APPENDIX D
AIR QUALITY AND CLIMATE

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D.1 Affected Environment

D.1.1 Nevada National Security Site

D.1.1.1 Meteorology

This section provides further details on the meteorology discussion presented in Chapter 4, Section 4.1.8.1, of this *Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (NNSS SWEIS)*. **Table D–1** shows the meteorological data used in the climate and air quality analysis. The use of different data in the various analyses reflects the availability of historical data collection efforts and consistency in the methodology used in the data collection.

Table D–1 Summary of Meteorological Data Used in the Nevada National Security Site Air Quality Analysis

Years	*Meteorological Parameter*	*Reference*
Climatological Data		
1983-2002	Temperature	NOAA (2006)
1983-2002	Snowfall	NOAA (2006)
1983-2002	Thunderstorms	NOAA (2006)
1966-2005	Precipitation	DOE (2008f), NOAA (2006)
1954-1983	Tornado Frequency	NRC (1986)
1973-1977	Mixing Heights – Yucca Flat	NOAA (2006)
2004-2008	Wind Roses MEDA Stations	NOAA (2010)
Dispersion Modeling		
2003-2007	Desert Rock Upper-Air – wind and temperature	DOE (2009b)
2003-2007	Desert Rock Surface – wind, temperature, cloud cover	DOE (2009b)

Temperature. Temperatures, especially daily maximum temperatures, have been trending upward over at least the last 25 years. The average annual maximum temperature at most Nevada National Security Site (NNSS) locations have increased about 4 degrees Fahrenheit (°F) from 1983 through 2002, while average annual minimum temperature trends ranged from about -2 °F to +3.3 °F between NNSS locations, with an average increase of about +1 °F (NOAA 2006).

Precipitation. Much of the 1980s and 1990s were wetter than normal. The rain gauge network within the NNSS, however, reflects local variations and tends to show precipitation amounts over the last 10 years being nearly equal or slightly greater than in the last 40 years (DOE 2008f).

Snowfall varies widely within the NNSS, but is generally confined to elevations above about 6,000 feet and is infrequent below about 4,000 feet. An estimated annual average of about 60 inches of snow might fall on the highest point in the NNSS (Rainier Mesa at 7,490 feet). At Desert Rock (southeastern NNSS, 3,251 feet), the average annual measured snowfall is about 3 inches (NOAA 2006).

Thunderstorms occur primarily during two time periods – in spring due to cold front passages and in middle to late summer due to convection from daytime heating. The two thunderstorm recording stations (Yucca Flat in east–central NNSS and Desert Rock in extreme southeastern NNSS) both report about 15 thunderstorm days per year, with multiple peaks in activity between early July and early September. Thunderstorms are more frequent and begin earlier in the afternoon on the mesas compared with lower elevations. Thunderstorm activity tends to reach a maximum in the early afternoon in the northern NNSS and in the later afternoon in the southern NNSS. Some thunderstorms move into the southern NNSS after midnight after forming earlier in the day over the Spring Mountain Range located to the south of the NNSS (NOAA 2006).

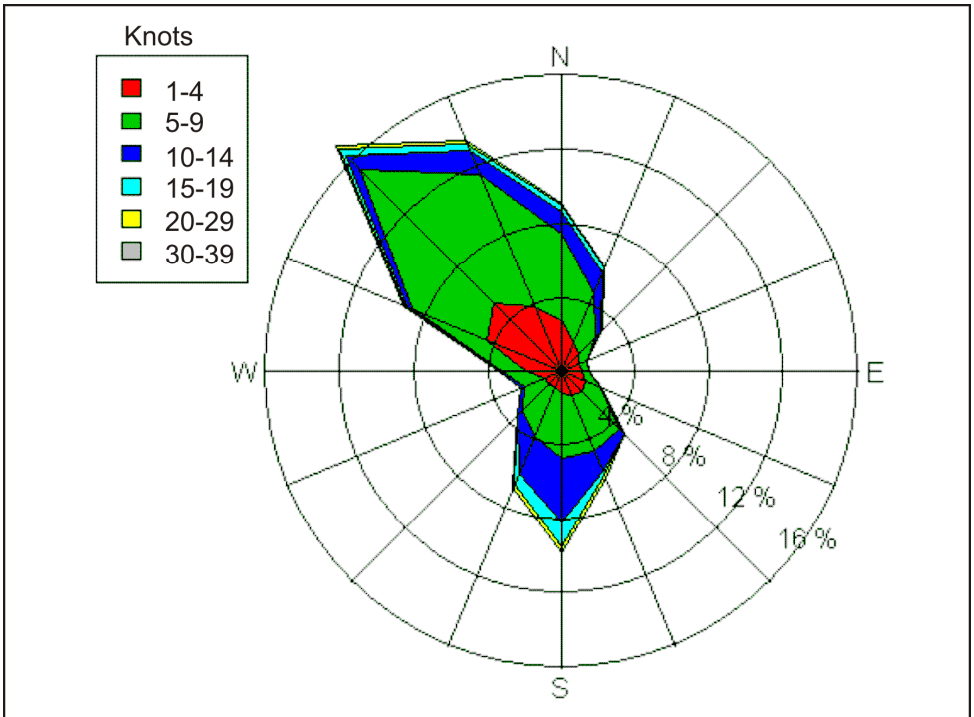
It is rare for a thunderstorm to produce more than about 0.5 inches of rain at a given location, so flooding is rarely a problem on the NNSS. Thunderstorms in the NNSS can be severe at times, with strong surface wind gusts and intense cloud-to-ground lightning, but hail is infrequent and hail size is small (less than about 0.5 inches in diameter). Cloud-to-ground lightning activity tends to maximize over higher elevations particularly during July through September (NOAA 2006). Tornadoes are very rare in Nevada as a whole, with a 1954 to 1983 tornado climatology indicating a statewide tornado strike probability of three per year (NRC 1986).

Wind Flow Patterns. Since nighttime low clouds are infrequent and nighttime mixing heights tend to be less than 700 feet (according to measurements taken at the Yucca Flat station during the period of record from 1973–1977), localized terrain gradients are the dominant nighttime wind flow modifier. In summer months, daytime heating is sufficient to generate uneven heating over the varying terrain, which creates up-slope (southerly) winds during the day. In the winter, daytime winds tend to be down-slope (northerly) (NOAA 2006).

Near the Big Explosives Experimental Facility (BEEF) (see **Figure D–1**), the dominant flow is northwesterly, with a secondary peak from the south. The most significant nearby elevated terrain runs north–south about 6 miles west of BEEF and curves towards the east about 9 miles north of BEEF, which may explain the down-slope preference from the northeast and the up-slope preference towards the north. The maximum observed peak wind speed during the period from 2004–2008 was 100 miles per hour, but the more typical annual maximum wind speed was around 70 miles per hour (not shown).

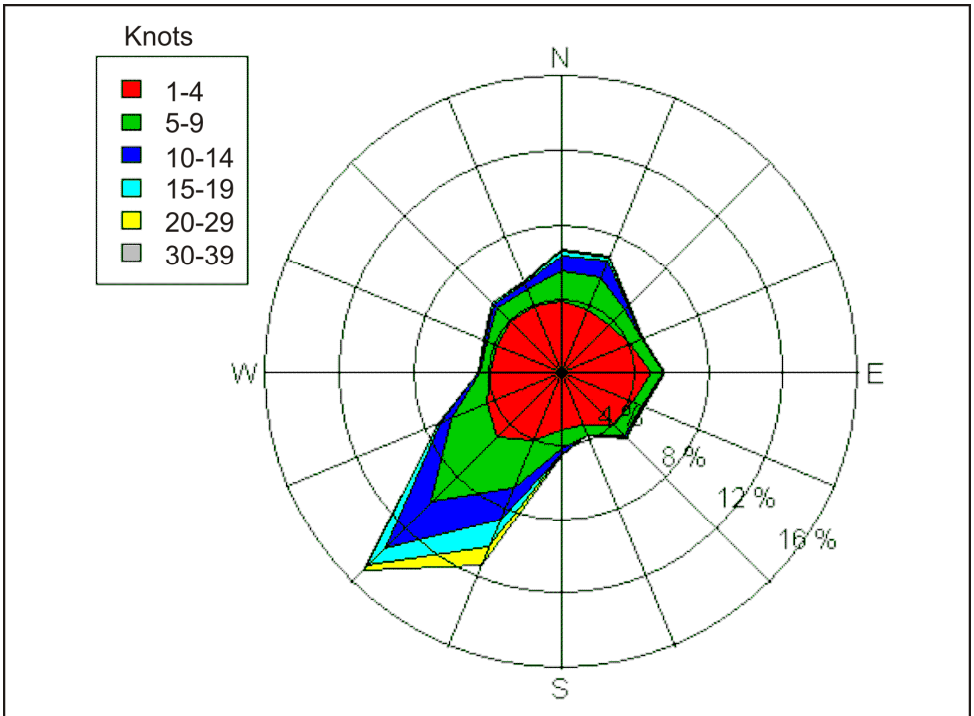
Near the Nonproliferation Test and Evaluation Complex (NPTEC) (**Figure D–2**), the dominant flow is south-southwesterly, with a minor peak from the north. The nearby terrain is fairly uniform in most directions, though the elevation steadily increases for about 4 miles northward and decreases for about 3 miles southward, which may explain the southerly and northerly up-slope and down-slope directions, respectively. The maximum observed wind speed during the period from 2004–2008 was about 90 miles per hour, but the more typical annual maximum wind speed was around 55 miles per hour.

Near Test Cell C (see **Figure D–3**), the dominant flow is northeasterly, with a secondary peak from the southwest. The most significant nearby elevated terrain is about 4 miles southeast and about 4 miles northeast of the station. Since the elevated terrain to the southeast faces west, away from the rising sun, it may not provide the uneven heating necessary to create slope flows. Instead, the terrain to the northeast may dominate up-slope and down-slope effects, perhaps leading to the northeasterly and southwesterly flow preferences. The maximum observed wind speed during the period from 2004–2008 was about 78 miles per hour, but the more typical annual maximum wind speed was around 56 miles per hour (not shown).



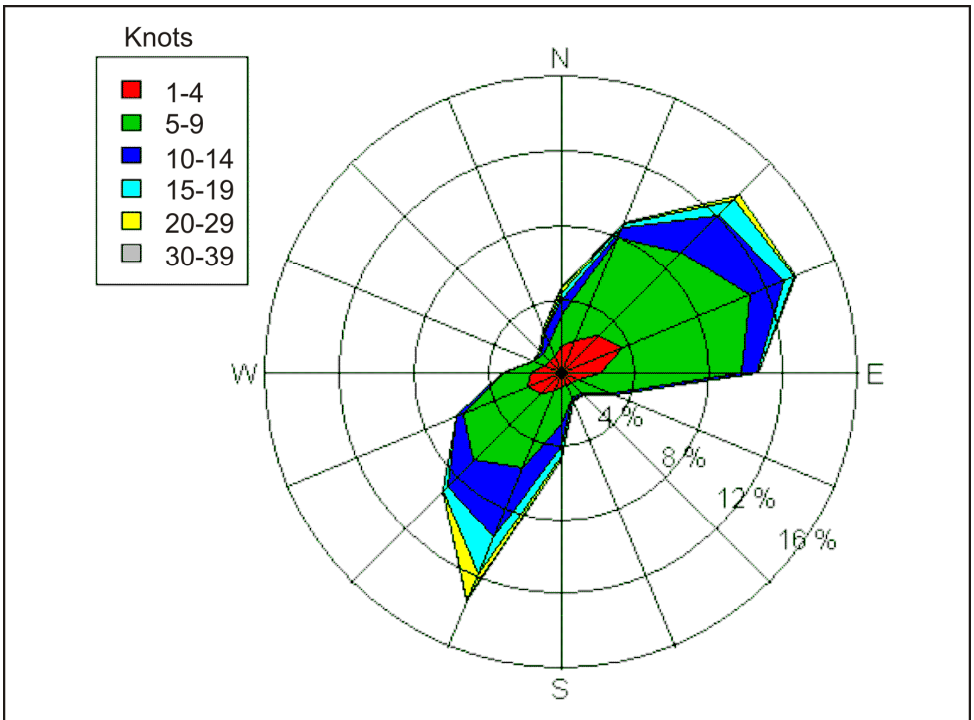
Note: Encompassing 2004 through 2008 (NOAA 2006).
To convert knots to ms^{-1}, multiply by 0.5144. To convert knots to mph, multiply by 1.151.

Figure D–1 Annual Average Wind Rose for Meteorological Data Acquisition Station 49 near the Big Explosives Experimental Facility



Note: Encompassing 2004 through 2008 (NOAA 2006).
To convert knots to ms^{-1}, multiply by 0.5144. To convert knots to mph, multiply by 1.151.

Figure D–2 Annual Average Wind Rose for Meteorological Data Acquisition Station 13 near the Nonproliferation Test and Evaluation Complex



Note: Encompassing 2004 through 2008 (NOAA 2006).
To convert knots to ms^{-1}, multiply by 0.5144. To convert knots to mph, multiply by 1.151.

Figure D–3 Annual Average Wind Rose for Meteorological Data Acquisition Station 26 near Test Cell C

Calm winds are infrequent at the NNSS. For example, at the stations near BEEF (see Figure D–1), NPTEC (see Figure D–2), and Test Cell C (see Figure D–3), the percentage of observations that showed wind speeds of less than 1 knot were between 1 and 2 percent. Locations in basins such as the dry lake beds in the Yucca and Frenchman Flats tend to have the lightest winds (i.e., average annual wind speeds of about 5 to 10 miles per hour). Mesa locations tend to have slightly stronger winds (i.e., average annual wind speeds of about 11 miles per hour) because they tend to reflect the larger-scale wind flow and have less surface roughness. Mountaintop locations tend to have the fastest winds (i.e., average annual wind speeds of about 13 to 20 miles per hour) because they are strongly influenced by upper-level winds. Locations with steep elevation gradients also tend to have higher wind speeds due to stronger up-slope and down-slope wind flows. Seasonally, winds tend to be strongest at all locations on the NNSS during the spring due to more-frequent frontal passages and weakest in the fall. Wind gusts in excess of 55 miles per hour can be observed during springtime frontal passages and during summertime convective thunderstorms (NOAA 2006). When unaccompanied by rainfall, stronger springtime wind speeds can commonly lead to dust storms.

D.1.1.2 Ambient Air Quality on and near the Nevada National Security Site

This section expands the ambient air quality discussion presented in Chapter 4, Section 4.1.8.2, of this *NNSS SWEIS*.

D.1.1.2.1 Existing Air Quality

Emissions from Stationary Sources. Title V of the Clean Air Act gives states the authority to use air quality permits to regulate stationary source emissions of criteria pollutants. At the NNSS, there is one Class II Air Quality Permit. Class II permits are issued for "minor" sources where the following emissions limits are in effect: (1) annual emissions of any one criteria pollutant must not exceed 100 tons; (2) annual emissions of any one hazardous air pollutant (HAP) must not exceed 10 tons (including lead); or (3) annual emissions of any combination of HAPs must not exceed 25 tons (including lead). The emissions limits with associated with the NNSS permit are occasionally re-evaluated and reissued—most recently in 2009. The NNSS facilities regulated by this permit include the following (DOE 2009d, 2009e):

- Over 15 facilities and 185 pieces of equipment in Areas 1, 3, 5, 6, 12, 23, and 27
- NPTEC (in Area 5)
- Sitewide chemical release areas
- BEEF in Area 4
- Explosives Ordnance Disposal Unit in Area 11
- Explosive pads at the HEST [High Explosive Simulation Technique] test range in Area 14,
- Test Cell C in Area 25, and Port Gaston in Area 26

A summary of the historical stationary source emissions and the maximum permitted emission rates are shown in **Table D–2** based on reports submitted to the Nevada Division of Environmental Protection. The actual annual emissions of individual criteria pollutants have been well below the permitted levels over the past 11 years. Most of these emissions are associated with emissions from diesel generators (DOE 2009d). The Class II permit also requires that the best practical method be used to limit the resuspension of soil dust into the air during various site activities. At the NNSS, the main method of dust control is the use of water sprays. Observations of fugitive dust tests conducted during 2008 showed no excessive fugitive dust events on the NNSS (DOE 2009d).

Table D–3 shows the 2008 onsite emissions of criteria pollutants and HAPs associated with permitted onsite stationary sources. Emissions from the current construction and associated surface disturbance activities were much smaller relative to the stationary sources and the other mobile sources and were not explicitly calculated. Levels of particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) for stationary sources have not been explicitly reported by the NNSS, so the $PM_{2.5}$ levels were conservatively assumed to be equal to emission rates of particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}).

Onsite stationary sources emitted approximately 5.18 tons of criteria pollutants in 2008, the bulk of which was attributable to diesel generators. The stationary sources emitted 0.09 tons of HAPs in 2008, most of which was attributable to chemical spill tests at NPTEC.

Table D–2 Calculated Emissions and Annual Permitted Amounts of Criteria Pollutants and Hazardous Air Pollutants from Nevada National Security Site Stationary Sources, 1998–2008 (tons per year)

Pollutant	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*Annual Permitted Amount*
PM_{10}	1.11	1.7	1.46	2.05	3.61	2.39	0.94	0.84	0.69	0.54	0.22	*25.59*
CO	1.85	1.87	2.76	4.84	4.6	1.79	0.24	0.15	0.43	0.51	0.94	*9.57*
NO_x	7.57	8.07	12.75	22.23	21.09	8.11	1.01	0.69	2.02	1.21	3.36	*28.53*
SO_2	0.37	0.42	0.98	1.68	1.62	0.76	0.12	0.04	0.03	0.01	0.06	*3.49*
VOCs	11.76	1.99	1.89	2.01	2.1	1.21	4.6	1.94	1.4	1.14	0.6	*14.91*
HAPs	NR [a]	NR [a]	0.01	0.03	0.01	0	0.41	0.05	1.87	0.02	0.09 [b]	*N/A*
Criteria pollutant total [c]	22.66	14.05	19.85	32.84	33.03	14.26	7.32	3.71	6.44	3.43	5.18	*N/A*

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NO_x = nitrogen oxides; NR = not reported; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] HAPs may have been released in 1998 and 1999 but were not reported.

[b] In 2008, 95 percent of HAPs were emitted during chemical spill tests at the Nonproliferation Test and Evaluation Complex.

[c] This total includes all displayed pollutants except HAPs.

Source: DOE 2009d.

Table D–3 Calculated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Nevada National Security Site Stationary Sources, 2008 (tons per year)

Pollutant	*BEEF*	*NPTEC*	*Storage Tanks*	*Other Sources* [a]	*TOTAL (all programs)*	*Reference*
PM_{10}	0.01	0	0	0.212	*0.22*	DOE 2009d, pages 3-22 and 3-23
$PM_{2.5}$	0.01	0	0	0.212	*0.22*	
CO	0.17	0.01	0	0.76	*0.94*	
NO_x	0	0.001	0	3.36	*3.36*	
SO_2	0	0	0	0.06	*0.06*	
VOCs	0.001	0.12	0.35	0.13	*0.60*	
Lead	N/A	N/A	N/A	N/A	*0.0023*	DOE 2009d, Table 10.2, page 10-3
HAPs	N/A	N/A	<0.09	N/A	*0.09*	DOE 2009d, pages 3-22 and 3-23

< = less than; BEEF = Big Explosives Experimental Facility; CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NO_x = nitrogen oxides; NPTEC = Nonproliferation Test and Evaluation Complex; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Note: Activities are partitioned by source type.

[a] Other sources include diesel-fired generators, aggregate and concrete handling, cement services equipment, and portable bins.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 [Motor Vehicle Emission Simulator 2010] (Version 20091221; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the NNSS. Onsite government-owned mobile source activity data were derived from the onsite vehicle counts in the *Traffic Study and Cost Benefit Analysis to Renovate Existing Roadways, Nevada Test Site* (referred to hereafter as the "1999 NTS road renovation study") (BN 1999). **Table D–4** and the discussion that follows contain further details on the activity and vehicle data used. See Chapter 4, Section 4.1.3, for more details.

Table D–4 Vehicle Activity Data Used to Model Emissions from Onsite Government Vehicles at the Nevada National Security Site

Vehicle Type Observed [a]	*MOVES2010 Vehicle Type*	*MOBILE6 Vehicle Type*	*Count*	*Annual VMT*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Types Used*	*Average Vehicle Age (model year)*	*Vehicle Fuel Economy (miles per gallon)*	*VMT per Applicable Fuel Type*	*Annual Lead Emissions (pounds)*
Single-unit trucks (2 to 3 axles)	Single-unit, short-haul trucks	Light-duty trucks, 6,001–8,500	141	715,842	98	Biodiesel (B-20) and No. 2 diesel	11 years (1997)	11.2	61,247 No. 2 diesel 324,195 B-20	0.007
Cars/light trucks	Light-duty passenger vehicles	Light-duty passenger vehicles, all	1,007	4,191,978	95	E85 (assumed to be E10 for MOVES modeling) and unleaded gasoline	9 years (1999)	24.1	2,974,970 Unleaded gasoline 1,258,657 E10	0.021
Cars/light trucks	Light-duty trucks	Light-duty trucks, 0–6,000	1,007	5,556,808	95	E85 (assumed to be E10 for MOVES modeling) and unleaded gasoline	9 years (1999)	18.5	3,875,501 Unleaded gasoline 1,639,656 E10	0.02
Buses	Transit buses	Heavy-duty transit buses, all	70	90,228	95	Biodiesel (B-20) and No. 2 diesel	9 years (1999)	4.4	77,933 No. 2 diesel 412,522 B-20	0.0087

MOBILE6 = Mobile Source Emission Factor Model; MOVES2010 = Motor Vehicle Emission Simulator 2010; VMT = vehicle miles traveled.
[a] Vehicle types observed in Traffic Study and Cost Benefit Analysis to Renovate Existing Roadways, Nevada National Security Site (BN 1999).
Note: Modeling performed using MOVES2010.

Onsite government vehicle data used for emissions modeling are discussed below (see Chapter 4, Section 4.1.3, for more details):

- **Onsite government vehicle types.** The vehicle types observed in the 1999 NTS road renovation study (BN 1999) were linked to MOVES vehicle types, as shown in Table D–3. Note that the light-duty vehicles and light-duty passenger trucks were not separated in the road renovation study, so vehicle data derived from that study were split equally among light-duty vehicles and light-duty passenger trucks for the purposes of MOVES modeling.
- **Vehicle counts.** The vehicle counts in Table D–4 were derived from those observed in the 1999 NTS road renovation study (BN 1999), which were scaled to reflect the change in NNSS employment since that study.
- **Vehicle miles traveled (VMTs).** The VMTs in Table D–4 were derived from the vehicle counts observed in the 1999 NTS road renovation study (BN 1999) and from assumed vehicle destinations.
- **Vehicle age.** The average national default age was used Table D–4 for each vehicle type since this information was not provided in the the 1999 study.
- **Fuel types.** The National Nuclear Security Administration (NNSA) provided fuel usage amounts of unleaded gasoline (435,000 gallons), E85 (184,000 gallons), biodiesel (343,191 gallons), and No. 2 diesel (644,844 gallons) by onsite government vehicles for fiscal year 2009. These fuel usage amounts were assumed to be similar to usage in calendar year 2008. Fuel amounts are not directly used in MOVES; rather, fuel fraction and fuel supply market share were incorporated into the model in the following way:
  - **Fuel types to vehicles.** Unleaded gasoline and E85 was allocated only to light-duty passenger trucks and light-duty vehicles. Buses and single-unit, short-haul heavy-duty trucks were assigned No. 2 diesel and biodiesel. E85 ethanol or B-100 biodiesel are not included in MOVES. As a conservative assumption, the fuel properties for E10 were used in place of E85 and B-20 in place of B-100.
  - **Market shares of each fuel.** The MOVES default fuel supply market share for Nye County includes only one formulation of diesel and two formulations of gasoline (due mostly to changes in Reid vapor pressure) with a seasonal split of 0.286 and 0.714. However, these default formulations do not include ethanol or biodiesel, which are used at the NNSS. The NNSS fuel usage numbers have an ethanol-to-(gasoline+ethanol) fuel usage ratio of 0.297. The corresponding gasoline market share was then adjusted as follows: (1 - 0.297) = 0.703. Multiplying this gasoline market share by the MOVES default market shares of gasoline formulations results in a 0.201 and 0.502 split between the two types of unleaded gasoline. For biodiesel and No.2 diesel, the NNSS fuel usage is 0.159, so the No. 2 diesel market share was set to 0.841.
- **Lead emissions per vehicle and fuel types.** The U.S. Environmental Protection Agency's (EPA) *Air Quality Criteria for Lead* (EPA 2006) was used to estimate the lead emissions factors for mobile sources. The reference has lead-mass-per-mile factors for gasoline, for No. 2 diesel consumed by trucks, and for No. 2 diesel consumed by buses. The reference contains no lead emission factors for ethanol or biodiesel, so it was conservatively assumed that the same factors apply for unleaded gasoline and No. 2 diesel, respectively. The results are shown in Table D–4.
- **Monthly and hourly distributions of VMT.** MOVES default data were used.
- **Road types.** All Nye County roads are assumed to be rural roads with unrestricted access.

- **Meteorology and road speed distributions.** MOVES default data for Nye County were used.
- **Emissions Types.** Only emissions from running exhaust, evbrake wear, and tire wear were modeled.

Table D–5 shows the modeled current (approximately 2008) onsite mobile emissions of criteria pollutants and HAPs associated with NNSS government-owned vehicles. Total onsite emissions from stationary sources (shown in more detail in Table D–2) are also provided in Table D–4 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources.

The mobile source criteria pollutant emissions were dominated by carbon monoxide (39.6 tons) and, to a lesser extent, nitrogen oxides (13.9 tons). Light-duty passenger trucks were the largest onsite mobile source emitters (65 percent of onsite government-owned vehicle emissions), followed by light-duty vehicles (21 percent).

Table D–5 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Nevada National Security Site Stationary Sources and Government-Owned Mobile Sources, 2008 (tons per year)

	Nye County						
	On NNSS						
	Government-Owned Mobile Source Type (Modeled)						
Pollutant	***Light-Duty Vehicles***	***Light-Duty Passenger Trucks***	***Buses***	***Single-Unit, Short-Haul Trucks***	***Total***	***Stationary Source Type (calculated)***	***Total***
PM_{10}	0.11	0.20	0.11	0.40	0.82	*0.22*	*1.0*
$PM_{2.5}$	0.066	0.12	0.10	0.37	0.66	*0.22*	*0.88*
CO	9.3	28.1	0.55	1.6	39.6	*0.94*	*40.5*
NO_x	2.1	6.9	1.3	3.6	13.9	*3.36*	*17.3*
SO_2	0.026	0.048	0.00035	0.0014	0.076	*0.06*	*0.14*
VOCs	0.10	0.60	0.013	0.084	0.80	*0.6*	*1.4*
Lead	0.0000050	0.000010	0.0000035	0.0000035	0.000022	*0.0023*	*0.0023*
HAPs	0.0098	0.046	0.00029	0.0018	0.058	*0.09*	*0.15*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.
Note: Government-owned mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–3.

Emissions from Commuter Vehicles. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from employees commuting to the NNSS using personal vehicles. **Table D–6** and the following discussion contain further details on the activity and vehicle data that were used. Chapter 4, Section 4.1.3, of this *NNSS SWEIS* contains information regarding the origin of these activity numbers.

Private-vehicle commuter activity data were based on employment numbers and residence information. Half of the commuter vehicles were assumed to be light-duty vehicles and the other half, light-duty passenger trucks. To estimate the personal-vehicle emissions in various locations, it was assumed that all personal-vehicle commuters enter the NNSS via Mercury Highway and park at Entry Gate 100. This commuting pattern results in about 4 miles round trip on site per commuter traveling by personal vehicle at the NNSS. It was also assumed that all personal-vehicle commuters coming from Clark County use

U.S. Route 95, which results in about 12 miles round trip per commuter traveling by personal vehicle within Nye County and outside of the NNSS. For Clark County roads, GIS [geographic information system] was used to estimate the total length of various road types; roads outside and inside of the Las Vegas spaghetti bowl correspond to rural and urban roads, respectively. For the Clark County portion of travel, the following fractions were used: 0.176 rural restricted, 0.595 rural unrestricted, 0.058 urban restricted, and 0.171 urban unrestricted.

Table D–6 Vehicle Activity Data Used to Model Emissions from Commuting to and from the Nevada National Security Site

MOVES2010 Vehicle Type	*Count Originating in Clark County*	*Count Originating in Nye County*	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the NNSS*	*Annual VMT Within Nye County and Inside the NNSS*	*Percentage Annual Clark County VMT Occurring on Weekdays*	*Percentage Annual Nye County VMT Outside the NNSS Occurring on Weekdays*	*Percentage Annual Nye County VMT Inside the NNSS Occurring on Weekdays*	*Fuel Type Used*
Light-duty vehicles	328	97	9,868,361	2,808,808	430,088	85	90	87	Unleaded gasoline
Light-duty passenger trucks	327	98	9,868,361	2,808,808	430,088				
Transit buses	11	0	420,347	19,667	147,576	89	89	89	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; NNSS = Nevada National Security Site; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

The default MOVES fuel market shares, meteorology, vehicle speed distributions, and monthly and hourly VMT distributions were used in the analysis. Only emissions associated with vehicle exhaust, brake wear, and tire wear were modeled. As was done for onsite government vehicles, light-duty vehicles and light-duty passenger trucks were conservatively assumed to have an average age of 9 years.

Emissions from transit buses were not modeled using MOVES2010. Instead, emissions from the NNSS bus fleet were modeled using the age of the current bus fleet (all 2003 model year buses) all meeting the 1998 EPA heavy-duty emissions standards. These emissions standards include the following: 72.5 grams per mile of carbon monoxide; 18.7 grams per mile of nitrogen oxides; and 0.468 grams per mile for particulate matter, conservatively assumed to be entirely $PM_{2.5}$. Sulfur dioxide emissions were calculated using Equation 39 from the PART5 Model, Appendix A (EPA 1995b), and using the standard fuel economy of transit buses from MOBILE6 [Mobile Source Emission Factor Model] (EPA 2003). These emissions standards were combined with the bus fleet annual VMT to arrive at annual emissions. The onsite government bus counts derived from the 1999 NTS *Traffic Study and Cost Benefit Analysis to Renovate Existing Roadways* (BN 1999) were used for the spatial allocation. All buses were assumed to make round trips between Clark County and the NNSS, spending 8 round-trip miles inside Nye County.

Table D–7 shows the modeled current (approximately 2008) mobile emissions of criteria pollutants and HAPs associated with onsite employees commuting to the NNSS. Light-duty passenger vehicles contributed about 21 percent of the criteria pollutant total, while light-duty passenger trucks contributed 46 percent and commuter buses, 33 percent. Carbon monoxide was emitted in the largest amounts (136.5 tons) among the criteria pollutants. Commuting activities related to the NNSS emitted approximately 0.14 tons of HAPs in 2008. The majority (71 percent) of emissions related to commuting to the NNSS took place in Clark County, while about 16 percent took place in the portion of Nye County that is outside of the NNSS, and the remaining 13 percent took place on the NNSS.

Table D–7 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Nevada National Security Site, 2008 (tons per year)

	Light-Duty Vehicles (Modeled)			*Light-Duty Passenger Tucks (Modeled)*			*Transit Buses (calculated)*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.25	0.076	0.025	0.37	0.11	0.036	0.22	0.010	0.076	*0.83*	*0.19*	*0.14*	*1.2*
$PM_{2.5}$	0.14	0.044	0.015	0.2	0.058	0.02	0.22	0.010	0.076	*0.56*	*0.11*	*0.11*	*0.78*
CO	20.9	6.1	2.1	44.5	14	4.9	33.6	1.6	11.8	*97*	*21*	*18.5*	*136.5*
NO_x	4.5	1.5	0.48	11.5	3.6	1.2	8.7	0.41	3.0	*24*	*5.3*	*4.6*	*34*
SO_2	0.073	0.02	0.0064	0.11	0.027	0.0097	0.010	0.00047	0.0035	*0.19*	*0.047*	*0.019*	*0.26*
VOCs	0.24	0.071	0.024	1.1	0.3	0.11	N/A	N/A	N/A	*1.2*	*0.35*	*0.12*	*1.7*
Lead	0.000022	6.2×10^{-6}	9.4×10^{-7}	0.000022	6.2×10^{-6}	9.7×10^{-7}	3.4×10^{-6}	1.6×10^{-7}	1.2×10^{-6}	*0.000048*	*0.000013*	*3.1×10^{-6}*	*0.000064*
HAPs	0.021	0.0069	0.0023	0.08	0.025	0.0087	N/A	N/A	N/A	*0.095*	*0.03*	*0.01*	*0.14*

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Mobile Sources. The MOVES2010 model was used to estimate emissions due to vehicle traffic from nonradioactive waste transport (commercial vendors). **Table D–8** and the following discussion provide further details on the activity and vehicle data used. See Chapter 4, Section 4.1.3, for more details on the development of these numbers.

Table D–8 Vehicle Activity Data Used to Model Emissions from Commercial Vendors Traveling to and from the Nevada National Security Site

MOVES2010 Vehicle Type	*Count*	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the NNSS*	*Annual VMT Within Nye County and Inside the NNSS*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Type Used*
Single-unit, short-haul trucks	17	399,126	55,692	194,922	95	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; NNSS = Nevada National Security Site; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

Commercial vendor activity was derived from employee count data and from the 1999 NTS road renovation study (BN 1999). Commercial vendors were assumed to use single-unit trucks fueled by No. 2 diesel. The lead emissions factors for mobile sources in EPA's *Air Quality Criteria for Lead* (EPA 2006) were used to estimate lead emissions for NNSS commercial vendor vehicles.

Commercial vendors were assumed to enter the NNSS via Mercury Highway and go to the Area 5 Radioactive Waste Management Site (RWMS). The RWMS was chosen because nearly all hazardous waste is currently (in 2008) stored at the Pit 3 Mixed Waste Disposal Unit, which is near RWMS (DOE 2009c). Hazardous waste was estimated to travel 84 miles per vehicle trip in Clark County, 12 miles per vehicle trip in Nye County but outside the NNSS, and 40 miles per vehicle trip inside the NNSS. MOVES default fuel supply market shares, meteorology, vehicle speed distribution, and monthly and hourly VMT distributions were used in the analysis. Only running exhaust, brake wear, and tire wear were modeled. As was done for onsite government vehicles, single-unit, short-haul trucks were assumed to have an average age of 11 years old. All Nye County roads were assumed to be rural roads with unrestricted access, and the same Clark County road distribution as used for commuter traffic was used for commercial vendors.

Table D–9 shows the 2008 mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS. Approximately 5.9 tons of criteria pollutants were emitted due to commercial vendor activities related to the NNSS in 2008. Nitrogen oxide emissions comprised the single largest amount (3.4 tons) among the criteria pollutants. About 0.068 tons of HAPs were emitted as a result of commercial vendor activities in 2008. The majority (63 percent) of emissions related to NNSS commercial vendors took place in Clark County, while about 29 percent took place in the portion of Nye County that is outside of the NNSS, and the remaining 8 percent took place on the NNSS.

Emissions from Radioactive Waste Truck Mobile Sources. The MOVES2010 (Version 20091221 for Nye County; Version 20100515 for Clark County; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from radioactive waste transport. **Table D–10** and the following discussion contain details on the activity and vehicle data that were used in modeling the emissions. See Chapter 4, Section 4.1.3, for more details on the development of the transportation activity levels.

Table D–9 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutant from Commercial Vendors Traveling to and from the Nevada National Security Site, 2008 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.24	0.032	0.11	0.38
$PM_{2.5}$	0.22	0.029	0.10	0.35
CO	0.98	0.13	0.46	1.6
NO_x	2.2	0.277494	0.97	3.4
SO_2	0.0041	0.00051	0.0018	0.0064
VOCs	0.32	0.042	0.15	0.51
Lead	3.8×10^{-6}	5.2×10^{-7}	1.8×10^{-6}	6.1×10^{-6}
HAPs	0.042	0.0056	0.020	0.068

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table D–10 Vehicle Activity Data Used to Model Emissions from Radioactive Waste Trucks Traveling to and from the Nevada National Security Site

MOVES2010 Vehicle Type	*Count*	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the NNSS*	*Annual VMT Within Nye County and Inside the NNSS*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Type Used*
Combination-unit, short-haul trucks	9 [a]	106,799	328,765	2,915	95	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; NNSS = Nevada National Security Site; VMT = vehicle miles traveled.

[a] The number of radioactive waste trucks was unknown. The number of multiple-axle trucks used by commercial vendors was used as a surrogate.

Note: Modeling performed using MOVES2010.

Radioactive waste transport activity was derived from the average number of transports in 2007 and 2008 and assumed origin-to-NNSS distances. After rounding to the nearest 100,000 miles to account for other special shipments that may not have been accounted for, this activity calculation resulted in an estimated 5.3 million miles driven annually within Nevada due to these transports. An estimated 0.55 percent of this mileage took place on the NNSS. A map of the seasonal routes taken by these transports was used to estimate the mileage percentages within Nye County (62 percent) and Clark County (20 percent). Radioactive waste was transported only by combination-unit trucks, and all of these trucks were assumed to use only No. 2 diesel. The lead emissions factors for mobile sources in EPA's *Air Quality Criteria for Lead* (EPA 2006) were used for estimating lead emissions for NNSS radioactive waste transport vehicles.

Radiological trucks were assumed to travel the preferred transportation routes through Nevada when transporting radioactive waste. MOVES default fuel supply market shares, meteorology, vehicle speed distribution, and monthly and hourly VMT distributions were used in estimating emissions. Only running exhaust, brake wear, and tire wear were modeled. As was done for onsite government vehicles and commercial vendors, combination-unit, short-haul trucks were assumed to have an average age of 11 years. All Clark County and Nye County roads on the seasonal routes taken by these transports were assumed to be rural roads with unrestricted access.

Table D–11 shows the modeled current (approximately 2008) mobile emissions of criteria pollutants and HAPs associated with radioactive waste transport to and from the NNSS. Approximately 13.4 tons of criteria pollutants were emitted due to radioactive waste truck activities related to the NNSS in 2008. Nitrogen oxides were the largest single pollutant at (9.6 tons). Approximately 0.058 tons of HAPs were emitted as a result of radioactive waste truck activities related to the NNSS in 2008. The majority (75 percent) of emissions related to NNSS radioactive waste trucks took place in the portion of Nye County that is outside of the NNSS, while about 25 percent took place in Clark County, and the remaining percentage (less than 1 percent) took place on the NNSS.

Table D–11 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the Nevada National Security Site, 2008 (tons per year)

	Combination-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.17	0.51	0.0046	*0.68*
$PM_{2.5}$	0.16	0.48	0.0042	*0.64*
CO	0.67	2	0.018	*2.7*
NO_x	2.3	7.2	0.064	*9.6*
SO_2	0.0033	0.01	0.000088	*0.013*
VOCs	0.11	0.33	0.0029	*0.44*
Lead	2.2×10^{-6}	1.9×10^{-6}	1.7×10^{-9}	4.1×10^{-6}
HAPs	0.014	0.044	0.00038	*0.058*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Measurements of Ambient Air Concentrations on the NNSS. The monitored concentrations cannot be directly compared with the standards because the standards use calendar years and some of the standards use other statistics and time periods as part of their calculation. However, given that the monitored concentrations presented in Chapter 4, Table 4–38, are maximum observed concentrations for their respective time periods, and given that none of them exceeded the ambient air quality standards, these monitored concentrations demonstrate that the area is attaining the air quality standards. Listed below are summary concentration statistics from the YMP1 station for the period from October 1991 through September 1995, compared directly with the standard concentration values (ignoring the above comparison issues):

- The maximum 1-hour carbon monoxide concentration was 0.2 parts per million, which is less than 1 percent of the National Ambient Air Quality Standards (NAAQS) value (35 parts per million).

- The maximum 8-hour carbon monoxide concentration was 0.2 parts per million, which is 2 percent of the Nevada standard value for elevations below 5,000 feet (9 parts per million; the YMP1 monitoring station is about 4,000 feet above mean sea level).

- The maximum October-to-September annual nitrogen dioxide concentration was 0.00214 parts per million, which is 4 percent of the NAAQS value (0.053 parts per million).

- The maximum 1-hour ozone concentration was 0.096 parts per million, which is 80 percent of the NAAQS value (0.120 parts per million; this NAAQS is no longer in effect).

- The maximum 3-hour, 24-hour, and September-to-October annual concentrations of sulfur dioxide were all 0.002 parts per million, which are less than 1 percent, 1 percent, and 7 percent of the 3-hour, 24-hour, and annual NAAQS values (0.5, 0.14, and 0.03 parts per million), respectively.

Ozone was the only gaseous criteria pollutant to routinely register ambient levels above the instrument threshold. Ozone levels never exceeded the regulatory limit for the 1-hour average standard (0.12 parts per million by volume). The 1-hour average standard was withdrawn in 2005, and has now been replaced with an 8-hour average standard (0.075 parts per million). Ozone is formed in the atmosphere under the presence of sunlight, nitrogen oxides, and volatile organic compounds. Ozone typically has the highest concentrations during warm weather because strong sunlight and high temperatures are more conducive to higher ambient concentrations. Approximately 90 percent of the warm-season hours had concentrations between 0.020 and 0.060 parts per million; only 44 hours had concentrations in excess of 0.080 parts per million.

No ambient monitoring data were available for lead. However, the U.S. Department of Energy (DOE) expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this contaminant into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

Some annual statistics on observed ambient PM_{10} concentrations at the YMP1, YMP5, YMP6, and YMP9 monitoring stations from 1989 through 2005 are shown in Chapter 4, Table 4–39. This table also shows the NAAQS or Nevada Ambient Air Quality Standards (whichever one is lower) that were in place at the time of monitoring. Note, however, that the air quality standards are not as restrictive as just the highest concentration. For example, the 24-hour PM_{10} standard is not to be exceeded more than once on average over 3 years and the annual PM_{10} standard is the 3-year weighted average PM_{10} concentration. However, these observed concentrations in Table 4–39 do demonstrate compliance with the current 24-hour PM_{10} standard as none of these concentrations exceed the ambient air quality standards. Listed below are some summary concentration statistics from these monitoring stations for the period from 1989 through 2005, compared directly with the air quality standard concentration values (ignoring the above comparison issues):

- The largest 24-hour averaged value observed across these 17 years and 4 monitoring stations was 67 micrograms per cubic meter (at the YMP5 station in 1995), or 45 percent of the NAAQS value (150 micrograms per cubic meter).
- Across the observations for these 17 years and 4 monitoring stations, 41 percent of the annual largest 24-hour averaged values were less than 20 percent of the NAAQS value (150 micrograms per cubic meter).
- The largest annual averaged value observed was 13 micrograms per cubic meter (at the YMP5 station in 1989), or 26 percent of the Nevada Ambient Air Quality Standard value.
- Across the observations for these 17 years and 4 monitoring stations, 54 percent of the annual averaged values were less than 20 percent of the Nevada Ambient Air Quality Standard value for PM_{10}.

No ambient monitoring data were available for $PM_{2.5}$; however, because $PM_{2.5}$ is a subset of PM_{10}, $PM_{2.5}$ can be estimated from measurements of ambient PM_{10}. In the region of influence, most of the PM_{10}

would be generated from the resuspension of surface-level soil and mineral materials with some additional PM_{10} from fuel combustion. A U.S. Department of Agriculture study on wind erosion in the western United States found that over all soils, the fraction of PM_{10} as $PM_{2.5}$ was about 15 percent, ranging from 10 to 30 percent (Hagen 2001). To be conservative, DOE applied the upper end of this range (30 percent) to the ambient PM_{10} data collected in Area 25 (the YMP1, YMP5, and YMP9 stations) over the past 8 years (1998 through 2005), and the resulting data indicated the highest expected 24-hour concentration of $PM_{2.5}$ would be 16 micrograms per cubic meter, and the highest expected annual average concentration would be 4 micrograms per cubic meter. These numbers are 46 and 26 percent of the ambient air quality standards for $PM_{2.5}$.

Modeling of Ambient Air Concentrations on and near the NNSS. Because the NNSS covers some 1,360 square miles, ambient air quality monitoring on the prevailing upwind side of the NNSS (Area 25) may not capture emission impacts from onsite sources. The majority of routine emission sources is concentrated in Areas 6 and 23 and is associated with sand and aggregate processing and fuel-burning, as shown in Table D–3. Impacts from those emissions are small and will likely have little effect on the ambient air quality. However, emissions from other sources (e.g., explosives testing) occur infrequently, but produce high concentrations for short periods. **Figure D–4** shows the locations of the emissions associated with these open detonations: Areas 4 (BEEF), 5 (NPTEC), 11 (EODU [Explosives Ordnance Disposal Unit]), 14 (HEST [High Explosive Simulation Technique] test range), 25 (Test Cell C), and 26 (Port Gaston).

Modeling Methodology. As part of an environmental evaluation for the NNSS Class II Air Quality Operating Permit AP9711-0549.01 (DOE 2009b), dispersion modeling was conducted in 2009 to estimate the air quality impacts from non-explosive emission sources and from explosives testing at the NNSS. Two EPA-approved models – AERMOD and OBODM [Open Burn/Open Detonation Model] – were used to model the non-explosive sources and the detonation activities, respectively.

For the NNSS Class II Air Quality Operating Permit modeling support study, AERMOD was run with many non-explosive stationary sources throughout the NNSS, including industrial sources and storage tanks. AERMOD was run without deposition to conservatively model the air concentration. The AERMOD modeling used 3,785 receptors surrounding the NNSS boundary, forming a 1.5-mile buffer around the NNSS boundary at a spacing of about 0.31 miles (500 meters). The receptors are shown in Figure D–4, but the non-explosive stationary sources are not shown.

OBODM was run for six explosive test sites in the NNSS. The OBODM modeling for the Permit used 1,203 receptors – some were placed at discrete locations along the NNSS boundary, and some were placed east of the NNSS boundary out to a distance of about 3.7 miles at a spacing of about 0.31 miles (500 meters). These eastern receptors were chosen because they are predominantly downwind from the detonation operations.

For this site-wide environmental impact statement (SWEIS), several supplementary OBODM model runs were performed to estimate particulate matter concentrations (not done in the permit support study) at locations accessible to the public (i.e., the Nevada Test and Training Range boundary downwind from the detonation operations) for the baseline affected environment conditions and for the future environmental consequences conditions. The public has access to areas along the southern border of the NNSS. Otherwise, the public's closest approach is along the border of the Nevada Test and Training Range. The Nevada Test and Training Range effectively creates a public access buffer zone of up to 30 miles beyond the northern, western, and eastern NNSS boundaries. The receptors used in the OBODM runs are shown in Figure D–4.

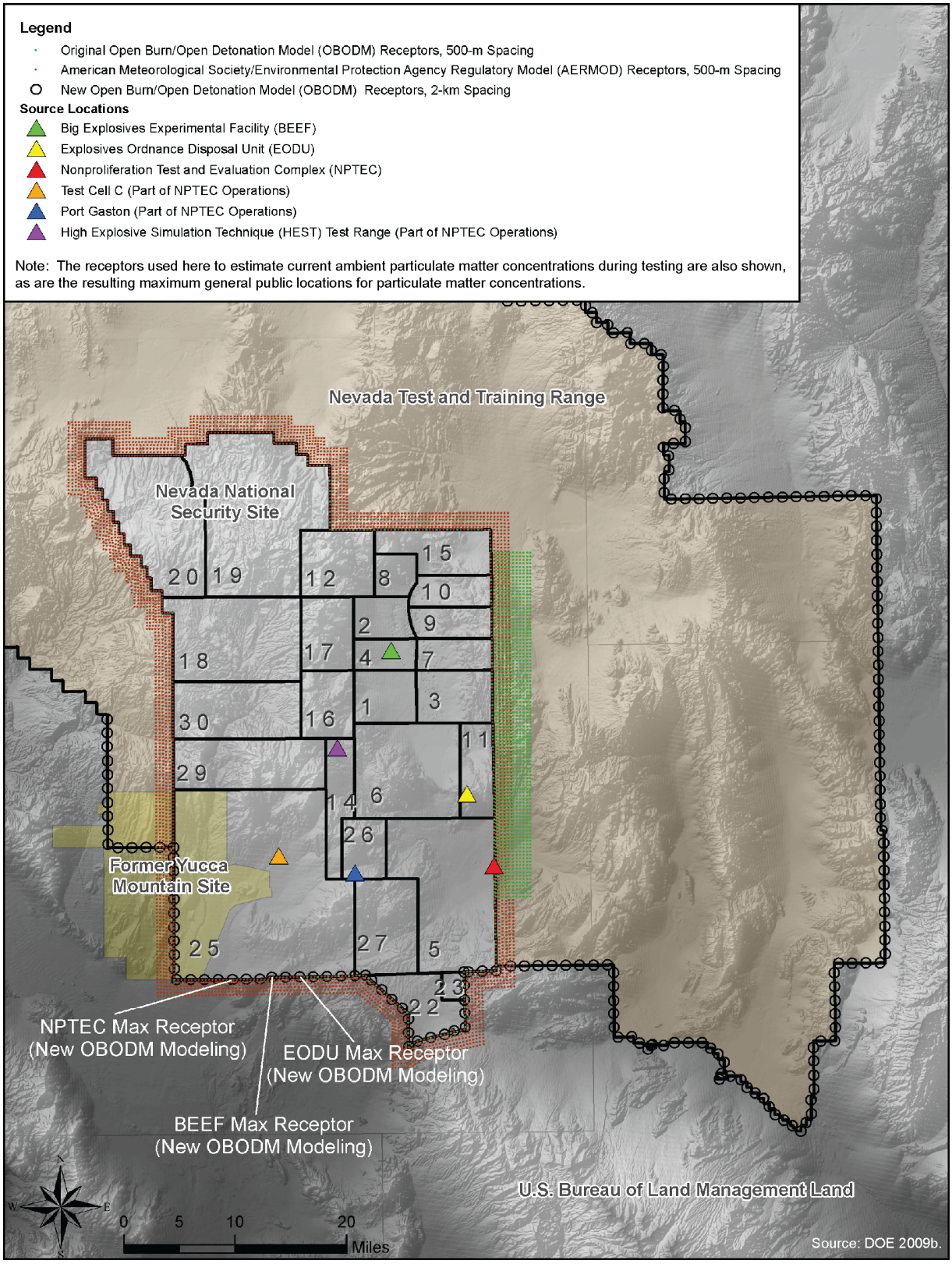


Figure D–4 Locations of the Open-Air Detonation Locations Modeled for the Nevada National Security Site Class II Air Quality Operating Permit (AP9711-0549.01)

AERMOD and OBODM use a suite of hourly meteorological data for years 2003-2007 to simulate dispersion of emissions in the atmosphere. The most complete set of hourly meteorological data is collected at the first order weather station at Desert Rock located on the southern side of the NNSS at 36.6241 degrees north, 116.0192, degrees west, and 3,300 feet (1,000 m) elevation above mean sea level. Both surface and upper air meteorological data are collected at the site and are consistent with the requirements for both models. The surface meteorological dataset contains wind direction and wind speed, temperature and sky cover. Surface temperature data are collected at 6.6 feet (2 meters) above ground level, and surface wind data are collected at 32.8 feet (10 meters). Very little surface data were missing or invalid. For OBODM modeling, wind speeds exceeding 34.4 feet per second (10.5 meters per second) were set to 0 feet per second because detonations would not take place during such high wind speeds and OBODM does not calculate concentrations during calm hours (i.e., when wind speeds are 0). For upper-air data, beginning in early 2005, upper-air data was not collected on weekends and holidays due to budget constraints, and no data substitutions were made because the next closest upper-air station was too far away. In regards to the surface data some differences are found in surface wind patterns within the NNSS (Figure 4-18, Soule, 2006) however, the nature of these elevated releases tend to minimize the differences particularly for the relatively long transport distances to the nearest off-site receptors.

The modeling analysis for the BEEF assumed a maximum emission rate that occurred once daily, that is, one detonation of 21.5 tons of explosives at 9 a.m. daily and then repeated each day. This same approach was used in the Nevada National Security Site Class II Air Quality Operating Permit AP9711-0549.01. This modeling was performed daily over the five year of meteorological data (2003-2007) to determine the maximum downwind concentration. These maximum concentrations are the explosive source result reported in **Table D–12**. For detonations at EODU, hourly detonations of 100 pounds of explosives were modeled to occur from 0800 LT through 1500 LT as long as the wind speed remained below 23.5 miles per hour. For the NPTEC the modeling analysis assumed a worst-case scenario that is a single detonation of 1 ton of explosives per day at 9 a.m.

Table D–12 Particle Mass Distribution per Particle Size Used in Open Burn/Open Detonation Modeling

Permit Modeling		*New Modeling for This SWEIS*	
Particle Diameter Interval (micrometers)	***Mass Fraction of Total PM_{10} Mass***	***Particle Diameter Interval (micrometers)***	***Mass Fraction of Total PM_{10} Mass (Mass Fraction of Total $PM_{2.5}$ Mass)***
4 to 5	0.033	0.21 to 0.24	0.00001 (0.00011)
5 to 6	0.126	0.24 to 0.33	0.00007 (0.00075)
6 to 7	0.341	0.33 to 0.46	0.00026 (0.00298)
7 to 8	0.341	0.46 to 0.64	0.00098 (0.01111)
8 to 9	0.126	0.64 to 0.89	0.00309 (0.03507)
9 to 10	0.033	0.89 to 1.23	0.00846 (0.09596)
		1.23 to 1.72	0.02066 (0.23442)
		1.72 to 2.28	0.03582 (0.40643)
		2.28 to 2.50	0.01879 (0.21317)
		2.50 to 2.65	0.01091 (N/A)
		2.65 to 3.34	0.10200 (N/A)
		3.34 to 4.66	0.14923 (N/A)
		4.66 to 6.49	0.22742 (N/A)
		6.49 to 8.76	0.27830 (N/A)
		8.76 to 10	0.14400 (N/A)

N/A = not applicable; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.
Source: DoD 2004; Pinnick et al. 1983.

Listed below are other important parameter settings used in the OBODM modeling. Some details about the environmental consequences scenarios are also shown. Note that the OBODM modeling for the Air Quality Permit study only modeled PM_{10}. For the supplementary OBODM modeling performed for this SWEIS, $PM_{2.5}$ was also modeled. Some details about the $PM_{2.5}$ modeling are shown in the list below, and $PM_{2.5}$ is discussed further in the text following the list.

- No depletion from gravitational deposition
- Final cloud-rise height used for all calculations
- Flat terrain, where receptor heights greater than zero are treated as flag poles
- Use both stable and adiabatic plume rise
- Let OBODM calculate: particulate matter settling velocity, reflection coefficient, source effective release height above ground, diameter of initial source material immediately after detonation, wind speed power law, lateral turbulence intensity, vertical turbulence intensity, alongwind turbulence intensity, vertical potential temperature gradients, wind speed shear, and pasquill stability category calculated by OBODM
- Standard deviations of wind direction angle and wind elevation angle calculated by OBODM using internal lookups and defaults at 600-s measuring time
- Calm wind or missing hours have no dispersion or deposition
- If short term wind averages have less than 75 percent valid (non-calm non-missing) hours, use EPA guideline of 75 percent of the possible hours rounded up to the nearest integer
- 24-hour concentration averaging time
- Fuel Heat Content 1000 cal/g
- Fuel Burn Time 2.5s
- Particulate Matter Molecular Weight 90.68 g/g-mol
- Particulate Matter Density of Species 2.05 g/cm^3
- BEEF:
  - 1 instantaneous volume source
  - PBXN-110 Propellant
  - X Coordinate (UTM 11N): 580601 meters, Y Coordinate (UTM 11N): 4105930 meters, Flagpole: 106.6 feet (35.2 meters)
  - Fraction of exhaust cloud constituting pollutant/species: $PM_{10} = 0.49$, $PM_{2.5} = 0.043169$
- EODU:
  - 1 instantaneous volume source
  - 0.38 Special Cartridges
  - X Coordinate (UTM 11N): 591532 meters, Y Coordinate (UTM 11N): 4085260 meters, Flagpole 15.4 feet (4.7 meters)
  - Fraction of exhaust cloud constituting pollutant/species: $PM_{10} = 0.057$, $PM_{2.5} = 0.005016$

- NPTEC:
  - 4 instantaneous volume sources
  - C-4 Demo Charges
  - 1. NPTEC: X Coordinate (UTM 11N): 595470 meters, Y Coordinate (UTM 11N): 4074879 meters, Flagpole 41.7 feet (12.7 meters)
  - 2. Test Cell C: X Coordinate (UTM 11N): 564419 meters, Y Coordinate (UTM 11N): 4076329 meters, Flagpole 41.7 feet (12.7 meters)
  - 3. Port Gaston: X Coordinate (UTM 11N): 575407 meters, Y Coordinate (UTM 11N): 4073895 meters, Flagpole 41.7 feet (12.7 meters)
  - 4. HEST: X Coordinate (UTM 11N): 572869 meters, Y Coordinate (UTM 11N): 4091869 meters, Flagpole 41.7 feet (12.7 meters)
  - Fraction of exhaust cloud constituting pollutant/species: $PM_{10} = 0.021$, $PM_{2.5} = 0.001848$

The particle mass size distribution used in the Permit modeling (shown in Table D–12) was not used in this analysis because the earlier modeling had assumed none of the particles had a mean aerodynamic diameter smaller than 4 micrometers since the permitting was focused only on PM_{10}. A study by Pinnick et al. (1983) examined several different types of high explosives detonated in a variety of soil types, including sand to silty sand soil as found at the NNSS. The study found that the post explosion particles ranged in mean particle diameter from 0.2 micrometers to larger than 200 micrometers. The study found that the particulate size mass distributions were similar across explosive material and soil types, and that the distributions were both bimodal and lognormal. Based on this information (Pinnick et al. 1983), an equation of two lognormal probability density functions was developed to describe the mass fraction as a function of mean particle diameter (DoD 2004) with the characteristic bimodal distribution. Integrating this equation across the particulate diameters yields the particulate mass fractions as shown in Table D–12 for PM_{10} and $PM_{2.5}$. Note that $PM_{2.5}$ makes up only 8.8 percent of PM_{10} by mass.

Other conservative modeling assumptions include the following: (1) 100 percent of nitric oxide was assumed to be converted into nitrogen dioxide in AERMOD modeling and (2) total pollutant concentrations attributable to NNSS sources were evaluated by adding together the highest calculated concentrations from AERMOD and OBODM, without coupling the concentrations in either time or space.

For this SWEIS, the background concentrations used in the Permit were updated to be based on the Area 25 monitoring data. Measurements taken at the YMP9 and YMP1 stations from 1998 through 2005 (DOE 2008d) show that the PM_{10} 24-hour average background concentration is 39 micrograms per cubic meter using the second highest high PM_{10} concentration, which approximates the PM_{10} exceedance-based standard, which allows no more than one exceedance per year on average across 3 years. The carbon monoxide, sulfur dioxide, and nitrogen dioxide background concentrations were the largest monitored concentrations shown in Chapter 4, Table 4–38.

Results of Permit Modeling. Table D–11 presents these maximum modeled concentrations of carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10}. These concentrations are only from the Permit modeling (does not include the supplementary OBODM runs made for this SWEIS), and they include the above update to background concentrations. **Table D–13** also shows the current (2009) NAAQS and Nevada Ambient Air Quality Standards. As shown in Table D–13, all of the maximum modeled concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide were significantly smaller than the ambient air quality standards. Due to the explosives detonations, the maximum modeled PM_{10} concentration exceeded the ambient air quality PM_{10} standard by a large margin in areas beyond the

eastern border of the NNSS. The maximum distance beyond the eastern border of the NNSS at which the PM_{10} standard was exceeded was 4.3 miles. However, this location is entirely within the non-public access area (Nevada Test and Training Range) of the Desert National Wildlife Refuge.

Table D–13 Dispersion Modeling Results from all Nevada National Security Site Stationary, Fugitive, and Detonation Sources (micrograms per cubic meter)

Pollutant	*Averaging Period*	*NAAQS* [a]	*Nevada AAQS* [a]	*Background Concentration* [a]	*Nonexplosive Sources*	*Explosive Sources*	*Total Maximum Concentration* [a] *(percentage of NAAQS, percentage of Nevada AAQS)*
					Maximum Concentration [a]	*Maximum Concentration* [a]	
CO	1-hour	40,000 [b]	40,500 [b]	229	41	< 1,007	< 1,277 (<3.2%, <3.2%)
	8-hour	10,000 [b]	10,500 [b,c]	229	10	< 137	< 376 (<3.8%, <3.6%)
NO_2	Annual	100 [d]	100 [d]	4.0	16 [e]	< 3.0 [e]	< 23 [e] (<23%, <23%)
PM_{10}	24-hour	150 [f]	150 [f]	39	5	< 4,013	< 4,057 (<2,163%, <2,163%)
SO_2 [g]	3-hour	1,300 [b]	N/A	5.2	6.3	< 6.4	< 17.9 (<1.4%, N/A)
	24-hour	365 [b]	365 [b]	5.2	1.1	< 0.66	< 7.0 (<1.9%, <1.9%)
	Annual	80 [d]	80 [d]	5.2	1.1 [e]	< 0.66 [e]	< 7.0 [e] (<8.8%, <8.8%)

< = less than; AAQS = Ambient Air Quality Standards; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; SO_2 = sulfur dioxide.

[a] Concentration units are micrograms per cubic meter. To convert micrograms per cubic meter to parts per million, multiply micrograms per cubic meter by 0.024465 and divide by the molecular weight at 760 millimeters mercury and 25 degrees Centigrade).

[b] Not to be exceeded more than once per year.

[c] For locations below 5,000 feet above mean sea level.

[d] Not to be exceeded.

[e] Maximum 24-hour average.

[f] Not to be exceeded more than once per year on average over 3 years.

[g] There is no 3-hour SO_2 Nevada Ambient Air Quality Standard.

Source: Based on data from DOE 2009b: App. 7, Table 7-1.

Results of Supplementary OBODOM Modeling Performed for This SWEIS: For areas where the public has access, worst-case activities at BEEF activities produced the highest modeled PM_{10} concentrations, but these concentrations were below the PM_{10} NAAQS value. The maximum modeled 24-hour average PM_{10} concentration was 62 micrograms per cubic meter (April 12, 2007; along southern border of Area 25 – see Figure D–4; X Coordinate (UTM 11N): 563420 meters, Y Coordinate (UTM 11N): 4058840 meters), which, even when combined with the maximum background concentration of 39 micrograms per cubic meter, is well below the Nevada Ambient Air Quality Standards value of 150 micrograms per cubic meter. The maximum modeled 24-hour average PM_{10} concentration associated with activities at NPTEC was about 8 micrograms per cubic meter (April 12, 2007; along southern border of Area 25 – see Figure D–4; X Coordinate (UTN 11N): 557729 meters, Y Coordinate (UTM 11N): 4058503 meters); for the Explosives Ordnance Disposal Unit, the corresponding concentration was less than 1 microgram per cubic meter(February 11, 2005; along southern border of Area 25 – See Figure D–4; X Coordinate (UTM 11N): 567419 meters, Y Coordinate (UTM 11N): 4058854 meters).

For areas where the public has access, worst-case BEEF activities produced the highest modeled $PM_{2.5}$ concentrations, but these concentrations were also below the NAAQS values. The maximum modeled

24-hour average $PM_{2.5}$ concentration was 11 micrograms per cubic meter (same date and location as with PM_{10} above), which, when combined with a maximum background concentration of 12 micrograms per cubic meter, is below the NAAQS value of 35 micrograms per cubic meter. The maximum modeled 24-hour average $PM_{2.5}$ concentrations due to worst case NPTEC and Explosives Ordnance Disposal Unit activities were each less than 1 microgram per cubic meter (same dates and locations as with PM_{10} above). Even if all three activities took place at the same time, their combined concentration would be less than the $PM_{2.5}$ NAAQS value of 35 micrograms per cubic meter. The maximum modeled annual average $PM_{2.5}$ concentration was less than 1 microgram per cubic meter, which adds little to the $PM_{2.5}$ annual background concentration of 3.6 micrograms per cubic meter. The $PM_{2.5}$ annual average NAAQS value is 15 micrograms per cubic meter.

Ozone was not modeled as part of the air permit evaluation for this *NNSS SWEIS*, but it is generally recognized as a regional-scale air quality problem. Ozone is formed in the atmosphere under the presence of sunlight, nitrogen oxides, and volatile organic compounds. The emissions of nitrogen oxides (a precursor to ozone formation) and volatile organic compounds at the NNSS are less than 50 tons per year (see Table D–3) and are small relative to the existing regional emissions of nitrogen oxides and volatile organic compounds. Further, these emissions are considerably less than the conformity emission threshold levels of 100 tons per year for nitrogen oxides and volatile organic compounds. These threshold emission levels were set small enough as to not create a measurable impact on ozone levels. Thus, current emissions at the NNSS are not anticipated to increase downwind ozone concentrations beyond the measured ozone concentrations, which are well below the ozone air quality standard.

D.1.1.2.2 Radiological Air Quality

This section expands the radiological air quality discussion presented in Chapter 4, Section 4.1.8.3, of this SWEIS.

The locations of the ambient radiological monitoring stations on and surrounding the NNSS are discussed in Section D.1.1.3.1. The locations of potential radiation emissions on the NNSS and the types of activities that might produce them are discussed in Section D.1.1.3.2. The recent radiation concentrations and exposure levels are discussed in Section D.1.1.3.3.

D.1.1.2.2.1 Ambient Radiological Monitoring on and near the Nevada National Security Site

On the NNSS, six of the 16 monitoring stations established by DOE that monitor ambient tritium (hydrogen-3) levels are considered "critical receptors." These "critical receptors" are approved to monitor levels of various radionuclides for National Emission Standards for Hazardous Air Pollutants (NESHAPs) compliance. The radiological monitoring network overall indicates that levels of americium-241; plutonium-238, -239, and -240; cesium-137; strontium-90; and tritium on the NNSS have been well below the NESHAPs concentration levels since the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*. More details about radiation detected at NNSS locations are provided in Section D.1.1.3.3.

The Desert Research Institute of the Nevada System of Higher Education runs the Community Environmental Monitoring Program (CEMP), which constitutes an offsite nonregulatory network of environmental air and radiation monitoring stations across southern Nevada, southeastern California, and southwestern Utah. These monitoring stations measure penetrating gamma radiation using thermoluminescent dosimeters, gamma radiation exposure rates using pressurized ion chamber detectors, gross alpha and beta radioactivity in airborne particulates using low-volume particulate air samplers, and meteorological data (DOE 2009b). Alpha and beta particles and gamma rays all occur naturally, but they can be proxies for manmade nuclear activity when detected above certain levels. Alpha particles are usually emitted by decaying uranium isotopes, beta particles are usually emitted as atomic decay products

of nuclear fission, and gamma rays occur with alpha and beta particle emissions when certain radionuclides transition to a lower energy state (DOE 2009b, 2009d). More details about the radiation detected at CEMP locations are provided in Section D.1.1.3.3.

D.1.1.2.2.2 Sources of Radiation on the Nevada National Security Site

Between 1951 and 1992, 100 atmospheric and 828 underground nuclear tests were conducted on the NNSS (DOE 2009d). Nuclear testing ended in 1992; since then, the NNSS radiation monitoring has focused on detecting airborne radionuclides from historically contaminated soils. Other than soil resuspension and evapotranspiration of historical radionuclides, as discussed in the main body of the SWEIS, some activities on and near the NNSS still involve radioactive materials. Some special research projects, analytical laboratory operations, Environmental Restoration Program projects, and Borehole Management projects may involve radioactive materials and may result in measurable air emissions of radionuclides. More-specific activities on the NNSS that involve radioactive materials and possible air releases of radionuclides in recent years include the following (DOE 2009d):

- Disposal of tritium-contaminated water removed from the sump well below Building A-1 of the offsite North Las Vegas Facility (NLVF) on the NNSS
- Underground Testing Area Project pumping of tritium-contaminated water to the surface from wells used to characterize the aquifers at the sites of past underground nuclear tests
- Pulsed neutron generator activities that can release tritium at the Dense Plasma Focus Facility (in Area 11)
- Dynamic experiments and hydrodynamic tests that may release tritium and depleted uranium at BEEF (in Area 4)
- Radioactive waste management, including the Area 3 RWMS and Area 5 Radioactive Waste Management Complex, from which measurable tritium releases have been detected
- Operations at the Radiological/Nuclear Countermeasures Test and Evaluation Complex (in Area 6)
- Subcritical experiments at the U1a Complex (in Area 1)
- Handling, transport, storage, and assembly of radioactive targets for the Joint Actinide Shock Physics Experiment Research gas gun (in Area 27)

Accidental or unplanned air releases of radiation are infrequent on the NNSS. Since 1997, such releases have only occurred on the NNSS in 2008, when contaminated debris was carried beyond two control boundaries. In one case, the contaminated area was blocked off, contaminated debris was recovered, and a corrective policy was implemented to ensure that highly contaminated waste is only generated when it can be immediately disposed of. In the other case, the debris was marked and the original contamination area was extended to include the debris (DOE 2009d).

D.1.1.2.2.3 Radiation Levels on and near the Nevada National Security Site

Table D–14 presents the estimated air emissions of radionuclides on the NNSS for the period from 1997 through 2008. The 1993 estimates that were cited in the *1996 NTS EIS* are also shown. These estimates are presented in each year's NNSS environmental report and are used in estimations of equivalent exposure. The methods used to estimate these air emissions included the use of annual field and water monitoring data, historical soil inventory data, and accepted soil resuspension and air transport models (DOE 2009d).

Table D–14 Annual Estimated Air Releases of Radionuclides on the Nevada Nuclear Security Site, 1997–2008 (curies) [a,b]

	1993 (presented in the 1996 NTS EIS)	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Tritium	708	160	297	362.7	431	564	290	314	560	170	245	550	440
Krypton-85 [c]	160	--	--	--	--	--	--	--	0	0	0	0	0
Plutonium (unspecified isotopes)	0.0018	--	--	--	--	--	--	--	--	--	--	--	--
Plutonium-238	--	0.0000015	0.0000043	0.0000055	~0	~0	~0	~0	~0	~0	~0	0.054	0.05
Plutonium-239 and -240	--	0.280034	0.240038	0.240048	0.32	0.32	0.29	0.29	0.29	0.29	0.29	0.32	0.29
Strontium-90	--	0.000015	0.000024	0.000032	--	--	~0	~0	0	~0	~0	~0	~0
Cesium-137	--	0.0017	0.0015	0.0041	~0	~0	~0	~0	~0	~0	~0	~0	~0
Americium-241	--	--	--	--	0.049	0.049	0.047	0.047	0.047	0.047	0.047	0.047	0.047
Reference	DOE 1996, page 4-150 (from DOE 1994)	DOE 1998, page 1-11	DOE 1999, page 1-12	DOE 2000, page 1-13	DOE 2001, page 1-11	DOE 2002, page 1-11	DOE 2003, page 1-10	DOE 2004, page ES-14	DOE 2005, page 3-21	DOE 2006, page iii	DOE 2007, page v	DOE 2008c, page v	DOE 2009d, page v

[a] Assumes worst-case point and diffuse source releases, including evaporation from containment ponds. Includes calculated data from air sampling results, postulated loss of laboratory standards, and calculated resuspension of surface deposits.

[b] "~0" indicates that observed concentrations were greater than the minimum detectable concentration only a small number of times or not at all, and/or the concentrations contributed less than 10 percent towards the dose estimated to be received by the maximally exposed public individual. "--" indicates that the air emissions of the radionuclide were not mentioned in the reference as contributing towards the official radionuclide air emissions estimation.

[c] Krypton was no longer monitored on site beginning in 1998 since there are no detectable emissions.

Table D–15 shows maximum observed and maximum annual averaged radionuclide concentrations at the six critical receptors for reporting years 2002 through 2008. Years prior to 2002 are not shown because the six critical receptors were chosen in the middle of 2001. The averaging periods for each radionuclide are also shown; tritium is sampled for 26 2-week periods per year, while the other radionuclides are sampled for 1 1-week period per month. So, for example, the maximum observed concentration of plutonium-238 presented in Table D–15 was one of the 12 1-week average values observed in 2006 at the 3545 Substation, and the maximum annual averaged observed concentration of plutonium-238 was the average of the 12 1-week average values observed in 2008 at the Schooner monitoring station.

Table D–15 Comparison of Observed Concentrations of Radionuclides on the Nevada National Security Site at the Six Critical Receptors Used for NESHAPs Compliance with NESHAPs Concentration Levels, 2002-2008

Radionuclide (averaging period; maximum number of annual samples)	*Maximum Observed Concentration*	*Year and Location of Observation*	*Maximum Annual Average Observed Concentration*	*Percentage of NESHAPs CL*	*Year and Location of Maximum*	*Reference*
Tritium (2 weeks; 26 annual samples)	$1{,}228 \times 10^{-6}$ pCi/mL	2006, Schooner (in Area 20)	434×10^{-6} pCi/mL	29	2002, Schooner (in Area 20)	DOE 2007, page 3-13; DOE 2003, page 2-14
Plutonium-238 (1 week; 12 annual samples)	32×10^{-18} µCi/mL	2006, 3545 Substation (in Area 16)	5×10^{-18} µCi/mL	<1	2008, Schooner (in Area 20)	DOE 2007, page 3-8; DOE 2009d, page 3-8
Plutonium-239 and -240 (1 week; 12 annual samples)	640×10^{-18} µCi/mL	2007, Gate 700 S (in Area 10)	59×10^{-18} µCi/mL	3 [a]	2007, Gate 700 S (in Area 10)	DOE 2008b, page 3-9
Cesium-137 (1 week; 12 annual samples)	48×10^{-16} µCi/mL	2004, Mercury Track (in Area 23)	9×10^{-16} µCi/mL	5	2004, Mercury Track (in Area 23)	DOE 2005, page 3-8
Americium-241 (1 week; 12 annual samples)	106×10^{-18} µCi/mL	2007, Gate 700 S (in Area 10)	12×10^{-18} µCi/mL	<1	2007, Gate 700 S (in Area 10)	DOE 2008b, page 3-6

< = less than; µCi/mL = microcuries per milliliter; CL = concentration level; NESHAPs = National Emission Standards for Hazardous Air Pollutants; pCi/mL = picocuries per milliliter.

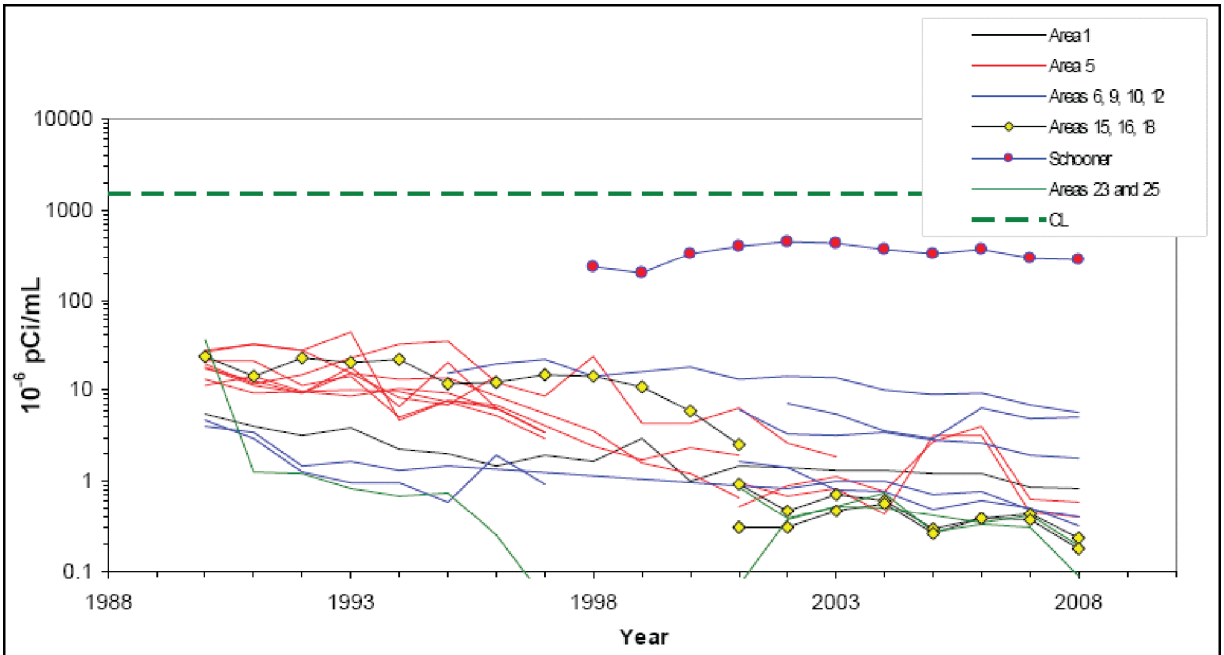
[a] For plutonium-239 and -240, the NESHAPs CL is for plutonium-239 only. Analytical methods cannot distinguish between plutonium-239 and plutonium-240.

Note: The averaging period for each concentration observation is shown in the first column.

As shown in Table D–15, the maximum annual averaged tritium concentration among the six critical receptors from 2002 through 2008 was about 434×10^{-6} picocuries per milliliter, which was 29 percent of the NESHAPs concentration level. Although the maximum observed 2-week averaged concentration cannot be compared to the NESHAPs concentration level for regulatory purposes, it is noteworthy that even the maximum concentration ($1{,}228 \times 10^{-6}$ picocuries per milliliter) was still only 82 percent of the NESHAPs CL. The maximum sampled tritium concentration always occurred at the Schooner monitoring station (in Area 20).

Figure D–5 shows the annual mean concentrations of tritium from 1990 through 2008 measured in many of the NNSS areas with long-term measurement histories. At most locations, tritium levels have been decreasing steadily, with an average rate of decline of 14 percent among all stations except Schooner. At Schooner (in Area 20), the tritium levels seem directly related to temperature and precipitation trends.

The increased tritium levels at Schooner is a result of much higher readings during the dry hot summer months when the movement of relatively deep soil moisture containing high concentrations of tritium migrates to the surface. The data also suggests that seasonal precipitation and recharge from below plays a role in maintaining the higher levels over time. All of these mean tritium concentrations are below the tritium NESHAPs concentration level, which is also shown in the figure.



CL = concentration level; pCi/mL = picocuries per milliliter.
Note: Data are presented on a logarithmic scale. Data before 1999 have been adjusted to compensate for sampling method changes.
The tritium National Emission Standards for Hazardous Air Pollutants concentration level is also shown (green, dotted line).
Source: DOE 2009d

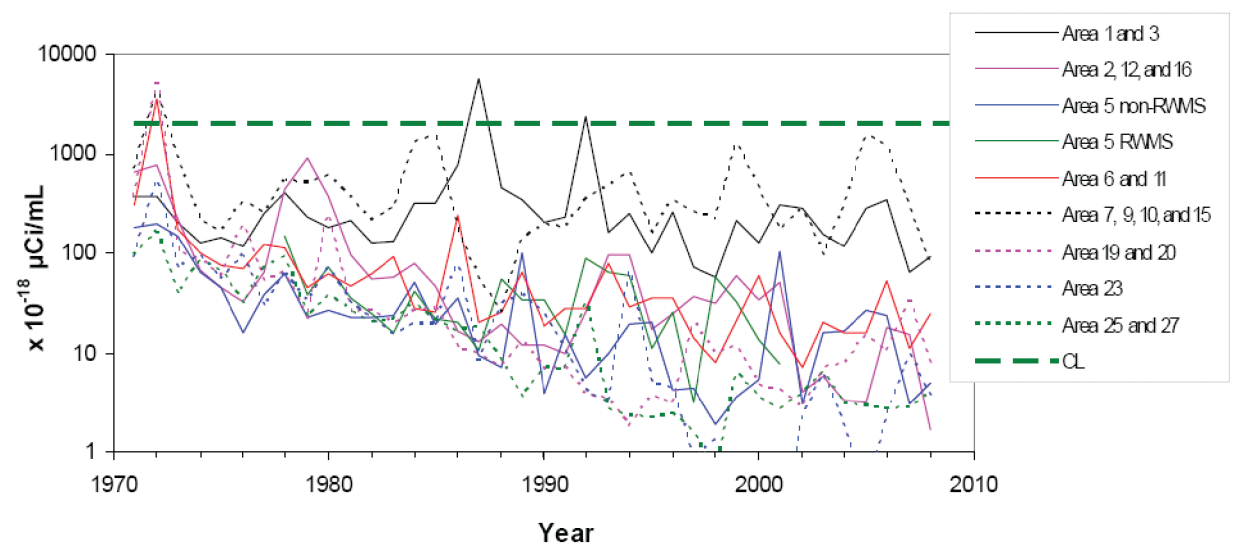
Figure D–5 Annual Mean Tritium Concentrations in Nevada National Security Site Areas with Long-Term Measurement Histories

As shown in Table D–15, the maximum annual averaged plutonium-238 concentration among the six critical receptors from 2002 through 2008 was about 5×10^{-18} microcuries per milliliter, which is less than 1 percent of the NESHAPs concentration level. Although the maximum observed 1-week averaged concentration cannot be compared to the NESHAPs concentration level for regulatory purposes, it is noteworthy that even the maximum concentration (32×10^{-18} microcuries per milliliter) was still only 2 percent of the NESHAPs concentration level. The maximum annual averaged plutonium-238 concentration usually occurred either at the Yucca station (in Area 6) or the 3545 Substation (in Area 16).

As shown in Table D–15, the maximum annual averaged plutonium-239 and -240 concentration among the six critical receptors measured from 2002 through 2008 was about 59×10^{-18} microcuries per milliliter, which was 3 percent of the NESHAPs CL. Although the maximum observed 1-week averaged concentration cannot be compared to the NESHAPs concentration level for regulatory purposes, it is noteworthy that even the maximum concentration (640×10^{-18} microcuries per milliliter) was still only 32 percent of the NESHAPs concentration level. The maximum annual averaged plutonium-239 and -240 concentration usually occurred either at the Yucca monitor (Area 6) or the Gate 700 S monitor (in Area 10).

Figure D–6 shows the highest annual mean plutonium-239 and -240 concentrations from 1971 through 2008 as observed by stations in NNSS areas. Only stations with at least 15 years of measurement history

are included. The average rate of concentration decline ranges from 2.9 percent (in Areas 1 and 3) to 17.7 percent (in Areas 19 and 20). These decline rates are faster than would be expected given the very long half-lives of plutonium-239 and -240, and are attributed to plutonium immobilization in the soil and/or decreases in NNSS activities that would resuspend the plutonium from the soil into the air. All of these maximum mean plutonium-239 and -240 concentrations have been below the plutonium-239 NESHAPs concentration level since 1993. In the period from 1971 through 1992, these maximum mean concentrations exceeded the NESHAPs concentration level three times (in 1972, 1987, and 1992).



µCi/mL = microcuries per milliliter; CL = concentration level; RWMS = Radioactive Waste Management Site.
Note: Data are presented on a logarithmic scale. The plutonium-239 National Emission Standards for Hazardous Air Pollutants concentration level is also shown (green, dotted line).
Source: DOE 2009d

Figure D–6 Highest Annual Mean Plutonium-239 and -240 Concentrations Observed Within Nevada National Security Site Areas with Long-Term Measurement Histories

As shown in Table D–15, the maximum annual averaged cesium-137 concentration among the six critical receptors from 2002 through 2008 was about 9×10^{-16} microcuries per milliliter, which was 5 percent of the NESHAPs concentration level. Although the maximum observed 1-week averaged concentration cannot be compared to the NESHAPs concentration level for regulatory purposes, it is noteworthy that even the maximum concentration (48×10^{-16} microcuries per milliliter) was still only 25 percent of the NESHAPs concentration level. The maximum annual averaged cesium-137 concentration usually occurred either at the Yucca station (in Area 6), the 3545 Substation (in Area 16), or the Mercury Track station (in Area 23).

As shown in Table D–15, the maximum annual averaged americium-241 concentration among the six critical receptors from 2002 through 2008 was about 12×10^{-18} microcuries per milliliter, which was less than 1 percent of the NESHAPs concentration level. Although the maximum observed 1-week averaged concentration cannot be compared to the NESHAPs concentration level for regulatory purposes, it is noteworthy that even the maximum concentration (106×10^{-18} microcuries per milliliter) was still only 6 percent of the NESHAPs concentration level. The maximum annual averaged americium-241 concentration usually occurred either at the Yucca monitoring station (in Area 6), the Gate 700 S station (in Area 10), or the Schooner station (in Area 20).

Since the offsite CEMP stations surrounding the NNSS were upgraded in 1999 (DOE 2009a), the CEMP monitors have not detected radiation that can be attributed to NNSS activities, and the observed radiation levels are well within the background levels typically observed in other parts of the country (DOE 2009d). **Table D–16** presents the maximum monthly average observed gamma radiation readings at some selected stations surrounding the NNSS from late 1999 through 2008 (see Figure D–4 for a map of all CEMP locations). Although these are maximum monthly average values, they are still well within the range of natural background exposures estimated for cities in the United States (see Table D–16).

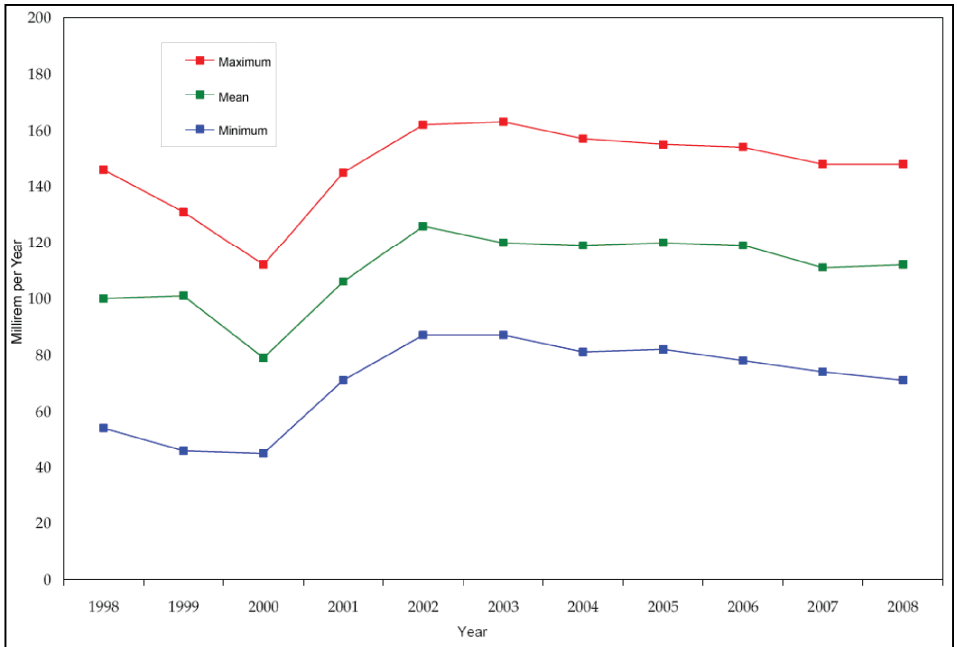
Table D–16 Average Monthly Maximum Gamma Radiation Observations from Select Community Environmental Monitoring Program Stations Surrounding the Nevada National Security Site (millirem per year [a])

	Tonopah	*Goldfield*	*Indian Springs*	*Las Vegas*	*Medlin's Ranch*	*Amargosa Valley*	*Average*
Jan	147	138	104	94	147	110	123
Feb	148	138	102	94	147	110	123
Mar	146	137	101	92	145	110	122
Apr	148	137	101	91	145	112	122
May	146	135	100	91	145	112	121
Jun	146	134	99	90	145	112	121
Jul	145	134	98	91	145	111	121
Aug	145	133	99	91	143	111	120
Sep	148	135	102	91	142	112	122
Oct	149	138	102	92	148	111	123
Nov	149	138	103	94	147	110	124
Dec	150	140	105	95	149	111	125
Period	Oct 1999 – Dec 2008	Oct 1999 – Dec 2008	Sep 1999 – Dec 2008	Jan 2000 – Dec 2008	Nov 1999 – Dec 2008	Oct 1999 – Dec 2008	

[a] Data in the reference source were presented in units of microroentgen per hour; this table presents the data in millirem per year for ease in comparing with the reference level of the National Emission Standards for Hazardous Air Pollutants. The conversion assumed that 1 roentgen gamma exposure from the most common external radionuclides generally produces a dose of 1 rem (DOE 2009d, page 14).

Source: DOE 2009e.

Figure D–7 shows the annual average radiation levels among all CEMP stations from 1998 through 2008, along with annual maximum and minimum values from among the individual stations. These levels were measured by thermoluminescent dosimeters, which measure ionizing radiation from all natural and manmade sources (DOE 2009d).



Note: Radiation levels measured by thermoluminescent dosimeters. The displayed radiation rate unit is milliroentgen per year, which is equivalent to a dose of 0.933 millirem per year, assuming 1 roentgen gamma exposure from the most common external radionuclides generally produces a 1 rem dose.
Source: DOE 2009d

Figure D–7 Annual Average Radiation Levels and Maximum and Minimum Values Among all Community Environmental Monitoring Program Stations, 1999–2008

Table D–17 presents a number of dose estimates resulting from the inhalation of radionuclides on or near the NNSS. From 2003 through 2008, the NNSS environmental reports presented the effective dose equivalent (EDE) (in millirem per year) received by a person residing at the critical receptor that had the largest sum of NESHAPs concentration level fractions (which in all cases was the Schooner receptor in Area 20). For example, in 2008, the Schooner critical receptor had a sum of NESHAPs concentration level fractions of 0.193. This sum of 0.193 indicates that the theoretical person at the receptor experienced an EDE that is 19.3 percent of the NESHAPs level. Since the NESHAPs level is 10 millirem per year, the EDE at the Schooner receptor was 1.93 millirem per year. Although no member of the public has access to areas near these critical receptors, these EDEs can be considered conservative; the EDE experienced by a member of the public off site would be considerably lower. Note that even these EDEs are well below the 10 millirem per year NESHAPs limit for inhalation.

Table D–17 also shows what each year's NNSS environmental report presents as the EDE experienced by the maximally exposed individual (MEI). However, the definition of the MEI changed in 2005, and the method of calculating the EDE changed in 2005 and in 2007. Prior to 2005, the CAP88-PC model (a computer model for estimating dose and risk from radionuclide air emissions) was used with onsite emissions estimates to calculate the EDE experienced by the offsite MEI. Beginning in 2005, CAP88-PC was no longer used for this purpose. In 2005 and 2006, the MEI was still assumed to be off site, but the EDE for the offsite MEI was not directly calculated. Instead, it was assumed to be no greater than 0.2 millirem per year, which was based on the CAP88-PC results from 1992 through 2004. In 2007 and 2008, the MEI was assumed to be located at the critical receptor that had the largest sum of NESHAPs concentration level fractions, and the EDE was estimated directly based on this sum (the sum was multiplied by the NESHAPs level of 10 millirem per year to arrive at the EDE). Compared with using CAP88-PC for an offsite MEI, using direct monitoring results for a critical receptor MEI is very conservative because critical receptors are generally the locations of maximum diffuse radioactive emissions on the NNSS so they likely overstate the radiation dose to the offsite MEI.

Table D–17 Effective Dose Equivalents for Maximally Exposed Individuals by Various Estimation Methods, 1997–2008 (millirem per year)

	1997	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
EDE received by an MEI at the critical receptor with the largest sum of NESHAPs CL fractions [a]	--	--	--	--	--	--	2.86	2.45	2.3	2.49	1.9	1.93
EDE to the MEI, as presented in the NNSS environmental reports	0.089 [b]	0.092 [b]	0.12 [b]	0.17 [b]	0.17 [b]	0.11 [b]	0.1 [b]	0.12 [b]	[c]	[c]	[d]	[d]
Reference	DOE 1998, page 7-2	DOE 1999, page 7-2	DOE 2000, page 1-4	DOE 2001, page 1-5	DOE 2002, page 1-5	DOE 2003, page 1-4	DOE 2004, pages 2-19 and 7-3	DOE 2005, pages 3-20 and 8-9	DOE 2006, pages 3-18 and 8-7	DOE 2007, pages 3-18 and 8-5	DOE 2008c, pages 3-18 and 8-5	DOE/NV 2009, pages 3-18 and 8-6

CL = concentration level; EDE = effective dose equivalent; MEI = maximally exposed individual; NESHAPs = National Emission Standards for Hazardous Air Pollutants; NNSS = Nevada National Security Site.

[a] The sum of NESHAP CL fractions was not presented in the NNSS environmental reports from 1997 through 2002. From 2003 through 2008, the critical receptor with the largest sum of NESHAPs CL fractions was the Schooner site in Area 20.

[b] Through 2004, the CAP88-PC model was used with onsite emissions estimates to calculate the EDE to the offsite MEI.

[c] Beginning in 2005, the CAP88-PC model was no longer used to estimate offsite exposure to onsite radioactive emissions. In 2005 and 2006, the EDE to the offsite MEI was estimated to be no more than 0.2 millirem per year based on the CAP88-PC results from 1992 through 2004.

[d] Beginning in 2005, the CAP88-PC model was no longer used to estimate offsite exposure to onsite radioactive emissions. In 2007 and 2008, the MEI was considered to be a person residing at the critical receptor with the largest sum of NESHAPs CL fractions, though the public has had never access to that location.

To put the inhalation radiation dose numbers in Table D–17 into perspective, **Figure D–8** shows a comparison of radiation dose sources received by an offsite MEI. Exposure to radon represents about 59 percent of total radiation exposure to the MEI, while the dose received from NNSS emissions (assumed to be 0.2 millirem per year, based on data in Table D–17) represents less than 1 percent of total radiation exposure to the MEI.

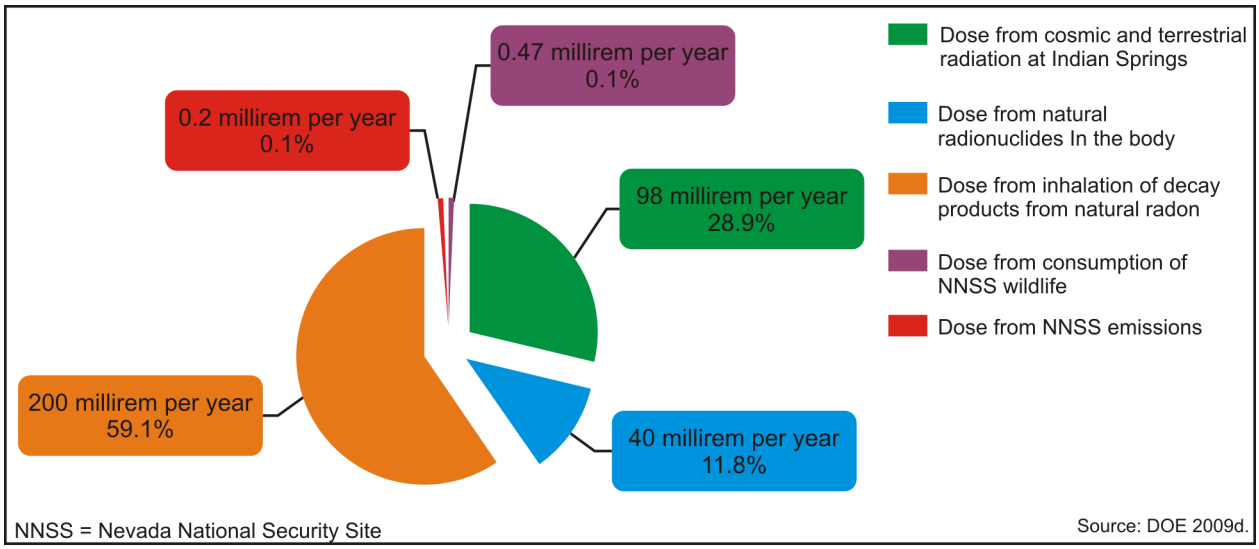


Figure D–8 Comparison of Radiation Doses to the Offsite Maximally Exposed Individual from Natural Background Sources and the Nevada National Security Site

D.1.1.3 Climate Change

Greenhouse gas emissions due to NNSS activities were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010). The electricity consumption by NNSS activities for fiscal year 2009 (45,300,740 kilowatt-hours) was provided by NNSA. This electricity consumption was assumed to be representative of calendar year 2008. The NNSS purchased electricity off of the Arizona-New Mexico (WECC Southwest) eGRID subregion. Greenhouse gas emissions from onsite permitted stationary sources were derived from the amount of red dye diesel used on site (66,433 gallons), as reported by NNSA for fiscal year 2009 and assumed to be representative of calendar year 2008. Emissions from refrigeration and air conditioning (22 pounds HFC-32 [diflouoromethane], 22 pounds HFC-125 [pentafluoroethane], 443 pounds HFC-134a [1,1,1,2-tetrafluoroethane], and 57.7 pounds of SF_6 [sulfur hexafluoride]) were provided by NNSA for fiscal year 2008 and are assumed to be representative of calendar year 2008.

For carbon dioxide emissions by onsite government vehicles, greenhouse gas emissions were estimated using vehicle fuel consumption. Fuel consumption amounts for each vehicle type and fuel type were derived in the same way as VMT amounts for each vehicle type and fuel type were derived (see the discussion in Section D.1.1.2). In short, the estimated fraction of each fuel group (gasoline+ethanol and No. 2 diesel+biodiesel) used by each vehicle type (see Table D–4) was multiplied by the total amount of each fuel type consumed on site (see Section D.1.1.2.1) to arrive at the amount of fuel consumed by each vehicle type and fuel type. For nitrous oxide and methane emissions by onsite government vehicles, and for the greenhouse gas emissions by all other NNSS-related vehicles, the VMT by each vehicle type and each fuel type (see Table D–4) were used. For the purposes of greenhouse gas emissions calculations, ethanol-consuming passenger cars and trucks were considered light-duty vehicles, gasoline-consuming

passenger trucks were considered light-duty trucks, and all No. 2 diesel-consuming vehicles were considered heavy-duty vehicles. All other vehicle type and fuel type combinations had obvious matches in the Greenhouse Gas Emissions Calculator.

D.1.2 Remote Sensing Laboratory

D.1.2.1 Meteorology

This section expands on the meteorological characteristics of the Remote Sensing Laboratory (RSL) site presented in Chapter 4, Section 4.2.8.1, of this *NNSS SWEIS*.

The average annual rainfall in the Las Vegas Valley is about 4.5 inches. Rainfall is most common in the late winter and early spring (during Pacific storm passage) and in the late summer (with convective thunderstorms, monsoons, and the occasional tropical storm) (based on climate averages measured at the Las Vegas Weather Service Office Airport from 1971–2000; NCDC 2009). Nevada on the whole has been in a drought most of the last decade, with precipitation amounts far below normal (DOE 2008f), though some recent years (notably 2003 through 2005) were wetter than normal (NWS VEF 2009). Snowfall in the Las Vegas area is rare, with an annual average snowfall total of about 1 inch (based on the measurements taken from 1937–2009 at the Las Vegas Weather Service Office Airport; NCDC 2009). The average annual number of thunderstorm days is about 13, with thunderstorms most frequently occurring in July and August (NWS VEF 2009). Tornadoes in Nevada are exceedingly rare (NRC 1986).

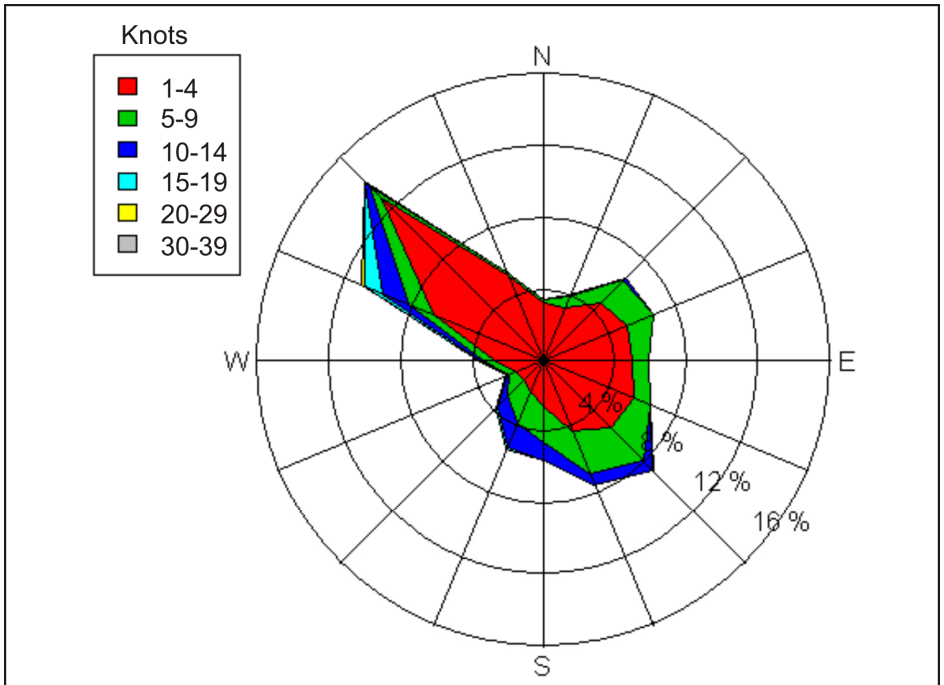
The Clark County Department of Air Quality and Environmental Management (DAQEM) maintains two ambient monitoring sites (the J.D. Smith and E. Craig Road sites) near RSL and NLVF. The annual average (2004–2008) wind roses are shown in **Figures D–9** and **D–10** for these two locations. A review of the timing in these figures shows that during the night, down-slope (northwesterly) drainage winds dominate. During the day, up-slope (southeasterly) winds dominate (Lehrman et al. 2006).

D.1.2.2 Ambient Air Quality on and near the Remote Sensing Laboratory

This section expands the ambient air quality discussion presented in Chapter 4, Section 4.2.8.2, of this SWEIS.

D.1.2.2.1 Existing Air Quality

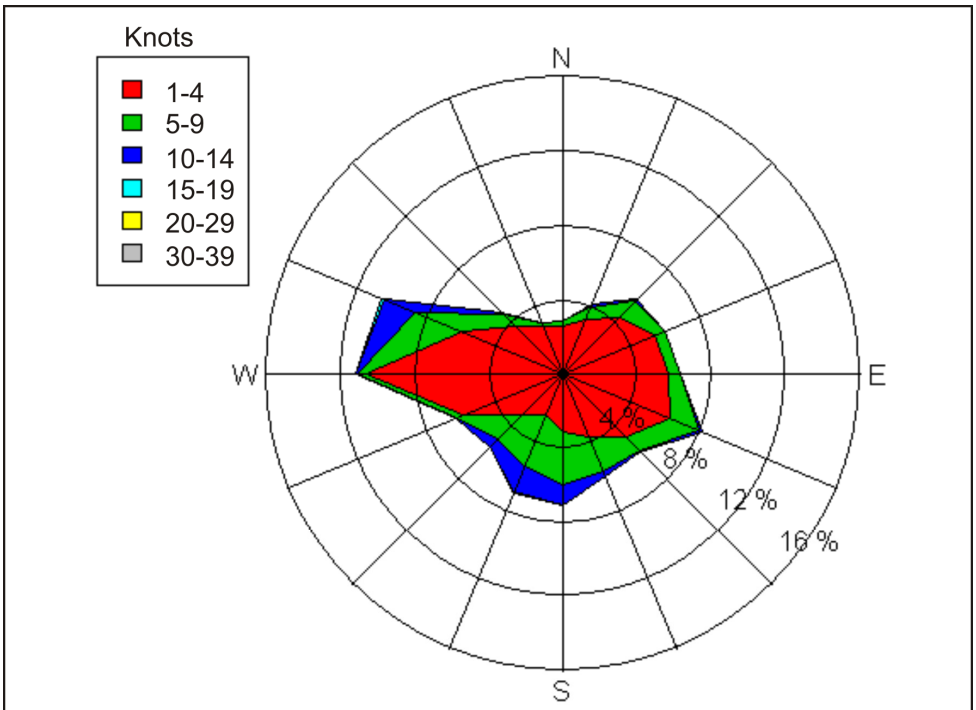
RSL is located about 60 miles southeast of the southern border of the NNSS. The region of influence for air quality and climate for RSL operations is northern Clark County. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the resolution of county or hydrographic areas and provide a basis for determining existing air quality in the region of influence and a metric for emissions comparison assessments. See Chapter 4, Section 4.1.8.2.2, for a discussion on the current NAAQS and Nevada Ambient Air Quality Standards.



Note: To convert knots to meters per second, multiply by 0.5144. To convert knots to miles per hour, multiply by 1.121.

Source: Clark County 2010.

Figure D–9 Annual Average Wind Rose for the E. Craig Road DAQEM Site at 4701 Mitchell Street, 2004–2008



Note: To convert knots to meters per second, multiply by 0.5144. To convert knots to miles per hour, multiply by 1.121.

Source: Clark County 2010.

Figure D–10 Annual Average Wind Rose for the J.D. Smith DAQEM Site at 1301 East Tonopah Road, 2004–2008

Emissions from Onsite Stationary and Mobile Sources. The 2008 emissions of onsite permitted stationary sources were from the 2008 NNSS environmental report (DOE 2009d). The amount of natural gas combusted for heating (33,673 therms, or 3,367,300 cubic feet) for fiscal year 2009 was provided by the DOE/NNSA Nevada Site Office (NSO), and the resulting emissions were derived from the EPA AP-42 emissions factors database (EPA 1995a). This natural gas combustion was assumed to be representative of calendar year 2008.

Table D–18 shows the emissions rates and activity times used to estimate emissions from activity related to RSL aircraft. The amount of jet fuel combusted by RSL aircraft (111,030 gallons) for fiscal year 2009 was provided by the DOE NNSA/NSO, and this aircraft fuel combustion was assumed to be representative of calendar year 2008. The number of landings and takeoffs for airplanes (Raytheon Beechcraft Super King Air 200) and helicopters (Bell model) for fiscal years 2005 through 2009 were also provided by DOE NNSA/NSO. Landing and takeoff counts for fiscal year 2006 (260 landings and takeoffs for airplanes, 180 landings and takeoffs for helicopters) were used here because they were the largest of the five years, which creates a more health-conservative calculation of aircraft-related emissions.

Emissions of carbon monoxide, volatile organic compounds, nitrogen oxides, sulfur oxides, PM_{10}, and $PM_{2.5}$ from the airplane activity were derived from EDMS [Emissions and Dispersion Modeling System], v5.1.1 (FAA 2009), where the engine type was PT6A-42, the average mixing depth was 3,000 feet, and the taxi-in and -out times were 4.58 minutes and 30.74 minutes, respectively, across 493.5 total landings and takeoffs. Jet fuel contains no lead.

Appropriate emissions factors for helicopters were not readily available, so the same emission rates used for airplanes (from EDMS, v5.1.1; FAA 2009) were used after scaling them by the generic estimated helicopter activity times compared to the generic estimated turboprop airplane activity times (from EPA 1992). Jet fuel contains no lead.

Emissions of carbon monoxide, volatile organic compounds, nitrogen oxides, sulfur oxides, PM_{10}, and $PM_{2.5}$ from airplane ground support equipment for Raytheon Beechcraft Super King Air 200 airplanes were estimated from the emissions factors in EDMS, v5.1.1 (FAA 2009). The emission rate of lead from ground support equipment was derived from the Health Effects Institute study of mobile source metal emissions (HEI 2006, pages 36 through 48).

Emissions from current construction and surface disturbance activities were much smaller relative to these stationary and other mobile sources and were not explicitly calculated. $PM_{2.5}$ levels were not reported, so the $PM_{2.5}$ levels were conservatively assumed to be equal to the PM_{10} emission rates.

Table D–19 shows the current (approximately 2008) onsite emissions of criteria pollutants and HAPs associated with RSL permitted stationary sources, with heating using natural gas, and with aircraft and aircraft-related operations associated with RSL operations.

Table D–18 Aircraft-Related Emission Rates Used to Calculate Emissions from Aircraft-Related Activities at the Remote Sensing Laboratory

Aircraft	*Engine*	*Mode*	*Time in Mode (minutes)*	*Emissions per Mode per Landing or Takeoff (kilograms)*						
				CO	*VOCs*	*NO_x*	*SO_x*	*PM_{10}*	*$PM_{2.5}$*	*Lead*
Raytheon Beechcraft Super King Air 200	PT6A-42	Taxi out	19	1.83471084	0.47912844	0.05182179	0.03140373	0	0	0
		Takeoff	0.5	0.0310217	0.00217574	0.00239067	0.00109993	0	0	0
		Climbout	2.5	0.02877526	0.00024815	0.00251907	0.00113136	0	0	0
		Approach	4.5	0.1401291	0.03659423	0.00392481	0.00236548	0	0	0
		Taxi in	7	0.2745547	0.07169902	0.00775485	0.0046994	0	0	0
		Ground support	--	0.2410693	0.00908567	0.02079159	0.00252632	0.00140188	0.00130097	0.00016
Helicopters (Raytheon Beechcraft Super King Air 200 as surrogate)	(PT6A-42 as surrogate)	Taxi out	3.5	0.33797305	0.0882605	0.00954612	0.0057849	0	0	0
		Takeoff	0	0	0	0	0	0	0	0
		Climbout	6.5	0.07481569	0.00064518	0.00654957	0.00294154	0	0	0
		Approach	6.5	0.2024087	0.05285834	0.00566917	0.00341681	0	0	0
		Taxi in	3.5	0.13727735	0.03584951	0.00387743	0.0023497	0	0	0

CO = carbon monoxide; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_x = sulfur oxides; VOC = volatile organic compound.

Table D–19 Calculated Air Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Remote Sensing Laboratory Activities (tons per year)

	Clark County								
	On the Remote Sensing Laboratory								
	Stationary Sources			*Aircraft-Related Sources*					
Pollutant	*Spray Paint Booths, Emergency Generators, Boilers, Cooling Towers, Vapor Degreasers, Water Heaters*	*Natural Gas for Heating*	*Total*	*Airplane LTOs*	*Helicopter LTOs*	*Aircraft Ground Support Equipment*	*Total*	*Total*	*Reference*
PM_{10}	0.025	0.013	*0.038*	0	0	0.00040	*0.00040*	*0.038*	DOE 2009c, page A-10; EPA 1992, page 176; EPA 1995a, pages 1.4-5 to 1.4-6; FAA 2009
$PM_{2.5}$	0.025 [a]	0.013 [a]	*0.038* [a]	0	0	0.00037	*0.00037*	*0.038*	
CO	0.217	0.14	*0.36*	0.66	0.15	0.069	*0.88*	*1.2*	
NO_x	0.426	0.47	*0.90*	0.020	0.0051	0.020	*0.045*	*0.94*	
SO_2	0.009	0.0010	*0.010*	0.012	0.0029	0.00072	*0.016*	*0.026*	
VOCs	0.023	0.0093	*0.032*	0.17	N/A	0.0026	*>0.17*	*>0.20*	
Lead	<0.01 [b]	8.4×10^{-7}	*0.010*	0	0	6.4×10^{-8}	*~0.00040*	*~0.038*	EPA 1995a, pages 1.4-5 to 1.4-6; HEI 2006, pages 36-48
HAPs	0.004	0.0031	*0.0071*	<0.17 [c]	N/A [c]	<0.0026 [c]	*~0.17* [c]	*~0.18*	DOE 2009c, page A-10

~ = approximately; < = less than; CO = carbon monoxide; HAP = hazardous air pollutant; LTOs = landings and takeoffs; N/A = not applicable; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] PM_{10}, as reported in the reference, is conservatively assumed to correspond to $PM_{2.5}$.

[b] Lead emissions are not explicitly reported on site, but they are assumed to be very small.

[c] HAP calculation was unavailable, but HAP emissions should be a factor of VOC emissions, and should be comparatively small.

Note: Activities are partitioned by source type. Stationary permitted source emissions are representative of 2008, while natural gas and aircraft-related sources are representative of fiscal year 2006, which is assumed to be representative of calendar year 2008.

Onsite permitted stationary sources emitted approximately 0.7 tons of criteria pollutants in 2008, the bulk of which (0.426 tons) was nitrogen oxides. Emissions from spray booths and vapor degreasers were nearly 0 (less than 0.001 tons of HAPs from spray booths and less than 0.01 tons of volatile organic compounds from vapor degreasers) (DOE 2008b). So, among the onsite permitted stationary sources, about 54 percent of emissions (about 0.38 tons criteria pollutants, 0 tons HAPs) were from boilers and water heaters and about 46 percent (about 0.32 tons criteria pollutants, 0 tons HAPs) were from diesel generators.

Natural gas used for heating on RSL resulted in about 0.63 tons of criteria pollutant emissions in fiscal year 2009, which is assumed to be representative of calendar year 2008. Most of the criteria pollutant emissions (0.47 tons) were nitrogen oxides. A very small amount (0.0031 tons) of HAPs was emitted.

Airplane landing and takeoff activities at RSL resulted in about 0.86 tons of criteria pollutant emissions in fiscal year 2006, which is assumed to be representative of calendar year 2008. Most of those criteria pollutant emissions (0.66 tons) were carbon monoxide. A very small amount (less than 0.17 tons) of HAPs were emitted. Ground support equipment related to these airplane landings and takeoffs emitted about 0.09 tons of criteria pollutants and less than 0.0026 tons of HAPs. Helicopters emitted about 0.16 tons of criteria pollutants, most of which (0.15 tons) was carbon monoxide. Altogether, aircraft-related activities emitted about 1.1 tons of criteria pollutants (0.88 tons of which was carbon monoxide) and less than 0.2 tons of HAPs.

Overall, onsite stationary source, heating, and aircraft-related sources emitted about 2.4 annual tons of criteria pollutants in 2008, most of which (about 1.2 tons) was carbon monoxide. Most (55 percent) of these onsite criteria pollutant emissions were from stationary sources, while 42 percent were from aircraft and 4 percent were from aircraft-related ground support equipment. A small amount of HAPs (less than 0.2 tons) was emitted on site.

Emissions from Commuter and Commercial Vendor Mobile Sources. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from employees commuting to the RSL using personal vehicles and from nonradioactive waste trucks (commercial vendors) servicing RSL. **Table D–20** and the following discussion contain further details on the activity and vehicle data that were used. See Chapter 4, Section 4.1.3, for further details on the traffic activity levels. Mobile emissions from onsite activities at RSL are believed to be very small compared to commuter emissions and are not shown.

Table D–20 Vehicle Activity Data Used to Model Emissions from Commuters and Commercial Vendors Traveling to and from the Remote Sensing Laboratory

Activity Type	*MOVES2010 Vehicle Type*	*Count*	*Annual VMT*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Type Used*
Commuting	Light-duty vehicles	53	471,731	95	Unleaded gasoline
	Light-duty passenger trucks	53	471,731		
Commercial vendors	Single-unit, short-haul trucks	5	72,072	95	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

Private-vehicle commuter activity data were derived from employee count and residence information. Commercial vendor activity was derived from employee count data and from the 1999 NTS road renovation study (BN 1999). Radioactive waste transport does not usually occur at RSL, and it did not occur in 2008. For personal-vehicle commuters, half were assumed to use light-duty vehicles and the other half were assumed to use light-duty passenger trucks. All personal-vehicle commuters were assumed to use only unleaded gasoline, and all commercial vendors were assumed to use only No. 2 diesel. The lead emissions factors for mobile sources in EPA's *Air Quality Criteria for Lead* (EPA 2006) were used to estimate lead emissions for RSL personal-vehicle commuter vehicles and RSL commercial vendor vehicles.

MOVES default fuel market shares, meteorology, vehicle speed distributions, and monthly and hourly VMT distributions were used. Only running exhaust, brake wear, and tire wear were modeled. As was done for NNSS onsite government vehicles, light-duty vehicles and light-duty passenger trucks were assumed to have an average age of 9 years and single-unit, short-haul trucks were assumed to have an average age of 11 years old. The same Clark County road distribution used for NNSS commuter traffic was used for RSL commuters and commercial vendors (see Section D.1.1.2.1).

Table D–21 shows the modeled current (approximately 2008) ground vehicle emissions of criteria pollutants and HAPs associated with onsite employees commuting to the RSL and with commercial vendors traveling to and from RSL. Mobile source emissions related to RSL commuters and commercial vendors were much larger than stationary source emissions on RSL and were smaller than aircraft landing and takeoff emissions. Mobile source commuter activities emitted about 4 tons of criteria pollutants (3.1 tons of carbon monoxide alone) and about 0.0048 tons of HAPs. Light-duty vehicles contributed about 31 percent towards this criteria pollutant commuter total and about 21 percent towards this HAP commuter total, while light-duty passenger trucks contributed the remainders. Commercial vendors emitted about 0.68 tons of criteria pollutants (0.40 tons of nitrogen oxides alone) and about 0.048 tons of HAPs.

Table D–21 Estimated 2008 Air Emissions of Criteria Pollutants and HAPs from Commuters and Commercial Vendors Traveling to and from the Remote Sensing Laboratory (tons per year)

	Clark County				
	Off the Remote Sensing Laboratory				
	Commuting			***Commercial Vendors***	
Pollutants	***Light-Duty Vehicles***	***Light-Duty Passenger Trucks***	***Total***	***Single-Unit, Short-Haul Trucks***	***Total***
PM_{10}	0.012	0.018	*0.030*	0.043	*0.073*
$PM_{2.5}$	0.0065	0.0097	*0.016*	0.040	*0.056*
CO	0.98	2.1	*3.1*	0.18	*3.3*
NO_x	0.21	0.55	*0.76*	0.40	*1.2*
SO_2	0.0035	0.0049	*0.0084*	0.00074	*0.0091*
VOCs	0.011	0.051	*0.062*	0.058	*0.12*
Lead	1.0×10^{-6}	1.0×10^{-6}	2.0×10^{-6}	6.8×10^{-7}	2.7×10^{-6}
HAPs	0.001	0.0038	*0.0048*	0.0076	*0.012*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.1.2.3 Climate Change

This section expands the climate change discussion presented in Chapter 4, Section 4.2.8.4, of this *NNSS SWEIS*.

Greenhouse gas emissions due to RSL activities were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010). About 33 percent of the electricity consumed by RSL was supplied by renewable sources for fiscal year 2009, which is assumed to be representative of calendar year 2008. The resulting nonrenewable electricity consumption by RSL activities (3,250,630 kilowatt-hours) was provided by NNSA. RSL purchased electricity off of the Arizona-New Mexico (WECC Southwest) eGRID subregion. The amount of natural gas consumed by RSL activities (33,673 therms, or 3,367,300 cubic feet) was supplied by NNSA for fiscal year 2009, which is assumed to be representative of calendar year 2008. Greenhouse gas emissions from onsite permitted diesel generators were derived from the amount of amount of red dye diesel used by the generators in 2008 (960 gallons), as reported by DOE (2008b).

The amount of jet fuel used by RSL-related aircraft activities (111,030 gallons) for fiscal year 2009 was provided by NNSA and is assumed to be representative of calendar year 2008. The amount of fuel used by aircraft-related ground support equipment, which are set as heavy-duty vehicles in the Greenhouse Gas Emissions Calculator, was unknown but should be fairly small given the relatively few airplane operations there (an average of 232 annually from fiscal years 2005 through 2009). Ground support equipment was assumed to use 60 gallons of diesel, which was back-calculated from the relationship between the known VMTs by RSL commercial vendors and the ratio of modeled PM_{10} emission rates to estimated fuel consumption based on assumed fuel economy.

VMTs by each vehicle type and each fuel type were used in developing the greenhouse gas emissions attributed to RSL commuter and commercial vendor vehicles. For the purposes of greenhouse gas emissions calculations, gasoline-consuming light-duty passenger trucks were considered light-duty trucks, and all No. 2 diesel-consuming vehicles were considered heavy-duty vehicles. All other vehicle type and fuel type combinations had obvious matches in the Greenhouse Gas Emissions Calculator.

D.1.3 North Las Vegas Facility

D.1.3.1 Meteorology

The meteorological characteristics of the NLVF and RSL sites are based on the same observations due to the close proximity of the locations. Please see Section D.6 for a complete analysis of the meteorological characteristics of the NLVF site.

D.1.3.2 Ambient Air Quality on or near the North Las Vegas Facility

This section expands the meteorology discussion presented in Chapter 4, Section 4.3.8.2, of this *NNSS SWEIS*.

D.1.3.2.1 Existing Air Quality

This section expands the discussion on the methodology used in determining the air emissions for the NLVF.

Emissions from Onsite Stationary Sources. The 2008 emissions of onsite permitted stationary sources were from the 2008 NNSS environmental report (DOE 2009d). The amount of natural gas combusted for

heating (25,947 therms, or 2,594,700 cubic feet) for fiscal year 2009 was provided by the DOE NNSA/NSO, and the resulting emissions were derived from the EPA AP-42 emissions factors database (EPA 1995a). This natural gas combustion was assumed to be representative of calendar year 2008. Emissions from current construction and surface disturbance activities were much smaller relative to these stationary and other mobile sources and were not explicitly calculated. $PM_{2.5}$ levels were not reported, so the $PM_{2.5}$ levels were conservatively assumed to be equal to the PM_{10} emission rates.

Onsite permitted stationary sources emitted approximately 0.5 tons of criteria pollutants in 2008, the bulk of which (0.365 tons) was nitrogen oxides. Emissions from sanders, blasters, and paint booths was nearly 0 (about 0.01 tons of PM_{10} from aluminum sanders; DOE 2008e), so among the onsite stationary sources, 98 percent of emissions were from diesel generators.

Natural gas used for heating on NLVF resulted in about 0.49 tons of criteria pollutants in fiscal year 2009, which is assumed to be representative of calendar year 2008. Most of the criteria pollutant emissions (0.36 tons) were nitrogen oxides. A very small amount (0.0024 tons) of HAPs were emitted.

Criteria pollutant and HAP emissions from activities at NLVF are shown in **Table D–22**. Activities are partitioned by source type. Stationary permitted source emissions are representative of 2008; natural gas combustion emissions are representative of fiscal year 2009 (assumed to be representative of calendar year 2008).

Table D–22 Calculated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite North Las Vegas Facility Activities (tons per year)

	Clark County			
	On the North Las Vegas Facility			
Pollutant	***Sanders, Blasters, Spray Paint Booths, Emergency Generators, Boilers, Cooling Towers***	***Natural Gas Consumption***	***TOTAL***	***Reference***
PM_{10}	0.027	0.0099	*0.037*	DOE 2009d, page A-7 and EPA 1995a, pages 1.4-5 to 1.4-6
$PM_{2.5}$	0.027 [a]	0.0099	*0.037*	
CO	0.082	0.11	*0.19*	
NO_x	0.365	0.36	*0.73*	
SO_2	0.016	0.00078	*0.017*	
VOCs	0.021	0.0071	*0.028*	
Lead	<0.01 [b]	6.5×10^{-7}	*<0.01*	EPA 1995a, pages 1.4-5 to 1.4-6
HAPs	0.0002	0.0024	*0.0026*	DOE 2009d, page A-7 and EPA 1995a, pages 1.4-7 to 1.4-8

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.
[a] PM_{10}, as reported in the reference, is conservatively assumed to correspond to $PM_{2.5}$.
[b] Lead emissions are not explicitly reported on site, but they are assumed to be very small.

Emissions from Commuter, Commercial Vendor, and Radioactive Waste Transport Mobile Sources. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic to and from the NNSS. **Table D–23** and the following discussion contain further details on the activity and vehicle data that were used. See Chapter 4, Section 4.1.3, for more details.

Table D–23 Vehicle Activity Data Used to Model Emissions from Commuters, Commercial Vendors, and Radioactive Waste Trucks Traveling to and from the North Las Vegas Facility

Activity Type	*MOVES2010 Vehicle Type*	*Count Originating in Clark County*	*Count Originating in Nye County*	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the NNSS*	*Annual VMT Within Nye County and Inside the NNSS*	*Percentage Annual Clark County VMT Occurring on Weekdays*	*Percentage Annual Nye County VMT Outside the NNSS Occurring on Weekdays*	*Percentage Annual Nye County VMT Inside the NNSS Occurring on Weekdays*	*Fuel Type Used*
Commuting	Light-duty vehicles	567	5	3,864,738	23,435	0	95	95	0	Unleaded gasoline
	Light-duty passenger trucks	566	4	3,864,738	23,435	0	95	95	0	
Commercial vendors	Single-unit, short-haul trucks	23	0	310,565	0	0	95	0	0	No. 2 diesel
Radioactive waste trucks	Combination-unit, short-haul trucks	1	0	3,068	312	208	100	100	100	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; NNSS = Nevada National Security Site; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

Private-vehicle commuter activity data were derived from employee count and residence information. Commercial vendor activity was derived from employee count data and from the 1999 NTS road renovation study (BN 1999). Radioactive waste transport activity was derived from the number of transports and the NNSS destination reported as part of the 2009 NESHAPs submission (NSTec 2010), and these 2009 data are assumed to be representative of 2008. Note that these radioactive waste transports are occurring only because of a 1995 tritium contamination in the Building A-1 basement, not due to any other regular activities at NLVF. Mobile emissions from onsite activities at NLVF are believed to be very small compared with commuter emissions and are not shown.

For personal-vehicle commuters, half were assumed to use light-duty vehicles and the other half were assumed to use light-duty passenger trucks. Commercial vendors and radioactive waste transports used combination-unit trucks. All personal-vehicle commuters were assumed to only use unleaded gasoline, and all waste trucks were assumed to only use No. 2 diesel. The lead emissions factors for mobile sources in EPA's *Air Quality Criteria for Lead* (EPA 2006) were used for estimating lead emissions for NLVF personal-vehicle commuter vehicles, NLVF commercial vendor vehicles, and NLVF radioactive waste transport vehicles.

MOVES default fuel market shares, meteorology, vehicle speed distributions, and hourly VMT distributions were used. Only running exhaust, brake wear, and tire wear were modeled. For commuters and commercial vendors, MOVES-default monthly VMT distributions were used. For radioactive waste trucks, transport activity data were available by month, so the monthly VMT distribution was developed from the monthly data. As was done for the NNSS, onsite government vehicles, light-duty vehicles, and light-duty passenger trucks were assumed to be 9 years old, and single-unit, short-haul trucks were assumed to be 11 years old. The same Clark County road distribution used for NNSS commuter traffic was used for NLVF personal-vehicle commuter vehicles, NLVF commercial vendor vehicles, and NLVF radioactive waste transport vehicles (see Section D.1.1.2.1).

Table D–24 shows the modeled current (approximately 2008) ground vehicle emissions of criteria pollutants and HAPs associated with onsite employees commuting to NLVF and with waste transport (commercial vendors and radioactive waste trucks) to and from NLVF.

Mobile source emissions related to NLVF commuting and waste transport were much larger than stationary source emissions on NLVF. Mobile source commuter activities emitted about 31.7 tons of criteria pollutants (24.9 tons of carbon monoxide alone) and about 0.038 tons of HAPs. Light-duty vehicles contributed about 32 percent towards this criteria pollutant commuter total and about 22 percent towards this HAP commuter total, while light-duty passenger trucks contributed the remainders. Over 99 percent of these commuter emissions took place in Clark County, and the remainder took place in Nye County. Commercial vendors emitted about 7.9 tons of criteria pollutants (5.2 tons of nitrogen oxides alone) and about 0.055 tons of HAPs. Single-unit trucks contributed about 37 percent towards this commercial vendor criteria pollutant total and about 60 percent of this commercial vendor HAP total, while combination-unit trucks contributed the remainders. Radioactive waste truck activities related to NLVF emitted approximately 0.11 tons of criteria pollutants and 0.00050 tons of HAPs in 2008. Nitrogen oxides were emitted in by far the largest amounts (0.080 tons) among the criteria pollutants.

Table D–24 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Ground Vehicle Activity Related to the North Las Vegas Facility, 2008 (tons per year)

	Commuting				*Commercial Vendors*	*Radioactive Waste Transport*			*Total*			
	Light-Duty Vehicles		*Light-Duty Passenger Trucks*		*Single-Unit, Short-Haul Trucks*	*Combination-Unit, Short-Haul Trucks*						
	Clark County	*Nye County*	*Clark County*	*Nye County*	*Clark County*	*Clark County*	*Nye County*		*Clark County*	*Nye County*		
Pollutant	***Off NLVF***	***Off NNSS***	***Off NLVF***	***Off NNSS***	***Off NLVF***	***Off NLVF***	***On NNSS***	***Off NNSS***	***Off NLVF***	***On NNSS***	***Off NNSS***	***Total***
PM_{10}	0.10	0.00063	0.15	0.00086	0.19	0.0051	0.00032	0.00048	*0.45*	*0.00032*	*0.002*	*0.45*
$PM_{2.5}$	0.053	0.00037	0.08	0.00049	0.17	0.0048	0.0003	0.00045	*0.31*	*0.00030*	*0.0013*	*0.31*
CO	8.1	0.051	17.4	0.11	0.76	0.020	0.0013	0.0019	*26.3*	*0.0013*	*0.16*	*26.4*
NO_x	1.7	0.012	4.5	0.030	1.7	0.069	0.0045	0.0068	*8.0*	*0.0045*	*0.049*	*8.0*
SO_2	0.029	0.00016	0.040	0.00023	0.0032	0.000098	6.2×10^{-6}	9.4×10^{-6}	*0.072*	*6.2×10^{-6}*	*0.00040*	*0.073*
VOCs	0.093	0.00060	0.42	0.0026	0.25	0.0033	0.00021	0.00032	*0.77*	*0.00021*	*0.0035*	*0.77*
Lead	8.5×10^{-6}	5.2×10^{-7}	8.5×10^{-6}	5.1×10^{-8}	2.9×10^{-6}	2.9×10^{-8}	2.9×10^{-9}	2.9×10^{-9}	*0.000020*	*2.9×10^{-9}*	*5.7×10^{-7}*	*0.000021*
HAPs	0.0082	0.000058	0.032	0.00020	0.033	0.00043	0.000028	0.000042	*0.074*	*0.000028*	*0.00030*	*0.074*

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x= nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.1.3.3 Climate Change

This section discusses the basis for estimating the greenhouse gas emissions as presented in Chapter 4, Section 4.3.8.4, of this *NNSS SWEIS*.

The greenhouse gas emissions due to NLVF activities were calculated within the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010). The electricity consumption by NLVF activities for fiscal year 2009 (13,331,050 kilowatt-hours) was provided by NNSA. This electricity consumption was assumed to be representative of calendar year 2008. NLVF purchased electricity off of the Arizona-New Mexico (WECC Southwest) eGRID subregion. The amount of natural gas consumed by NLVF activities (25,947 therms, or 2,594,700 cubic feet) was supplied by NNSA for fiscal year 2009, which is assumed to be representative of calendar year 2008. Greenhouse gas emissions from onsite permitted diesel generators were derived from the amount of amount of red dye diesel used by the generators in 2008 (1,298 gallons), as reported by DOE (2008e). For greenhouse gas emissions by NLVF commuter, commercial vendor, and radioactive waste transport vehicles, the VMT by each vehicle type and each fuel type (see Table D–23) were used. For the purposes of greenhouse gas emissions calculations, gasoline-consuming light-duty passenger trucks were considered light-duty trucks, and all No. 2 diesel-consuming vehicles were considered heavy-duty vehicles. All other vehicle type and fuel type combinations had obvious matches in the Greenhouse Gas Emissions Calculator.

D.1.4 Tonopah Test Range

D.1.4.1 Meteorology

This section expands the meteorology discussion presented in Chapter 4, Section 4.4.8.2, of this *NNSS SWEIS*.

Precipitation. From about 1983 to 1990, the average annual snowfall total at the Tonopah Test Range Airport was about 15 inches (SORD 2002). A 7-year record (1961–1967) at a weather station that existed about 2 miles northeast of the current Tonopah Test Range Airport station recorded an average annual snowfall of about 19 inches (Schaeffer 1968). At the Tonopah Airport (about 25 miles northeast of KTNX at an elevation of about 5,394 feet above mean sea level), the average annual snowfall is about 13 inches (averaged over the period from 1954–2009 Average; NCDC 2009). At the highest elevations, annual snowfall amounts between about 40 and 60 inches are anticipated based on estimates made for Rainier Mesa (about 50 miles southeast of the Tonopah Test Range Airport at an elevation of 7,490 feet above mean sea level; Soulé 2006) and measurements (averaged over the period from 1966–2002) made at Snowball Ranch (90 miles northeast of the Tonopah Test Range Airport; at an elevation of about 7,159 feet above mean sea level; NCDC 2009).

Thunderstorms at the Tonopah Test Range occur primarily in springtime due to frontal passages and in the middle to late summer due to convection from daytime heating (Soulé 2006), and the same is likely true for the Tonopah Test Range (TTR). In a 29-month period (March 1990 through August 1992) at the Tonopah Test Range Airport, the average annual number of days with thunderstorms was 28 (USAF 2003), which is about 13 more than are typically recorded on the NNSS at Yucca Flat (about 68 miles southeast of the Tonopah Test Range Airport at an elevation of 3,921 feet above mean sea level) and at Desert Rock (90 miles southeast of the Tonopah Test Range Airport at an elevation of 3,304 feet above mean sea level). Observations on the NNSS suggest that thunderstorms are more frequent and begin earlier in the afternoon on the mesas compared to lower elevations (Soulé 2006). At the Tonopah Test Range Airport, thunderstorm activity tends to reach a maximum in the middle afternoon, with some summertime thunderstorms existing near and sometimes after midnight (USAF 2003).

On the NNSS, and likely on the TTR as well, it is rare for a thunderstorm to produce more than about 0.5 inches of rain at a given location, so flooding is rarely a problem. Thunderstorms on the NNSS can be severe at times, with strong surface wind gusts and intense cloud-to-ground lightning, but hail is infrequent and hail size is small (less than about 0.5 inches in diameter). Cloud-to-ground lightning activity tends to maximize over higher elevations particularly during the period from July through September (Soulé 2006). Tornadoes are very rare in Nevada as a whole, with a 1954–1983 tornado climatology indicating a tornado strike probability of 3 per year statewide (NRC 1986).

Wind Flow Overview. On the whole, the preferences towards down-slope winds (which tend to be northwesterly) and up-slope winds (which tend to be southerly or southeasterly) are apparent in the Tonopah Test Range Airport annual average wind rose (see **Figure D–11**). Similar wind flows are seen near the town of Tonopah at its CEMP station (see **Figure D–12**), about 31 miles northeast of the Tonopah Test Range Airport at an elevation of about 6,181 feet above mean sea level.

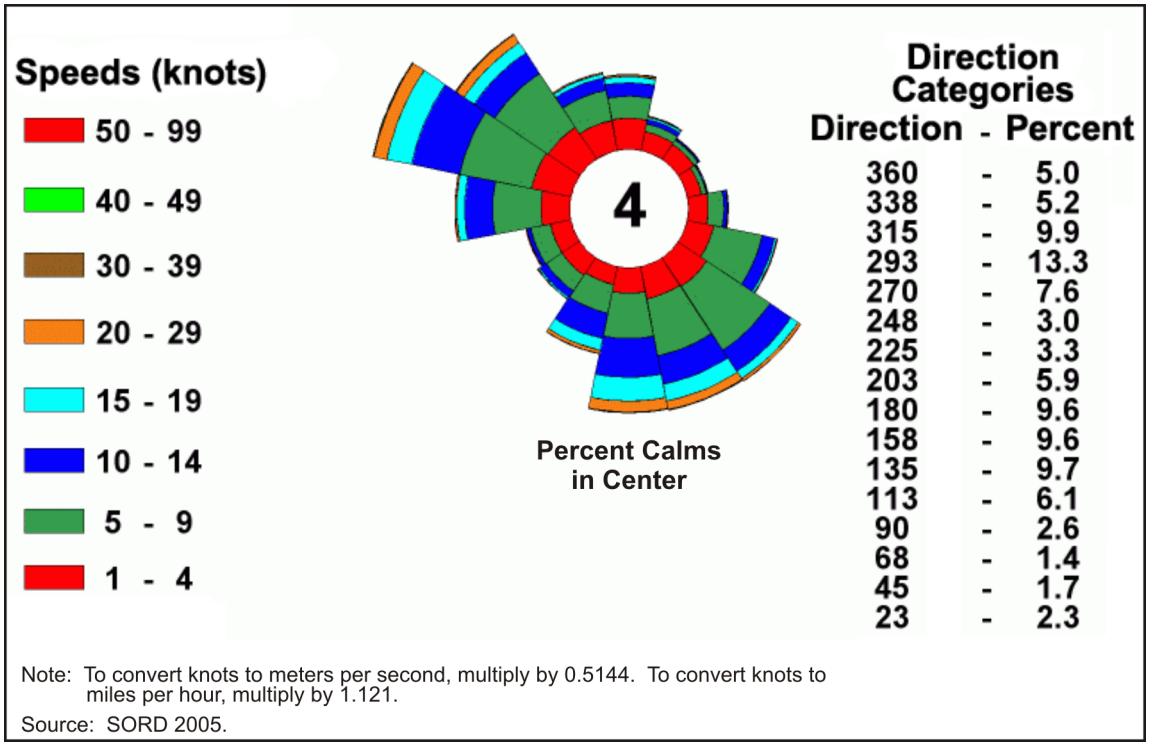
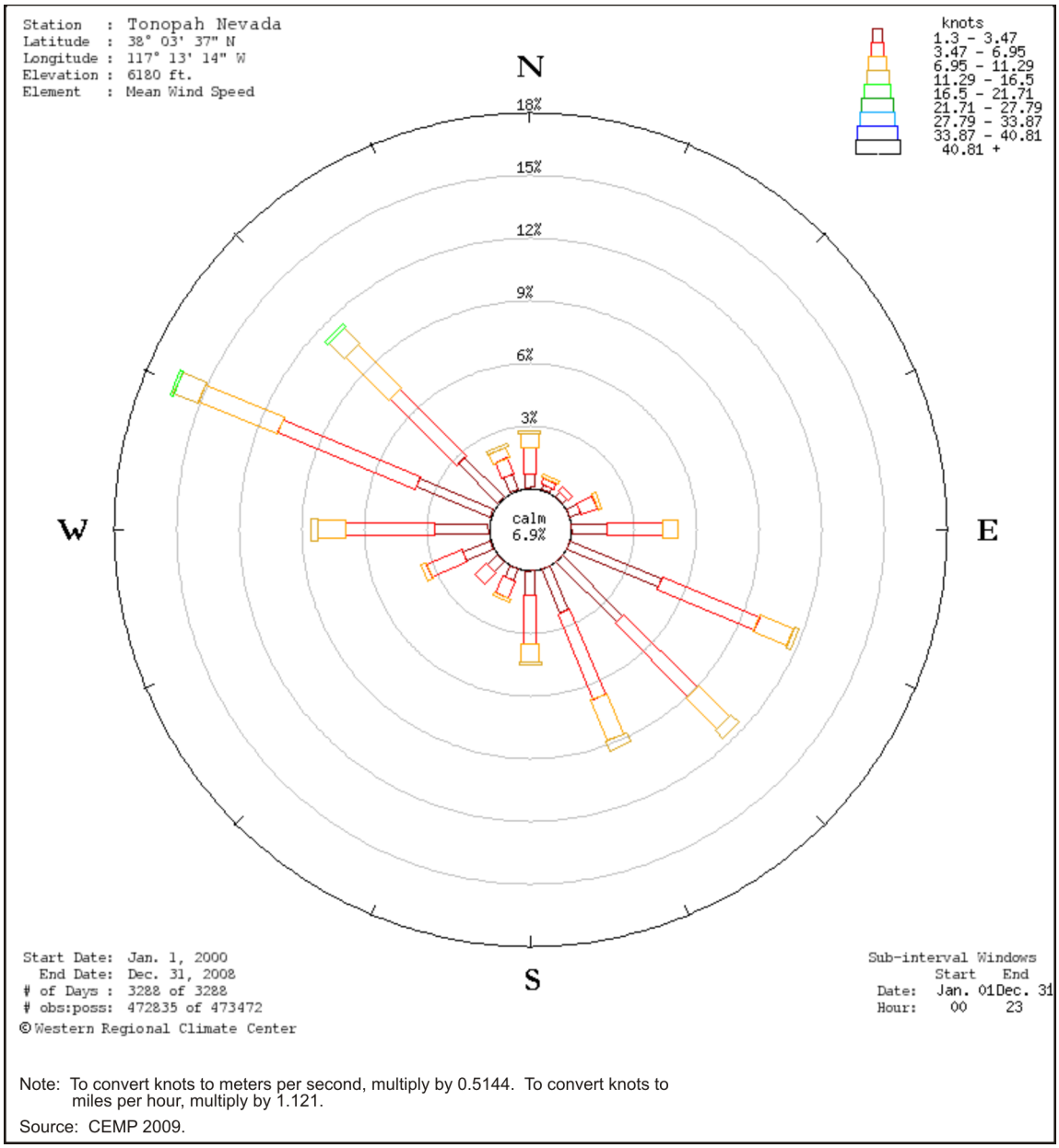


Figure D–11 Annual Average Wind Rose for Tonopah Test Range Airport, 1981–2004

Calm winds occur about 4 percent of the hours at the Tonopah Test Range Airport (see Figure D–11) and about 7 percent of the hours at the Tonopah CEMP station (see Figure D–12), with calm conditions more frequent during the winter months and less frequent during the summer. The annual average wind speed at the Tonopah Test Range Airport is about 9 miles per hour (USAF 2003) and at the Tonopah CEMP, about 7 miles per hour (CEMP 2009). Wind speeds along the Cactus and Kawich Mountain Ranges tend to be stronger because they are more influenced by generally stronger upper-level winds. Seasonally, winds tend to be strongest in the spring due to frontal passages and weakest in the fall. Wind gusts in excess of about 55 miles per hour can be observed during springtime frontal passages and during summertime convective thunderstorms (Soulé 2006). Dust storms are common in the spring, when monthly average wind speeds reach about 16 miles per hour (DOE 2009e).

Cloud cover measurements used to estimate atmospheric stability are available from the Desert Rock site located in the southeastern corner of the NNSS, 90 miles southeast of the Tonopah Test Range Airport.

Based on data recorded from 1978 through 2004 at Desert Rock, stable conditions dominate at night, though stronger wind speeds will tend to mix the atmosphere, leading to neutral conditions. Nighttimes tend to be more stable during the summer and fall months because of lighter winds at night relative to the winter and spring periods. Since greater solar radiation leads to greater instability, unstable conditions dominate the daytime hours and the months with the greatest solar radiation (summer) (Soulé 2006). These stability patterns would be slightly modified within the TTR based primarily on wind speed differences and potentially on differences in local cloud cover relative to what occurs at Desert Rock.



Note: To convert knots to meters per second, multiply by 0.5144. To convert knots to miles per hour, multiply by 1.121.

Source: CEMP 2009.

Figure D–12 Annual Average Wind Rose for the Tonopah Test Range Community Environmental Monitoring Program Station, 2000–2008

D.1.4.2 Ambient Air Quality on or near the Tonopah Test Range

This section expands the ambient air quality discussion presented in Chapter 4, Section 4.4.8.2, of this *NNSS SWEIS*.

D.1.4.2.1 Existing Air Quality

Emissions from Onsite Stationary Sources. The emissions from the TTR generators and propane boilers were not explicitly available. However, the horsepower and activity data for the TTR air permit were available for each generator and boiler. This information, in conjunction with the EPA AP-42 emissions factors (EPA 1995a), was used to estimate maximum allowed emissions levels. The emissions from the TTR storage tanks were not explicitly available.

Table D–25 shows the estimated maximum allowed air emissions of criteria pollutants and HAPs from onsite stationary TTR activities. These estimates reflect both permitted facilities operating at maximum permitted capacity and non-permitted facilities operating at peak capacity. The data are approximately representative of 2007, but are assumed to be representative of 2008 as well.

Table D–25 Estimated Maximum Allowed Air Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Stationary Tonopah Test Range Activities (tons per year)

	Nye County						
	On Tonopah Test Range						
Pollutant	*Screening Plant*	*Diesel Generators*	*Gasoline Generators*	*Propane Boilers*	*Storage Tanks*	*TOTAL (all programs)*	*Reference*
PM_{10}	<2.7	<0.95	<0.00072	<0.000031	0	*<3.7*	NDEP 2007, page V-1–V-7 and Appendix; and EPA 1995a, pages 1.5-3 and 3.3-6
$PM_{2.5}$	<2.7	<0.95	<0.00072	<0.000031	0	*<3.7*	
CO	N/A	<2.9	<0.0070	<0.00032	0	*<2.9*	
NO_x	N/A	<13.3	<0.011	<0.00057	0	*<13.3*	
SO_2	N/A	<0.88	<0.00059	<0.033	0	*<0.91*	
VOCs	<0.35	<0.13	<0.13	N/A	<0.35	*<0.96*	
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	*<0.01*	
HAPs	<0.83	<0.21	<0.00049	N/A	<0.09	*<1.1*	NDEP 2007, page V-1–V-7 and Appendix; and EPA 1995a, page 3.3-7

< = less than; CO = carbon monoxide; N/A = not applicable; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to n micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Onsite Government-Owned Vehicle Mobile Sources. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to government vehicle traffic on the TTR. Onsite mobile source activity data were derived from the onsite TTR fleet count from the *1996 NTS EIS* (DOE 1996), the NNSS onsite government-owned vehicle counts in the 1999 NTS road renovation study (BN 1999), the NNSS onsite government-owned fuel usage data (see Section D.1.1.2), the current estimated TTR VMTs (SNL 2010), and the weekday/weekend traffic ratios used for the TTR commuters (see commuter discussion below). The same methodology for estimating lead emissions that was used for onsite government vehicles (see Section D.1.1.2.1) was also used for personal-vehicle commuter vehicles. **Table D–26** contains further details on the activity and vehicle data that were used. See Chapter 4, Section 4.1.3, for more details.

Table D–26 Vehicle Activity Data Used to Model Emissions from Onsite Government Vehicles at the Tonopah Test Range

Vehicle Type Observed [a]	*MOVES2010 Vehicle Type*	*MOBILE6 Vehicle Type*	*Count*	*Annual VMT*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Types Used*	*Average Vehicle Age (model year)*	*Vehicle Fuel Economy (miles per gallon)*	*VMT per Applicable Fuel Type*	*Annual Lead Emissions (pounds)*
Single-unit trucks (2 to 3 axles)	Single-unit, short-haul trucks	Light-duty trucks 6,001–8,500	6	64,928	97	Biodiesel (assumed to be B-20 for MOVES modeling) and No. 2 diesel	11 years (1997)	11.2	10,317 No. 2 diesel 54,611 B-20	0.0012
Cars/light trucks	Light-duty vehicles	Light-duty trucks All	43	380,216		E85 (assumed to be E10 for MOVES modeling) and unleaded gasoline	9 years (1999)	24.1	267,178 Unleaded gasoline 113,038 E-10	0.0017
Cars/light trucks	Light-duty passenger trucks	Light-duty trucks 0–6,000	42	504,008		E85 (assumed to be E10 for MOVES modeling) and unleaded gasoline	9 years (1999)	18.5	354,166 Unleaded gasoline 149,842 E10	0.0022

MOBILE6 = Mobile Source Emission Factor Model; MOVES2010 = Motor Vehicle Emission Simulator 2010; VMT = vehicle miles traveled.
[a] Vehicle types observed in *Traffic Study and Cost Benefit Analysis to Renovate Existing Roadways, Nevada Test Site* (BN 1999).
Note: Modeling performed using MOVES2010.

Table D–27 shows the modeled current (approximately 2008) onsite mobile emissions of criteria pollutants and HAPs associated with TTR government vehicles. Total onsite emissions from stationary sources (shown in more detail in Table D–25) are also provided in Table D–27 to show the total onsite emissions from both stationary sources and government vehicle mobile sources.

The mobile source criteria pollutant emissions were dominated by carbon monoxide and nitrogen oxide emissions. Light-duty passenger trucks were the largest emitters (3.3 tons of criteria pollutants). Altogether, onsite TTR activities (mobile and stationary) emitted up to 26.5 tons of criteria pollutants and up to 1.1 tons of HAPs in 2008 if stationary sources were operating at maximum allowed levels.

Table D–27 Estimated Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Stationary Tonopah Test Range Sources and Mobile Sources, 2008 (tons per year)

	Nye County					
	On Tonopah Test Range					
	Government-Owned Mobile Source Type (Modeled)					
Pollutant	*Light-Duty Vehicles*	*Light-Duty Passenger Trucks*	*Single-Unit, Short-Haul Trucks*	*Total*	*Stationary Source Type (calculated)*	*Total*
PM_{10}	0.010	0.018	0.037	*0.065*	*<3.7*	<3.8
$PM_{2.5}$	0.0059	0.010	0.034	*0.050*	*<3.7*	<3.8
CO	0.84	2.6	0.15	*3.6*	*<2.9*	<4.5
NO_x	0.024	0.63	0.32	*0.97*	*<13.3*	<14.3
SO_2	0.0023	0.0043	0.00051	*0.0071*	*<0.91*	<0.92
VOCs	0.0095	0.054	0.041	*0.10*	*<0.96*	<1.1
Lead	0.0017	0.0022	0.00096	*0.0049*	*<0.01*	<0.015
HAPs	0.00089	0.0042	0.0046	*0.0097*	*<1.1*	<1.1

< = less than; CO = carbon monoxide; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.
Note: Mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–24.

Emissions from Commuter Mobile Sources. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from employees commuting to the TTR using personal vehicles. **Table D–28** and the following discussion contain further details on the activity and vehicle data that were used. See Chapter 4, Section 4.1.3, for more details.

Table D–28 Vehicle Activity Data Used to Model Emissions from Commuting to and from the Tonopah Test Range

MOVES2010 Vehicle Type	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the TTR*	*Annual VMT Within Nye County and Inside the TTR*	*Percentage Annual Clark County VMT Occurring on Weekdays*	*Percentage Annual Nye County VMT Outside of the TTR Occurring on Weekdays*	*Percentage Annual Nye County VMT Inside the TTR Occurring on Weekdays*	*Fuel Type Used*
Light-duty vehicles	138,902	574,804	16,978	100	97	92	Unleaded gasoline
Light-duty passenger trucks	138,902	574,804	16,978				

MOVES2010 = Motor Vehicle Emission Simulator 2010; TTR = Tonopah Test Range; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

Private-vehicle commuter activity data were derived from employee count and residence information. For personal vehicle commuters, half were assumed to use light-duty vehicles and the other half were assumed to use light-duty passenger trucks. All personal-vehicle commuters were assumed to use only unleaded gasoline. The lead emissions factors for mobile sources in EPA's *Air Quality Criteria for Lead* (EPA 2006) were used for estimating lead emissions for TTR personal-vehicle commuter vehicles.

To estimate the personal-vehicle emissions taking place in various locations, it was assumed that all personal-vehicle commuters enter the TTR via Route 504 near the Tonopah Test Range Airport. All personal-vehicle commuters coming from Clark County were assumed to use U.S. Route 95, which means that about 75 percent of their commute (about 371 round-trip miles per vehicle) is within Nye County and outside of the TTR and about 24 percent of their commute (about 119 round-trip miles per vehicle) is within Clark County. Roads within Nye County were assumed to be rural roads with unrestricted access. For Clark County roads, the same Clark County road distribution used for NNSS commuter traffic was used for TTR commuters (see Section D.1.1.2.1).

MOVES default fuel market shares, meteorology, vehicle speed distributions, and monthly and hourly VMT distributions were used. Only running exhaust, brake wear, and tire wear were modeled. Average age for onsite government vehicles, light-duty vehicles, and light-duty passenger trucks was assumed to be 9 years old.

Table D–29 shows the modeled current (approximately 2008) mobile emissions of criteria pollutants and HAPs associated with onsite employees commuting to the TTR. Commuting activities included privately owned light-duty vehicles and light-duty passenger trucks. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from employees commuting to the TTR. Private vehicle mobile source activity data were derived from employee count and residence information. See Chapter 4, Section 4.1.3, for more details on how commuter private vehicle activity data were determined.

Commuting activities related to the TTR emitted approximately 6.5 tons of criteria pollutants in 2008. Light-duty vehicles contributed about 31 percent towards this criteria pollutant total, while light-duty passenger trucks contributed the remainder. Carbon monoxide was emitted in the largest amounts at 5.1 tons. Commuting activities related to the TTR emitted approximately 0.0079 tons of HAPs in 2008. The majority (82 percent) of emissions related to commuting to the TTR took place in Nye County, most of which (98 percent) took place outside of the TTR. The remaining 18 percent of commuting emissions took place in Clark County.

Table D–29 Vehicle Activity Data Used to Model Emissions from Onsite Government Vehicles at the Tonopah Test Range (tons per year)

Pollutant	*Light-Duty Vehicles*			*Light-Duty Passenger Trucks*			*Total*			
	Clark County	*Nye County*		*Clark County*	*Nye County*		*Clark County*	*Nye County*		*Total*
		Off TTR	*On TTR*		*Off TTR*	*On TTR*		*Off TTR*	*On TTR*	
PM_{10}	0.0036	0.016	0.00046	0.0052	0.021	0.00062	*0.0087*	*0.037*	*0.0010*	*0.047*
$PM_{2.5}$	0.0019	0.0090	0.00026	0.0029	0.012	0.00035	*0.0048*	*0.021*	*0.00061*	*0.026*
CO	0.29	1.3	0.037	0.63	2.9	0.0085	*0.91*	*4.1*	*0.047*	*5.1*
NO_x	0.063	0.29	0.0087	0.16	0.73	0.022	*0.22*	*1.0*	*0.030*	*1.2*
SO_2	0.0010	0.0040	0.00012	0.0014	0.0056	0.00016	*0.0024*	*0.0095*	*0.00028*	*0.012*
VOCs	0.0034	0.015	0.00043	0.015	0.062	0.0018	*0.018*	*0.075*	*0.0022*	*0.095*
Lead	6.0×10^{-7}	1.3×10^{-6}	3.7×10^{-8}	6.1×10^{-7}	1.2×10^{-6}	3.7×10^{-8}	*1.2×10^{-6}*	*2.5×10^{-6}*	*7.4×10^{-8}*	*3.8×10^{-6}*
HAPs	0.00029	0.0014	0.000041	0.0011	0.0051	0.00015	*0.0014*	*0.0063*	*0.00019*	*0.0079*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.
Note: Modeling performed using MOVES2010.

Emissions from Commercial Vendor Mobile Sources. The MOVES2010 (Version 20091221; EPA 2009) mobile source model was used to estimate emissions due to vehicle traffic from nonradioactive waste transport (commercial vendors). **Table D–30** and the following discussion contain further details on the activity and vehicle data that were used. See Chapter 4, Section 4.1.3, for more details on the waste transport activity levels. Radioactive waste transport does not usually occur at the TTR, and it did not occur in 2008.

Table D–30 Vehicle Activity Data Used to Model Emissions from Commercial Vendors Traveling to and from the Tonopah Test Range

MOVES2010 Vehicle Type	*Daily Average Count*	*Annual VMT Within Clark County*	*Annual VMT Within Nye County but Outside the TTR*	*Annual VMT Within Nye County and Inside the TTR*	*Percentage Annual VMT Occurring on Weekdays*	*Fuel Type Used*
Single-unit, short-haul trucks	8	199,093	946,851	11,575	95	No. 2 diesel

MOVES2010 = Motor Vehicle Emission Simulator 2010; TTR = Tonopah Test Range; VMT = vehicle miles traveled.
Note: Modeling performed using MOVES2010.

Commercial vendor activity data were derived from employee count data. To estimate the commercial vendor emissions in various locations, all commercial vehicles (which are combination- and single-unit, short-haul trucks) were assumed to enter the TTR via Route 504.

MOVES default fuel supply market shares, meteorology, vehicle speed distribution, and monthly and hourly VMT distributions were used in the analysis. Only running exhaust, brake wear, and tire wear were modeled. As was done for NNSS onsite government vehicles, combination- and single-unit, short-haul trucks were assumed to have an average age of 11 years. All roads in Nye County were assumed to be rural roads with unrestricted access. For Clark County roads, the same Clark County road distribution used for NNSS commuter traffic was used for TTR commercial vendors (see Section D.1.1.2.1).

Table D–31 shows the modeled current (approximately 2008) mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the TTR. Commercial vendor activities related to the TTR emitted approximately 10.2 tons of criteria pollutants in 2008. Nitrogen oxides were emitted in by far the largest amounts (5.9 tons) among the criteria pollutants. Commercial vendor activities related to the TTR emitted approximately 0.12 tons of HAPs in 2008. The majority (82 percent) of emissions related to TTR commercial vendors took place in Nye County, with most of those emissions (99 percent) taking place outside of the TTR. About 18 percent of TTR-related commercial vendor emissions took place in Clark County.

Table D–31 Estimated Annual Emissions of Criteria Pollutants and HAPs from Commercial Vendors Traveling to and from the Tonopah Test Range, 2008 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off TTR, Off NNSS*	*On TTR*	*Total*
PM_{10}	0.12	0.54	0.0066	*0.67*
$PM_{2.5}$	0.11	0.5	0.0061	*0.62*
CO	0.49	2.2	0.027	*2.7*
NO_x	1.1	4.7	0.058	*5.9*
SO_2	0.002	0.0087	0.00011	*0.011*
VOCs	0.16	0.72	0.0088	*0.89*
Lead	1.9×10^{-6}	8.9×10^{-6}	1.1×10^{-7}	*0.000011*
HAPs	0.021	0.095	0.0012	*0.12*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

D.1.4.3 Climate Change

Greenhouse gas emissions due to TTR activities were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010). The typical annual electricity consumption by TTR activities (595,000 kilowatt-hours) was provided by DOE (2008g). This electricity consumption was assumed to be representative of calendar year 2008. The TTR purchased electricity off of the Northwest Power Pool (Western Electric Coordinating Council Northwest) eGRID subregion. The permitted stationary sources at the TTR are not associated with combustion and should generate no greenhouse gases. The carbon dioxide emissions from onsite, nonpermitted diesel generators and propane boilers were not calculated using the Greenhouse Gas Emissions Calculator, but rather were calculated using maximum operating hours, maximum horsepower, maximum energy usage (NDEP 2007), and the EPA AP-42 emissions factors database (EPA 1995a).

For carbon dioxide emissions by onsite government vehicles, greenhouse gas emissions were estimated using vehicle fuel consumption. For each vehicle type, given how many VMTs were estimated for each applicable fuel type (see Table D–26), the amount of each fuel type consumed was estimated using those VMTs and the estimated vehicle fuel economies (see Table D–26). For nitrous oxide and methane emissions by onsite government vehicles, and for greenhouse gas emissions by all other NNSS-related vehicles, the VMT by each vehicle type and each fuel type (see Table D–26) were used. For the purposes of greenhouse gas emissions calculations, ethanol-consuming light-duty vehicles and light-duty passenger trucks were considered light-duty vehicles, gasoline-consuming light-duty passenger trucks were considered light-duty trucks, and all No. 2 diesel-consuming vehicles were considered heavy-duty vehicles. All other vehicle type and fuel type combinations had obvious matches in the Greenhouse Gas Emissions Calculator.

D.2 Environmental Consequences

D.2.1 Nevada National Security Site

D.2.1.1 No Action Alternative

D.2.2 Emissions on and near the Nevada National Security Site

Emissions from Construction Activities. Construction emissions for the proposed solar power generation facility were scaled based on the generating capacity of the Amargosa Farm Road Solar Energy Project Environmental Impact Statement (BLM 2010). Emissions for criteria pollutants under construction and operations were scaled based on total energy output of the solar power generation facility.

Emissions from Stationary Sources. No specific changes to the operation of established stationary sources on the NNSS are anticipated under the No Action Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources. Emissions from stationary sources required for the operation of the proposed solar power generation facility are included with the stationary source emissions in the No Action Alternative. Operation emissions for the solar power generation facility are based on the operation of the auxiliary boiler for startup, weekly diesel generator testing, cooling tower operations, HTF ullage system vent, and maintenance vehicles operated at the site.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the NNSS. Section D.1.1.2.1 describes how onsite government-owned vehicle activity data representative of 2008 were derived. PM_{10} and $PM_{2.5}$ emissions from the diesel fueled vehicles are included in the total PM_{10} and $PM_{2.5}$ throughout the analysis. Actions on efforts to mitigate diesel emissions are discussion in Chapter 7, Section 7.9. For the No Action Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 9 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) for the No Action Alternative compared to the 2008 baseline. The modeling for the No Action Alternative used 2015 as the midpoint year (relative to 2008 baseline year) and the MOVES national default age distributions for each vehicle type to determine the total mobile source emissions. By 2015, all gasoline-type vehicles in this area of Nevada are assumed by MOVES to be run on ethanol blends, while diesel-type vehicles (buses and short-haul trucks) are operating on the same fraction of No. 2 diesel and biodiesel as in 2008.

Table D–32 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS government-owned vehicles under the No Action Alternative. Total onsite emissions from stationary sources are also provided in Table D–32 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources. Despite a 9 percent increase in VMTs, these modeled No Action Alternative emissions are about 30 percent lower overall than the 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–32 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Nevada National Security Site Stationary Sources and Government-Owned Mobile Sources Under the No Action Alternative, 2015 (tons per year)

	Nye County						
	Government-Owned Mobile Source Type (Modeled)						
Pollutant	*Light-Duty Vehicles*	*Light-Duty Passenger Trucks*	*Buses*	*Single-Unit, Short-Haul Trucks*	*Total*	*Stationary Source Type (calculated)*	*Total*
PM_{10}	0.12	0.23	0.097	0.41	0.86	4.0	5.7
$PM_{2.5}$	0.067	0.14	0.092	0.38	0.68	1.4	2.8
CO	9.0	18.6	0.22	1.7	29.5	2.6	61.6
NO_x	0.84	2.5	0.74	3.4	7.5	4.0	19.0
SO_2	0.029	0.05	0.00021	0.0010	0.080	0.21	0.37
VOCs	0.12	0.31	0.0090	0.071	0.51	1.8	2.8
Lead	0.000010	0.000013	7.2×10^{-7}	7.3×10^{-6}	0.000031	<0.03	<0.030
HAPs	0.011	0.028	0.00020	0.0015	0.041	~0.1	~0.18

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NNSS employees and solar power generation facility contract employees traveling to and from the NNSS in personal vehicles. However, the NNSS bus fleet was calculated separately because, by 2015, the fleet will be using buses that meet the 2010 EPA heavy-duty diesel emission standards.

Section D.1.1.2.1 describes how personal commuter vehicle activity data representative of 2008 were derived. For the No Action Alternative, the 2008 personal commuter vehicle activity data (vehicle counts and VMTs) were scaled up 9 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) under the No Action Alternative compared to the 2008 baseline. The number of employee transit buses needed under the No Action Alternative was also scaled up 9 percent from the number needed for the 2008 baseline. The total transit bus VMTs under the No Action Alternative were derived based on the 2008 baseline VMT-per-bus ratio. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type (compared to single). By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends

Table D–33 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS employee commuters traveling to and from the NNSS under the No Action Alternative. Despite a 9 percent increase in VMTs, these modeled No Action Alternative emissions are about 37 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–33 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Nevada National Security Site Under the No Action Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
	Clark County	*Nye County*		*Clark County*	*Nye County*		*Clark County*	*Nye County*		*Clark County*	*Nye County*		
Pollutant		*Off NNSS*	*On NNSS*		*Off NNS*	*On NNSS*		*Off NNSS*	*On NNSS*		*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.27	0.081	0.012	0.42	0.13	0.020	0.024	0.0011	0.0083	0.71	0.21	0.040	0.97
$PM_{2.5}$	0.14	0.046	0.007	0.23	0.076	0.012	0.024	0.0011	0.0083	0.39	0.12	0.027	0.54
CO	20.8	5.7	0.87	44.3	13.0	2.0	1.2	0.057	0.43	66.3	18.8	3.3	88.4
NO_x	2.9	0.85	0.13	9.0	2.6	0.39	0.47	0.022	0.17	12.4	3.5	0.69	16.5
SO_2	0.071	0.019	0.0029	0.93	0.025	0.0038	0.011	0.00051	0.0039	1.0	0.045	0.011	1.1
VOCs	0.39	0.12	0.019	1.4	0.40	0.62	N/A	N/A	N/A	1.8	0.52	0.64	2.9
Lead	0.000024	6.7×10^{-6}	1.0×10^{-6}	0.000024	6.7×10^{-6}	1.0×10^{-6}	3.7×10^{-6}	1.7×10^{-7}	1.3×10^{-6}	0.000052	0.000014	3.3×10^{-6}	0.000069
HAPs	0.031	0.011	0.0016	0.11	0.032	0.0049	N/A	N/A	N/A	0.14	0.043	0.0065	0.19

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commuter Vehicles Used by Construction Employees. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to construction employees commuting to and from the NNSS in personal vehicles. The 2010 EPA heavy-duty mobile emission standards were used to estimate nitrogen oxides and PM emissions due to commuters using transit buses. The 2010 standard does not specifically improve carbon monoxide emission standards, but the MOVES model suggests that, by 2015, emissions will improve to about 2.4 grams per mile.

These construction employees were assumed to reside in central-west Las Vegas and to commute an average distance of 66 miles each way to and from the NNSS during weekdays only. Similar to regular NNSS employees, half of the construction employees were assumed to commute via personal vehicles, while the remaining half was assumed to use transit buses. Because new construction is anticipated to take place over the next few years, the modeling for the No Action Alternative used 2011 as the modeling year and the MOVES national default age distributions for each vehicle type. The same passenger-to-bus and VMT-to-bus ratios used for the 2008 baseline were used for the No Action Alternative analysis.

Table D–34 shows the modeled 2011 annual onsite mobile emissions of criteria pollutants and HAPs associated with construction employee commuters traveling to and from the NNSS under the No Action Alternative.

Table D–34 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Construction Employees Commuting to and from the Nevada National Security Site Under the No Action Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.044	0.0093	0.0031	0.065	0.013	0.0045	0.0059	0.00028	0.0021	0.11	0.023	0.0097	0.15
$PM_{2.5}$	0.023	0.0056	0.0019	0.035	0.0085	0.0028	0.0059	0.00028	0.0021	0.064	0.014	0.0068	0.085
CO	3.7	0.84	0.28	7.2	1.7	0.57	0.30	0.014	0.11	11.2	2.6	0.96	14.7
NO_x	0.73	0.17	0.058	1.5	0.37	0.12	0.12	0.0055	0.042	2.4	0.55	0.22	3.1
SO_2	0.010	0.0022	0.00072	0.014	0.0029	0.00096	0.0027	0.00013	0.00096	0.027	0.0052	0.0026	0.035
VOCs	0.11	0.026	0.0086	0.29	0.061	0.020	N/A	N/A	N/A	0.40	0.087	0.029	0.52
Lead	2.9×10^{-6}	6.9×10^{-7}	2.3×10^{-7}	2.9×10^{-6}	6.9×10^{-7}	2.3×10^{-7}	9.2×10^{-7}	4.3×10^{-8}	3.2×10^{-7}	6.7×10^{-6}	1.4×10^{-6}	7.8×10^{-7}	8.9×10^{-6}
HAPs	0.0083	0.0021	0.00070	0.021	0.0048	0.0016	N/A	N/A	N/A	0.029	0.0069	0.0023	0.039

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the NNSS. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the No Action Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 9 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) under the No Action Alternative compared to the 2008 baseline. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–35 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the No Action Alternative. Despite a 9 percent increase in VMTs, these modeled No Action Alternative emissions are about 59 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–35 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Nevada National Security Site Under the No Action Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.096	0.012	0.043	0.15
$PM_{2.5}$	0.078	0.010	0.036	0.12
CO	0.36	0.049	0.17	0.58
NO_x	0.96	0.12	0.43	1.5
SO_2	0.0022	0.00027	0.00095	0.0034
VOCs	0.10	0.014	0.049	0.16
Lead	4.1×10^{-6}	5.6×10^{-7}	2.0×10^{-6}	6.7×10^{-6}
HAPs	0.014	0.0018	0.0064	0.022

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Trucks. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from the NNSS. Section D.1.1.2.1 describes how radioactive waste truck activity data representative of 2008 were derived. Based on the anticipated radioactive waste projections under the No Action Alternative, these 2008 VMT data were scaled up about 250 percent. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for combination-unit, short-haul trucks.

Table D–36 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the No Action Alternative. Despite about a 250 percent increase in VMTs, these modeled No Action Alternative emissions are about 1 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–36 Estimated 2015 Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the Nevada National Security Site Under the No Action Alternative (tons per year)

	Combination-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.20	0.55	0.031	0.78
$PM_{2.5}$	0.17	0.49	0.027	0.68
CO	0.56	1.6	0.088	2.2
NO_x	2.5	7.2	0.40	10.1
SO_2	0.0056	0.016	0.00088	0.022
VOCs	0.11	0.31	0.017	0.44
Lead	3.5×10^{-6}	0.000011	6.1×10^{-7}	0.000015
HAPs	0.014	0.041	0.0023	0.057

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Explosive and Open Detonation Tests. Conventional high-explosives experiments are anticipated under the No Action Alternative. These experiments may be conducted underground or at or above the ground surface. The air emissions from these explosive experiments have been estimated based on actual experiments and their associated emissions conducted at BEEF in 2008 (see Table D–2 for the 2008 BEEF emissions).

Under the No Action Alternative, up to 20 conventional high-explosives experiments may be conducted at BEEF per year and up to 10 per year at other Nuclear and High Explosives Test Zone locations, using up to 70,000 TNT [2,4,6-trinitrotoluene]-equivalent pounds of explosives. **Table D–37** shows the estimated emissions from these explosive tests under the No Action Alternative. These emissions were estimated by scaling the 2008 BEEF emissions (when 2.55 tons of explosives were used) up to a maximum of 70,000 pounds of explosives per 12-month period. All modeled concentrations where the general public may have access were modeled to be below the ambient air quality standards.

Table D–37 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Conventional High-Explosives Experiments Under the No Action Alternative (tons per year) [a]

	Nye County
Pollutant	*On NNSS*
PM_{10}	0.14
$PM_{2.5}$	0.14
CO	2.3
NO_x	0
SO_2	0
VOCs	0.014
Lead	N/A
HAPs	N/A

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] These emissions may be considered maximum, as they are scaled from the amount of TNT-equivalent explosives used at BEEF in 2008 (2.55 tons) up to 35 tons (70,000 pounds) of TNT-equivalent explosives per 12-month period.

D.2.2.1 Expanded Operations Alternative

D.2.2.1.1 Emissions on and near the Nevada National Security Site

Emissions from Construction Activities. New construction activities at the NNSS under the Expanded Operations Alternative are presented in **Table D–38**.

Table D–38 Summary of All New Buildings Under the Expanded Operations Alternative

Building Type	*Location*	*Approximate Size of Building(s) Floor Space (square feet)*	*Years of Construction*
Miscellaneous New Facilities [a]	Area 17	89,000	4
Arms Control Building	TBD	10,000	3
Counterterrorism Building	TBD	10,000	3
Work for Others Program	Counterterrorism	10,000	3
Work for Others Program	Future Counterterrorism	10,000	3
Work for Others Program Aerial Platforms	Desert Rock Airport	200,000	3
Work for Others Program Aerial Platforms	Area 6 Hangar	20,000	3
Work for Others Program Aerial Platforms	Unknown location	5,000	3
Work for Others Program Active Interrogation of Nuclear Materials	Area 12 or 16	10,000	2
Work for Others Program Test Bed Applications - New Facility	TBD	50,000	3
Waste Management Program New Facility	Area 23	5,000	1
Waste Management Program New Facility for Solar Support	Area 25	5,000	1
Total Size (square feet)		424,400	

TBD = to be determined.
[a] Represents the sum of all new facilities under "Conduct Training for Office of Secure Transportation."

Emissions of PM_{10} due to construction activities were calculated using the Western Regional Air Partnership's (*WRAP) Fugitive Dust Handbook* (WGA 2006). A general emission factor of 0.11 tons of PM_{10} per acre-month was used for all construction activities. Due to the scale of each project, it was estimated that only 10 percent of the total site would be disturbed in any 1-month period. Periodic watering of the disturbed areas would reduce the fugitive dust emissions by 74 percent per WRAP guidance. Equation D–1 was used to determine PM_{10} emissions from new construction activities.

Equation D–1. PM_{10} emissions from general construction activities per year.

PM_{10} EmissionsC = EFC x AcrePerMonth x Months x (1-ContEff) / TotalYears

Where:

PM_{10} EmissionsC = Total PM_{10} emissions per year due to new construction activities under the Expanded Operations Alternative

EFC = Emission factor for general construction activities (0.11 tons PM_{10} per acre-month)

AcrePerMonth = Total acres disturbed per month

Months = Total number of months to complete construction on entire sire (assumed to be 10)

ContEff = Control efficiency of daily water application to disturbed site (0.74)

TotalYears = Total length of construction period in years

Road construction was calculated with an average emission factor of 0.42 tons PM_{10} per acre-month following the WRAP handbook. The number of miles disturbed was calculated using local and minor roads ("Group 4") presented in the WRAP handbook. Equation D–2 is the final equation used to determine PM_{10} emissions from new road construction.

Equation D–2. PM_{10} emissions from road construction activities per year

PM_{10} EmissionsR = EFR x AcrePerMonth x Months x (1-ContEff) / TotalYears

Where:

PM_{10} EmissionsR = Total PM_{10} emissions per year due to new road construction activities under the Expanded Operations Alternative

EFR = Emission factor for road construction activities (0.42 tons PM_{10} per acre-month)

AcrePerMonth = Total acres disturbed per month (assumed to be 10 percent of total disturbed site). Total acres were calculated by multiplying total miles of new road (20 miles) by the miles-to-acres conversion factor (7.9 acres per mile) (WGA 2006).

Months = Total number of months to complete construction on entire sire (assumed to be 10)

ContEff = Control efficiency of daily water application to disturbed site (0.74)

TotalYears = Total length of construction period in years

Emissions from construction vehicles during new construction were scaled from the Caliente Rail Corridor Analysis Report (BSC 2007). Emissions for criteria pollutants were scaled based on the building footprint size (number of square feet).

Construction emissions for the proposed solar power generation facility were scaled based on generating capacity from the *Amargosa Farm Road Solar Energy Project Environmental Impact Statement* (BLM 2010). Emissions for criteria pollutants under construction and operations were also scaled based on generating capacity of the solar power generation facility.

Emissions from Stationary Sources. No specific changes to the operation of established stationary sources on the NNSS are anticipated under the Expanded Operations Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources. Emissions from stationary sources required for the operation of the proposed solar power generation facility are included with the stationary source emissions under the Expanded Operations Alternative. Operation emissions for the solar power generation facility are based on the operation of the auxiliary boiler for start-up, weekly testing of diesel generators, cooling tower operations, HTF ullage system vent, and maintenance vehicles that operate exclusively onsite at the solar power generation facility.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the NNSS. Section D.1.1.2.1 describes how onsite government-owned vehicle activity data representative of 2008 were derived. For the Expanded Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 37 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) under the Expanded Operations Alternative compared to the 2008 baseline. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type (compared to single, averaged age values for the baseline). By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends, while diesel-type vehicles are assumed to still consume the same fractions of No. 2 diesel and biodiesel that were determined for the 2008 baseline.

Table D–39 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS government-owned vehicles under the Expanded Operations Alternative. Total onsite emissions from stationary sources (shown in more detail in Table D–3) are also shown in Table D–39 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources. Despite a 37 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are about 12 percent lower than the 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NNSS employees and solar power generation facility contract employees commuting to and from the NNSS in personal vehicles. The 2010 EPA heavy-duty mobile emission standards were used to estimate nitrogen oxides and PM emissions from NNSS transit buses. The current 15 parts per million standard for sulfur dioxide was assumed to still apply. Section D.1.1.2.1 describes how personal commuter vehicle activity data representative of 2008 were derived.

For the Expanded Operations Alternative, the 2008 personal commuter vehicle activity data (vehicle counts and VMTs) were scaled up 37 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) under the Expanded Operations Alternative compared to the 2008 baseline. The number of employee transit buses needed under the Expanded Operations Alternative was also scaled up 37 percent from the number needed for the 2008 baseline. The total transit bus VMTs under the Expanded Operations Alternative were derived based on the 2008 baseline VMT-per-bus ratio. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for

each vehicle type (compared to single, averaged age values for the baseline). By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends.

Table D–39 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Nevada National Security Site Stationary Sources and Government-Owned Mobile Sources Under the Expanded Operations Alternative, 2015 (tons per year) [a]

	Clark County						
	On NNSS						
	Government-Owned Mobile Source Type (Modeled)					*Stationary Source Type (calculated)*	*Total*
Pollutant	*Light-Duty Vehicles*	*Light-Duty Passenger Trucks*	*Buses*	*Single-Unit, Short-Haul Trucks*	*Total*		
PM_{10}	0.15	0.29	0.12	0.51	1.1	16.2	18.4
$PM_{2.5}$	0.084	0.18	0.12	0.48	0.86	5.1	6.8
CO	11.3	23.4	0.28	2.1	37.1	7.9	82.1
NO_x	1.1	3.1	0.93	4.3	9.4	5.8	24.6
SO_2	0.036	0.063	0.00026	0.0013	0.10	0.68	0.88
VOCs	0.15	0.39	0.011	0.089	0.64	5.6	6.9
Lead	0.000013	0.000016	9.0×10^{-7}	9.2×10^{-6}	0.000039	<0.010	~0.010
HAPs	0.014	0.035	0.00025	0.0019	0.051	~0.1	~0.20

< = less than; ~ = approximately; CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Government-owned mobile source activities are partitioned by source type.

Table D–40 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS employee commuters traveling to and from the NNSS under the Expanded Operations Alternative. Despite a 37 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are about 21 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Emissions from Commuter Vehicles Used by Construction Employees. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to construction employees commuting to and from the NNSS in personal vehicles. The 2010 EPA heavy-duty mobile emission standards were used to estimate nitrogen oxides and PM emissions due to commuters using transit buses. The current 15 parts per million standard for sulfur dioxide was assumed to still apply.

These construction employees were assumed to reside in central-west Las Vegas and to commute an average distance of 66 miles each way to and from the NNSS during weekdays only. Similar to regular NNSS employees, half of the construction employees were assumed to commute via personal vehicles, while the remaining half was assumed to use transit buses. Because new construction is anticipated to take place over the next few years, the modeling for the Expanded Operations Alternative used 2011 as the modeling year and the MOVES national default age distributions for each vehicle type. The same passenger-to-bus and VMT-to-bus ratios used for the 2008 baseline were used for the Expanded Operations Alternative analysis.

Table D–41 shows the modeled 2011 annual onsite mobile emissions of criteria pollutants and HAPs associated with construction employee commuters traveling to and from the NNSS under the Expanded Operations Alternative.

Table D–40 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Nevada National Security Site Under the Expanded Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.34	0.10	0.015	0.53	0.16	0.025	0.030	0.0014	0.010	0.89	0.26	0.050	1.2
$PM_{2.5}$	0.18	0.058	0.0088	0.29	0.096	0.015	0.030	0.0014	0.010	0.49	0.15	0.034	0.68
CO	26.1	7.2	1.1	55.7	16.3	2.5	1.5	0.072	0.54	83.3	23.6	4.1	111.1
NO_x	3.6	1.1	0.16	11.3	3.3	0.49	0.59	0.028	0.21	15.6	4.4	0.87	20.7
SO_2	0.089	0.024	0.0036	1.2	0.031	0.0048	0.014	0.00064	0.0049	1.3	0.057	0.014	1.4
VOCs	0.49	0.15	0.024	1.8	0.50	0.78	N/A	N/A	N/A	2.3	0.65	0.80	3.6
Lead	0.000030	8.4×10^{-6}	1.3×10^{-6}	0.000030	8.4×10^{-6}	1.3×10^{-6}	4.7×10^{-6}	2.1×10^{-7}	1.6×10^{-6}	0.000065	0.000018	4.1×10^{-6}	0.000087
HAPs	0.039	0.014	0.0020	0.14	0.040	0.0062	N/A	N/A	N/A	0.18	0.054	0.0082	0.24

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table D–41 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Construction Employees Commuting to and from the Nevada National Security Site Under the Expanded Operations Alternative, 2011 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.066	0.014	0.0047	0.098	0.020	0.0068	0.0089	0.00042	0.0032	0.17	0.035	0.015	0.23
$PM_{2.5}$	0.035	0.0084	0.0029	0.053	0.013	0.0042	0.0089	0.00042	0.0032	0.096	0.021	0.010	0.13
CO	5.6	1.3	0.42	10.8	2.6	0.86	0.45	0.021	0.17	16.8	3.9	1.4	22.1
NO_x	1.1	0.26	0.087	2.3	0.56	0.18	0.18	0.0083	0.063	3.6	0.83	0.33	4.7
SO_2	0.015	0.0033	0.0011	0.021	0.0044	0.0014	0.0041	0.00020	0.0014	0.041	0.0078	0.0039	0.053
VOCs	0.17	0.039	0.013	0.44	0.092	0.030	N/A	N/A	N/A	0.60	0.13	0.044	0.78
Lead	4.4×10^{-6}	1.0×10^{-6}	3.5×10^{-7}	4.4×10^{-6}	1.0×10^{-6}	3.6×10^{-7}	1.4×10^{-6}	6.5×10^{-8}	4.8×10^{-7}	0.000010	2.1×10^{-6}	12×10^{-6}	0.000013
HAPs	0.012	0.0032	0.0011	0.032	0.0072	0.0024	N/A	N/A	N/A	0.044	0.010	0.0035	0.059

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the NNSS. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the Expanded Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 37 percent, corresponding to the increase in NNSS employees (including solar power generation facility contractors) for the Expanded Operations Alternative compared to the 2008 baseline. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks (compared to a single, averaged age value for the baseline).

Table D–42 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the Expanded Operations Alternative. Despite a 37 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are about 49 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–42 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Nevada National Security Site Under the Expanded Operations Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.12	0.015	0.054	0.19
$PM_{2.5}$	0.098	0.013	0.045	0.16
CO	0.45	0.062	0.21	0.72
NO_x	1.2	0.15	0.54	1.9
SO_2	0.0028	0.00034	0.0012	0.0043
VOCs	0.13	0.018	0.062	0.21
Lead	5.2×10^{-6}	7.0×10^{-7}	2.6×10^{-6}	8.4×10^{-6}
HAPs	0.018	0.0023	0.0080	0.028

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Trucks. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from the NNSS. Section D.1.1.2.1 describes how radioactive waste truck activity data representative of 2008 were derived. The same number of trucks (12) was used for both the 2008 baseline and the Expanded Operations Alternative. Based on the anticipated radioactive waste needs under the Expanded Operations Alternative, these 2008 VMT data were scaled up about 550 percent. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to 2008 for the baseline) and the MOVES national default age distributions for combination-unit, short-haul trucks (compared to a single, averaged age value for the baseline).

Table D–43 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the Expanded Operations Alternative. Despite about a 550 percent increase in VMTs, these modeled Expanded Operations Alternative emissions increased by 88 percent overall compared to the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–43 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the Nevada National Security Site Under the Expanded Operations Alternative, 2015 (tons per year)

	Combination-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.37	1.0	0.058	1.5
$PM_{2.5}$	0.32	0.91	0.05	1.3
CO	1.0	3.0	0.16	4.1
NO_x	4.6	13.3	0.74	18.8
SO_2	0.010	0.03	0.0016	0.041
VOCs	0.20	0.58	0.032	0.82
Lead	6.5×10^{-6}	0.000020	1.1×10^{-6}	0.000028
HAPs	0.026	0.076	0.0043	0.11

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Explosive and Open Detonation Tests. The dynamic experiments anticipated under the Expanded Operations Alternative would use considerably less explosive material than was used at BEEF in 2008. These experiments also would be underground, with little to no air releases. Thus, air emissions from these dynamic experiments are anticipated to be much less than those from BEEF in 2008 (see Table D–3 for 2008 BEEF emissions).

Up to 100 annual conventional high-explosives tests and experiments may be conducted at Nuclear and High Explosives Test Zone locations, using up to 120,000 TNT-equivalent pounds of explosives (with no more than 70,000 TNT-equivalent pounds of explosives used at BEEF). **Table D–44** shows the estimated emissions from these explosive tests under the Expanded Operations Alternative. These emissions were estimated by scaling the 2008 BEEF emissions (when 2.55 tons of explosives were used) up to a maximum of 120,000 pounds of explosives per 12-month period. The modeled maximum offsite concentrations were: 24-hour average PM_{10} concentration (about 84 micrograms per cubic meter), 24-hour average $PM_{2.5}$ concentration (about 15 micrograms per cubic meter), and annual average $PM_{2.5}$ concentration (less than 1 microgram per cubic meter), all of which would likely occur a few miles east of the Amargosa Valley, but would be well below their respective NAAQS levels (150 micrograms per cubic meter, 35 micrograms per cubic meter, and 15 micrograms per cubic meter, respectively). Even when combined with background concentrations of 39 micrograms per cubic meter, 3.6 micrograms per cubic meter, and 2.0 micrograms per cubic meter, respectively, these offsite concentrations would still be well below NAAQS levels.

Table D–44 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Nevada National Security Site Conventional High-Explosives Tests Under the Expanded Operations Alternatives (tons per year) [a]

Pollutant	*Nye County*
	On NNSS
PM_{10}	0.24
$PM_{2.5}$	0.24
CO	4
NO_x	0
SO_2	0
VOCs	0.024
Lead	Not applicable
HAPs	Not applicable

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] These emissions may be considered "worst-case" because they are scaled from the amount of TNT-equivalent explosives used at BEEF in 2008 (2.55 tons) up to 60 tons (120,000 pounds) of TNT-equivalent explosives per 12-month period.

D.2.2.2 Reduced Operations Alternative

D.2.2.2.1 Emissions on and near the Nevada National Security Site

Emissions from Construction Activities. Construction emissions for the proposed solar power generation facility were scaled from the Amargosa Farm Road Solar Energy Project Environmental Impact Statement (BLM 2010). Emissions for criteria pollutants under construction and operations were scaled based on total energy output of the solar power generation facility.

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on the NNSS are anticipated under the Reduced Operations Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the NNSS. For the Reduced Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled down by 3 percent, corresponding to the decrease in NNSS employees (including solar power generation facility contractors) for the Reduced Operations Alternative compared to the 2008 baseline. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type (compared to single, averaged age values for the baseline). By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends, while diesel-type vehicles are assumed to still consume the same fractions of No. 2 diesel and biodiesel that were determined for the 2008 baseline.

Table D–45 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS government-owned vehicles under the Reduced Operations Alternative. Total onsite emissions from stationary sources are provided in Table D–45 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources. Despite only a 3 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 38 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–45 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Nevada National Security Site Stationary Sources and Government-Owned Mobile Sources Under the Reduced Operations Alternative, 2015 (tons per year) [a]

	Clark County						
	On NNSS						
	Government-Owned Mobile Source Type (Modeled)					*Stationary Source Type (calculated)*	*Total*
Pollutant	*Light-Duty Vehicles*	*Light-Duty Passenger Trucks*	*Buses*	*Single-Unit, Short-Haul Trucks*	*Total*		
PM_{10}	0.11	0.20	0.086	0.36	0.77	0.22	0.98
$PM_{2.5}$	0.060	0.12	0.082	0.34	0.61	0.22	0.82
CO	8.0	16.6	0.20	1.5	26.3	0.94	27.2
NO_x	0.75	2.2	0.66	3.0	6.7	3.36	10.0
SO_2	0.026	0.044	0.00019	0.00089	0.071	0.06	0.13
VOCs	0.11	0.28	0.0080	0.063	0.45	0.60	1.1
Lead	8.9×10^{-6}	0.000012	6.4×10^{-7}	6.5×10^{-6}	0.000028	0.0023	0.0023
HAPs	0.0098	0.025	0.00018	0.0013	0.036	0.09	0.13

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Government-owned mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–2.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NNSS employees and solar power generation facility contract employees traveling to and from the NNSS in personal commuter vehicles. The 2010 EPA heavy-duty mobile emission standards were used to estimate emissions for commuters using transit buses.

Section D.1.1.2.1 describes how the personal commuter vehicle activity data representative of 2008 were derived. For the Reduced Operations Alternative, the 2008 personal commuter vehicle activity data (vehicle counts and VMTs) were scaled down by 3 percent, corresponding to the decrease in NNSS employees (including solar power generation facility contractors) under the Reduced Operations Alternative compared to the 2008 baseline. The number of employee transit buses needed under the Reduced Operations Alternative was also scaled down by 3 percent from the number needed for the 2008 baseline. The total transit bus VMTs under the Reduced Operations Alternative were derived based on the 2008 baseline VMT-per-bus ratio. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed by MOVES to be run on ethanol blends.

Table D–46 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NNSS employee commuters traveling to and from the NNSS under the Reduced Operations Alternative. Despite only a 3 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 43 percent smaller overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–46 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Nevada National Security Site Under the Reduced Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.24	0.072	0.011	0.38	0.12	0.018	0.021	0.00098	0.0074	0.64	0.19	0.036	0.87
$PM_{2.5}$	0.13	0.041	0.0063	0.21	0.068	0.011	0.021	0.00098	0.0074	0.35	0.11	0.024	0.48
CO	18.6	5.1	0.78	39.6	11.6	1.8	1.1	0.051	0.38	59.3	16.8	3.0	79.0
NO_x	2.6	0.76	0.12	8.1	2.3	0.35	0.42	0.020	0.15	11.1	3.1	0.62	14.8
SO_2	0.064	0.017	0.0026	0.083	0.022	0.0034	0.0098	0.00046	0.0035	0.16	0.040	0.0098	0.21
VOCs	0.35	0.11	0.017	1.3	0.36	0.55	N/A	N/A	N/A	1.6	0.47	0.57	2.6
Lead	0.000021	6.0×10^{-6}	8.9×10^{-7}	0.000021	6.0×10^{-6}	8.9×10^{-7}	3.3×10^{-6}	1.5×10^{-7}	1.2×10^{-6}	0.000047	0.000013	3.0×10^{-6}	0.000062
HAPs	0.028	0.0098	0.0014	0.098	0.029	0.0044	N/A	N/A	N/A	0.13	0.038	0.0058	0.17

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commuter Vehicles Used by Construction Employees. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to construction employees commuting to and from the NNSS in personal vehicles. It was assumed that the NNSS transit buses would comply with the 2010 EPA heavy-duty diesel mobile emission standards.

The construction employees were assumed to reside in central-west Las Vegas and to commute an average distance of 66 miles each way to and from the NNSS during weekdays only. Similar to regular NNSS employees, half of the construction employees were assumed to commute via personal vehicles, while the remaining half was assumed to use transit buses. Because new construction is anticipated to take place over the next few years, the modeling for the Reduced Operations Alternative used 2011 as the modeling year and the MOVES national default age distributions for each vehicle type. The same passenger-to-bus and VMT-to-bus ratios used for the 2008 baseline were used for the Reduced Operations Alternative analysis.

Table D–47 shows the modeled 2011 annual onsite mobile emissions of criteria pollutants and HAPs associated with construction employee commuters traveling to and from the NNSS under the Reduced Operations Alternative.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the NNSS. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the Reduced Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled down by 3 percent, corresponding to the decrease in NNSS employees (including solar power generation facility contractors) under the Reduced Operations Alternative compared to the 2008 baseline. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks (compared to a single, averaged age value for the baseline).

Table D–48 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the Reduced Operations Alternative. Despite only a 3 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 63 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–47 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Construction Employees Commuting to and from the Nevada National Security Site Under the Reduced Operations Alternative, 2011 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Transit Buses*			*Total*			
		Nye County			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.035	0.0074	0.0025	0.052	0.010	0.0036	0.0047	0.00022	0.0017	0.088	0.018	0.0078	0.12
$PM_{2.5}$	0.018	0.0045	0.0015	0.028	0.0068	0.0022	0.0047	0.00022	0.0017	0.051	0.011	0.0054	0.068
CO	3.0	0.67	0.22	5.8	1.4	0.46	0.24	0.011	0.088	9.0	2.1	0.77	11.8
NO_x	0.58	0.14	0.046	1.2	0.30	0.096	0.096	0.0044	0.034	1.9	0.44	0.18	2.5
SO_2	0.0080	0.0018	0.00058	0.011	0.0023	0.00077	0.0022	0.00010	0.00077	0.022	0.0042	0.0021	0.028
VOCs	0.088	0.021	0.0069	0.23	0.049	0.016	N/A	N/A	N/A	0.32	0.070	0.023	0.42
Lead	2.3×10^{-6}	5.5×10^{-7}	1.8×10^{-7}	2.3×10^{-6}	5.5×10^{-7}	1.8×10^{-7}	7.4×10^{-7}	3.4×10^{-8}	2.6×10^{-7}	5.4×10^{-6}	1.1×10^{-6}	6.2×10^{-7}	7.1×10^{-6}
HAPs	0.0066	0.0017	0.0056	0.017	0.0038	0.0013	N/A	N/A	N/A	0.023	0.0055	0.0018	0.031

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table D–48 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Nevada National Security Site Under the Reduced Operations Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.086	0.011	0.038	0.14
$PM_{2.5}$	0.070	0.0089	0.032	0.11
CO	0.32	0.044	0.15	0.51
NO_x	0.86	0.11	0.38	1.4
SO_2	0.0020	0.00024	0.00085	0.0031
VOCs	0.089	0.013	0.044	0.15
Lead	3.7×10^{-6}	5.0×10^{-7}	1.8×10^{-6}	6.0×10^{-6}
HAPs	0.013	0.0016	0.0057	0.020

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Trucks. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from the NNSS. See Section D.1.1.2.1 for more details on how the radioactive waste truck activity data representative of 2008 were derived. The same number of trucks (12) was used for both the 2008 baseline and the Reduced Operations Alternative. Based on the anticipated radioactive waste needs under the Reduced Operations Alternative, these 2008 VMT data were scaled up about 240 percent in Clark County and in the portion of Nye County outside of the NNSS. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for combination-unit, short-haul trucks (compared to a single, averaged age value for the baseline).

Table D–49 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the NNSS under the Reduced Operations Alternative. Despite the 240 percent increase in VMTs, these modeled Reduced Operations Alternative emissions decreased by 2 percent overall compared to the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–49 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the Nevada National Security Site Under the Reduced Operations Alternative, 2015 (tons per year)

	Combination-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.19	0.54	0.03	0.76
$PM_{2.5}$	0.17	0.48	0.026	0.67
CO	0.54	1.6	0.088	2.2
NO_x	2.4	7.0	0.39	9.7
SO_2	0.0054	0.016	0.00088	0.022
VOCs	0.11	0.30	0.017	0.42
Lead	3.4×10^{-6}	0.000011	6.1×10^{-7}	0.000015
HAPs	0.014	0.040	0.0023	0.056

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Explosive and Open Detonation Tests. The dynamic experiments anticipated under the Reduced Operations Alternative would use considerably less explosive material than was used at BEEF in 2008. These experiments also would be underground, with little to no air releases. Thus, air emissions from these dynamic experiments are anticipated to be much less than those from BEEF in 2008 (see Table D–3 for 2008 BEEF emissions).

Up to 10 annual conventional high-explosives tests and experiments may be conducted at Nuclear and High Explosives Test Zone locations, using up to 70,000 TNT-equivalent pounds of explosives. If the full 70,000 TNT-equivalent pounds of explosives were used at BEEF, the limit on total annual explosive tonnage at any one location (32 tons) would be in place. **Table D–50** shows the estimated emissions from these explosive tests under the Reduced Operations Alternative. These emissions were estimated by scaling the 2008 BEEF emissions (when 2.55 tons of explosives were used) up to a maximum of 70,000 pounds of explosives per 12-month period. The same maximum PM_{10} and $PM_{2.5}$ air concentrations modeled for BEEF in Section D.1.1.2 would apply for this Reduced Operations Alternative scenario. All modeled radiation exposures in locations accessible to the public would be well below NAAQS levels.

Table D–50 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from the Nevada National Security Site Conventional High-Explosives Tests (tons per year) [a]

Pollutant	*Nye County*
	On NNSS
PM_{10}	0.14
$PM_{2.5}$	0.14
CO	2.3
NO_x	0
SO_2	0
VOCs	0.014
Lead	N/A
HAPs	N/A

CO = carbon monoxide; HAP = hazardous air pollutant; N/A = not applicable; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] These emissions may be considered "worst-case," as they are scaled from the amount of TNT-equivalent explosives used at BEEF in 2008 (2.55 tons) up to 35 tons (70,000 pounds) of TNT-equivalent explosives per 12-month period.

D.2.3 Remote Sensing Laboratory

D.2.3.1 No Action Alternative

D.2.3.1.1 Emissions on and near the Remote Sensing Laboratory

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on RSL are anticipated under the No Action Alternative. See Chapter 4, Section 4.2.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Aircraft-Related Sources. No specific changes the operation of aircraft-related sources on RSL are anticipated under the No Action Alternative. See Chapter 4, Section 4.2.8.2.2, of this document for the current (2008) air emissions from aircraft-related sources.

Emissions from Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to RSL employees traveling to and from RSL in personal vehicles.

For the No Action Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were used because no change in the number of employees is anticipated under this alternative. The modeling for the No Action Alternative used 2015 as the midpoint modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends.

Table D–51 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with RSL employee commuters traveling to and from RSL under the No Action Alternative. Even with the same VMT, mobile emissions decrease under the No Action Alternative by about 13 percent overall compared to the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–51 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Remote Sensing Laboratory Under the No Action Alternative, 2015 (tons per year)

Pollutant	*Light-Duty Vehicles*	*Light-Duty Passenger Trucks*	*Total*
	Clark County		
	Off RSL		
PM_{10}	0.012	0.018	0.030
$PM_{2.5}$	0.0061	0.010	0.016
CO	0.91	1.9	2.8
NO_x	0.13	0.4	0.53
SO_2	0.0031	0.0041	0.0072
VOCs	0.017	0.062	0.079
Lead	1.0×10^{-6}	1.0×10^{-6}	2.0×10^{-6}
HAPs	0.0014	0.0046	0.0060

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; RSL = Remote Sensing Laboratory; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from RSL.

For the No Action Alternative, these 2008 activity data (vehicle counts and VMTs) were used because no change in the number of employees is anticipated under this alternative. The modeling for the No Action Alternative used 2015 as the midpoint modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–52 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from RSL under the No Action Alternative. Despite the same VMT, these modeled No Action Alternative emissions are about 63 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–52 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from Remote Sensing Laboratory Under the No Action Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks
	Clark County
Pollutant	***Off RSL***
PM_{10}	0.016
$PM_{2.5}$	0.013
CO	0.060
NO_x	0.16
SO_2	0.00036
VOCs	0.017
Lead	6.8×10^{-7}
HAPs	0.0023

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; RSL = Remote Sensing Laboratory; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.2.4 North Las Vegas Facility

D.2.4.1 No Action Alternative

D.2.4.1.1 Emissions on and near the North Las Vegas Facility

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on NLVF are anticipated under the No Action Alternative. See Chapter 4, Section 4.3.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NLVF employees traveling to and from NLVF in personal vehicles.

For the No Action Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were scaled up 1 percent, corresponding to the increase in NLVF employees for the No Action Alternative compared to the 2008 baseline. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and used national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends.

Table D–53 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NLVF employee commuters traveling to and from NLVF under the No Action Alternative. Despite a small increase in VMTs, these modeled No Action Alternative emissions are about 11 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–53 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the North Las Vegas Facility Under the No Action Alternative, 2015 (tons per year)

	Light-Duty Vehicles		*Light-Duty Passenger Trucks*		*Total*		
	Clark County	*Nye County*	*Clark County*	*Nye County*	*Clark County*	*Nye County*	
Pollutant	*Off NLVF*	*Off NNSS*	*Off NLVF*	*Off NNSS*	*Off NLVF*	*Off NNSS*	*Total*
PM_{10}	0.099	0.00063	0.15	0.00097	0.25	0.0016	0.25
$PM_{2.5}$	0.051	0.00036	0.085	0.00059	0.14	0.00095	0.14
CO	7.6	0.044	16.2	0.10	23.8	0.14	23.9
NO_x	1.1	0.0066	3.3	0.020	4.4	0.027	4.4
SO_2	0.026	0.00015	0.034	0.00019	0.060	0.00034	0.060
VOCs	0.14	0.00095	0.52	0.0031	0.66	0.0041	0.66
Lead	8.6×10^{-6}	5.2×10^{-8}	8.6×10^{-6}	5.2×10^{-8}	0.000017	1.0×10^{-7}	0.000017
HAPs	0.011	0.000082	0.038	0.00025	29.2	0.17	0.049

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from NLVF.

See Section D.1.3.2.1 for more details on how the commercial vendor vehicle activity data representative of 2008 were derived. For the No Action Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 1 percent, corresponding to the increase in NLVF employees for the No Action Alternative compared to the 2008 baseline. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) using the MOVES model with the national default age distribution.

Table D–54 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from NLVF under the No Action Alternative. Despite a small increase in VMTs, these modeled No Action Alternative emissions are about 62 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–54 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from North Las Vegas Facility Under the No Action Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks
	Clark County
Pollutant	*Off NLVF*
PM_{10}	0.069
$PM_{2.5}$	0.057
CO	0.26
NO_x	0.70
SO_2	0.0016
VOCs	0.076
Lead	3.0×10^{-6}
HAPs	0.01

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from NLVF.

See Section D.1.3.2.1 for more details on how the radioactive waste truck activity data representative of 2008 were derived. The same number of trucks was used for the 2008 baseline and the No Action Alternative. For the No Action Alternative, the 2008 VMTs were scaled up 1 percent, corresponding to the increase in NLVF employees for the No Action Alternative compared to the 2008 baseline. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions.

Table D–55 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with radioactive waste trucks traveling to and from NLVF under the No Action Alternative. Despite a small increase in VMTs, these modeled No Action Alternative emissions are about 71 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–55 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the North Las Vegas Facility Under the No Action Alternative, 2015 (tons per year)

	Combination-Unit, Short-Haul Trucks			
	Clark County	*Nye County*		
Pollutant	*Off NLVF*	*Off NNSS*	*On NNSS*	*Total*
PM_{10}	0.0017	0.00015	0.00010	0.0020
$PM_{2.5}$	0.0014	0.00013	0.000090	0.0016
CO	0.0046	0.00045	0.00030	0.0054
NO_x	0.021	0.0020	0.0013	0.024
SO_2	0.000046	4.4×10^{-6}	2.0×10^{-6}	0.000053
VOCs	0.00091	0.000086	0.000057	0.0011
Lead	2.9×10^{-8}	3.0×10^{-9}	2.0×10^{-9}	3.4×10^{-8}
HAPs	0.00012	0.000011	0.0000076	0.00014

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.2.4.2 Expanded Operations Alternative

D.2.4.2.1 Emissions on and near the North Las Vegas Facility

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on NLVF are anticipated under the Expanded Operations Alternative. See Chapter 4, Section 4.3.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NLVF employees traveling to and from NLVF in personal vehicles.

For the Expanded Operations Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were scaled up 27 percent, corresponding to the increase in NLVF employees for the Expanded Operations Alternative compared to the 2008 baseline. The modeling for the Expanded Operations

Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends.

Table D–56 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NLVF employee commuters traveling to and from NLVF under the Expanded Operations Alternative. Despite a 27 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are only 12 percent greater overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–56 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from North Las Vegas Facility Under the Expanded Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles		*Light-Duty Passenger Trucks*		*Total*		
	Clark County	*Nye County*	*Clark County*	*Nye County*	*Clark County*	*Nye County*	
Pollutant	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Total*
PM_{10}	0.12	0.00079	0.19	0.0012	0.31	0.0020	0.31
$PM_{2.5}$	0.064	0.00045	0.11	0.00074	0.17	0.0020	0.18
CO	9.5	0.055	20.3	0.13	29.8	0.19	29.9
NO_x	1.4	0.0083	4.1	0.025	5.5	0.033	5.5
SO_2	0.033	0.00019	0.043	0.00024	0.076	0.00043	0.075
VOCs	0.18	0.0012	0.65	0.0039	0.83	0.0051	0.83
Lead	0.000011	6.5×10^{-8}	0.000011	6.5×10^{-8}	0.000022	1.3×10^{-7}	0.000021
HAPs	0.014	0.00010	0.048	0.00031	0.062	0.00041	0.061

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from NLVF.

For the Expanded Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled up 27 percent, corresponding to the increase in NLVF employees for the Expanded Operations Alternative compared to the 2008 baseline. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–57 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from NLVF under the Expanded Operations Alternative. Despite a 27 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are about 52 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology resulting from vehicle fleet turnover.

Table D–57 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the North Las Vegas Facility Under the Expanded Operations, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks
	Clark County
Pollutant	***Off NLVF***
PM_{10}	0.086
$PM_{2.5}$	0.071
CO	0.33
NO_x	0.88
SO_2	0.002
VOCs	0.095
Lead	3.8×10^{-6}
HAPs	0.013

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from NLVF.

For the Expanded Operations Alternative, the 2008 VMTs were scaled up 27 percent, corresponding to the increase in NLVF employees for the Expanded Operations Alternative compared to the 2008 baseline. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for combination-unit, short-haul trucks.

Table D–58 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with radioactive waste trucks traveling to and from NLVF under the Expanded Operations Alternative. Despite about a 27 percent increase in VMTs, these modeled Expanded Operations Alternative emissions are about 64 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–58 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the North Las Vegas Facility Under the Expanded Operations Alternative, 2015 (tons per year)

	Combination-Unit, Short-Haul Trucks			
	Clark County	***Nye County***		
Pollutant	***Off NLVF***	***Off NLVF***	***On NLVF***	***Total***
PM_{10}	0.0021	0.00019	0.00013	0.0025
$PM_{2.5}$	0.0018	0.00016	0.00011	0.0020
CO	0.0058	0.00056	0.00038	0.0068
NOx	0.026	0.0025	0.0016	0.030
SO2	0.000058	5.5×10^{-6}	3.6×10^{-6}	0.000066
VOCs	0.0011	0.00011	0.000071	0.0014
Lead	3.6×10^{-8}	3.8×10^{-9}	2.5×10^{-9}	4.3×10^{-8}
HAPs	0.00015	0.000014	9.5×10^{-6}	0.00018

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.2.4.3 Reduced Operations Alternative

D.2.4.3.1 Emissions on and near the North Las Vegas Facility

Emissions from Stationary Sources. No specific changes to the operation of established stationary sources on NLVF are anticipated under the Reduced Operations Alternative. See Chapter 4, Section 4.3.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to NLVF employees traveling to and from NLVF in personal vehicles.

For the Reduced Operations Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were scaled down by 9 percent, corresponding to the decrease in NLVF employees for the Reduced Operations Alternative compared to the 2008 baseline. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends

Table D–59 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with NLVF employee commuters traveling to and from NLVF under the Reduced Operations Alternative. Despite only a 9 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 19 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–59 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the North Las Vegas Facility Under the Reduced Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles		*Light-Duty Passenger Trucks*		*Total*		
	Clark County	*Nye County*	*Clark County*	*Nye County*	*Clark County*	*Nye County*	
Pollutant	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Off NLVF*	*Total*
PM_{10}	0.089	0.00057	0.14	0.00087	0.23	0.0014	0.23
$PM_{2.5}$	0.046	0.00032	0.077	0.00053	0.12	0.00085	0.13
CO	6.8	0.040	14.6	0.090	21.4	0.13	21.5
NO_x	0.99	0.0059	3.0	0.018	4.0	0.024	4.0
SO_2	0.023	0.00014	0.031	0.00017	0.054	0.00031	0.054
VOCs	0.13	0.00086	0.47	0.0028	0.60	0.0037	0.59
Lead	7.7×10^{-6}	4.7×10^{-8}	7.7×10^{-6}	4.7×10^{-8}	0.000015	9.4×10^{-8}	0.000015
HAPs	0.0099	0.000074	0.034	0.00022	0.044	0.00029	0.044

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from NLVF.

See Section D.1.3.2.1 for more details on how the commercial vendor vehicle activity data representative of 2008 were derived. For the Reduced Operations Alternative, the 2008 personal vehicle activity data

(vehicle counts and VMTs) were scaled down by 9 percent, corresponding to the decrease in NLVF employees for the Reduced Operations Alternative compared to the 2008 baseline. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–60 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from NLVF under the Reduced Operations Alternative. Despite only a 9 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions show a 66 percent overall reduction from the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–60 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the North Las Vegas Facility Under the Reduced Operations Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks
	Clark County
Pollutant	***Off NLVF***
PM_{10}	0.062
$PM_{2.5}$	0.051
CO	0.23
NO_x	0.63
SO_2	0.0014
VOCs	0.068
Lead	0.0000027
HAPs	0.0090

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Emissions from Radioactive Waste Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to radioactive waste trucks traveling to and from NLVF.

The same number of trucks was used for the 2008 baseline and the Reduced Operations Alternative. For the Reduced Operations Alternative, the 2008 VMTs were scaled lower by 9 percent, corresponding to the decrease in NLVF employees for the Reduced Operations Alternative compared to the 2008 baseline. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for combination-unit, short-haul trucks.

Table D–61 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with radioactive waste trucks traveling to and from NLVF under the Reduced Operations Alternative. Despite only a 9 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are projected to decrease 74 percent compared to the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–61 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Radioactive Waste Trucks Traveling to and from the North Las Vegas Facility Under the Reduced Operations Alternative, 2015 (tons per year)

	Combination-Unit, Short-Haul Trucks			
	Clark County	*Nye County*		
Pollutant	*Off NLVF*	*Off NLVF*	*On NLVF*	*Total*
PM_{10}	0.0015	0.00013	0.00009	0.0018
$PM_{2.5}$	0.0013	0.00012	0.000081	0.0014
CO	0.0041	0.00041	0.00027	0.0049
NO_x	0.019	0.0018	0.0012	0.022
SO_2	0.000041	4.0×10^{-6}	2.6×10^{-6}	0.000048
VOCs	0.00082	0.000077	0.000051	0.00099
Lead	2.6×10^{-8}	2.7×10^{-9}	1.8×10^{-9}	3.1×10^{-8}
HAPs	0.00011	9.9×10^{-6}	6.8×10^{-6}	0.00013

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

D.2.5 Tonopah Test Range

D.2.5.1 No Action Alternative

D.2.5.1.1 Emissions on and near the Tonopah Test Range

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on the TTR are anticipated under the No Action Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the TTR. See Section D.1.4.2 for more details on how the activity data representative of 2008 were derived. For the No Action Alternative, the 2008 onsite government-owned vehicle activity data (vehicle counts and VMTs) were used because no change in the number of employees is anticipated under this alternative. The modeling for the No Action Alternative used the midpoint year of 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blends, while diesel-type vehicles are assumed to still consume the same fractions of No. 2 diesel and biodiesel as used in 2008.

Table D–62 shows the modeled 2015 annual onsite mobile and stationary source emissions of criteria pollutants and HAPs associated with TTR government-owned vehicles and equipment under the No Action Alternative. Despite no change in VMTs, these modeled No Action Alternative emissions are about 33 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–62 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Tonopah Test Range Stationary Sources and Government-Owned Mobile Sources Under the No Action Alternative, 2015 (tons per year) [a]

Pollutant	*Government-Owned Mobile Source Type (modeled)*				*Stationary Source Type (calculated)*	*Total*
	Light-Duty Vehicles	*Light-Duty Passenger Trucks*	*Single-Unit, Short-Haul Trucks*	*Total*		
	Nye County					
	On Tonopah Test Range					
PM_{10}	0.011	0.02	0.036	0.067	<3.7	<3.8
$PM_{2.5}$	0.0059	0.012	0.033	0.051	<3.7	<3.8
CO	0.79	1.6	0.15	2.5	<2.9	<5.4
NO_x	0.073	0.22	0.29	0.58	<13.3	<13.9
SO_2	0.0025	0.0044	0.000087	0.007	<0.91	<0.92
VOCs	0.011	0.027	0.0062	0.044	<0.96	<1.0
Lead	8.9×10^{-7}	1.2×10^{-6}	6.4×10^{-7}	2.7×10^{-6}	<0.01	<0.01
HAPs	0.001	0.0025	0.00013	0.0036	<1.1	<1.1

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] Government-owned mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–24.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to TTR employees traveling to and from the TTR in personal commuter vehicles. Section D.1.1.2.1 describes how personal commuter vehicle activity data representative of 2008 were derived. For the No Action Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were used because no change in the number of employees is anticipated under this alternative. The modeling for the No Action Alternative used the midpoint year of 2015 as the modeling year and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-fueled vehicles in this area of Nevada are assumed to be run on ethanol blends.

Table D–63 shows the modeled 2015 annual mobile emissions of criteria pollutants and HAPs associated with TTR employee commuters traveling to and from the TTR under the No Action Alternative. Despite no change in VMTs, these modeled No Action Alternative emissions are about 15 percent lower overall than the 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–63 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Tonopah Test Range Under the No Action Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Total*			
		Nye County			*Nye County*			*Nye County*		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Clark County*	*Off TTR*	*On TTR*	*Clark County*	*Off TTR*	*On TTR*	*Total*
PM_{10}	0.0035	0.014	0.0016	0.0064	0.022	0.0024	0.0099	0.036	0.0040	0.05
$PM_{2.5}$	0.0018	0.008	0.00088	0.0030	0.013	0.0015	0.0048	0.021	0.0024	0.028
CO	0.27	1.0	0.11	0.57	2.3	0.25	0.84	3.3	0.36	4.5
NO_x	0.038	0.15	0.016	0.12	0.45	0.049	0.16	0.60	0.065	0.82
SO_2	0.00092	0.0033	0.00036	0.0012	0.0043	0.00048	0.0021	0.0076	0.00084	0.011
VOCs	0.0050	0.021	0.0023	0.018	0.070	0.0077	0.023	0.091	0.010	0.12
Lead	3.1×10^{-7}	1.2×10^{-6}	1.3×10^{-7}	3.1×10^{-7}	1.2×10^{-6}	1.3×10^{-7}	6.2×10^{-7}	2.4×10^{-6}	2.6×10^{-7}	3.3×10^{-6}
HAPs	0.00041	0.0018	0.00020	0.0014	0.0056	0.00062	0.0018	0.0074	0.00082	0.01

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the TTR. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the No Action Alternative, these 2008 activity data (vehicle counts and VMTs) were used because no change in the number of employees is anticipated under this alternative. The modeling for the No Action Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–64 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the TTR under the No Action Alternative. Despite no change in VMTs, these modeled No Action Alternative emissions are about 62 percent lower overall than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–64 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Tonopah Test Range Under the No Action Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Total*
PM_{10}	0.044	0.19	0.0019	0.24
$PM_{2.5}$	0.036	0.16	0.0016	0.20
CO	0.17	0.77	0.0078	0.95
NO_x	0.44	1.9	0.020	2.4
SO_2	0.00099	0.0042	0.000043	0.0052
VOCs	0.048	0.22	0.0022	0.27
Lead	1.9×10^{-6}	8.9×10^{-6}	9.0×10^{-8}	0.000011
HAPs	0.0063	0.029	0.00029	0.036

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

D.2.5.2 Expanded Operations Alternative

D.2.5.2.1 Emissions on and near the Tonopah Test Range

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on the TTR are anticipated under the Expanded Operations Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the TTR. For the Expanded Operations Alternative, the 2008 onsite government-owned vehicle activity data (vehicle counts and VMTs) were scaled down by 59 percent, corresponding to the decrease in TTR employees for the Expanded Operations Alternative. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be using ethanol blends, while diesel-type vehicles use the same fractions of No. 2 diesel and biodiesel that used in the 2008 baseline.

Table D–65 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with TTR government-owned vehicles under the Expanded Operations Alternative. Total onsite emissions from stationary sources (shown in more detail in Table D–25) are also provided in Table–65 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources. Even with a 59 percent decrease in VMTs, these modeled Expanded Operations Alternative emissions are about 73 percent lower than the modeled 2008 baseline emissions, largely due to improvements in vehicle control technology due to vehicle fleet turnover.

Table D–65 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Tonopah Test Range Stationary Sources and Government-Owned Mobile Sources Under the Expanded Operations Alternative, 2015 (tons per year) [a]

	Government-Owned Mobile Source Type (Modeled)				*Stationary Source Type (calculated)*	*Total*
	Light-Duty Vehicles	*Light-Duty Passenger Trucks*	*Single-Unit, Short-Haul Trucks*	*Total*		
	Nye County					
Pollutant	*On TTR*					
PM_{10}	0.0045	0.0082	0.015	0.027	<3.7	<3.7
$PM_{2.5}$	0.0024	0.0049	0.014	0.021	<3.7	<3.7
CO	0.32	0.66	0.062	1.0	<2.9	<3.9
NO_x	0.030	0.090	0.012	0.24	<13.3	<13.4
SO_2	0.0010	0.0018	0.000036	0.0029	<0.91	<0.91
VOCs	0.0045	0.011	0.0025	0.018	<0.96	<0.98
Lead	3.6×10^{-7}	4.9×10^{-7}	2.6×10^{-7}	1.1×10^{-6}	<0.01	<0.01
HAPs	0.00041	0.0010	0.000053	0.0015	<1.1	<1.1

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

[a] Government-owned mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–24.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to TTR employees traveling to and from the TTR in personal commuter vehicles. Section D.1.1.2.1 describes how personal commuter vehicle activity data representative of 2008 were derived. For the Expanded Operations Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were scaled down by 59 percent, corresponding to the decrease in TTR employees for the Expanded Operations Alternative. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blended fuel.

Table D–66 shows the modeled 2015 annual mobile emissions of criteria pollutants and HAPs associated with TTR employee commuters traveling to and from the TTR under the Expanded Operations Alternative. Even with a 59 percent decrease in VMTs, these modeled Expanded Operations Alternative emissions are about 66 percent lower overall than the modeled 2008 baseline emissions, largely due to a combination of reduced vehicle activity and improvements in vehicle control technology due to vehicle fleet turnover.

Table D–66 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Tonopah Test Range Under the Expanded Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Total*			
		Nye County			*Nye County*		*Clark County*	*Nye County*		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Clark County*	*Off TTR*	*On TTR*		*Off TTR*	*On TTR*	*Total*
PM_{10}	0.0014	0.0057	0.00065	0.0026	0.0089	0.00097	0.0040	0.015	0.0016	0.020
$PM_{2.5}$	0.00073	0.0032	0.00036	0.0012	0.0053	0.00061	0.0019	0.0085	0.00097	0.011
CO	0.11	0.41	0.044	0.23	0.93	0.10	0.34	1.3	0.15	1.8
NO_x	0.015	0.061	0.0065	0.049	0.18	0.020	0.065	0.24	0.026	0.33
SO_2	0.00037	0.0013	0.00015	0.00049	0.0017	0.00019	0.00085	0.0031	0.00034	0.0045
VOCs	0.0020	0.0085	0.00093	0.0073	0.028	0.0031	0.0093	0.037	0.0041	0.049
Lead	1.3×10^{-7}	4.9×10^{-7}	5.3×10^{-8}	1.3×10^{-7}	4.9×10^{-7}	5.3×10^{-8}	2.5×10^{-7}	9.7×10^{-7}	1.1×10^{-7}	1.3×10^{-6}
HAPs	0.00017	0.00073	0.000081	0.00057	0.0023	0.00025	0.00073	0.003	0.00033	0.0041

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the TTR. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the Expanded Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled down by 59 percent, corresponding to the decrease in TTR employees under the Expanded Operations Alternative. The modeling for the Expanded Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the national default age distributions for single-unit, short-haul trucks.

Table D–67 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the TTR under the Expanded Operations Alternative. Even with a 59 percent decrease in VMTs, these modeled Expanded Operations Alternative emissions are about 85 percent lower than the modeled 2008 baseline emissions, largely due to a combination of reduced vehicle activity and improvements in vehicle control technology due to vehicle fleet turnover.

Table D–67 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Tonopah Test Range Under the Expanded Operations Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Total*
PM_{10}	0.018	0.077	0.00077	0.097
$PM_{2.5}$	0.015	0.065	0.00065	0.081
CO	0.069	0.31	0.0032	0.39
NO_x	0.18	0.77	0.0081	0.97
SO_2	0.00040	0.0017	0.000017	0.0021
VOCs	0.019	0.089	0.00089	0.11
Lead	7.7×10^{-7}	3.6×10^{-6}	3.7×10^{-8}	4.5×10^{-6}
HAPs	0.0026	0.012	0.00012	0.015

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

D.2.5.3 Reduced Operations Alternative

D.2.5.3.1 Emissions on and near the Tonopah Test Range

Emissions from Stationary Sources. No specific changes to the operation of stationary sources on the TTR are anticipated under the Reduced Operations Alternative. See Chapter 4, Section 4.1.8.2.2, of this document for the current (2008) air emissions from onsite stationary sources.

Emissions from Onsite Government-Owned Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to government vehicle traffic on the TTR. See Section D.1.4.2 for more details on how the activity data representative of 2008 were derived. For the Reduced Operations Alternative, the 2008 onsite government-owned vehicle activity data (vehicle counts and VMTs) were scaled down by 63 percent, corresponding to the decrease in TTR employees for the Expanded Operations Alternative. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada

are assumed to be run on ethanol blends, while diesel-type vehicles are assumed to continue with same fractions of No. 2 diesel and biodiesel that were used in 2008.

Table D–68 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with TTR government-owned vehicles under the Reduced Operations Alternative. Total onsite emissions from stationary sources (shown in more detail in Table D–24) are also provided in Table D–68 to show the total onsite emissions from both stationary sources and government-owned vehicle mobile sources. Even with a 63 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 75 percent lower overall than the modeled 2008 baseline emissions, largely due to a combination of reduced activity and improvements in vehicle emission control technology due to vehicle fleet turnover.

Table D–68 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Onsite Tonopah Test Range Stationary Sources and Government-Owned Mobile Sources Under the Reduced Operations Alternative, 2015 (tons per year) [a]

	Government-Owned Mobile Source Type (Modeled)				*Stationary Source Type (calculated)*	*Total*
	Light-Duty Vehicles	*Light-Duty Passenger Trucks*	*Single-Unit, Short-Haul Trucks*	*Total*		
	Nye County					
Pollutant	*On TTR*					
PM_{10}	0.0041	0.0074	0.013	0.025	<3.7	<3.7
$PM_{2.5}$	0.0022	0.0044	0.012	0.019	<3.7	<3.7
CO	0.29	0.59	0.056	0.93	<2.9	<3.8
NO_x	0.027	0.081	0.11	0.21	<13.3	<13.5
SO_2	0.00093	0.0016	0.000032	0.0026	<0.91	<0.91
VOCs	0.0041	0.010	0.0023	0.016	<0.96	<0.98
Lead	3.3×10^{-7}	4.4×10^{-7}	2.4×10^{-7}	1.0×10^{-6}	<0.01	<0.01
HAPs	0.00037	0.00093	0.000048	0.0013	<1.1	<1.1

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

[a] Government-owned mobile source activities are partitioned by source type. The source type partitioning of stationary source activities is shown in Table D–24.

Emissions from Personal Commuter Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to TTR employees traveling to and from the TTR in personal commuter vehicles. Section D.1.1.2.1 describes how commuting activity data representative of 2008 were derived. For the Reduced Operations Alternative, the 2008 personal vehicle activity data (vehicle counts and VMTs) were scaled down by 63 percent, corresponding to the decrease in TTR employees for the Expanded Operations Alternative. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for each vehicle type. By 2015, all gasoline-type vehicles in this area of Nevada are assumed to be run on ethanol blended gasoline

Table D–69 shows the modeled 2015 annual mobile emissions of criteria pollutants and HAPs associated with TTR employee commuters traveling to and from the TTR under the Reduced Operations Alternative. Even with a 63 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 68 percent lower overall than the modeled 2008 baseline emissions, largely due to a combination of reduced vehicle activity and improvements in vehicle emission control technology due to vehicle fleet turnover.

Table D–69 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commuting to and from the Tonopah Test Range Under the Reduced Operations Alternative, 2015 (tons per year)

	Light-Duty Vehicles			*Light-Duty Passenger Trucks*			*Total*			
		Nye County			*Nye County*		*Clark County*	*Nye County*		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Clark County*	*Off TTR*	*On TTR*		*Off TTR*	*On TTR*	*Total*
PM_{10}	0.0013	0.0052	0.00059	0.0024	0.0081	0.00088	0.0036	0.013	0.0015	0.018
$PM_{2.5}$	0.00066	0.0029	0.00032	0.0011	0.0048	0.00055	0.0018	0.0077	0.00088	0.010
CO	0.099	0.37	0.040	0.21	0.85	0.092	0.31	1.2	0.13	1.7
NO_x	0.014	0.055	0.0059	0.044	0.17	0.018	0.059	0.22	0.024	0.30
SO_2	0.00034	0.0012	0.00013	0.00044	0.0016	0.00018	0.00077	0.0028	0.00031	0.0040
VOCs	0.0018	0.0077	0.00085	0.0066	0.026	0.0028	0.0085	0.033	0.0037	0.044
Lead	1.1×10^{-7}	4.4×10^{-7}	4.8×10^{-8}	1.1×10^{-7}	4.4×10^{-7}	4.8×10^{-8}	2.3×10^{-7}	8.8×10^{-7}	9.6×10^{-8}	1.2×10^{-6}
HAPs	0.00015	0.00066	0.000074	0.00052	0.0021	0.00023	0.00066	0.0027	0.00030	0.0037

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

Emissions from Commercial Vendor Vehicles. The MOVES2010 (Version 20100515; EPA 2009) mobile source emissions model was used to estimate annual emission rates due to commercial vendors traveling to and from the TTR. Section D.1.1.2.1 describes how commercial vendor vehicle activity data representative of 2008 were derived. For the Reduced Operations Alternative, these 2008 activity data (vehicle counts and VMTs) were scaled down by 63 percent, corresponding to the decrease in TTR employees for the Expanded Operations Alternative. The modeling for the Reduced Operations Alternative used 2015 as the modeling year (compared to the 2008 baseline) and the MOVES national default age distributions for single-unit, short-haul trucks.

Table D–70 shows the modeled 2015 annual onsite mobile emissions of criteria pollutants and HAPs associated with commercial vendors traveling to and from the TTR under the Reduced Operations Alternative. Even with a 63 percent decrease in VMTs, these modeled Reduced Operations Alternative emissions are about 86 percent lower overall than the modeled 2008 baseline emissions, largely due to a combination of reduced vehicle activity and improvements in vehicle emission control technology due to vehicle fleet turnover.

Table D–70 Estimated Annual Emissions of Criteria Pollutants and Hazardous Air Pollutants from Commercial Vendors Traveling to and from the Tonopah Test Range Under the Reduced Operations Alternative, 2015 (tons per year)

	Single-Unit, Short-Haul Trucks			
		Nye County		
Pollutant	*Clark County*	*Off TTR*	*On TTR*	*Total*
PM_{10}	0.016	0.070	0.00070	0.088
$PM_{2.5}$	0.013	0.059	0.00059	0.073
CO	0.063	0.28	0.0029	0.35
NO_x	0.16	0.70	0.0074	0.88
SO_2	0.00036	0.0015	0.000016	0.0019
VOCs	0.018	0.081	0.00081	0.099
Lead	0.00000070	0.0000033	0.000000033	0.0000041
HAPs	0.0023	0.011	0.00011	0.013

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

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