Sundar, Danielle

CAHA #1737

From: Fox, Lori
Sent: Monday, October 26, 2009 10:07 AM
To: Sundar, Danielle
Subject: FW: CAHA ORV Plan - ARS Report
Attachments: FINAL CAHA Air Quality Appendices.doc; FINAL CAHA Air Quality Report.doc

Categories: Projects/ CAHA

For caha admin...

Lori Fox
Deputy Director, Denver Operations/Senior Planner

Direct 303-985-6602
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Mobile 301-461-8772

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-----Original Message-----
From: Sandra_Hamilton@nps.gov [mailto:Sandra_Hamilton@nps.gov]
Sent: Thursday, October 15, 2009 4:10 PM
To: Fox, Lori
Subject: Fw: CAHA ORV Plan - ARS Report

Hi Lori,

For the admin record below is the air quality report referred to in the air quality section for CH 1 from Andrea Stacy that I forwarded to you a little bit ago today.

Can you put it on your agenda for the RT that we need to get park confirmation that posting it in PEPC is OK. They may just want us to put it in the admin record. Either is OK with me.

Sandy

Sandy Hamilton
Environmental Protection Specialist
National Park Service - Environmental Quality Division Academy Place P.O. Box 25287 Denver CO 80225

PH: (303) 969-2068
FAX: (303) 987-6782
----- Forwarded by Sandra Hamilton/DENVER/NPS on 10/15/2009 04:06 PM -----

"James Wu"
<Jwu@air-resource
.com>

10/15/2009 03:09
PM

To
<Andrea_Stacy@nps.gov>

cc
<John_Bunyak@nps.gov>,
<John_Notar@nps.gov>,
<Sandra_Hamilton@nps.gov>

Subject
Re: CAHA ORV Plan - ARS Report

Andrea,

Please find attached the Final Report & appendices. I accepted your changes in the report, and also added a line at the end about SO2 emissions, as we had discussed by email. Appendix A has the vehicle class count data labeled now, as well.

Let me know if you need anything else - I enjoyed working with everyone on this interesting project and am glad we were able to finish the report in the past few weeks.

Thanks,

James Wu
Project Manager
Environmental Compliance Section

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: (970) 484-7941
Fax: (970) 484-3423

>>> <Andrea_Stacy@nps.gov> 10/15/2009 10:49 AM >>>
Thanks James - I agree - you should add the additional title line in bold text to the appendix to make this stand out. Can you make this change & accept my previous comments/changes in the document (if you are okay with them) & send it back to me with a cc to everyone on this email list? I think this would represent the final report; I spoke with Notar this morning & that was his only comment, everything else looks good. Sandy is heading to the east coast tomorrow for a meeting with the park & would like to have this in hand for that meeting. Thanks & I appreciate all your work on this!

Andrea Stacy

National Park Service
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Denver, CO 80225
andrea_stacy@nps.gov
303-969-2816 (phone)
303-969-2822 (Fax)

"James Wu"
<Jwu@air-resource
.com>

10/15/2009 10:10
AM

To
<Andrea_Stacy@nps.gov>,
<John_Notar@nps.gov>

cc
<John_Bunyak@nps.gov>

Subject
Re: CAHA ORV Plan - ARS Report

John,

The vehicle classification for the modeling was based on data collected by RTI, which is in Appendix A, at the bottom of page A-2. Classes LDT1&2 were counted together, as were LDT3&4, so I just divided those percentages evenly for the modeling. I can put an additional title line in that part of Appendix A, so it's clear that the data is there.

Thanks,

James Wu
Project Manager
Environmental Compliance Section

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>>> <John_Notar@nps.gov> 10/14/2009 2:09 PM >>>
James & Andrea: the only comment I have & you might not have the data yet, is the percentage of the different (6) classes of motor vehicles:
light-duty vehicles (LDV), light-duty trucks (LDT1, LDT2, LDT3 and LDT4); and heavy-duty vehicles (HDV2B) counted or/ modeled. If we don't have a firm % we could just say the mix was based on the vehicle survey count, and leave it at that.
thanks
John

Andrea
Stacy/DENVER/NPS

10/05/2009 02:49 PM

To
"James Wu" <jwu@air-resource.com>
cc
John Bunyak/DENVER/NPS@NPS, John Notar/DENVER/NPS@NPS
Subject
Re: CAHA ORV Plan - ARS Report (Document link: OLDMAIL-2009)

Hi James - this looks great! I have just a couple of suggestions for fine-tuning the language, otherwise I think everything we need is in the Report. I'm still reviewing the appendices & would like to give Notar a chance to look over that, but we'll get back to you soon on those.

Also, I see that the pollutants are listed in task #2, so I apparently overlooked this initially, but was there a reason the SO2 emissions were excluded from the pollutant summaries, other than they aren't in the task order? Granted, it appears they are even smaller than some of the others, so I can't remember whether we decided it would be unnecessary to include them (which is entirely possible). I seem to recall that I was initially thinking we would analyze all criteria pollutants, but maybe we changed our minds on that . . . Either way, you completed what was in the Task order so everything is good there.

(See attached file: DRAFT CAHA Report_ascomments.doc)

Like I said before, thanks for your perseverance with this. I know waiting for the vehicle count information seemed never ending!

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303-969-2822 (Fax)

"James Wu"
<jwu@air-resource
.com>

10/02/2009 11:24
AM

To
<Andrea_Stacy@nps.gov>

cc
"Kristi Savig"
<KSavig@air-resource.com>

Subject
Re: Fwd: Re: Fw: ORV Plan
information needed

Andrea,

Sorry the report is coming to you later in the week - please find attached the drafts for your review. I'm sure you might want to fine-tune the language regarding the traffic data from NPS (RTI?) and possibly the modeling/baseline year of 2009.

Let me know if have any questions and if you'll like to send me your comments/edits.

Thanks,

James Wu
Project Manager
Environmental Compliance Section

Air Resource Specialists, Inc.
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Fax: (970) 484-3423

>>> <Andrea_Stacy@nps.gov> 09/24/09 2:18 PM >>>
Thanks James. Yes, we are good for now with the just the emissions inventory - the one you sent yesterday is the one to use, i.e. it hasn't changed since your QA/QC? I'll wait for the report for sometime next week . . . Thanks for your help!

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"James Wu"
<Jwu@air-resource
.com>

09/24/2009 01:21
PM

To
"Andrea Stacy"
<Andrea_Stacy@nps.gov>

cc

Subject
Fwd: Re: Fw: ORV Plan information
needed

Andrea,

I completed my QA/QC on the emissions and post-model calcs. I've also attached the calcs I did to determine weekly trip levels and the min/max temps.

I assume the emissions inventory is all you need for now, so I'll start working on the report. Let me know if you need anything else.

Thanks,

James Wu
Project Manager
Environmental Compliance Section

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Fax: (970) 484-3423

>>> James Wu 9/23/2009 5:14 PM >>>
Andrea,

I've attached my draft emission inventory. I just finished this, so I need to do a review/QA of this tomorrow morning, but I thought you might want to look at it and give me any initial comments/suggestions.

I'll let you know if I need to update or revise something critical by late morning.
thanks,

James Wu
Project Manager
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Fax: (970) 484-3423

>>> <Andrea_Stacy@nps.gov> 9/23/2009 4:29 PM >>>

James we've heard back from a couple folks. Darrell is the assist.
superintendent and he concurs, so I think it is pretty safe to say we can use this estimate.

Andrea Stacy
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----- Forwarded by Andrea Stacy/DENVER/NPS on 09/23/2009 04:27 PM -----

Darrell Echols/CAHA/NPS		
		To
09/23/2009 03:49 PM	Andrea Stacy/DENVER/NPS@NPS, Jon Anglin/CAHA/NPS@NPS, John McCutcheon/CAHA/NPS@NPS, Kenny Ballance/CAHA/NPS@NPS	
		cc
	"jwu" <jwu@air-resource.com>, Sandra Hamilton/DENVER/NPS@NPS	
		Subject
	Re: Fw: Fw: ORV Plan information needed(Document link: Andrea Stacy)	

Andrea,

I believe using 6 miles for a round trip seems reasonable and appropriate for analysis.

Darrell

----- Original Message -----
From: Andrea Stacy
Sent: 09/23/2009 10:17 AM MDT
To: Darrell Echols; Jon Anglin; John McCutcheon; Kenny Ballance
Cc: jwu@air-resource.com; Sandra Hamilton
Subject: Re: Fw: Fw: ORV Plan information needed All, Thank you for your response to our questions. Our modeling contractor and I have been reviewing the estimates your provided and

are trying to distill this into something that will work in the analysis based on the estimates for other parameters that we are accounting for (i.e. vehicle counts on a park-wide basis). So, with that in mind, we have observed that it appears the majority of the visitors travel between 2 and 5 miles, with relatively few traveling further than that, obviously some traveling less, and slight variations by district. If we were to put this into a park-wide annual estimate, does it seem appropriate to assume that the average visitor travels approx. 3 miles one way (potentially 6 miles round trip)? We are hoping this value would account for the fact that some obviously travel a shorter distance and some travel much further, but on average this would adequately capture that range. We could attempt to parse this out on a district by district basis, but if this value seems reasonable to you, it would make the analysis more understandable and easier to apply and report using a park-wide average.

If at all possible, could you please let us know your thoughts on this by the end of the day? I know this is really short notice, but our contractor needs final concurrence to complete the AQ analysis in time for the internal review draft. Thanks in advance for your help!

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Darrell
Echols/CAHA/NPS

09/18/2009 03:02 PM

To: "Andrea Stacy" <Andrea_Stacy@nps.gov>

cc:

Subject: Fw: Fw: ORV Plan information needed

Andrea,

Here is what I received from our Hatteras district ranger.

I am out of the office today, but I thought you would like to see it before I return to the office on Monday.

Darrell

----- Original Message -----
From: John McCutcheon
Sent: 09/18/2009 04:41 PM EDT
To: Darrell Echols
Subject: Re: Fw: ORV Plan information needed Darrell,

Sorry for the lateness of this. Here is my guesstimation for Hatteras:

Average estimate of speed on the beach? - 20 mph

Average Distance For Winter - 3 to 5 miles
Spring - 3 to 5 miles
Summer - 1 to 2 miles
Fall - 3 to 5 miles

Highly subjective.

(Embedded image moved to file: pic15940.jpg)

Darrell
Echols/CAHA/NPS

09/16/2009 07:34 AM

To: Jon Anglin/CAHA/NPS@NPS, John McCutcheon/CAHA/NPS@NPS
cc: Paul Stevens/CAHA/NPS@NPS
Subject: Fw: ORV Plan information needed

Guys,

I need your estimates as per the message I sent below. I needed this last week so please get this to me today.

Thanks,
Darrell

Darrell L. Echols
Deputy Superintendent

National Park Service
Outer Banks Group

Cape Hatteras National Seashore/Wright Brothers National Memorial/Fort Raleigh National Historic Site
1401 National Park Drive
Manteo, NC 27954

phone: (252) 473-2111, x148
fax: (252) 473-2595

E-mail: Darrell_Echols@nps.gov
Webpage: http://www.nps.gov/

----- Forwarded by Darrell Echols/CAHA/NPS on 09/14/2009 04:01 PM -----

Darrell Echols/CAHA/NPS

09/08/2009 03:53 PM

To: Jon Anglin/CAHA/NPS, John McCutcheon/CAHA/NPS, Kenny Ballance/CAHA/NPS

cc: Paul Stevens/CAHA/NPS@NPS

Subject: ORV Plan information needed

Guys,

The Air Resources Division needs some information related to vehicle use of the beach, which will be used to model air emissions at the park. I don't have a good read on the level of use or the seasonal variations, so I need your help. Can you answer the following questions by Friday, September 11?

- What is the average estimated speed of vehicles on the beach?

- What is an estimated distance that vehicles drive when they are on the beach during Spring, Summer, Winter, and Fall? This is four different estimates for your respective district.

I know the last question is entirely subjective based on visitation, the amount of beaches open to ORV, environmental factors, and more. However, I figure that you can provide some kind of information about what vehicles are doing in your respective districts by taking into mind where most vehicles go and the number of vehicles that are on the beach each season.

Thanks,
Darrell

Darrell L. Echols

Deputy Superintendent

National Park Service
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Cape Hatteras National Seashore/Wright Brothers National Memorial/Fort Raleigh National Historic Site
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----- Forwarded by Darrell Echols/CAHA/NPS on 09/16/2009 08:28 AM -----

Kenny Ballance/CAHA/NPS
09/09/2009 03:17 PM

To: Darrell Echols/CAHA/NPS@NPS
cc:
Subject: Re: ORV Plan information needed (Document link: Darrell Echols)

Darrell. : Hope this is what you are needing and want from me for the Ocracoke District

Speed Limits 80% drive at a speed of 15-20 miles per hour (These are your average park visitors who have a destination to get to on the beach and stop there)

20% drive at a speed of 10-15 miels per hour (These are fishermen and sightseeers who are looking for certain things)

As for Miles per season :

Summer 75 % will travel 2 miles to get to Ramp 70 & 72
Tourist - Park Visitors - Day Trippers - Locals
5% will travel 2.5 miles to Ramp 68
5 % will travel 3 miles to Ramp 67
15% will travel 14 miles to Ramp 59

Fall 60% will travel 2 miles to get to Ramp 70 & 72
Park Visitors - Some Day Trippers - Fall fishermen - Locals

10 % will travel 2.5 Miles to Ramp 68
10 % will travel 3 miles to Ramp 67
20 % will travel 14 miles to Ramp 59

Winter 85 % will travel 2 miles to get to Ramp 70 & 72
Park Visitors - Locals - Local Fishermen
5% will travel 2.5 Miles to Ramp 68
5% will travel 3 miles to Ramp 67
5% will travel 14 miles to Ramp 59

Spring 75 % will travel 2 miles to get to Ramp 70 & 72
Spring fisherman - Park visitors - Locals
5% will travel to Ramp 68
5% will travel to Ramp 67
15 %^ will travel 14 miles to Ramp 59 [attachment "ORVEstimates ARS.xls" deleted by Andrea Stacy/DENVER/NPS]

[attachment "DRAFT CAHA Report.doc" deleted by Andrea Stacy/DENVER/NPS] (See attached file: DRAFT CAHA Appendices.doc)

(See attached file: FINAL CAHA Air Quality Appendices.doc) (See attached file: FINAL CAHA Air Quality Report.doc)

Air Quality Modeling Report
Cape Hatteras National Seashore

1.0 Introduction

In support of the Off-Road Vehicle Negotiated Rulemaking and Management Plan/Draft Environmental Impact Statement (DEIS) for the Cape Hatteras National Seashore (CAHA), Air Resource Specialists, Inc. (ARS) completed air emissions modeling to quantify emissions from off-road vehicle (ORV) use in the park. ORV visitation, fleet characteristics, and other information were provided by National Park Service (NPS) and their contractor, RTI, to ARS and are included in the Appendices.

For this study of ORV use emissions, annual emission estimates for criteria pollutants (carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), and nitrogen oxides (NO_x)), and hydrocarbons (HC) were calculated. The methodology employed for this study is discussed in the following sections.

2.0 Pollutants

Carbon monoxide (CO), a colorless, odorless, and poisonous gas, is produced in locations with motor vehicles, primarily by the incomplete combustion of gasoline and other fossil fuels. Health effects include impairment of the central nervous system, particularly on people with heart disease. CO also interferes with the transport of oxygen in the blood. In the vicinity of roadways, the majority, if not all, CO emissions are from motor vehicles. CO concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to locations near crowded intersections, typically along heavily traveled and congested roadways. This analysis estimated CO emissions from ORV use within the park.

Particulate matter (PM_{10} and $PM_{2.5}$) is emitted into the atmosphere from a variety of sources: industrial facilities, power plants, construction activity, etc. Gasoline powered vehicles typically do not produce any significant quantities of particulate emissions. Although less relevant to this study, diesel-powered vehicles, especially heavy trucks and buses, also emit particulates, and particulate concentrations may be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. This analysis estimated particulate (PM_{10} and $PM_{2.5}$) emissions from ORV use within the park.

Hydrocarbon (HC) emissions from motor vehicles can result from partially-burned fuel emitted through the tailpipe and from fuel evaporations from the crankcase, carburetor and gas tank. Hydrocarbons are also released from gasoline fuel vapor when vehicles are re-fueled at gas stations and when bulk storage tanks are refilled. When exposed to sunlight, hydrocarbons or volatile organic compounds (VOCs) contribute to formation of harmful ground level ozone, also known as smog. For the purposes of this study, hydrocarbons may also be expressed as VOCs, which include air toxins or

hazardous air pollutants (HAPs). This analysis estimated VOC emissions from ORV use within the park.

Nitrogen oxides (NO_x), are typically of principal concern because of their role as precursors in the formation of photochemical oxidants, such as ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. NO_x also contributes to atmospheric particles, and can cause respiratory problems and visibility impairment. NO_x emissions from mobile sources and the pollutants formed from NO_x can be transported over long distances, so they are generally examined on a regional basis and are assessed in this study.

3.0 MOBILE6 Emission Factors

To estimate annual ORV use emissions (CO, PM, NO_x and VOC), vehicle emission factors were necessary. Emission factor estimates were computed using the current EPA recommended model for mobile source emissions, the EPA-developed Mobile Source Emissions Model (MOBILE6), for up to six (6) classes of motor vehicles: light-duty vehicles (LDV), light-duty trucks (LDT1, LDT2, LDT3 and LDT4); and heavy-duty vehicles (HDV2B).

MOBILE6 emission factors were prepared to account for low altitude, assumed no Inspection and Maintenance (I&M) programs, conventional gasoline east, and local inputs such as maximum and minimum temperatures, varying by season modeled, and fuel parameters, etc. (e.g., fuel volatility). NPS provided vehicle classification data (Appendix A), and national default vehicle age distributions were used. The model's default settings were used to determine diesel fractions for the vehicle classes estimated. Emission factors for ORV use were determined for average travel speeds of 15mph and 25mph, representing the speed limit proposed under Alternative x and the current speed limit, respectively. .

Composite emission factors for ORV use were determined for the (baseline) year of 2009, based on the parameters discussed above and are included in Appendix B. MOBILE6 input and output files are included as Appendix C.

4.0 ORV Traffic Data

Traffic data for the air quality analysis were derived from counting surveys of ORV use in the park and other vehicle travel assumptions and information provided to ARS by NPS (Appendix A). This data included mean estimates of daily ORV trips in the park for weekdays and weekends, for three seasons: low season, mid season, and high season. ARS converted these estimates to weekly values for each season and utilized the mean and upper bound values for input to the emission inventory calculations. In addition, NPS provided a park-wide estimate of six (6) miles as the distance (round-trip) the average ORV visitor travels on the beach.

5.0 Emissions Inventory

An emissions inventory of ORV use in CAHA was completed, based on 2009 traffic data and other information (included in the appendices). Estimates were prepared for criteria pollutants (CO, PM, and NOx) and VOC. The range of total potential annual emissions due to ORV activity in the park in tons per year are shown in Table 5-1, for the two (2) modeled speeds, along with employing both the mean and upper bound ORV estimates. Detailed calculations for the emission inventory are included in Appendix B. For this analysis, all PM_{10} was conservatively assumed to also be $PM_{2.5}$ emissions. Sulfur dioxide (SO_2) emission factors were also provided by MOBILE6, however, annual emission estimates were less than 0.1 tons per year, and therefore were not included in Table 5-1.

Table 5-1
Park-wide Total Annual ORV Emissions (Tons per Year)

Speed	Description	CO	VOC	NOx	PM
15 mph	Mean ORV Estimates	36.1	3.9	3.3	0.1
15 mph	Upper Bound ORV Estimates	63.3	6.7	5.7	0.1
25 mph	Mean ORV Estimates	30.8	3.1	3.0	0.1
25 mph	Upper Bound ORV Estimates	54.2	5.3	5.2	0.1
Note: PM as $PM_{10}/PM_{2.5}$					

APPENDIX A
ORV TRAFFIC DATA

Appendix A:

Average of ORVs Entering/Leaving the Beach

Season	Day	Hatteras Est Lower bou	Mean	Upper Bound
Low	Weekday	0.00	400.00	949.45
Low	Weekend	372.51	821.11	1,269.71
Mid	Weekday	0.00	640.00	1,570.14
Mid	Weekend	238.32	1,349.99	2,461.64
High	Weekday	889.57	1,738.67	2,587.76
High	Weekend	1,651.06	2,251.46	2,851.87

Weekly Estimates

	Mean	Upper Bound
Low	3,642	7,287
Mid	5,900	12,774
High	13,196	18,643

ORVs Entering the Beach

Season	Day	Hatteras Est Lower bou	Mean	Upper Bound
Low	Weekday	-252.75	224.00	700.75
Low	Weekend	357.36	746.62	1,135.87
Mid	Weekday	-384.69	659.20	1,703.09
Mid	Weekend	340.48	1,588.11	2,835.74
High	Weekday	679.05	1,632.00	2,584.95
High	Weekend	1,737.77	2,411.60	3,085.44

ORVs Leaving the Beach

Season	Day	Hatteras Est Lower bou	Mean	Upper Bound
Low	Weekday	-152.26	576.00	1,304.26
Low	Weekend	301.01	895.60	1,490.20
Mid	Weekday	-371.46	620.80	1,613.06
Mid	Weekend	-74.05	1,111.87	2,297.78
High	Weekday	939.53	1,845.34	2,751.13
High	Weekend	1,450.83	2,091.33	2,731.83

Vehicle Classification Count Data

Type	Count	Percentage
LDV	45	1.61%
LDT1&2	1134	40.46%
LDT3&4	1261	44.99%
HDV2B	363	12.95%

Average Min and Max Temperatures from Outer Banks Visitor's Bureau

	Min	Max
Dec	40	55
Jan	36	51
Feb	37	54
Mar	43	60
April	51	69
May	60	76
June	68	83
July	72	86
Aug	72	85
Sept	67	81
Oct	57	71
Nov	48	63

		Modeling Season Averages	
		Min	Max
LOW	Dec-Mar	39	55
HIGH	June-Sept	70	84
MID	April, May, Oct, Nov	54	70

Note:
Outer Banks Visitor's Bureau covers the Outer Banks areas in Dare County. (Bodie and Hatteras Islands are in Dare County. Ocracoke, the southern most island in CAHA, is in Hyde County, the county south of Dare County).

APPENDIX B
EMISSION FACTORS

Summary of Parkwide Total Annual ORV Mobile Source Emissions (Tons per Year)
Cape Hatteras National Seashore

Vehicle Emissions - 2009 (15 mph Average Speed)

Pollutant	MOBILE6 Emission Factors (15 mph)		
	Low Season (g/mi)	Mid Season (g/mi)	High Season (g/mi)
CO	19.109	14.545	12.189
VOC	1.473	1.492	1.524
NOx	1.405	1.303	1.246
PM	0.0326	0.0326	0.032

Mean Vehicle Count

Pollutant	Distance (mi)	Low Season Unit Emissions (g)	Mid Season Unit Emissions (g)	High Season Unit Emissions (g)	Low Season Emissions (lb/week)	Mid Season Emissions (lb/week)	High Season Emissions (lb/week)	**Total Mean Emissions (tons/yr)**
CO	6	114.65	87.27	73.13	919.81	1134.12	2125.76	36.09
VOC	6	8.838	8.952	9.144	70.90	116.34	265.79	3.91
NOx	6	8.43	7.818	7.476	67.63	101.60	217.30	3.34
PM	6	0.1956	0.1956	0.192	1.57	2.54	5.58	0.08
								43.42

Upper Bound Vehicle Count

Pollutant	Distance (mi)	Low Season Unit Emissions (g)	Mid Season Unit Emissions (g)	High Season Unit Emissions (g)	Low Season Emissions (lb/week)	Mid Season Emissions (lb/week)	High Season Emissions (lb/week)	**Total Upper Bound Emissions (tons/yr)**
CO	6	114.65	87.27	73.13	1840.18	2455.47	3003.09	63.27
VOC	6	8.838	8.952	9.144	141.85	251.88	375.48	6.66
NOx	6	8.43	7.818	7.476	135.30	219.97	306.99	5.74
PM	6	0.1956	0.1956	0.192	3.14	5.50	7.88	0.14
								75.81

Weekly Vehicle Count	Season Low	Mid	High
Mean	3,642	5,900	13,196
Upper Bound	7,287	12,774	18,643

Summary of Parkwide Total Annual ORV Mobile Source Emissions (Tons per Year)
Cape Hatteras National Seashore

Vehicle Emissions - 2009 (25 mph Average Speed)

Pollutant	MOBILE6 Emission Factors (25 mph) Low Season (g/mi)	Mid Season (g/mi)	High Season (g/mi)
CO	16.798	12.55	10.225
VOC	1.187	1.178	1.193
NOx	1.282	1.19	1.13
PM	0.0326	0.0326	0.032

Mean Vehicle Count

Pollutant	Distance (mi)	Low Season Unit Emissions (g)	Mid Season Unit Emissions (g)	High Season Unit Emissions (g)	Low Season Emissions (lb/week)	Mid Season Emissions (lb/week)	High Season Emissions (lb/week)	**Total Mean Emissions (tons/yr)**
CO	6	100.79	75.30	61.35	808.57	978.57	1783.24	30.84
VOC	6	7.122	7.068	7.158	57.14	91.85	208.06	3.08
NOx	6	7.692	7.14	6.78	61.71	92.79	197.07	3.03
PM	6	0.1956	0.1956	0.192	1.57	2.54	5.58	0.08
								37.04

Upper Bound Vehicle Count

Pollutant	Distance (mi)	Low Season Unit Emissions (g)	Mid Season Unit Emissions (g)	High Season Unit Emissions (g)	Low Season Emissions (lb/week)	Mid Season Emissions (lb/week)	High Season Emissions (lb/week)	**Total Upper Bound Emissions (tons/yr)**
CO	6	100.79	75.30	61.35	1617.64	2118.68	2519.21	54.23
VOC	6	7.122	7.068	7.158	114.31	198.87	293.93	5.26
NOx	6	7.692	7.14	6.78	123.46	200.89	278.41	5.22
PM	6	0.1956	0.1956	0.192	3.14	5.50	7.88	0.14
								64.86

Weekly Vehicle Count	Season Low	Mid	High
Mean	3,642	5,900	13,196
Upper Bound	7,287	12,774	18,643

APPENDIX C
MOBILE6 INPUT/OUTPUT FILES

```
*
*  This input file was updated on 9/23/2009
*
MOBILE6 INPUT FILE :

* 2009, January 1 (LOW SEASON)
* 15 and 25 mph runs
* HC CO NOX PM10
* No I/M programs
* HC emissions as VOCs
* Low Season temps
* Conventional gasoline East (default)
* Diesel fuel sulfer 15 ppm
* VMT fract: 1.6% CLASS LDV/20.2% CLASS LDT1/20.2% CLASS LDT2/22.5% CLASS LDT3/22.5%
CLASS LDT4/13% CLASS 2b HDV

POLLUTANTS       : HC CO NOX
PARTICULATES     :

RUN DATA


SCENARIO REC     : Cape Hatteras 15 mph
PARTICULATE EF   : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE    : 10.0
CALENDAR YEAR    : 2009
MIN/MAX TEMP     : 39. 55.
VMT FRACTIONS    :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED    : 15 Arterial
DIESEL SULFUR    : 15.00
FUEL RVP         : 9.0

END OF RUN


SCENARIO REC     : Cape Hatteras 25 mph
PARTICULATE EF   : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE    : 10.0
CALENDAR YEAR    : 2009
MIN/MAX TEMP     : 39. 55.
VMT FRACTIONS    :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED    : 25 Arterial
DIESEL SULFUR    : 15.00
FUEL RVP         : 9.0

END OF RUN
```

```
*
*  This input file was updated on 9/23/2009
*
MOBILE6 INPUT FILE :

* 2009, January 1 (MID SEASON)
* 15 and 25 mph runs
* HC CO NOX PM10
* No I/M programs
* HC emissions as VOCs
* Mid Season temps
* Conventional gasoline East (default)
* Diesel fuel sulfer 15 ppm
* VMT fract: 1.6% CLASS LDV/20.2% CLASS LDT1/20.2% CLASS LDT2/22.5% CLASS LDT3/22.5%
CLASS LDT4/13% CLASS 2b HDV

POLLUTANTS      : HC CO NOX
PARTICULATES    :

RUN DATA


SCENARIO REC    : Cape Hatteras 15 mph
PARTICULATE EF  : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE   : 10.0
CALENDAR YEAR   : 2009
MIN/MAX TEMP    : 54. 70.
VMT FRACTIONS   :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED   : 15 Arterial
DIESEL SULFUR   : 15.00
FUEL RVP        : 9.0

END OF RUN


SCENARIO REC    : Cape Hatteras 25 mph
PARTICULATE EF  : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE   : 10.0
CALENDAR YEAR   : 2009
MIN/MAX TEMP    : 54. 70.
VMT FRACTIONS   :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED   : 25 Arterial
DIESEL SULFUR   : 15.00
FUEL RVP        : 9.0

END OF RUN
```

```
*
*  This input file was updated on 9/23/2009
*
MOBILE6 INPUT FILE :

* 2009, July 1 (HIGH SEASON)
* 15 and 25 mph runs
* HC CO NOX PM10
* No I/M programs
* HC emissions as VOCs
* High Season temps
* Conventional gasoline East (default)
* Diesel fuel sulfer 15 ppm
* VMT fract: 1.6% CLASS LDV/20.2% CLASS LDT1/20.2% CLASS LDT2/22.5% CLASS LDT3/22.5%
CLASS LDT4/13% CLASS 2b HDV

POLLUTANTS        : HC CO NOX
PARTICULATES      :

RUN DATA


SCENARIO REC      : Cape Hatteras 15 mph
PARTICULATE EF    : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE     : 10.0
CALENDAR YEAR     : 2009
EVALUATION MONTH  : 7
MIN/MAX TEMP      : 70. 84.
VMT FRACTIONS     :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED     : 15 Arterial
DIESEL SULFUR     : 15.00
FUEL RVP          : 9.0

END OF RUN


SCENARIO REC      : Cape Hatteras 25 mph
PARTICULATE EF    : PMGZML.CSV PMGDR1.CSV PMGDR2.CSV PMDZML.CSV PMDDR1.CSV
PMDDR2.CSV
PARTICLE SIZE     : 10.0
CALENDAR YEAR     : 2009
EVALUATION MONTH  : 7
MIN/MAX TEMP      : 70. 84.
VMT FRACTIONS     :
0.016 0.202 0.202 0.225 0.225 0.13 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
AVERAGE SPEED     : 25 Arterial
DIESEL SULFUR     : 15.00
FUEL RVP          : 9.0

END OF RUN
```

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-LOW.IN (file 1, run 1).                                    *
*******************************************************************************

* ##########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
* ##########################

* 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
 M615 Comment:
        User supplied VMT mix.
 M583 Warning:
       The user supplied arterial average speed of 15.0
       will be used for all hours of the day.  100% of VMT
       has been assigned to the arterial/collector roadway
       type for all hours of the day and all vehicle types.
 M 48 Warning:
        there are no sales for vehicle class HDGV8b

* Reading Ammonia (NH3) Basic Emissiion Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

             Calendar Year:  2009
                  Month:  Jan.
               Altitude:  Low
```

```
        Minimum Temperature:  39.0 (F)
        Maximum Temperature:  55.0 (F)
          Absolute Humidity:   75. grains/lb
          Nominal Fuel RVP:   9.0 psi
            Weathered RVP:   9.0 psi
        Fuel Sulfur Content:   30. 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:   0.0160   0.4040   0.4435           0.0996   0.0000   0.0065   0.0304   0.0000   1.0000
 -------------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
    Composite VOC :     0.993    1.084    1.940    1.532    1.452   0.341    0.720    0.311     0.00    1.473
    Composite CO  :    14.50    16.49    23.44    20.13    17.76    1.477    1.218    1.389     0.00   19.109
    Composite NOX :     0.753    0.908    1.589    1.264    2.232   0.575    0.896    3.081     0.00    1.405
 -------------------------------------------------------------------------------------------------------------
 ******************************************************************************
 * MOBILE6.2.03 (24-Sep-2003)                                                 *
 * Input file: 2009-LOW.IN (file 1, run 2).                                   *
 ******************************************************************************

 * ##########################
 * Cape Hatteras 25 mph
 * File 1, Run 2, Scenario 1.
 * ##########################

 * 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
M615 Comment:
User supplied VMT mix.
M583 Warning:
The user supplied arterial average speed of 25.0
will be used for all hours of the day. 100% of VMT
has been assigned to the arterial/collector roadway
type for all hours of the day and all vehicle types.
M 48 Warning:
there are no sales for vehicle class HDGV8b

Calendar Year: 2009
Month: Jan.
Altitude: Low
Minimum Temperature: 39.0 (F)
Maximum Temperature: 55.0 (F)
Absolute Humidity: 75. grains/lb
Nominal Fuel RVP: 9.0 psi
Weathered RVP: 9.0 psi
Fuel Sulfur Content: 30. 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:	0.0160	0.4040	0.4435	0.0996	0.0000	0.0065	0.0304	0.0000	1.0000	

Composite Emission Factors (g/mi):

Composite VOC :	0.803	0.888	1.599	1.260	0.964	0.261	0.546	0.214	0.00	1.187
Composite CO :	13.08	15.02	21.33	18.32	10.35	1.043	0.859	0.829	0.00	16.798
Composite NOX :	0.657	0.796	1.410	1.117	2.437	0.477	0.742	2.533	0.00	1.282

```
*****************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                    *
* Input file: 2009-MID.IN (file 1, run 1).                      *
*****************************************************************************

* ##########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
* ##########################

* 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
 M615 Comment:
        User supplied VMT mix.
 M583 Warning:
      The user supplied arterial average speed of 15.0
      will be used for all hours of the day.  100% of VMT
      has been assigned to the arterial/collector roadway
      type for all hours of the day and all vehicle types.
 M 48 Warning:
       there are no sales for vehicle class HDGV8b

* Reading Ammonia (NH3) Basic Emissiion Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

            Calendar Year: 2009
                Month: Jan.
             Altitude:  Low
```

```
        Minimum Temperature:  54.0 (F)
        Maximum Temperature:  70.0 (F)
         Absolute Humidity:   75. grains/lb
          Nominal Fuel RVP:   9.0 psi
            Weathered RVP:    9.0 psi
        Fuel Sulfur Content:  30. 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:    0.0160 0.4040 0.4435          0.0996 0.0000 0.0065 0.0304 0.0000 1.0000
 ---------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    1.048  1.099  1.945  1.542  1.548  0.341  0.720  0.311  0.00   1.492
   Composite CO  :   10.67  12.07  17.66  15.00  16.23  1.477  1.218  1.389  0.00   14.545
   Composite NOX :    0.701  0.829  1.447  1.152  2.167  0.575  0.896  3.081  0.00   1.303
 ---------------------------------------------------------------------------------------------------------------
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                   *
* Input file: 2009-MID.IN (file 1, run 2).                                     *
*******************************************************************************

* ##########################
* Cape Hatteras 25 mph
* File 1, Run 2, Scenario 1.
* ##########################

* 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
 M615 Comment:
         User supplied VMT mix.
 M583 Warning:
        The user supplied arterial average speed of 25.0
        will be used for all hours of the day.  100% of VMT
        has been assigned to the arterial/collector roadway
        type for all hours of the day and all vehicle types.
 M 48 Warning:
        there are no sales for vehicle class HDGV8b

             Calendar Year:  2009
                    Month:  Jan.
                 Altitude:  Low
          Minimum Temperature:  54.0 (F)
          Maximum Temperature:  70.0 (F)
            Absolute Humidity:  75. grains/lb
             Nominal Fuel RVP:  9.0 psi
               Weathered RVP:  9.0 psi
          Fuel Sulfur Content:  30. 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:  0.0160  0.4040  0.4435          0.0996  0.0000  0.0065  0.0304  0.0000  1.0000
 ---------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    0.830   0.873   1.568   1.237   1.066   0.261   0.546   0.214    0.00   1.178
   Composite CO  :    9.45   10.84   15.89   13.48    9.46   1.043   0.859   0.829    0.00  12.550
   Composite NOX :    0.610   0.726   1.283   1.017   2.366   0.477   0.742   2.533    0.00   1.190
 ---------------------------------------------------------------------------------------------------
```

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-HI.IN (file 1, run 1).                                     *
*******************************************************************************

* ##########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
* ##########################

* 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
 M615 Comment:
        User supplied VMT mix.
 M583 Warning:
       The user supplied arterial average speed of 15.0
       will be used for all hours of the day.  100% of VMT
       has been assigned to the arterial/collector roadway
       type for all hours of the day and all vehicle types.
 M 48 Warning:
        there are no sales for vehicle class HDGV8b

* Reading Ammonia (NH3) Basic Emissiion Rates
* from the external data file PMNH3BER.D

* Reading Ammonia (NH3) Sulfur Deterioration Rates
* from the external data file PMNH3SDR.D

             Calendar Year:  2009
                  Month:  July
               Altitude:  Low
```

```
        Minimum Temperature:  70.0 (F)
        Maximum Temperature:  84.0 (F)
          Absolute Humidity:  75. grains/lb
          Nominal Fuel RVP:  9.0 psi
            Weathered RVP:  8.8 psi
        Fuel Sulfur Content:  30. 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:   0.0160  0.4040  0.4435          0.0996  0.0000  0.0065  0.0304  0.0000  1.0000
 ---------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
   Composite VOC :    1.115   1.142   1.962   1.571   1.618   0.334   0.694   0.300    0.00   1.524
   Composite CO  :     9.03   10.09   14.34   12.32   15.66   1.464   1.182   1.287    0.00  12.189
   Composite NOX :    0.740   0.821   1.376   1.111   1.987   0.554   0.848   2.938    0.00   1.246
 ---------------------------------------------------------------------------------------------------------
*************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                            *
* Input file: 2009-HI.IN (file 1, run 2).                               *
*************************************************************************

* ##########################
* Cape Hatteras 25 mph
* File 1, Run 2, Scenario 1.
* ##########################

* 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
M615 Comment:
User supplied VMT mix.
M583 Warning:
The user supplied arterial average speed of 25.0
will be used for all hours of the day. 100% of VMT
has been assigned to the arterial/collector roadway
type for all hours of the day and all vehicle types.
M 48 Warning:
there are no sales for vehicle class HDGV8b

Calendar Year: 2009
Month: July
Altitude: Low
Minimum Temperature: 70.0 (F)
Maximum Temperature: 84.0 (F)
Absolute Humidity: 75. grains/lb
Nominal Fuel RVP: 9.0 psi
Weathered RVP: 8.8 psi
Fuel Sulfur Content: 30. 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:	0.0160	0.4040	0.4435	0.0996	0.0000	0.0065	0.0304	0.0000	1.0000	

Composite Emission Factors (g/mi):

Composite VOC :	0.869	0.896	1.565	1.246	1.140	0.256	0.527	0.207	0.00	1.193
Composite CO :	7.72	8.80	12.64	10.81	9.13	1.036	0.835	0.768	0.00	10.225
Composite NOX :	0.627	0.714	1.212	0.975	2.170	0.460	0.702	2.415	0.00	1.130

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-LOW.IN (file 1, run 1).                                    *
*******************************************************************************

*#########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
*#########################

                  Calendar Year:  2009
                      Month:  Jan.
          Gasoline Fuel Sulfur Content:  30. ppm
           Diesel Fuel Sulfur Content:  15. 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:  0.0160   0.4040   0.4435           0.0996   0.0000   0.0065   0.0304   0.0000   1.0000
 ---------------------------------------------------------------------------------------------------------
 Composite Emission Factors (g/mi):
          Lead:  0.0000   0.0000   0.0000   0.0000   0.0000   ------   ------   ------   0.0000   0.0000
        GASPM:   0.0040   0.0041   0.0046   0.0043   0.0447   ------   ------   ------   0.0205   0.0082
       ECARBON:  ------   ------   ------   ------   ------   0.0526   0.0292   0.0440   ------   0.0015
       OCARBON:  ------   ------   ------   ------   ------   0.0148   0.0421   0.0458   ------   0.0017
          SO4:   0.0005   0.0006   0.0006   0.0006   0.0012   0.0002   0.0003   0.0005   0.0000   0.0007
 Total Exhaust PM:  0.0045   0.0047   0.0052   0.0050   0.0459   0.0676   0.0716   0.0902   0.0205   0.0121
         Brake:   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0125   0.0000   0.0125
          Tire:   0.0080   0.0080   0.0080   0.0080   0.0080   0.0080   0.0080   0.0080   0.0000   0.0080
      Total PM:   0.0250   0.0252   0.0258   0.0255   0.0664   0.0881   0.0921   0.1108   0.0205   0.0326
          SO2:   0.0067   0.0087   0.0114   0.0101   0.0161   0.0030   0.0056   0.0074   0.0000   0.0106
          NH3:   0.1017   0.1012   0.1000   0.1006   0.0451   0.0068   0.0068   0.0270   0.0000   0.0922
 ---------------------------------------------------------------------------------------------------------
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-LOW.IN (file 1, run 2).                                    *
*******************************************************************************

*#########################
* Cape Hatteras 25 mph
* File 1, Run 2, Scenario 1.
*#########################

                  Calendar Year:  2009
```

Month: Jan.
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 15. 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:	0.0160	0.4040	0.4435	0.0996	0.0000	0.0065	0.0304	0.0000	1.0000	

Composite Emission Factors (g/mi):

Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0041	0.0046	0.0044	0.0446	------	------	------	0.0205	0.0082
ECARBON:	------	------	------	------	------	0.0526	0.0292	0.0440	------	0.0015
OCARBON:	------	------	------	------	------	0.0148	0.0421	0.0458	------	0.0017
SO4:	0.0004	0.0005	0.0006	0.0006	0.0013	0.0002	0.0003	0.0005	0.0000	0.0006
Total Exhaust PM:	0.0044	0.0047	0.0052	0.0049	0.0460	0.0676	0.0716	0.0902	0.0205	0.0121
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0000	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0000	0.0080
Total PM:	0.0250	0.0252	0.0258	0.0255	0.0665	0.0881	0.0921	0.1108	0.0205	0.0326
SO2:	0.0068	0.0088	0.0114	0.0102	0.0161	0.0030	0.0056	0.0074	0.0000	0.0106
NH3:	0.1017	0.1012	0.1000	0.1006	0.0451	0.0068	0.0068	0.0270	0.0000	0.0922

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-MID.IN (file 1, run 1).                                    *
*******************************************************************************

*##########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
*##########################

                  Calendar Year: 2009
                      Month: Jan.
          Gasoline Fuel Sulfur Content:  30. ppm
           Diesel Fuel Sulfur Content:  15. 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:  0.0160  0.4040  0.4435          0.0996  0.0000  0.0065  0.0304  0.0000  1.0000
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
         Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
       GASPM:  0.0040  0.0041  0.0046  0.0043  0.0447  ------  ------  ------  0.0205  0.0082
      ECARBON:  ------  ------  ------  ------  ------  0.0526  0.0292  0.0440  ------  0.0015
      OCARBON:  ------  ------  ------  ------  ------  0.0148  0.0421  0.0458  ------  0.0017
         SO4:  0.0005  0.0006  0.0006  0.0006  0.0012  0.0002  0.0003  0.0005  0.0000  0.0007
 Total Exhaust PM:  0.0045  0.0047  0.0052  0.0050  0.0459  0.0676  0.0716  0.0902  0.0205  0.0121
       Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0000  0.0125
        Tire:  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0000  0.0080
    Total PM:  0.0250  0.0252  0.0258  0.0255  0.0664  0.0881  0.0921  0.1108  0.0205  0.0326
         SO2:  0.0067  0.0087  0.0114  0.0101  0.0161  0.0030  0.0056  0.0074  0.0000  0.0106
         NH3:  0.1017  0.1012  0.1000  0.1006  0.0451  0.0068  0.0068  0.0270  0.0000  0.0922
-------------------------------------------------------------------------------------------------------------
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-MID.IN (file 1, run 2).                                    *
*******************************************************************************

*##########################
* Cape Hatteras 25 mph
* File 1, Run 2, Scenario 1.
*##########################

                  Calendar Year: 2009
```

Month: Jan.
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 15. 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:	0.0160	0.4040	0.4435		0.0996	0.0000	0.0065	0.0304	0.0000	1.0000

Composite Emission Factors (g/mi):

Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0041	0.0046	0.0044	0.0446	------	------	------	0.0205	0.0082
ECARBON:	------	------	------	------	------	0.0526	0.0292	0.0440	------	0.0015
OCARBON:	------	------	------	------	------	0.0148	0.0421	0.0458	------	0.0017
SO4:	0.0004	0.0005	0.0006	0.0006	0.0013	0.0002	0.0003	0.0005	0.0000	0.0006
Total Exhaust PM:	0.0044	0.0047	0.0052	0.0049	0.0460	0.0676	0.0716	0.0902	0.0205	0.0121
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0000	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0000	0.0080
Total PM:	0.0250	0.0252	0.0258	0.0255	0.0665	0.0881	0.0921	0.1108	0.0205	0.0326
SO2:	0.0068	0.0088	0.0114	0.0102	0.0161	0.0030	0.0056	0.0074	0.0000	0.0106
NH3:	0.1017	0.1012	0.1000	0.1006	0.0451	0.0068	0.0068	0.0270	0.0000	0.0922

```
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-HI.IN (file 1, run 1).                                     *
*******************************************************************************

*##########################
* Cape Hatteras 15 mph
* File 1, Run 1, Scenario 1.
*##########################

                Calendar Year: 2009
                    Month: July
        Gasoline Fuel Sulfur Content:  30. ppm
         Diesel Fuel Sulfur Content:  15. 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:  0.0160  0.4040  0.4435          0.0996  0.0000  0.0065  0.0304  0.0000  1.0000
-------------------------------------------------------------------------------------------------------------
Composite Emission Factors (g/mi):
        Lead:  0.0000  0.0000  0.0000  0.0000  0.0000  ------  ------  ------  0.0000  0.0000
      GASPM:  0.0040  0.0040  0.0045  0.0043  0.0419  ------  ------  ------  0.0205  0.0079
     ECARBON:  ------  ------  ------  ------  ------  0.0503  0.0273  0.0404  ------  0.0014
     OCARBON:  ------  ------  ------  ------  ------  0.0142  0.0393  0.0421  ------  0.0015
        SO4:  0.0005  0.0006  0.0006  0.0006  0.0012  0.0002  0.0003  0.0005  0.0000  0.0007
 Total Exhaust PM:  0.0045  0.0046  0.0052  0.0049  0.0431  0.0647  0.0670  0.0831  0.0205  0.0115
      Brake:  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0125  0.0000  0.0125
       Tire:  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0080  0.0000  0.0080
   Total PM:  0.0250  0.0252  0.0257  0.0255  0.0636  0.0852  0.0875  0.1036  0.0205  0.0320
        SO2:  0.0067  0.0087  0.0114  0.0101  0.0161  0.0030  0.0056  0.0074  0.0000  0.0106
        NH3:  0.1017  0.1012  0.1001  0.1007  0.0451  0.0068  0.0068  0.0270  0.0000  0.0923
-------------------------------------------------------------------------------------------------------------
*******************************************************************************
* MOBILE6.2.03 (24-Sep-2003)                                                  *
* Input file: 2009-HI.IN (file 1, run 2).                                     *
*******************************************************************************

*##########################
* Cape Hatteras 25 mph
* File 1, Run 2, Scenario 1.
*##########################

                Calendar Year: 2009
```

Month: July
Gasoline Fuel Sulfur Content: 30. ppm
Diesel Fuel Sulfur Content: 15. 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:	0.0160	0.4040	0.4435		0.0996	0.0000	0.0065	0.0304	0.0000	1.0000

Composite Emission Factors (g/mi):

Lead:	0.0000	0.0000	0.0000	0.0000	0.0000	------	------	------	0.0000	0.0000
GASPM:	0.0040	0.0041	0.0046	0.0043	0.0418	------	------	------	0.0205	0.0079
ECARBON:	------	------	------	------	------	0.0503	0.0273	0.0404	------	0.0014
OCARBON:	------	------	------	------	------	0.0142	0.0393	0.0421	------	0.0015
SO4:	0.0004	0.0005	0.0006	0.0006	0.0014	0.0002	0.0003	0.0005	0.0000	0.0006
Total Exhaust PM:	0.0044	0.0046	0.0051	0.0049	0.0432	0.0647	0.0670	0.0831	0.0205	0.0115
Brake:	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0000	0.0125
Tire:	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0000	0.0080
Total PM:	0.0250	0.0252	0.0257	0.0254	0.0637	0.0852	0.0875	0.1036	0.0205	0.0320
SO2:	0.0068	0.0088	0.0114	0.0102	0.0161	0.0030	0.0056	0.0074	0.0000	0.0106
NH3:	0.1017	0.1012	0.1001	0.1007	0.0451	0.0068	0.0068	0.0270	0.0000	0.0923

Sundar, Danielle

CAHA # 1739

From: Fox, Lori
Sent: Monday, October 26, 2009 10:15 AM
To: Sundar, Danielle
Subject: FW: Paragraph for CAHA
Attachments: chapter1_AQv.2.doc; chapter1_AQ.doc; DRAFT CAHA Report_ascomments.doc

Categories: Projects/ CAHA

For CAHA admin...

Lori Fox
Deputy Director, Denver Operations/Senior Planner

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-----Original Message-----
From: Sandra_Hamilton@nps.gov [mailto:Sandra_Hamilton@nps.gov]
Sent: Thursday, October 15, 2009 3:57 PM
To: Fox, Lori
Subject: Fw: Paragraph for CAHA

Sandy Hamilton
Environmental Protection Specialist
National Park Service - Environmental Quality Division Academy Place P.O. Box 25287 Denver CO 80225
PH: (303) 969-2068
FAX: (303) 987-6782
----- Forwarded by Sandra Hamilton/DENVER/NPS on 10/15/2009 03:56 PM -----

Sandra Hamilton/DENVER/NPS
10/15/2009 03:56 PM

To Andrea Stacy/DENVER/NPS
cc
Subject

Re: Paragraph for CAHA(Document link: Sandra Hamilton)

Hi Andrea

Sorry if you're getting this twice. It disappeared somewhere a minute ago so I''m rewriting it.
Looks good. Thank you. See if my two suggestions are OK and let me and Lori know.
(See attached file: chapter1_AQv.2.doc)
Sandy

Sandy Hamilton
Environmental Protection Specialist
National Park Service - Environmental Quality Division Academy Place P.O. Box 25287 Denver CO 80225
PH: (303) 969-2068
FAX: (303) 987-6782

Andrea
Stacy/DENVER/NPS

10/15/2009 02:33 PM

To: Sandra Hamilton/DENVER/NPS@NPS
cc:
Subject: Paragraph for CAHA

Okay - I've rewritten it. I think it still needs work, but I wanted to get you something before we both leave today. Let me know if anything in here causes concern or if it doesn't make sense. We can put more explanation in this section, but I'm wavering on whether more is less . . . in other words, I'm afraid too much info will get confusing, but I don't want to omit too much either. For instance, I left a discussion of CO emiss. out.
What do you think?

I'm still waiting on the final report from James Wu. I've attached a copy with my comments - as you can see, there aren't very many, so the final will probably look similar to this. I'll send the final as soon as I get it.

(See attached file: chapter1_AQ.doc)(See attached file: DRAFT CAHA

Report_ascomments.doc)

Andrea Stacy
National Park Service
Air Resources Division
12795 W. Alameda Pkwy
P.O. Box 25287
Denver, CO 80225
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303-969-2816 (phone)
303-969-2822 (Fax)

Air Quality: Currently, Cape Hatteras National Seashore is located in an area classified by the U.S. Environmental Protection Agency (EPA) as being in attainment for all six criteria air pollutants. Activities associated with ORV use (driving, idling engines) result in the emission of criteria air pollutants; the pollutants of most concern for this project include nitrogen oxides (NOx), volatile organic compounds (VOCs) and Particulate Matter (PM). For this reason, the NPS completed a modeling analysis to quantify the magnitude of annual emissions associated with ORV activities at Cape Hatteras National Seashore, and utilized these results to determine whether additional air quality modeling was necessary to estimate downwind pollutant concentrations and associated impacts.

Comment [a1]: Technically, these areas are "unclassifiable" because the section 107 areas don't contain monitors, but for all intensive purposes, they are in "attainment".

Emission factor estimates were computed using the current EPA recommended model for mobile source emissions, the EPA-developed Mobile Source Emissions Model (MOBILE6) and ORV data specific to the Seashore. The results of this analysis show that for the current average vehicle use patterns on the Seashore, emissions of VOCs, NOx and PM are all individually below 5 tons per year (TPY). Emissions for these pollutants associated with the upper bound estimates for ORV use patterns (i.e. the highest estimates of observed ORV use anticipated to occur park-wide on an annual basis under any of the alternatives), are just above 5 TPY, but all below 7 TPY. Given these low annual emission levels[1], daily pollutant concentrations resulting from ORV use are anticipated to be extremely low. Accordingly, it was determined that implementation of the ORV management plan would result in negligible air quality impacts, and air quality was dismissed from further analysis and discussion. ~~For more information on t~~The MOBILE6 modeling results and report~~, please see Appendix ???~~. are available on the ORV Management Plan/EIS project PEPC website at http://parkplanning.nps.gov/CAHA.

[1] For reference, EPA's threshold for determining a "Major Stationary Source" is 250 tons per year for any criteria pollutant, or 100 tons per year for source categories specifically listed in the clean air act. North Carolina Division of Air Quality (NC DAQ) considers any stationary source below this level to be a "minor source". Individual mobile vehicles are exempt from North Carolina permitting requirements. Again, for reference, NC DAQ exempts any minor stationary source below 5 TPY for any pollutant from all permitting and reporting requirements.

Air Quality: Currently, Cape Hatteras National Seashore is located in an area classified by the U.S. Environmental Protection Agency (EPA) as being in attainment for all six criteria air pollutants. Activities associated with ORV use (driving, idling engines) result in the emission of criteria air pollutants; the pollutants of most concern for this project include nitrogen oxides (NOx), volatile organic compounds (VOCs) and Particulate Matter (PM). For this reason, the NPS completed a modeling analysis to quantify the magnitude of annual emissions associated with ORV activities at Cape Hatteras National Seashore, and utilized these results to determine whether additional air quality modeling was necessary to estimate downwind pollutant concentrations and associated impacts.

Comment [a1]: Technically, these areas are "unclassifiable" because the section 107 areas don't contain monitors, but for all intensive purposes, they are in "attainment"

Emission factor estimates were computed using the current EPA recommended model for mobile source emissions, the EPA-developed Mobile Source Emissions Model (MOBILE6) and ORV data specific to the Seashore. The results of this analysis show that for the current average vehicle use patterns on the Seashore, emissions of VOCs, NOx and PM are all individually below 5 tons per year (TPY). Emissions for these pollutants associated with the upper bound estimates for ORV use patterns (i.e. the highest estimates of observed ORV use anticipated to occur park-wide on an annual basis), are just above 5 TPY, but all below 7 TPY. Given these low annual emission levels[1], daily pollutant concentrations resulting from ORV use are anticipated to be extremely low. Accordingly, it was determined that implementation of the ORV management plan would result in negligible air quality impacts, and air quality was dismissed from further analysis and discussion. For more information on the MOBILE6 modeling results and report, please see Appendix ???.

[1] For reference, EPA's threshold for determining a "Major Stationary Source" is 250 tons per year for any criteria pollutant, or 100 tons per year for source categories specifically listed in the clean air act. North Carolina Division of Air Quality (NC DAQ) considers any stationary source below this level to be a "minor source". Individual mobile vehicles are exempt from North Carolina permitting requirements. Again, for reference, NC DAQ exempts any minor stationary source below 5 TPY for any pollutant from all permitting and reporting requirements.

DRAFT Air Quality Modeling Report
Cape Hatteras National Seashore

1.0 Introduction

In support of the Off-Road Vehicle Negotiated Rulemaking and Management Plan/Draft Environmental Impact Statement (DEIS) for the Cape Hatteras National Seashore (CAHA), Air Resource Specialists, Inc. (ARS) completed air emissions modeling to quantify emissions from off-road vehicle (ORV) use in the park. ORV visitation, fleet characteristics, and other information were provided by National Park Service (NPS) and their contractor, RTI, to ARS and are included in the Appendices.

For this study of ORV use emissions, annual emission estimates for criteria pollutants (carbon monoxide (CO), particulate matter (PM_{10} and $PM_{2.5}$), and nitrogen oxides (NO_x)), and hydrocarbons (HC) were calculated. The methodology employed for this study is discussed in the following sections.

2.0 Pollutants

Carbon monoxide (CO), a colorless, odorless, and poisonous gas, is produced in locations with motor vehicles, primarily by the incomplete combustion of gasoline and other fossil fuels. Health effects include impairment of the central nervous system, particularly on people with heart disease. CO also interferes with the transport of oxygen in the blood. In the vicinity of roadways, the majority, if not all, CO emissions are from motor vehicles. CO concentrations can vary greatly over relatively short distances. Elevated concentrations are usually limited to locations near crowded intersections, typically along heavily traveled and congested roadways. This analysis estimated CO emissions from ORV use within the park.

Particulate matter (PM_{10} and $PM_{2.5}$) is emitted into the atmosphere from a variety of sources: industrial facilities, power plants, construction activity, etc. Gasoline powered vehicles typically do not produce any significant quantities of particulate emissions. Although less relevant to this study, diesel-powered vehicles, especially heavy trucks and buses, also emit particulates, and particulate concentrations may be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. This analysis estimated particulate (PM_{10} and $PM_{2.5}$) emissions from ORV use within the park.

Hydrocarbon (HC) emissions from motor vehicles can result from partially-burned fuel emitted through the tailpipe and from fuel evaporations from the crankcase, carburetor and gas tank. Hydrocarbons are also released from gasoline fuel vapor when vehicles are re-fueled at gas stations and when bulk storage tanks are refilled. When exposed to sunlight, hydrocarbons or volatile organic compounds (VOCs) contribute to formation of harmful ground level ozone, also known as smog. For the purposes of this study, hydrocarbons may also be expressed as VOCs, which include air toxins or

hazardous air pollutants (HAPs). This analysis estimated VOC emissions from ORV use within the park.

Nitrogen oxides (NO_x), are typically of principal concern because of their role as precursors in the formation of photochemical oxidants, such as ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. NO_x also contributes to atmospheric particles, and can cause respiratory problems and visibility impairment. NO_x emissions from mobile sources and the pollutants formed from NO_x can be transported over long distances, so they are generally examined on a regional basis and are assessed in this study.

3.0 MOBILE6 Emission Factors

To estimate annual ORV use emissions (CO, PM, NO_x and VOC), vehicle emission factors were necessary. Emission factor estimates were computed using the current EPA recommended model for mobile source emissions, the EPA--developed Mobile Source Emissions Model (MOBILE6), for up to six (6) classes of motor vehicles: light-duty vehicles (LDV), light-duty trucks (LDT1, LDT2, LDT3 and LDT4); and heavy-duty vehicles (HDV2B).

MOBILE6 emission factors were prepared to account for low altitude, assumed no Inspection and Maintenance (I&M) programs, conventional gasoline east, and local inputs such as maximum and minimum temperatures, varying by season modeled, and fuel parameters, etc. (e.g., fuel volatility). NPS provided vehicle classification data (Appendix A), and national default vehicle age distributions were used. The model's default settings were used to determine diesel fractions for the vehicle classes estimated. Emission factors for ORV use were determined for average travel speeds of 15mph and 25mph, representing ~~the~~the speed limit proposed under Alternative x and the current speed limit, respectively. ~~slower traveling speeds on the beach~~.

Composite emission factors for ORV use were determined for the ~~no action~~ (baseline) year of 2009, based on the parameters discussed above and are included in Appendix B. MOBILE6 input and output files are included as Appendix C.

4.0 ORV Traffic Data

Traffic data for the air quality analysis were derived from counting surveys of ORV use in the park and other vehicle travel assumptions and information provided to ARS by NPS (Appendix A). This data included mean estimates of daily ORV trips in the park for weekdays and weekends, for three seasons: low season, mid season, and high season. ARS converted these estimates to weekly values for each season and utilized the mean and upper bound values for input to the emission inventory calculations. In addition, NPS provided a park-wide estimate of six (6) miles as the distance (round-trip) the average ORV visitor travels on the beach.

5.0 Emissions Inventory

An emissions inventory of ORV use in CAHA was completed, based on 2009 traffic data and other information (included in the appendices). Estimates were prepared for criteria pollutants (CO, PM, and NOx) and VOC. The range of total potential annual emissions due to ORV activity in the park in tons per year are shown in Table 5-1, for the two (2) modeled speeds, along with employing both the mean and upper bound ORV estimates. Detailed calculations for the emission inventory are included in Appendix B. For this analysis, all PM_{10} was conservatively assumed to ~~be~~ also be $PM_{2.5}$ emissions.

Table 5-1
Park-wide Total Annual ORV Emissions (Tons per Year)

Speed	Description	CO	VOC	NOx	PM
15 mph	Mean ORV Estimates	36.1	3.9	3.3	0.1
15 mph	Upper Bound ORV Estimates	63.3	6.7	5.7	0.1
25 mph	Mean ORV Estimates	30.8	3.1	3.0	0.1
25 mph	Upper Bound ORV Estimates	54.2	5.3	5.2	0.1
Note: PM as $PM_{10}/PM_{2.5}$					