FINAL

2001 AIR EMISSIONS INVENTORY

CARLSBAD CAVERNS NATIONAL PARK
NEW MEXICO

U.S. NATIONAL PARK SERVICE

JUNE 2003

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NEW MEXICO

Prepared for..

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Cover Photo: Natural Entrance to Carlsbad Caverns

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1. INTRODUCTION

1.1 BACKGROUND

In August of *1999,* the National Park Service (NPS) embarked on the Natural Resource Challenge, a major effort to substantially improve how the NPS manages the natural resources under its care. As part of Natural Resource Challenge, the NPS Air Resources Division (ARD) was tasked with the responsibility of expanding efforts to monitor and understand air quality and related values in the parks. In addition, the NPS Environmental Leadership policy directs the NPS to manage the parks in a manner "that demonstrates sound environmental stewardship by ¡mplementing sustainable practices in all aspects of NPS management...." In order to achieve both of these objectives, it is necessary to gain an understanding of air pollution emissions that result from activities within the park. In this regard, development of an in-park air emissions inventory for Carlsbad Caverns National Park (NP) serves three functions. First, it provides an understanding of the sources and magnitude of in-park emissions and a basis for contrasting them with emissions from the surrounding area. Second, it identifies existing and potential strategies to mitigate in-park air emissions. Finally, it evaluates and ensures the compliance status of the park relative to state and federal air pollution regulations.

1.2 TYPICAL AIR EMISSION SOURCES

Typical air emission sources within NPS units include stationary, area, and mobile sources. Stationary sources can include fossil fuel-fired space and water heating equipment, generators, fuel storage tanks, and wastewater treatment plants. Area sources may include woodstoves, fireplaces, campfires, and prescribed burning. Mobile sources may include vehicles operated by visitors, tour operators, and NPS and concessioner employees, and nonroard vehicles and equipment.

The air pollutants that are addressed in this report are summarized in the table below. Of the pollutants noted, ozone is not produced and emitted directly from stationary, area, or mobile sources, but rather it is formed as a result a chemical reaction of NOx and VOC emissions in the presence of sunlight. It is primarily an issue on the East Coast and Southern California, while particulate matter is more of an issue in the West. Carbon dioxide historically has not been considered a pollutant. However, in recent years, there has been much interest in its contribution to global climate warming since it is considered a greenhouse gas.

AIR POLLUTANTS AND THEIR CHARACTERISTICS

Pollutant	Characteristics
Particulates (PM_{10})	• Mixture of solid particles and liquid droplets; fine particles (less than 2.5 micrometers) produced by fuel combustion, power plants, and diesel buses and trucks • Can aggravate asthma, produce acute respiratory symptoms, including aggravated coughing and difficult or painful breathing, and chronic bronchitis • Impairs visibility
Sulfur Dioxide ($S0_2$)	• Can cause temporary breathing difficulties for people with asthma • Reacts with other chemicals to form sulfate particles that are major cause of reduced visibility in many parts of the country
Nitrogen Oxides (NOx)	• High temperature fuel combustion exhaust product • Can be an irritant to humans and participates in the formation of ozone
Carbon Monoxide (CO)	• Odorless, colorless gas produced by fuel combustion, particularly mobile sources • May cause chest pains and aggravate cardiovascular diseases, such as angina • May affect mental alertness and vision in healthy individuals
Volatile Organic Compounds (VOCs)	• Fuel combustion exhaust product • Consists of a wide variety of carbon-based molecules • Participates in the formation of ozone
Ozone (03)	• Not directly emitted by mobile, stationary, or area sources • Formed from complex reactions between NO_x and VOC emissions in the presence of sunlight • Occurs regionally due to multiplicity of sources • Can irritate the respiratory system • Can reduce lung function • Can aggravate asthma and increase susceptibility to respiratory infections • Can inflame and damage the lining of the lungs
Carbon Dioxide (C02)	• Does not directly impair human health • It is a greenhouse gas that traps the earth's heat and contributes to the potential for global warming

1.3 INVENTORY METHODOLOGY

The methodology to accomplish the air emissions inventory was outlined in a protocol that was prepared at the initiation of the project (EA Engineering 2001). Tasks consisted of a site survey in January 2003, interviews with Carlsbad Caverns NP[1] personnel, review of applicable park records, emission calculations, review of applicable state and local air quality regulations, an assessment of mitigation measures and potential emission reduction initiatives, and report preparation. The data were used in conjunction with a number of manual and computer software computational tools to calculate emissions. Computational tools included U.S. Environmental Protection Agency (USEPA) emission factors such as the Factor Information Retrieval System (FIRE) database, USEPA *TANKS 4.0* model, U.S. Forest Service *First Order Fire Effects Model (FOFEM) 4.0* model, and USEPA *MOBILE6.2* mobile source emissions model. The year 2001

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was selected as the basis for the air emission inventory since data for that year were the most recent available at the park. It should be noted that emissions are expected to vary from year to year due to fluctuations in visitation, prescribed and wildland fires, and other activities. Additional information on emission estimation methodology, including emission factors, is provided in Appendices A and B.

1.4 PARK DESCRIPTION

Carlsbad Caverns NP is located in southeast New Mexico approximately 165 miles east of El Paso, Texas (Figure 1). It was established to preserve Carlsbad Cavern and numerous other caves within the Guadalupe Mountains, a Pewnian-age fossil reef. The park contains over 100 known caves, including the famous Lechuguilla Cave. Carlsbad Cavern, with one of the world's largest underground chambers and countless formations, is accessible via walking tours offered year-round. Established first as a National Monument on October 25, 1923, the park was designated a National Park on May 14, 1930. Carlsbad Caverns NP became a World Heritage Site on December 6, 1995.

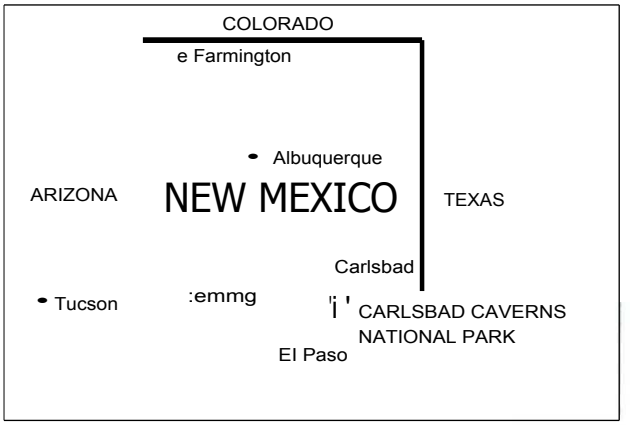
The park contains a total of *46,766.45* acres; 33,125 acres are a designated wilderness area. Park use is highest in the months of June, July, and August, and generally on weekends and holidays. January is the least busy month. From 1991 to 2001, total annual visitation ranged from 688,742 (1992) to 455,617 (2001). The backcountry of the park gets little use, and there are no campgrounds within the park boundary. The principal visitor destination is the Visitor Center that is located over the main cavern in the northeast section of the park (Figure 2). Table 1 summarizes the developed areas in the park, and Figure 3 notes the principal structures at the Visitor Center complex.

TABLE 1: CARLSBAD CAVERNS NP DEVELOPED AREAS

Name/Location	Function/Facilities
Visitor Center/Headquarters	Visitor Center, Headquarters, Maintenance Yard and Shops, and Employee Residences
Rattlesnake Springs	Ranger Station, Picnic Area, and Employee Residence
Slaughter Canyon Cave	No structures

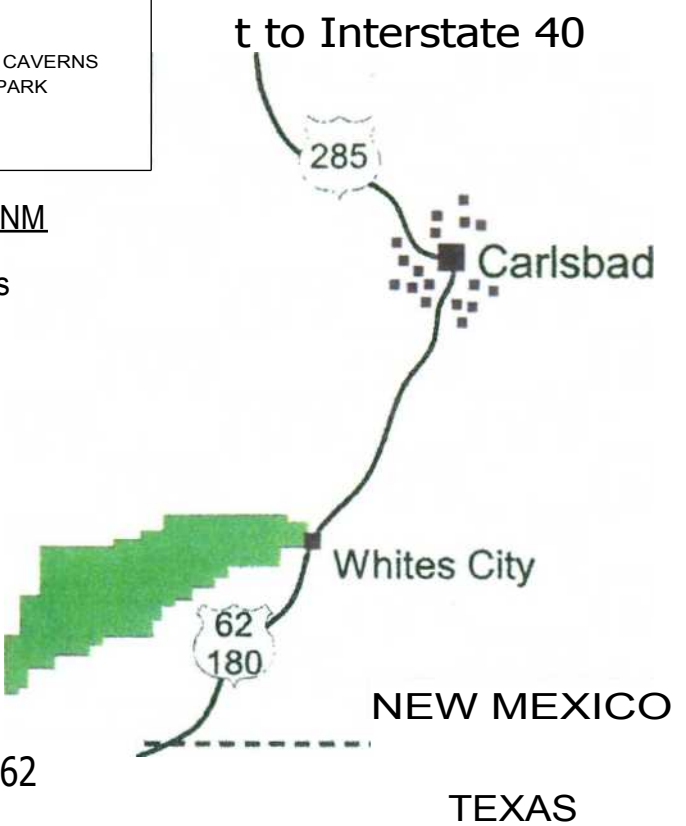
1.5 AIR QUALITY STATUS

Carlsbad Caverns NP is located in Eddy County, NM, which is in attainment for all national and state ambient air quality standards (AAQS), including ozone and particulate matter (PM_{10}). Carlsbad Caverns NP is designated a Class I airshed under the Clean Air Act, which requires the highest level of air-quality protection. The New Mexico Environment Department's Air Quality Bureau (AQB) is the governing authority for regulating air pollution in the park.



Driving Distances from Carlsbad, NM

to Carlsbad Caverns NP- 27 miles
to Guadalupe Mtns NP- 55 miles
to El Paso, TX- 165 miles
to Albuquerque, NM- 300 miles



CARLSBAD CAVERNS NATIONAL PARK

Vicinity Map

Carlsbad Cavern

Carlsbad Caverns National Park
US Department of the Interior
National Park Service

130/20040 OSC March 2000

FIGURE 1. CARLSBAD CAVERNS NATIONAL PARK LOCATION

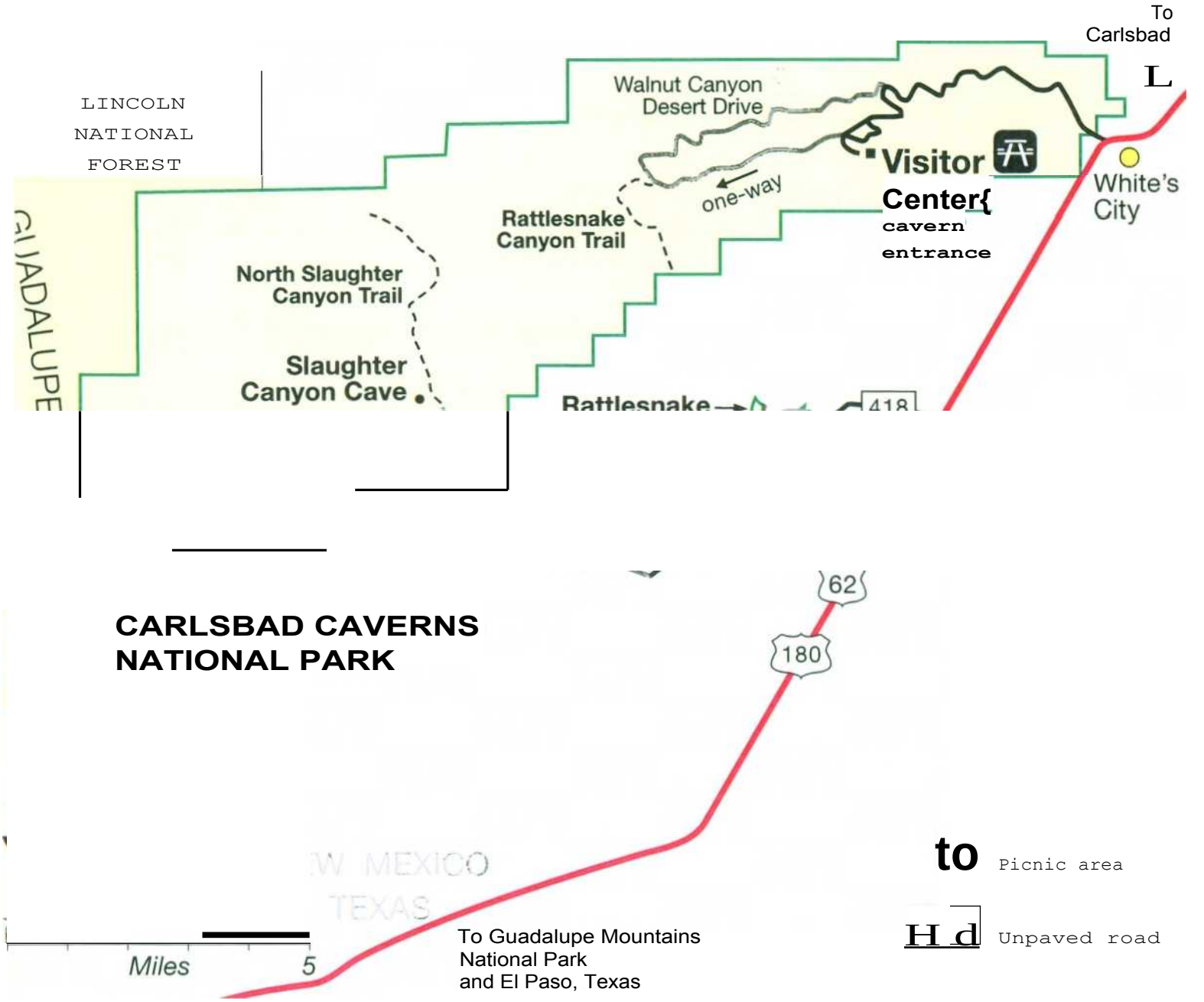
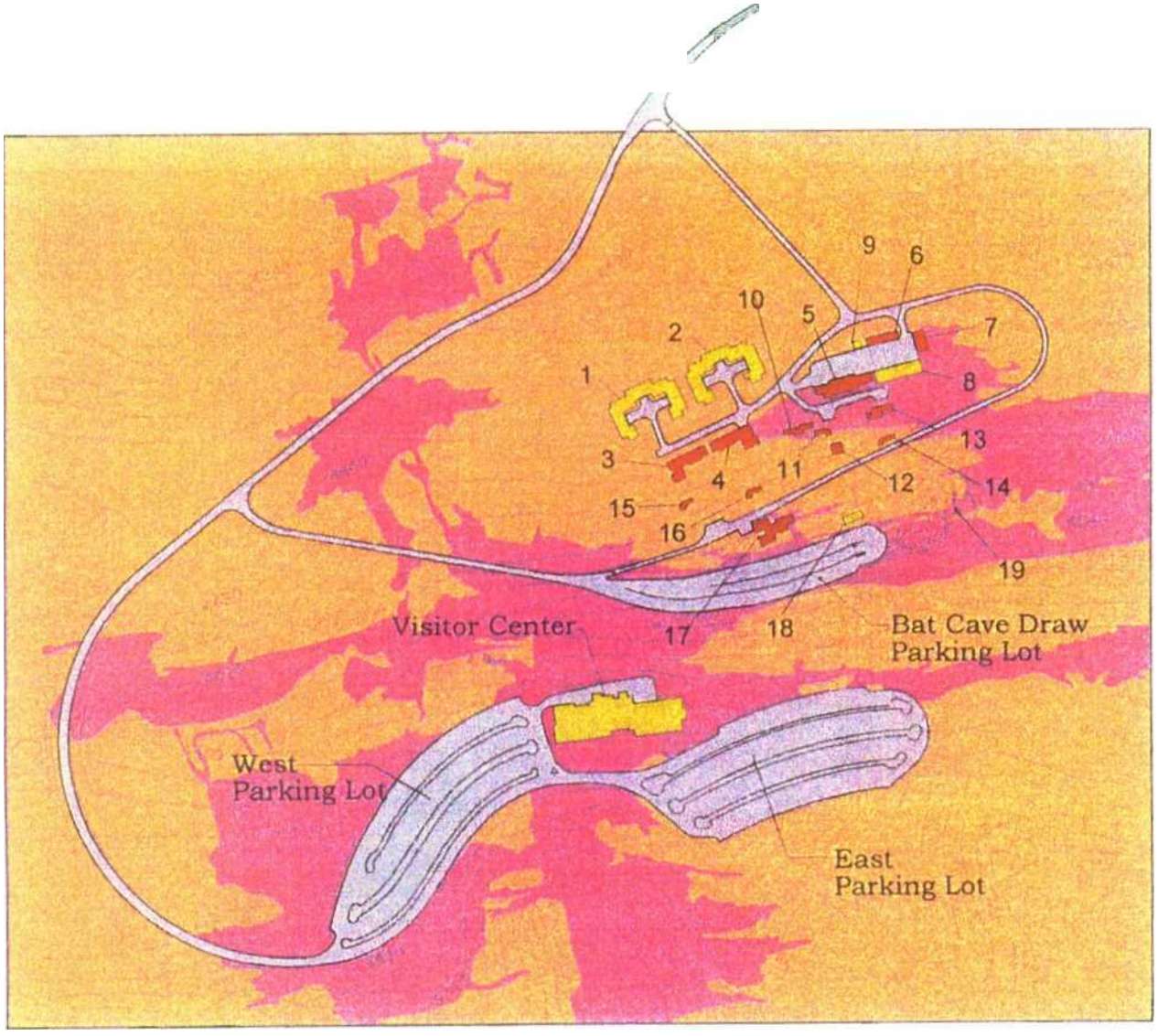


FIGURE 2. CARLSBAD CAVERNS NATIONAL PARK



KEY:

1 Mission 66 Era Residence
2 Mission 66 Era Residence
3 Employee Quarters
4 Employee Quarters
5 Maintenance Structure
6 Maintenance Structure
7 Maintenance Structure
8 Maintenance Structure
9 Maintenance Structure
10 Employee Quarters
11 Employee Quarters
12 Research Hut
13 Employee Quarters
14 Research Hut
15 Employee Quarters
16 Law Enforcement Office
17 Superintendent's Office Complex
18 Bat Flight Restroom/ Lift Station
19 Natural Cave Entrance and Amphitheater

No Historic Structure

Non-historic Structure

CAVERN SYSTEM (subsurface)

Existing Development
Carlsbad Cavern

Carlsbad Caverns National Park
US Department of the Interior
National Park Service
30/20041 oSC March 2000

0 100 300 FEET

FIGURE 3. CARLSBAD CAVERNS NATIONAL PARK VISITOR CENTER COMPLEX

2. STATIONARY AND AREA SOURCE EMISSIONS

This section summarizes emissions from stationary sources at the Park for the year 2001. The discussion is divided into sections covering emissions from combustion sources, fuel storage sources, and area sources. The following emissions were calculated for each source: particulate matter (PM10), sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), carbon dioxide (C02), and volatile organic compounds (VOCs).

2.1 STATIONARY SOURCES

2.1.1 Space And Water Heating Equipment

There are approximately twenty propane and one No. 2 oil heating units in the park, and criteria emissions were calculated using the appropriate residential emission factors. For example, NOx emissions from the propane furnace in the Visitor Center building were calculated as follows:

$$5{,}000 \text{ gallons/yr} \times \frac{18 \text{ lb NOx}}{1{,}000 \text{ gallons}} = 90 \text{ lb PM10/yr}$$

Actual criteria pollutant emissions from the heating equipment are summarized in Table 2. Potential emissions for the propane heating equipment also were calculated by assuming that the heating units were operated continuously during the year, and these emissions are noted in Table 3.

TABLE 2. 2001 ACTUAL AIR EMISSIONS FROM CARLSBAD CAVERNS NP HEATING EQUIPMENT

Location (No.)	Fuel	Consumption (gal/yr)	PM_{10} (lbs/yr)	SO2 (lbs/yr)	NO_x (lbs/yr)	CO (lbs/yr)	CO_2 (lbs/yr)	VOC (lbs/yr)
Carpenter Shop	Propane	1,777	1	0	25	3	22,217	1
Fire Cache/Weight Room	Propane	1,693	1	0	24	3	21,159	1
Auto Shop (2)	Propane	4,401	2	0	62	8	55,015	1
Plumbing Shop	Propane	592	0	0	8	1	7,406	0
Fire Trick Garage	Propane	846	0	0	12	2	10,580	0
Quarters 13	Pro ap ne	1,862	1	0	26	4	23,275	1
Employee Quarters (11)	Propane	12,103	5	0	169	23	151,290	4
Building 6	Propane	1,100	0	0	15	2	13,754	0
Rattlesnake Springs Residence	Propane	1,100	0	0	15	2	13,754	0
Visitor Center/ Restaurant/Gift Shop	No. 2 Oil	5,000	2	355	90	25	107,500	4
		Total	12	355	447	73	425,950	11

TABLE 3. 2001 POTENTIAL AIR EMISSIONS FROM CARLSBAD CAVERNS NP HEATING EQUIPMENT

Location (No.)	Fuel	Consumption (gal/yr)	PM_{10} (lbs/yr)	SO_2 (lbs/yr)	NO_x (lbs/yr)	(lbs/ r)	CO_2 (lbs/yr)	(b O y
Carpenter Shop	Propane	10,052	4	0	141	19	125,656	3
Fire Cache/Weight Room	Propane	9,574	4	0	134	18	119,672	3
Auto Shop (2)	Propane	24,892	10	0	348	47	311,148	7
Plumbing Shop	Propane	3,351	1	0	47	6	41,885	1
Fire Trick Garage	Propane	4,787	2	0	67	9	59,836	1
Quarters 13	Propane		4	0	147	20	131,639	3
Employee Quarters (11)	Propane	68,452	27	1	958	130	855,656	21
Building 6	Propane	6,223	2	0	87	12	77,787	2
Rattlesnake Springs Residence	Propane	6,223	2	0	87	12	77,787	
Visitor Center/ Restaurant/Gift Shop	No. 2 Oil	106,371	43	7,552	1,915	532	2,286,986	76
		Total	100	7,555	3,932	806	4,088,051	119

2.1.2 Generators

2.1.2.1 Generator Emissions - Actual

Emissions were calculated by multiplying the unit rating (kW) of the generators by an estimated annual run time (hr/yr) to get the kW-hr/yr, and the appropriate emission factors were then applied. For example, PM emissions from the 545 kW generator at the Visitor Center as backup for cave lighting are calculated as:

$$545\ kW \quad \frac{12\ hours}{year} \quad x \quad \frac{1.34\ hp}{kW} \quad x \quad \frac{0.00220\ lb\ PM}{hp\text{ - }hr} \quad = 19\ lb\ PM/yr$$

Actual generator criteria emissions are summarized in Table 4.

TABLE 4: 2000 ACTUAL CARLSBAD CAVERNS NP GENERATOR CRITERIA EMISSIONS

Location	Rating (kW)	Run Time (hrs/ r)	PM_{10} (lbs/ r	SO_2 (lbs/ r)	NO, (lbs/ r)	CO (lbs/ r)	CO_2 (lbs/ r)	VOC (lbs/ r
V sitor Center	545	12		35	210	48	10,078	

2.1.2.2 Generator Emissions - Potential

Potential emissions were also calculated for the generators, and the same emission factors that were used to calculate the actual emissions were used to calculate these potential emissions. To

calculate potential emissions, EPA guidance on the number of hours of operation to assume was adopted:

> EPA does not recommend the use of 8,760 hours per year (i.e., full-year operation) for calculating PTE (potential to emit) for emergency generators ... The EPA believes that 500 hours is an appropriate default assumption for estimating the number of hours that an emergency generator could be expected to operate under worst-case conditions.'

Potential criteria generator emissions are summarized in Table 5.

TABLE 5: 2000 POTENTIAL CARLSBAD CAVERNS NP GENERATOR CRITERIA EMISSIONS

Location	**Rating** (kW)	**Run Time hrs/ r)**	PM_{10} **(lbs/ r)**	SO_2 **(lbs/ r)**	NO_X **(Ibs/ r)**	**CO (lbs/ r)**	CO_2 **(Ibs/ r)**	**VOC (lbs/ r)**
Visitor Center	545	500	256	1,477	8,764	2,439	419,923	234

2.1.3 Fuel Storage Tanks

Carlsbad Caverns NP has one gasoline and one diesel fuel underground storage tanks in the maintenance yard that service NPS vehicles and other motorized equipment. There are no public automotive service stations in the park.

There are two basic types of VOC emissions from storage tanks: working losses and standing losses. Working losses are composed of both withdrawal and refilling loss emissions. Withdrawal loss emissions result from the vaporization of liquid fuel residue on the inner surface of tank walls as the liquid levels in the tank are decreased and air is drawn into the tank. Refilling losses refer to fuel vapor releases to the air during the process of refilling the tank as the liquid level in the tank increases and pressurizes the vapor space. Standing losses describe those tank emissions from the vaporization of the liquid fuel in storage due to changes in ambient temperatures. VOC losses are also a direct function of the annual product throughput or turnovers. Emissions from diesel tanks are extremely small since the volatility of diesel fuel is extremely low compared to gasoline. VOC emissions from the NPS fuel storage tanks were calculated using the USEPA *TANKS* software program. *TANKS* is based on the emission estimation procedures from Chapter 7 of EPA's Compilation of Air Pollutant Emission Factors (AP-42) and uses chemical, meteorological, and other data to generate emission estimates for

i *Calculating Potential to Emit (PTE) for Emergency Generators*, Office of Air Quality Planning and Standards (MD-10), U.S. Environmental Protection Agency, 06 September 1995.

different types of storage tanks. Table 6 summarizes the calculated emissions from the gasoline tank.

TABLE 6: 2001 CARLSBAD CAVERNS NP FUEL TANK EMISSIONS

Location	Product	Tank Type	Volume (gal)	Throughput (gal/yr)	VOC (lbs/yr)
Maintenance Yard	Gasoline	UST	2,000	15,556	105

2.1.4 Wastewater Treatment Plants

There are no wastewater treatment facilities in the park.

2.2 AREA SOURCES

2.2.1 Woodstoves/Fireplaces

There is one woodstove, but no fireplaces in the park. The estimated emissions are summarized in Table 7.

TABLE 7: WOODSTOVE AIR EMISSIONS FROM CARLSBAD CAVERNS NP

Location	Number	Fuel Consum i tion	PM_{10} (lbs/ r)	SO_2 (lbs/ r)	NO_X (lbs/ r)	CO (lbs/ r	VOC (lbs/ r
Ra tlesnake Springs Residence	1	0.5 cord/yr	17			129	30

2.2.2 Campfires

There are no campgrounds in the park.

2.2.3 Wildland Fires and Prescribed Burning

Wildland fires are ignited naturally, usually by lightening, and are typically suppressed, while prescribed fires are ignited intentionally in order to achieve fire management objectives. Prescribed burning is a land treatment process to accomplish natural resource management objectives, including reducing the potential for destructive wildfires, eliminating excessive fuel buildup, controlling insects and disease, improving wildlife habitat and forage production, maintaining natural succession of plant communities, and restoring natural processes. Only prescribed burning emissions are considered as anthropogenic emissions.

Over the 1990-2002 time period, there were prescribed burns of grass/shrub that covered approximately 6,840 acres or 570 acres a year on average. In addition, wildland fires consumed an average of 2,930 acres per year over the same time period. The First Order Fire Effects Model (FOFEM) was used to estimate emissions. FOFEM is a computer program developed by the Intermountain Fire Sciences Lab, U.S. Forest Service to predict the effects of prescribed fire and wildfire in forests and rangelands throughout the U.S. In particular, it quantifies emissions of PM10, PM2.5, CO, CO2, and CH4, which are summarized in Table 8.

TABLE **8:** PRESCRIBED BURNING AND WILDLAND FIRE AIR EMISSIONS FROM CARLSBAD CAVERNS NP

Pine Grassland	570	6,270	5,130		2,	
Wildland Fires						
Pine Grassland	2,930	32,230	26,370	164,080	11,758,090	11,720

As methane

2.2.4 Miscellaneous Area Sources

Miscellaneous area sources include food preparation, degreasers, paints and other surface coatings, lighter fluid consumption, consumer solvents, and propane use by visitors in recreational vehicles. However, there are no data on the consumption of these materials whose emissions are estimated to be negligible.

2.3 SUMMARY OF STATIONARY AND AREA SOURCE EMISSIONS

Table 9 summarizes the stationary and area source emissions calculated above in a format that allows comparison between the various sources as well as providing totals for each pollutant or pollutant category under consideration.

TABLE 9: SUMMARY OF 2001 STATIONARY AND AREA SOURCE EMISSIONS AT CARLSBAD CAVERNS NP

Activity	Particulates (PM_{10})		Sulfur Dioxide		Nitrogen Oxides		Carbon Monoxide		Carbon Dioxide		VOCs	
	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr
Stationary Sources												
Heating Equipment	12	<0.01	355	0.18	447	0.22	73	0.04	425,950	213	11	<0.01
Generators	6	<0.01	35	0.02	210	0.11	48	0.02	10,078	5.04	22	0.01
Gasoline Storage Tanks	--	--	--	--	--	--	--	--	--	--	105	0.05
Stationary Sources Subtotal	18	0.01	390	0.20	657	0.33	121	0.06	436,028	218	138	0.07
Area Sources-												
Woodstove	17	<0.01	--	--	2	<0.01	129	0.07	--		30	0.02
Prescribed Burning	6,270	3.14	--	--	--	--	31,920	15.96	2,287,410	1,144	2,280	1.14
Wildland Fires	32,230	16.12	--	--	--	--	164,080	82.04	11,758,090	5,879	11,720	5.86
	38,517	19.26.	--		2	<0.01	196,129	98.06	14,045,500	7,023	14,030	7.02
Totals												
	Particulates (PM_{10})		Sulfur Dioxide		Nitrogen Oxides		Carbon Monoxide		Carbon Dioxide		VOCs	
	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr
Totals without Prescribed Burning	35	0.01	390	0.20	657	0.33	250	0.13	436,028	218	168	0.08
Totals with Prescribed Burning	6,305	3.15	390	0.20	657	0.33	32,170	16.09	2,723,438	1,362	2,448	1.22

3. MOBILE SOURCE EMISSIONS

This section summarizes emissions from mobile sources at Carlsbad Caverns NP for 2001. Mobile emission sources include highway and nonroad vehicles.

3.1 HIGHWAY VEHICLES

3.1.1 Visitor Vehicles

An estimated 455,617 visitors entered the park during the most recent year. Assuming a visitor to vehicle ratio of 2.8, an estimated 162,720 visitor vehicles traveled to the park. The road leading from the park entrance to the Visitor Center and caverns is 6.6 miles long. This would equate to an estimated 2,148,000 vehicle-miles-traveled in the most recent year. In addition, there is one 9.8-mile, unpaved, one-way scenic loop road near the Visitor Center, and park officials estimated that only 2,000 vehicles traversed this road a year.

The majority of mobile source emissions can be categorized as either exhaust or evaporative emissions. Exhaust emissions are related to the combustion of fuel in the engine and include VOC, NOx, CO, and PMio. Exhaust emissions are dependent on a number of factors, including engine load, engine design and age, combustion efficiency, emissions equipment such as catalytic converters, and other factors. Evaporative emissions, which can occur while the vehicle is running or at rest, are related to the volatilization of fuel from vapor expansion, leaks and seepage, and fuel tank vapor displacement. Evaporative emissions are primarily dependent on daily temperature cycles and fuel volatility. In addition to vehicle exhaust, PM10 emissions also result from brake and tire wear, as well as the re-entrainment of dust from paved and unpaved roads (referred to as fugitive dust).

Emission factors produced by the USEPA MOBILE6.2 model were used in conjunction with VMT data in order to estimate mobile source emissions for VOC (both exhaust and evaporative), NOx, CO, and PM1o (exhaust, brake, and tire) for visitor vehicles. MOBILE6.2 produces exhaust and evaporative emission factors for light duty gasoline vehicles, light duty gasoline trucks, heavy duty gasoline vehicles, light duty diesel vehicles, light duty diesel trucks, heavy duty diesel vehicles, and motorcycles. It also produces a composite emission factor for all vehicles based on the vehicle VMT mix supplied to the model. Inputs to the model include average vehicle speed, vehicle VMT mix, inspection and maintenance (UM) program information, fuel information, ambient temperature data, elevation, and others. Fugitive PM10 emissions resulting from tire-

roadway interaction were based on EPA's road dust emission factors.

The MOBILE6.2 model is typically used to support planning and modeling efforts in urban or regional areas and include default inputs suited for these applications. Therefore, it is suitable for applications over large, regional transportation networks. Application of the MOBILE6.2 model required the utilization of unique inputs that were representative of mobile source activity within the park: In particular, it was necessary to utilize unique inputs for the visitor vehicle VMT mix and the vehicle age distribution. The Center for Environmental Research and Technology within the College of Engineering at the University of California's Riverside Campus (CE-CERT) established park-specific vehicle fleet characterizations in developing air emission inventories for Zion National Park (CE-CERT, 2001). CE-CERT found that the distribution of vehicle ages in the park reflected a larger fraction of newer vehicles compared to the general vehicle population. The park-specific mix vehicle types and vehicle age distribution developed by CE-CERT have been applied in the mobile modeling for Carlsbad Caverns NP.

In addition to park-specific age distribution, CE-CERT also developed park-specific modeling inputs for driving patterns that differ significantly from the default driving patterns typically used in mobile modeling, such as the Federal Test Procedure (FTP). In particular, they found that the FTP reflects both higher speeds and a wider range of speeds than observed in national parks. However, since the MOBILE6.2 model is not designed to readily incorporate unique driving pattern data, the default driving cycle remains the basis for the mobile source emission estimates provided here.

Other important mobile modeling inputs that can significantly affect mobile emission factors are the average speed, fuel characteristics, and UM program parameters. The average speed input to the mobile model was 35 mph, fuel volatility was assumed to be Reid vapor pressure (RVP) of 9.0 in the summer and winter, and refoiinulated gasoline (RFG) was not assumed to be present. Finally, UM program inputs were not included since there are no UM programs in the areas near the park.

In order to account for seasonal differences in mobile emissions, separate MOBILE6.2 runs were performed to produce emission factors for winter and summer. A composite emission factor for each season, reflecting a park specific VMT mix adapted from CE-CERT, served as the basis for mobile source emission estimates. Additional particulate emissions (or entrained road dust) from vehicles operating on paved roads in Carlsbad Caverns NP also were calculated based on VMT. A summary of visitor vehicle emissions is provided in Table 12 at the end of this section.

3.1.2 GSA/NPS Highway Vehicles

Carlsbad Caverns NP operates a fleet of highway vehicles that are owned by the NPS or leased from the General Services Administration (GSA). Emission factors specific to vehicle types (e.g., light-duty gasoline vehicles) were used to estimate emissions from the NPS and GSA vehicles. Since vehicle mileages were not available, estimates were made based on another southeast park unit whose size is similar to Carlsbad Caverns NP. A summary of NPS and GSA vehicles and their estimated annual mileage is provided in Table 10, and emissions are summarized in Table 12 at the end of this section.

TABLE 10: NPS AND GSA ROAD VEHICLES AT CARLSBAD CAVERNS NP

Vehicle Type	Number	Annual Usage (mi/yr)
Light Duty Gasoline Vehicles (LDGV)		
Autos		60,787
Light Duty Gasoline Trucks (LDGT)		
Pickups		24,654
Sport Utility Vehicles	16	152,132
Total	22	176,786
Medium Duty Gasoline Vehicles		
Trucks		4.633
Heavy Duty Gasoline Vehicles (HDGV)		
Trucks		20.086
Heavy Duty Diesel Trucks (HDDT)		
Heavy-Duty Trucks	1	1,720
Park Total)	331	264,012

3.2 NPS NONROAD VEHICLES

The NPS also owns and operates nonroad motorized equipment that is used to maintain roads and grounds and for other purposes. There are records of the Carlsbad Caverns NP equipment inventory, and park officials estimated usage data, which are noted in Table 11. Annual usage and emission factors from the USEPA nonroad emission database were used to calculate annual emissions that are provided in Table 12.

TABLE 11: NPS NONROAD VEHICLES AT CARLSBAD CAVERNS NP

Vehicle Type	Number	**Annual Usage (hrs/yr)**
Grader	1	90
Backhoe		135
Sweepers	1	110
Forklift	1	175
Mowers	1	75
Utility Vehicle	4	400
ATVs	3	30

3.3 SUMMARY OF MOBILE SOURCE EMISSIONS

Table 12 summarizes the mobile source emissions calculated above in a format that allows comparison between the various sources as well as providing totals for each pollutant or pollutant category under consideration.

TABLE 12: SUMMARY OF 2001 MOBILE SOURCE EMISSIONS AT CARLSBAD CAVERNS NP

Activity	Particulates (PM_{10})		Sulfur Dioxide		Nitrogen Oxides		Carbon Monoxide		VOCs	
	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr	lbs/yr	tons/yr
Road Vehicles										
Visitor Vehicles	16,116`	8.06			22,714	11.36	66,988	33.49	4,073	2.04
Buses	12'	<0.01			158	0.08	48	0.02	9	<0.01
NPS/GSA Road Vehicles	500'	0.25			771	0.39	9,617	4.81	500	0.25
Road Vehicle Emission Subtotal	16,628'	8.31			23,643	11.82	76,653	38.33	4,582	2.29
Nonroad Vehicles										
NPS Nonroad Vehicles	6	0.06			691	0.35	3 6	0.16	141	0.07
Totals										
	Particulates (PM10)		Sulfur Dioxide		Nitrogen Oxides		Carbon Monoxide		VOCs	
	lbs/ r									tons/ r
Totals	16,744	8.37	--	--	24,334	12.17	76,969	38.48	4,723	2.36

Includes exhaust PM_{10} and dust from paved and unpaved roads

4. CARLSBAD CAVERNS NP AND REGIONALEMISSION SUMMARY

4.1 CARLSBAD CAVERNS NP SUMMARY

A summary of Carlsbad Caverns NP emissions is provided in Table 13.

TABLE 13: ESTIMATED ANNUAL EMISSIONS FROM CARLSBAD CAVERNS NP

Source	PM_{10} (tons)	SO_2 (tons)	NO, (tons)	CO (tons)	VOCs (tons)
Point Sources					
Heating Equipment	<0.01	0.18	0.22	0.04	<0.01
Generators	0.01	0.02	0.14	0.03	0.01
Gasoline Storage Tanks	--	--	--	--	0.05
Subtotal	0.01	0.20	0.33	0.06	0.07
Area Sources					
Woodstove	<0.01	--	<0.01	0.07	0.02
Prescribed Burning	3.14	--	--	15.96	1.14
Subtotal	3.14	--	<0.01	16.03	1.16
Mobile Sources					
Road Vehicles	8.31	--	11.82	38.33	2.29
Nonroad Vehicles	0.06	--	0.35	0.16	0.07
Subtotal	8.37		12.17	38.48	2.36
Totals					
Totals	11.52	0.20	12.50	54.57	3.59

[1] As methane

4.2 REGIONAL AIR EMISSIONS

Emission estimates for Eddy County and the State of New Mexico were obtained from the 1999 National Emission Inventory (NEI) maintained by USEPA. It is important to note that differences may exist between the methodologies used to generate the park emission inventory and those used to generate the NEI. For example, here gasoline storage tanks have been included as stationary sources, while the NEI treats them as area sources. Table 14 provides a comparison of Carlsbad Caverns NP emissions with those from the surrounding county and the state. For all pollutants, Carlsbad Caverns NP emissions account for less than 1 percent of the surrounding county point source emissions.

TABLE 14: ESTIMATED ANNUAL EMISSIONS FROM CARLSBAD CAVERNS NP, SURROUNDING COUNTY, AND THE STATE OF ARIZONA

Area	PM_{10} (tons/yr)	SO_2 (tons/yr)	NO_x (tons/yr)	CO (tons/yr)	VOC (tons/yr)
	Point Sources				
Carlsbad Caverns NP Total	0.01	0.20	0.33	0.06	0.07
Eddy County	686	9,446	11,770	8,527	3,615
New Mexico Total	14,243	169,819	194,512	51,582	18,933
	Area Sources				
Carlsbad Caverns NP Total	3.14		<0.01	16.03	1.16
Eddy County	8,522	503	4,797	48,448	5,688
New Mexico Total	88,927	7,506	31,739	187,803	58,632
	Mobile Sources				
Carlsbad Caverns NP Total	8.37	--	12.17	38.48	2.36
Eddy County	22,681	168	2,327	18,097	1,784
New Mexico Total	710,324	5,981	100,397	681,103	66,929

5. COMPLIANCE AND RECOMMENDATIONS

5.1 COMPLIANCE

The New Mexico Environment Department's Air Quality Bureau (AQB) is the governing authority for regulating air pollution in the park. Park personnel should coordinate with the agency on permit issues relating to stationary sources, as well as prescribed burning activities. Prior, to replacing or adding relatively large heating units, generators, and fuel storage tanks, the appropriate agency should be consulted regarding the need to obtain a permit to construct or a permit to operate such sources. For example, the NM Air Quality Regulations Title 20, Chapter 2, Part 202 exempt from its permit requirements:

- Fuel burning equipment that uses gaseous fuel and has a design rate of less than five (5) million Btu per hour
- Fuel burning equipment that uses distillate oil (not including waste oil) and has a design rate of less than one (1) million Btu per hour
- Emergency standby generators that are operated only during unavoidable loss of commercial utility power and/or are operated less than 500 hors per year.

Therefore, if the park plans to replace the No. 2 heating oil unit that is rated greater than one million Btu per hour at the Visitor Center, officials should contact the New Mexico AQB regarding the need for a construction permit.

The AQB has exemptions to open burning regulations that may apply to visitor activities in the park. For example, Title 20 Chapter 2 Part 60.109 "...peiinits open burning for recreational and ceremonial purposes, for barbecuing, for heating purposes in fireplaces, for noncommercial cooking of food for human consumption, and for warming by small wood fires at construction sites." These regulations are included in Appendix D of this report. The park appears to be in compliance with all state air quality regulations.

5.2 RECOMMENDATIONS

Actions to promote sustainable development in the design, retrofit, and construction of park facilities have associated air quality benefits. These include actions that reduce or replace consumption of conventional fossil fuels and/or reduce the consumption of other resources. Reductions in potable and non-potable water consumption also achieve concurrent reductions in energy consumption and associated air emissions. Acquisition of energy efficient appliances whenever possible also is an incremental energy saving measure that has associated air quality benefits.

The park currently operates an employee shuttle bus system, but it makes only one roundtrip a day between the town of Carlsbad and the park, a distance of approximately 25 miles and is utilized by a very small number of employees. A recent investigation was undertaken to examine the feasibility of implementing a visitor shuttle bus system, which would reduce air emissions and other negative impacts from visitor vehicles operating within the park boundaries. However, an engineering analysis indicated that a transit system was not practical for the park at this time (NPS 2002).

The only air quality issue raised by the park was directed at existing and proposed oil and gas well developments. This has been a frequently raised issue by other mid-western and western park. In recent years, the NPS Air Resources Division (ARD) has been monitoring energy developments in these areas and seeks opportunities to engage in the process.

6. REFERENCES

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APPENDIX A

FUEL DATA AND EMISSION FACTORS

FUEL DATA

Fuel	Heating Value	Sulfur Content
No. 2 Distillate Fuel Oil/Diesel	140,000 Btu/gal	0.05% by weight
Natural Gas	1,050 Btu./ft'	2,000 grains/10^6 ft^3
Propane	91,500 Btu/gal	0.18 grains/100 ft^3

STATIONARY SOURCE EMISSION FACTORS - BOILERS/HEATING UNITS

DISTILLATE OIL (DF-2) - CRITERIA POLLUTANTS					
Combustor Type	Emission Factor (lb/1,000 gal fuel burned)				
	PM[a]	SO. [b]	NO,(`)	CO	VOC [dl
Residential Furnace [e]	0.4	142S	18	5	0.713
Boilers < 100 Million Btu/hr (Commercial/Institutional Combust. [c])	2	142S	20	5	0.34
Boilers < 100 Million Btu/hr (Industrial Boilers [g])	2	142S	20	5	0.2
Boilers > 100 Million Btu/hr (Utility Boilers)	2	157S	24	5	--
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Tables 1.3-1 and 1.3-3.					

NATURAL GAS - CRITERIA POLLUTANTS					
Combustor Type (MMBtu/hr Heat Input)	Emission Factor (lb/10^6 ft^3 fuel burned)				
	PM°	SO,	NO,,(`)	CO	VOC
Residential Furnaces (<0.3)					
-Uncontrolled	7.6	0.6	94	40	5.5
Tangential-Fired Boilers (All Sizes)					
-Uncontrolled	7.6	0.6	170	24	5.5
-Controlled-Flue gas recirculation	7.6	0.6	76	98	5.5
Small Boilers (<100)					
-Uncontrolled	7.6	0.6	100	84	5.5
-Controlled-Low NO, burners	7.6	0.6	50	84	5.5
-Controlled-Low NO,, burners/Flue gas recirculation	7.6	0.6	32	84	5.5
Large Wall-Fired Boilers (>100)					
-Uncontrolled (Pre-NSPS)[lk]	7.6	0.6	280	84	5.5
-Uncontrolled (Post-NSPS)[k]	7.6	0.6	190	84	5.5
-Controlled-Low NO, burners	7.6	0.6	140	84	5.5
-Controlled-Flue gas recirculation	7.6	0.6	100	84	5.5
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Tables 1.4-1 and 1.4-2.					

STATIONARY SOURCE EMISSION FACTORS - BOILERS/HEATING UNITS (Continued)

PROPANE (LPG) - CRITERIA POLLUTANTS					
Combustor Type	Emission Factor (lb/1,000 al fuel burned)				
	PM[a]	SO2[b]	NO_x[c]	CO	VOC)
Commercial Boilers[f]	0.4	0.105	14	1.9	0.3
Industrial Boilers[s]	0.6	0.10S	19	3.2	0.3
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Table 1.5-1.					

STATIONARY SOURCE EMISSION FACTORS - GENERATORS

For generators rated at less than or equal to 448 kW (600 hp):

Fuel Type	Emission Factor (lb/h -hr)				
	PM	SO_X	NO,,	CO	VOC
DF-2	2.20 E-03	2.05 E-03	0.031	6.68 E-03	2.51 E-03
Gasoline	7.21 E-04	5.91 E-04	0.011	0.439	0.022
Natural Gas/Propane	1.54 E-04	7.52 E-03(S)	3.53 E-03	8.6 E-04	1.92 E-04
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Table 3.3-1 and 3.1-1					

For generators rated at greater than 448 kW (600 hp):

Fuel Type	Emission Factor (lb/hp-hr)				
	PM	SO_X[b]	NO,,	CO	VOC
DF-2	0.0007	(8.09 E-03)S	0.024	5.5 E-03	6.4 E-04
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Table 3.4-1.					

FIREPLACE EMISSION FACTORS

FuelTyP e	Emission Factor (lb/ton)				
	PMc)	SO,,	NO_X[c]	CO	VOC
Wood	34.6	0.4	2.6	252.6	229.0
Source: AP-42. 5th Edition, Supplements A, B, C, D, and E, Table 1.9-1.					

WOODSTOVE EMISSION FACTORS

Stove Type	Emission Factor (Ib/ton)				
	PM°)	SO_X	NO_X(o)	CO	VOC
Conventional	30.6	0.4	2.8	230.8	53
Noncatalytic	19.6	0.4	--	140.8 ---	12
Catalytic	20.4	0.4	2.0	104.4	15
Source: AP-42, 5th Edition, Supplements A, B, C, D, and E, Table 1.10-1.					

STATIONARY SOURCE EMISSION FACTORS - SURFACE COATING OPERATIONS

Surface Coating Type	VOC Emission Factor (lb/gal)
Paint: Solvent Base	5.6
Paint: Water Base	1.3
Enamel: General	3.5
Lacquer: General	6.1
Primer: General	6.6
Varnish/Shellac: General	3.3
Thinner: General	7.36
Adhesive: General	4.4
Source: *Calculation Methods for Criteria Air Pollutant Emission Inventories,* AL/OE-TR-1994-0049, July 1994. Armstrong Laboratory.	

(a) PM = Filterable Particulate Matter.

(b) These factors must be multiplied by the fuel sulfur content (for example, if the sulfur content is 0.05%, then S equals 0.05).

(c) Expressed as NO2.

(d) Emission factors given in AP-42 are actually for non-methane total organic compounds (NMTOC) which ¡ncludes all VOCs and all exempted organic compounds (such as ethane, toxics and HAPs, aldehydes and semivolatile compounds) as measured by EPA reference methods.

(e) Unit Rating <300,000 Btu/hr.

(f) Unit Rating 3300,000 Btu/hr, but <10,000,000 Btu/hr.

(g) Unit Rating 310,000,000 Btu/hr, but <100,000,000 Btu/hr.

(h) Unit Rating 3 100,000,000 Btu/hr.

(i) POM = Particulate POM only.

(j) PM = Filterable Particulate Matter + Condensible Particulate Matter.

(k) NSPS = New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction, modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction, modification, or reconstruction after June 19, 1984.

(1) Emission factors are given on a fuel input basis (lb/MMBtu). To convert to a power output basis (lb/hp-hr), use an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr.

APPENDIX B

EMISSION CALCULATIONS

2001 ACTUAL **CRITERIA EMISSIONS FROM GENERATORS AT CARLSBAD CAVERNS NP**

Emission Source	Location	Fuel	Number of Sources	Rating (kW)	Run Time (hrs/yr)	Output (kW-hr/yr)	PM (lbs/yr)	SO, (Ibs/yr)	NO,, (lbs/yr)	CO (Ibs/yr)	CO, (lbs/yr)	VOC (lbs/yr)
Generator	Visitor Center	Diesel	1	545	12	6,540	6	35	210	48	10,078	
Emission Factors from AP-42, Chapter 3.4-1 for generators rated more than 448 kW, S=.05							7.00E-04 (0.00809)S		2.40E-02	5.50E-03	1.15E+00	6.40E-04

Formula = Output (kW-hr/yr) * 1.34 (hp/kW) * Emission Factor (lb/hp-hr)

2001 POTENTIAL CRITERIA EMISSIONS FROM GENERATORS AT **CARLSBAD CAVERNS** NP

Emission Source	Location	Fuel	Number of Sources	Rating (kW)	Run Time (hrs/yr)	Output (kW-hr/yr)	PM (Ibs/yr)	SO_2 (lbs/yr)	NO, (lbs/yr)	CO (lbs/yr)	CO_2 (lbs/yr)	VOC (Ibs/yr)
Generator	Visitor Center	Diesel	1	545	500	272,500	256	1,477	8,764	2,008	419,923	234
Emission Factors from AP-42, Chapter 3.4-1 for generators rated less than 448 kW, S=.05							7.00E-04 (0.00809)S		2.40E-02	5.50E-03	1.15E+00	6.40E-04

Formula = Output (kW-hi/yr) * 1.34 (hp/kW) * Emission Factor (lb/hp-hr)

2001 ACTUAL CRITERIA EMISSIONS FROM HEATING UNITS AT CARLSBAD CAVERNS NATIONAL PARK

Emission Source	Location	Fuel	Number of Sources	Capacity (Btu/hr)		Consumption (gal/yr)	PM (lbs/yr)	SO, (lbs/yr)	NO, (lbs/yr)	CO (lbs/yr)	CO_2 (lbs/yr)	VOC (lbs/yr)
Furnace	Carpenter Shop	Propane	1	105,000	105,000	1,777	1	0	25	3	22,217	1
Furnace	Fire Cache/Weight Room	Propane	1	100,000	100,000	1,693	1	0	24	3	21,159	1
Furnace	Auto Shop	Propane	2	130,000	260,000	4,401	2	0	62	8	55,015	1
Furnace	Plumbing Shop	Propane	1	35,000	35,000	592	0	0	8	1	7,406	0
Furnace	Fire Trick Garage	Propane	1	50,000	50,000	846	0	0	12	2	10,580	0
Furnace	Quarters 13	Propane	1	110,000	110,000	1,862	1	0	26	4	23,275	1
Furnace	Employee Quarters	Propane	11	65,000	715,000	12,103	5	0	169	23	151,290	4
Furnace	Building 6	Propane	1	65,000	65,000	1,100	0	0	15	2	13,754	0
Furnace	Rattlesnake Springs Residence	Propane	1	65,000	65,000	1,100	0	0	15	2	13,754	0
		Propane Totals	20		1,505,000	25,476	10	0	357	48	318,450	8
Furnace	Visitor Center/Restaurant/Gift Shop	No. 2 Oil	1	1,700,000	1,700,000	5,000	2	355	90	25	107,500	
		Park Totals	21				12	355	447	73	425,950	11

	Emission Factors (lbs/1,000 gal)					
Emission Factors from AP-42 Table 1.5-1 for commercial boilers S = 18 grains/100 cu ft	0.4	0.1*S	14	1.9	12,500	0.3
Emission Factors from AP-42 Tables 1.3-1 and 1.3-3 for residential furnaces <300,000 Btu/hr S=0.5 percent	0.4	142*S	18	5	21,500	0.713

2001 POTENTIAL CRITERIA EMISSIONS FROM HEATING UNITS AT CARLSBAD CAVERNS NATIONAL PARK

Emission Source	Location	Fuel	Number of Sources	Capacity (Btu/hr)		Consumption (gaUyr)	PM (lbs/yr)	SO_2 (lbs/yr)	NO, (lbs/yr)	CO (ibs/yr)	CO_2 (lbs/yr)	VOC (lbs/yr)
Furnace	Carpenter Shop	Propane	1	105,000	105,000	10,052	4	0	141	19	125,656	3
Furnace	Fire Cache/Weight Room	Propane	1	100,000	100,000	9,574	4	0	134	18	119,672	3
Furnace	Auto Shop	Propane	2	130,000	260,000	24,892	10	0	348	47	311,148	7
Furnace	Plumbing Shop	Propane	1	35,000	35,000	3,351	1	0	47	6	41,885	1
Furnace	Fire Trick Garage	Propane	1	50,000	50,000	4,787	2	0	67	9	59,836	1
Furnace	Quarters 13	Propane	1	110,000	110,000	10,531	4	0	147	20	131,639	3
Furnace	Employee Quarters	Propane	11	65,000	715,000	68,452	27	1	958	130	855,656	21
Furnace	Building 6	Propane	1	65,000	65,000	6,223	2	0	87	12	77,787	2
Furnace	Rattlesnake Springs Residence	Propane	1	65,000	65,000	6,223	2	0	87	12	77,787	2
		Propane Totals ~	20		1,505,000	144,085	58	3	2,017	274	1,801,066	43
Furnace	Visitor Center/Restaurant/Gift Shop	No. 2 Oil	1	1,700,000	1,700,000	106,371	43	7,552	1,915	532	2,286,986	761
1		Park Totals)	21				100	7,555	3,932	806	4,088,051	1191

	Emission Factors (lbs/1,000 gal)					
Emission Factors from AP-42 Table 1.5-1 for commercial boilers S = 18 grains/100 cu ft	0.4	0.1 `S	14	1.9	12,500	0.3
Emission Factors from AP-42 Tables 1.3-1 and 1.3-3 for residential furnaces <300,000 Btu/hr S=0.5 percent	0.4	142*S	18	5	21,500	0.713

TANKS 4.0
Emissions Report - Summary Format
Tank Identification and Physical Characteristics

Identification

User Identification:	Carlsbad Caverns NP
City:	Albuquerque
State:	New Mexico
Company:	NPS
Type of Tank:	Horizontal Tank
Description:	2,000 UST

Tank Dimensions

Shell Length (ft):	12.00
Diameter (ft):	5.50
Volume (gallons):	2,000.00
Turnovers:	0.00
Net Throughput (gal/yr):	15,556.00
Is Tank Heated (y/n):	N
Is Tank Underground (y/n):	Y

Paint Characteristics

Shell Color/Shade:	
Shell Condition:	

Breather Vent Settings

Vacuum Settings (psig):	0.00
Pressure Settings (psig):	0.00

Meteorological Data used in Emissions Calculations: Albuquerque, New Mexico (Avg Atmospheric Pressure = 12.15 psia)

TANKS 4.0
Emissions Report - Summary Format
Liquid Contents of Storage Tank

Mixture/Component	Month	Daily Liquid Surf. Temperatures (deg F) Avg.	Min.	Max.	Liquid Bulk Temp. (deg F)	Vapor Pressures (psia) Avg.	Min.	Max.	Vapor Mol. Weight	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 9)	All	55.59	55.59	55.59	55.15	4.2250	4.2250	4.2250	67.0000			92.00	Option 4: RVP=9, ASTM Slope=3

TANKS 4.0
Emissions Report - Summary Format
Individual Tank Emission Totals

Annual Emissions Report

	Losses(lbs)		
Components	Working Loss	Breathing Loss	To al Emissions
Gasoline RVP 9	104.85	0.00	104.85

2001 ACTUAL EMISSIONS FROM WOODSTOVES AT CARLSBAD CAVERNS NATIONAL PARK

Location	Number	Cords	tons/yr	PM (lbs/yr)	SO_2 (lbs/yr)	NO_X (lbs/yr)	CO (Ibs/yr)	CO, (Ibs/yr)	VOC (lbs/yr)
Rattlesnake Springs Residences	1	0.5	0.56	17	0	2	129	ND	30
				(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)	(tons/yr)
				0.01	0.00	0.00	0.06	ND	0.01
				Emission Factors (lbs/ton)					
				30.6	0.4	2.8	230.8	ND	53.0

TITLE: Results of FOFEM model execution on date: 1/23/2003

FUEL CONSUMPTION CALCULATIONS

Region: Interior West
Cover Type: SAF/SRM - SRM 612 - Sagebrush - Grass
Fuel Type: Natural
Fuel Reference: FOFEM 461

FUEL CONSUMPTION TABLE

Fuel Component Name	Preburn Load (t/acre)	Consumed Load (t/acre)	Postburn Load (t/acre)	Percent Reduced (%)	Equation Reference Number	Moisture
Litter	0.07	0.07	0.00	100.0	999	
Wood (0-1/4 inch)	0.00	0.00	0.00	0.0	999	
Wood (1/4-1 inch)	0.00	0.00	0.00	0.0	999	25.0
Wood (1-3 inch)	0.00	0.00	0.00	0.0	999	
Wood (3+ inch) Sound	0.00	0.00	0.00	0.0	999	20.0
3->6	0.00	0.00	0.00	0.0		
6->9	0.00	0.00	0.00	0.0		
9->20	0.00	0.00	0.00	0.0		
20->	0.00	0.00	0.00	0.0		
Wood (3+ inch) Rotten	0.00	0.00	0.00	0.0	999	20.0
3->6	0.00	0.00	0.00	0.0		
6->9	0.00	0.00	0.00	0.0		
9->20	0.00	0.00	0.00	0,.0.		
20->	0.00	0.00	0.00	0.0		
Duff	0.00	0.00	0.00	0.0	2	100.0
Herbaceous	0.45	0.45	0.00	100.0	22	
Shrubs	1.26	0.63	0.63	50.0	232	
Crown foliage	0.00	0.00	0.00	0.0	37	
Crown branchwood	0.00	0.00	0.00	0.0	38	
Total Fuels	1.78	1.15	0.63	64.6		

4

FIRE EFFECTS ON FOREST FLOOR COMPONENTS

Forest Floor Component	Preburn Condition	Amount Consumed	Postburn Condition	Percent Reduced	Equation Number
Duff Depth (in)	0.0	0.0	0.0	0.0	6
Min Soil Exp (G)	.0	21.9	21.9	21.9	10

	Emissions -- lbs/acre flaming	smoldering	total
PM 10	7	4	11
PM 2.5	6	3	9
CH 4	2	2	4
CO	14	42	56
CO 2	3841	172	4013

	Consumption tons/acre	Duration hour: min: sec
Flaming:	1.08	00:01:00
Smoldering:	0.07	00:01:00
Total:	1.15	

2001 PRESCRIBED FIRE EMISSIONS AT CARLSBAD CAVERNS NATIONAL PARK

Type	Acres	PM,p (lbs/yr)	$PM_{2.5}$ (lbs/yr)	CH_4 (lbs/yr)	CO (lbs/yr)	CO_2 (lbs/yr)
Prescribed Fires	570	6,270	5,130	2,280	31,920	2,287,410
Wildland Fires	2,930	32,230	26,370	11,720	164,080	11,758,090
Totals	3,500	38,500	31,500	14,000	196,000	14,045,500
		tons/yr				
		19.25	15.75	7.00	98.00	7,022.75
		Emission Factors (lbs/acre)				
		PM, (lbs/acre)	$PM_{2.5}$ (lbs/acre)	CH_4 (lbs/acre)	CO (lbs/acre)	CO_2 (lbs/acre)
		11	9	4	56	4,013

```
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
* Carlsbad C NP Winter Conditions.
* File 1, Run 1, Scenario 31.
* # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M584 Warning:
            The user supplied area wide average speed of 35.0
            will be used for all hours of the day. 1000 of VMT
            has been assigned to a fixed combination of freeways,
            freeway ramps, arterial/collector and local roadways
            for all hours of the day and all vehicle types.

• Reading PM Gas Carbon ZML Levels
• from the external data file PMGZML.CSV

• Reading PM Gas Carbon DR1 Levels
• from the external data file PMGDR1.CSV

• Reading PM Gas Carbon DR2 Levels
• from the external data file PMGDR2.CSV

• Reading PM Diesel Zero Mile Levels
• from the external data file PMDZML.CSV

• Reading the First PM Deterioration Rates
• from the external data file PMDDR1.CSV

• Reading the Second PM Deterioration Rates
• from the external data file PMDDR2.CSV

         User supplied gasoline sulfur content = 300.0 ppm.

  M616 Comment:
              User has supplied post-1999 sulfur levels.
  M 48 Warning:
             there are no sales for vehicle class HDGV8b

                   Calendar Year:  2001
                           Month:  Jan.
                        Altitude:  High
             Minimum Temperature:  30.0 (F)
```

```
Maximum Temperature:   56.0 (F)
  Absolute Humidity:    75. grains/lb
   Nominal Fuel RVP:    9.0 psi
      Weathered RVP:    9.0 psi
Fuel Sulfur Content:   299. ppm

Exhaust I/M Program:   No
   Evap I/M Program:   No
        ATP Program:   No
   Reformulated Gas:   No
```

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.7002	0.1410	0.1044		0.0060	0.0008	0.0016	0.0180	0.0280	1.0000
Composite Emission Factors (g/mi):										
Composite VOC :	0.732	0.965	0.868	0.924	0.827	0.433	0.439	0.509	2.61	0.828
Composite CO	15.28	20.03	18.04	19.18	25.34	1.308	0.931	6.582	24.22	16.356
Composite NOX :	0.792	1.135	1.326	1.216	3.786	1.267	1.212	16.834	1.12	1.214

Veh. Type:	LDGT1	LDGT2	LDGT3	LDGT4	LDDT12	LDDT34
VMT Mix:	0.0330	0.1080	0.0719	0.0325	0.0000	0.0016
Composite Emission Factors (g/mi):						
Composite VOC :	0.907	0.983	0.846	0.918	2.424	0.391
Composite CO	19.37	20.24	17.93	18.27	6.522	0.795
Composite NOX :	0.892	1.210	1.197	1.611	2.555	1.180

Veh. Type:	HDGV2B	HDGV3	HDGV4	HDGV5	HDGV6	HDGV7	HDGV8A	HDGV8B
VMT Mix:	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Composite Emission Factors (g/mi):								
Composite VOC :	0.827	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Composite CO	25.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composite NOX :	3.786	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Veh. Type:	HDDV2B	HDDV3	HDDV4	HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B

```
            VMT Mix:     0.0020     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000
-------------------------------------------------------------------------------------------------------- -------  --------------
 Composite Emission Factors (g/mi):
     Composite VOC :      0.378      0.000      0.000      0.000      0.000      0.000      0.000      0.000
     Composite CO         1.942      0.000      0.000      0.000      0.000      0.000      0.000      0.000
     Composite NOX :      4.150      0.000      0.000      0.000      0.000      0.000      0.000      0.000
--- ------------------------------------------------------ ------------------------------------------------------------

• # # # # # # # # # # # # # # # # # # # # # # # # # # #
• Carlsbad C NP Summer Conditions.
• File 1, Run 1, Scenario 32.
• # # # # # # # # # # # # # # # # # # # # # # # # # # #
  M584 Warning:
            The user supplied area wide average speed of 35.0
            will be used for all hours of the day. 1000 of VMT
            has been assigned to a fixed combination of freeways,
            freeway ramps, arterial/collector and local roadways
            for all hours of the day and all vehicle types.

• Reading PM Gas Carbon ZML Levels
• from the external data file PMGZML.CSV

• Reading PM Gas Carbon DR1 Levels
• from the external data file PMGDR1.CSV

• Reading PM Gas Carbon DR2 Levels
• from the external data file PMGDR2.CSV

• Reading PM Diesel Zero Mile Levels
• from the external data file PMDZML.CSV

• Reading the First PM Deterioration Rates
• from the external data file PMDDR1.CSV

• Reading the Second PM Deterioration Rates
• from the external data file PMDDR2.CSV

         User supplied gasoline sulfur content = 300.0 ppm.

  M616 Comment:
              User has supplied post-1999 sulfur levels.
```

M 48 Warning:
there are no sales for vehicle class HDGV8b

Calendar Year:	2001
Month:	July
Altitude:	High
Minimum Temperature:	60.0 (F)
Maximum Temperature:	89.0 (F)
Absolute Humidity:	75. grains/lb
Nominal Fuel RVP:	9.0 psi
Weathered RVP:	8.7 psi
Fuel Sulfur Content:	299. ppm
Exhaust I/M Program:	No
Evap I/M Program:	No
ATP Program:	No
Reformulated Gas:	No

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.7002	0.1410	0.1044		0.0060	0.0008	0.0016	0.0180	0.0280	1.0000
Composite Emission Factors (g/mi):										
Composite VOC :	0.757	0.916	0.904	0.911	0.867	0.405	0.461	0.490	3.55	0.868
Composite CO	12.29	15.00	14.73	14.89	22.94	1.277	0.945	6.500	24.55	13.206
Composite NOX :	0.751	1.017	1.288	1.132	3.587	1.170	1.239	16.586	0.92	1.152

Veh. Type:	LDGT1	LDGT2	LDGT3	LDGT4	LDDT12	LDDT34
VMT Mix:	0.0330	0.1080	0.0719	0.0325	0.0000	0.0016

Composite Emission Factors (g/mi):

Composite VOC :	0.876	0.929	0.886	0.944	2.512	0.418
Composite CO	14.58	15.13	14.64	14.93	6.775	0.824
Composite NOX :	0.806	1.081	1.161	1.570	2.574	1.212

Veh. Type:	HDGV2B	HDGV3	HDGV4	HDGV5	HDGV6	HDGV7	HDGV8A	HDGV8B
VMT Mix:	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Composite Emission Factors (g/mi):

Composite VOC :	0.867	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Composite CO	22.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composite NOX :	3.587	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Veh. Type:	HDDV2B	HDDV3	HDDV4	HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B
VMT Mix:	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Composite Emission Factors (g/mi):

Composite VOC :	0.374	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Composite CO	1.957	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Composite NOX :	4.078	0.000	0.000	0.000	0.000	0.000	0.000	0.000

```
k ################################
k Carlsbad C NP Winter Conditions.
k File 1, Run 1, Scenario 31.
k ################################

                          Calendar Year:   2001
                                  Month:   Jan.
          Gasoline Fuel Sulfur Content:    299. ppm
            Diesel Fuel Sulfur Content:    500. ppm
                  Particle Size Cutoff:  10.00 Microns
                      Reformulated Gas:   No

     Vehicle Type:       LDGV    LDGT12    LDGT34      LDGT      HDGV      LDDV      LDDT      HDDV        MC   All Veh
             GVWR:                <6000     >6000     (All)

  VMT Distribution:     0.7002    0.1410    0.1044                0.0060    0.0008    0.0016    0.0180    0.0280    1.0000
-----------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
             Lead:     0.0000    0.0000    0.0000    0.0000    0.0000    ------    ------    ------    0.0000    0.0000
            GASPM:     0.0042    0.0047    0.0044    0.0046    0.0523    ------    ------    ------    0.0205    0.0050
          ECARBON:     ------    ------    ------    ------    ------    0.1244    0.0488    0.1250    ------    0.0024
          OCARBON:     ------    ------    ------    ------    ------    0.0351    0.0703    0.0997    ------    0.0019
              S04:     0.0028    0.0049    0.0047    0.0048    0.0118    0.0049    0.0106    0.0540    0.0010    0.0043
  Total Exhaust PM:    0.0071    0.0096    0.0091    0.0094    0.0640    0.1644    0.1297    0.2786    0.0215    0.0136
             Brake:    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125    0.0125
              Tire:    0.0080    0.0080    0.0080    0.0080    0.0080    0.0080    0.0080    0.0115    0.0040    0.0080
          Total PM:    0.0276    0.0302    0.0297    0.0300    0.0846    0.1849    0.1503    0.3027    0.0380    0.0341
               S02:    0.0684    0.0804    0.1134    0.0944    0.1603    0.0939    0.2028    0.7715    0.0328    0.0872
               NH3:    0.1016    0.1005    0.1015    0.1009    0.0451    0.0068    0.0068    0.0270    0.0113    0.0970
Idle Emissions (g/hr)
          PM Idle:     ------    ------    ------    ------    ------    ------    ------    1.0557    ------    0.0190
-----------------------------------------------------------------------------------------------------------------------------
        Veh. Type:      LDGT1     LDGT2     LDGT3     LDGT4     LDDT12    LDDT34

          VMT Mix:     0.0330    0.1080    0.0719    0.0325    0.0000    0.0016
-----------------------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
             Lead:     0.0000    0.0000    0.0000    0.0000
            GASPM:     0.0047    0.0047    0.0044    0.0044    ------
          ECARBON:     ------    ------    ------    ------    0.1498    0.0464
          OCARBON:     ------    ------    ------    ------    0.2156    0.0668
```

S04:	0.0049	0.0049	0.0047	0.0047	0.0062	0.0107
Total Exhaust PM:	0.0096	0.0096	0.0091	0.0091	0.3717	0.1238
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
Total PM:	0.0302	0.0302	0.0297	0.0297	0.3922	0.1444
S02:	0.0804	0.0804	0.1134	0.1134	0.1196	0.2049
NH3:	0.1005	0.1005	0.1015	0.1015	0.0068	0.0068
Idle Emissions (g/hr)						
PM Idle:	------	------	------	------	------	------

Veh. Type:	HDGV2B	HDGV3	HDGV4	HDGV5	HDGV6	HDGV7	HDGV8A	HDGV8B
VMT Mix:	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Composite Emission Factors (g/mi):								
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GASPM:	0.0523	0.0523	0.0503	0.0504	0.0503	0.0503	0.0503	0.0000
ECARBON:	------	------	------	------	------	------	------	------
OCARBON:	------	------	------	------	------	------	------	------
S04:	0.0118	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Exhaust PM:	0.0640	0.0523	0.0503	0.0504	0.0503	0.0503	0.0503	0.0000
Brake:	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tire:	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total PM:	0.0846	0.0523	0.0503	0.0504	0.0503	0.0503	0.0503	0.0000
S02:	0.1603	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NH3:	0.0451	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Idle Emissions (g/hr)								
PM Idle:	------	------	------	------	------	------	------	

Veh. Type:	HDDV2B	HDDV3	HDDV4	HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B
VMT Mix:	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Composite Emission Factors (g/mi):								
Lead:	------	------	------	------	------	------	------	------
GASPM:	------	------	------	------	------	------	------	------
ECARBON:	0.0514	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OCARBON:	0.0535	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S04:	0.0172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Exhaust PM:	0.1221	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brake:	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tire:	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total PM:	0.1426	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S02:	0.2452	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NH3:	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Idle Emissions (g/hr)								
PM Idle:	1.0617	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

---

* #
* Carlsbad C NP Summer Conditions.
* File 1, Run 1, Scenario 32.
* #

Calendar Year: 2001
Month: July
Gasoline Fuel Sulfur Content: 299. ppm
Diesel Fuel Sulfur Content: 500. ppm
Particle Size Cutoff: 10.00 Microns
Reformulated Gas: No

Vehicle Type:	LDGV	LDGT12	LDGT34	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
GVWR:		<6000	>6000	(All)						
VMT Distribution:	0.7002	0.1410	0.1044		0.0060	0.0008	0.0016	0.0180	0.0280	1.0000
Composite Emission Factors (g/mi):										
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0042	0.0046	0.0044	0.0045	0.0523	------	------	------	0.0205	0.0050
ECARBON:	------	------	------	------	------	0.1192	0.0485	0.1160	------	0.0023
OCARBON:	------	------	------	------	------	0.0336	0.0698	0.0926	------	0.0018
S04:	0.0028	0.0049	0.0047	0.0048	0.0120	0.0049	0.0106	0.0540	0.0010	0.0042
Total Exhaust PM:	0.0070	0.0095	0.0091	0.0093	0.0643	0.1576	0.1289	0.2626	0.0215	0.0133
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0116	0.0040	0.0080
Total PM:	0.0276	0.0300	0.0297	0.0299	0.0848	0.1782	0.1494	0.2867	0.0380	0.0338
S02:	0.0684	0.0804	0.1134	0.0944	0.1601	0.0929	0.2031	0.7714	0.0328	0.0872
NH3:	0.1016	0.1007	0.1015	0.1010	0.0451	0.0068	0.0068	0.0270	0.0113	0.0970
Idle Emissions (g/hr)										
PM Idle:	------	------	------	------	------	------	------	1.0472	------	0.0189

Veh. Type:	LDGT1	LDGT2	LDGT3	LDGT4	LDDT12	LDDT34
VMT Mix:	0.0330	0.1080	0.0719	0.0325	0.0000	0.0016

Composite Emission Factors (g/mi):						
Lead:	0.0000	0.0000	0.0000	0.0000	------	------
GASPM:	0.0046	0.0046	0.0044	0.0044	------	------
ECARBON:	------	------	------	------	0.1498	0.0464
OCARBON:	------	------	------	------	0.2156	0.0668
S04:	0.0049	0.0049	0.0047	0.0047	0.0062	0.0107
Total Exhaust PM:	0.0095	0.0095	0.0091	0.0091	0.3717	0.1238.
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
Total PM:	0.0300	0.0300	0.0297	0.0297	0.3922	0.1444
S02:	0.0804	0.0804	0.1134	0.1134	0.1196	0.2049
NH3:	0.1007	0.1007	0.1015	0.1015	0.0068	0.0068
Idle Emissions (g/hr)						
PM Idle:	------	------	------	------	------	------

Veh. Type:	HDGV2B	HDGV3	HDGV4	HDGV5	HDGV6	HDGV7	HDGV8A	HDGV8B
VMT Mix:	0.0060	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Composite Emission Factors (g/mi):								
Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GASPM:	0.0523	0.0523	0.0506	0.0506	0.0506	0.0506	0.0505	0.0000
ECARBON:	------	------	------	------	------	------	------	------
OCARBON:	------	--- --		------	------	------		
S04:	0.0120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Exhaust PM:	0.0643	0.0523	0.0506	0.0506	0.0506	0.0506	0.0505	0.0000
Brake:	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tire:	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total PM:	0.0848	0.0523	0.0506	0.0506	0.0506	0.0506	0.0505	0.0000
S02:	0.1601	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NH3:	0.0451	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Idle Emissions (g/hr)								
PM Idle:								

Veh. Type:	HDDV2B	HDDV3	HDDV4	HDDV5	HDDV6	HDDV7	HDDV8A	HDDV8B
VMT Mix:	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Composite Emission Factors (g/mi):								
Lead:								
GASPM:					------	------	-	

ECARBON:	0.0503	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OCARBON:	0.0523	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S04:	0.0171	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Exhaust PM:	0.1198	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Brake:	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tire:	0.0080	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total PM:	0.1403	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S02:	0.2450	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NH3:	0.0270	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Idle Emissions (g/hr)								
PM Idle:	1.0504	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

CARLSBAD CAVERNS NATIONAL PARK VISITOR VEHICLE EMISSIONS

Paved Road Annual VMT	Unpaved Road Annual VMT
2,148,000	19,600

Emission Factors (g/mi) - All Vehicles

				PM_{10} (Paved)			PM_{10} (Unpaved)		
	NO,	**CO**	**VOC**	Exhaust, Brake, and Tire	Fugitive	Total	Exhaust, Brake, and Tire	Fugitive	Total
Summer	1.152	13.206	0.868	0.0338	0.84	0.8738	0.0338	271.25	271.2838
Winter	1.214	16.356	0.828	0.0341	0.84	0.8741	0.0341	271.25	271.2841
Average	1.183	14.781	0.848			0.874			271.284

Emissions (tons/yr) - All Vehicles

NO,	**CO**	**VOC**	Paved PM10	Unpaved PM"	Total PM"
2.80	34.92	2.00	2.06	5.85	7.91

Emissions (lbs/yr) - All Vehicles

NO,	**CO**	**VOC**	Paved **PM_{10}**	Unpaved PM"	Total PM_{10}
5,590	69,849	4,007	4,130	11,698	15,828

Bus Annual VMT
4,950

Emission Factors (g/mi) - Buses

				PM_{10} (Paved)		
	NO,	**CO**	**VOC**	Exhaust, Brake, and Tire	Fugitive	Total
Summer	16.586	6.500	0.490	0.2867	0.84	1.1267
Winter	16.834	6.582	0.509	0.3027	0.84	1.1427
Average	16.710	6.541	0.500			1.135

Emissions (tons/yr) - Buses

NO,	**CO**	**VOC**	Paved **PM_{10}**
0.09	0.04	0.00	0.01

Emissions (lbslyr) - Buses

NO,	**CO**	**VOC**	Paved **PM_{10}**
182	71	5	12

CARLSBAD CAVERNS NATIONAL PARK NPS AND GSA VEHICLES

	LDGV	LDGT	HDGV	HDDV	Total
Total Miles	60,787	176,786	20,086	1,720	259,379

Emission Factors (g/mi) - LDGV

	NO_x	CO	VOC	PM" Exhaust, Brake, and Tire	PM" Fugitive	PM" Total
Summer	0.7510	12.2900	0.7570	0.0276	0.8400	0.8676
Winter	0.7920	15.2800	0.7320	0.0276	0.8400	0.8676
Average	0.7715	13.7850	0.7445			0.8676

Emissions (tonslyr) - LDGV

NOx	CO	VOC	PM_{10}
0.05	0.92	0.05	0.06

Emission Factors (glmi) - LDGT

	NO_x	CO	VOC	PM" Exhaust, Brake, and Tire	PM" Fugitive	PM" Total
Summer	1.132	14.890	0.911	0.030	0.840	0.870
Winter	1.216	19.180	0.924	0.030	0.840	0.870
Average	1.174	17.035	0.918			0.870

Emissions (tons/yr) - LDGT

NOx	CO	VOC	PM_{10}
0.23	3.31	0.18	0.17

Emission Factors (glmi) - HDGV

	NO_x	CO	VOC	PM_{10} Exhaust, Brake, and Tire	PM_{10} Fugitive	PM_{10} Total
Summer	3.587	22.940	0.867	0.085	0.840	0.925
Winter	3.786	25.450	0.827	0.085	0.840	0.925
Average	3.687	24.195	0.847			0.925

Emissions (tonslyr) - HDGV

NO_x	CO	VOC	PM_{10}
0.08	0.53	0.02	0.02

Emission Factors (glmi) - HDDV

	NO_x	CO	VOC	PM" Exhaust, Brake, and Tire	PM" Fugitive	PM" Total
Summer	16.586	6.500	0.490	0.287	0.840	1.127
Winter	16.834	6.582	0.509	0.303	0.840	1.143
Average	16.710	6.541	0.500			1.135

Emissions (tonslyr) - HDDV

NOx	CO	VOC	PM_{10}
0.03	0.01	0.00	0.00

Emissions (tons/yr) - Total

NO_x	CO	VOC	PM_{10}
0.39	4.78	0.25	0.25

Emissions (lbs/yr) -Total

NO_x	CO	VOC	PM_{10}
786	9,563	496	500

2001 CARLSBAD CAVERNS NP NONROAD VEHICLE EMISSIONS

		Emission Factors (gm/hp-hr)								Emissions (lbs/yr)		
Vehicle	No.	PM	Nox	CO	VOC	hp	load	hrs/yr	PM	Nox	CO	VOC
Utility Vehicle	4	2.04	1.03	2.31	2.19	15	0.55	400	14.8	7.5	16.8	15.9
Backhoe	1	2.04	1.03	2.31	2.19	77	0.55	135	25.7	13.0	29.1	27.5
Riding Mower	1	1.11	10.3	4.8	1.3	15	0.55	75	1.5	14.0	6.5	1.8
ATV	3	2.04	1.03	2.31	2.19	15	0.55	30	1.1	0.6	1.3	1.2
Grader	1	1.06	9.6	3.8	1.43	172	0.61	90	22.0	199.4	78.9	29.7
Sweeper	1	1.7	14	6.06	1.46	30	0.68	110	8.4	69.1	29.9	7.2
Forklift	1	1.06	9.6	3.8	1.43	172	0.61	175	42.8	387.8	153.5	57.8
							Totals:	(lbs/yr)	116	691	316	141
								(tons/yr)	0.06	0.35	0.16	0.07

APPENDIX C

PUBLIC USE DATA

Monthly Public Use Report

Printed on 01/22/2003

CARLSBAD CAVERNS NP			12/2002	7170
	December 2002			
	Recreational	Non-Recreational	Total	Calendar Year-To-Date
Visits	27,221	0	27,221	476,258
Visitor Hours	100,800		100,800	1,870,528
				Fiscal YTD
Total Fiscal YTD Visitor Days				22,725

Recreation O/N stays	Current Month	Year-To-Date	
Concessioner Lodging	0	0	NPS Campgrounds
Concessioner Campgrounds	0	0	Tents 0
NPS Campgrounds	0	0	R/V's 0
NPS Backcountry	12	162	Total 0
NPS Miscellaneous	0	0	
Non Recreation O/N stays	0	0	
Total Overnight stays	12	162	

	This Month	Same Month Last Year	Percent Change
Total Rec	27,221	23,651	15.09
Total NonRec	0	0	0.00
Total Visits	27,221	23,651	15.09
Total YTD	476,258	455,618	4.53

Special Use Data	This Month	Year-To-Date
WILD CAVES	5	116
ENTRANCE VEHICLES	22,628	215,460
SLAUGHTER CAVE	157	4,358
BAT FLIGHT ATTEND	0	88,312
MAIN CAVE	20,627	424,551
BUS PASSENGERS	738	5,460
RATTLESNAKE CANYON	4,344	4,344
WEB HITS	0	137,155
TOTAL CAVES	20,789	429,025

Form.LL-J57
(Rev. 3/77)

S. DEPARTMENT OF INTERIOR -

MONTHLY PUBLIC USE REPORT

PARK	MONTH YEAR	UPDATE CODE	PARK CODE	MONTH	YEAR	CATE-GORY	R/
CARLSBAD CAVERNS NATIONAL PARK	12/2001	(	7170				

	CURRENT-MONTH Recreational	Ncnrecreaticnal	Total	YEAR-TO-DAT
VISITS	236471		23647	455617

	CURRENT-MONTH Recreational	Nonrecreational	Total	YEAR-TO-DAT
VISITOR HOURS	86232		862321	1788811

	CURRENT MONTH	YEAR-TO-DATE
RECREATION 0/N STAYS		
CONCESSIONER LODGING 1		
CONCESSIONER CAMPGROUNDS		
NPS CAMPGROUNDS		
NPS 3ACKCOUNTRY	10~	157
NPS MISCELLANEOUS I		
NON RECREATION O/N STAYS		
TOTAL OVERNIGHT STAYS	10	157

NPS CAMPGROUNDS

TENTS

R/VS

TOTAL

VISITOR-HOUR APPENDIX

SEE WORKSHEET

SPECIAL USE DATA	THIS MONTH	YEAR-TO DATE		THIS MONTH	YEAR-DATE
WILD CAVES	0	139	ENTRANCE VEHICLES	0	-4449 5
SLAUGHTER CAVE	230	4433	BAT FLIGHT ATTEND	0	843c9
MAIN CAVE	21264	407810	BUS PASSENGERS	330	47
RATTLESNAKE CANYON	0	2020	WEB HITS	0	C
TOTAL CAVES	21494	412382	BUSES	10	2 9

	THIS MONTH	SAME MONTH LAST YEAR		CHG
TOTAL VISITS	23647	TOTAL VISITS	19242	22.
YTD VISITS	455617	YTD VISITS	469303	-2.9

SIGNATURE CHRISTA BEHAN — TITLE VISITOR USE ASSISTANT — DATE 01/02/02

APPENDIX D

SELECTED NEW MEXICO AIR QUALITY REGULATIONS

20.2.72.202 **EXEMPTIONS:** The following exemptions are made to the following requirements of 20.2.72.200 NMAC - 20.2.72.299 NMAC. The exemptions in this section do not apply to emissions of toxic air pollutants listed under 20.2.72.502 NMAC, do not alter the calculation of the potential emissions of toxic air pollutants for applicability under 20.2.72.402 NMAC, and do not exempt the Department or the owner or operator of any source from any requirement under 20.2.72.403 NMAC, 20.2.72.404 NMAC, or 20.2.72.405 NMAC.

A. The following sources and activities shall not be reported in the permit application. Emissions from such activities shall not be included in the calculation of facility-wide potential emission rate under Paragraphs 1 or 2 of Subsection A of 20.2.72.200 NMAC. Such activities may be commenced or changed without a permit or permit revision under 20.2.72.200 NMAC - 20.2.72.299 NMAC:

(1) Activities which occur strictly for maintenance of grounds or buildings, including: lawn care, pest control, grinding, cutting, welding, painting, woodworking, sweeping, general repairs, janitorial activities, and building roofing operations;

(2) Activities for maintenance of equipment or pollution control equipment, either inside or outside of a building, including cutting, welding, and grinding, but excluding painting;

(3) Exhaust emissions from forklifts, courier vehicles, front end loaders, graders, carts, maintenance trucks, and fugitive emissions from fleet vehicle refueling operations, provided such emissions are not subject to any requirements under this Chapter (Air Quality), NSPS or NESHAP;

(4) " Use of fire fighting equipment and fire fighting training;

(5) Government military activities such as field exercises, explosions, weapons testing and demolition to the extent that such activities:

(a) Do not result in visible emissions entering publicly accessible areas; and

(b) Are not subject to a NSPS or NESHAP;

(6) Office activities, such as photocopying;

(7) Test drilling for characterization of underground storage tank and waste disposal sites;

(8) Non-anthropogenic wind blown dust;

(9) Residential activities such as use of fireplaces, woodstoves, and barbecue cookers;

(10) Gases used to calibrate plant instrumentation, including continuous emission monitoring (CEM) systems;

(11) Food service, such as cafeteria activities;

(12) Automotive repair shop activities, except painting and use of solvents;

(13) Use of portable aerospace ground equipment (such as power generators, compressors, heaters, air conditioners, lighting units) in direct support of aircraft operations and on or in the immediate vicinity of an airfield;

(14) Activities which occur strictly for preventive maintenance of highway bridges, displays and water towers, including: grinding, cutting, welding, painting, and general repairs;

(15) The act of repositioning or relocating equipment, pipes, ductwork, or conveyors within the plant site, but only when such change in physical configuration does not:

(a) Reposition or relocate any source of air emissions or the emission points from any such source; or

(b) Increase the amount of air emissions or the ambient impacts of such emissions.

B. The presence of the following new or modified sources and activities at the facility shall be reported as provided for in the permit application forms supplied by the Department. Emissions from such sources and activities shall not be included in the calculation of facility-wide potential emission rate under Paragraphs 1 or 2 of Subsection A of 20.2.72.200 NMAC. Construction of such sources or commencement of such activities after issuance of the permit shall be subject to the administrative permit revision procedures in 20.2.219 NMAC.

(1) Fuel burning equipment which is used solely for heating buildings for personal comfort or for producing hot water for personal use and which:

(a) Uses gaseous fuel and has a design rate less than or equal to five (5) million BTU per hour; or

(b) Uses distillate oil (not including waste oil) and has a design rate less than or equal to one (1) million BTU per hour;

(2) VOC emissions resulting from the handling or storing of any VOC if:

(a) Such VOC has a vapor pressure of less than two tenths (0.2) PSI at temperatures at which the compound is stored and handled; and

(b) The owner or operator maintains sufficient record keeping to verify that the requirements of Sub-paragraph (a) of this paragraph are met;

(3) Standby generators which are:

(a) Operated only during the unavoidable loss of commercial utility power;

(b) Operated less than 500 hours per year; and

(c) Either are:

i. The only source of air emissions at the site; or

ii. Accompanied by sufficient record keeping to verify that the standby generator is operated less than 500 hours per year;

(4) The act of repositioning or relocating sources of air emissions or emissions points within the plant site, but only when such change in physical configuration does not increase air emissions or the ambient impacts of such emissions;

(5) Any emissions unit, operation, or activity that has a potential emission rate of no more than one-half ('/2) ton per year of any pollutant for which a National or New Mexico Ambient Air Quality Standard has been set or one-half ('/2) ton per year of any VOC. Multiple emissions unitsoperations, and activities that perform identical or similar functions shall be combined in determining the applicability of this exemption;

(6) Surface coating of equipment, including spray painting, roll coating, and painting with aerosol spray cans, if:

TITLE 20 ENVIRONMENTAL PROTECTION
CHAPTER 2 AIR QUALITY (STATEWIDE)
PART 60 OPEN BURNING

20.2.60.1 ISSUING AGENCY: Environmental Improvement Board.
[11/30/95; 20.2.60.1 NMAC - Rn, 20 NMAC 2.60.100 10/31/02]

20.2.60.2 SCOPE: All geographic areas within the jurisdiction of the Environmental Improvement Board.
[11/30/95; 20.2.60.2 NMAC - Rn, 20 NMAC 2.60.101 10/31/02]

20.2.60.3 **STATUTORY AUTHORITY:** Environmental Improvement Act, NMSA 1978, section 74-1-8(A) (4) and (7), and Air Quality Control Act, NMSA 1978, sections 74-2-1 et seq., including specifically, section 74-2-5(A), (B) and (C).
[11/30/95; 20.2.60.3 NMAC - Rn, 20 NMAC 2.60.102 10/31/02]

20.2.60.4 DURATION: Permanent.
[11/30/95; 20.2.60.4 NMAC - Rn, 20 NMAC 2.60.103 10/31/02]

20.2.60.5 EFFECTIVE DATE: November 30, 1995.
[11/30/95; 20.2.60.5 NMAC - Rn, 20 NMAC 2.60.104 10/31/02]
[The latest effective date of any section in this Part is 10/31/02.]

20.2.60.6 OBJECTIVE: The objective of this Part is to establish controls on the use of open burning. This Part is not intended to preempt any more stringent controls on open burning provided in the Board's Solid Waste Management Regulations (20.9.1 NMAC) or in any local ordinance or regulation.
[11/30/95; 20.2.60.6 NMAC - Rn, 20 NMAC 2.60.105 10/31/02]

20.2.60.7 DEFINITIONS: In addition to the terms defined in 20.2.2 NMAC (Definitions), as used in this Part:

A. "Open burning" means any manner of burning not in a device or chamber designed to achieve combustion, where the products of combustion are emitted, directly or indirectly, into the open air.

B. "Part" means an air quality control regulation under Title 20, Chapter 2 of the New Mexico Administrative Code, unless otherwise noted; as adopted or amended by the Board.

[11/30/95; 20.2.60.7 NMAC - Rn, 20 NMAC 2.60.107 10/31/02]

20.2.60.8 AMENDMENT AND SUPERSESSION OF PRIOR REGULATIONS: This Part amends and supersedes Air Quality Control Regulation ("AQCR") 301 - Regulation to Control Open Burning last filed July 24, 1984.

A. All references to AQCR 301 in any other rule shall be construed as a reference to this Part.

B. The amendment and supersession of AQCR 301 shall not affect any administrative or judicial enforcement action pending on the effective date of such amendment nor the validity of any permit issued pursuant to AQCR 301.

[11/30/95; 20.2.60.8 NMAC - Rn, 20 NMAC 2.60.106 10/31/02]

20.2.60.9 to 20.2.60.107 [RESERVED]

20.2.60.108 RESTRICTIONS ON OPEN BURNING: Except as otherwise provided in this Part, no person shall permit, cause, suffer or allow open burning.
[11/30/95; 20.2.60.108 NMAC - Rn, 20 NMAC 2.60.108 10/31/02]

20.2.60.109 UNRESTRICTED OPEN BURNING:

A. Open burning is permitted for recreational and ceremonial purposes, for barbecuing, for heating purposes in fireplaces, for the noncommercial cooking of food for human consumption and for warming by small wood fires at construction sites.

B. Open burning of natural gas is permitted at gasoline plant and compressor stations and when used or produced in drilling, completion and workover operations on oil and gas wells when necessary to avoid serious hazard to safety.

C. Open burning of explosive materials is permitted where the transportation of such materials to other facilities could be dangerous.

[11/30/95; 20.2.60.109 NMAC - Rn, 20 NMAC 2.60.109 10/31/02]

20.2.60.110 RESTRICTED OPEN BURNING OF REFUSE:

A. Subject to the conditions contained in 20.2.60.112 NMAC, open burning of refuse is permitted in communities having:

(1) a population of less than 3000; and

(2) no public refuse collection service or the economic means of obtaining or establishing one.

B. 20.2.60.110 NMAC does not apply to any kind of salvage operation or to any person to whom a collection service is available.

[11/30/95; 20.2.60.110 NMAC - Rn, 20 NMAC 2.60.110 10/31/02]

20.2.60.111 OTHER RESTRICTED OPEN BURNING: Subject to the conditions contained in 20.2.60.112 NMAC, open burning is permitted for the following purposes:

A. disposal of fully dried tumbleweeds; and

B. agricultural management, excluding timber, directly related to the growing or harvesting of crops.

[11/30/95; 20.2.60.111 NMAC - Rn, 20 NMAC 2.60.111 10/31/02]

20.2.60.112 CONDITIONS FOR RESTRICTED OPEN BURNING: Any open burning permitted under 20.2.60.110 NMAC and 20.2.60.111 NMAC must be maintained under the following conditions:

A. the emission of smoke shall not be allowed to pass onto or across a public road or landing strip such that a hazard is created by impairment of visibility;

B. no natural or synthetic rubber or petroleum products may be burned. For the purpose of frost control in agricultural operations, natural petroleum products may be burned;

C. care must be taken to minimize the amount of dirt on the material being burned;

D. all burning, except agricultural burning, must take place between the hours of 10:00 a.m. and 4:00 p.m.;

E. the material to be burned must be as dry as possible; and

F. the wind direction at the site of agricultural burning must be such that the smoke will generally be carried away from areas of human habitation.

[11/30/95; 20.2.60.112 NMAC - Rn, 20 NMAC 2.60.112 10/31/02]

20.2.60.113 OPEN BURNING FOR WHICH PERMITS MUST BE OBTAINED: Subject to whatever conditions the Department may impose, open burning is permitted for the following purposes when a permit is obtained from the Department: weed abatement; prevention of fire hazards; disposal of dangerous materials; instruction and training of bona fide fire-fighting and fire-rescue personnel; civil defense; conservation; game management; disease and pest control; land clearance for highway construction; forestry management; control of vegetation in irrigation ditches and canals; clearance and maintenance of watercourses and flood control channels to eliminate flood hazards; disposal of hydrocarbons spilled or lost from pipeline breaks or other transport failure; and other special circumstances.

[11/30/95; 20.2.60.113 NMAC - Rn, 20 NMAC 2.60.113 10/31/02]

20.2.60.114 REQUEST FOR PERMIT: Any person seeking a permit to open burn shall do so by submitting a request to the Department. The Department may require the requestor to submit his request in writing and any or all of the following information:

A. the requestor's name, address and telephone number;

B. the location where the burning is to be conducted;

C. the type and quantity of material to be burned;

D. the date when the burning is to be conducted;

E. the methods that will be followed to ignite, maintain and control the burning;

F. reasons why the requestor believes the burning is necessary; and

G. the alternatives to burning and the reasons why the requestor believes them not to be feasible.