Marine and Land-Based Mobile Source Emission Estimates for 50-Foot Deepening Project

for

The Port Authority of New York & New Jersey

Under Contract with Killam Associates

Rev. 3 Jan 2002
10 Sept 2001

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REVISION TO ORIGINAL DOCUMENT
3 JANUARY 2002

INTRODUCTION

In a continuing Quality Assurance review of the final document and its assumptions, it was determined that there was a unit conversion equation error that affected the emission estimates associated with all marine vessel emission sources. This error has been corrected and all affected emission estimates have been revised in this re-release of the final report. The nature of the revision and the pages affected by this revision are provided below.

This revision lowered the marine source emission estimates associated with the project by 44%. This revised re-released report represents the most accurate presentation of emission data for the Harbor Navigation Project. An updated Table of Contents was also added.

REVISION

Unit conversion equation changed from:

(g/kW-hr x 1.341 kW-hr/hp-hr) / 453.59 g/lb

to:

(g/kW-hr / 1.341hp-hr/kW-hr) / 453.59 g/lb

PAGES AFFECTED:

Page 3 – Summary 2005 & 2007 Table
Page 4 – Summary Emissions Table
Page 9 – Marine Emission Factors Table
Page 11 – Daily Emission Calculation Tables
Page 12 – Transit Emission Rates Table
Appendix A

NOTICE OF ASSUMPTIONS USED IN THIS DOCUMENT

- All marine emissions do not take into account any fleet turnover, marine engine rule, nor any other emission reductions in out years and therefore should be considered base-case.
- All nonroad land-based equipment associated with the upland facilities is assumed to meet Tier 1 EPA nonroad engine standards. The nonroad modeling in the out years assumes no turnover or newer standard engines such as Tier 2 or 3 nor any other emission reductions in out years and therefore should be considered base-case.
- Railroad emissions are based on Tier 0 engines and are not adjusted in the out years. Railroad operational data are assumed with correlation from local knowledgeable industry personnel.
- Dredge volumes, percent volume by dredge type, and dredge type per soil type are based on ACOE data

KEY ITEMS THAT HAVE A POTENTIAL FOR EMISSION REDUCTIONS THAT HAVE NOT BEEN TAKEN INTO ACCOUNT

- Dredge material volumes for the Ambrose Channel outside the 3 mile off shore limit.
- Dredge material volumes for the Ambrose Channel associated with currently planned New Jersey sand mining projects, not part of the proposed action.
- Dredge material volumes for the Ambrose Channel associated with the potential of New York sand mining projects, not part of the proposed action.

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SUMMARY RESULTS

The projected emissions for volatile organic compounds (VOC), nitrogen oxides (NOx), and carbon monoxide (CO) for the years 2005 and 2007 are provided below in tons per year (tpy).

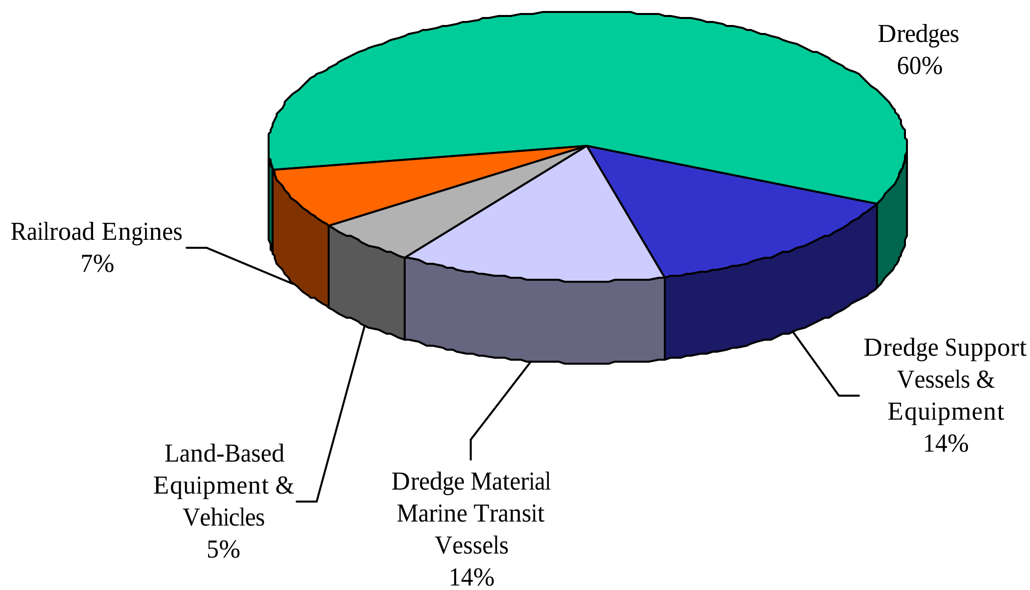
Pollutant	General Conformity Trigger Levels	2005	2007
VOC	25	15.73	12.11
NOx	25	542.80	359.71
CO	100	138.01	90.22

Note: Ozone precursors are VOC and NOx; Ozone General Conformity trigger level of 25 tpy is for VOC or NOx

The table presented on the next page provides the estimated base case summary emission results from the potential dredging operations required by the compressed schedule for the 50-foot deepening project. The emission estimates are considered base case because only those emission reduction rules that are currently promulgated are included. Therefore, the base case emissions will generally overstate the potential emissions impacts and thus provide a conservatively high estimate. In addition, there are no mitigation measures assumed in the base case estimates. Potential emission reduction measures will be provided in a separate document.

As presented in the below figure, it is clear that the dredges contribute nearly two-thirds of the nonroad NOx emissions over the entire project (from 2003 to 2016). Note employee vehicle emissions are not included in the below figure as estimates for this source type are only for the years 2005 (rate of progress year) and 2007 (attainment date).

Estimated Base Case Nonroad Total Project NOx Emission Contribution by Source Type



Detailed dredge emission estimates by channel and soil type are provided in Appendix A.

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Summary Emissions

Emissions	Emissions (tons) 2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
VOC																
Dredge Material Marine Transit Vessels	0.00	0.95	1.76	**1.70**	1.57	**0.89**	1.09	0.98	0.98	0.74	0.74	0.22	0.21	0.16	0.12	0.00
Dredge & Support Vessels	0.00	2.70	9.24	**8.64**	8.43	**5.54**	7.67	6.83	6.83	3.73	3.73	1.12	1.06	0.81	0.53	0.00
Railroad Engines	0.00	0.56	2.86	**1.80**	1.80	**2.67**	2.69	2.69	2.69	1.42	1.42	0.26	0.23	0.10	0.06	0.00
Employee Vehicles[1]	-	-	-	**2.48**	-	**1.26**	-	-	-	-	-	-	-	-	-	-
Land-Based Equipment & Vehicles	0.00	0.36	1.87	**1.18**	1.18	**1.75**	1.76	1.76	1.76	0.93	0.93	0.17	0.15	0.07	0.04	0.00
Total	**0.00**	**4.58**	**15.73**	**15.79**	**12.98**	**12.11**	**13.21**	**12.25**	**12.25**	**6.82**	**6.82**	**1.78**	**1.65**	**1.13**	**0.74**	**0.00**
(tpd)	***0.00***	***0.01***	***0.04***	***0.04***	***0.04***	***0.03***	***0.04***	***0.03***	***0.03***	***0.02***	***0.02***	***0.00***	***0.00***	***0.00***	***0.00***	***0.00***
NOx																
Dredge Material Marine Transit Vessels	0.00	44.04	81.76	**78.68**	72.88	**41.12**	50.67	45.20	45.20	34.30	34.30	10.36	9.90	7.28	5.58	0.00
Dredge & Support Vessels	0.00	148.86	442.69	**415.45**	401.41	**249.08**	344.28	306.27	306.27	167.14	167.14	50.16	47.14	36.08	23.54	0.00
Railroad Engines	0.00	8.17	41.84	**26.35**	26.35	**39.13**	39.39	39.39	39.39	20.81	20.81	3.79	3.34	1.49	0.82	0.00
Employee Vehicles[1]	-	-	-	**2.84**	-	**1.44**	-	-	-	-	-	-	-	-	-	-
Land-Based Equipment & Vehicles	0.00	6.05	30.95	**19.49**	19.49	**28.94**	29.13	29.13	29.13	15.39	15.39	2.80	2.47	1.10	0.60	0.00
Total	**0.00**	**207.12**	**597.24**	**542.80**	**520.12**	**359.71**	**463.47**	**420.00**	**420.00**	**237.64**	**237.64**	**67.11**	**62.86**	**45.94**	**30.54**	**0.00**
(tpd)	***0.00***	***0.57***	***1.64***	***1.49***	***1.42***	***0.99***	***1.27***	***1.15***	***1.15***	***0.65***	***0.65***	***0.18***	***0.17***	***0.13***	***0.08***	***0.00***
CO																
Dredge Material Marine Transit Vessels	0.00	8.47	15.71	**15.12**	14.01	**7.90**	9.74	8.68	8.68	6.59	6.59	1.99	1.90	1.40	1.07	0.00
Dredge & Support Vessels	0.00	28.06	83.84	**78.67**	76.04	**47.28**	65.34	58.10	58.10	31.69	31.69	9.50	8.92	6.83	4.45	0.00
Railroad Engines	0.00	1.21	6.17	**3.89**	3.89	**5.77**	5.81	5.81	5.81	3.07	3.07	0.56	0.49	0.22	0.12	0.00
Employee Vehicles[1]	-	-	-	**32.33**	-	**17.38**	-	-	-	-	-	-	-	-	-	-
Land-Based Equipment & Vehicles	0.00	2.48	12.71	**8.00**	8.00	**11.89**	11.96	11.96	11.96	6.32	6.32	1.15	1.02	0.45	0.25	0.00
Total	**0.00**	**40.22**	**118.43**	**138.01**	**101.94**	**90.22**	**92.85**	**84.56**	**84.56**	**47.67**	**47.67**	**13.20**	**12.34**	**8.90**	**5.89**	**0.00**
(tpd)	***0.00***	***0.11***	***0.32***	***0.38***	***0.28***	***0.25***	***0.25***	***0.23***	***0.23***	***0.13***	***0.13***	***0.04***	***0.03***	***0.02***	***0.02***	***0.00***
PM10																
Dredge Material Marine Transit Vessels	0.00	1.90	3.71	**3.56**	3.32	**1.97**	2.43	2.17	2.17	1.65	1.65	0.50	0.48	0.35	0.27	0.00
Dredge & Support Vessels	0.00	6.64	19.83	**18.60**	17.97	**11.18**	15.47	13.80	13.80	7.55	7.55	2.28	2.15	1.64	1.08	0.00
Railroad Engines	0.00	0.30	1.52	**0.96**	0.96	**1.42**	1.43	1.43	1.43	0.76	0.76	0.14	0.12	0.05	0.03	0.00
Land-Based Equipment & Vehicles	0.00	0.35	1.78	**1.12**	1.12	**1.67**	1.68	1.68	1.68	0.89	0.89	0.16	0.14	0.06	0.03	0.00
Total	**0.00**	**9.18**	**26.84**	**24.24**	**23.37**	**16.25**	**21.01**	**19.08**	**19.08**	**10.84**	**10.84**	**3.08**	**2.89**	**2.11**	**1.41**	**0.00**
(tpd)	***0.00***	***0.03***	***0.07***	***0.07***	***0.06***	***0.04***	***0.06***	***0.05***	***0.05***	***0.03***	***0.03***	***0.01***	***0.01***	***0.01***	***0.00***	***0.00***

Note: 1) Employee vehicle emission estimates were provided by AKRF, Inc.

Rev. 1/3/02

INTRODUCTION

Starcrest Consulting Group, LLC (Starcrest) has developed an estimate of emissions associated with the potential dredging activities proposed for the 50-foot deepening project within seven channels of the New York-New Jersey Harbor (NYNJH). The purpose of this study are to develop potential project related uncontrolled direct and indirect emission estimates based on the best available planning information and emission factors/estimating procedures currently available. Uncontrolled means that the emissions are estimated using only those regulations that are currently promulgated and do not take into account any proposed regulation, emission technology, or change in operational activities.

The 50-foot deepening project would involve the dredging of over 50 million cubic yards of material for the deepening of seven channels within the NYNJH system. Dredging activities are proposed for the following channels:

- Ambrose
- Anchorage
- Kill Van Kull
- Newark Bay
- Arthur Kill
- Port Jersey
- Bay Ridge

Emission estimates are calculated for the following pollutants: volatile organic compounds (VOCs), nitrogen oxides (NOx), and carbon monoxide (CO), and particulate matter less than 10 microns (PM-10).

MATERIAL TYPES

The US Army Corps of Engineers (ACOE) provided their detailed schedule of annual dredge material volume projections for each channel based on the type of material within each channel. The types of materials are described in the following table:

Material Type	Description
Type A	Sandy HARS Material: Potentially suitable for HARS, habitat restoration/creation, beach nourishment, construction aggregate, etc.
Type C	Glacial Till/Mixed HARS Suitable Material: Potentially suitable for HARS remediation or other beneficial uses.
Type D	Stiff Clay HARS Material: Potentially suitable for HARS, fill for habitat, restoration/creation, land remediation (e.g., landfill cover), etc.
Type E	Rock Material: Potentially suitable for fish reef creation or construction material.
Type F	Non-Ocean Placement Material: Potentially suitable for inshore placement in subaqueous pits, fill for habitat restoration/creation, land remediation or construction material.

DREDGE MATERIAL FLOW

The dredge material flow for the project was developed with the assistance of the Port Authority of New York & New Jersey (PANYNJ), the ACOE, and conversations with those dredging companies most familiar with the conditions in the NYNJH.

The flow chart on the next page presents the dredge material flow and associated volumes for the project.

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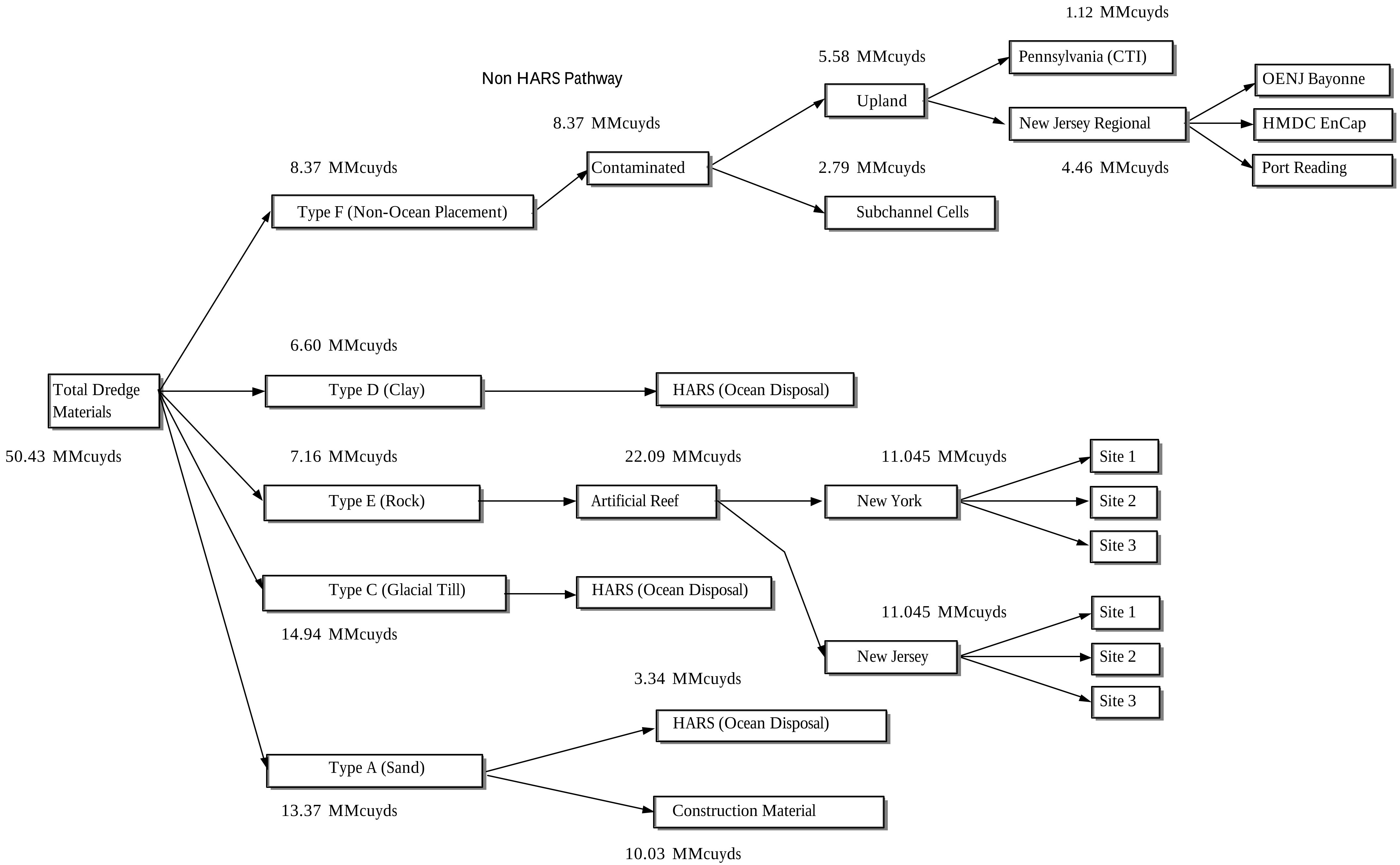
Dredge Material Flow Chart



SOURCE TYPES

There are two categories of emission sources for the proposed project: marine and land-based sources.

The marine sources include:

- Dredges
- Tenders (Pushboats)
- Crewboats
- Blast Barges
- Dredge Material Transports (Towboats Moving Scows)

The land-based are broken into two categories, nonroad and onroad and include:

Nonroad

- Rail
- Excavators
- Material Transport Trucks/Haulers
- Loaders
- Compressors
- Material Handlers

Onroad:

- Employee Vehicles (AKRF, Inc)

AKRF, Inc. evaluated and estimated employee vehicle regional emissions are included in Appendix B. Killam and AKRF, Inc. are also evaluating localized CO impacts are provided in Appendix C.

The interaction between the emission sources is presented in the flow chart on the following page.

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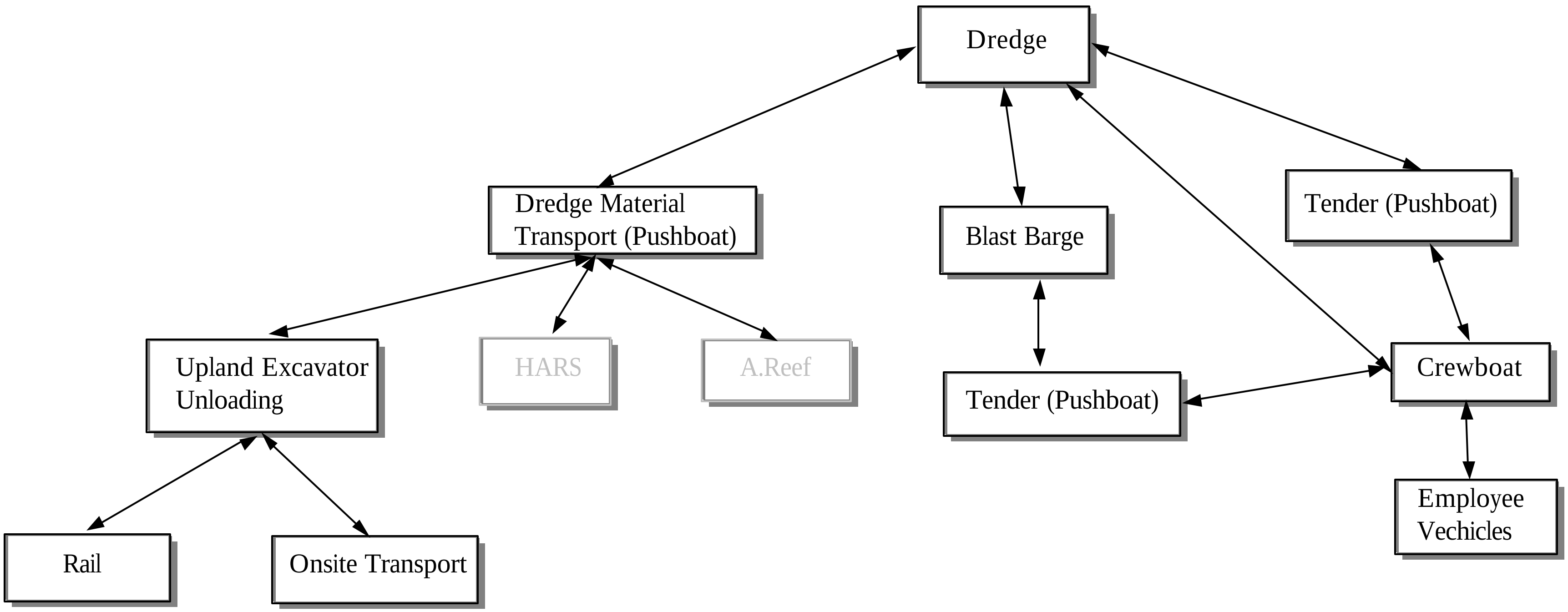
Emission Sources Evaluated



Note: Employee vehicles emission estimates were developed by AKRF, Inc.

MARINE SOURCES

The follow sections detail how the potential marine emissions associated with the 50-foot deepening project were estimated.

AVERAGE VESSEL PROFILE

In obtaining information for this study, emphasis was placed on conducting personal interviews with individuals having specific knowledge of the activities and/or equipment contributing to emissions associated with the proposed project. Dredge owners and operators from five dredging companies that are familiar with the NYNJH system were interviewed to determine the physical and operational characteristics of their dredging operations, such as operational schedules, support operations, engine and generator capacities, vessel speeds, and general dredging characteristics for a large-scale project. Information obtained from the dredging contractors was then averaged to determine representative values for each of the emission sources used in the calculations. A summary of the average vessel data is presented in the following table.

	Average Operational Engine Power						Average Operational Schedule		
Type	Auxiliary		Main Engine		Compressors		Auxiliary	Main Engine	Compressors
	hp	LF	hp	LF	hp	LF	hrs/day	hrs/day	hrs/day
Clamshell D/E	390	0.40	1,920	0.56	N/A	N/A	24	18	N/A
Excavator D/H	350	0.40	3,000	0.50	N/A	N/A	24	18	N/A
Hopper	850	0.40	4,300	0.5	N/A	N/A	24	8	8
Tender (Pushboat)	35	0.40	1,131	0.68	N/A	N/A	24	5	N/A
Crew Boat	N/A	N/A	425	0.50	N/A	N/A	24	9	N/A
Blast Barge	275	0.40	N/A	N/A	220	0.5	24	N/A	13
Upland Towboat	50	0.40	1,970	0.60	N/A	N/A	24	N/A	N/A
Ocean Towboat	50	0.40	3,500	0.60	N/A	N/A	24	N/A	N/A

Note: D/E – Diesel Electric D/H – Diesel Hydraulic LF – Load Factor hp – horsepower hrs – hours N/A – Not Applicable. LF represents the average percentage of rated horsepower used during a source's operational profile.

The average production rates by each dredge and material type are provided below.

	Dredge Material Type Average Production Rates (cuyd/day)				
Dredge Type	A	C	D	E	F
Clamshell	5,570	2,440	8,500	1,660	5,403
Excavator	6,500	5,000	5,750	5,000	4,000
Hopper	16,500	-	-	-	-

Dredging material storage prior to transit from the dredge bcation is accomplished by the use of either a hopper dredge or by an upland or ocean towboat towing/pushing a scow. There are two different types of scow, coastal (upland) and ocean; the difference being ocean scows have a greater material capacity.

Type	Material Capacity Cubic Yards	Average Speed (knots)
Hopper Dredge	3,500	10.5
Upland Scow	4,075	6.4
Ocean Scow	5,667	11.2

MARINE ENGINE EMISSION FACTORS

The emission factors for marine engines are provided below.

Pollutant	Engine Type	Emission Factors (g/kW-hr)	(lbs/hp-hr)	(tons/hp-hr)
VOC	Marine Propulsion	0.10	1.64E-04	8.22E-08
	Clamshell and Excavator Power	0.28	4.60E-04	2.30E-07
	Pushboat Propulsion, & Compressor	0.28	4.60E-04	2.30E-07
	Auxiliary	0.28	4.60E-04	2.30E-07
NOx	Marine Propulsion	13.36	0.022	1.10E-05
	Clamshell and Excavator Power	13.00	0.021	1.07E-05
	Pushboat Propulsion & Compressor	13.00	0.021	1.07E-05
	Auxiliary	10.00	0.016	8.22E-06
CO	Marine Propulsion	2.48	0.004	2.04E-06
	Clamshell and Excavator Power	2.50	0.004	2.06E-06
	Pushboat Propulsion & Compressor	2.50	0.004	2.06E-06
	Auxiliary	1.70	0.003	1.40E-06
PM10	Marine Propulsion	0.32	5.26E-04	2.63E-07
	Clamshell and Excavator Power	0.30	4.93E-04	2.47E-07
	Pushboat Propulsion & Compressor	0.30	4.93E-04	2.47E-07
	Auxiliary	0.40	6.58E-04	3.29E-07

Note: Pushboat Propulsion includes Dredge Tenders, Upland Towboats, & Open Towboats

Reference: EPA 199b, "Final Regulatory Impact Analysis: Control of Emissions from Compression Ignition Marine Engines" EPA420-R-99-026

ENGINE EMISSIONS

Engine emissions are calculated using the following equations:

Engine Emissions (Daily) = Engine Rating (hp) x LF x Average Daily Operation Hours x EF (tons/hp-hr)

Engine Emission (Hourly) = Engine Rating (hp) x LF x 1 hr x EF (tons/hp-hr)

DREDGING EMISSIONS BY MATERIAL TYPE

Dredge work group and support vessel configurations varied by material type. The following dredge vessel configurations were identified from interviews with dredging companies:

Material Type	Work Group Configurations
Type A	Hopper Dredge, Crew Boat
Type C, D, F	Clamshell, Tender (Pushboat), Crew Boat, Upland Towboat Excavator, Tender (Pushboat), Crew Boat, Upland Towboat
Type E	Clamshell, Tenders (Pushboats) (2), Crew Boat, Blast Barge, Ocean Towboat Excavator, Tenders (Pushboats) (2), Crew Boat, Blast Barge, Ocean Towboat

The following equation are used to calculate daily emissions by material type:

Daily Emissions by Material Type (tons) = Sum of Vessel Engine Emissions by Work Group Configuration

The daily emissions calculations by dredge and material types are presented in the following tables (for completeness, Soil Type A emission factors for clamshells and excavators are included):

VOC

	Daily Emissions (tons) by Material Type				
	A	C	D	E	F
CS	0.007	0.007	0.007	0.008	0.007
HD	0.005	-	-	-	-
Ex	0.008	0.008	0.008	0.009	0.008

Note: CS – Clam Shell, HD – Hopper Dredge, Ex - Excavator

NOx

	Daily Emissions (tons) by Material Type				
	A	C	D	E	F
CS	0.302	0.302	0.302	0.335	0.302
HD	0.335	-	-	-	-
Ex	0.380	0.380	0.380	0.414	0.380

Note: CS – Clam Shell, HD – Hopper Dredge, Ex – Excavator

CO

	Daily Emissions (tons) by Material Type				
	A	C	D	E	F
CS	0.057	0.057	0.057	0.063	0.057
HD	0.063	-	-	-	-
Ex	0.072	0.072	0.072	0.078	0.072

Note: CS – Clam Shell, HD – Hopper Dredge, Ex – Excavator

PM10

	Daily Emissions (tons) by Material Type				
	A	C	D	E	F
CS	0.008	0.008	0.008	0.009	0.008
HD	0.008	-	-	-	-
Ex	0.009	0.009	0.009	0.011	0.009

Note: CS – Clam Shell, HD – Hopper Dredge, Ex – Excavator

Transit emission rates vary depending on material placement methods and locations. Hourly emission rates used in the calculations are presented in the following table.

Type	Hourly Emission Rate (tons) Auxiliary	Propulsion
VOC		
HD	7.826E-05	5.146E-04
Upland Towboat	4.568E-06	2.721E-04
Ocean Towboat	4.568E-06	4.833E-04
NOx		
HD	3.633E-03	2.389E-02
Upland Towboat	1.631E-04	1.263E-02
Ocean Towboat	1.631E-04	2.244E-02
CO		
HD	6.987E-04	4.595E-03
Upland Towboat	2.773E-05	2.429E-03
Ocean Towboat	2.773E-05	4.316E-03
PM10		
HD	8.385E-05	5.514E-04
Upland Towboat	6.526E-06	2.915E-04
Ocean Towboat	6.526E-06	5.179E-04

Note: HD – Hopper Dredge

DREDGING EMISSIONS

Dredging emissions are calculated using the following equations:

Average Dredge Daily Production Rate = Sum of (Daily Production Rates (by Dredge Type)) / Number of Dredges

Days Dredging = (Channel Volume x Percent Dredge Volume by Dredge Type) / Average Dredge Daily Production Rate

Daily Emissions by Dredge Type = Sum of Engine Emissions (Hourly)

Dredging Emissions = Days Dredging x Daily Emissions by Dredge Type

The following tables present the Channel Volumes, Percent Dredge Volume, Days Dredging by year for the proposed project.

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Material Volumes by Channel

Channel	Year																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total
	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards	cu yards
Ambrose - Type A	0	3,500,000	3,500,000	3,500,000	2,871,000	0	0	0	0	0	0	0	0	0	0	0	**13,371,000**
Anchorage - Type C	0	0	1,400,000	1,400,000	1,359,000	0	0	0	0	0	0	0	0	0	0	0	**4,159,000**
Anchorage - Type F	0	0	239,000	239,000	239,000	0	0	0	0	0	0	0	0	0	0	0	**717,000**
Kill Van Kull - Type C	0	400000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	19,000	0	0	0	0	**4,019,000**
Kill Van Kull - Type E	0	320000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	320,000	11,000	0	0	0	0	**3,211,000**
Kill Van Kull - Type F	0	220000	220,000	220,000	220,000	220,000	220,000	220,000	220,000	220,000	220,000	12,000	0	0	0	0	**2,212,000**
Newark Bay - Type D	0	0	796,000	725,000	725,000	725,000	725,000	725,000	725,000	725,000	725,000	0	0	0	0	0	**6,596,000**
Newark Bay - Type E	0	0	170,000	135,000	135,000	135,000	135,000	135,000	135,000	135,000	135,000	0	0	0	0	0	**1,250,000**
Newark Bay - Type F	0	0	356,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000	0	0	0	0	0	**2,356,000**
Arthur Kill - Type C	0	0	0	0	0	36,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	140,000	50,000	0	**1,206,000**
Arthur Kill - Type E	0	0	0	0	0	200,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	200,000	195,000	0	**2,695,000**
Arthur Kill - Type F	0	0	0	0	0	90,000	90,000	90,000	90,000	90,000	90,000	90,000	90,000	40,000	22,000	0	**782,000**
Port Jersey - Type C	0	0	481,000	500,000	550,000	550,000	500,000	0	0	0	0	0	0	0	0	0	**2,581,000**
Port Jersey - Type F	0	0	311000	0	0	0	0	0	0	0	0	0	0	0	0	0	**311,000**
Bay Ridge - Type C	0	0	0	0	0	273,000	900,000	900,000	900,000	0	0	0	0	0	0	0	**2,973,000**
Bay Ridge - Type F	0	0	0	0	0	493,000	500,000	500,000	500,000	0	0	0	0	0	0	0	**1,993,000**
Totals	0	4,440,000	8,193,000	7,689,000	7,069,000	3,692,000	4,480,000	3,980,000	3,980,000	2,580,000	2,580,000	572,000	530,000	380,000	267,000	0	50,432,000

Reference: 2011planb.xls from Jim Lodge and Richard Dabal, ACOE

The Port Authority of New York & New Jersey

Percent of Annual Dredge Material by Dredge Type

Channel	Percent Volume by Dredge Type															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	CS	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**
Anchorage - Type C			100%	100%	100%											
Anchorage - Type F			100%	100%	100%											
Kill Van Kull - Type C																
Kill Van Kull - Type E																
Kill Van Kull - Type F			100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Newark Bay - Type D			100%	100%	100%	100%	100%	100%	100%	100%	100%					
Newark Bay - Type E																
Newark Bay - Type F			100%	100%	100%	100%	100%	100%	100%	100%	100%					
Arthur Kill - Type C						100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Arthur Kill - Type E																
Arthur Kill - Type F						100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Port Jersey - Type C																
Port Jersey - Type F			100%													
Bay Ridge - Type C						100%	100%	100%	100%							
Bay Ridge - Type F						100%	100%	100%	100%							

Channel	Percent of Volume by Dredge Type															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	Ex	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**
Anchorage - Type C																
Anchorage - Type F																
Kill Van Kull - Type C		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Kill Van Kull - Type E		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%				
Kill Van Kull - Type F		100%														
Newark Bay - Type D																
Newark Bay - Type E		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%					
Newark Bay - Type F																
Arthur Kill - Type C																
Arthur Kill - Type E						100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Arthur Kill - Type F																
Port Jersey - Type C			100%	100%	100%	100%	100%									
Port Jersey - Type F																
Bay Ridge - Type C																
Bay Ridge - Type F																
	HD	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**						
Ambrose - Type A		100%	100%	100%	100%											

Reference: Richard Dabal and Jim Lodge, ACOE

CS - Clam Shell

Ex - Excavator

HD - Hopper Dredge

The Port Authority of New York & New Jersey
Days Dredging by Channel

Channel	Days Dredging															
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
Anchorage - Type C	0	0	574	574	557	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type F	0	0	44	44	44	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type F	0	0	41	41	41	41	41	41	41	41	41	2	0	0	0	0
Newark Bay - Type D	0	0	94	85	85	85	85	85	85	85	85	0	0	0	0	0
Newark Bay - Type E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newark Bay - Type F	0	0	66	46	46	46	46	46	46	46	46	0	0	0	0	0
Arthur Kill - Type C	0	0	0	0	0	15	57	57	57	57	57	57	57	57	20	0
Arthur Kill - Type E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthur Kill - Type F	0	0	0	0	0	17	17	17	17	17	17	17	17	7	4	0
Port Jersey - Type C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port Jersey - Type F	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type C	0	0	0	0	0	112	369	369	369	0	0	0	0	0	0	0
Bay Ridge - Type F	0	0	0	0	0	91	93	93	93	0	0	0	0	0	0	0

Channel	Days Dredging															
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex
Anchorage - Type C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type C	0	80	80	80	80	80	80	80	80	80	80	4	0	0	0	0
Kill Van Kull - Type E	0	64	64	64	64	64	64	64	64	64	64	2	0	0	0	0
Kill Van Kull - Type F	0	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newark Bay - Type D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Newark Bay - Type E	0	0	34	27	27	27	27	27	27	27	27	0	0	0	0	0
Newark Bay - Type F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthur Kill - Type C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthur Kill - Type E	0	0	0	0	0	40	60	60	60	60	60	60	60	40	39	0
Arthur Kill - Type F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Port Jersey - Type C	0	0	96	100	110	110	100	0	0	0	0	0	0	0	0	0
Port Jersey - Type F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD	HD
Ambrose - Type A	0	212	212	212	174	0	0	0	0	0	0	0	0	0	0	0

CS - Clam Shell
Ex - Excavator
HD - Hopper Dredge

DREDGING MATERIAL MARINE TRANSIT EMISSIONS

Potential transit emissions are estimated by first evaluating the annual material volumes that are provided by the ACOE. Based on these volumes, the number of material transits are estimated using transit vessel capacities, provided by the dredging contractors and distances from the various channels to the appropriate remediation site.

Based on the number of transits, the annual mileage traveled is estimated. Mileage is based on the following factors: material type, remediation location of material type, and distance to dredge material placement location from the mid-point of each channel. The potential placement locations for each material type are assumed based on the information provided by the PANYNJ. The following table summarizes the potential dredge material placement locations assumed for each material type.

Material Type	Potential Dredge Material Placement Location(s)
Type A	HARS (Ocean Remediation)[1] – 100%
Type C	HARS (Ocean Remediation) – 100%
Type D	HARS (Ocean Remediation) – 100%
Type E	New York Artificial Reef – 50%
	New Jersey Artificial Reef – 50%
Type F	Subchannel cells – 33%
	Upland facilities:
	Pennsylvania CTI – 12%
	OENJ Bayonne – 18.3%
	HMDC Encap – 18.3%
	Port Reading – 18.3%

Note 1: Assumes all Type A material that will be used in construction will be moved a distance similar to the HARS and therefore estimated at the same middle channel distance to the HARS.

Once the dredge material transit mileage are calculated, the number of transit hours can be estimated based on an assumed average vessel speed, which was provided by the dredging contractors. Transit hours are subsequently converted to emissions estimates (tons).

Dredging material transit emissions are calculated using the following equations:

Dredge Material Trips = Channel Volume / Average Material Transport Capacity

Dredge Material Round Trip Mileage = Dredge Material Trips x (Middle Channel Distances to Placement Areas x 2)

Dredge Material Transit Hours = Dredge Material Transit Round Trip Mileage / Average Transit Speed (by Vessel Type)

Dredge Material Transit Emissions = Dredge Material Transit Hours x (Hourly Propulsion Emission Rate + Hourly Auxiliary Emission Rate)

The following tables present Dredge Material Transit Trips, Middle Channel Distances, Dredge Material Round Trip Mileage, and Dredge Material Transit Hours by year for the proposed project.

The Port Authority of New York & New Jersey

Dredge Material Transit Annual Trips

Channel	Dredge Material Transit Trips															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Ambrose - Type A	0	1,000	1,000	1,000	820	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type C	0	0	247	247	240	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type F	0	0	59	59	59	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type C	0	71	71	71	71	71	71	71	71	71	71	3	0	0	0	0
Kill Van Kull - Type E	0	79	79	79	79	79	79	79	79	79	79	3	0	0	0	0
Kill Van Kull - Type F	0	54	54	54	54	54	54	54	54	54	54	3	0	0	0	0
Newark Bay - Type D	0	0	140	128	128	128	128	128	128	128	128	0	0	0	0	0
Newark Bay - Type E	0	0	42	33	33	33	33	33	33	33	33	0	0	0	0	0
Newark Bay - Type F	0	0	87	61	61	61	61	61	61	61	61	0	0	0	0	0
Arthur Kill - Type C	0	0	0	0	0	6	25	25	25	25	25	25	25	25	9	0
Arthur Kill - Type E	0	0	0	0	0	49	74	74	74	74	74	74	74	49	48	0
Arthur Kill - Type F	0	0	0	0	0	22	22	22	22	22	22	22	22	10	5	0
Port Jersey - Type C	0	0	85	88	97	97	88	0	0	0	0	0	0	0	0	0
Port Jersey - Type F	0	0	76	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type C	0	0	0	0	0	48	159	159	159	0	0	0	0	0	0	0
Bay Ridge - Type F	0	0	0	0	0	121	123	123	123	0	0	0	0	0	0	0

The Port Authority of New York & New Jersey

Upland Material Nautical Travel Distances

Channel	Middle Channel Distances to: OENJ Bayonne miles	HMDC EnCap miles	SubChannel Cells miles	Port Reading miles
Ambrose	10.8	25.7	15.0	20.5
Anchorage	2.7	17.3	6.6	14.1
Kill Van Kull	3.6	12.7	2.0	9.4
Newark Bay	6.4	11.7	1.0	10.5
Arthur Kill (to Howland Hook)	11.3	18.7	8.0	1.2
Port Jersey	2.1	17.0	6.3	14.0
Bay Ridge	3.9	18.5	7.8	12.3

Channel	Middle Channel Distances to: Pennsylvania/CTI miles	HARS[1] miles	NY Art. Reef miles	NJ Art. Reef miles
Ambrose	12.4	6.3	7.0	9.1
Anchorage	2.1	16.1	18.6	18.4
Kill Van Kull	5.2	18.9	19.5	21.5
Newark Bay	8.0	21.9	24.2	22.6
Arthur Kill (to Howland Hook)	12.9	26.6	26.3	28.9
Port Jersey	2.2	17.6	17.3	19.9
Bay Ridge	5.5	15.3	16.0	17.6

Note: 1 distant to the edge of the nonattainment area (3 miles from the terrioral sea designation)

Source: The Port Authority of New York & New Jersey

The Port Authority of New York & New Jersey
Dredge Material Transit Annual Round Trip Mileage

Channel	Dredge Material Transit Round Trip Mileage															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Ambrose - Type A	0	12,600	12,600	12,600	10,336	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type C	0	0	7,955	7,955	7,722	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type F	0	0	1,018	1,018	1,018	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type C	0	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	2,668	127	0	0	0	0
Kill Van Kull - Type E	0	3,218	3,218	3,218	3,218	3,218	3,218	3,218	3,218	3,218	3,218	111	0	0	0	0
Kill Van Kull - Type F	0	647	647	647	647	647	647	647	647	647	647	35	0	0	0	0
Newark Bay - Type D	0	0	6,153	5,604	5,604	5,604	5,604	5,604	5,604	5,604	5,604	0	0	0	0	0
Newark Bay - Type E	0	0	1,952	1,550	1,550	1,550	1,550	1,550	1,550	1,550	1,550	0	0	0	0	0
Newark Bay - Type F	0	0	1,142	802	802	802	802	802	802	802	802	0	0	0	0	0
Arthur Kill - Type C	0	0	0	0	0	338	1,314	1,314	1,314	1,314	1,314	1,314	1,314	1,314	469	0
Arthur Kill - Type E	0	0	0	0	0	2,709	4,064	4,064	4,064	4,064	4,064	4,064	4,064	2,709	2,641	0
Arthur Kill - Type F	0	0	0	0	0	438	438	438	438	438	438	438	438	195	107	0
Port Jersey - Type C	0	0	2,988	3,106	3,416	3,416	3,106	0	0	0	0	0	0	0	0	0
Port Jersey - Type F	0	0	1,284	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type C	0	0	0	0	0	1,474	4,860	4,860	4,860	0	0	0	0	0	0	0
Bay Ridge - Type F	0	0	0	0	0	2,322	2,355	2,355	2,355	0	0	0	0	0	0	0

Type F 33% volume to sub channels
12% volume to CTI
55% volume avg of OENJ, HMDC, NJ Regional & Port Reading

The Port Authority of New York & New Jersey
Dredge Material Transit Hours

Channel	Dredge Material Transit Hours															
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ambrose - Type A	0	1,200	1,200	1,200	984	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type C	0	0	712	712	692	0	0	0	0	0	0	0	0	0	0	0
Anchorage - Type F	0	0	160	160	160	0	0	0	0	0	0	0	0	0	0	0
Kill Van Kull - Type C	0	239	239	239	239	239	239	239	239	239	239	11	0	0	0	0
Kill Van Kull - Type E	0	288	288	288	288	288	288	288	288	288	288	10	0	0	0	0
Kill Van Kull - Type F	0	58	58	58	58	58	58	58	58	58	58	3	0	0	0	0
Newark Bay - Type D	0	0	551	502	502	502	502	502	502	502	502	0	0	0	0	0
Newark Bay - Type E	0	0	175	139	139	139	139	139	139	139	139	0	0	0	0	0
Newark Bay - Type F	0	0	102	72	72	72	72	72	72	72	72	0	0	0	0	0
Arthur Kill - Type C	0	0	0	0	0	30	118	118	118	118	118	118	118	118	42	0
Arthur Kill - Type E	0	0	0	0	0	243	364	364	364	364	364	364	364	243	237	0
Arthur Kill - Type F	0	0	0	0	0	39	39	39	39	39	39	39	39	17	10	0
Port Jersey - Type C	0	0	268	278	306	306	278	0	0	0	0	0	0	0	0	0
Port Jersey - Type F	0	0	115	0	0	0	0	0	0	0	0	0	0	0	0	0
Bay Ridge - Type C	0	0	0	0	0	132	435	435	435	0	0	0	0	0	0	0
Bay Ridge - Type F	0	0	0	0	0	208	211	211	211	0	0	0	0	0	0	0

LAND-BASED EQUIPMENT

The following section discusses how emissions from land-based equipment associated with the proposed 50-foot deepening project have been estimated.

NONROAD ESTIMATION METHODOLOGY

Land-based equipment emissions are estimated in a very different fashion from the marine or railway sources. Primarily, a computer model are used, as opposed to manual calculations. The emission factors are contained in the model and need no specification or modification, although there are variables to consider, which are discussed below. After the following discussion of the modeling protocol, emissions in terms of tons of emission per cubic yard of dredged material are provided in Appendix A.

Information for twenty-four pieces of equipment, including hours of use per month, are supplied by the PANYNJ and ACOE for two locations in New Jersey: OENJ and Pennsylvania CTI transfer sites. The equipment identified at these locations included dozers, backhoes, excavators, off-road trucks, and other material processing equipment. Both sites were combined for the analysis, since they are in the same state and airshed. The equipment data was augmented by horsepower data, and whether the equipment are electric powered or not.

Version 1.2 of the NONROAD model are used to estimate annual emissions. Information about this draft, state-of the-science model are available at http://www.epa.gov/otaq/nonrdmdl.htm. Procedures included modification of the default equipment population file for New Jersey, first by setting all diesel construction equipment to zero and then entering the numbers of pieces of equipment in each category and horsepower band (e.g., 75-150 HP, 150-300 HP, 300-600 HP). Since it are not known exactly what certification the equipment would be (EPA regulations known as TIER 0, 1, 2, or 3), a blend of equipment over all model years are determined by multiplying the equipment county for each entry by 1,000 (representing a fleet size of 1,000). The effect of this modification are to create an "average" emissions estimate that would decline as the new EPA standards became effective; that are, as new equipment are rented or purchased and older equipment are scrapped. For such a small fleet of equipment, this may not be an completely appropriate assumption, since non-road engines can last for 30 years in between rebuilds and servicing, without any reduction in emission rates, but it are clear that the NONROAD emissions output does not assume that the newest, cleanest equipment are being used.

As for the emission factors, they are embedded in the NONROAD model and reflect the latest science regarding "in-use" emissions that allows for some degree of deterioration, as the engine parts wear. The input assumes that non-road diesel fuel (averaging 3,300 ppm sulfur) would be used. Temperatures do not generally affect diesel engines as to their emissions (there are no "cold start" cycle), so annual temperature ranges of 25 to 85 degrees was used. No growth in equipment was assumed to occur over the years, so the twenty-four pieces of equipment had to be held constant by modifying the growth factor file (all entries set to 1000, or no growth at all).

Annual emissions are reported by tons per year, using the NONROAD model's report utility, being divided by 1,000. Daily emissions are obtained by dividing the annual totals by 365, without any seasonal correction factor. Seasonal correction factors are needed when modeling a large area, since housing and agricultural activity drops in the winter, but it are assumed that the land-based dredge material remediation operations would be relatively continuous, the equipment being operated between 160 and 220 hours per month.

Finally, emissions are also expressed in terms of cubic yards of dredged material. Both the OENJ and Pennsylvania CTI sites are assumed to handle 3,000 cubic yards per day, for a total of 6,000 cubic yards per day for both facilities.

Land-Based Emission Factor (tons/cuyd) = (Land-Based Emissions (tons) / 365 days/year) / Processed Volume for Both Facilities (6,000 cuyd/day)

RAILROAD

Emissions from railroad sources are associated with the movement of dredge material and stabilization ash from the Pennsylvania CTI site in New Jersey to the receiving mine in the Pennsylvania. For the purposes of this study and general conformity, those emissions that are generated in the New York and New Jersey nonattainment area are estimated and considered.

There are two different source types associated with railroad emissions: switch and line-haul. Switch engines are used onsite to "make up" a unit train with filled railroad cars. A unit train are then transported out of the area by line-haul engines.

Tier 0 base emission factors from the Environmental Protection Agency in grams/brake horsepower-hour are converted into tons per cubic yard for both switch and line-haul operations by the following methodologies.

Switch Engines

Switch engine emissions are based on the following assumptions:

- 1 – 500 hp switch engine
- 6 hours/day operation associated with dredge material
- 20% ash added to dredge material
- 3,600 cubic yards per day (dredge material + 20% ash volume)

Adjusted emission factors (EFs) in tons per cuyds are developed by using the following equations:

Switch Engine Emissions (tons/day) = horsepower x hours/day x Base EF [converted to tons/hp-hr]

Switch Engine Emissions (tons/cuyd) = Switch Engine Emissions (tons/day) / 3,600 cubic yards/day

Line-Haul Engines

Line-haul engine emissions are based on the following assumptions:

- 3 – 3,000 hp line-haul engines
- 3 hours to transverse 68.2 miles out of nonattainment area
- 120 rail cars per train
- 110 cubic yards per rail car
- 20% ash added to dredge material

Adjusted EFs in tons per cubic yards are developed by using the following equations:

Line-Haul Emissions (tons/train) = Number of Engines x horsepower x hours x Base EF [converted to tons/hp-hr]

Line-Haul Emission (tons/cuyd) = Line-Haul Emissions (tons/day) / (Number of Rail Cars/Train x Capacity of Rail Cars (cuyds))

Combined Adjusted Emission Factors

The adjusted switch and line-haul engine emissions are then combined to estimate the total railroad operational emissions per cubic yard. The combined adjusted emission factors are presented below.

Pollutant	Combined Adjusted Emission Factor (tons/cuyd)
VOC	2.12E-06
NOx	3.10E-05
CO	4.57E-06
PM10	1.13E-06

EMPLOYEE VEHICLES

Emissions estimates for employee vehicles associated with the project were calculated by AKRF, Inc. and a summary of the 2005 and 2007 VOC, NOx, and CO emissions are provided in Appendix B. These emissions are included in the 2005 and 2007 summary in the Summary Results section. Local CO analysis, completed by AKRF, Inc. are provided in Appendix C.

APPENDIX A

Detailed Dredge Emission Estimates

The Port Authority of New York & New Jersey
Annual Dredging Emissions by Dredge Type - Rev. 1/3/02

Channel		VOC Emissions (tons) Excluding Dredge Material Transit Emissions															
		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
		CS	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**
Anchorage - Type C		0.0	0.0	3.9	3.9	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F		0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F		0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D		0.0	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F		0.0	0.0	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C		0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.1	0.0
Arthur Kill - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type F		0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Port Jersey - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F		0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C		0.0	0.0	0.0	0.0	0.0	0.8	2.5	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F		0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	
	VOC (tons)	*0.0*	*0.0*	*5.9*	*5.3*	*5.2*	*2.7*	*4.7*	*4.7*	*4.7*	*1.7*	*1.7*	*0.5*	*0.5*	*0.4*	*0.2*	*0.0*

Channel		VOC Emissions (tons) Excluding Dredge Material Transit Emissions															
		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
		Ex	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**
Anchorage - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C		0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E		0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F		0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E		0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type E		0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.0
Arthur Kill - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C		0.0	0.0	0.8	0.8	0.9	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	VOC (tons)	*0.0*	*1.7*	*2.4*	*2.4*	*2.4*	*2.8*	*2.9*	*2.1*	*2.1*	*2.1*	*2.1*	*0.6*	*0.6*	*0.4*	*0.4*	*0.0*
		HD	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**
Ambrose - Type A		0.0	1.0	1.0	1.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dredging	**VOC (tons)**	**0.0**	**2.7**	**9.2**	**8.6**	**8.4**	**5.5**	**7.7**	**6.8**	**6.8**	**3.7**	**3.7**	**1.1**	**1.1**	**0.8**	**0.5**	**0.0**

CS - Clam Shell Ex - Excavator HD - Hopper Dredge

The Port Authority of New York & New Jersey
Dredge Material Transit Emissions - Rev. 1/3/02

Channel	VOC Emissions (tons)															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Ambrose - Type A	0.0	0.7	0.7	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type C	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Transit VOC (tons)	**0.0**	**0.9**	**1.8**	**1.7**	**1.6**	**0.9**	**1.1**	**1.0**	**1.0**	**0.7**	**0.7**	**0.2**	**0.2**	**0.2**	**0.1**	**0.0**
Total Dredge VOC (tons)	**0.0**	**2.7**	**9.2**	**8.6**	**8.4**	**5.5**	**7.7**	**6.8**	**6.8**	**3.7**	**3.7**	**1.1**	**1.1**	**0.8**	**0.5**	**0.0**
Vessel Emissions (tons)	**0.0**	**3.7**	**11.0**	**10.3**	**10.0**	**6.4**	**8.8**	**7.8**	**7.8**	**4.5**	**4.5**	**1.3**	**1.3**	**1.0**	**0.6**	**0.0**
(tpd)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

The Port Authority of New York & New Jersey
Annual Dredging Emissions by Dredge Type - Rev. 1/3/02

Channel							NOx Emissions (tons) Excluding Dredge Material Transit Emissions									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
Anchorage - Type C	0.0	0.0	173.0	173.0	168.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	13.3	13.3	13.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.0	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	0.7	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	28.2	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	19.9	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	4.4	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	6.2	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.2	1.2	0.0
Port Jersey - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	33.7	111.2	111.2	111.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	27.5	27.9	27.9	27.9	0.0	0.0	0.0	0.0	0.0	0.0	
NOx (tons)	*0.0*	*0.0*	*264.1*	*238.3*	*233.3*	*122.7*	*213.4*	*213.4*	*213.4*	*74.3*	*74.3*	*23.0*	*22.3*	*19.5*	*7.4*	*0.0*

Channel							NOx Emissions (tons) Excluding Dredge Material Transit Emissions									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex
Anchorage - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	30.4	1.4	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	0.9	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	14.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	16.5	24.8	24.8	24.8	24.8	24.8	24.8	24.8	16.5	16.1	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C	0.0	0.0	36.6	38.0	41.8	41.8	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NOx (tons)	*0.0*	*77.8*	*107.5*	*106.1*	*109.9*	*126.4*	*130.9*	*92.9*	*92.9*	*92.9*	*92.9*	*27.2*	*24.8*	*16.5*	*16.1*	*0.0*
	HD	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**
Ambrose - Type A	0.0	71.1	71.1	71.1	58.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dredging NOx (tons)	**0.0**	**148.9**	**442.7**	**415.4**	**401.4**	**249.1**	**344.3**	**306.3**	**306.3**	**167.1**	**167.1**	**50.2**	**47.1**	**36.1**	**23.5**	**0.0**

The Port Authority of New York & New Jersey

Dredge Material Transit Emissions - Rev. 1/3/02

Channel	NOx Emissions (tons)															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Ambrose - Type A	0.0	33.0	33.0	33.0	27.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type C	0.0	0.0	14.0	14.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	1.8	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	0.2	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	0.2	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	10.8	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	3.4	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	1.1	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.6	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.8	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	4.8	7.2	7.2	7.2	7.2	7.2	7.2	7.2	4.8	4.6	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.1	0.0
Port Jersey - Type C	0.0	0.0	5.3	5.5	6.0	6.0	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	2.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	2.3	2.3	2.3	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Transit NOx (tons)	**0.0**	**44.0**	**81.8**	**78.7**	**72.9**	**41.1**	**50.7**	**45.2**	**45.2**	**34.3**	**34.3**	**10.4**	**9.9**	**7.3**	**5.6**	**0.0**
Total Dredge NOx (tons)	**0.0**	**148.9**	**442.7**	**415.4**	**401.4**	**249.1**	**344.3**	**306.3**	**306.3**	**167.1**	**167.1**	**50.2**	**47.1**	**36.1**	**23.5**	**0.0**
Vessel Emissions (tons)	**0.0**	**192.9**	**524.5**	**494.1**	**474.3**	**290.2**	**395.0**	**351.5**	**351.5**	**201.4**	**201.4**	**60.5**	**57.0**	**43.4**	**29.1**	**0.0**
(tpd)	**0.0**	**0.5**	**1.4**	**1.4**	**1.3**	**0.8**	**1.1**	**1.0**	**1.0**	**0.6**	**0.6**	**0.2**	**0.2**	**0.1**	**0.1**	**0.0**

The Port Authority of New York & New Jersey

Annual Dredging Emissions by Dredge Type - Rev. 1/3/02

Channel		CO Emissions (tons) Excluding Dredge Material Transit Emissions															
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
		CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS	CS
Anchorage - Type C		0.0	0.0	32.8	32.8	31.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F		0.0	0.0	2.5	2.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F		0.0	0.0	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.1	0.0	0.0	0.0	0.0
Newark Bay - Type D		0.0	0.0	5.4	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F		0.0	0.0	3.8	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C		0.0	0.0	0.0	0.0	0.0	0.8	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	1.2	0.0
Arthur Kill - Type E		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type F		0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.4	0.2	0.0
Port Jersey - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F		0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C		0.0	0.0	0.0	0.0	0.0	6.4	21.1	21.1	21.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F		0.0	0.0	0.0	0.0	0.0	5.2	5.3	5.3	5.3	0.0	0.0	0.0	0.0	0.0	0.0	
	CO (tons)	*0.0*	*0.0*	*50.1*	*45.2*	*44.3*	*23.3*	*40.5*	*40.5*	*40.5*	*14.1*	*14.1*	*4.4*	*4.2*	*3.7*	*1.4*	*0.0*

Channel		CO Emissions (tons) Excluding Dredge Material Transit Emissions															
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
		Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex	Ex
Anchorage - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C		0.0	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	0.3	0.0	0.0	0.0	0.0
Kill Van Kull - Type E		0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	0.2	0.0	0.0	0.0	0.0
Kill Van Kull - Type F		0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E		0.0	0.0	2.7	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type E		0.0	0.0	0.0	0.0	0.0	3.1	4.7	4.7	4.7	4.7	4.7	4.7	4.7	3.1	3.0	0.0
Arthur Kill - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C		0.0	0.0	7.0	7.2	8.0	8.0	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CO (tons)	*0.0*	*14.8*	*20.4*	*20.1*	*20.9*	*24.0*	*24.8*	*17.6*	*17.6*	*17.6*	*17.6*	*5.1*	*4.7*	*3.1*	*3.0*	*0.0*
		HD	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**
Ambrose - Type A		0.0	13.3	13.3	13.3	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dredging	**CO (tons)**	**0.0**	**28.1**	**83.8**	**78.7**	**76.0**	**47.3**	**65.3**	**58.1**	**58.1**	**31.7**	**31.7**	**9.5**	**8.9**	**6.8**	**4.5**	**0.0**

CS - Clam Shell Ex - Excavator HD - Hopper Dredge

The Port Authority of New York & New Jersey

Dredge Material Transit Emissions - Rev. 1/3/02

Channel	CO Emissions (tons)															
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Ambrose - Type A	0.0	6.4	6.4	6.4	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type C	0.0	0.0	2.7	2.7	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	2.1	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.9	1.4	1.4	1.4	1.4	1.4	1.4	1.4	0.9	0.9	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Port Jersey - Type C	0.0	0.0	1.0	1.1	1.2	1.2	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.5	1.6	1.6	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Transit CO (tons)	**0.0**	**8.5**	**15.7**	**15.1**	**14.0**	**7.9**	**9.7**	**8.7**	**8.7**	**6.6**	**6.6**	**2.0**	**1.9**	**1.4**	**1.1**	**0.0**
Total Dredge CO (tons)	**0.0**	**28.1**	**83.8**	**78.7**	**76.0**	**47.3**	**65.3**	**58.1**	**58.1**	**31.7**	**31.7**	**9.5**	**8.9**	**6.8**	**4.5**	**0.0**
Vessel Emissions (tons)	**0.0**	**36.5**	**99.6**	**93.8**	**90.0**	**55.2**	**75.1**	**66.8**	**66.8**	**38.3**	**38.3**	**11.5**	**10.8**	**8.2**	**5.5**	**0.0**
(tpd)	**0.0**	**0.1**	**0.3**	**0.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

The Port Authority of New York & New Jersey
Annual Dredging Emissions by Dredge Type - Rev. 1/3/02

Channel	PM10 Emissions (tons) Excluding Dredge Material Transit Emissions															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	CS	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**	**CS**
Anchorage - Type C	0.0	0.0	4.3	4.3	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Port Jersey - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.8	2.8	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	
PM10 (tons)	*0.0*	*0.0*	*6.6*	*5.9*	*5.8*	*3.1*	*5.3*	*5.3*	*5.3*	*1.9*	*1.9*	*0.6*	*0.6*	*0.5*	*0.2*	*0.0*

Channel	PM10 Emissions (tons) Excluding Dredge Material Transit Emissions															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
	Ex	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**	**Ex**
Anchorage - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.4	0.4	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C	0.0	0.0	0.9	0.9	1.0	1.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM10 (tons)	*0.0*	*1.9*	*2.7*	*2.6*	*2.7*	*3.2*	*3.3*	*2.3*	*2.3*	*2.3*	*2.3*	*0.7*	*0.6*	*0.4*	*0.4*	*0.0*
	HD	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**	**HD**
Ambrose - Type A	0.0	1.8	1.8	1.8	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Dredging PM10 (tons)	**0.0**	**3.7**	**11.0**	**10.3**	**10.0**	**6.2**	**8.6**	**7.7**	**7.7**	**4.2**	**4.2**	**1.3**	**1.2**	**0.9**	**0.6**	**0.0**

CS - Clam Shell Ex - Excavator HD - Hopper Dredge

The Port Authority of New York & New Jersey
Dredge Material Transit Emissions - Rev. 1/3/02

Channel	PM10 Emissions (tons)															
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Ambrose - Type A	0.0	0.8	0.8	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type C	0.0	0.0	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Anchorage - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type C	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type E	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Kill Van Kull - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type D	0.0	0.0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type E	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Newark Bay - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthur Kill - Type C	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Arthur Kill - Type E	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0
Arthur Kill - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type C	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Jersey - Type F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type C	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bay Ridge - Type F	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Transit PM10 (tons)	**0.0**	**1.0**	**1.9**	**1.8**	**1.7**	**1.0**	**1.2**	**1.0**	**1.0**	**0.8**	**0.8**	**0.2**	**0.2**	**0.2**	**0.1**	**0.0**
Total Dredge PM10 (tons)	**0.0**	**3.7**	**11.0**	**10.3**	**10.0**	**6.2**	**8.6**	**7.7**	**7.7**	**4.2**	**4.2**	**1.3**	**1.2**	**0.9**	**0.6**	**0.0**
Vessel Emissions (tons)	**0.0**	**4.7**	**12.9**	**12.2**	**11.7**	**7.2**	**9.8**	**8.7**	**8.7**	**5.0**	**5.0**	**1.5**	**1.4**	**1.1**	**0.7**	**0.0**
(tpd)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Pollutant		Annual Nonroad Emissions Associate with Upland Remediation															
		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Type F	*(cuyds)*	*0*	*220,000*	*1,126,000*	*709,000*	*709,000*	*1,053,000*	*1,060,000*	*1,060,000*	*1,060,000*	*560,000*	*560,000*	*102,000*	*90,000*	*40,000*	*22,000*	*0*
VOC	(tons)	0.00	0.36	1.87	1.18	1.18	1.75	1.76	1.76	1.76	0.93	0.93	0.17	0.15	0.07	0.04	0.00
	(tpd)	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	(tons)	0.00	6.05	30.95	19.49	19.49	28.94	29.13	29.13	29.13	15.39	15.39	2.80	2.47	1.10	0.60	0.00
	(tpd)	0.00	0.02	0.08	0.05	0.05	0.08	0.08	0.08	0.08	0.04	0.04	0.01	0.01	0.00	0.00	0.00
CO	(tons)	0.00	2.48	12.71	8.00	8.00	11.89	11.96	11.96	11.96	6.32	6.32	1.15	1.02	0.45	0.25	0.00
	(tpd)	0.00	0.01	0.03	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.00	0.00	0.00	0.00	0.00
PM10	(tons)	0.00	0.35	1.78	1.12	1.12	1.67	1.68	1.68	1.68	0.89	0.89	0.16	0.14	0.06	0.03	0.00
	(tpd)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Base-Case Emission Factors

Pollutant	**2002** **tons/cuyd**
VOC	1.658E-06
NOX	2.748E-05
CO	1.129E-05
PM10	1.584E-06

Emission Factors do not take into account any fleet turnover

The Port Authority of New York & New Jersey

Railroad Emissions

Pollutant		Annual Nonroad Emissions Associate with Upland Remediation															
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Type F	*(cuyds)*	*0*	*220,000*	*1,126,000*	*709,000*	*709,000*	*1,053,000*	*1,060,000*	*1,060,000*	*1,060,000*	*560,000*	*560,000*	*102,000*	*90,000*	*40,000*	*22,000*	*0*
Mixed Type F	*(cuyds)*	*0*	*264,000*	*1,351,200*	*850,800*	*850,800*	*1,263,600*	*1,272,000*	*1,272,000*	*1,272,000*	*672,000*	*672,000*	*122,400*	*108,000*	*48,000*	*26,400*	*0*
VOC	(tons)	0.00	0.56	2.86	1.80	1.80	2.67	2.69	2.69	2.69	1.42	1.42	0.26	0.23	0.10	0.06	0.00
	(tpd)	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	(tons)	0.00	8.17	41.84	26.35	26.35	39.13	39.39	39.39	39.39	20.81	20.81	3.79	3.34	1.49	0.82	0.00
	(tpd)	0.00	0.02	0.11	0.07	0.07	0.11	0.11	0.11	0.11	0.06	0.06	0.01	0.01	0.00	0.00	0.00
CO	(tons)	0.00	1.21	6.17	3.89	3.89	5.77	5.81	5.81	5.81	3.07	3.07	0.56	0.49	0.22	0.12	0.00
	(tpd)	0.00	0.00	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00
PM10	(tons)	0.00	0.30	1.52	0.96	0.96	1.42	1.43	1.43	1.43	0.76	0.76	0.14	0.12	0.05	0.03	0.00
	(tpd)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Switch Engine Data & Adjusted EFs

500	hp
6	hours/day
3,600	cuyds/day
3.52E-03	tons VOC per day
4.17E-02	tons NOx per day
6.05E-03	tons CO per day
1.46E-03	tons PM10 per day
9.77E-07	tons VOC/cuyd
1.16E-05	tons NOx/cuyd
1.68E-06	tons CO/cuyd
4.04E-07	tons PM10/cuyd

Line-Haul Data & Adjusted EFs

3,000	hp
3	hours to transit out of nonattainment hours
3	line-haul engines per train
120	number of rail cars per train
110	number of cuyd per rail car
20%	pecentage of filler per dredge material cuyds
68.2	miles in nonattainment area
0.02	tons VOC per trip
0.26	tons NOx per trip
0.04	tons CO per trip
0.01	tons PM10 per trip
1.14E-06	tons VOC/cuyd
1.94E-05	tons NOx/cuyd
2.89E-06	tons CO/cuyd
7.22E-07	tons PM10/cuyd

Railroad Base Emission Factors (EFs)

Pollutant	Engine Type (g/bhp-hr) Switch	Line-Haul
VOC	1.06	0.51
NOx	12.6	8.60
CO	1.83	1.28
PM10	0.44	0.32

Reference: *Emission Factors for Locomotives*, Office of Transporatation Air Quality (formerly Office of Mobile Sources), USEPA, Dec 1997, EPA420-F-97-051

Railroad Combined (Switch and Line-Haul) Adjusted Emission Factors

2.12E-06	tons VOC/cuyd
3.10E-05	tons NOx/cuyd
4.57E-06	tons CO/cuyd
1.13E-06	tons PM10/cuyd

APPENDIX B

Employee Vehicle Emissions

Provided by Killam Associates and AKRF, Inc.

Employee vehicle emissions

As part of the air pollution impact analysis for the "Marine and Land Based Mobile Source Emission Estimates for 50-Foot Deepening Project," employee vehicle emissions were calculated. The proposed project will hire employees, which will generate additional vehicular trips to and from the worksite. Following is the methodology used to evaluate the pollutant emission concentrations from these trips.

1. Each dredge group configuration requires different support vessels with varying number of crewmembers and shifts. Crew per day for each configuration was calculated.
2. Total annual* employee days was calculated by multiplying the number of dredge days for each configuration times the number of crewmembers required each day for that configuration.
3. Total trip number is the number of employees doubled – coming and going.
4. Emission Factors were generated using Mobile5B, assuming an average trip distance of 25 miles and an average speed of 20 miles/hour**.
5. Total emissions were calculated by multiplying the total number of miles traveled by the emission factor (per pollutant) (assuming a vehicle occupancy of 1.2/vehicle.

Emissions concentrations were calculated for VOC's, NOx and CO.

Year	VOC (tons/year)	NOx (tons/year)	CO (tons/year)
2005	2.48	2.84	32.33
2007	1.26	1.44	17.38

* Numbers were calculated for the years 2005 and 2007 only.
** Other assumptions used in the model include all hot cars and a temperature of 43°F.

Crew Numbers

Material Type	Dredging System	Vessels per system	Crew per vessel	daily shifts	Daily crew per vessel
A	Hopper Dredging System	Hopper Dredge	14	2	28
		Survey/Crewboat	1	2	2
			Total crew per material type		**30**
C,D,F	Clamshell/ Excavator Dredging System	Clamshell Dredge	14	2	28
		Upland Towboat	10	2	20
		Tender (Pushboat)	2	2	4
		Crewboat	1	2	2
			Total crew per material type		**54**
E	Clamshell/ Excavator Dredging System	Clamshell Dredge	14	2	28
		Ocean Towboat	10	2	20
		Tender (Pushboat)	2	2	4
		2nd Tender (Pushboat)	2	2	4
		Crewboat	1	2	2
		Blast Barge	11	2	22
			Total crew per material type		**80**

		2005 - # dredge days			2007 - # dredge days			crew/day	crew/day	crew/day		2005			2007	
		CS	**EX**	**HP**	**CS**	**EX**	**HP**	**CS**	**EX**	**HP**	**ual emp d**	**total trips**	**total trips**	**total trips**	**total trips**	**total trips**
											CS	**EX**	**HP**	**CS**	**EX**	**HP**
Anchorage	Type C	574						54			30996					
Anchorage	Type F	44						54			2376					
Kill Van Ku	Type C		80			80			54			4320			4320	
Kill Van Ku	Type E		64			64			80			5120			5120	
Kill Van Ku	Type F	41			41			54			2214			2214		
Newark Ba	Type D	55			55			54			2970			2970		
Newark Ba	Type E		27			27			80			2160			2160	
Newark Ba	Type F	46			46			54			2484			2484		
Arthur Kill	Type C				15											
Arthur Kill	Type E					40			80						3200	
Arthur Kill	Type F				17			54						918		
Port Jersey	Type C		100			110			54			5400			5940	
Bay Ridge	Type C				112			54						6048		
Bay Ridge	Type F				91			54						4914		
Ambrose	Type A			212						30			6360			
								Total Trips				**64400**			**40288**	
								TT with VOF*				**53667**			**33573**	
								Ave weekday trips**				**210**			**132**	

*vehicle occupancy factor of 1.2
**average work year is 255 days

Pollutant emissions from employee vehicles*

NOx	ave. trip dist. (miles)	emission factor** (grams/mile)	Emp. Days	# trips	Total Emissions (gr/year)	tons/year
2005	25	0.96	53667	107333	2576000	**2.84**
2007	25	0.78	33573	67147	1309360	**1.44**

CO	ave. trip dist. (miles)	emission factor** (grams/mile)	Emp. Days	# trips	Total Emissions (gr/year)	tons/year
2005	25	10.93	53667	107333	29328833	**32.33**
2007	25	9.39	33573	67147	15762680	**17.38**

VOC	ave. trip dist. (miles)	emission factor** (grams/mile)	Emp. Days	# trips	Total Emissions (gr/year)	tons/year
2005	25	0.84	53667	107333	2254000	**2.48**
2007	25	0.68	33573	67147	1141493	**1.26**

* assuming 1.2 vehicle occupancy factor
**generated using MOBILE5B (ave speed 20 miles/hour; Temperature 43 F; All hot car thermal temperatures)

APPENDIX C

Local CO Emissions Analysis

Provided by Killam Associate and AKRF, Inc.

Harbor Navigation Local Carbon Monoxide Emissions Analysis

A. SUMMARY

Local air quality at the four (4) New York / New Jersey Marine terminals would be affected by increased employee vehicular activity due to the proposed United States Army Corps of Engineers (USACOE) 50-foot Deepening Project. A carbon monoxide (CO) microscale analysis was performed for 2005 and 2007 to determine the potential localized impacts from trips related to construction activities. Two project alternatives were analyzed: without the proposed action (the No Build) and with the proposed action (the Build). Since it is uncertain where such incremental trips would occur, it was conservatively assumed that all vehicular activity would occur at each of the port terminals. The mobile source receptor locations analyzed under the Build condition predict that CO levels would be less than the corresponding ambient air standard at all four sites for both years, and therefore, there would be no predicted adverse localized air quality impacts from the proposed action.

B. INTRODUCTION

This report identifies and quantifies all local carbon monoxide (CO) air quality impacts from the proposed USACOE 50-foot Deepening Project. Regional effects stem mainly from emissions generated by the dredges and dredge support equipment and have been described in "Marine and Land-based Mobile Source Emission Estimate for 50-Foot Deepening Project" Draft July, 2001. Localized CO impacts would be generated by the employee vehicles arriving to and departing from the various ports/work sites. The four ports that may service the proposed project are Port Newark/Elizabeth, Port Jersey/MOTBY, South Brooklyn Marine Terminal, and Howland Hook Marine Terminal. If worker trips were to occur at other locations, such as contractor locations throughout the Port, the impacts from such trips would be expected to be less than those presented near the four terminals in this study.

C. CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In the New York City metropolitan area, approximately 80 to 90 percent of 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, along heavily traveled and congested roadways. Consequently, CO concentrations must be predicted on a localized or microscale basis. The proposed action would increase traffic volumes on streets near the project area and could therefore result in localized increases in CO levels.

D. AIR QUALITY STANDARDS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the Clean Air Act, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: carbon monoxide, nitrogen dioxide, ozone, respirable particulate matter, sulfur dioxide, and lead. (Hydrocarbon standards have been rescinded because these pollutants are primarily of concern only in their role as ozone precursors.) EPA has adopted 24-hour and annual standards for respirable particulate matter with an aerodynamic equivalent diameter less than 2.5 :m ($PM_{2.5}$), which became effective September 16, 1997. As recognized by EPA, the adoption of the $PM_{2.5}$ standard is intended to provide increased protection of public health from fossil fuel combustion. At this time, EPA is only requiring states to implement monitoring programs to determine the scope of the problem. It will likely be at least 5 years before any attainment/non-attainment designations are made and a few more years before any implementation plans are required.

Table 1, on the following page, shows the standards for these pollutants. These standards have also been adopted as the ambient air quality standards for the State of New York and the State of New Jersey. The primary standards protect the public health, and represent levels at which there are no known significant effects on human health. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. For carbon monoxide, nitrogen dioxide, ozone, and respirable particulates, the primary and secondary standards are the same.

Table 1

National, New York State and New Jersey State Ambient Air Quality Standards

Pollutant	Primary PPM	Primary Micrograms Per Cubic Meter	Secondary PPM	Secondary Micrograms Per Cubic Meter
Carbon Monoxide				
Maximum 8-Hour Concentration[1]	9		9	
Maximum 1-Hour Concentration[1]	35		35	
Lead				
Maximum Arithmetic Mean Averaged Over 3 Consecutive Months		1.5		1.5
Nitrogen Dioxide				
Annual Arithmetic Average	0.05	100	0.05	100
Ozone				
1-Hour Average[2]	0.12	235	0.12	235
8-Hour Average	0.08	157	0.08	157
Total Suspended Particulates (TSP)[3]				
Annual Mean		75		
Maximum 24-Hour Concentration		250		
Respirable Particulates (PM_{10})				
Annual Arithmetic Mean		50		50
Maximum 24-Hour Concentration[4]		150		150
Respirable Particulates ($PM_{2.5}$)				
Annual Arithmetic Mean		15		15
Maximum 24-Hour Concentration[5]		65		65
Sulfur Dioxide				
Annual Arithmetic Mean	0.03	80		
Maximum 24-Hour Concentration[1]	0.14	365		
Maximum 3-Hour Concentration[1]			0.50	1,300

Notes:
1 Not to be exceeded more than once a year.
2 Applies only to areas that were designated nonattainment when the ozone standard was adopted in July 1997.
3 TSP levels are regulated by a New York State Standard only.
4 Not to be exceeded by 99th percentile of 24-hour PM_{10} concentrations in a year (averaged over 3 years).
5 Not to be exceeded by 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year (averaged over 3 years).
PPM = parts per million

Sources: 40 CFR Part 50—National Primary and Secondary Ambient Air Quality Standards 40 CFR 50.12 "National Primary and Secondary Standard for Lead," 43 CFR 46245

STATE IMPLEMENTATION PLAN (SIP)

The Clean Air Act requires each state to submit a SIP for attainment of NAAQS to EPA. The 1977 and 1990 amendments require comprehensive plan revisions for areas where one or more of the standards have yet to be attained. In the New York City metropolitan area, the standard for ozone continues to be exceeded. CO attainment demonstrations were submitted to EPA by New York State Department of Environmental Conservation (NYSDEC) and New Jersey Department of Environmental Protection (NJDEP) in 1992.

SIGNIFICANCE CRITERIA

Criteria to determine the significance of air quality impacts are based on federal, state, and local air pollution standards and regulations. Impacts are considered to be significant if project emissions (1) increase ambient pollutant levels from below to above the NAAQS, (2) are inconsistent with measures contained in the SIP, or (3) exceed the general conformity thresholds. This report addresses the potential for the proposed action's construction related traffic to result in adverse CO impacts.

E. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS FROM MOBILE SOURCES

INTRODUCTION

To compare estimated carbon monoxide concentrations with the national and state ambient air quality standards for carbon monoxide (which are based on 1- and 8-hour averages of carbon monoxide concentrations), estimates of maximum concentrations for these same periods must be prepared.

The prediction of motor vehicle-generated carbon monoxide concentrations in an urban environment influenced by meteorological phenomena, traffic conditions, and physical configurations is a challenging problem. Air pollutant dispersion models simulate mathematically how traffic, meteorology, and geometry combine to affect pollutant concentrations. The mathematical expressions and formulations that make up the various models attempt to describe an extremely complex physical phenomenon as closely as possible. However, because all models contain simplifications and approximations of actual conditions and interactions, and because a worst-case condition is of most interest, most of these dispersion models are conservative and tend to overpredict pollutant concentrations, particularly under adverse meteorological conditions.

The CO analysis for the proposed action has employed a modeling approach approved by EPA that has been widely used for evaluating air quality impacts of projects in the New York City region, and has coupled this approach with a series of worst-case assumptions relating to meteorology, traffic, background concentration levels, etc. This combination results in a conservative estimate of expected CO concentrations and resulting air quality impacts caused by the proposed action.

DISPERSION MODELS FOR MICROSCALE ANALYSES

At the sites selected for study, a first-level conservative analysis was performed using EPA's CAL3QHC model, version 2* [1]. The CAL3QHC model is based on the CALINE-3 line source dispersion model with an additional algorithm for estimating vehicle queue lengths at signalized intersections. The CALINE-3 model is a Gaussian model, which assumes that the dispersion of pollutants downwind of a pollution source follows a Gaussian (or normal) distribution, and is used for predicting CO concentrations along roadway segments. The pollution source is the emissions from motor vehicles operating under free-flow conditions. The refinement that CAL3QHC provides is the inclusion of the contribution of emissions from idling vehicles in the overall concentration. The queuing algorithm requires additional input for site-specific traffic parameters, such as signal timing, and performs delay calculations from the *Highway Capacity Manual* traffic forecasting model to predict the number of idling vehicles. The CAL3QHC model was recently modified to include saturation flow rate, vehicle arrival type, and signal actuation characteristics as input parameters.

For a more refined analysis, the CAL3QHC model has been updated with an extended module, which allows for the incorporation of actual meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is only employed if maximum predicted CO concentrations are greater than the applicable ambient air quality standards or if significant air quality impacts are predicted with the first-level screening CAL3QHC modeling. The refined version of the model was not required for this study.

WORST-CASE METEOROLOGICAL CONDITIONS

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability.

Wind direction influences the accumulation of pollutants at a particular receptor location. Wind direction was chosen to maximize pollutant concentrations at each of the prediction sites. In applying the CAL3QHC model, the wind angle was varied to determine the worst-case wind direction resulting in the maximum concentrations. Persistence factors and ambient air temperatures were selected for the New York and New Jersey sites, and are discussed further under Probable Impacts of the Proposed Action. For the CAL3QHC screening level analysis, at each receptor location, the wind angle that maximized the pollutant concentrations was used in the analysis, regardless of frequency of occurrence.

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1 *User's Guide to CAL3QHC, A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections,* Office of Air Quality, Planning Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina

ANALYSIS YEARS

The CO microscale analysis was performed for 2 years—2005 and 2007, in order to assist in the conformity determination for the proposed action. The analyses were performed both without (the No Build) and with the proposed action (Build).

VEHICLE EMISSIONS DATA

To predict ambient concentrations of pollutants generated by vehicular traffic, emissions from vehicle exhaust systems must be estimated accurately. Vehicular emissions were computed using the EPA-developed Mobile Source Emissions Model, MOBILE5B. Emission estimates were made for five classes of motor vehicles:

- Light-duty, gasoline-powered automobiles;
- Light-duty, gasoline-powered new taxis;
- Light-duty, gasoline-powered trucks (includes SUV's);
- Heavy-duty, gasoline-powered trucks; and
- Heavy-duty, diesel-powered vehicles.

No light-duty diesel-powered vehicles (automobiles and taxis), light-duty diesel-powered trucks, or motorcycles were assumed. In the case of motorcycles, the number of such vehicles on any street is generally small. In the case of diesel-powered vehicles, emissions from a comparable class of gasoline-powered vehicles were included. Carbon monoxide emissions from the gasoline-powered vehicles are higher than the comparable diesel-powered vehicle emissions and thus yield conservative estimates of total composite CO emissions and concentrations. Reformulated fuel credits were incorporated into the analysis.

For the two New York sites, emission estimates were based on implementation of the New York State auto and light-duty gasoline-powered truck inspection and maintenance (I&M) program begun in January 1982 and the taxi I&M program begun in October 1977. The I&M program requires annual inspections of automobiles and light trucks to determine if carbon monoxide and hydrocarbon emissions from the vehicles' exhaust systems are below emission standards. Vehicles failing the emissions test must undergo maintenance and pass a re-test to be registered in New York State. Heavy-duty vehicle emission estimates reflect local engine displacement and vehicle loading characteristics. Light-duty truck emissions were based on an assumed 73 percent-27 percent split between trucks weighing less than 6,000 pounds and trucks weighing 6,000 to 8,500 pounds. These data were obtained from the New York City Department of Environmental Protection (NYCDEP) and are based on vehicle registration data. For the New Jersey sites, the local vehicle mix percentages and registration data were obtained from the NJDEP guidance document on Air Quality Analysis for Intersections.

For the two New Jersey sites, emissions estimates were based on the implementation of the New Jersey I&M Program starting in January, 1974 and requiring annual inspections of automobiles and light-duty trucks to determine if CO and HC exhaust emissions are below emissions standards. The I&M program provides emission estimates using NJDEP recommended inputs that assume for analysis years 1999 and later, the I&M program will be 92 percent centralized and 8 percent decentralized and emission factors represented by a composite based on these components.

For automobiles and light-duty gasoline-powered trucks, emission estimates account for three possible vehicle operating conditions: cold-vehicle operation, hot-start operation, and hot-stabilized operation. It is important to distinguish between these three operating categories, because vehicles emit carbon monoxide at different rates depending on whether they are cold or warmed up. All taxis were assumed to be operating in a hot-stabilized mode; all arriving project-generated autos were assumed to be operating in a hot-stabilized mode; and all departing project-generated autos were assumed to be operating in a cold-start mode. For the New York sites, based on New York local registration data, 25% of the construction related autos were assumed to be sport utility vehicles (SUVs), which were simulated as light duty gas trucks.

Auto and light duty truck operating conditions used in the future No Build emission calculations were obtained from data supplied by NYCDEP, Bureau of Science and Technology *Report No. 34 (Revised)* for the two New York City locations. For the two New Jersey locations, the NJDEP recommendation of 35 percent catalyst and non-catalyst cold starts and 20 percent catalyst hot starts for estimating worst case emissions was used. For conservatism, all construction vehicles exiting the project site in the PM peak hour were assumed to be operating in a cold-start mode which maximizes vehicle emissions.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from traffic counts and other information obtained for the year 1997. Volumes were grown by a specific growth factor. Facility expansion and expected production increases were considered as well. For the air quality analysis, the weekday PM (5-6 PM) peak period was subjected to full-scale microscale analysis. This time period was selected for the mobile source analysis because it produces the maximum project-generated traffic and therefore has the greatest potential for significant traffic and/or air quality impacts.

BACKGROUND CONCENTRATIONS

Background concentrations are those pollutant concentrations not directly accounted for through the modeling analysis (which directly accounts for vehicular-generated emissions on the streets within 1,000 feet and line-of-sight of the receptor location). Background concentrations must be added to modeling results to obtain total pollutant concentrations at a prediction site.

The 1- and 8-hour average CO background concentrations used in this analysis are presented in Table 2 for 2005 and 2007. These values, are based on CO concentrations measured at NYSDEC, NYCDEP and NJDEP monitoring stations and are adjusted to reflect the changes in future vehicular emissions expected since the concentrations were measured.

Table 2

Carbon Monoxide Background Concentrations

Analysis Years	1-Hour (ppm)* Howland Hook	8-Hour (ppm)* Howland Hook	1-Hour (ppm)* PN/E**	8-Hour (ppm)* PN/E**	1-Hour (ppm)* Port Jersey /MOTBY	8-Hour (ppm)* Port Jersey/ MOTBY	1-Hour (ppm)* South Brooklyn	8-Hour (ppm)* South Brooklyn
2005	5.8	2.3	5.0	3.5	5.0	3.5	5.8	2.0
2007	5.9	2.3	5.0	3.5	5.0	3.5	5.9	2.0

Note: * Parts per million.
**** PN/E: Port Newark/Elizabeth**

MOBILE SOURCE RECEPTOR LOCATIONS

A receptor site is a computer simulation of sidewalk or roadside locations near the intersection with continuous public access. Multiple receptor sites were modeled at these intersections (i.e., receptors were placed along the approach and departure links at spaced intervals).

These receptor sites were selected because they are key locations in the study area where the combination of the highest levels of project-generated traffic and overall constrained traffic conditions are expected and therefore represent the locations where the greatest air quality impacts and maximum changes in the CO concentrations would be expected.

F. PROBABLE IMPACTS OF THE PROPOSED ACTION

INTRODUCTION

Operation of the proposed action would result in increased mobile source emissions in the immediate vicinity of the four NY/NJ ports - Port Newark/Elizabeth, Port Jersey/MOTBY, South Brooklyn Marine Terminal and Howland Hook Marine Terminal. As it is unclear at this point what percentage of the vehicle trips may travel to each port, the analysis for each port assumes all vehicles arriving at that port.

PORT NEWARK/ELIZABETH

The CAL3QHC model developed by the USEPA was used in conjunction with a series of worst-case assumptions relating to meteorology, traffic, and background concentration levels to model traffic at a road segment on North Avenue near I-95 at the point of maximum port-generated traffic congestion. This combination results in a conservative estimate of expected CO concentrations and resulting air quality impacts caused by the proposed action.

The CAL3QHC model automatically determined the worst-case wind angle for the receptor and wind directions analyzed. Carbon monoxide computations were performed using a wind speed of 1 meter/second, and stability class E. A persistence factor of 0.7 for the 8-hour period was selected. This persistence factor takes into account that over 8 hours, vehicle volumes will fluctuate downward from the peak, speeds may vary, and wind directions and speeds will change somewhat as compared with the conservative assumptions used for the single highest hour. A surface roughness of 3.21 meters was chosen, and a 31E Fahrenheit ambient temperature was assumed for the emissions computations. The CO microscale analysis was performed for 2005 and 2007 for two conditions: without (the No Build) and with the proposed action (Build).

Vehicular emissions were computed using the EPA-developed Mobile Source Emissions Model, MOBILE5A-H. Traffic data for the air quality analysis, including vehicle mix and volumes of traffic, were derived from traffic counts and other information developed as part of the proposed action's traffic analysis as discussed above (see "Traffic Data"). For the air quality analysis, the weekday PM (5-6 PM) time periods were subjected to full-scale microscale analysis because the maximum project-generated traffic occur during this period and therefore the greatest potential for significant traffic and/or air quality impacts occurs at this time.

Receptors were located at the four corners of the intersection analyzed and setback adjacent to the approaches to represent mid-block receptors. A survey was conducted to determine if sensitive air quality land uses (schools, residences) were located near the intersection, thereby requiring additional receptor placement. The survey revealed that only industrial and commercial uses were present in the vicinity of the intersection.

Table 3 shows the maximum predicted future No Build and Build CO 1- and 8-hour average concentrations at the intersection. The values shown are the highest predicted concentrations for each receptor location for any time period analyzed. At the receptor site, the maximum predicted 1- and 8-hour average concentrations are within the National Ambient Air Quality Standards of 35 ppm and 9 ppm, respectively. The results indicate that the proposed action would not result in any violations of the CO standard or any significant adverse impacts at the receptor location.

Table 3

Future Maximum Predicted 1 and 8-Hour Average Carbon Monoxide Concentrations at North Avenue

	2005		2007	
	1-Hour	8-Hour	1-Hour	8-Hour
No Build	9.1	6.4	9.9	6.9
Build	9.3	6.5	9.9	6.9

PORT JERSEY/MOTBY

The CAL3QHC model developed by the USEPA was used in conjunction with a series of worst-case assumptions relating to meteorology, traffic, and background concentration levels to model traffic at the intersection of West Pulaski Street and Port Jersey Boulevard. This combination results in a conservative estimate of expected CO concentrations and resulting air quality impacts caused by the proposed action. The same methodology was applied in the modeling of this intersection as was described for the analysis of the intersection in the vicinity of the Port Newark/Elizabeth.

Table 4 shows the maximum predicted future No Build and Build CO 1- and 8-hour average concentrations at the intersection. The values shown are the highest predicted concentrations for each receptor location for any time period analyzed. At the receptor site, the maximum predicted 1- and 8-hour average concentrations are within the National Ambient Air Quality Standards of 35 ppm and 9 ppm, respectively. The results indicate that the proposed action would not result in any violations of the CO standard or any significant adverse impacts at the receptor location.

Table 4

Future Maximum Predicted 1 and 8-Hour Average Carbon Monoxide Concentrations at the Intersection of West Pulaski St./Port Jersey Blvd.

	2005		2007	
	1-Hour	8-Hour	1-Hour	8-Hour
No Build	8.4	5.9	7.6	5.3
Build	8.7	6.1	7.8	5.5

SOUTH BROOKLYN

The CAL3QHC model developed by the USEPA was used in conjunction with a series of worst-case assumptions relating to meteorology, traffic, and background concentration levels to model traffic at the intersection of 39th Street and Second Avenue. This combination results in a conservative estimate of expected CO concentrations and resulting air quality impacts caused by the proposed action.

The methodology applied in the determination of CO levels at this location was very similar to that used at the Port Elizabeth/Newark and Port Jersey /MOTBY locations. There were minor differences, however. A stability class D and an ambient temperature of 43E Fahrenheit was assumed for the emissions computations for the analysis at the intersection of 39th Street and Second

Avenue. Additionally, vehicular emissions were computed using the EPA-developed Mobile Source Emissions Model MOBILE5B at this location. The

land use survey conducted for South Brooklyn revealed that only industrial and commercial uses were located in the vicinity of the intersection.

Table 5 shows the maximum predicted future No Build and Build CO 1- and 8-hour average concentrations at the intersection. The values shown are the highest predicted concentrations for each receptor location for any time period analyzed. At the receptor site, the maximum predicted 1- and 8-hour average concentrations are within the National Ambient Air Quality Standards of 35 ppm and 9 ppm, respectively. The results indicate that the proposed action would not result in any violations of the CO standard or any significant adverse impacts at the receptor location.

Table 5

Future Maximum Predicted 8-Hour Average Carbon Monoxide Concentrations at the Intersection of 39th Street and Second Avenue

	2005		2007	
	1-Hour	8-Hour	1-Hour	8-Hour
No Build	8.6	4.0	8.4	3.8
Build	9.0	4.2	8.6	4.2

HOWLAND HOOK

The CAL3QHC model developed by the USEPA was used in conjunction with a series of worst-case assumptions relating to meteorology, traffic, and background concentration levels to model traffic at the intersection of Goethals North and Western Avenue. This combination results in a conservative estimate of expected CO concentrations and resulting air quality impacts caused by the proposed action. The same methodology was applied in the modeling of this intersection as was described for the analysis of the intersection in South Brooklyn.

Table 6 shows the maximum predicted future No Build and Build CO 1- and 8-hour average concentrations at the intersection. The values shown are the highest predicted concentrations for each receptor location for any time period analyzed. At the receptor site, the maximum predicted 1- and 8-hour average concentrations are within the National Ambient Air Quality Standards of 35 ppm and 9 ppm, respectively. The results indicate that the proposed action would not result in any violations of the CO standard or any significant adverse impacts at the receptor location. Therefore, the future Build condition would not result in any significant mobile source air quality impacts.

Table 6

Future Maximum Predicted 8-Hour Average Carbon Monoxide Concentrations at the Intersection of Goethals North and Western Avenue

	2005		2007	
	1-Hour	8-Hour	1-Hour	8-Hour
No Build	7.2	3.3	7.4	3.4
Build	7.7	3.6	7.6	3.5

CONSISTENCY WITH STATE AIR QUALITY IMPLEMENTATION PLANS

The mobile source receptor locations analyzed under the Build condition predict that CO levels would be less than the corresponding ambient air standard. Therefore, construction of the proposed action would be consistent with the New York and New Jersey State Implementation Plans with respect to air quality impacts associated with construction worker vehicle trips.