concrete dikes that are adequately designed with a margin of safety to contain and control the single-largest container of liquid in the respective area in the event a spill occurs. Pad areas and dikes that serve areas containing equipment with potentially hazardous or corrosive chemicals are coated or sealed and maintained to prevent leakage through the pad or wall surfaces and joints. Those pad and dike areas are also designed with a containment volume with a design margin for the single-largest container volume in the respective area. Pumps, including an appropriate number of redundant pumps, are installed inside the contained dike areas to transfer liquors to the Environmental Protection Process (EPP) or other appropriate collection or treatment equipment. Controls are provided for detection, alarm and notification to the area Control Room for Operator response in event of a spill. Also, a second level of detection and control is provided to activate automatic pumping to the appropriate treatment facility if the first level of spill volume exceeds the alarm-response action.

Just north of the process area are located the Process Offices and Laboratory Building with scrubber and containment pad, closed-loop cooling tower, solar panels, Material Warehouse, Utilities Building and Main Switchgear Building. A truck access road is installed between the Utilities Building and the Material Warehouse loading dock. This access road connects with the North Road.

Inside the intersection of the East and South Roads is located the Maintenance and Stores Building.

Just east of the East Road are located two (2) above-ground Fire Water Tanks (100,000 gallons each) and the Fire Pump House. The Fire Pump House contains the main fire water pump, the back-up diesel fire water pump, jockey pump, piping and controls. The IIFP Facility fire protection system is described in Chapter 7 of the IIFP License Application, Revision B including the classification of individual buildings.

2.2 Buildings and Associated Process Areas

Table 2-1 is a listing of sizes of buildings located on site.

Table 2-1 Estimated Building Sizes

Building* *Areas where uranium is processed or stored are marked in "BOLD" print."	Dimensions, ft			Approximate Area, ft^2	Approximate Volume, ft^3
	Length	Width	Eave Height		
DUF_6 Autoclave Building					
DUF_4 Process Building					
DUF_4 Container Storage Building					
DUF_4 Container Staging Building					
Decontamination (Decon) Building					
FEP Process Building (SiF_4 and BF_3)					
FEP Oxide Staging Building					
FEP Product Gas Storage and Packaging Building					
AHF Staging Containment Building					
Fluoride Products Trailer Loading Building					
Maintenance and Stores Building	60	50	15	3,000	45,000
EPP Building	40	30	18	1,200	21,600
Utilities Building	50	50	18	2,500	45,000
Material Warehouse	100	50	18	5,000	90,000
Main Switchgear Building	50	40	18	2,000	36,000
Fire Pump House	20	20	15	400	6,000
Water Treatment Building	30	15	15	450	6750
Process Offices	50	30	15	1,500	22,500
Laboratory **(small uranium samples handled)**	30	30	15	900	13,500
Administrative Building	80	50	15	4,000	60,000
Guard House	25	20	10	500	5,000

2.3 Building Codes and Standards

The design and construction of the on-site IIFP Facility buildings conform to applicable building codes and standards. The IIFP LA, Revision B Chapter 3 Section 3.15 provides a listing of applicable federal, state and local codes and standards that the DB contractor will use during the detailed design, construction and startup stage of the project to ensure adequate protection against natural phenomena, environmental conditions and dynamic effects.

Table 2-2 is a listing of code conformance for buildings located on site based on NMCBC, 2009, National Fire Protection Association (NFPA)-13 (NFPA, 2010) and NFPA-101 (NFPA, 2009).

Table 2-2 Code Construction Conformance

Building Areas where uranium is processed are shown in "BOLD" print	Code Construction Conformance			
	NMCBC Class	NMCBC Type	Sprinkler Code, NFPA 13	Life Safety Code, NFPA 101
DUF_6 Autoclave Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Process Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Container Storage Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
DUF_4 Container Staging Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
Decontamination (Decon) Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Process Building (SiF_4 and BF_3)	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Oxide Staging Building	H4	IIB	ORD HAZ-GP2	SPECIAL PURPOSE IND
FEP Product Storage and Packaging Building	H4	IIB	ORD HAZ-GP2	INDUSTRIAL
AHF Staging Containment Building	H4	IB	ORD HAZ-GP2	STORAGE
Fluoride Products Trailer Loading Building	H4	IB	ORD HAZ-GP2	STORAGE
Maintenance and Stores Building	F1/S2	IIIB	ORD HAZ-GP2	STORAGE-MIXED
EPP Building	H4	IIB	ORD HAZ-GP2	STORAGE
Utilities Building	F1	IIB	ORD HAZ-GP2	INDUSTRIAL
Material Warehouse	S2	IIB	ORD HAZ-GP2	STORAGE
Main Switchgear Building	F2	IIB	NOT SPKLR	INDUSTRIAL
Fire Pump House	F1	IIB	ORD HAZ-GP2	INDUSTRIAL
Water Treatment Building	F1	IIB	ORD HAZ-GP2	INDUSTRIAL
Process Offices	B	IIIB	LGT HAZ	BUSINESS-MIXED
Laboratory **(small uranium samples handled)**	B	IIIB	ORD HAZ-GP2	INDUSTRIAL-MIXED
Administrative Building	B	IIIB	LGT HAZ	BUSINESS
Guard House	B	IIIB	LGT HAZ	BUSINESS

2.4 Process Buildings and Areas

The DUF_6 Autoclave Building, DUF_4 Process Building, DUF_4 Container Storage Building, DUF_4 Container Staging Building, Decontamination (Decon) Building, FEP Process Building (SiF_4 and BF_3), the FEP Oxide Staging Building, FEP Product Storage and Packaging Building and the EPP Building are of structural steel beam and column construction with metal wall panels and with Class 1 metal roofs. The first floor of each building is constructed of reinforced concrete with curbing to function as a containment barrier.

The AHF Staging Containment Building and the Fluoride Products Trailer Loading Building are constructed of reinforced concrete floor slabs turned up to form containment barriers. The upper sections of these buildings are of concrete block construction with Class 1 metal roofs.

Radiological boundary control hand-foot monitors are strategically located at building walkway exits of areas where licensed materials are handled. Fluoride and radiological detection systems, local alarms and alarm notification to Control Rooms are also strategically located in those building areas, where applicable.

The process buildings are multi-story buildings where necessary to provide requirements for equipment space and to provide elevations for permitting gravity flow of particulate solids. The upper floors are configured such as to provide adequate room for equipment function and maintenance. The upper floor areas below equipment and piping containing powdered materials are constructed of reinforced concrete with curbing and seal coatings on floor and wall surfaces. Other upper floor areas of the buildings are constructed of metal grating or expanded metal flooring.

Process Control Rooms are provided, including monitoring, recording, alarm notification and control instrumentation. During the detail design of Control Room alarms, displays, and control instrumentation, the design review (style guide) and the standards criteria developed from the Human Factors Engineering (HFE) Implementation Plan will be used as guidance for the design engineers in the consideration of human-system interfaces and human factors. The guidance will be developed prior to beginning detail design of affected Control Room instrumentation. The affected Control Room alarms, displays and control instrumentation will be determined from: 1) the reviews and evaluations of the IROFS, 2) the tasks that involve human interaction relative to IROFS functions and responses including development of written procedures and Operator aids, 3) the functional analysis of the IROFS structures, systems and components and how those functions involve human tasks in support or response of the function, 4) evaluation of the alarm, readout, display and instrumentation interface with the Operator for effective and accurate communications and 5) the consequences of human action responses relative to an IROFS SSC functionality.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

See Table 2-2 for code construction classification requirements in accordance with the NMCBC-2009, NFPA 13-2010 and NFPA 101-2009.

The process buildings are classified per NFPA 13-2010 as Ordinary Group 2 and are protected with 100 percent coverage, wet-type fire protection sprinkler systems with Class 1 standpipes between floors in all exit stairways of multi-story buildings.

2.4.1 DUF_6 Autoclave Building

The DUF_6 Autoclave Building is
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.2 DUF_4 Process Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.3 DUF_4 Container Staging Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.4 Decontamination (Decon) Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.5 FEP Process Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.6 FEP Oxide Staging Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.7 DUF_4 Container Storage Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.8 FEP Product Storage and Packaging Building

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.9 FEP Building Dock

An elevated dock on the southeast side of the FEP Process Building provides access for truck loading for transporting oxide containers to licensed waste disposal facilities and for truck loading for shipping SiF_4 and BF_3 cylinders to customers.

2.4.10 Plant Potassium Hydroxide Scrubbing System

Two (2) three-stage, in-series KOH scrubbing lines (referred to as the Plant KOH Scrubbing System) are provided for the IIFP Facility. The KOH venturi-type (primary), packed tower (secondary) and coke box (tertiary) scrubbers and pumps; KOH tanks and associated equipment; and dike pad that serve primarily the DUF_4 process and pre-condensers from the SiF_4 and BF_3 processes are located outside and adjacent to the east side of the DUF_4 Process Building. The KOH venturi-type (primary), packed tower (secondary), coke box (tertiary) scrubbers and pumps, KOH tanks and associated equipment and dike pad that serve primarily the SiF_4 and BF_3 processes are located outside and on the west side of the FEP Process Building. This configuration provides primary, secondary and tertiary treatment of the final effluents from the DUF_4 and FEP processes prior to venting to the atmosphere through a common stack. This stack is monitored to measure for potential traces of fluorides or uranium in the vent gas.

The spent liquors resulting from scrubbing the fluorides contain mainly potassium fluoride, water and some un-reacted KOH. The spent liquors are sent to the EPP Facility to regenerate the KOH liquid for recycle back to the scrubbing system.

2.4.11 Treated Process Off-gas Vent Stacks

There are a total of thirteen (13) main vent stacks at the IIFP Facility, excluding building ventilation exhausts, where either process related or combustion product gases or particulates are vented to the atmosphere. Prior to venting, the process related vent streams are filtered and/or scrubbed to ensure effective treatment within the established safety and environmental regulated control limits. Some of the vents where uranium and fluorides may be present are filtered or scrubbed through multi-stage equipment that is configured in series flow to ensure high removal efficiency. Of the thirteen (13) stacks there is one boiler vent stack where combustion products of natural gas primarily used in the production of steam are vented to the atmosphere and one Laboratory stack that vents via a scrubber.

In areas where uranium particulate solids are handled or processed, such as depleted UF_4 or depleted uranium oxides, dust capture and collection systems are provided. The dust collection systems are filter-type units that are used to remove the uranium material prior to discharging through vent stacks to the outside environment.

Additional information that identifies each stack, heights, estimated vent flow rates and approximate location is provided in Section 3.1.10.

2.4.12 Environmental Protection Process Building

The xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx. The building equipment is used to treat fluoride bearing liquors for recycle and reuse in the plant processes. It houses the EPP control systems, rotary vacuum filter, dryer feed screw, dryer and discharge screw. Equipment for reacting lime with the fluoride bearing liquors includes the reaction tank, clarifier, pumps, regenerated KOH recycle tank, holding/feed tanks and associated equipment. This equipment is located outside the EPP Building and within the process dike area.

In this process, hydrated lime is reacted with spent KOH solution that is received from the Plant KOH Scrubbing System. The reaction results in regeneration of KOH and formation of calcium fluoride (CaF_2). The solid particulate CaF_2 is filtered and dried for shipment to customers or for disposal at an off-site licensed disposal facility. The regenerated KOH is pumped back to the Plant KOH Scrubbing System for reuse.

2.4.13 AHF Staging Containment and Fluoride Products Trailer Loading Buildings

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

2.4.14 Full DUF_6 Cylinder Storage Pad

Cylinders containing solid DUF_6 are received by truck from customers/suppliers in accordance with approved DOT shipping requirements. After following pre-unloading procedures for material accountability, cylinder inspection, shipping document verifications and IROFS requirements related to assay and weight verification, the cylinder is unloaded for temporary storage at the Full DUF_6 Cylinder Storage Pad. This pad is used to stage full DUF_6 cylinders for processing. Cylinders are moved by a special cylinder hauler to the DUF_6 Autoclave Building as needed for feeding of contents to the DUF_6-to-DUF_4 process. Protective anchored concrete-filled pipe bollards are installed around the perimeter of the cylinder pad in locations where a potential exposure to uncontrolled vehicle traffic exists. The pad is constructed of reinforced concrete and is approximately 175 feet wide by 200 feet long and is sized to store xxxxxxxx cylinders. The entire storage pad is curbed for storm water collection and is provided with underground drains connecting to the Cylinder Pad Storm Water Retention Basin located south of the cylinder pad. The surface and slope of the cylinder pad is designed to prevent any significant pooling of liquids. The pad is provided with saddles to space and support the cylinders. A full cylinder is placed in a saddle for temporary storage and full cylinders are never stacked.

2.4.15 Empty DUF_6 Cylinder Storage Pad

Approximately 150 ft east of the intersection of the East and South Roads is the Empty DUF_6 Cylinder Storage Pad. This pad is used to stage empty DUF_6 cylinders in preparation for shipment from the facility. A security fence is installed around the entire perimeter of the cylinder pad and has one entrance opening with clearance for the cylinder hauler to maneuver. The pad is constructed of reinforced concrete and is approximately 105 ft wide x 185 ft long with a layout footprint sized to contain up to forty (40) empty cylinders. The pad is provided with saddles to space and support the cylinders. Empty cylinders may be double stacked if necessary.

2.5 Non-Process Buildings

Buildings on-site that are not used to process, store or stage raw materials, products or by-products are of prefabricated metal construction with reinforced concrete slab floors, structural supports, metal siding and sloped metal standing seam roofs. Buildings of this type of construction include Maintenance and Stores Building, Material Warehouse, Utilities Building, Main Switchgear Building, Fire Pump House, Water Treatment Building, Process Offices and Laboratory, Administrative Building and Guard House. Interior partitions in office areas consist of metal studs with 5/8" sheetrock on both sides. Ceilings are acoustical tile "lay-in" type with grids on two (2) foot centers. All required means of egress are contained in fire barrier walls per NMCBC-2009 and NFPA 101-2009 requirements.

2.5.1 Guard House

The Guard House is located just inside the main gate and adjacent to the main entrance road. This building is used as the main security entrance for required traffic into and out of the facility and for visitor control. The Guard House contains security monitors and main gate controls.

2.5.2 Administrative Building

The Administrative Building houses the offices of personnel not directly involved in the production and maintenance functions of the facility. This building is accessed directly through the front door from the parking lot. The rear portion of this building is the Change/Locker Area with toilet facilities, showers and lockers. The main employee entrance and boundary control area are located on the west side of the Change/Locker Area. A turnstile with access controls is located at the security fence permitting employee entrance into the Controlled Area.

2.5.3 Process Offices and Laboratory

The Process Office Building is located adjacent to, and north of the DUF_4 equipment access pad. This Building contains the offices for the process engineering, Environmental, Safety and Health (ESH) and plant management supervisory staff. The north side of this building contains the Laboratory used for analysis of raw materials, in-process materials, final product and discharge monitoring samples. The Laboratory is furnished with work benches, fume hoods, containment devices and exhaust systems with streams exiting to an outdoor scrubber on a containment pad just east of the Laboratory area. The Laboratory provides areas that receive, prepare and store various samples as follows:

- Radiological Protection (Health Physics) Lab for calibration of instruments and radiological sample analysis
- Chemical Laboratory for process and product sample analysis
- Environmental Monitoring Lab for environmental sample analysis

2.5.4 Maintenance and Stores Building

The Maintenance and Stores Building is located southeast of the Fluoride Products Trailer Loading Building. This building contains small tools, and maintenance supplies such as pipe and fittings, hardware, electrical parts and other small items required for maintenance of the facility. No raw, licensed, or in-process materials or finished products are stored in this building. Offices are provided for plant engineering, maintenance supervision and stores personnel.

2.5.5 Material Warehouse

The Material Warehouse is located just northeast of the Process Offices and Laboratory Building. This warehouse is used to receive and store such items as piping components, electrical conduit, wiring, equipment for capital construction projects and spare parts. Small quantities of chemicals such as paints, oils and cleaning agents are stored in the warehouse, but the quantities are limited to meet NMCBC-2009 and NFPA 30-2008 (NFPA, 2008) requirements. No licensed, raw, or in-process materials or finished products are stored in this building. Part of the Material Warehouse is used for managing non-radioactive waste. This function is described in Subsection 9.2.2.1 Revision B, Chapter 9 “Environmental Protection” of the IIFP License Application.

2.5.6 Utilities Building

The Utilities Building is xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx. This building contains the steam boiler and associated equipment and the plant air compressors.

2.5.7 Main Switchgear Building

The Main Switchgear Building xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

2.5.8 Fire Pump House

The Fire Pump House xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx .

2.5.9 Water Treatment Building

The Water Treatment Building is located east of the electrical utility substation and adjacent to the facility water wells. This building contains the domestic water storage tank, pumps, treatment system and controls required to furnish potable water for use throughout the facility.

2.6 References

NFPA, 2008	National Fire Protection Association NFPA, 30, “Flammable and Combustibles Liquids Code,” 2008
NFPA, 2009	National Fire Protection Association, NFPA 101, "Life Safety Code," Quincy, MA, 2009.
NFPA, 2010	National Fire Protection Association NFPA 13, "Installation of Sprinkler Systems," Quincy, MA, 2010.
NMCBC, 2009	New Mexico Commerical Building Code, Chapter 7, Building Codes General Part 2, 2009.

3 PROCESSES, HAZARDS AND ACCIDENT SEQUENCES

This section includes descriptions of each process system analyzed in the ISA, the hazards that were identified in the ISA and descriptions of the accident sequences.

3.1 Process Descriptions

This section provides additional detail about the processes of the IIFP Facility. The facility description is provided in Section 2. This facility: 1) de-converts DUF_6 to $DUF_{4,}$ 2) utilizes the DUF_4 as a raw material for producing fluorine products and 3) provides the infrastructure for supporting the processes.

The process descriptions are based on the existing level of design detail, much of which is developed from: 1) engineering calculations and estimates, 2) known physical and chemical data derived from literature and 3) the plant equipment and system concepts obtained from knowledge of other similar processes and from some pilot plant tests. The design and process parameter data are subject to some changes as design detail progresses. The PHA and risk-based ISA reflect the safety design features and the prevention and mitigation measures developed and evaluated using the existing level of design. The ISA process provides the method for continuing review and analysis of design as it develops, becomes more detailed, or changes and requires updating of the ISA Summary.

IIFP is requesting an NRC license for a possession limit of 750,000 kg of depleted uranium. Additionally, IIFP has a written agreement with the State of New Mexico Environment Department (NMED) on maximum total limits of depleted uranium. Those limits are defined in the IIFP License Application, Revision B Chapter 1.

The IIFP Plant has a de-conversion capacity of approximately eight (8) million pounds (3.4 to 3.7 million kg) per year (lb/yr) DUF_6. From that de-converted DUF_6, the plant will produce approximately 2-3 million pounds (about 0.9-0.14 million kg) per year of extracted fluorine products and up to nearly one (1) million pounds (0.45 million kg) per year of AHF. These annual design capacities are provided only for general information. The facility actual production volumes of depleted uranium and fluoride products will be the quantities necessary to support routine operations and sales demand.

The specific process descriptions are presented essentially in the order of material flow through the major processes:

1. Receiving and feeding DUF_6 into the plant process
2. Returning empty DUF_6 cylinders
3. De-converting the DUF_6 to DUF_4 and the by-product AHF
4. Producing FEP products, such as SiF_4 and BF_3, from DUF_4
5. Treating process off-gases
6. Treating process water discharges and regenerating treating agents
7. Temporarily storing AHF, SiF_4 and BF_3 products and loading for shipment

Flow schematics are shown in each of the sections that describe the processes. An estimated range of process operating parameters is presented for the DUF_6 to DUF_4, SiF_4 and BF_3 processes. Larger more detailed and legible process flow sheets are provided as an Engineering Drawing Package in separate document files of the IIFP License Application.

3.1.1 Process Technology and Chemistry

In performing de-conversion services for the uranium enrichment industry, the IIFP Facility utilizes fluorine contained in the DUF_6 to manufacture high-purity specialty fluoride gases and AHF. The DUF_6 is reacted with hydrogen and converted to DUF_4 and AHF. The resulting DUF_4 is reacted with oxides of silicon or boron to produce high-purity SiF_4 or BF_3 gas products, respectively.

Fluoride gas products are valuable materials for applications in the solar, semiconductor and electronics industries. In addition, AHF is a by-product of the DUF_6 to DUF_4 de-conversion process. The AHF is sold in the marketplace as a valuable industrial chemical commodity. The DUF_6 ultimately has its fluoride content extracted as a value-added product or by-product. The by-product uranium, as a chemically stable oxide solid powder, is sent to an off-site licensed disposal site.

Fluoride compounds are known to result from reaction of the UF_4 with oxides of the p- and d-elements of the III, IV and VI groups of Mendeleev's Periodic Table. Volatile fluorides form in the interaction according to the general reaction:

$UF_4 + MO_n \rightarrow UO_2 + MF_m$; where M is the element boron, silicon, germanium, titanium, etc.

The IIFP DUP/FEP Plant processes involve the following major chemical reactions:

- **DUF_6 to DUF_4 Process**

  $UF_6 + H_2 \rightarrow UF_4 + 2HF$

- **SiF_4 Production Process**

  $SiO_2 + UF_4 \rightarrow SiF_4 + UO_2$ (or U_3O_8 or a mix of these uranium oxides)

- **BF_3 Production Process**

  $2B_2O_3 + 3UF_4 \rightarrow 4BF_3 + 3UO_2$ (or U_3O_8 or mix of these uranium oxides)

- **Process Off-gas Effluent Scrubber Treatment Systems**

  HF + dilution water → HF (aqueous)

  $HF + KOH \rightarrow KF + H_2O$

  $3SiF_4 + 4KOH \rightarrow 2K_2SiF_6 + 2H_2O + SiO_2$

  $SiO_2 + 2KOH \rightarrow K_2SiO_3 + H_2O$

  $4BF_3 + 3KOH \rightarrow 3KBF_4 + B(OH)_3$

- **Scrubber Liquor Treatment and Regeneration/Recycle**

  $2HF + Ca(OH)_2 \rightarrow CaF_2 + 2H_2O$

  $2KF + Ca(OH)_2 \rightarrow CaF_2 + 2KOH$

Two (2) main process technologies are employed as described in the following sections:

- DUF_6 de-conversion to DUF_4, i.e. the DUF_4 Process
- The FEP for producing SiF_4 and BF_3 by reacting DUF_4 with the respective inorganic oxides

3.1.2 DUF_6 to DUF_4 Process

DUF_6 can be converted to DUF_4 by a high temperature reaction with hydrogen. The basic chemical equation is:

$$UF_6\,(\text{gaseous}) + H_2\,(\text{gas}) \rightarrow UF_4\,(\text{solid}) + 2HF\,(\text{anhydrous})$$

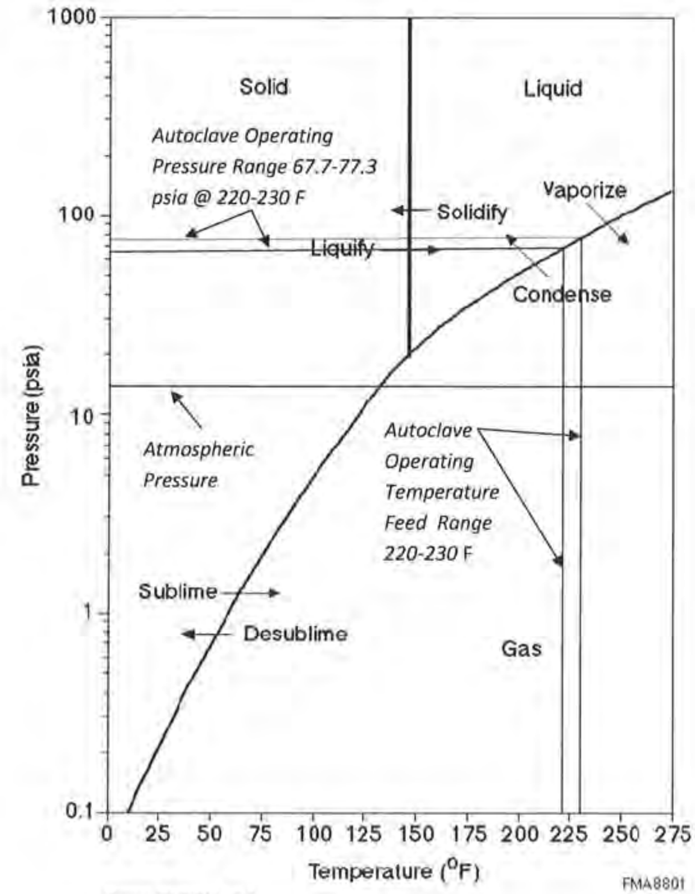
The DUF_4 is used as a feed material to produce high-purity fluoride products such as SiF_4 and BF_3.

3.1.2.1 Process Flows and Operating Parameter Ranges

The DUF_6 is received from suppliers (toll de-conversion customers) in solid form contained in 14-ton (nominal content capacity) steel cylinders that are approved for packaging, storing and transporting the material.

The DUF_6 cylinder is placed in a containment-type autoclave where the contents are vaporized. Redacted

The DUF_6 vapor is fed to a reaction vessel where it undergoes exothermic reaction to produce DUF_4 and AHF. The DUF_4 solids are continuously withdrawn from the bottom of the reaction vessel through a cooling screw mechanism.



Source: DOE/EIS 2011

Figure 3-1 UF_6 Phase Diagram

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

The sections of electrical heat tracing on piping, valves, manifolds and DUF_6 surge tank are designed with electrical circuitry that alarms and notifies the Control Room Operator if any one section of the heat tracing loses electrical power or if the tracing fails open and is not heating. The configuration of the tracing is such to facilitate evenly distributed heating of the components and pipes. The heat tracing has a self-limiting temperature. Also, temperature indicators are located along the piping and components in the system with alarm points to notify and allow the Operator to ascertain if heating is being maintained and evenly distributed. Insulation of the components and pipes in the feed system minimizes any rapid loss of heating and assists in maintaining set temperatures and even heat distribution.

In the event a significant loss of heating occurs in the feed system components and piping and in the event the Operator does not receive alarm notification or take corrective action, the cooling and solidification of DUF_6 in the components or piping could result and cause an operational problem. Such solidification could cause restrictions resulting in pressure and flow indicators reaching the administrative set point levels with an alarm notification to the Control Room Operator to shut down the feed systems. Operational controls will automatically shut off the feed valves if the Operator fails to take corrective action and if the pressure and flows deviate beyond the administrative action levels and reach the automatic shutoff set point. Solidification of the DUF_6 (referred to as freeze-out) is an operating issue, but safety has to be considered upon resumption of heat to the freeze-out location. If the return of heating to a localized area is too rapid or if certain areas are heated while some adjacent areas are not, this uneven heating could liquefy some of the DUF_6 between two (2) plugs of solidified material thereby creating a potential for abnormal pressure on the component or internal walls of the piping. The feed piping and components are code designed and pressure tested with safety margins well in excess of hydrostat pressure.

Additionally, the electrical heat tracing is designed with insulated spacers to prevent direct contact with the component or pipe metal. The potential for localized hot spots is minimized by this design and by the heat tracing self-limiting temperature design and temperature indicators and alarms. For these aforementioned reasons, the design of electrical heat tracing with more fine control capability is used rather than steam tracing. In the event of a solid DUF_6 restriction or blockage in the feed system, the safe return of heating allows for re-vaporization and remediation of the blockage either through: 1) restart of the feed system and reaction vessel or 2) the building Purge and Evacuation System for those local isolated sections of the feed systems requiring evacuation.

In the reaction vessel during operation, the DUF_4 produced from the reaction of hydrogen with DUF_6 is in powder form and transferred to storage hoppers for use as raw material feed in the IIFP Plant for producing FEP products.

Off-gases from the reaction vessel leave the cooling screw equipment and pass through a series of filters and carbon-bed traps to remove entrained particulates and residual traces of un-reacted DUF_6, respectively. The off-gas flow exiting the carbon-bed trap system passes through heat exchangers where the by-product AHF is condensed. Residual off-gases exit the condenser equipment to a hydrogen burner system to remove any un-reacted hydrogen gas followed by a three-stage scrubbing system designed for removing trace quantities of fluorides. Off-gas flow through the plant scrubbing system is described in Section 3.1.7.

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Major flows for the DUF_6 conversion to DUF_4 process are shown in Figure 3-2 and associated process parameters are provided in Table 3-1.

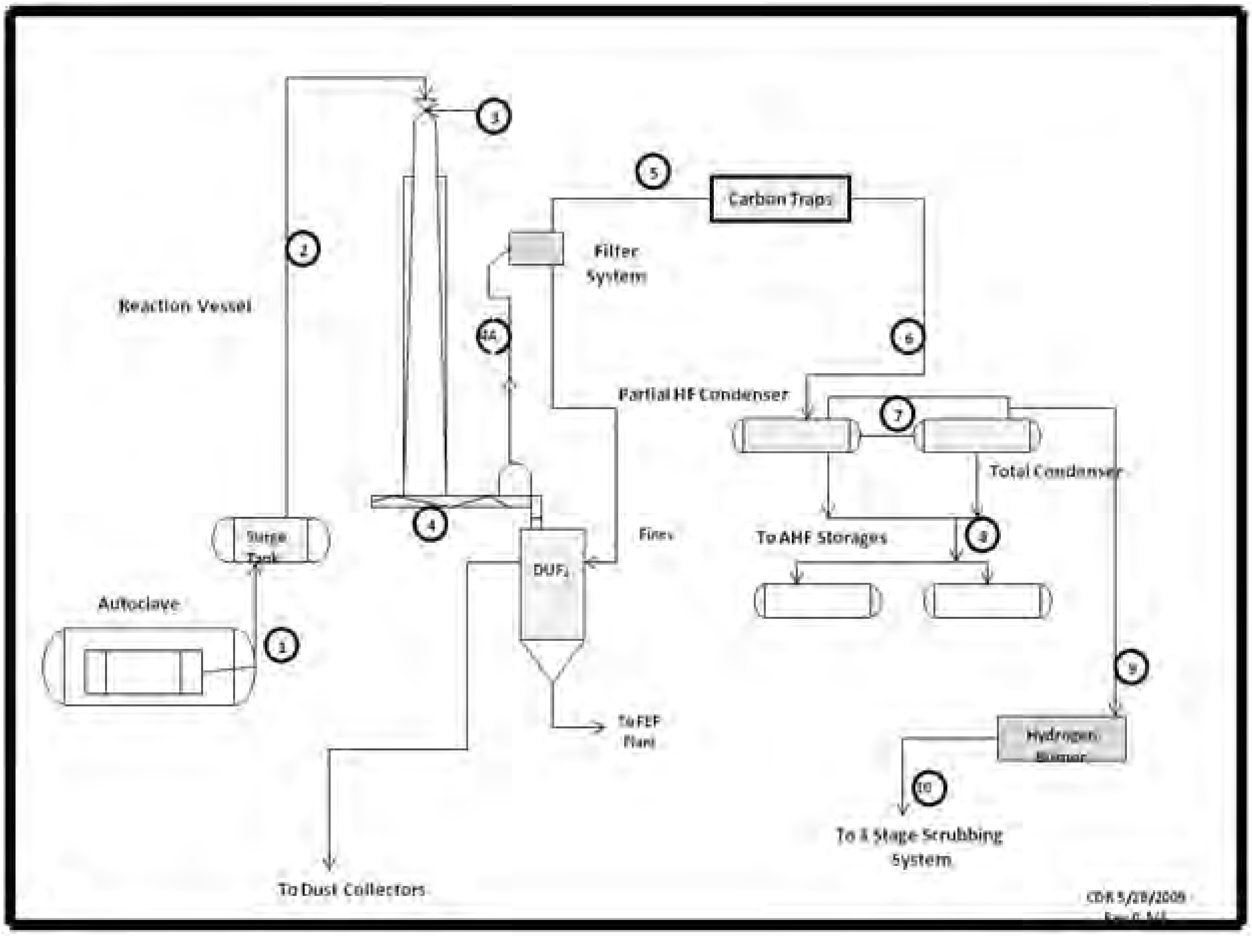
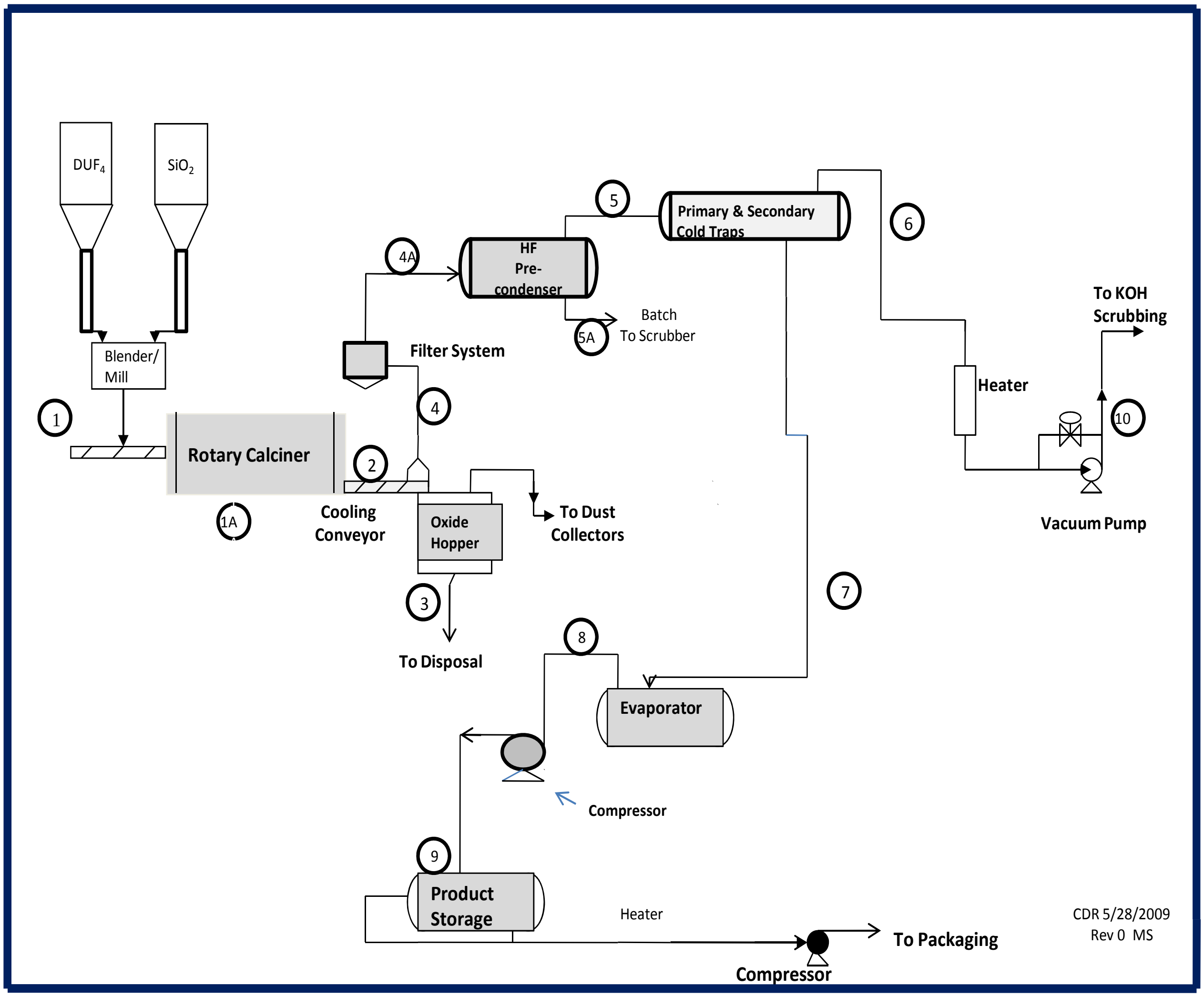


Figure 3-2 DUF_6 to DUF_4 Process Flow Diagram



Figures 3-4 SiF_4 Process Flow Diagram

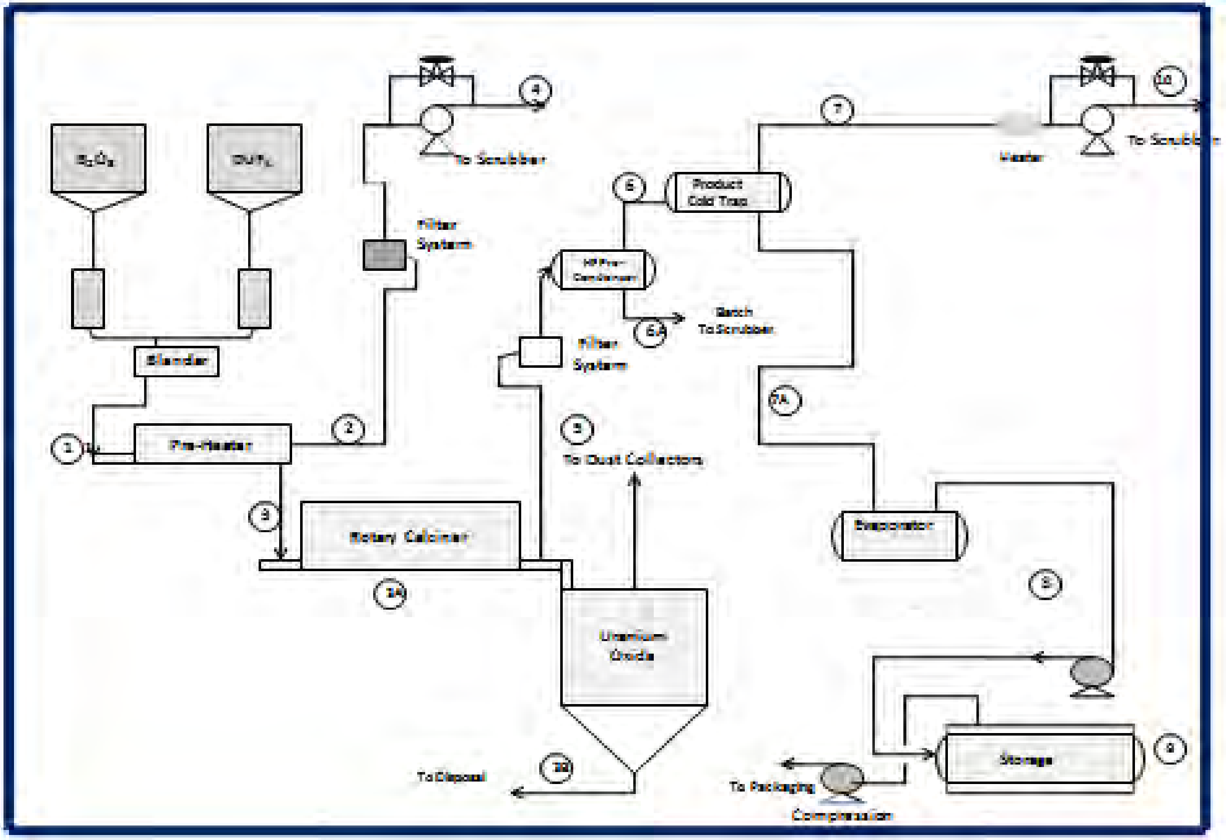


Figure 3-5 BF_3 Process Flow Diagram

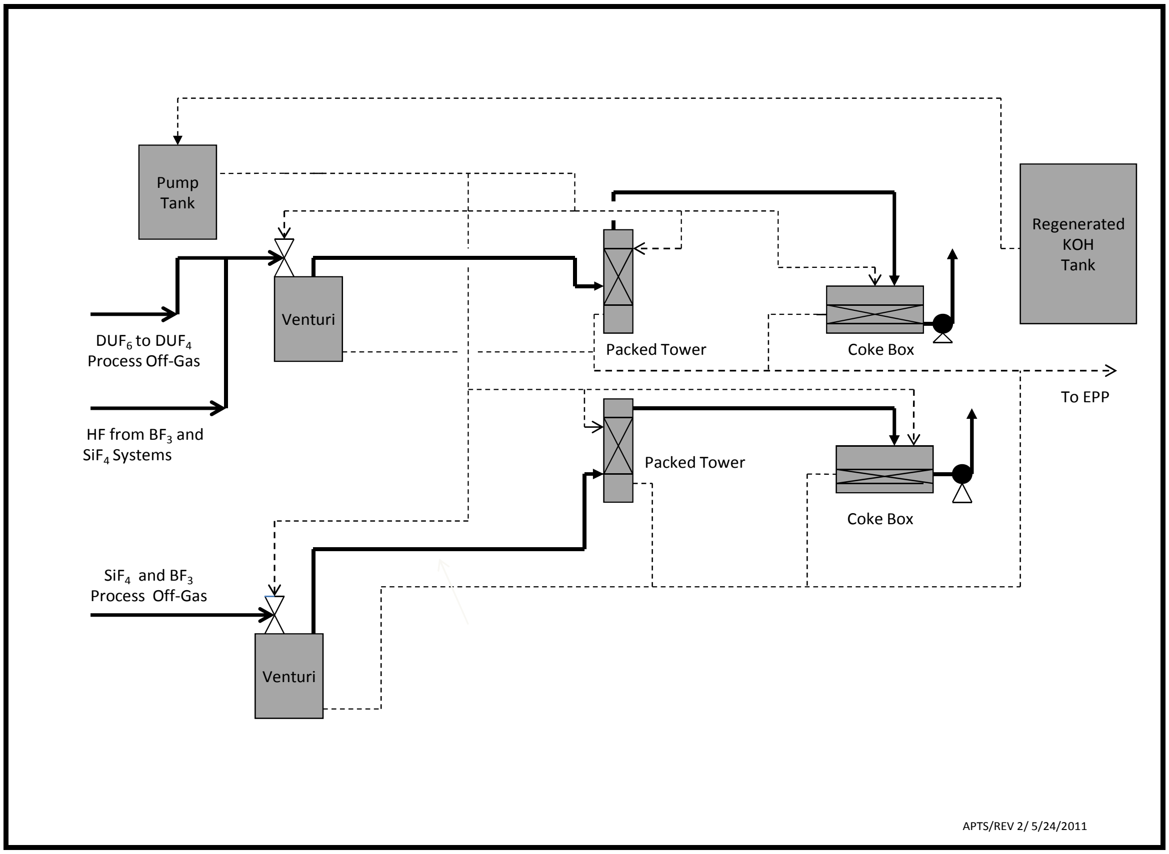


Figure 3-6 Plant KOH Process Scrubbing System Flow Diagram

HF from the discharge of the DUF_6 to DUF_4 process and from the SiF_4 and BF_3 pre-condensers is routed to one venturi. Final off-gas streams exiting the SiF_4 and BF_3 processes, containing some of the uncollected SiF_4 and BF_3 and trace quantities of other fluorides are routed to another venturi scrubber. The Plant KOH Scrubbing System vents treated gases through plant stack number 01 as described in Table 3-5. The three-stage KOH scrubbing system is designed for removing fluoride bearing components in the gas streams at approximate efficiencies of greater than 80%, 95%, and 99% for the first, second and third stages, respectively. The overall system removal efficiency is designed at greater than about 99.9%. The Plant KOH Scrubbing System stack is routinely sampled and analyzed to measure for traces of fluorides or uranium in the vent gas.

3.1.8 Environmental Protection Process

The EPP provides a means of treating two (2) types of liquids (solutions) that result from the production processes; potassium fluoride solutions (KOH regeneration process) and weak aqueous HF (HF neutralization process). Each of these materials originates from scrubbing systems designed to prevent air emissions. The potassium fluoride solution is a by-product of using KOH as a scrubbing medium. In the KOH regeneration process of the EPP, the potassium fluoride, water, and excess KOH spent solution from the Plant KOH Scrubbing System is reacted with a lime-slurry. Calcium fluoride and regenerated potassium hydroxide solution are produced. The regenerated KOH is recycled and reused in the Plant KOH Scrubbing System. The calcium fluoride is filtered, dried and packaged for shipment to an approved commercial waste burial site, to an HF producer or other potential users.

The other stream treated in the EPP is weak aqueous HF solutions, or water or KOH solution that may contain a low concentration of fluoride. Also, small spills that may occur and require clean up from spill control containment areas may contain weak fluoride concentrations. In this case, the spilled collected liquids may have too much water to send to the KOH regeneration/recycle system. The HF neutralization process uses lime slurry to react with weak HF to produce CaF_2 and water.

Figure 3-7 depicts the general flow of the EPP Neutralization and KOH Regeneration and Recycle processes. These processes are discussed below.

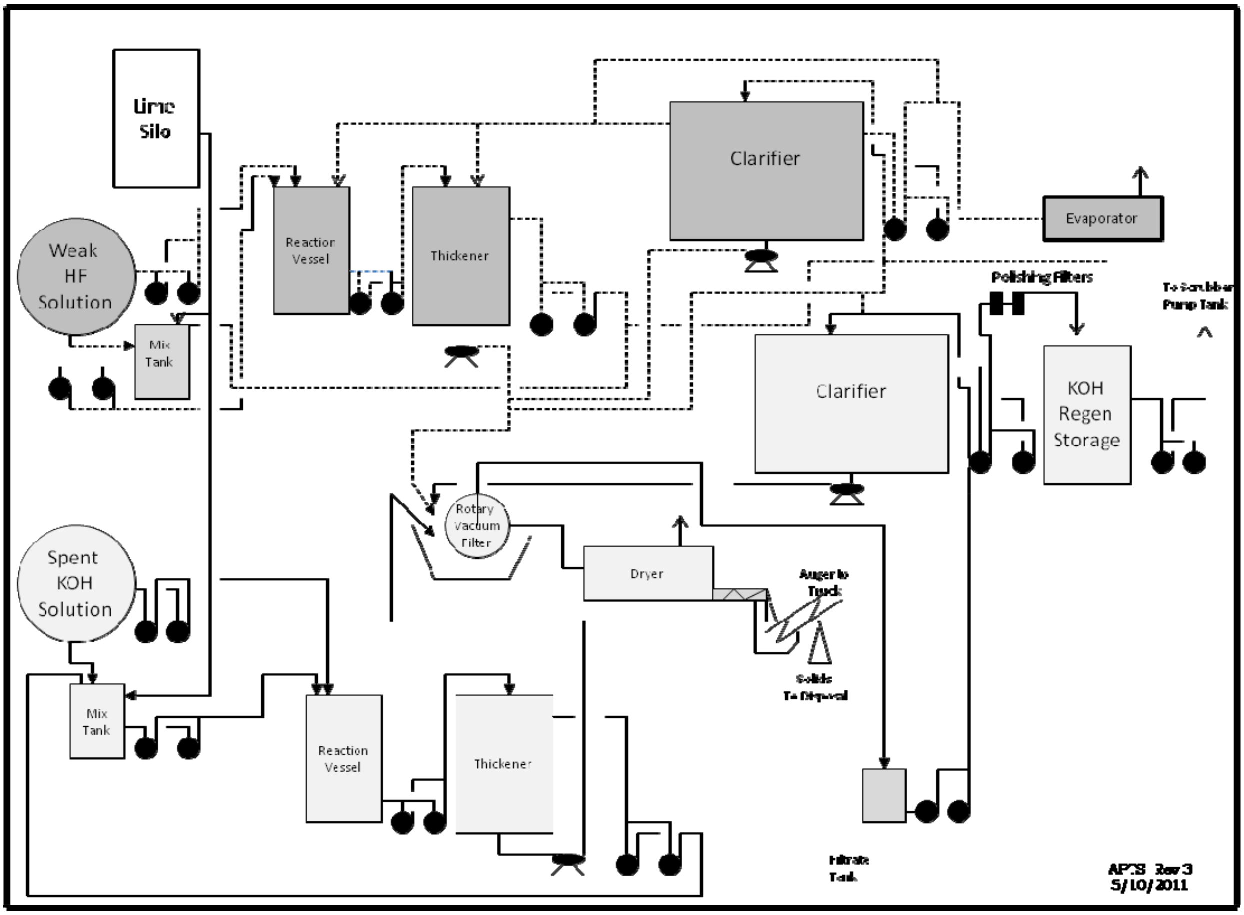


Figure 3-7 Environmental Protection Process Water Treatment

3.1.8.1 HF Neutralization

The HF Neutralization process is designed to operate intermittently, as needed. There is a carbon steel lime silo which holds an inventory of hydrated lime. It is equipped with its own dust collection system. Lime is fed through a rotary valve to a mix tank where it is mixed with harvested water. The slurry generated is ~30% solids. Weak HF solution is transferred from the weak HF holding tank (rubber-lined and closed top) to an agitated acid reaction vessel that has a volume of about 6,000 gallons. The lime-slurry from the mix tank is also transferred to the acid reaction vessel. The materials in the acid tank require a retention time of about one hour or greater for reaction completion. With the reaction complete, materials from the acid reaction vessel are transferred to a thickener tank for settling. After thickening, calcium fluoride and excess lime are transferred by a slurry pump from the bottom of the thickener to a rotary drum vacuum filter. Solids are discharged from the filter to a dryer capable of processing excess water. Liquors from the rotary vacuum filter are recycled to the weak HF tank for recycling. After drying, the calcium fluoride is packaged suitable for sale or disposal at an appropriate off-site licensed disposal facility. The primary chemical reaction is:

$$2HF + Ca(OH)_2 \rightarrow CaF_2 + 2H_2O$$

3.1.8.2 KOH Regeneration

Lime is fed to an agitated mix tank where it mixes with harvested water. The slurry generated is ~30% solids. Spent KOH solution (KF solution with weak KOH) is transferred from storage (holding) tank (carbon steel construction and closed top) to an agitated reaction vessel (steel-construction, flat-bottom and open top) that has a volume of about 6,000 gallons. The lime-slurry from the mix tank is also transferred to the reaction vessel. The materials in the reaction vessel tank are given a retention time of about one hour or greater for reaction completion. With the reaction complete, materials from the reaction vessel are transferred to a thickening tank for settling. Calcium fluoride and excess lime are transferred by a slurry pump from the bottom of the thickener to a rotary drum vacuum filter. Solids are discharged from the filter to a dryer capable of processing excess water. Liquors are transferred to a clarifier with a capacity of approximately 15,000 gallons where residual solids are allowed to settle. Regenerated KOH is removed (clarified overflow) from the top of the clarifier and passed through a set of filters to the regenerated KOH storage tank of about 3,000-5000 gallons capacity. The regenerated KOH solution is pumped to the Plant KOH Scrubbing System as needed for reuse by the scrubbers. Solids are transferred via a slurry pump from the bottom of the clarifier to the rotary drum vacuum filter and subsequently transferred to the dryer. The dried material is packaged and temporarily stored for sale or sent to an approved off-site licensed disposal facility.

The primary chemical reaction is:

$$2KF + Ca(OH)_2 \rightarrow CaF_2 + 2KOH$$

3.1.9 AHF Staging Containment and Fluoride Products Trailer Loading Buildings

.

When AHF inventories reach a level for shipment, the AHF is loaded into an approved tank trailer staged in the Fluoride Products Trailer Loading Building. The tank trailer is the type approved by the DOT and of the design type routinely used for shipping AHF nationwide. A transfer line from the storage tanks enters the tank trailer side of the building. The containment building has a truck entrance door on one side that remains sealed, closed and controlled except for short periods when the trailer is moved in and out. Safety precautions are taken to prevent the trailer from accidentally contacting the fill line by the installation of physical barriers.

3.1.10 Process Vent Stacks

There are three (3) major stacks from which treated process gases are vented to the atmosphere: 1) the Plant KOH Scrubbing System, 2) the DUF_4 Dust Collector System and 3) the FEP Dust Collector System. Prior to venting, the particulate and gas process streams are filtered and/or scrubbed using multi-stage equipment that is configured in series to ensure effective treatment within the established safe and environmental regulated control limits. Additionally there are ten (10) other process related or utilities equipment stacks including one (1) boiler vent stack that are vented to the atmosphere.

Table 3-4 provides a listing of the off-gas treatment equipment and corresponding design efficiencies. Information is presented on stack heights, estimated vent flow rates, stack size and approximate location is shown in Table 3-5.

Table 3-4 Design Efficiencies for Process Vent Off-gas Treatment Equipment

Component	Design Efficiency	Comments
DUF_4 dust collectors	>99.5% particulates	All primary, secondary and redundant units
FEP uranium oxide	>99.5% particulates	All primary, secondary and redundant units
DUF_4 vacuum cleaner cyclone	>80% particulates	Cyclone discharges to DUF_4 vacuum cleaner dust collector for further removal efficiency
FEP uranium oxide vacuum cleaner cyclone	>80% particulates	Cyclone discharges to oxide vacuum cleaner dust collector for further removal efficiency
DUF_4 vacuum cleaner dust collector	>99.5% particulates	Discharges to inlet of DUF_4 secondary dust collector
FEP uranium oxide vacuum cleaner dust collector	>99.5% particulates	Discharges to inlet of FEP uranium oxide secondary dust collector
DUF_4 primary metal filter	>95% particulates	Removes entrained particulates from the DUF_4 to DUF_6 reaction vessel off-gas. Discharges to secondary filter for further removal efficiency

Table 3-4 Design Efficiencies for Process Vent Off-gas Treatment Equipment

Component	Design Efficiency	Comments
DUF_4 secondary metal filter	>95% particulates	Removes entrained particulates that may pass through the DUF_4 primary metal filter
SiF_4 primary metal filter	>95% particulates	Removes entrained particulates from the SiF_4 rotary calciner off-gas. Discharges to secondary filter for further removal
SiF_4 secondary metal filter	>95% particulates	Removes entrained particulates that may pass through the SiF_4 primary metal filter.
BF_3 pre-heater primary metal filter	>95% particulates	Removes entrained particles from the BF_3 pre-heater vessel off-gas. Discharges to secondary filter for further removal efficiency
BF_3 pre-heater secondary metal filter	>95% particulates	Removes entrained particles that may pass through the BF_3 pre-heater primary metal filter
BF_3 primary metal filter	>95% particulates	Removes entrained particles from the BF_3 rotary calciner off-gas. Discharges to secondary filter for further removal efficiency
BF_3 secondary metal filter	>95% particulates	Removes entrained particles that may pass through the BF_3 primary metal filter
KOH venturi scrubber	>80% gaseous and particulates	Receives vent gas from DUF_4 and FEP process off-gas system. Exit gas of venturi discharges to packed tower scrubber for further efficiency
KOH packed tower scrubber	>95% gaseous	Second stage system. Exit gas discharges to coke box system for further removal efficiency
KOH coke box scrubber	>99% gaseous	Discharges to atmosphere through Plant KOH Scrubbing System vent stack
DUF_4 off-gas primary carbon-bed trap	>95% gaseous and particulate uranium	Absorbs DUF_6 gas and traces of DUF_4 and discharges to secondary trap for further removal efficiency.
DUF_4 off-gas secondary carbon-bed trap	>95% gaseous uranium	Absorbs DUF_6 trace gas that may pass through primary carbon bed. Discharges to tertiary carbon-bed trap for further removal efficiency.
DUF_4 off-gas tertiary carbon-bed trap	>95% gaseous uranium	Absorbs final traces of DUF_6 that may pass through the secondary carbon-bed trap and provides added margin of safety in removing gaseous uranium
DUF_4 Hydrogen burner	>99% hydrogen burned	Gas-fired burner to destroy excess hydrogen from DUF_6 to DUF_4 reaction vessel off-gas
FEP hood vent system emergency KOH scrubber	>95% gaseous fluoride	Treated gas from emergency scrubber exits to SiF_4 venturi scrubber in the Plant KOH Scrubbing System for further and final treatment
Calcium fluoride dust Collector	>99.5% particulates	Removes air particulates in the CaF_2 storage area and process
DUF_4 transfer dust collector	>99.5% particulates	Allows for the transfer of particulate DUF_4 from the DUF_6-to-DUF_4 process to FEP consumers
B_2O_3 unloading dust collector	>99.5% particulates	Removes particulates in the B_2O_3 unloading process
Hydrated lime unloading dust collector	>99.5% particulates	Removes particulates in the Hydrated Lime unloading process

3.4 References

ANSI, N14.12001 — American National Standard for Nuclear Materials -"Uranium Hexafluoride-Packaging for Transport," ANSI, 2001.

CFR, 2011 — Code of Federal Regulations Title 49 "Transportation, Hazardous Materials," CFR, 2011.

4.1.3 Likelihood Analysis

Tables 4-3 through 4-6 specify the likelihood of the potential accident sequences that were identified that could have consequences that are Category 2 or 3 based on the performance criteria of 10 CFR 70.61. (The likelihoods indicated in the tables were derived utilizing the methods described in Section 5.2.4. Table 5-9 provides the definitions for the terms “unlikely” and “highly unlikely” developed in accordance with NUREG-1520 (NRC, 2002).

4.2 Management Measures

Management measures are the formal methods applied to maintain IROFS at a needed level of reliability and availability. These methods ensure that protection and mitigation features are adequate to keep accidents within the bounds of acceptable risk. Management measures are applied to all structures, systems and components associated with the performance of any IROFS. A graded approach is implemented based on the level of protection needed by each IROFS to meet acceptable performance criteria. For instance, sole IROFS require more robust management measures since no credited IROFS remain to prevent unacceptable consequences.

No management measure requirements or guidance are provided in 10 CFR Part 40 (CFR, 2009c); however, the program elements defined in 10 CFR 70.4 (CFR, 2009d) are followed, which are discussed summarily below. Detailed management measures are described in LA, Revision B Chapter 11 “Management Measures.” At a minimum, all IROFS meet the general requirements in the following sections. Additional measures may be applicable to certain IROFS if exceptionally high availability and reliability is needed to meet performance requirements. Such additional management methods will be defined when specific need is identified.

4.2.1 Configuration Management

Configuration Management (CM) Program elements are specified in 10 CFR 70.72 (CFR, 2009e). Such a program is needed to establish and maintain a technical baseline for the facility based on clearly defined requirements. The technical baseline consists of facility design drawings, procedures, specifications and other technical documents including the ISA. The CM Program ensures adequate change control for the technical baseline. Change control is needed to assure that any facility or process changes are evaluated appropriately and such changes are reflected in updated drawings, procedures and other plant documents. CM ensures that all but “like kind” replacements of equipment and minor non-process changes receive review and approval from all safety, security and licensing organizations. The impacts of these changes are evaluated and documented by the individual organizational groups. After approval, plant modifications are implemented and verified to be in accordance with the revised technical baseline. All corresponding safety, security and licensing documentation are updated in a timely manner following approval of the change.

Changes are evaluated for impact on the safety and health of workers and the public. New facilities and modifications to existing facilities and processes must meet certain criteria, or a license amendment is required. Any change that requires NRC approval will be submitted as a license amendment request and the change will not be implemented without prior NRC approval. Changes requiring NRC approval include conditions that meet the following criteria:

(1) Changes that create new types of accident sequences that, if unmitigated or not prevented, exceed performance requirements of 10 CFR 70.61 (CFR, 2009a) and are not previously described and analyzed in this ISA Summary.

(2) Changes that use new processes, technologies or control systems that are outside the bounds of the plant experience and expertise, except for research and development activities that do not have an adverse effect on the safety of currently licensed operations as documented by a safety analysis

(3) Changes that remove, without at least an equivalent replacement of the safety function, an IROFS that is listed in this ISA Summary and is necessary for compliance with the performance requirements of 10 CFR 70.61(CFR, 2009a)

(4) Alters any Sole IROFS that is listed in this ISA Summary as the lone item preventing or mitigating an accident sequence that would otherwise exceed the performance requirements of 10 CFR 70.61(CFR, 2009a)

(5) Any change prohibited by 10 CFR 70.72 (CFR, 2009e), license condition, or order

All changes not requiring NRC approval shall be submitted to the NRC annually, including a revised ISA Summary.

Periodic assessments of the CM Program are conducted to determine the program's effectiveness and to correct deficiencies.

4.2.2 Maintenance

Maintenance activities include general repair and upkeep of facilities and processes along with preventive maintenance and testing of engineered IROFS and important process controls. Maintenance also includes surveillance and monitoring to identify conditions requiring corrective maintenance and to ensure that preventive maintenance remains effective. These activities are coordinated through safety group reviews and approval via safety work orders, hot work permits and radiation work permits, as needed. Any maintenance activities on specific systems are evaluated for their impact on other, nearby systems. Results of surveillance/monitoring activities related to IROFS will be evaluated by all safety disciplines to determine any impact on the ISA and any updates needed.

Testing plans for IROFS and certain process controls will be developed prior to initial installation of the devices. Testing can include functional tests, performance tests, software checks and updates and instrument calibration. The frequency of such tests depends on the reliability of the equipment and the importance of the IROFS of meeting performance goals. At a minimum, all Active Engineered Control IROFS including Instrumentation and Control IROFS will be tested following maintenance and on an annual basis. To maintain accuracy within specified limits, Measuring and Test Equipment (M&TE) will be properly controlled, calibrated and adjusted at specified periods in accordance with program procedures. PEC surveillance will be performed at regular intervals based on configuration management and approved procedures, consistent with the graded quality approach and commensurate with the item's importance to safety.

Preventive Maintenance (PM) activities include periodic refurbishment or like kind replacement of IROFS at a predetermined frequency. The frequency is based on the expected life of the device along with the relative importance of the IROFS in meeting performance goals and the results of surveillance and monitoring. Generally, sole IROFS will be refurbished and/or replaced at a greater frequency. Any functional test and/or calibration required will be performed following these maintenance activities. The PM program will adjust the frequency of PM on IROFS (up or down) over time based on the condition of the item being maintained.

Corrective maintenance includes repair or like kind replacement of equipment that has failed to perform or is performing outside of desired safety and process parameter limits. The work order process mentioned above will address the safety aspects of this work. As with any maintenance, a functional test and/or calibration will be performed, as needed, following completion of this work.

4.2.3 Training and Qualifications

The IIFP Training Program will ensure job proficiency of facility personnel through effective training and qualification. The objective of the training shall be to ensure safe and efficient operation of the facility and compliance with applicable established regulations and requirements. Continuing training courses shall be established when applicable to ensure that personnel remain proficient. Personnel requiring training include all operating and maintenance employees, engineering, safety, management, supervisor, quality assurance, emergency preparedness, fire prevention and first-responder personnel.

Qualification is indicated by successful completion of prescribed training, demonstration of the ability to perform assigned tasks and the maintenance of requirements established by regulations. Qualifications will also include minimum education, technical background, experience, etc., along with physical skills needed to perform individual tasks.

Qualifications and training requirements are established for each functional type of work. Employees are provided formal classroom training along with specific on-the-job training. Workers will read, understand and follow formal area procedures when performing work. Additionally, workers will understand and obey requirements in work orders, hot work permits and RWPs along with posted limits and controls. Job Task Analysis is used, as needed, to supplement training when tasks associated with IROFS are involved.

Along with job-specific training mentioned above, all employees will be given formal general employee training and safety training, as needed. General worker training will include site access information and an overview of site hazards, emergency alarms and evacuation plans. Safety training may include radiation worker training, hazards communication and general health and safety training. Training and qualification related documentation is maintained as quality records. Continuous training and improvement is stressed for the entire workforce.

4.2.4 Procedures

Procedures are used to ensure that activities involving licensed materials or IROFS are carried out in a safe manner and in accordance with regulatory requirements. All production work aside from routine custodial and office duties will be governed by approved written procedures. Additionally, all program requirements, including these management measures, will be implemented via procedures. Procedures are necessary to provide consistent and reliable performance of site-wide activities. IROFS and other safety related items are highlighted in work procedures, typically as “cautions” and “warnings.”

Procedures are developed, reviewed, approved and controlled by the responsible organizations. Employees are trained on all procedures they follow as part of their work assignments. Work procedures and supplemental safety-related procedures will be located in the general work areas. Temporary work shall be performed under temporary work orders or RWPs. If a step of a procedure cannot be performed as written, work is stopped, the system is immediately placed in a safe condition and corrective actions are initiated in accordance with site procedures.

Facility and process changes require procedure updates in the form of revisions. Such revisions must be in place before restart of the operation can commence. Changes to safety systems and safety basis documentation must also be incorporated into respective procedures. Employees must be retrained on the revised procedures before the restart of work. Records generated during procedure use are identified and controlled according to the Records Management and the Document Control Program.

4.2.5 Audits and Assessments

Audits and inspections are periodically performed on all operations at the plant site, both for production and nonproduction related activities. Assessments are also routinely performed but are generally focused on support programs such as environmental, safety and health programs. Audits/inspections focus on review of certain aspects of compliance whereas assessments look more generally at program and process performance. Specifically, assessments are focused on ensuring that IROFS, and any items that affect the function of IROFS, are reliable and available to perform their intended safety functions.

Audits/inspections and assessments are performed in accordance with program plans and/or procedures. Audits and independent assessments are performed by personnel independent of the operation/activity being audited or assessed. Management assessments are performed by management to assess the adequacy of the part of the plant organization for which they are responsible. The frequency of audits/inspections and assessments will vary based on the safety aspects of the activities performed. Inspections are expected to be routine and frequent. Most production areas will have a walk down and general visual inspection of work areas daily. Non-routine work areas may be done on a weekly basis. Safety organizations are expected to perform weekly inspections over various process areas. The more formal audits will be performed quarterly or annually and will generally focus on safety and regulatory compliance issues. Program or process assessments are performed as needed, based on performance trends and identified need. Audit and assessment results are tracked in the Corrective Action Program. Records of audits, inspections and assessments will be maintained as quality records.

4.2.6 Incident Investigations

Incidents and accidents include abnormal events that may occur during operation of the facility. Incidents and accidents are formally investigated by plant personnel with knowledge of the process systems involved, the safety areas affected and formal incident/accident investigation methodologies. When an incident occurs, management will form a qualified team that will determine root causes of the event and develop recommendations to reduce the likelihood of recurrence. Lessons learned will also be developed so unaffected organizations can review their operations for similar type potential incident initiators.

Incidents/accidents are tracked and trended to identify weaknesses in types and areas of operation and to look for common causes of events. Corrective actions are assigned and tracked programmatically to ensure that timely and adequate corrections to deficiencies are incorporated. Any required plant changes as a result of corrective actions follow the management methods described above. Corrective actions are closed out in plant records when implementation is complete or adequate justification for not implementing the corrective action is properly documented.

4.2.7 Records Management

Records required to be maintained for the IIFP Facility include:

1. Results of surveys to determine the dose from external sources and used in the assessment of individual dose equivalents

2. Results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose

3. Results of air sampling, surveys and bioassays

4. Results of measurements and calculations used to evaluate the release of radioactive effluents to the environment

5. Records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site

6. As-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored

7. IROFS design specifications and maintenance records

8. Training and qualification records

9. Audit, assessment and inspection results

10. Incident investigation reports.

11. Quality Assurance (QA) records

All records associated with the above Management Measures Program elements will be retained as quality assurance records. The records are systematically stored and are easily retrievable for individuals, groups, programs and activities. Records are categorized and handled in accordance with their relative importance to safety and storage requirements. All facility and process design elements and items relating to the environment and safety and health to workers and the public will be maintained as quality records. Quality assurance records are stored in authorized facilities or containers providing protection from fire hazards, natural disasters and other adverse environmental conditions. The Records Management organization is ultimately responsible for maintaining plant records, although some records retention may be delegated to specific organizations.

Controlled documents are approved records identified as such in procedures which control their generation and revision. Changes to controlled documents are approved and released by the organization that performed the document's initial approval. After approval, the documents are forwarded to Document Control for control and distribution to the personnel on the approved distribution list.

4.2.8 Other Quality Assurance Elements

Other Quality Assurance elements relating to IROFS or the plant in general are specified in IIFP's Quality Assurance Program Description (QAPD), in LA, Revision B Appendix A. that governs facility operations. Personnel performing activities covered by the QA Program shall perform work in accordance with approved procedures and must demonstrate suitable proficiency in their assigned tasks. Training programs are established for QA policies, requirements, procedures and methods.

The QA Program (as described in the QAPD), in conjunction with the other management measures, ensures IROFS will be available and reliable to perform the required safety functions when needed. The level of QA applied to IROFS and other plant elements is based on a graded approach to meet risk and operation performance requirements and goals. Section 6 identifies the graded quality levels applied to IROFS.

4.3 Criticality Monitoring

Because only depleted uranium materials will be received and processed in the IIFP Plant, criticality monitoring is not required.

4.4.8 Inspection, Testing and Maintenance

Structures, systems and components (SSCs) are inspected, tested and maintained in accordance with the graded levels of the IIFP QAPD Revision B. SSCs that are determined to be IROFS have applicable management measures applied as discussed in IIFP LA, Revision B Chapter 11.

Engineered IROFS will be designed to permit inspection, testing and maintenance. Inspection, testing and maintenance of IROFS are addressed in LA, Revision B Chapter 11. The minimum level of management measures applied to administrative and engineered IROFS are briefly described in Table 6-1. Application of minimum graded quality levels are marked in Table 6-2. In general, IROFS credited with a high level of risk reduction will be inspected, tested and maintained on a more frequent basis than IROFS with lower levels of risk reduction; however, all specified inspections, testing and maintenance will be, at a minimum, commensurate with required reliability and consistent with the graded approach as described in Section 4.2.8. The design of credited IROFS will include adequate management measures for pre-operation certification, periodic testing, maintenance, calibration and inspection, for verification of safety function capability.

4.4.9 Criticality Control

Not applicable. Only depleted uranium materials will be received and processed in the IIFP Plant.

4.6 References

ASCE, 2006	ASCE 7-05. "Minimum Design Loads for Buildings and Other Structures," s.l. : American Society of Civil Engineers, 2006.
ASME, 2003	ASME B31. "Standards of Pressure Piping," s.l. : American Society of Mechanical Engineers, 2003.
ATS, 2011	"Medical Management Guidelines for Hydrogen Fluoride," Agency for Toxic Substances and Disease Registry, CAS # 7664-39-3, UN # 1052 and 1790, 2011.
CFR, 2009a	10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 61, Performance Requirements." 2009.
CFR, 2009b	10 CFR 70.64. Title 10, Code of Federal Regulations, Section 70.64, "Requirements for New Facilities or New Processes at Existing Facilities," 2009.
CFR, 2009c	10 CFR Part 40. Title 10, Code of Federal Regulations, Part 40, "Domestic Licensing of Source Material," 2009.
CFR, 2009d	10 CFR 70.4. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 4, Definitions," 2009.
CFR, 2009e	10 CFR 70.72. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 72, Facility Changes and Change Process," 2009.
Goode, W.D. et al. 1995	K/GDP/SAR-65. "Application of the HGSYSTEM/UF6 Model to Simulate Atmospheric Dispersion of UF6 Releases from Uranium Enrichment Plants," 1995.
IEEE,	IEEE-603. "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronic Engineers,2009.
IEEE, 2003	IEEE-383." Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2003.
NFPA, 2008a	NFPA 780. "Standard for the Installation of Lightning Protection Systems," s.l. : National Fire Protection Association, 2008.
NFPA, 2008b	NFPA 801. "Standard for Fire Protection for Facilities Handling Radioactive Materials," National Fire Protection Association, 2008.
NIOSH, 2011	" Skin Notation Profile for HF", National Institute for Occupational Safety and Health, Publication No. 2011-137, 2011, 2011.
NSA, 2009	"Fire Hazards Analysis for FEP/DUP Plant," Nuclear Safety Associates, 2009.
NRC, 1998	NUREG/CR-6410." Nuclear Fuel Cycle Facility Accident Analysis Handbook," US Nuclear Regulatory Commission, 1998.
NRC, 2002	NUREG-1520. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," US Nuclear Regulatory Commission, 2002.

5 ISA TEAM AND QUALIFICATIONS AND ISA METHODS

This section includes description of the team, qualifications and the methods used to perform the Integrated Safety Analysis.

5.1 ISA Team and Qualifications

A single ISA team completed all aspects of the ISA activities. Team member qualifications were consistent with guidance provided in NUREG 1520 (NRC, 2002). The ISA team was made up of a diverse group of individuals with expertise in engineering, safety, safety analysis, UF_6, HF and general uranium chemistry. The team possessed expertise in the following range of specialties, at a minimum:

- Facility and chemical process safety
- Health physics and radiation protection
- Chemical, mechanical and electrical engineering
- Plant operations and maintenance
- Process hazards analysis
- Safety analysis and risk assessment
- UF_6 and chemical/nuclear processing
- Fire safety
- Human Factors (Not part of original ISA team but will be added to team prior to the Design and Build Contractor beginning detailed design of IROFS SSCs)

The ISA team members are trained, knowledgeable and experienced in a wide array of ISA methods including hazards identification, process hazards analysis and safety analysis and risk assessment at various chemical/nuclear facilities. The team leader was ultimately responsible for the methods and approach of the overall ISA development. A brief summary of the ISA team who participated in the ISA process and their corresponding experience and qualifications is provided in Table 5-1.

Table 5-1 Experience and Qualifications of ISA Team

ISA Team Member	Experience and Qualifications
Ron Green, ISA Team Leader	20 years experience in nuclear safety analysis and risk assessment. Degreed Nuclear Engineer. Completed ISA Team Leader training with extensive experience leading ISA efforts at nuclear facilities.
Carol Mason, Safety Analyst	More than 30 years of experience in safety analysis, reliability analysis and risk assessment for NRC and DOE nuclear and non-nuclear facilities. ISA expertise includes identification of accident initiators, PHA, accident sequence development, radiological and non-radiological source term analysis, frequency quantification and application of atmospheric dose calculation codes to estimate on-site and off-site consequences. Experience with development and implementation of methodologies and databases for conducting chemical hazard analysis for hazards screening and accident analysis.

Table 5-1 Experience and Qualifications of ISA Team

ISA Team Member	Experience and Qualifications
Tammy Wheeler, Safety Analyst	Certified Health Physicist with 15 years experience in radiation protection, safety analysis and risk assessment for NRC, DOE and NASA nuclear and non-nuclear facilities. Proficient in atmospheric dispersion modeling, radiological pathway analysis, dose assessment and shielding calculations.
Mike Balmert, Safety Analyst	30 years experience in nuclear safety, criticality safety analysis and risk assessment. Degreed Mechanical and Nuclear Engineer. Knowledgeable of NRC Nuclear Material and Enrichment Facility operations and safety regulations. Experienced as ISA team member identifying and qualifying hazards, selecting IROFS and documenting safety analyses.
Andy O'Connor, Fire Protection Engineer	38 years of Fire Protection experience; 30 years of commercial nuclear and DOE experience. Passed the National Fire Protection PE exam. Developed FHAs, fire protection evaluations, training programs and readiness assessments.
Jim Thomas, Process Engineer	More than 30 years of technical, process engineering, environmental, safety and health (ESH), regulatory and management experience in the uranium nuclear fuel cycle industry. Eleven (11) of those years were in uranium conversion as process engineer, corporate process technology manager and plant manager in the commercial production of uranium hexafluoride, fluorine and specialty fluorine chemicals. Worked 17 years in uranium enrichment with responsibilities for operations, management, maintenance and corporate manager of advanced technology development and engineering. Six (6) years experience as ESH and regulatory manager and VP.
Donnie Chumbler	40 years in uranium enrichment with experience in technical and engineering evaluations, health physics management and quality assurance development and implementation. Certified Quality Manager, American Society of Quality.
Tommy Thompson, Process Engineer	More than 30 years in design, engineering and project management of industrial and commercial facilities and processes. Licensed Professional Engineer (PE).
Gary Holland, Process Engineer	More than 30 years in chemical and uranium enrichment industry with experiences in process and project engineering, maintenance, engineering design, capital and engineering cost estimating, procurement engineering and site selection studies. For 5 years was design authority for uranium enrichment advanced technology development.

Specific qualifications for each ISA team member who participated in the PHA are shown in Table 5-2.

Table 5-2 ISA Team Members PHA Qualifications

Team Member	Role(s)	Radiological Safety	Fire Safety	Chemical Process Safety	Process Engineering	Environmental Safety	Human Factors Engineering
Ron Green	Team Leader	X		X	X		
Carol Mason	Safety Analyst, Chemical Process Safety			X	X	X	
Tammy Wheeler	Safety Analyst, Health Physics	X				X	
Mike Balmert	Facility Safety, PHA			X	X		
Andy O'Connor	Fire Safety		X				
Jim Thomas	Chemical, mechanical and electrical engineering; plant operations and maintenance; UF_6 and chemical-nuclear processing			X	X	X	
Don Chumbler	Quality Assurance, Environmental Safety, Radiation Protection	X			X	X	
Tommy Thompson	Fire Hazard Analyst		X		X		
Gary Holland	UF_6 and chemical-nuclear processing			X	X		
To Be Added	Human Factors Engineering Professional						X

5.2 ISA Methods

	Redacted			

5.2.2 Process Hazards Analysis Method

A Process Hazards Analysis was performed by using a "What if…" type hazards analysis methodology (Table 5-4). The "What if..." PHA technique was chosen because of its structured format, straightforward approach, and its utility for identification of potential hazards and their associated consequences. As the technique's name implies, it uses questions that begin with "What if…" to identify potential upset conditions related to a process that result in a consequence of concern. A checklist that identifies process parameters and potential upset conditions was selected for this analysis as shown in Table 5-5.

Table 5-4 Process Hazards Analysis ("What if…") Sample Form

Scenario Number	"What if…"	Causes	Failure Frequency Index	Consequences	Consequence Category	Prevention Features	Mitigation Features	Comments
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

(1) Scenario identification number

(2) "What if..." upset condition being analyzed

(3) Sequence initiators for the upset condition

(4) Judgment of the frequency of occurrence of the upset condition assuming no prevention features

(5) Potential radiological, chemical and/or environmental consequences resulting from the upset condition

(6) Estimate of the severity or magnitude of the event consequences assuming no mitigation features

(7) Engineered and/or administrative features to prevent or reduce the likelihood the upset condition

(8) Engineered and/or administrative features to mitigate the event consequences

(9) Comments and discussions to clarify selection of likelihood and/or consequence categories

5.2.3 Consequence Analysis Method

The consequence severity categories are based on the amount of hazard (energy) available for release and the resultant impact to on-site and off-site populations and the environment. The severity categories are defined in Table 5-7. Consequences within a facility assume a “normal” facility and do not rely upon any special design features or containment.

Table 5-7 Consequence Severity Categories

Category	Workers	Off-Site Public	Environment
Category 3 High Consequences	Radiation Dose >100 rem Chemical Dose = endanger life	Radiation Dose >25 rem 30 mg soluble uranium intake Chemical Dose = long-lasting health effects	
Category 2 Intermediate Consequences	Radiation Dose >25 rem Chemical Dose = long-lasting health effects	Radiation Dose >5 rem Chemical Dose = mild transient health effects	Radiological release >5000 times values in Table 2 of 10 CFR Part 20, Appendix B
Category 1 Low Consequences	Accidents of lower radiological and chemical exposures than Category 2	Accidents of lower radiological and chemical exposures than Category 2	Radiological releases lower than Category 2

Per the guidance provided in NUREG-1520 (NRC, 2002), three consequence severity categories are assigned: High Consequences, Intermediate Consequences and Low Consequences. The primary driver for the PHA is to screen hazards and identify and evaluate accident sequences that result in intermediate and high consequence events. Scenarios that meet these consequence levels must then be evaluated with respect to risk and the adequacy of design and administrative features to prevent occurrence of the event and/or limit the severity of the consequences.

5.2.4 Likelihood Evaluation Method

As mentioned above, the PHA screening method is based solely on the uncontrolled, unmitigated consequences of the upset condition. A frequency estimate is assigned based on system design and the analysts’ knowledge of system operation along with the expected design and administrative safety features. This frequency is the frequency of the upset condition alone, not the likelihood of a subsequent accident, which may require more failures to occur. This is done to support the more detailed accident sequence analysis and also to understand the likelihood of identified low consequence events. The frequency of occurrence is based on the criteria as defined in Table 5-8. Both frequency of occurrence and consequence magnitude assessment are consistent with the requirements specified in NUREG-1520 (NRC, 2002).

Table 5-8 Initiating Event Failure Frequency Index Values

Failure Frequency Index*	Based on Evidence
-6	External Event with frequency of <10^{-6}/yr
-5	External Event with frequency of >10^{-6}/yr and <10^{-5}/yr
-4	No occurrences in 30 years for hundreds of similar systems in industry
-3	No occurrences in 30 years for tens of similar systems in industry
-2	No occurrences of this type in this facility in 30 years
-1	A few occurrences during facility lifetime
0	Occurs every 1 to 3 years
1	Several occurrences per year
2	Occurs every week or more often

*Based on the example provided in NUREG-1520. Indices less than (more negative than) -1 should not be assigned unless the configuration management, auditing and other management measures are high quality.

Accident sequence evaluation is performed on all PHA scenarios that resulted in uncontrolled consequences of intermediate or high severity, Consequence Category 2 and 3, respectively. Accident sequence evaluation results in a more detailed evaluation of hazards and a determination of risk. Risk for an accident is defined as the likelihood of occurrence times the magnitude of the consequence. Consequence levels are discussed above and are categorized in Table 5-7. Likelihood categories are based on criteria in 10 CFR 70.61 (CFR, 2009), which specifies the permissible likelihood of occurrence of accidents of differing consequences. Per 10 CFR 70.61 (CFR, 2009), high consequence accidents must be highly unlikely and intermediate consequence accidents must be unlikely. By default, low consequence accidents can be less than unlikely to occur. Table 5-9 below presents the three likelihood categories used to determine risk.

Table 5-9 Likelihood Categories

Event Likelihood	Likelihood Category	Probability of Occurrence	Qualitative Description
Not Unlikely	3	Greater than 10^{-4} per event per year	
Unlikely	2	Between 10^{-4} and 10^{-5} per event per year	Consequence Category 2 accidents must be "unlikely."
Highly Unlikely	1	10^{-5} or less per event per year	Consequence Category 3 accidents must be "highly unlikely."

The three (3) consequences and likelihood categories are displayed in Table 5-10 in a 3 x 3 risk index matrix. Multiplying the likelihood category number by the consequence category number results in an overall risk number for an accident. The unacceptable risk levels are highlighted with shaded areas. IROFS are needed for accidents that fall in this region so that an acceptable risk level is achieved.

Table 5-10 Risk Matrix and Risk Index Values

Severity of Consequences	Likelihood of Occurrence		
	Likelihood Category 1 Highly Unlikely (1)	**Likelihood Category 2 Unlikely (2)**	**Likelihood Category 3 Not Unlikely (3)**
Category 3 High Consequence (3)	Acceptable Risk 3	Unacceptable Risk 6	Unacceptable Risk 9
Category 2 Intermediate Consequence (2)	Acceptable Risk 2	Acceptable Risk 4	Unacceptable Risk 6
Category 1 Low Consequence (3)	Acceptable Risk 1	Acceptable Risk 2	Acceptable Risk 3

The table above shows that accidents that result in risk index levels of 6 or above do not meet the performance criteria in 10 CFR 70.61 (CFR, 2009). Uncontrolled and unmitigated accident sequences with risk index values of 4 or less meet performance criteria and do not require IROFS type controls. By default, any accident sequence with uncontrolled and unmitigated risk index levels of 5 or above must have IROFS applied to lower the risk to an acceptable value. These IROFS could be applied to reduce the likelihood of the event by establishing preventive measures, or they could be applied as mitigation features to reduce the severity of the consequences.

A simple way to ensure acceptable risk levels are always met is to establish likelihood level limits for high and intermediate consequence events. As mentioned before, intermediate consequence events must be unlikely to occur and high consequence events must be highly unlikely to occur. This is done by establishing probability of occurrence values to the likelihood categories in Table 5-9. Therefore, high consequence events require a likelihood of occurrence of no greater than 10^{-5} and intermediate consequence events require a likelihood of occurrence of no greater than 10^{-4} to meet the performance criteria specified in 10 CFR 70.61 (CFR, 2009).

Likelihood of an accident sequence is determined by multiplying the frequency of the initiating event by the probability of failure of independent controls. For simplicity, this is done by using indices for initiating event frequencies and control failures and adding them together to get a total likelihood index. The frequency index for initiating events was provided previously in Table 5-8. Failure probability index numbers for independent controls, or IROFS, are provided in Table 5-11. These values are derived from NUREG-1520 (NRC, 2002), and, as is consistent with this document, non-IROFS controls are credited with a maximum protection factor of -1. More highly credited controls require configuration management, auditing and other management measures to maintain the high availability and reliability assigned to IROFS. The index values below are given as a range, as not all controls, even the same type, offer the same level of availability and performance. Significant research along with engineering judgment was performed when assigning such numbers. Types of IROFS never exceeded their corresponding probability index range unless justified. Any such cases are justified in a latter portion of this summary document.

Table 5-11 Failure Probability Index Values for IROFS

Probability Index*	Probability of Failure on Demand	Based on Type of IROFS	Comments
-6	10^{-6}		If initiating event, no IROFS needed.
-4 or -5	$10^{-4} – 10^{-5}$	Exceptionally robust passive engineered control (PEC) IROFS or an inherently safe process, or two independent active engineered controls (AECs), PECs or enhanced administrative controls IROFS	Rarely can be justified by evidence. Further, most types of single IROFS have been observed to fail.
-3 or -4	$10^{-3} – 10^{-4}$	A single passive engineered IROFS or an active engineered IROFS with high availability	
-2 or -3	$10^{-2} – 10^{-3}$	A single active engineered IROFS, a single enhanced administrative IROFS, or an administrative IROFS for routine planned operations	
-1 or -2	$10^{-1} – 10^{-2}$	A single administrative IROFS that must be performed in response to a rare unplanned demand	
-1	10^{-1}	Maximum protection credit given to an non-IROFS engineered or administrative control	Such controls lack the management measures needed for high availability as IROFS

*Choosing the high (most negative number) range should generally be accompanied with a brief justification in the comment section of risk assignment forms. Using values outside of these ranges (more negative) requires detailed justification later in the ISA.

The overall accident sequence likelihood is determined by summing the three individual indices discussed above. This gives a Likelihood Index T, with T = Initiating Event Failure Frequency (FF) Index (Table 5-8) + Failure Probability (FP) Index for IROFS (Table 5-11). The final likelihood category is based on the Likelihood Index as described below in Table 5-12.

Table 5-12 Likelihood Category Determination

Likelihood Category	Likelihood Index T (sum of index values)
1	$T \leq -5$
2	$-5 < T \leq -4$
3	$-4 < T$

Risk is determined for all accident scenarios with intermediate or high consequence levels. In order to meet the performance criteria specified in 10 CFR 70.61 (CFR, 2009), engineered and administrative controls must be established, if necessary, such that intermediate severity consequence events have Likelihood Category of 1 or 2 and high severity consequence events have a Likelihood Category of 1.

5.3 References

CFR, 2009 10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 61, Performance requirements," 2009.

NRC, 2001 NUREG-1513. "Integrated Safety Analysis Guidance Document." US Nuclear Regulatory Commission, 2001.

NRC, 2002 NUREG-1520. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," US Nuclear Regulatory Commission, 2002.

6 LIST OF IROFS

This section lists all of the Items Relied on for Safety designated for high-and intermediate-consequence accident sequences.

6.1 Descriptive List of IROFS

The list of IROFS that are credited as engineered and administrative controls to either prevent or mitigate accidents is provided in Table 6-1. The majority of the IROFS designated for this facility are preventive. The IROFS designated for the IIFP Facility ensure that the hazards identified for this facility result in potential accident sequences that are of acceptable risk, as defined in LA, Revision B Chapter 4. There are no IROFS that are frequently or continuously challenged. The information in the table includes the unique IROFS item number, the safety function and description of the IROFS, the type of IROFS control and the management measures required to maintain the reliability of the IROFS.

There are four (4) types of IROFS controls that are used to maintain an acceptable risk level. These four (4) types are defined below.

- Passive Engineered Control: Fixed design features or devices that rely on natural forces such as gravity, natural convection, etc., to maintain safe process conditions. No human action is required except for maintenance and inspection.

- Active Engineered Control: A device that relies on in situ electrical, mechanical or hydraulic hardware that can sense process conditions and provide automatic action to maintain safe process conditions without human intervention.

- Enhanced Administrative Control: A limit or control that is maintained by action of an individual using judgment, training and/or procedures to maintain safe process conditions but is augmented by visual, audible or structural aids.

- Administrative Control (AC): A requirement that is maintained by action of an individual using judgment, training and/or procedures to maintain safe process conditions.

The Table 6-1 description of each IROFS also identifies the Failure Frequency or Failure Probability Index Numbers. For indices that are more negative than the lower absolute value nominally assigned to the type of IROFS indicated from Table 5-11, a justification is provided. The reliability of an IROFS is proportionate to the amount of risk reduction relied upon in the Integrated Safety Analysis. Thus, the level of the reliability management measures applied to an IROFS is commensurate with the required reliability. Management measures will ensure that IROFS are designed, implemented and maintained, as necessary, to be available and reliable to perform their safety function when needed. The degree of reliability and availability of IROFS ensured by these measures are consistent with the evaluations of accident likelihood in the ISA. As shown in Table 6-1, as a minimum, general high-quality management measures are applied to all IROFS.

The following information related to IROFS will be available onsite in the ISA documentation once final design is completed and approved for construction:

- Hardware IROFS design details, such as system schematics and/or descriptive lists, sufficient to determine the structures, systems, components or equipment included within the hardware IROFS' boundary

- Identification of essential utilities and support systems on which the IROFS depend to perform the intended safety functions

- Operating ranges and limits for measured process variables, e.g., temperature, pressure, associated with IROFS

- Basis for establishing the average vulnerable outage time to maintain acceptable IROFS availability

- Safety limits and safety margins, as applicable

Note that some engineered controls, passive and active, contain an administrative function as part of its control. For example, fixed cradles for storing DUF_6 cylinders still rely on an Operator to properly place the cylinder in the cradles. In many cases such controls are assigned as enhanced administrative controls. In the remaining cases these IROFS were separated into two distinct IROFS, one engineered and one administrative. The latter case was done when the failure modes of the control were uniquely different. The goal in all cases is to support the best assignment of accurate failure probabilities or failure frequencies of the controls.

IIFP commits to following acceptable Human Factors Engineering (HFE) guidance for administrative components identified in IROFS where human actions are relied upon to ensure the performance of the administrative controls. These IROFS will be designed in accordance with applicable guidance provided in NUREG-0700, “Human-System Interface Design Review Guidelines,” Rev. 2, May 2002, NUREG-0711, “Human Factors Engineering Program and Review Model,” Rev. 2, February 2004, and NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility,” Rev. 1, Appendix E, “Human Factors Engineering for Personnel Activities”, May 2010.

6.2 Accident Sequences for IROFS

Table 6-2 lists each IROFS credited in the Section 4 risk tables with reducing the likelihood of postulated intermediate and high consequence events to unlikely or highly unlikely levels as required by 10 CFR 70.61 (CFR, 2009) and references the accident sequence (as found in Section 3.3) that describes the conditions needed for the IROFS to reliably perform its function and the effects of its failure. The information provided in the IROFS tables form the basis for development of procedures, postings, controlled equipment lists and other IROFS implementing documents. The development of management measures is further defined in Section 4.2.

IROFS that prevent or mitigate an accident sequence with high consequences for which there are no other IROFS present are subject to higher quality assurance standards (Quality Level 1), and as such, have more rigorous management measures applied to them. Accident sequences that have multiple IROFS with either high or intermediate consequences, or accident sequences with sole IROFS with intermediate consequences, have a somewhat reduced quality standards (Quality Level 2) and management measures applied to the IROFS. Sole IROFS (both Quality Level 1 and Quality Level 2) are listed in Section 8.

6.2 References

CFR, 2009 10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, “Domestic Licensing of Special Nuclear Materials, Section 61, Performance Requirements,” 2009.

7 CHEMICAL CONSEQUENCE STANDARDS

The quantitative standards used to assess the consequence severity from chemical exposures to licensed materials, or chemicals produced by licensed materials before those product chemicals are separated from the licensed materials, are shown in Table 7-1. The "level of concern" values shown are derived from the U.S. Environmental Protection Agency Acute Exposure Guideline Levels (AEGLs) (EPA, 2009), based on an exposure for up to 30 min for public exposure limits and 10 min for worker exposure limits. The AEGL-1, -2 and -3 values were used as the threshold concentration levels for establishing a low, intermediate, or high consequence as specified in 10 CFR 70.61 (CFR, 2009). When worker exposure times differ from the defined level-of-concern exposure times, the level-of-concern values are scaled from the published values using Haber's Law based on the specific accident exposure time.

Those chemicals that do not have AEGL values, level-of-concern values (shown in Table 7-1) are derived from Emergency Response Planning Guidelines (ERPGs) (DOE, 2009). ERPG values are based on exposures for up to 60 min and are scaled to 30-min exposures for the public and 10-min exposures for workers. The ERPG 1, -2 and -3 values were used as the threshold concentration levels for establishing a low, intermediate, or high consequence.

The performance requirement for high consequence is defined in 10 CFR 70.61 (CFR, 2009) as an intake of 30 mg or greater of uranium in soluble form by any individual located outside the controlled area. For workers, IIFP intends to use a soluble uranium intake performance requirement for high consequence of 75 mg or greater. This value corresponds to the threshold for permanent renal damage consistent with a high consequence event to a worker as defined in 10 CFR 70.61(b) (4)(i) and has previously been approved by the NRC for application to processing of UF_6 (NRC,2007b). The soluble uranium intake criteria will be applied to intakes of both UF_6 and UO_2F_2. Other uranium materials present in the facility (UF_4 and UO_2) are not considered soluble.

7.1 References

CFR, 2009 — 10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 61, Performance Requirements," 2009.

DOE, 2009 — "Emergency Response Planning Guidelines." Subcommittee on Consequence Assessment and Protective Action, U.S. Department of Energy, 2009.

EPA, 2009 — "Acute Exposure Guidline Levels," US Environmental Protection Agency, 2009.

NRC, 2007b — US Nuclear Regulatory Commission, NRC Accession Number ML072010285, “Communication from Habighorst," NRC to Link, AREVA NP, Inc.” 2007.

9 DEFINITIONS OF LIKELIHOOD CATEGORIES

IIFP uses the definitions provided in NUREG-1520 (NRC, 2002) for the likelihood terms of 10 CFR 70.61 (CFR, 2009). These definitions and their application are described in Section 5.2.4.

Accident sequences that do not meet the definition of “not credible” are considered credible and treated in accordance with 10 CFR 70.61 (CFR, 2009). An accident sequence is considered “not credible” if it has the qualities associated with at least one (1) of the following criteria:

- Represent an external event for which the frequency of occurrence can conservatively be estimated as less than once in a million years (10^{-6})

- Represent process deviations for which there is a sound argument, based on physical laws or sound engineering/technical data that the deviations are not possible, or are extremely unlikely

  The validity of the argument must be independent of any feature, design, or materials controlled by a system of safeguards or IROFS or of management measures.

9.1 References

CFR, 2009 — 10 CFR 70.61. Title 10, Code of Federal Regulations, Part 70, "Domestic Licensing of Special Nuclear Materials, Section 61, Performance Requirements," 2009.

NRC, 2002 — NUREG-1520. "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," U.S. Nuclear Regulatory Commission, 2002.