With regard to past operations at the site involving an oil recovery facility with tanks within the CIS Facility Site boundary, it should be noted that there are no oil recovery operations presently occurring on the Site and none are reasonably foreseeable. There are 7 aboveground storage tanks (ASTs) associated with past brine disposal activities on the site. These ASTs are holding tanks that were used for storing brine and settling solids and separating residual oil from oil-field brines. 'The tanks range in size from 150 barrels to 250 barrels. These holding tanks or ASTs are not in use. No containers of hazardous substances have been noted in prior site visits (2007) or most recent site visits (2016). Within Section 13, which is where the CIS Facility would be located, two additional tanks (250 gallon barrels) are present at the well location in the southwest portion of the Site. One active oil/gas well on the southwest portion of Section 13 operates at minimum production to maintain mineral rights.

2.2.3 Air Transportation

The airspace surrounding the CIS Facility is unrestricted and at any given time there would be the potential for commercial aircraft, military aircraft, and civilian aircraft to be flying in that airspace at various altitudes and at various speeds. Commercial aircraft would fly in accordance with flight plans filed with the Federal Aviation Administration (FAA) and would be controlled by the national air traffic control system [2.2.5] [2.2.18]. Military aircraft would fly within designated Military Training Routes (MTRs), which may or may note be flown under air traffic control.

Commercial aircraft flight plans would be limited to the Federal Airways that make up the en route airspace structure of the National Airspace System. There are multiple federal airways near the CIS Facility: V83, V102, and V291 [2.2.16] [2.2.17]. Victor routes are low altitude airways that make up the majority of the lower stratum of the federal en route airspace structure. Victor routes extend from the floor of the controlled airspace up to but not including 18,000 feet above mean sea level [2.2.18]. They are defined as straight line segments between VOR stations and have a width of 4NM on either side of the centerline when VOR stations are less than 102 NM apart, with the width increasing for VORs farther apart [2.2.18]. Additional information for these airways, including their distances from the site, is included in Table 2.2.5. These federal airways are illustrated on Figure 2.2.6.

Because airspace above the United States from the surface to 10,000 feet above sea level is limited to 250 knots (indicated airspeed) by FAA regulations, any aircraft below 10,000 feet would be travelling at speeds of less than 250 knots. There is a military exception to this requirement, however. The Military Training Route Program is a joint venture by the FAA and the Department of Defense (DOD), developed for use by military aircraft to gain and maintain proficiency in tactical "low-level" flying. These low-level training routes are generally established below 10,000 feet for speeds in excess of 250 knots. Military Training Routes do not constitute an official airspace and are all open to civilian traffic [2.2.6].

MTRs are designated either IR (Instrument Route) or VR (Visual Route), with IR routes being flown under air traffic control [2.2.19]. Military training routes are usually limited to 420 knots, and in no case are aircraft allowed to exceed Mach 1 within United States sovereign airspace, except in designated Military Operation Areas. While on the route, military aircraft squawk a Mode C Transponder code of '4000', which informs controllers that they are 'speeding' on a route. This squawk however is only legal by military aircraft, while inside a properly scheduled route corridor [2.2.20].

There are four designated Military Training Routes in the vicinity of the proposed CIS Facility: IR-128, IR-180, IR-192, and IR-194. However, these four designations represent only 2 mapped airways, as IR-128 and IR-180, and IR-192 and IR-194 share the same airway but represent opposite directions of travel (hereafter referred to as IR-128/180 and IR-192/194, respectively). IR-128 and IR-192 both represent the North to South direction, while IR-180 and IR-194 represent the South to North flight direction of their respective corridors [2.2.19] [2.2.16]. The routes are individually operated by an Air Force Base, which schedule and 'own' the route. IR-128/180 is “owned” by Dyess AFB while IR-192/194 is “owned” by Holloman AFB. The FAA requires the military to provide advance notice to other aircraft that the Military Training Routes will be used to allow for civilian traffic to de-conflict if needed. Department of Defense publication AP/1B defines all MTRs giving coordinates of airway fixes, or points between segments as well as the airway width different points along the route. Additional information for these airways, including their distances from the site and widths, is included in Table 2.2.5. These Military Training Routes are also illustrated on Figure 2.2.6.

A Military Operation Area (MOA) is “airspace established outside Class A airspace to separate or segregate certain nonhazardous military activities from IFR Traffic and to identify for VFR traffic where these activities are conducted." [2.2.21]. The nearest MOAs to the CIS facility are the Talon High East MOA, which is located north of Carlsbad, NM and the Bronco 3 MOA, which is located North of Hobbs, NM. The nearest edge of both of these MOAs is greater than 25 miles from the site.

As discussed below, most of the commercial airline operations at airports in the area of the CIS Facility involve regional jets. The largest commercial planes (Boeing 737s) are flown in and out of Midland International Air and Space. A summary of the airplane operations at airports near the CIS Facility are provided below. Airport operation numbers have been gathered from 2 sources, first is the Air Traffic Activity Data System (ATADS), which contains the official NAS air traffic operations data available for public release. The other is GRC Inc.’s AirportIQ 5010, which is a compilation of FAA form 5010-5 Airport Master Records and Reports. ATADS gives data as far back as 1990, where AirportIQ gives only the past year’s data. Additionally, ATADS only gives data for Airports that have an FAA certified Air traffic control tower, so data for some of the smaller airports has only been sourced from AirportIQ.

Artesia Municipal Airport* is a public use general aviation airport located 4 miles west of the Main Street business district or Atresia, in Eddy County, New Mexico, approximately 47 miles from the CIS Facility. The city owned airport and its 2 runways covers 1,440 acres. For the 12 month period ending April 05, 2017 the airport had approximately 14,050 aircraft operations, an average of 38 per day: 82 percent general aviation, and 18 percent military. During this period, 30 aircraft were based at this airport: 26 single engine, and 4 multi engine [2.2.22].

> *Note that Atresia Municipal Airport does not have an FAA funded air traffic control tower, and therefore does not have data reported to ATADS.

Cavern City Air Terminal* is a public use airport in Eddy County, New Mexico, United States. It is owned by the city of Carlsbad and located five miles southwest of its central business district, approximately 34 miles from the CIS Facility. The airport is served by one commercial airline. For the 12 month period ending December, 31, 2016, the airport had approximately 6,900 aircraft operations, an average of 19 per day: 53 percent general aviation, 4 percent air taxi, 39 percent air carrier, and 4 percent military. During this period, 22 aircraft were based at this airport: 15 single-engine, 2 multi-engine, 2 jet, 2 helicopter, and 1 ultra-light [2.2.23]. The approach pattern for Cavern City Air Terminal is approximately 14 miles North East of the airport, locating it a little more than 22 miles from the CIS Facility see Table 2.2.6 [2.2.30].

> *Note that Cavern City Air Terminal does not have an FAA funded air traffic control tower, and therefore does not have data reported to ATADS.

Lea County Regional Airport* is 4 miles west of Hobbs in Lea County, NM, approximately 30 miles from the CIS Facility. The airport covers 898 acres and has three runways. It is an FAA certified commercial airport served by United Airlines' affiliate with daily regional flights. Lea County Regional Airport is the largest of the three airports owned and operated by Lea County Government. Lea County also owns and operated two general aviation airports in Lovington and Jal, New Mexico. For the 12-month period ending April 1, 2017, the Lea County Regional Airport had approximately 12,745 aircraft operations, an average of 35 per day: 67 percent general aviation, 16 percent air taxi, 10 percent air carrier, and 7 percent military. During this period, 52 aircraft were based at this airport: 41 single-engine, 6 multi-engine, 4 jet, and 1 helicopter [2.2.24]. Average annual aircraft operations for the past 15 years is approximately 12,500, this data is illustrated in Table 2.2.7 [2.2.28]. The missed approach holding pattern for Lea County Regional is approximately 19 miles South West of the airport, locating it just over 12.5 miles from the CIS Facility see Table 2.2.6 [2.2.31]

> *Note that for Lea County Regional data reported on AiportIQ does not match the data for the same time period reported on ATADS.

Lea County - Zip Franklin Memorial Airport* also known as Lovington airport is located 3 miles west of the central business district of Lovington in Lea county, NM, approximately 32 miles from the CIS Facility. For the 12-month period ending April 3, 2017 the airport had approximately 2,200 aircraft operations, all general aviation. During this period, 12 aircraft were based at this airport: 11 single engine, and 1 multi engine [2.2.25].

> *Note that Zip Franklin Memorial Airport does not have an FAA funded air traffic control tower, and therefore does not have data reported to ATADS.

Midland International Air and Space is located approximately midway between the Texas cities of Midland and Odessa. It is owned and operated by the City of Midland. In September 2014 it became the first US facility licensed by the FAA to serve both scheduled airline flights and commercial human spaceflight. Midland International Air and Space Port is ranked eighth in Texas for primary commercial service airports. For the 12-month period ending April 30, 2017, the airport has approximately 63,055 aircraft operations, averaging 173 per day: 43 percent general aviation, 14 percent air taxi, 18 percent air carrier, and 25 percent military. During this period, 105 aircraft were based at the airport: 24 single-engine, 40 multi-engine, 39 jet and 2 helicopter. The airport has three airlines, two serving hubs with regional jets and one (Southwest) flying mainline jets (Boeing 737s) [2.2.26]. Average annual aircraft operations for the past 15 years is approximately 76,412, this data is presented in Table 2.2.8 [2.2.28].

Roswell International Air Center is located 5 miles south of the central business district of Roswell, in Chaves County, NM, approximately 68 miles from the CIS Facility. The former Air Force Base currently covers 5,029 acres and has 2 runways. It is also an FAA certified commercial airport but is served by American Airlines with daily regional flights to Dallas-Fort Worth and Phoenix. The airport is owned by the city of Roswell and also serves as a storage facility for retired aircraft. For the 12-month period ending December 31, 2016, the Roswell International Air Center had approximately 34,280 aircraft operations, an average of 94 per day: 23 percent general aviation, 18 percent air taxi, 1 percent air carrier, and 58 percent military. During this period, 39 aircraft were based there: 31 single engine, 4 multi engine, 3 jet, and 1 helicopter [2.2.27]. Average annual aircraft operations for the past 15 years is approximately 49,050, this data illustrated in Table 2.2.9 [2.2.28].

In order to assure that risks from aircraft hazards is sufficiently low, a probabilistic assessment of the nearby air transportation infrastructure as described above has been performed. NUREG-0800 Standard Review Plan, gives acceptance criteria for the probabilistic assessment to meet NRC regulations. NUREG-0800 section 3.5.1.6 states that the requirements are met if the probability of aircraft accident is less than an order of magnitude of 10^{-7} per year. It also provides screening criteria which, if met, the probability is considered to be less than the 10^{-7} threshold by inspection.

Table 2.2.4 summarizes the data presented for each of the nearby airports, including its distance from the site, annual number of operations, as well as the SRP screening criteria. The value used for annual aircraft operations is the higher of the 15-year average from ATADS or the most recent year's value from AirportIQ (where both values are available). Given the distance to each of the near by airports, none of their annual operations comes within an order of magnitude of the screening criteria. Therefore, each of the nearby airports pose a negligible hazard risk.

Table 2.2.5and Table 2.2.6 summarizes the data presented for each of the federal airways, and holding or approach patterns that are near the site. The tables include distance from the site to the nearest edge of the airway or holding/approach pattern, as well as the screening criteria. Each of the proximate federal airways, holding patterns and approach patterns are greater than the 2-statute mile SRP screening criteria. Therefore, they pose a negligible hazard risk.

Table 2.2.5 also summarizes the data presented for each of the adjacent Military Training Routes, including the distance from the site to the nearest edge of the route, as well as the SRP screening criteria. The nearest edge of IR-192/194 is greater than 10 miles from the site, which is greater than the screening criteria of 5 statute miles. However, the centerline of IR-128/180 is less than 2 miles from the site, which puts its full width over top of the CIS Facility. Therefore, IR-192/194 is screened by inspection, while IR-128/180 needs to be assessed following SRP Section 3.5.1.6 III [2.2.33].

SRP Section 3.5.1.6 III provides the following equation for determining the probability of an aircraft using an airway crashing at the site:

$$P = C * N * {}^{A}/_{w}$$

Where:

C = in-flight Crash Rate per mile for aircraft using the airway
N = Number of flights per year along the airway
A = effective Area of the site in square miles
w = Width of the airway in miles

The area of each of the important to safety structures constitutes the effective area of the site. In this case, it is conservatively taken as the out to out area of the full 10,000 cask UMAX ISFSI array plus the area of the Cask Transfer Building, $A = 0.173\ mi^2$. The total width of the airway, as noted in Table 2.2.5, is 7 miles. And using a crash rate of $C = 4*10^{-9}$ (an order of magnitude greater than commercial aircraft), the number of flights per year that would yield a crash probability higher than $P = 10^{-7}$ would be 1011 flights.

The Air Force Base that controls IR-128/180, Dyess AFB has stated that "IR-180 has not been used in years and we do not expect to fly IR-180 in the near future, the way it's currently laid out" [2.2.32]. They also provided Figure 2.2.7 showing how IR-128 is flown and how they "expect to fly it in the foreseeable future" [2.2.32]. Figure 2.2.7 illustrates the racetrack which is used as part of operations on IR-128 and then exited from. This racetrack is north of Lovington, NM greater than 30 miles from the site. The portion of IR-128 closest to the site is not used. Therefore, it is reasonable to assume that less than 1011 flights per year occur on these MTRs near the site, and they pose a negligible hazard risk.

2.2.4 Ground Transportation

U.S. Highway 62/180, approximately 1 mile south of the proposed CIS Facility is the closest and most trafficked public road. It provides a route from the state of Texas to Carlsbad, New Mexico and points further west. It is a divided highway with a maximum speed limit of 70 miles per hour in the area near the proposed CIS Facility. This, in addition to other transportation infrastructure near the site, can be seen in Figure 2.2.4. This highway is on the National Hazardous Materials Route Registry (79 FR 40844, July 14, 2014) and can be used for the transportation of radioactive waste materials to WIPP [2.2.7] (Note: as shown on Figure 2.2.5, the WIPP route is approximately 5 miles southwest of the CIS Facility. There have been instances where transuranic wastes associated with WIPP have been transported along U.S. Highway 62/180 within approximately 1 mile of the proposed CIS Facility).

Like similar roads, commercial shipments of hazardous materials are also transported over U.S. Highway 62/180. Such shipments could include a wide range of hazardous materials, including, but not limited to: gasoline, diesel fuel, acids, carbon dioxide (CO_2), nitrogen (N_2), liquid nitrogen (LN_2), chlorine (Cl) gas, refrigerants, fuel gases, oxygen (O_2), explosives, and low-level radioactive materials. The State of New Mexico does not keep records of hazardous material shipments via roadways or rail. Consequently, specific types and quantities cannot be provided. In 2015, the annual average daily traffic on U.S. Highway 62/180 was 5,696 vehicles per day in the vicinity of the proposed Site (near the Eddy-Lea County line) and approximately 43 percent of these vehicles were associated with commercial trucks [2.2.9]. In 2014, in the entire state of New Mexico, there were 69 Hazardous Material Incidents required to be reported by 49 CFR §§ 171.15

Table 2.2.4: Nearby Airport SRP Screening

Airports	City	Distance from Site (miles)	Average Annual Operations	Screening Criteria 1000 D^2 Operations
Artesia Municipal (ATS)	Artesia, NM	47	14,050*	2,209,000
Cavern City (CNM)	Carlsbad, NM	34	6,900*	1,156,000
Lea County Regional (HOB)	Hobbs, NM	30	12,745	900,000
Lea Co. Zip Franklin Mem (E06)	Lovington, NM	32	2,200*	1,024,000
Roswell International (ROW)	Roswell, NM	68	49,045	4,624,000
Midland Intl air and space port (MAF)	Midland, TX	98	76,412	9,604,000

Table 2.2.5: Nearby Federal Airway and Military Training Route SRP Screening

Airways	Federal/MTR	Travel Direction	Distance to Centerline	Width left of Center	Width Right of center	Site Side	Distance to nearest edge [miles]	Screening Criteria
V-102	Federal	Either	6.8	4	4	N/A	2.8	> 2 mile
V-291	Federal	Either	12.0	4	4	N/A	8.0	> 2 mile
V-83	Federal	Either	34.8	4	4	N/A	30.8	> 2 mile
IR-192/ IR-194	MTR	N to S	13.5	3	7	Left	10.5	> 5 mile
		S to N	13.5	7	3	Right		
IR-128/ IR-180	MTR	N to S	1.8	3	4	Right	**Over Site**	**> 5 mile**
		S to N	1.8	4	3	Left		

Note: Bolded items do not satisfy criteria and are discussd further in chapter

Table 2.2.6: Nearby Airport Holding and Approach Pattern SRP Screening

Holding/Approach Pattern	Distance from Site [miles]	Screening Criteria
CNM Approach Pattern	22.76	>2 mile
HOB Missed Approach Pattern	12.64	>2 mile

Table 2.2.7: ATADS Standard Report for LEA County Regional Airport 2003-2017

			Itinerant					Local			
Calendar Year	State	Facility	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total Operations
2003	NM	HOB	0	3,047	8,676	167	11,890	6,138	468	6,606	18,496
2004	NM	HOB	0	3,002	6,850	200	10,052	5,224	344	5,568	15,620
2005	NM	HOB	0	2,277	5,082	77	7,436	3,660	166	3,826	11,262
2006	NM	HOB	0	2,195	4,574	72	6,841	3,694	155	3,849	10,690
2007	NM	HOB	0	2,237	5,468	62	7,767	4,006	82	4,088	13,810
2008	NM	HOB	0	2,388	5,165	85	7,638	5,240	188	5,428	17,366
2009	NM	HOB	0	2,136	10,327	171	12,634	6,884	390	7,274	19,908
2010	NM	HOB	4	2,190	9,806	280	12,280	3,991	366	4,357	16,637
2011	NM	HOB	2	1,944	6,332	137	8,415	2,011	326	2,337	10,752
2012	NM	HOB	0	2,264	5,817	157	8,238	856	176	1,032	9,270
2013	NM	HOB	2	2,341	5,622	100	8,065	738	90	828	8,893
2014	NM	HOB	0	2,358	5,153	257	7,768	511	244	755	8,523
2015	NM	HOB	0	1,979	5,336	399	7,714	1,196	304	1,500	9,214
2016	NM	HOB	0	2,115	5,351	374	7,840	818	226	1,044	8,884
2017	NM	HOB	0	1,870	5,049	157	7,076	1,097	16	1,113	8,189
Sub-Total for HOB			8	34,343	94,608	2,695	131,654	46,064	3,541	49,605	187,514
Sub-Total for NM			8	34,343	94,608	2,695	131,654	46,064	3,541	49,605	187,514
Total:			**8**	**34,343**	**94,608**	**2,695**	**131,654**	**46,064**	**3,541**	**49,605**	**187,514**
										15yr AVG	**12,501**

Table 2.2.8: ATADS Standard Report for Midland International Air and Space Port 2003-2017

			Itinerant					Local			
Calendar Year	State	Facility	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total Operations
2003	TX	MAF	9,612	14,111	23,557	17,704	64,984	4,703	22,745	27,448	92,432
2004	TX	MAF	9,603	12,264	25,137	16,555	63,559	4,149	18,401	22,550	86,109
2005	TX	MAF	9,560	13,783	24,571	16,220	64,134	4,696	18,060	22,756	86,890
2006	TX	MAF	10,309	15,615	26,352	16,197	68,473	4,463	16,563	21,026	89,499
2007	TX	MAF	9,408	14,055	17,745	13,015	54,223	4,172	16,442	20,614	84,302
2008	TX	MAF	8,613	13,827	12,608	7,747	42,795	4,129	16,369	20,498	84,037
2009	TX	MAF	8,574	12,574	18,070	10,447	49,665	2,629	9,547	12,176	61,841
2010	TX	MAF	8,196	14,935	22,290	10,587	56,008	2,792	11,766	14,558	70,566
2011	TX	MAF	8,336	12,479	23,490	12,777	57,082	2,823	14,991	17,814	74,896
2012	TX	MAF	7,903	13,850	25,202	9,972	56,927	2,466	10,345	12,811	69,738
2013	TX	MAF	7,099	16,433	25,111	10,531	59,174	2,402	10,988	13,390	72,564
2014	TX	MAF	8,987	15,464	27,562	10,181	62,194	3,390	11,093	14,483	76,677
2015	TX	MAF	11,478	11,648	22,745	10,379	56,250	4,175	9,960	14,135	70,385
2016	TX	MAF	11,033	9,370	21,423	9,878	51,704	5,471	6,733	12,204	63,908
2017	TX	MAF	11,757	8,715	23,029	6,835	50,336	5,230	6,777	12,007	62,343
Sub-Total for MAF			140,468	199,123	338,892	179,025	857,508	57,690	200,780	258,470	1,146,187
Sub-Total for TX			140,468	199,123	338,892	179,025	857,508	57,690	200,780	258,470	1,146,187
Total:			**140,468**	**199,123**	**338,892**	**179,025**	**857,508**	**57,690**	**200,780**	**258,470**	**1,146,187**
										15yr AVG	**76,412**

Table 2.2.9: ATADS Standard Report for Roswell International Air Center 2003-2017

			Itinerant					Local			
Calendar Year	State	Facility	Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total Operations
2003	NM	ROW	398	8,579	13,861	13,394	36,232	9,741	12,181	21,922	58,154
2004	NM	ROW	94	9,418	18,547	13,495	41,554	12,800	13,032	25,832	67,386
2005	NM	ROW	222	9,379	16,714	12,433	38,748	7,802	13,233	21,035	59,783
2006	NM	ROW	218	8,590	19,998	15,359	44,165	7,408	15,695	23,103	67,268
2007	NM	ROW	225	8,559	14,855	11,284	34,923	6,094	18,324	24,418	66,890
2008	NM	ROW	301	6,953	8,735	5,580	21,569	4,396	9,532	13,928	50,108
2009	NM	ROW	337	6,360	12,020	11,178	29,895	6,005	12,826	18,831	48,726
2010	NM	ROW	116	6,405	9,468	10,242	26,231	4,774	20,953	25,727	51,958
2011	NM	ROW	268	6,999	8,922	7,496	23,685	4,064	7,924	11,988	35,673
2012	NM	ROW	603	6,168	7,232	8,309	22,312	4,373	7,986	12,359	34,671
2013	NM	ROW	519	6,006	6,498	13,329	26,352	2,339	24,384	26,723	53,075
2014	NM	ROW	518	6,551	7,384	12,371	26,824	3,127	16,979	20,106	46,930
2015	NM	ROW	260	5,412	6,522	8,573	20,767	2,382	12,081	14,463	35,230
2016	NM	ROW	285	6,116	6,317	8,771	21,489	1,630	11,161	12,791	34,280
2017	NM	ROW	1,652	4,718	6,593	5,252	18,215	2,301	5,030	7,331	25,546
Sub-Total for ROW			6,016	106,213	163,666	157,066	432,961	79,236	201,321	280,557	735,678
Sub-Total for NM			6,016	106,213	163,666	157,066	432,961	79,236	201,321	280,557	735,678
Total:			**6,016**	**106,213**	**163,666**	**157,066**	**432,961**	**79,236**	**201,321**	**280,557**	**735,678**
										15yr AVG	**49,045**

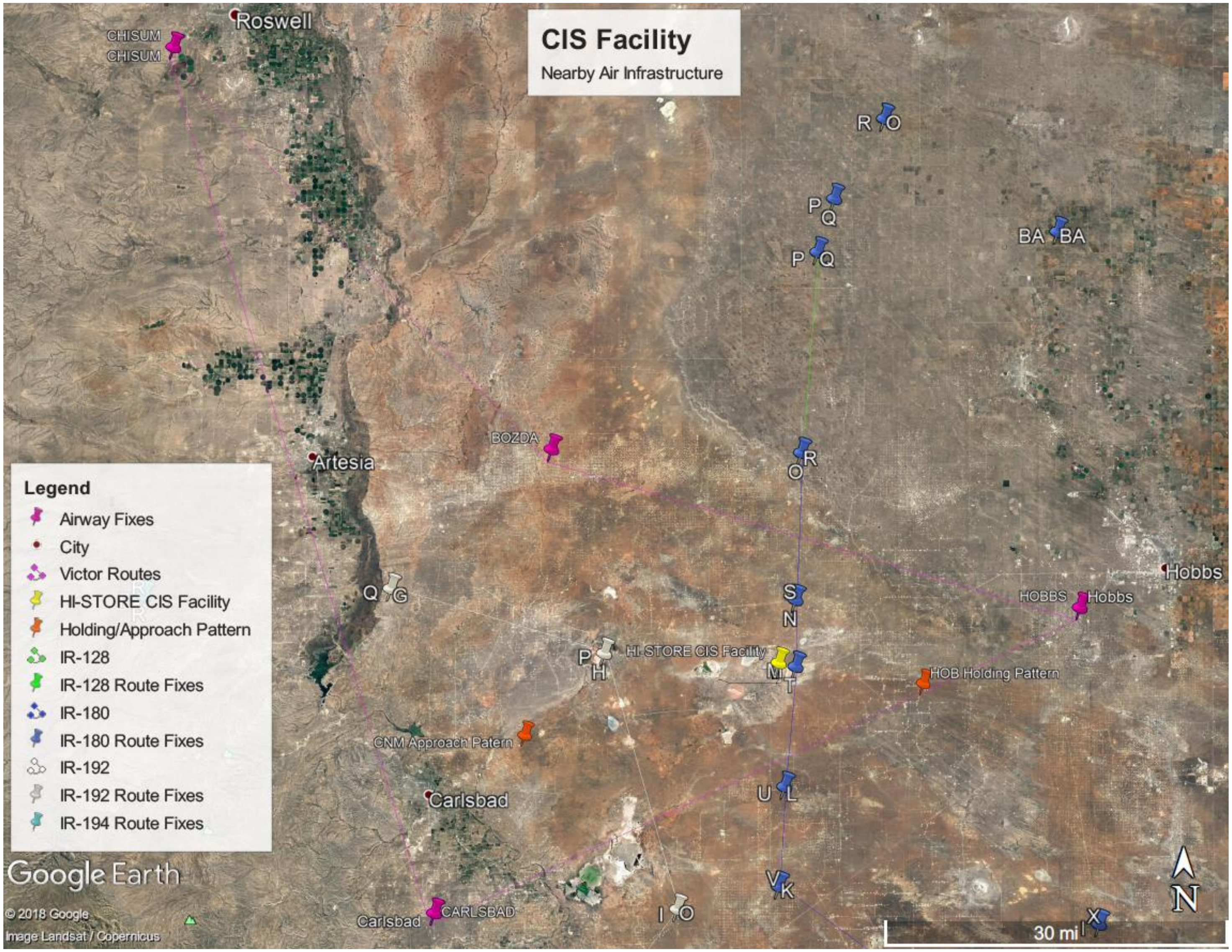

Figure 2.2.6: Air Transportation Infrastructure Near the CIS Facility

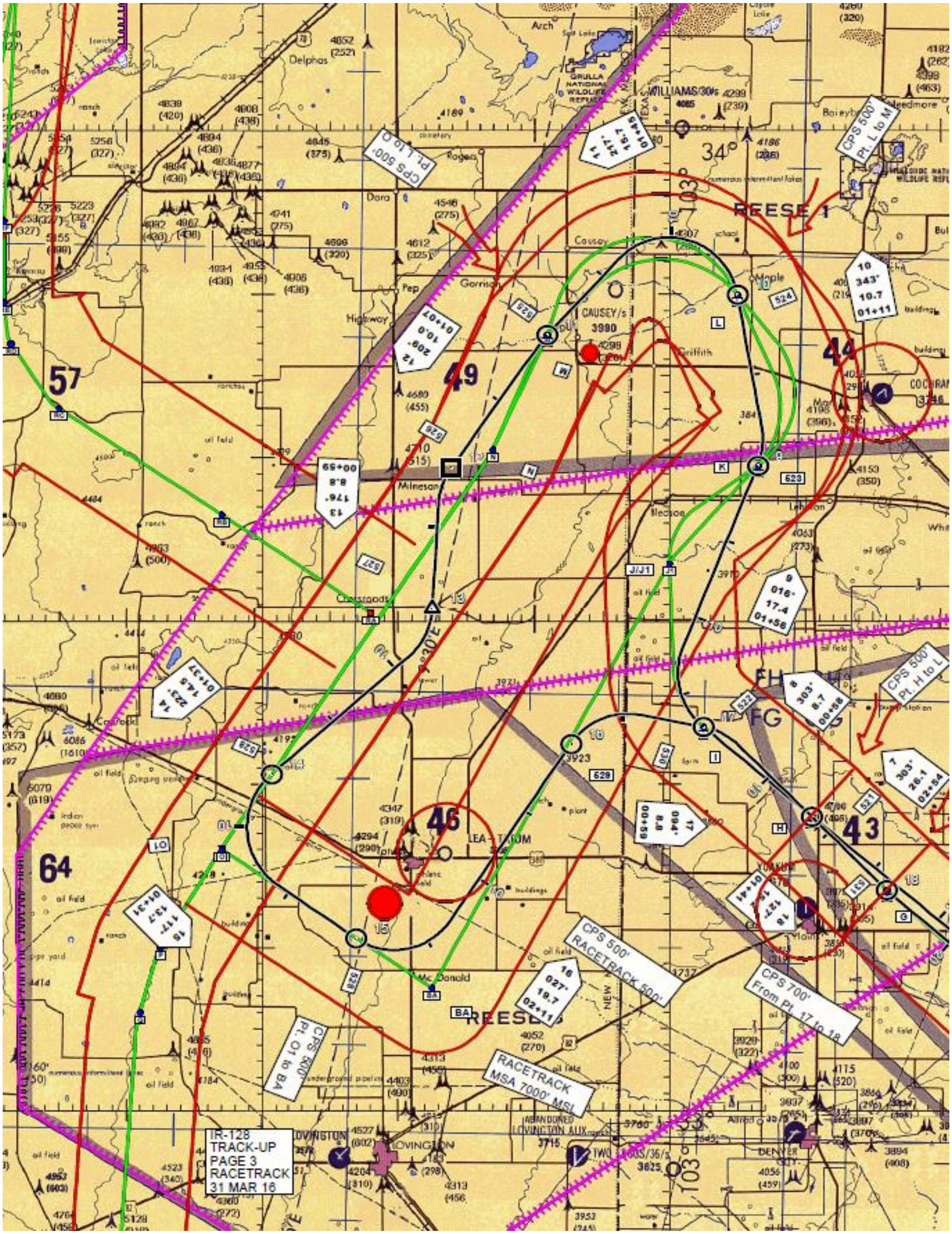

Figure 2.2.7: IR-128 Exit Racetrack

With regard to potential future drilling on the Site, Holtec has an agreement [2.6.9] with Intrepid Mining LLC (Intrepid) such that Holtec controls the mineral rights on the Site and Intrepid will not conduct any potash mining on the Site. Additionally, any future oil drilling or fracking beneath the Site would occur at greater than 5,000 feet depth, which ensures there would be no subsidence concerns [2.1.8].

Based on the data from the borings and analyses, the soils at the site are not susceptible to liquefaction. The soils encountered at the site were evaluated for liquefaction potential using the methods described in Youd, et al., 2001 [2.6.12] as prescribed by Regulatory Guide 1.198 [2.6.11]. Corrected N-values greater than 30 blows per foot are too dense to liquefy in an earthquake of any size, and are therefore classified as non-liquefiable. In addition, soils above the groundwater table are not susceptible to liquefaction [2.6.12].

2.6.5 Slope Stability

The site terrain ranges in elevation from 3,520 to 3,540 feet above mean sea-level sloping gently downward from south to north. Most of the site is flat with slopes ranging from 0 to 3 percent, as shown in Figure 2.6.15. Therefore, there is no risk from slope instability (i.e. landslides) in the vicinity of the Site.

2.6.6 Construction Excavation

During the construction of Phase 1 of the HI-STORE CISF, there will be multiple areas where excavation will be required to accommodate and install the underground facilities; specifically, the Canister Transfer Facilities (CTF) which are located in the Cask Transfer Building (CTB), and the UMAX field. In both cases, the expected total excavation depth is approximately twenty-five (25) feet.

According to the geotechnical borings, there are two layers of subsurface material that will be encountered during construction excavations. The native caliche layer, which is approximately 12 feet in depth from top of existing grade, and the native residual soil layer, which makes up approximately 13 feet of depth for the remaining required excavation depth for site facilities. In no instance is it expected that construction excavations will encounter the native Chinle layer.

In order to accommodate construction vehicle access and industry wide safety standards, it is expected that construction practices will utilize a minimum 1:1 slope around the extents of the excavation pits. This method will create ~124,000 cubic yards (CY) of caliche spoils and ~121,500 CY of residual soil spoils; some of which (~24,000 CY) will be utilized to backfill the excavation area. It should be noted that the residual soil layer will be utilized for the backfill material as it meets the minimum density and shear wave velocity requirements that are required for Space B, referenced in Figure 4.3.1.

Once the areas have been excavated, the supporting soil will be prepared to receive the reinforced concrete Support Foundation Pad (SFP). The residual soil surfaces shall be proof rolled by a heavy vibrating compactor, prior to the placement of compacted fill or foundations. Careful observation shall be made by a professional engineer licensed in New Mexico or their approved representative during proof rolling in order to identify any areas of soft, yielding soils that may require over-excavation and replacement. Once the subsurface has been prepared and compacted, the supporting residual soil fill (Space C) shall be confirmed to have reached a compaction of 95 percent (minimum) of the modified Proctor maximum dry density (in accordance with ASTM

D1557). The compaction should be conducted at or close to the optimum moisture content indicated by the modified Proctor test procedure (ASTM D1557).

Upon completion of subgrade preparation/compaction, placement of the reinforced concrete Support Foundation Pad (SFP) and UMAX Cavity Enclosure Containers (CECs), backfilling of Spaces A and B (Figure 4.3.1) will commence. Space A will consist of a Controlled Low Strength Material (CLSM) or lean concrete that has a minimum compressive strength and density of 1,000 psi and 120 pcf, respectively, as referenced in Table 4.3.3. Since the backfilling process is iterative, as the fill materials are brought back up to finished grade, the sloped areas of the excavation pit that make up Space B of the UMAX lateral subgrade, will be composed of the aforementioned residual soil. Again, it is expected that for Phase 1 of the HI-STORE CISF, and all subsequent phases, ~24,000 CY of this residual soil will be required to fill out the Space B portion of the excavated area.

further consideration in this SAR, are outlined in Table 4.3.1. Environmental conditions and constraints that differ from those bounded by [1.0.6], although minor in nature, are described in Table 4.3.2 and evaluated herein. With the following exceptions, all subsections of the HI-STORM UMAX FSAR are relevant to the HI-STORE CIS evaluation:

1 Criteria related to the HI-TRAC VW system. The HI-TRAC VW system is supplanted by the HI-TRAC CS system in this application, with the design criteria for the HI-TRAC CS system described herein.

2 Service conditions related to the used of Forced Helium Drying (FHD) described in Paragraph 2.3.3.5 of the HI-STORM UMAX FSAR. As the HI-STORE CIS facility accepts only pre-packaged canisters, operations related to internal canister drying are not applicable.

Information consistent with the regulatory requirements related to shielding, thermal performance, confinement, radiological, and operational considerations is also provided. The licensing drawing of the HI-STORM UMAX design variant used in the HI-STORE CIS application is included in Section 1.5 of this SAR. The licensing drawing provides information on the necessary critical characteristics that define the HI-STORE CIS UMAX system for this application.

4.3.2.1 Structural

The applicable loads, affected parts under each loading condition, and the applicable structural acceptance criteria related to the HI-STORM UMAX VVM and ISFSI structures that are compiled in Section 2.0 of [1.0.6] provide a complete framework for the required qualifying safety analyses in this SAR. The VVM storage system at the HI-STORE CIS ISFSI will be functionally identical to that certified in the HI-STORM UMAX docket. The conservative approach of basing the HI-STORE CIS design on the certified HI-STORM UMAX design is supported by the following:

1. The subgrade and under-grade soil properties at the HI-STORE CIS site are uniformly better than those assumed for the general certification of the HI-STORM UMAX system. These properties can be found in the geotechnical investigation completed December 2017 [2.1.24]. HI-STORE Bearing Capacity and Settlement Calculation report HI-2188143 [4.3.5] details the methodology used to compute the bearing capacity at the site. This calculation confirms the required bearing capacity is met for the soil underneath the planned construction.

2. The top-of-pad earthquake spectra corresponding to a 10,000-year earthquake at the HI-STORE CIS site is enveloped by that assumed for the HI-STORM UMAX in its general certification. (Subsection 4.3.6 and Table 4.3.3 provide a summary of the applicable seismic loadings for the HI-STORE CIS facility).

3. The long-term settlement at the HI-STORE CIS ISFSI is computed in [4.3.5] to be less than that assumed in the certification of the HI-STORM UMAX. The methodology followed is stated in the calculation itself. As stated in item 1, above, soil properties at the HI-STORE CIS site are more favorable than those assumed in the HI-STORM UMAX system certification [2.1.24].

The structural qualification of HI-STAR 190 to the loadings of 10CFR71.71 (normal condition) and 10CFR71.73 (accident condition) in [1.3.6] are clearly much more severe than those encountered during its handling in the CTB. Nevertheless, certain structural requirements are unique to the operations in the CTB that are unique to the Short Term Operations. Table 4.3.6 contains the structurally significant loadings on the HI-STAR 190 cask in the Cask Transfer Building. Acceptance criteria are provided in Section 4.4.

4.3.4.2 Thermal

The thermally-significant loadings on HI-STAR 190 that warrant safety demonstration are summarized in Table 4.3.6. The permissible temperature limits for all steel weldments in casks and structures used at HI-STORE, provided in Table 4.4.4, are applicable to the HI-STAR 190.

4.3.4.3 Shielding

HI-STAR 190 is designed to meet the dose attenuation requirements of 10CFR71 [1.3.2] which far exceed those expected of on-site transfer casks. However, HI-STAR 190's contribution to meeting the dose limits of Part 72, set down in Subsection 4.4 herein, is considered in demonstrating compliance.

4.3.4.4 Confinement

The confinement function of the canister is unaffected by the function of HI-STAR 190.

4.3.4.5 Criticality Control

HI-STAR 190 does not participate in the criticality control function.

4.3.5 Canister Transfer Facility (CTF)

The HI-STORE CTF is an underground structure used to effectuate transfer of the SNF canister from the transport cask (HI-STAR 190) to the transfer cask (HI-TRAC CS).

4.3.5.1 Structural

The CTF includes both structural and non-structural radiation shielding components that are classified as important-to-safety. The structural steel components of the CTF are designed to meet the stress limits of Section III, Subsection NF, of the ASME Code [4.5.1] for normal, off-normal and accident conditions, as applicable. The CTF reinforced concrete structures shall meet the applicable strength requirements of ACI 318-05 [5.3.1].

The CTF must withstand the loads associated with the weights of each of its components, including the weight of the HI-TRAC CS transfer cask with the loaded MPC stacked on top during the canister transfer, and the weight of the transport cask with the loaded MPC staged on the CTF foundation slab. The CTF shall be capable of withstanding lateral loading in a seismic event as determined by the provisions of Chapter 8 of ASCE 4 [4.3.4].

4.3.5.2 Thermal

Table 4.3.3

Applicable Earthquake and Long Term Settlement data for the Certified HI-STORM UMAX System and the HI-STORE CIS Facility

#	Data	HI-STORM UMAX Generic License Value (see Note 1)	HI-STORE CIS Site Value	Comment
7	Strain compatible effective shear wave velocity in Space B	450 ft/sec minimum	780 ft/sec minimum	Space will contain native soil.
8	Strain compatible effective shear wave velocity in Space C	485 ft/sec minimum	980 ft/sec minimum	Space will contain native soil.
9	Strain compatible effective shear wave velocity in Space D, V	485 ft/sec minimum	980 ft/sec minimum	Space will contain native soil.
10	Density of plain concrete in the Closure Lid (nominal)	150 lb/cubic feet	150 lb/cubic feet	Used in shielding calculations
11	Reference compressive strength of plain concrete in the Closure Lid	4,000 psi	4,000 psi	Used in analysis of mechanical loadings on the Closure Lid
12	Minimum compressive strength of SES in Space A (see Figure 4.3.1)	1,000 psi	1,000 psi	Used in tornado missile impact analysis and SSI analysis
13	Two orthogonal horizontal and one vertical ZPAs for 10,000 -year return earthquake (DBE)	-	0.15,0.15, 0.15	5% Damped Reg. Guide 1.60 spectra [4.3.2]
14	Two orthogonal horizontal and one vertical ZPAs for 1000- year return earthquake (OBE)	-	0.10, 0.10, 0.10	2% Damped Reg. Guide 1.60 spectra [4.3.2]
15	Two orthogonal horizontal and one vertical ZPAs for Design Extended Condition Earthquake (DECE)	-	0.25,0.25, 0.25	5% Damped Reg. Guide 1.60 spectra [4.3.2]

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