Appendix D
Air Quality Resources
Impact Assessment Methods and Results

Kayenta Complex

D.1 INTRODUCTION

OSM authorizes surface coal mining and reclamation activities in five-year incremental periods to provide an opportunity to review the mine's compliance with applicable terms and conditions of permits. Two of the criteria which allow OSM to deny a requested permit renewal for a five-year period are:

(1) The present surface coal mining and reclamation operations are not in compliance with the environmental protection standards of the SMCRA and the regulatory program; or

(2) The requested renewal substantially jeopardizes the operator's continuing ability to comply with the Act and the regulatory program on existing permit areas.

With respect to air quality protection standards, the predominant consideration with surface coal mining is whether impacts of particulate matter emissions from mining and reclamation activities comply with applicable national ambient air quality standards (NAAQS). In addition, air quality impacts due to emissions of nitrogen oxides from blasting and from exhausts of mining equipment and vehicles are frequently evaluated for compliance.

This analysis was prepared to evaluate if the requested permit renewal will jeopardize the ability of Kayenta's mining and reclamation activities to comply with the NAAQS for PM_{10}, $PM_{2.5}$ and NO_2 during the permit renewal period. Notably, emission rates of those pollutants during the permit renewal period will not differ appreciably from their emission rates during the current permit period. This analysis includes a modeling projection of the impacts of those pollutants from the Kayenta Complex during the permit renewal to evaluate if the applicable NAAQSs will not be threatened or exceeded at any location. Among the findings are predicted ambient impacts of those pollutants in many locations throughout the resource area are expected to be insignificant.

D.2 SOURCE REPRESENTATION

The Kayenta Complex has a variety of fugitive and process fugitive sources of particulate matter. The only significant sources of nitrogen oxides are blasting and tailpipe emissions from large mining equipment.

Fugitive emission sources at the Complex include excavation, haulage and land reclamation activities. Specifically, overburden removal by dragline and shovel, coal removal by shovel or front-end loader, dozer activity on spoil and coal piles, topsoil haulage, natural wind erosion of disturbed areas and stockpiles, and truck haulage of both coal and overburden are among the significant activities falling under this category of sources.

Process fugitive emissions include primary crushing, secondary crushing, screening, unloading and loading at the preparation facilities. Also included are conveyor transfer points at the preparation plants and along the belt to the train loadout.

While the locations of the preparation plants will remain fixed and their maximum emissions will be essentially constant throughout the permit renewal period, the situation for mining activities is different.

Mining activities at surface coal mines are not fixed at a single location from year-to-year, as they move with the progressions of the pits, roads, and backfill and reclamation areas. Emission rates vary as well with the varying quantities of overburden, disturbed acreages, haul distances, etc., encountered through the permit renewal period. Table D-1 presents the operating parameters for the three years examined for this analysis.

Table D-1 Mine Operating Parameters

Area	Activity	CY2010	CY2012	CY2018
J28	Truck Dumping at Pile (tons)	5,943,800	5,840,000	5,759,400
	Hopper Loading (tons)	5,943,800	5,840,000	5,759,400
	Transfer Points (tons)	5,943,800	5,840,000	5,759,400
	Primary Crushing (tons)	5,943,800	5,840,000	5,759,400
	Secondary Crushing (tons)	297,190	292,000	287,970
	Screening (tons)	5,943,800	5,840,000	5,759,400
	Sample System Transfer Points (tons)	106,988	105,120	103,669
	Sample System Crushing (tons)	4,707	4,625	4,561
	Wheeled Dozer (hr/yr)	2,000	2,000	2,000
	Coal Pile Wind Erosion			
	K5 (acres)	4.2	4.2	4.2
	K6/6A (acres)	11.8	11.8	11.8
N11	Truck Dumping at Pile (tons)	1,946,000	2,260,000	2,492,000
	Hopper Loading (tons)	1,946,000	2,260,000	2,492,000
	Transfer Points (tons)	1,946,000	2,260,000	2,492,000
	Sample System Transfer Points (tons)	19,460	22,600	24,920
	Primary Crushing (tons)	1,946,000	2,260,000	2,492,000
	Sample System Crushing (tons)	1,168	1,356	1,495
	Screening (tons)	1,946,000	2,260,000	2,492,000
	Wheeled Dozer (hr/yr)	1,000	1,000	1,000
	Coal Pile Wind Erosion (acres)	4.4	4.4	4.4
N8	Stacker/Hopper Loading (tons)	7,889,800	8,100,000	8,251,400
	Transfer Points (tons)	7,889,800	8,100,000	8,251,400
	Sample System Transfer Points (tons)	77,320	79,380	80,864
	Sample System Crushing (tons)	4,821	4,949	5,042
	Screening (tons)	7,889,800	8,100,000	8,251,400
	Secondary Crushing (tons)	395,437	405,972	413,560
	Track Dozers on Coal (hr/yr)	16,400	16,400	16,400
	Coal Pile Wind Erosion			
	K1 (acres)	7.8	7.8	7.8
	K2 (acres)	5.2	5.2	5.2
	K3 (acres)	5.4	5.4	5.4
Overland	Transfer Points Conv 20 – 25 (tons)	5,943,800	5,840,000	5,759,400
Conveyor	Transfer Points Conv 21A – 23 (tons)	7,889,800	8,100,000	8,251,400
Kayenta	Topsoil Scrapers (hr/yr)	13,648	13,648	13,648
Complex Pits	Overburden Blasting (number of blasts)	242	242	242
	Overburden Drilling (number of holes)	67,401	67,401	67,401
	Dragline Overburden Removal & Replacement (yds^3)	40,707,800	38,537,400	38,569,900
	Truck-Shovel Overburden Removal & Replacement (tons)	2,610,320	4,418,080	2,176,000
	Dozers on Overburden (hr/yr)	61,208	61,208	61,208

Area	Activity	CY2010	CY2012	CY2018
	Overburden Haul Trucks – Unpaved Roads (mi/yr)	55,539	94,002	46,298
	Coal Blasting (number of blasts)	273	273	273
	Coal Drilling (number of holes)	60,403	60,403	60,403
	Truck-Shovel Coal Removal (tons)	8,200,000	8,200,000	8,200,000
	Coal Haul Trucks – Unpaved Roads (mi/yr)	230,524	230,524	230,524
	Graders (hr/yr)	16,586	16,586	16,586
	Road Repair – Graders Travel Mode (mi/yr)	36,551	36,551	36,551
	Open Acres – Wind Erosion (number of acres)	5,283	5,287	4,605

D.3 EMISSION ESTIMATES – COAL PREPARATION FACILITIES

At the Complex, Peabody maintains coal preparation facilities at three locations referred to as N8, N11, and J28. These areas "prepare" coal by crushing and screening operations, which in turn are supported by various conveying, dumping and storage activities. Emission estimates were calculated for dust-generating activities at these areas by using emission factors found in U.S. EPA's AP-42, "Compilation of Air Pollutant Emission Factors," in conjunction with operational parameters provided by Peabody. Summaries of emissions by preparation plant and emission activity are provided in Table D-2.

Annual inventories were developed for years 2010, 2012, and 2018. The year 2010 was chosen as the baseline year for comparison, because this analysis was initiated in 2010 and sufficient mining data was not available to accurately characterize the latest actual operational parameters resulting in current emissions estimates needed for comparison with projected operational parameters and future emissions estimates. The year 2012 was selected because projected mine operational parameters in that year are estimated to result in the greatest or "worst-case" potential emissions during the five-year permit term. Finally, the year 2018 was evaluated because that year results in the greatest reasonably foreseeable air polluting emission levels during the permit renewal period through 2018 in the three coal resource areas currently approved for mining.

Table D-2 Preparation Plant Emission Summary (tons/yr)

Activity	2010			2012			2018		
	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
J-28									
Truck dumping	0.37	0.06	0.00	0.36	0.06	0.00	0.36	0.05	0.00
Hopper loading	0.19	0.03	0.00	0.18	0.03	0.00	0.18	0.03	0.00
Transfer points	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Primary crushing	0.36	0.36	0.00	0.35	0.35	0.00	0.35	0.35	0.00
Secondary crushing	0.02	0.02	0.00	0.02	0.02	0.00	0.02	0.02	0.00
Screening	2.23	2.23	0.00	2.19	2.19	0.00	2.16	2.16	0.00
Sample system transfer points	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample system crushing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wheeled dozer	9.60	0.80	4.17	9.60	0.80	4.17	9.60	0.80	4.17
Wind erosion from coal piles	26.27	3.94	0.00	26.27	3.94	0.00	26.27	3.94	0.00
	39.04	**7.44**	**4.17**	**38.98**	**7.39**	**4.17**	**38.94**	**7.35**	**4.17**
N-11 Extension									
Truck dumping	0.12	0.02	0.00	0.14	0.02	0.00	0.16	0.02	0.00
Hopper loading	0.06	0.01	0.00	0.07	0.01	0.00	0.08	0.01	0.00
Transfer points	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Primary crushing	0.12	0.12	0.00	0.14	0.14	0.00	0.15	0.15	0.00
Screening	0.73	0.73	0.00	0.85	0.85	0.00	0.93	0.93	0.00
Sample system transfer points	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample system crushing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Activity	2010			2012			2018		
	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x	PM_{10}	$PM_{2.5}$	NO_x
Wheeled dozer	4.80	0.40	2.08	4.80	0.40	2.08	4.80	0.40	2.08
Wind erosion from coal piles	6.63	0.99	0.00	6.63	0.99	0.00	6.63	0.99	0.00
	12.46	**2.27**	**2.08**	**12.63**	**2.41**	**2.08**	**12.75**	**2.52**	**2.08**
N-8									
Hopper loading	0.39	0.06	0.00	0.40	0.06	0.00	0.41	0.06	0.00
Transfer points	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
Secondary crushing	0.02	0.02	0.00	0.02	0.02	0.00	0.02	0.02	0.00
Screening	2.96	2.96	0.00	3.04	3.04	0.00	3.09	3.09	0.00
Sample system transfer points	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sample system crushing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tracked dozers on coal	31.48	2.64	10.33	31.48	2.64	10.33	31.48	2.64	10.33
Wind erosion from coal piles	30.21	4.53	0.00	30.21	4.53	0.00	30.21	4.53	0.00
	65.08	**10.22**	**10.33**	**65.17**	**10.30**	**10.33**	**65.23**	**10.36**	**10.33**

D.4 EMISSION ESTIMATES – MINING ACTIVITIES

Emission factors endorsed by the Wyoming Department of Environmental Quality (WDEQ) were used to determine fugitive particulate emissions from the mining activities.[1] A summary of PM_{10} and $PM_{2.5}$ emissions by activity type are provided in Table D-3. Mine-wide inventories of nitrogen oxides (NO_x) from vehicle tailpipes and blasting were also developed and are presented in Table D-4.

Table D-3 PM_{10} and $PM_{2.5}$ Emission Summary from Mining Activities (tons/yr)

Activity	2010		2012		2018	
	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Scrapers	45.02	4.50	45.02	4.50	45.02	4.50
Overburden drilling	2.19	0.22	2.19	0.22	2.19	0.22
Overburden blasting	2.27	0.23	2.27	0.23	2.27	0.23
Overburden removal (truck/shovel)	9.79	0.98	16.57	1.66	8.16	0.82
Overburden truck travel	9.92	0.99	16.79	1.68	8.27	0.83
Overburden removal (dragline)	305.31	30.53	289.03	28.90	289.27	28.93
Coal drilling	0.33	0.03	0.33	0.03	0.33	0.03
Coal blasting	1.79	0.18	1.79	0.18	1.79	0.18
Coal removal	4.31	0.43	4.31	0.43	4.31	0.43
Coal truck travel	13.68	1.37	13.68	1.37	13.68	1.37
Dozers on overburden	23.04	12.66	23.04	12.66	23.04	12.66
Graders	43.77	4.38	43.77	4.38	43.77	4.38
Wind erosion of open acres	660.38	99.06	660.88	99.13	575.63	86.34
	1,121.79	**155.56**	**1,119.66**	**155.37**	**1,017.73**	**140.91**

Table D-4 NO_x Emission Summary from Mining Activities (tons/yr)

Activity	2010	2012	2018
	NO_x	NO_x	NO_x
Scrapers	26.20	26.20	26.20
Drills	3.53	3.44	3.00
Blasting	129.97	126.38	110.17
Overburden haul trucks	57.33	51.77	45.14
Wheeled dozers – pits	6.15	6.13	6.32

[1] Collins, Charles A., "Fugitive Dust Emission Factors," Wyoming Department of Environmental Quality, January 1979.

Activity	2010 NO_x	2012 NO_x	2018 NO_x
Track dozers – pits	37.33	33.72	29.40
Wheeled loaders	10.97	10.93	11.27
Coal haul trucks	63.61	63.35	65.32
Graders	5.91	5.91	5.91
Water trucks	19.68	19.60	20.21
	360.70	**347.43**	**322.93**

D.5 EMISSIONS CHANGES DURING PERMIT RENEWAL TERM

EPA's program for the prevention of significant deterioration of air quality defines when an emissions increase that results from a change at a stationary source is "significant," and thereby warrants investigation into the extent of the ambient air quality impact caused by that emissions increase. By definition, a PM_{10} emissions increase of 15 tpy or more is "significant." Similarly, an emissions increase of 10 tpy or more of direct $PM_{2.5}$ is "significant." Likewise, a NO_x emissions increase of 40 tpy or more is "significant."[2]

The preceding tables show that an increase in emissions of either PM_{10}, $PM_{2.5}$ or NO_x during the permit renewal term above the level of those pollutants' emissions during the baseline will not be, by definition, "significant." Some of those pollutants' emissions during the permit renewal term and beyond will actually be lower than their corresponding levels during the current permit term. Thus, the requested permit renewal will not result in any "significant" emissions increases from Kayenta Complex. In keeping with the protocol of the PSD program, that finding indicates that an examination of the air quality impacts associated with any emission changes during the permit renewal term would not be necessary.

D.6 AIR QUALITY IMPACTS CORRELATED WITH EMISSIONS CHANGE

A fundamental principle of air quality analysis is that the ambient air concentration of an air pollutant discharged from a source is proportional to the rate at which that pollutant is emitted from that source. Thus, if the permit renewal will not result in a "significant" emissions increase of PM_{10}, any change in ambient levels of PM_{10} due to the permit renewal is expected to be insignificant or negligible. Similarly, because the permit renewal will not result in a "significant" emissions increase of either $PM_{2.5}$ or NO_x, the permit renewal will not result in a significant increase in ambient concentration of either pollutant.

In keeping with requirements of the PSD program for the review of changes at stationary sources, the change in each pollutant's emissions due to the permit renewal is so minor that an evaluation of any air quality impacts due to that emissions change is not necessary. Nevertheless, this analysis includes the following projection of ambient air concentrations that result from the Complex's total PM_{10} emissions during the permit renewal term in order to demonstrate that the permit renewal will not jeopardize the ability of Kayenta's mining and reclamation activities to comply with the NAAQS for PM_{10}, $PM_{2.5}$ and NO_2 during the permit renewal period.

D.7 OVERVIEW OF MODELING METHODOLOGY

As previously explained, emission inventories for PM_{10} and $PM_{2.5}$ were developed for the coal preparation facilities using emission factors found in U.S. EPA's AP-42, "Compilation of Air Pollutant Emission Factors," and operational parameters provided by Peabody. PM_{10} and $PM_{2.5}$ inventories for

[2] 40 CFR 52.21(b)(23).

mining activities were calculated using emission factors endorsed by the WDEQ. Mine-wide inventories of nitrogen oxides (NO_x) from vehicle tailpipes and blasting were also developed.

The AERMOD dispersion model was run in regulatory default mode to predict short-term (24-hour) impacts for PM_{10}, short-term and annual impacts for $PM_{2.5}$, and annual impacts of NO_2 during each of the three years evaluated.

One year of on-site meteorological data was used to drive the atmospheric dispersion aspects of the AERMOD model. Relevant concentration predictions were made at receptors along the Complex permit boundary and at specific residences near the permit boundary. Concentrations were also predicted at other key cultural locations in the region

D.8 EMISSIONS APPORTIONING

Fugitive emissions for each of the worst-case years were apportioned into area sources based on the activity type. The number and location of the area sources, as well as their dimensions and orientation, were based on the pit configurations provided by Peabody. Emissions were divided by the cross-sectional area of each area source in which they occurred to arrive at an emission rate in grams/second/square meter.

D.9 METEOROLOGICAL DATA

For this modeling effort, a single year of data from meteorological monitoring site BM-MET9 was selected for modeling. Data obtained by BM-MET9 are representative of site-wide atmospheric transport and dispersion conditions. Data for year 2008 were used in this analysis.

The most recent version of AERMET (06341) was utilized to generate AERMOD-ready meteorological data files. AERMET processes data in three stages using on-site meteorological data and/or National Weather Service (NWS) data, along with NWS upper air data. For this project, AERMET was run for Stages 1 and 2 with on-site data from BM-MET9 and concurrent upper air data from Flagstaff. Because BM-MET9 collects both solar radiation and delta temperature (differential temperature between two levels), cloud cover from an off-site NWS station was not required.

For Stage 3 processing, results from Stage 2 are combined with land surface parameters (e.g., surface roughness) around the meteorological station. These parameters were obtained by importing USGS NLCD92 land use data from the USGS Seamless Data Server into the pre-processor program AERSURF (08009). Settings for AERSURF included the meteorological site not being at an airport, no continuous snow cover in the winter, an arid region, and standard seasons (winter is December, January and February; etc.). To assess whether 2008 was a climatologically wet, dry or average year, annual precipitation data for Winslow, Arizona was used as a proxy for the Complex. Annual Winslow precipitation data were compared against Winslow's precipitation probabilities from 30-year climatology (1971-2000) based on guidance in the AERSURF User's Guide. For 2008, the total amount of precipitation received was 4.66 inches. This is considered "dry" because the total precipitation is at or below the "0.3 30-year probability" of 6.89 inches (Table D-5). Output from AERSURF for dry surface parameters were incorporated into AERMET Stage 3 for 2008, and the two final surface and profile meteorological data files (*.sfc and *.pfl) were generated. These files are directly imported in AERMOD.

Table D-5 Precipitation Probabilities for Winslow, Arizona (1971-2000)

30-Year Probability	Precipitation Amount (inches)	Climatological Condition
≤0.3	≤6.89	Dry
0.31 to 0.69	6.90 to 8.91	Average
≥0.7	≥8.92	Wet

D.10 RECEPTORS

Receptors were placed around the permit boundary at a linear resolution of 500 meters. In addition, receptors were placed at residences which will not be affected during the permit renewal period for reasons directly related to mining and safety. Receptors were also placed at the nearest approach to the Navajo National Monument, the intersection of Highway 160 and Navajo Route 41, the town of Piñon, the Monument Valley Visitors Center, and the town of Kayenta. A receptor grid was created beyond the Complex boundary to determine whether significant pollutant concentrations would approach any sensitive areas. Receptor elevations were determined using USGS National Elevation Dataset digital files with 30-meter resolution. All receptor locations are referenced to the NAD1927 datum.

D.11 BACKGROUND CONCENTRATION FOR MODELING

PM_{10} monitoring data obtained from Peabody's air quality monitoring program was used to establish a background PM_{10} concentration for modeling purposes. Monitoring site AIRQ200 was not proximate to mining activities or preparation facilities for years 2007-2009, and was therefore determined to be representative of recent background concentrations. The annual average PM_{10} concentration for the three-year period at site AIRQ200 was 13.6 µg/m^3.

A $PM_{2.5}$ background value was obtained from EPA's AIRData website. The nearest $PM_{2.5}$ monitor with data available is located in Flagstaff. The annual average $PM_{2.5}$ concentration at this site for years 2007-2009 was 7.0 µg/m^3.

The NO_2 background was established at 2.1 µg/m^3 annual average based on guidance from the Arizona Department of Environmental Quality for a previous modeling analysis at the Complex.

D.12 MODEL RESULTS

Under its PSD program, EPA prescribes "significant impact levels" or "SILs" for particulate matter, NO_x and other criteria pollutants. The SIL is the level of ambient impact from an emission increase that is deemed significant enough to warrant a complete source impact analysis involving modeling the collective impacts of that source along with emissions from other existing sources. Evaluation of the source's ambient impact is only required when the emissions increase from the source will be "significant." However, even though the permit renewal will not cause any "significant" emissions increases, the relevant SILs have been used in this analysis to demonstrate the relatively minor, often insignificant, ambient impacts that result from a pollutant's total emissions from Kayenta Complex during the permit renewal.

D.12.1 PM_{10}

The SIL for PM_{10} is 5 μg/m^3 on a 24-hour basis for the resource area of this analysis. The AERMOD model was run to identify the 24-hour, 5 μg/m^3 significant impact areas (SIA) for PM_{10} for all three modeled years. That is, the total PM_{10} emissions from the entire Kayenta Complex during the baseline period, during the permit renewal term, and beyond that period were each modeled. The 24-hour SIA isopleths are shown in Figures D-1 through D-3 for years 2010, 2012 and 2018, respectively. Table D-6 shows that significant impacts (> 5 μg/m^3) are not predicted at the nearest culturally important locations, which are the Navajo National Monument and Monument Valley. The SIAs do not extend to any Class I areas.

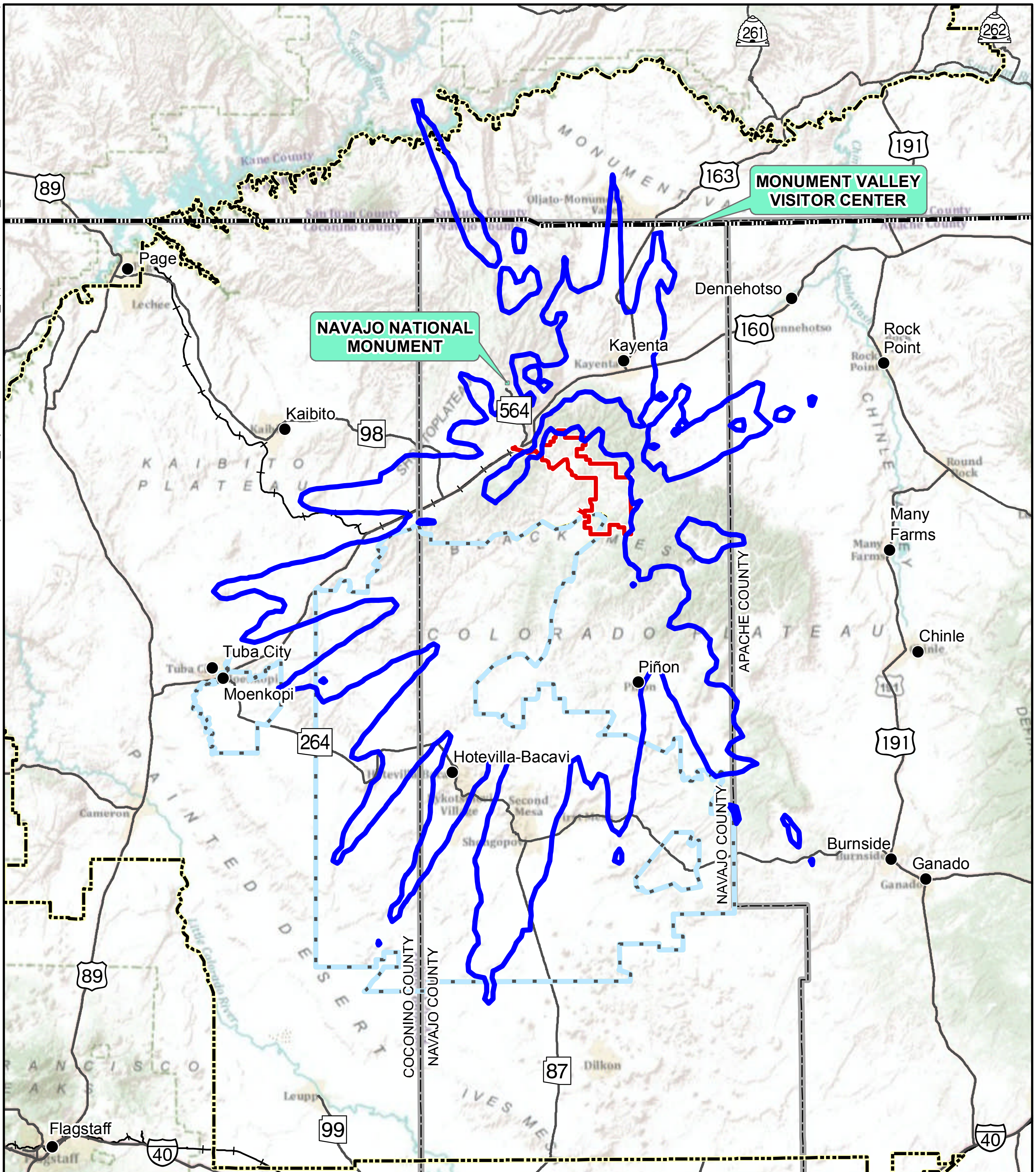
Table D-6 PM_{10} Impacts from the Complex on Local Sensitive Receptors

Receptor	PM_{10} 24-Hour Impact (μg/m^3)		
	2010	2012	2018
Navajo National Monument	0.86	1.03	1.04
Monument Valley Visitor Center	4.38	3.82	4.14

A summary of PM_{10} modeling results is provided in Table D-7 for each of the three modeled years. Importantly, predicted concentrations due to the Complex's total PM_{10} emissions in all cases were less than the NAAQS for PM_{10} for the 24-hour averaging period.

Table D-7 Kayenta Complex Maximum Predicted 24-Hour PM_{10} Concentrations

Model Year	Location	X-UTM	Y-UTM	PM_{10} Concentration (μg/m^3)	PM_{10} Concentration with Background (μg/m^3)	National Ambient Air Quality Standard (μg/m^3)
2010	Boundary	563581.26	4028888.44	110.58	124.18	150
2012	Boundary	564284.86	4029187.00	97.88	111.48	150
2018	Boundary	562794.76	4027179.78	124.70	138.30	150



Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 5 μg/m³ Impact Contour
- Sensitive Class II Area

Figure D-1

2010 24-Hour PM_{10} Significant Impact Area

Kayenta Mine Permit Renewal EA

N

0 8 16 Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

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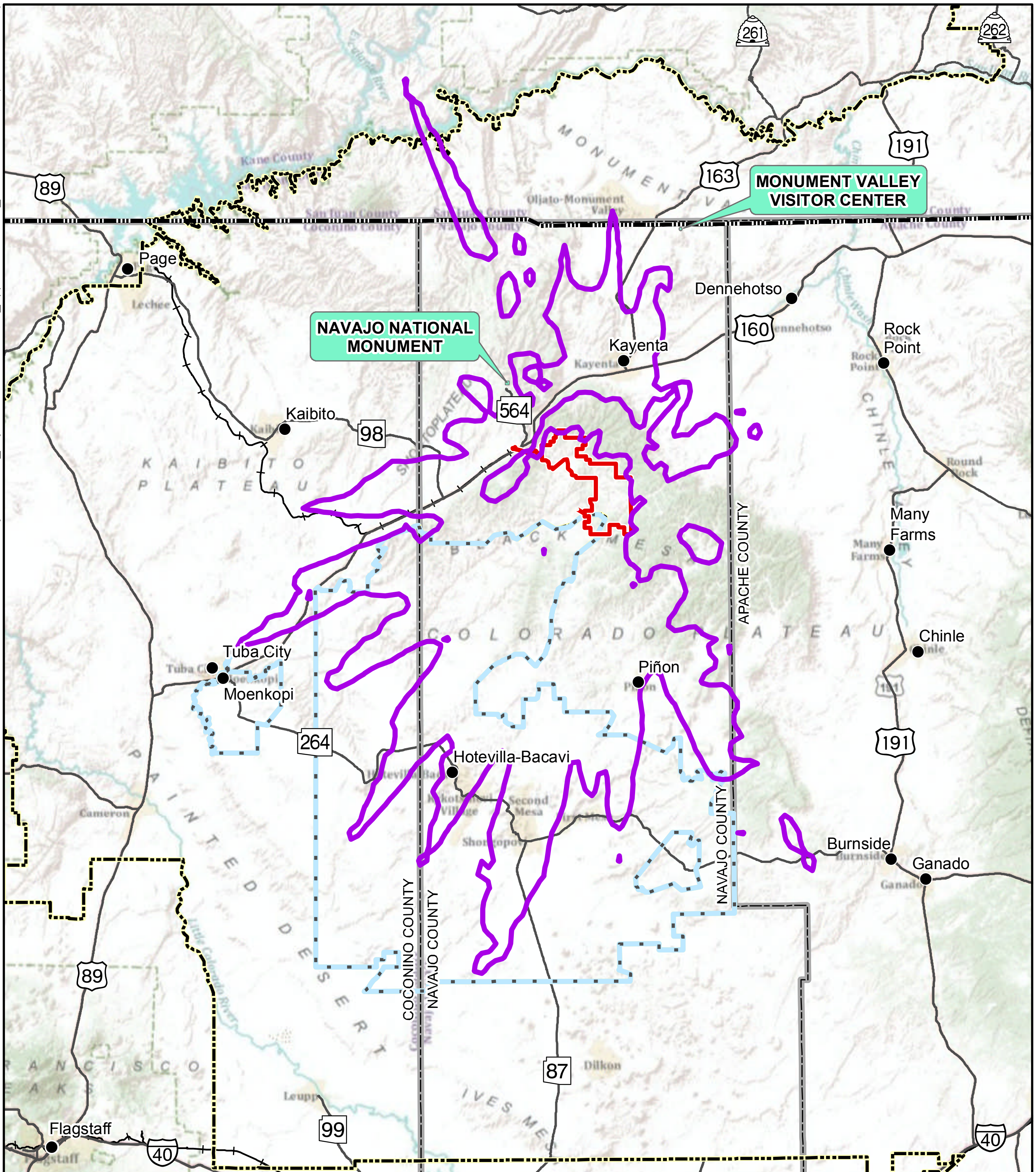


Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 5 µg/m³ Impact Contour
- Sensitive Class II Area

Figure D-2

2012 24-Hour PM_{10} Significant Impact Area

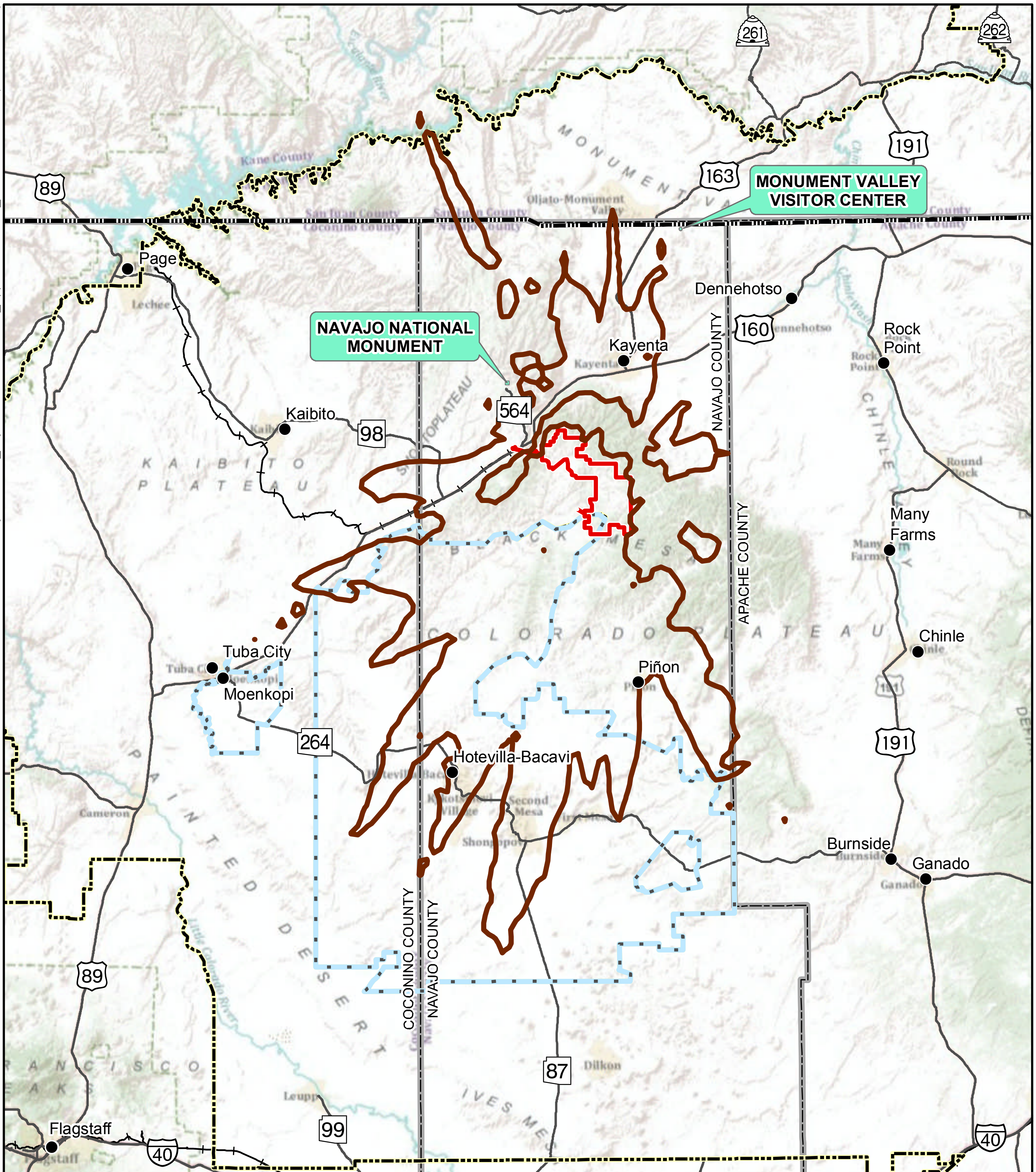
Kayenta Mine Permit Renewal EA

N

0 8 16 Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS



Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 5 µg/m³ Impact Contour
- Sensitive Class II Area

Figure D-3

2018 24-Hour PM_{10} Significant Impact Area

Kayenta Mine Permit Renewal EA

N

0 8 16 Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

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D.12.2 $PM_{2.5}$

The SILs for $PM_{2.5}$ are 1.2 µg/m^3 on a 24-hour basis and 0.3 µg/m^3 on an annual basis. Modeling was performed to identify the 24-hour SIA and the annual SIA for $PM_{2.5}$ for the three modeled years, using the corresponding total $PM_{2.5}$ emissions from the Complex for each year. Table D-8 shows that significant impacts are not predicted at the Navajo National Monument or Monument Valley. The 24-hour SIA isopleths are shown in Figures D-4 through D-6 for years 2010, 2012, and 2018, respectively. Annual SIA isopleths are shown in Figures D-9 through D-12.

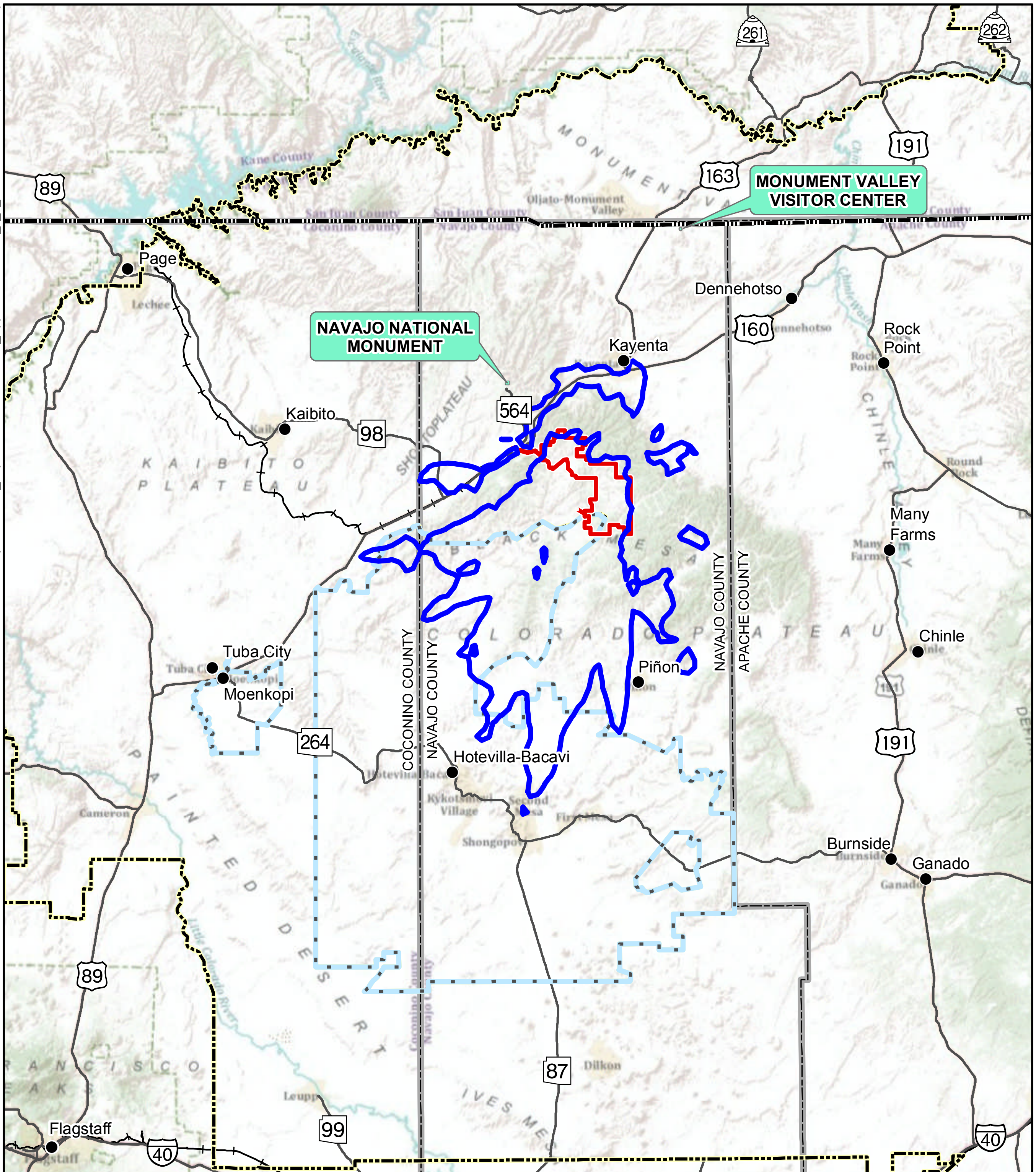
Table D-8 $PM_{2.5}$ Impacts from the Complex on Local Sensitive Receptors

Receptor	$PM_{2.5}$ 24-Hour Impact (µg/m^3)			$PM_{2.5}$ Annual Impact (µg/m^3)		
	2010	2012	2018	2010	2012	2018
Navajo National Monument	0.12	0.14	0.15	0.01	0.01	0.01
Monument Valley Visitor Center	0.61	0.54	0.59	0.01	0.01	0.01

A summary of 24-hour and annual $PM_{2.5}$ modeling results is provided in Table D-9 for each of the three modeled years. Predicted concentrations were less than the applicable NAAQS for both averaging periods.

Table D-9 Kayenta Complex Maximum Predicted $PM_{2.5}$ Concentrations

Model Year	Averaging Period	Location	X-UTM	Y-UTM	$PM_{2.5}$ Concentration (µg/m^3)	$PM_{2.5}$ Concentration with Background (µg/m^3)	National Ambient Air Quality Standard (µg/m^3)
2010	24-hour	Boundary	563581.26	4028888.44	15.31	22.31	35
2012	24-hour	Residence	564096.53	4028747.66	13.27	20.27	35
2018	24-hour	Boundary	562794.76	4027179.78	17.36	24.36	35
2010	Annual	Boundary	563581.26	4028888.44	3.46	10.46	15
2012	Annual	Residence	564096.53	4028747.66	4.37	11.37	15
2018	Annual	Boundary	562294.76	4027177.14	4.96	11.96	15



Legend

Kayenta Mine Area

Hopi Reservation

Navajo Nation Reservation Boundary

Highway

Railroad

Air Quality Feature

1.2 µg/m³ Impact Contour

Sensitive Class II Area

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

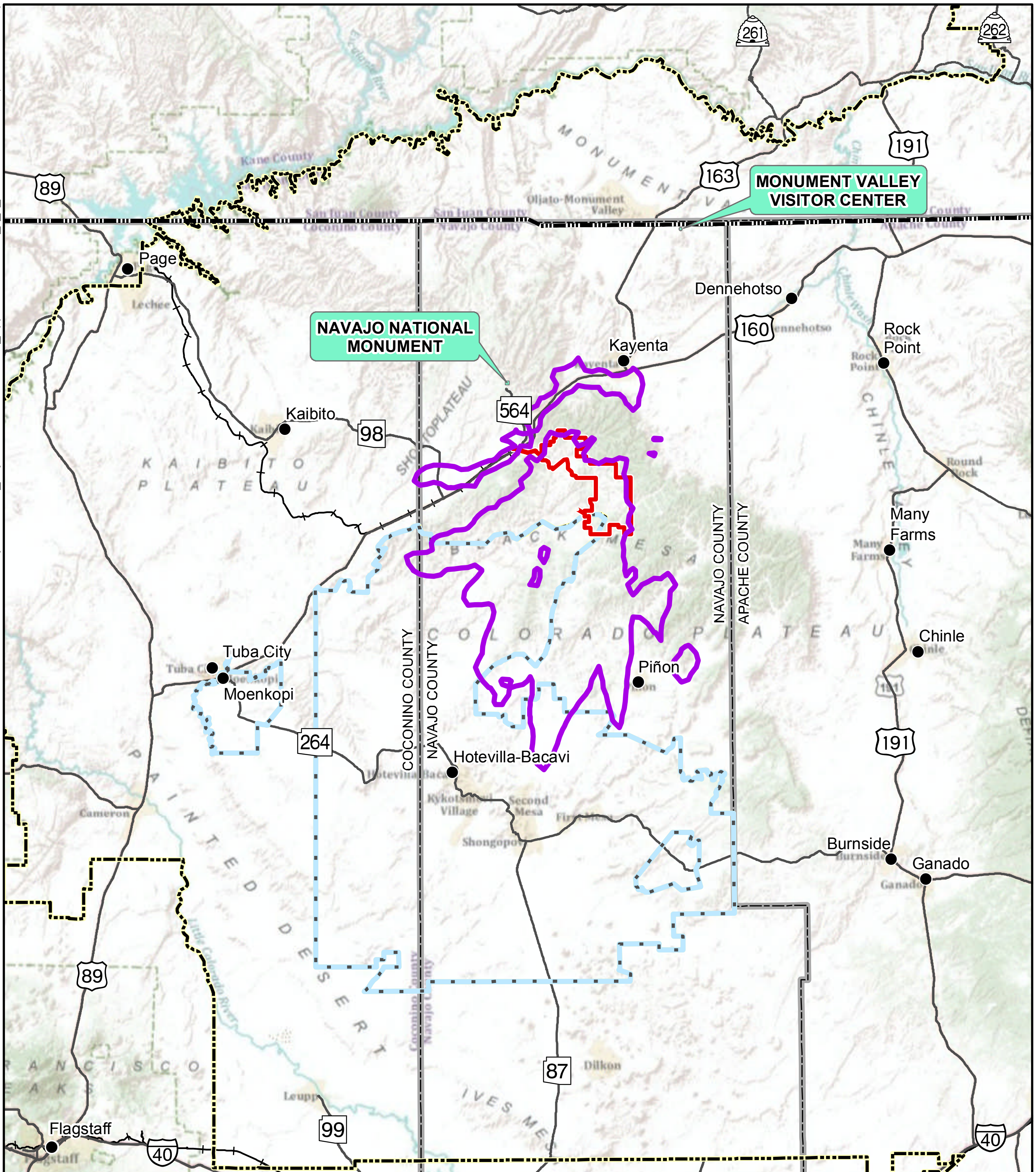
0 8 16
Miles

Figure D-4

2010 24-Hour $PM_{2.5}$
Significant Impact Area

Kayenta Mine Permit Renewal EA

PWCC URS



Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 1.2 µg/m³ Impact Contour
- Sensitive Class II Area

Figure D-5

2012 24-Hour $PM_{2.5}$ Significant Impact Area

Kayenta Mine Permit Renewal EA

N

0 8 16 Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

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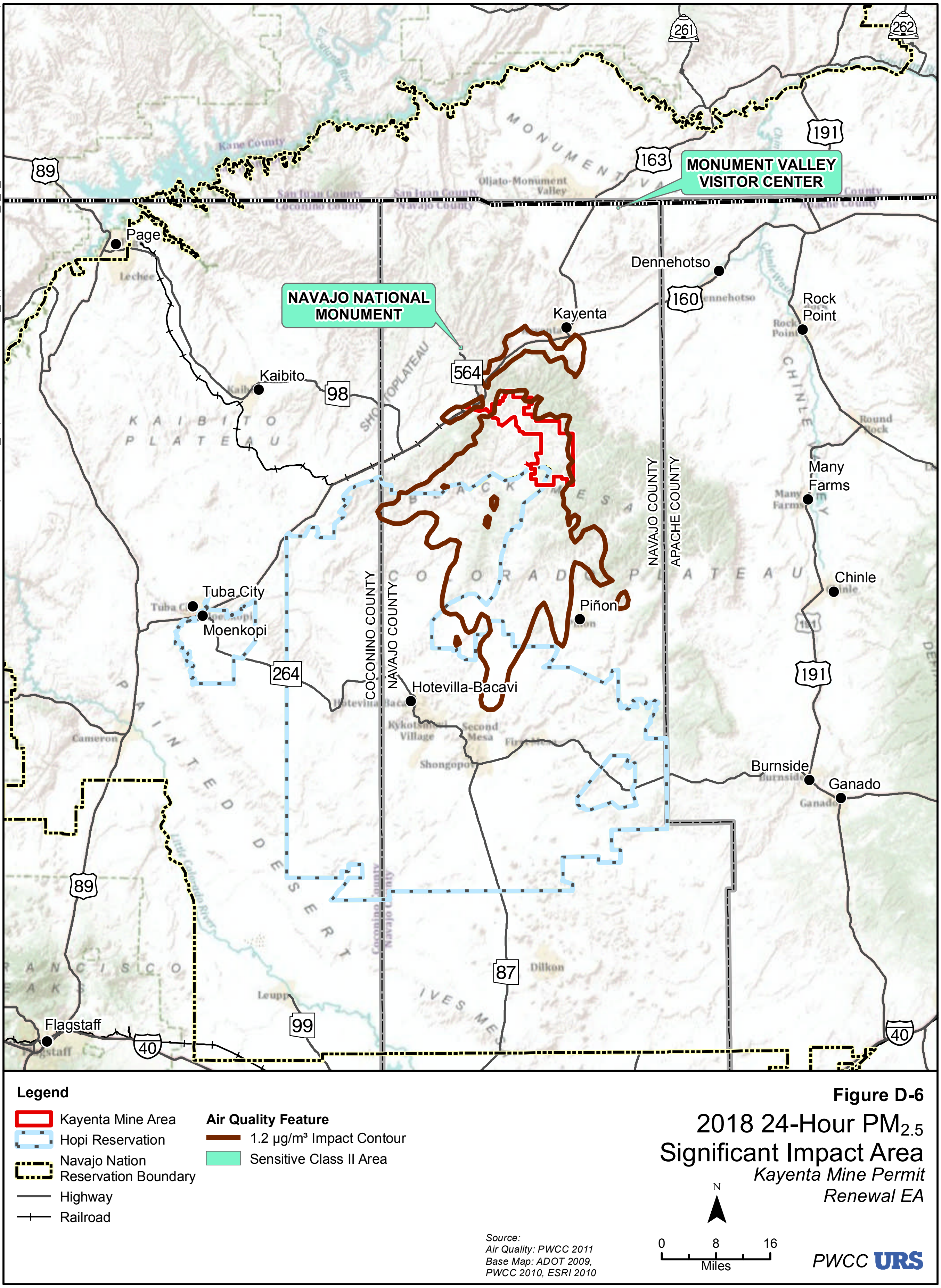
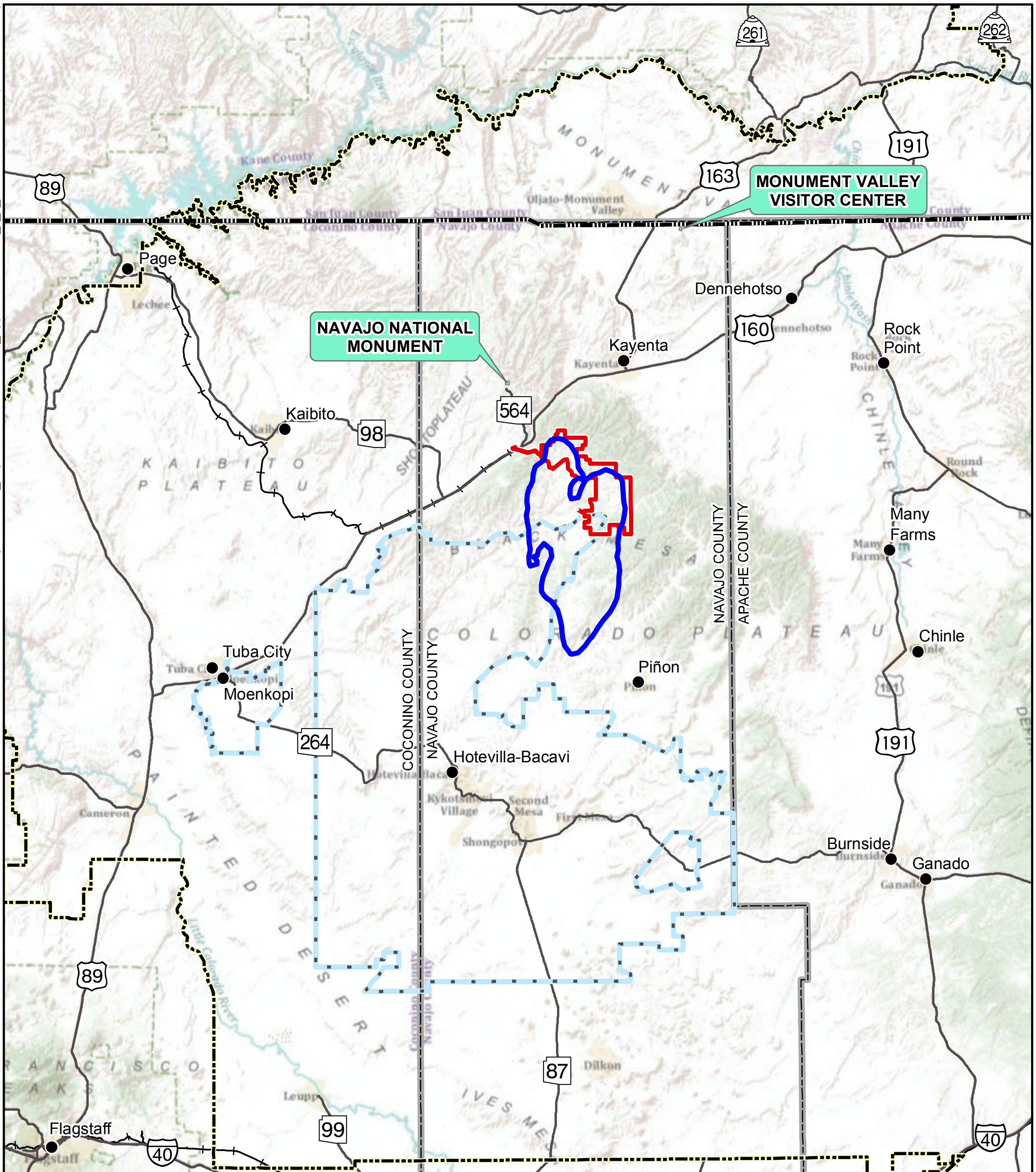


Figure D-6
2018 24-Hour $PM_{2.5}$ Significant Impact Area
Kayenta Mine Permit Renewal EA



Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 0.3 µg/m³ Impact Contour
- Sensitive Class II Area

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

0 8 16
Miles

Figure D-7

2010 Annual $PM_{2.5}$ Significant Impact Area

Kayenta Mine Permit Renewal EA

PWCC URS

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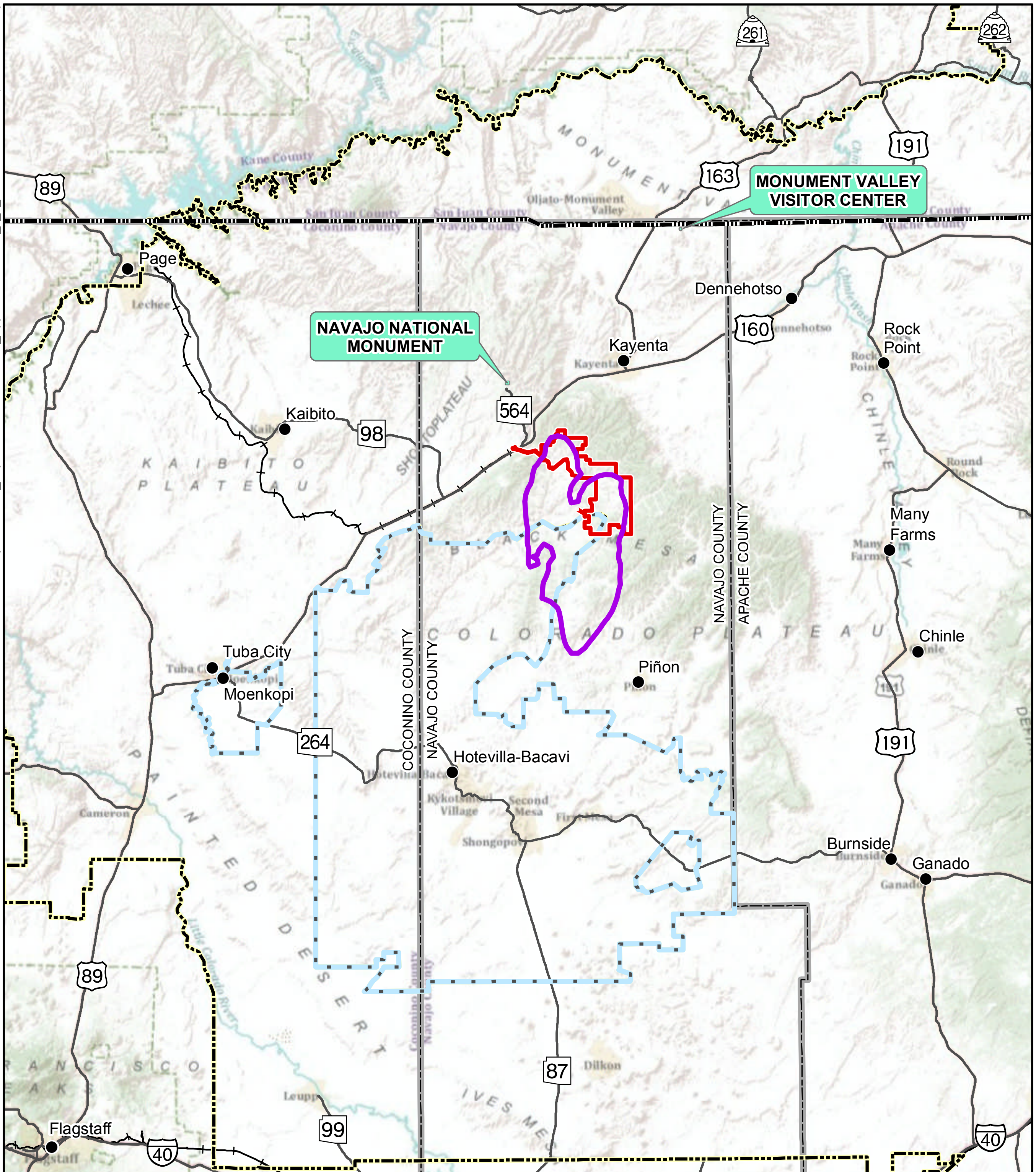

Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 0.3 µg/m³ Impact Contour
- Sensitive Class II Area

Figure D-8

2012 Annual $PM_{2.5}$
Significant Impact Area

Kayenta Mine Permit Renewal EA

N

0 8 16
Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

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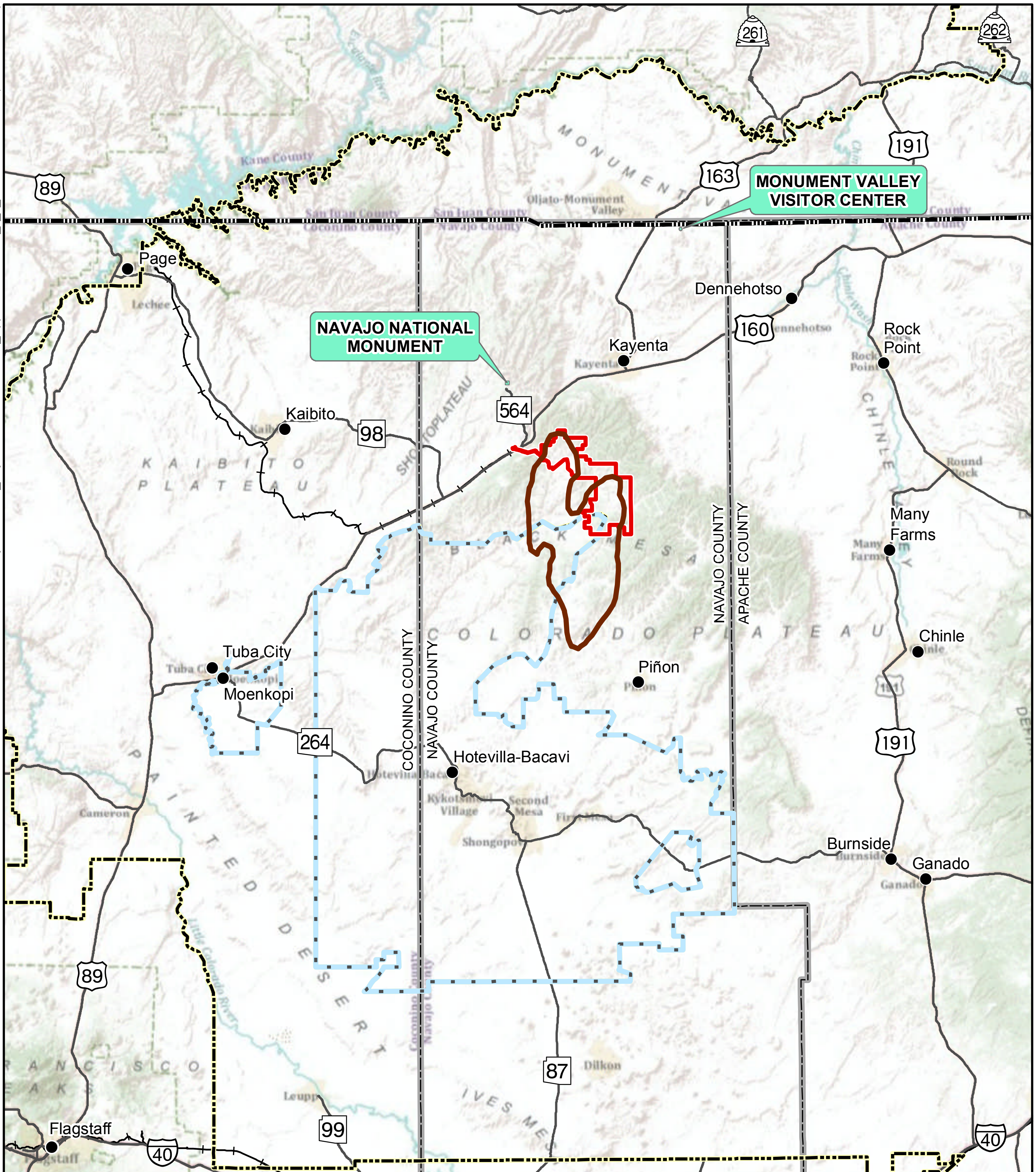


Legend

- Kayenta Mine Area
- Hopi Reservation
- Navajo Nation Reservation Boundary
- Highway
- Railroad

Air Quality Feature

- 0.3 µg/m³ Impact Contour
- Sensitive Class II Area

Figure D-9

2018 Annual $PM_{2.5}$ Significant Impact Area

Kayenta Mine Permit Renewal EA

N

0 8 16 Miles

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

D.12.3 Nitrogen Dioxide (NO_2)

The SIL for NO_2 is 1 µg/m^3 on an annual basis. NO_2 SIAs were developed in the same manner as for PM_{10} and $PM_{2.5}$. The NO_2 SIAs are shown in Figures D-10 through D-12.

Predicted annual concentrations of NO_2 are provided in Table D-10. All predicted concentrations are well below the applicable NAAQS.

Table D-10 Kayenta Complex Maximum Predicted Annual NO_2 Concentrations

Model Year	Location	X-UTM	Y-UTM	NO_2 Concentration (µg/m^3)	NO_2 Concentration with Background (µg/m^3)	National Ambient Air Quality Standard (µg/m^3)
2010	Boundary	563581.26	4028888.44	5.29	7.39	100
2012	Boundary	564284.86	4029187.00	9.34	11.44	100
2018	Boundary	563581.26	4028888.44	6.61	8.71	100

D.12.4 Atmospheric Deposition of Metals

Potential environmental impacts to surface waters from the atmospheric deposition of metals contained in particulate matter emissions have been examined in prior NEPA analyses of proposed actions in the Four Corners region. Therefore, an evaluation of the possible extent of any metals deposition due to Kayenta Mine's particulate emissions was performed.

The rate of atmospheric deposition of metals from Kayenta Mine was estimated as a fraction of the deposition rate for total suspended particulate (TSP) from the Mine. Inventories of the Mine's TSP emissions were developed for years 2010, 2012 and 2018, using methods similar to those previously described for estimating PM_{10} emissions from the Mine. Annual, TSP deposition rates resulting from those TSP emissions were predicted with the AERMOD dispersion model, using the same meteorological data that was previously used with the PM_{10} modeling.

The Salt River Project Agricultural Improvement and Power District (SRP) retained ENVIRON to conduct an analysis of the emissions, environmental transport, transformation, and aquatic impacts of mercury (Hg) and selenium (Se) emissions from the Navajo Generating Station (NGS) (see Appendix E). ENVIRON provided an 84 km by 84 km modeling receptor grid that encompasses the area surrounding NGS, including seven different drainage basins for Lake Powell and the Colorado River.

Peabody provided analytical data describing typical concentrations of mercury and selenium in the coal and in the overburden at Kayenta Mine. AERMOD model runs were performed separately for TSP emissions from Mine operations handling coal and for TSP emissions from Mine operations handling overburden. An average annual TSP deposition rate from modeling TSP emissions from coal operations and an average annual TSP deposition rate from modeling TSP emissions from overburden operations were determined for each of the seven drainage basins.

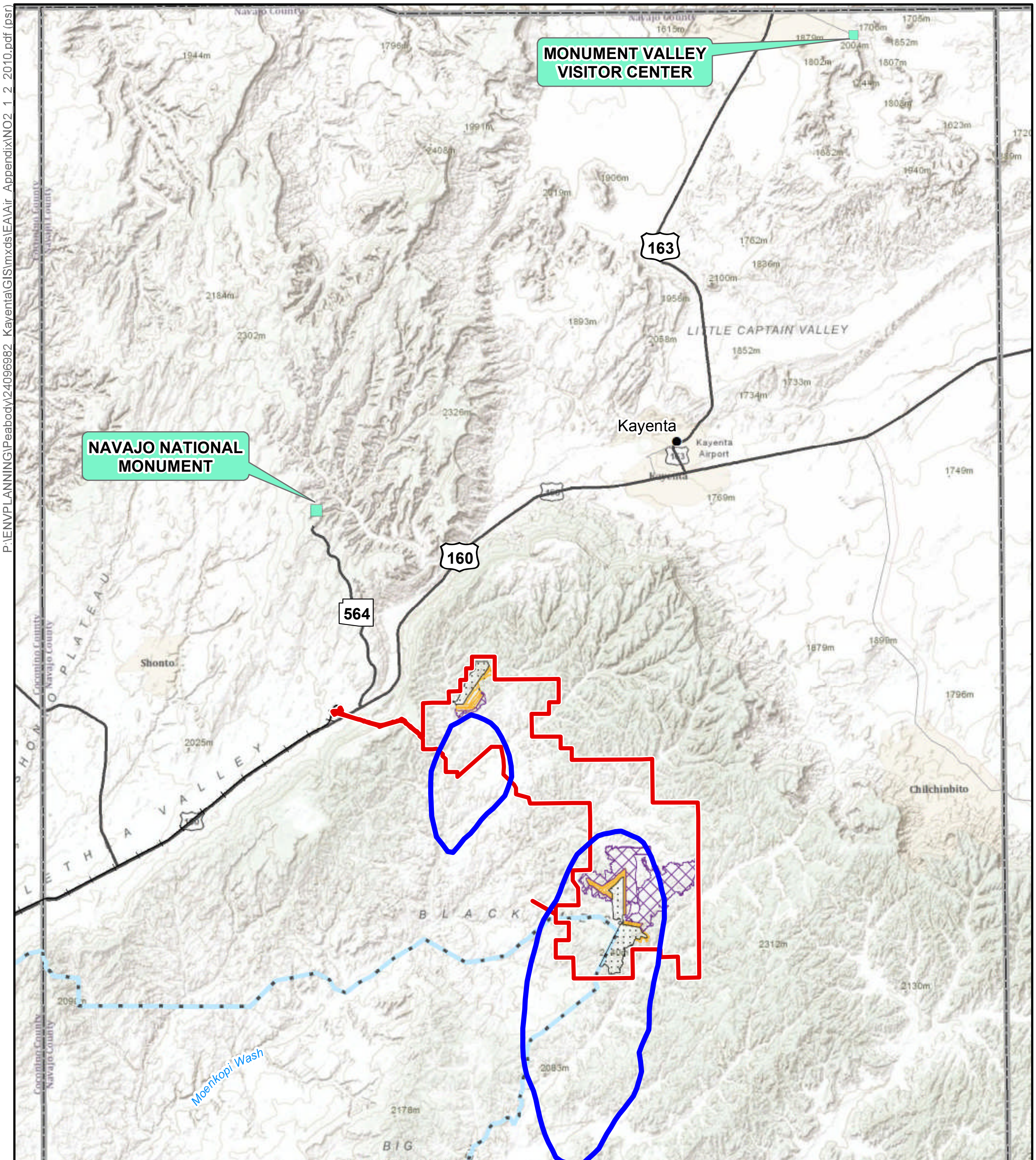
Average annual deposition rates of particulate mercury (Hg^P) from coal operations were determined for each drainage basin by multiplying the basin's TSP deposition rate from coal operations by the concentration of mercury in the Mine's coal. Likewise, average annual deposition rates of Hg^P from overburden operations were determined for each drainage basin by multiplying the basin's TSP deposition rate from overburden operations by the concentration of mercury in the Mine's overburden. The total average annual Hg^P deposition rate for each drainage basin was calculated as the sum of the basin's Hg^P deposition rate from coal operations and the basin's Hg^P deposition rate from overburden operations. The total average annual Se deposition rate for each drainage basin was calculated in an analogous manner. The resulting rates of deposition of Hg^P and Se in each drainage basin are shown in Table D-11.

Table D-11. Deposition Results (μg/m²/year)

	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Area 7
2010 Hg^P	2.7E-05	2.1E-05	1.8E-05	1.3E-05	1.2E-05	2.2E-05	1.2E-05
2010 Se	3.7E-03	2.9E-03	2.5E-03	1.8E-03	1.7E-03	3.0E-03	1.7E-03
2012 Hg^P	2.7E-05	2.1E-05	1.8E-05	1.3E-05	1.2E-05	2.2E-05	1.2E-05
2012 Se	3.7E-03	2.9E-03	2.5E-03	1.8E-03	1.7E-03	3.0E-03	1.7E-03
2018 Hg^P	2.6E-05	2.0E-05	1.7E-05	1.2E-05	1.2E-05	2.1E-05	1.2E-05
2018 Se	3.4E-03	2.7E-03	2.3E-03	1.6E-03	1.5E-03	2.7E-03	1.6E-03
Max. Hg^P	2.7E-05	2.1E-05	1.8E-05	1.3E-05	1.2E-05	2.2E-05	1.2E-05
Max. Se	3.7E-03	2.9E-03	2.5E-03	1.8E-03	1.7E-03	3.0E-03	1.7E-03

D.12.5 Summary

The permit renewal will not result in any "significant" emissions increase. Consequently, any ambient impacts due to the permit renewal will also be insignificant or negligible. Modeling was nevertheless performed to demonstrate that the ambient impacts due the total emissions from the Complex during the permit renewal term are projected to be not only low but actually insignificant in many locations throughout the resource area. In sum, the modeling analysis confirms what a comparison of emissions before and after permit renewal has already demonstrated, i.e., that the requested permit renewal will not substantially jeopardize Kayenta Complex's ability to comply with the national ambient air quality standards.



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Legend

- Kayenta Mine Area
- Permit Period Mine Area
- Previously Mined Area
- Future Mine Area
- Hopi Reservation
- Highway
- PWCC Mine Road
- Railroad

Air Quality Feature

- 1.2 µg/m³ Impact Contour
- Sensitive Class II Area

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

N

0 2.5 5
Miles

Figure D-10

2010 Annual NO_2
Significant Impact Area

Kayenta Mine Permit Renewal EA

PWCC URS

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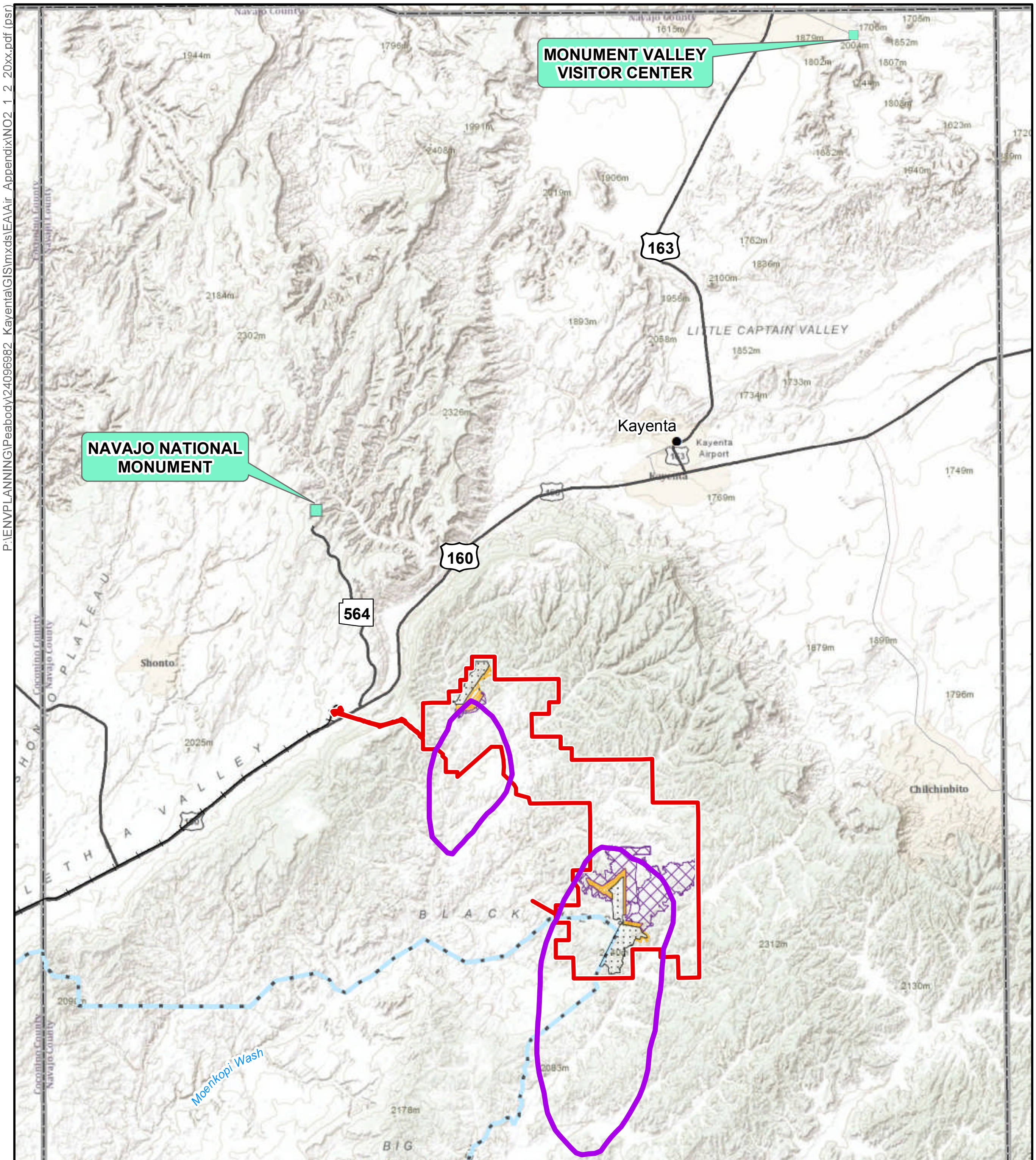

Legend

- Kayenta Mine Area
- Permit Period Mine Area
- Previously Mined Area
- Future Mine Area
- Hopi Reservation
- Highway
- PWCC Mine Road
- Railroad

Air Quality Feature

- 1.2 µg/m³ Impact Contour
- Sensitive Class II Area

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

N

0 2.5 5
Miles

Figure D-11
2012 Annual NO_2 Significant Impact Area
Kayenta Mine Permit Renewal EA

PWCC URS

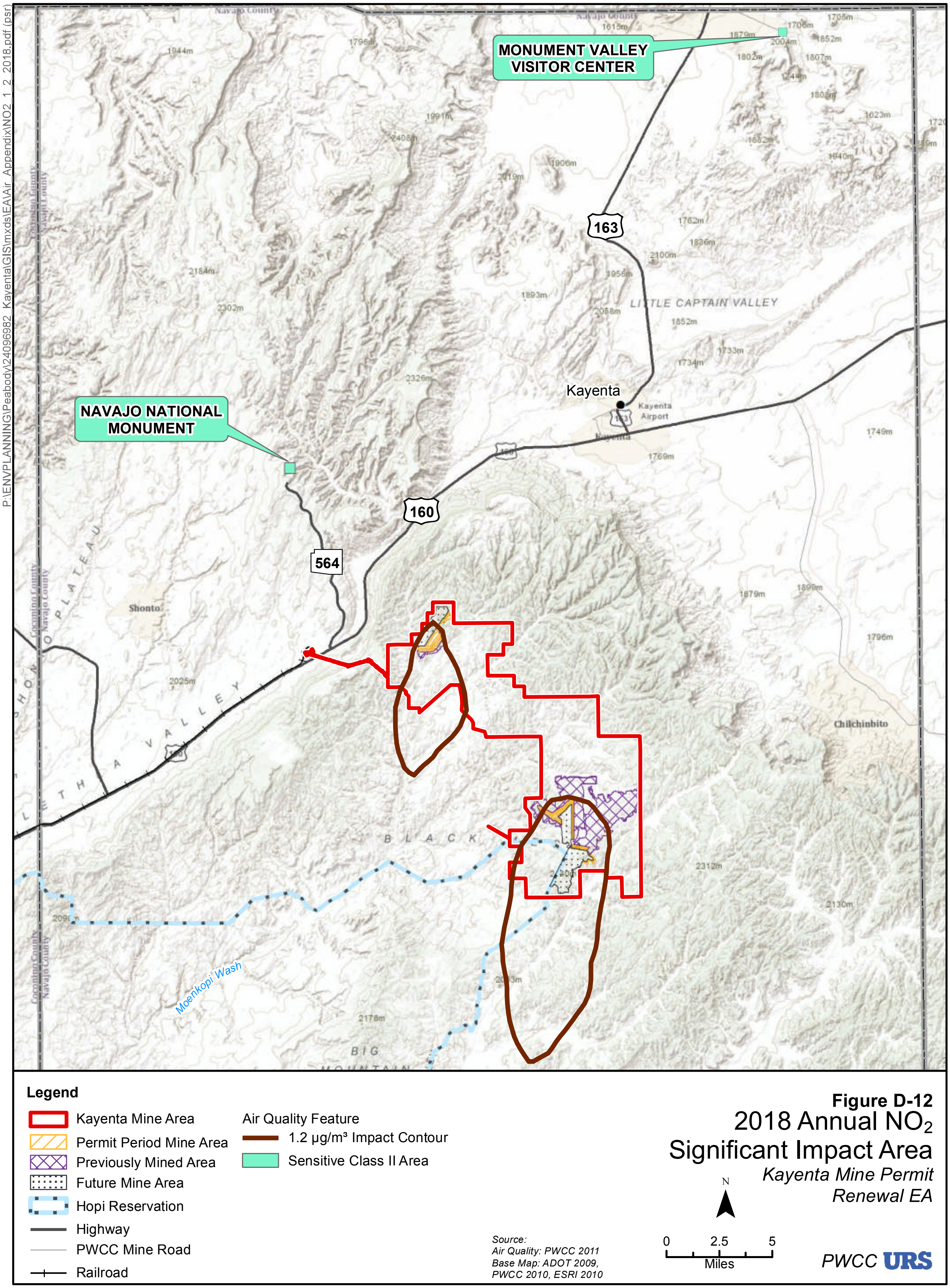

Figure D-12
2018 Annual NO_2 Significant Impact Area
Kayenta Mine Permit Renewal EA

Source:
Air Quality: PWCC 2011
Base Map: ADOT 2009, PWCC 2010, ESRI 2010

PWCC URS

D.11 MITIGATION

For obvious reasons, fugitive dust controls at the Complex focus on those substantive sources of particulate emissions which typically contribute the most to ambient levels of that pollutant, e.g., draglines, shovels and haul roads. Accordingly, design of the particulate monitoring network focuses on a general orientation of ambient monitors upwind and downwind of those activities which constitute major dust sources. Differences in measured upwind and downwind concentrations provide a relative indication of the "emissions strength" of the subject activities and success of the dust control practices being employed at those activities. Downwind measured concentrations likewise suggest whether ambient impacts from those activities might possibly cause or contribute to exceedances of the ambient standards. Should monitoring data indicate that the effectiveness of associated control practices for fugitive dust is not adequate, the Company can enhance the scope and frequency of its dust control measures as appropriate to further reduce downwind, ambient particulate concentrations.

The fugitive dust control plan for the Complex currently utilizes the following activities, practices and equipment to ensure that the mining operations do not result in a pattern of ambient impacts in excess of the applicable NAAQS:

- Exposed surface areas are protected and stabilized to control erosion and attendant fugitive dust by timely revegetation, stabilization of topsoil stockpiles, and revegetation management;
- Rills and gullies which form in regraded and topsoiled areas are filled, regraded or otherwise stabilized;
- Exposed surface areas are minimized to the extent practicable;
- Before or during loading, shot coal is watered as necessary;
- The drop height from earth excavating equipment is minimized to the extent feasible;
- Haulage and ancillary mine roads are watered at frequencies dependent upon the amount and timing of use, condition of the roads, and the amount of dust observed when in use;
- Frequently used haul roads and light-duty roads are chemically treated at least twice per year with a dust suppressant (35% magnesium chloride or equivalent at a chemical-to-water ratio of approximately 5:1);
- Magnesium chloride is stored year-round on site for use in spot treatment of roads, when necessary;
- Some light-duty roads and parking lots are paved;
- Water injection or rotoclones are employed on all overburden drills;
- Haul truck speeds are mechanically limited to 30 mph, and all other vehicles are limited to 45 mph, or as posted;
- Sprays of water or water and a surfactant are installed and used at coal handling and conveying equipment locations;
- Spoil and coal fires are suppressed and extinguished as soon as reasonably and safely possible;
- All conveyors are covered; and
- Chutes, drapes or other means are used to enclose conveyor transfer points, screens and crushers.

In summary, the Complex implements fugitive dust control measures as necessary to ensure that environmental requirements associated with fugitive dust and ambient standards are satisfied. A comprehensive meteorological and ambient PM_{10} monitoring program at the Complex is used to determine the effectiveness of those dust control practices. Should monitoring data indicate that ambient particulate standards are being threatened by impacts from mining operations, the Complex can adjust the nature, extent and frequency of its various, available dust control measures as necessary to reduce those impacts in order to maintain compliance with the applicable NAAQS.