International Isotopes Fluorine Products

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

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

Integrated Safety Analysis Summary

Revision A

December 23, 2009

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ISA SUMMARY AND ISA DOCUMENTATION

The purpose of this document, the International Isotopes Fluorine Products (IIFP) Fluorine Extraction Process and Depleted Uranium De-Conversion Plant (FEP/DUP) Integrated Safety Analysis (ISA) Summary is to provide a synopsis of the results of the FEP/DUP 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 FEP/DUP ISA Summary principally differs from the ISA by focusing on higher 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, 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 (CFR, 2009b), including a description 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 (CFR, 2009a).

7. A description of the proposed 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, which are on-site, or expected to be on-site.

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 (CFR, 2009a).

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: review of the operation, identification of the hazards, hazards evaluation and estimation of the potential risk, and the establishment of safety controls to reduce or eliminate the risk, if needed. By its nature, 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 (USNRC, 2002) 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 (CFR, 2009a) 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, byproduct and/or waste. Design criteria were reviewed for other energy sources including electrical, mechanical, thermal, 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 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 FEP/DUP Plant will not be licensed to possess special nuclear material and therefore will be licensed under Title 10 CFR Part 40 (CFR, 2009e). 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 (CFR, 2009d) performance requirements as part of the licensing basis for the application review of certain new source material facilities as an interim measure pending the completion of 10 CFR Part 40 rulemaking (USNRC, 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 Plant meet requirements similar to those stipulated in 10 CFR Part 70, Subpart H.

Consistent with the 10 CFR Part70.4 (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 Process Occupational Safety and Health Administration (OSHA) regulations (CFR, 2009g) and Risk Management Programs for Chemical Accidental Release Prevention regulations, developed by EPA (1994) so long as a release of these chemicals would not adversely affect radiological safety.

For the purposes of this 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 (CFR, 2009h).

References

CFR, 2009a. 10 CFR 70.65(b). *Title 10, Code of Federal Regulations, Section 70.65, Additional content of application* .

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

CFR, 2009c. 10 CFR 70.64. *Title 10, Code of Federal Regulations, Section 70.64, Requirements for new facilities or new processes at existing facilities.* US Nuclear Regulatory Commission.

CFR, 2009d. 10 CFR 70.61, Subpart H. *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* .

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

CFR, 2009f. 10 CFR 70.4. *Title 10, Code of Federal Regulations, Part 70, Domestic Licensing of Special Nuclear Materials, Section 4, Definistions* .

CFR, 2009g. 29 CFR 1910.119. *Title 29, Code of Federal Regulations, Part 1910, Occupational Safety and Health Standards, Section 119, Process safety management of highly hazardous chemicals* .

CFR, 2009h. 10 CFR Part 40.13. *Title 10, Code of Federal Regulations, Part 40, Domestic Licensing of Source Material, Section 13, Unimportant quantities of source material* .

USNRC, 2002. NUREG-1520. *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* . USNRC.

USNRC, 2007. SECY-07-0146, Staff Requirements Memorandum, Regulatory Options for Licensing New Uranium Conversion and Depleted Uranium Deconversion Facilities. USNRC.

1 Site Description

This section contains a summary description of the New Mexico site, selected for the IIFP Plant, and surrounding areas. The IIFP Environmental Report (ER) (IIFP, 2009) contains more detailed 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 proposed IIFP site is located in Southeast New Mexico, approximately 23 km (14 mi) west of Hobbs, New Mexico (population 28,657). The site is located in Lea County, approximately 27 km (17 mi) west of the Texas state border, 85 km (53 mi) northwest of Andrews, Texas (population 10,182) and 308 km (242 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 134 km (83 mi) to the southeast. See Figure 1-1for 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.

Lea County is situated at an average elevation of 1,220 m (4,000 ft) above mean sea level (msl) and is characterized most often by its flat topography. Lea County covers 11,381 km^2 (4,393 mi^2) or approximately 1,138,114 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 proposed IIFP site location will be carved out of 958.7 ha (2369 ac) in Township 18S, Range 37E, Sections 26, 27, 34, and 35. The site lies along the north side of U.S. Highways 62/180 and 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 50 miles from the proposed site. U.S. Highways 62/180 runs east through Seminole, Texas, 28 miles from Hobbs to Forth 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.

Figure 1-1. IIFP Location in Southeastern New Mexico

The proposed 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 south to southwest. Surface drainage is into numerous un-drained depressions as well as a small intermittent water tributary running from the southeastern boundary to the northwest.

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 are no mountain ranges 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 Playa lakes on the site, but no significant bodies of water such as rivers or lakes. There are no parks, wilderness areas or other recreational areas located within or immediately adjacent to the IIFP site. In addition, there are no architectural or aesthetic features that would attract tourists to the area.

1.2 Demographics

This section provides the current census results (calendar year [CY] 2000) for the area surrounding the IIFP New Mexico 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 Andrews County was 13,004 in 2000 with a population density of 3.3 people per square kilometer (IIFP, 2009). Its population experienced a similar growth/decline pattern as that of Lea County. The population of Gaines County in 2000 was 14,467. Unlike in Andrews County, the population of Gaines County was relatively stable during the 1990's. The total population of the three principal counties in the region of influence was nearly 83,000 in 2000. The area did not experience the population increase that occurred in other areas of New Mexico and Texas.

1.2.2 Description, Distance, and Direction to Nearby Population Area

The proposed 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 14 miles. Other population centers are at distances from the site as follows:

- Eunice, Lea County, New Mexico: 34 km (21 mi) south
- Jal, Lea County, New Mexico: 69 km (43 mi) south
- Lovington, Lea County, New Mexico: 31 km (19 mi) north-northwest
- Seminole, Gaines County, Texas: 47 km (29 mi) east
- Denver City, Gaines County, Texas: 32 km (20 mi) north-northeast
- Andrews, Andrews County, Texas: 85 km (53 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 New Mexico Power and Light Company on the west boundary (New Mexico Highway 483) of the IIFP proposed property line. Cattle grazing on nearby sites occur throughout the year. Land around the proposed site has been mostly developed by the oil and gas industry. The nearest residence is situated at the north of the site 9 km (5.6 mi) from the northern boundary. There are no known public recreational areas within 5 miles of the site.

1.2.3 Proximity to Public Facilities

Urban development is relatively sparse in the vicinity of the proposed IIFP site. The nearest city, Hobbs, New Mexico, is approximately 22.5 m (14 mi) to the east. Within Hobbs, New Mexico, several educational institutions are available for the education of personnel in the local community. There are three colleges including a community vocational junior college, a high school and an alternative high school, three junior high schools, and eleven elementary schools as well as two private schools.

As mentioned above, there are no state or federal parks located within five (5) miles of the IIFP site.

1.2.4 Nearby Industrial Facilities

Land around the proposed site has been mostly developed by the oil and gas industry. Three gas-fueled power plants and a gas-processing facility are located nearby including the industrial Xcel Energy Cunningham Station on the west boundary (New Mexico Highway 483) of the IIFP proposed property line, Xcel Energy Maddox Station on the east side, and Colorado Energy Station on the northeast of the site. DCP Midstream Linam Ranch Plant, a natural gas processing facility, is located 5 km (3.1 mi) southeast of the IIFP site. Land Use within a Five-Mile Radius

As mentioned above, the site is undeveloped and utilized for oil and gas wells. Several power lines and underground power lines run generally east to west and several gas pipelines run north and west as well as east to west.

Cattle grazing on nearby sites occur throughout the year. Land around the proposed site has been mostly developed by the oil and gas industry (see Section 1.2.4). The nearest residence is situated at the north of the site 9 km (5.6 mi) from the northern boundary.

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 mile of the facility is essentially the same as that within 5 miles of the facility.

1.2.6 Uses of Nearby Bodies of Water

Water resources at the site are minimal. There are two local playa lakes on the site with a small stream that runs from the southeast to the northwest across the property that is predominantly dry during the year. The site sits upon the Ogallala Aquifer where groundwater resources are at depths greater than approximately 36.58 m (120 ft). 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.

1.3 Meteorology

1.3.1 Primary Wind Direction and Wind Speeds

Spring is the windy season. Winds of 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 regional locations are shown below in Figure 1-2.

As described in the IIFP ER, the normal annual total rainfall as measured in Hobbs, New Mexico is 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 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.

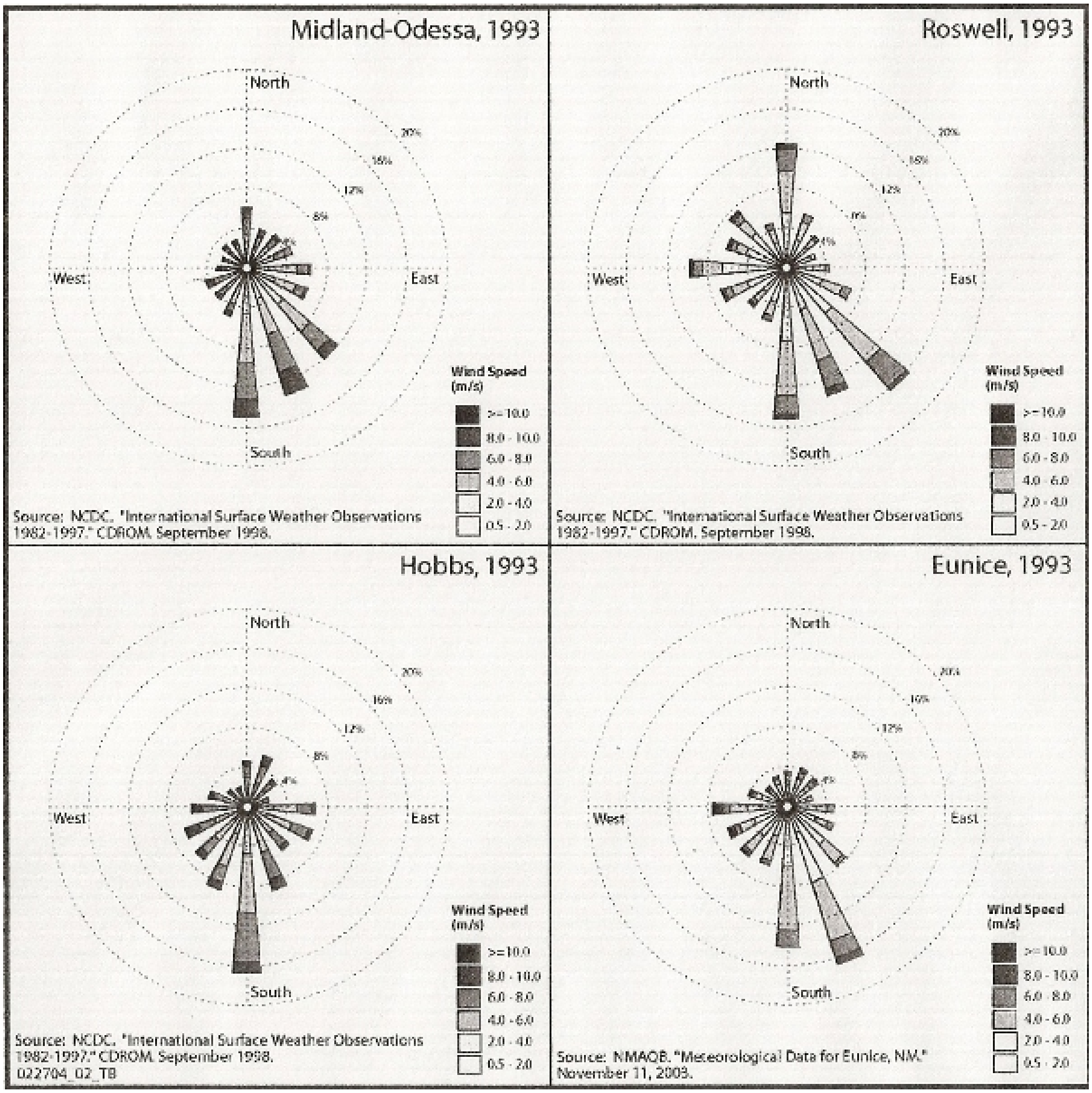


Figure 1-2. Wind Roses for Midland-Odessa, Roswell, Hobbs, and Eunice for 1993.

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

	Precipitation							Total Snowfall		
Month	**Mean**	**High**	**Month**	**Mean**	**High**	**Month**		**Mean**	**High**	**Month**
January	1.14 cm (0.45 in)	7.52 cm (2.96 in)	January	1.14 cm (0.45 in)	7.52 cm (2.96 in)	January	1.14 cm (0.45 in)	7.52 cm (2.96 in)	January	1.14 cm (0.45 in)
February	1.14 cm (0.45 in)	6.20 cm (2.44 in)	February	1.14 cm (0.45 in)	6.20 cm (2.44 in)	February	1.14 cm (0.45 in)	6.20 cm (2.44 in)	February	1.14 cm (0.45 in)
March	1.40 cm (0.55 in)	7.57 cm (2.98 in)	March	1.40 cm (0.55 in)	7.57 cm (2.98 in)	March	1.40 cm (0.55 in)	7.57 cm (2.98 in)	March	1.40 cm (0.55 in)
April	2.03 cm (0.80 in)	13.13 cm (5.17 in)	April	2.03 cm (0.80 in)	13.13 cm (5.17 in)	April	2.03 cm (0.80 in)	13.13 cm (5.17 in)	April	2.03 cm (0.80 in)
May	5.16 cm (2.03 in)	35.13 cm (13.83 in)	May	5.16 cm (2.03 in)	35.13 cm (13.83 in)	May	5.16 cm (2.03 in)	35.13 cm (13.83 in)	May	5.16 cm (2.03 in)
June	4.80 cm (1.87 in)	23.62 cm (9.30 in)	June	4.80 cm (1.87 in)	23.62 cm (9.30 in)	June	4.80 cm (1.87 in)	23.62 cm (9.30 in)	June	4.80 cm (1.87 in)
July	5.33 cm (2.10 in)	23.90 cm (9.41 in)	July	5.33 cm (2.10 in)	23.90 cm (9.41 in)	July	5.33 cm (2.10 in)	23.90 cm (9.41 in)	July	5.33 cm (2.10 in)
August	6.02 cm (2.37 in)	23.29 cm (9.17 in)	August	6.02 cm (2.37 in)	23.29 cm (9.17 in)	August	6.02 cm (2.37 in)	23.29 cm (9.17 in)	August	6.02 cm (2.37 in)
September	6.68 cm (2.60 in)	32.99 cm (12.99 in)	September	6.68 cm (2.60 in)	32.99 cm (12.99 in)	September	6.68 cm (2.60 in)	32.99 cm (12.99 in)	September	6.68 cm (2.60 in)
October	4.04cm (1.59 in)	20.70 cm (8.15 in)	October	4.04cm (1.59 in)	20.70 cm (8.15 in)	October	4.04cm (1.59 in)	20.70 cm (8.15 in)	October	4.04cm (1.59 in)
November	1.45 cm (0.57 in)	11.00 cm (4.33 in)	November	1.45 cm (0.57 in)	11.00 cm (4.33 in)	November	1.45 cm (0.57 in)	11.00 cm (4.33 in)	November	1.45 cm (0.57 in)
December	1.42 cm (0.56 in)	12.90 cm (5.08 in)	December	1.42 cm (0.56 in)	12.90 cm (5.08 in)	December	1.42 cm (0.56 in)	12.90 cm (5.08 in)	December	1.42 cm (0.56 in)
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	12.95 cm (5.1 in)	68.83 cm (27.1 in)	1980

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 [^oC (^0F)]			
	High	**Date**	**Low**	**Date**
Hobbs	45.6 (114)	June 27, 1998	21.7 (-7)	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. August and September are the rainiest months with 30 to 40 percent of the year's total moisture falling during those months.

1.3.2.3 Extreme Winds

Wind speeds over the State of New Mexico are usually moderate, although relatively strong winds often accompany occasional frontal activity during late winter and spring months and sometimes occur just in advance of thunderstorms. Frontal winds may exceed 30 mile/hr for several hours and reach peak speeds of more than 50 mile/hr.

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 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). 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 deaths.

1.3.2.6 Tornadoes

Tornadoes are occasionally reported in New Mexico, most frequently during afternoon and early evening hours from May through August. There is an average of nine tornados a year in New Mexico. Tornadoes occur infrequently in the vicinity of the IIFP site. Only two tornadoes were reported in Lea County from 1980 to 1989. Only one tornado was reported in Andrews County, Texas in the same period.

1.3.2.7 Tropical Storms and Hurricanes

Hurricanes are low pressure weather systems that develop over the tropical oceans and as they move inward they lose their intensity quickly once they make landfall. The IIFP site is approximately 500 mile from the nearest coast, it is likely that any hurricane that moved in that direction would have downgraded to a tropical depression before it reached IIFP.

1.3.2.8 Floods

The IIFP site does not fall within 100-year or 500-year floodplains (IIFP, 2009). The site is located in a semi-arid location with limited bodies of water.

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, water use, 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 playa lakes that have no external drainage. There is also a small stream that runs from the southeast to the northwest 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 ER (IIFP, 2009). 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 33 to 38 cm/yr (13 to 15 in/yr). Evaporation and transpiration rates are high which results in minimal, if any, surface water occurrence or groundwater recharge.

Surface drainage at the site is contained within two local playa lakes that have no external drainage. Runoff does not drain to one of the state's major rivers. Surface water is lost through evaporation, resulting in high salinity conditions and the waters in soils associated with the playas. These conditions are not favorable for the development of viable aquatic or riparian habitats. There are no designated FEMA Zone A areas that would be inundated during a 100-year flood event.

1.4.2 Depth to the Groundwater Table

The site sits upon the Ogallala Aquifer where groundwater resources are at depths greater than approximately 36.58 m (120 ft). 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.

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 to silty 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 Hobbs site sits on the Ogallala 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 proposed 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 FEP/DUP site is located outside the 100-year flood-plain.; however, a flood of any magnitude was considered credible during the accident analysis performed in the ISA. The likelihood of any major flood at the plant site was low and the consequences were limited (due to no fissile material existing at the site). Thus, flood type accidents are not a significant risk for plant 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. 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 is formed.

Pecos Plains section is characterized by its more irregular erosion topographic expression. The boundary between the two 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 proposed 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.

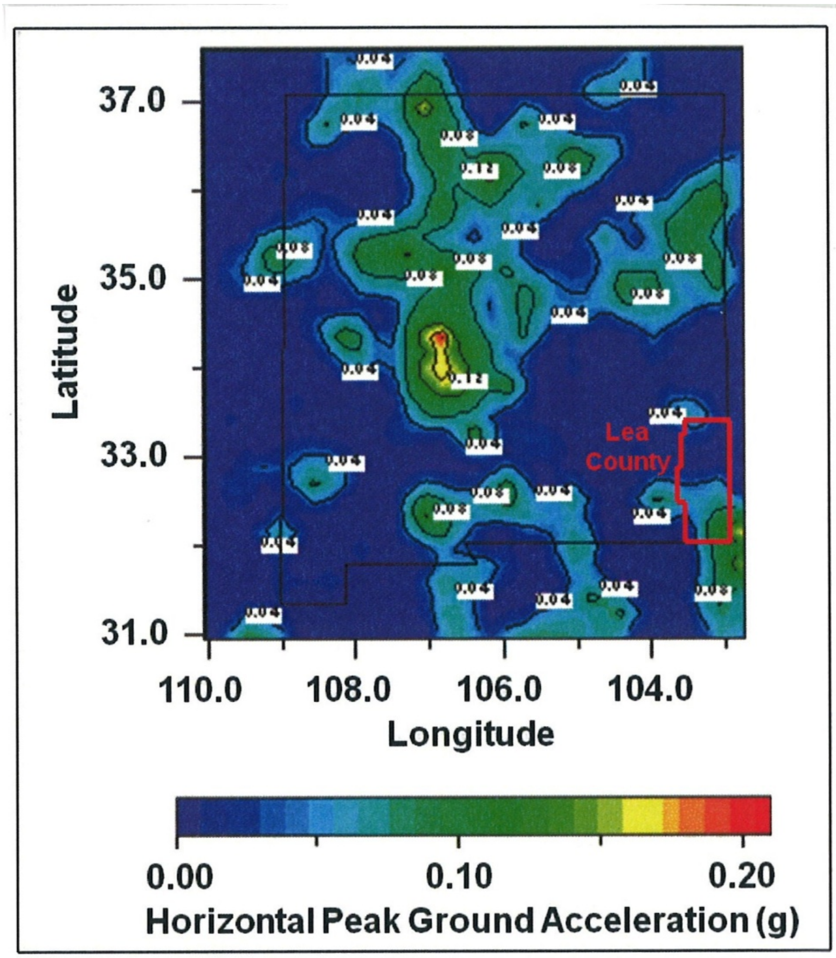
The upper formation of the Dockum Group is the Chinle Formation, a tight claystone and silty clay layer. The Chinle Formation is regionally extensive with outcrops as far away as the Grand Canyon region in Arizona. In the vicinity of the site, the Chinle Formation consists of red, purple, and greenish 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).

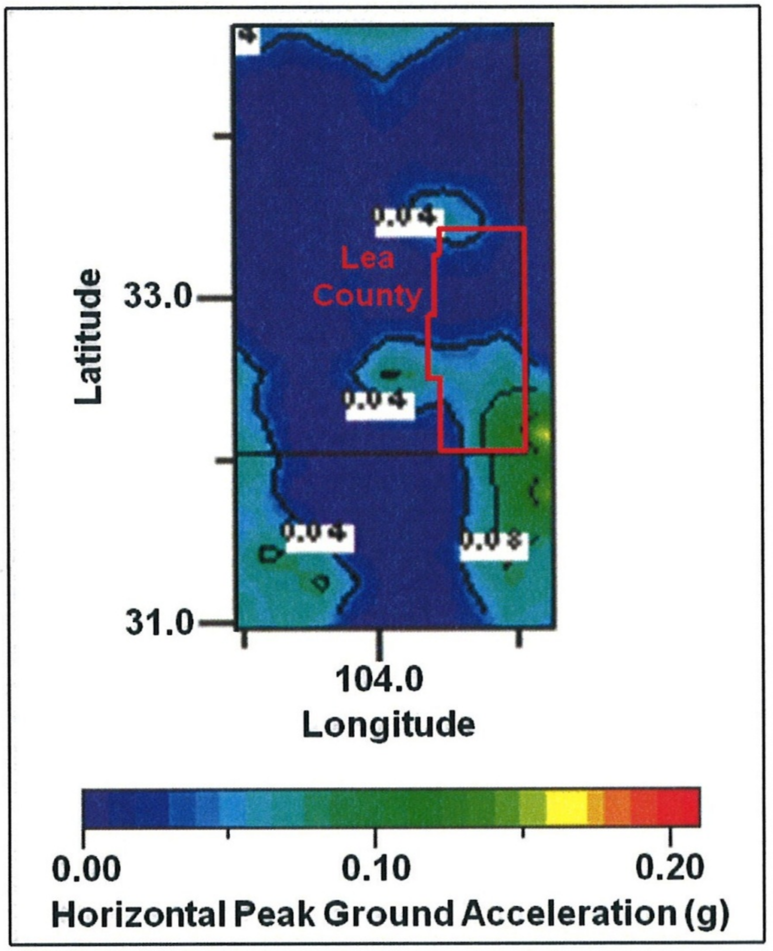
The Hobbs site is in a seismically quiet region, with nearby earthquakes being of relatively small (< 2.0 Md) magnitude. No Quaternary faults or folds, thought to be associated with most earthquakes of moment magnitude 6 or greater over the last 1.6 million years, exist in the southeast New Mexico/west 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).



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. Detailed Map Showing Lea County Seismic Hazard for a Moment Magnitude (Md) 6 Earthquake

Seismic activity is well documented as the result of the Louisiana Energy Services National Enrichment Facility (NEF) license application and the extensive network of seismometers established for the WIPP facility. The Peak Horizontal Ground Acceleration for a 1,000 and 2,500 year return is 0.05g and 0.12g respectively, 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).

Table 1-3. Seismic Criteria for New Mexico 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)	0.12g(USGS, 2002)

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

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 requirement.

1.6 References

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

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

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

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.

Chapters 2 through 8 redacted in accordance with 10 CFR §2.390

Contain Security Related Information

9 Definitions of Likelihood Categories

IIFP uses the definitions provided in NUREG-1520 (USNRC, 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.

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