US Army Corps of Engineers ®
Pittsburgh District

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UPPER OHIO NAVIGATION STUDY, PENNSYLVANIA

CLEAN AIR ACT CONFORMITY APPLICABILITY EVALUATION

Background

Section 176(c) of the Clean Air Act (CAA) (40 C.F.R. Part 93) provides that "[n]o department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an [approved State Implementation Plan]." 40 C.F.R. §93.150(b) outlines the basic requirement: "A Federal agency must make a determination that a Federal action conforms to the applicable implementation plan in accordance with the requirements of this subpart before the action is taken." For projects other than transportation, the U.S. Environmental Protection Agency (EPA) has set *de minimis* levels beneath which the conformity requirements do not apply. The U.S. Army Corps of Engineers (USACE) General Council has indicated that the USACE "should err on the side of caution in writing CAA conformity determinations" for large-scale projects. For small-scale projects, on the other hand, the General Counsel stated that the USACE could probably rely on the *de minimis* exclusions "at least where no CAA-related litigation can be anticipated."

The purpose of this assessment is to quantitatively analyze the air emissions associated with the Upper Ohio Navigation Study's (UONS) recommended plan. The draft report recommends construction of three new lock chambers at Emsworth, Dashields, and Montgomery Locks and Dams in Allegheny and Beaver Counties, PA. Work at each site would involve set-up and operation of a concrete batch plant. For estimating purposes, construction would be efficiently funded to occur concurrently over a 6-year period. The study area is in non-attainment status for a number of parameters. Basic calculations are needed to properly determine whether the emissions equal or exceed limits for conformity determination or would result in no or de minimis emissions increase.

Overall, the UONS project will likely lead to a decrease in indirect emissions because of improved boat and barge traffic flow through the area and the potential to remove some truck or rail freight from the overall transportation system. Direct emissions will result from construction and operation of central mix concrete batch plants associated with the project. The following sections quantify these direct emissions.

Emission Calculations

Air emissions calculations are performed utilizing emissions factors associated with an activity. Emissions factors are a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. The general equation for emissions estimation is:

E = A x EF x (1-ER/100)

where:

E = emissions;

A = activity rate;

EF = emission factor, and

ER =overall emission reduction efficiency, %

The EPA manual *Compilation of Air Pollutant Emission Factors (AP-42)* was the main source consulted for specific equations and emission factors used in the calculations for this site. In order to calculate the expected emissions the following sources were used: cost engineering assumptions from the feasibility study; existing data from current District concrete batching operations; and established professional methods and references for air quality quantification. To further refine the calculations for particulate matter less than 2.5 micrometers (PM2.5) the South Coast Air Quality Management District's *Final Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds* (FMPM2.5) was consulted.

It is also necessary to determine the standards with which to compare the emission calculations set in 40 C.F.R. §93.153(b). These standards are based on the area's CAA attainment status and apply only to those areas in maintenance or non-attainment. Table 1 below lists the attainment status of the areas where construction is anticipated based on the UONS. The following criteria pollutants are in a nonattainment status in the UONS construction areas: ozone (O_3); PM2.5; Particulate matter greater than 10 microns (PM10); and lead (Pb). Ozone (O_3) is derived from two precursor criteria pollutants: volatile organic compounds (VOC) and nitrogen oxides (NOx). The respective criteria pollutants that are in nonattainment are outlined in Table 2.

Criteria Pollutant	**Project Area Attainment Status**		**Area Classification**
	Allegheny	**Beaver**	
8-hour O_3	NA*	NA	Marginal
PM2.5	NA	NA	Nonattainment
PM10	A**	A	
SO_2	A	A	
CO	A	A	
NO_2	A	A	
Pb	A	NA	Nonattainment
*NA=Non-attainment **A=Attainment			

Table 1. Clean Air Act attainment status of counties where construction is anticipated.

Based on this information and the fact that the State of Pennsylvania is located on the Northeast Ozone Transport Region, Table 2 lists the applicable CAA standards and the direct and indirect rates that must be met in an evaluation of conformity.

Criteria Pollutants in Nonattainment	Rate (Tons/year)
Other ozone NAA's inside an ozone transport region:	
VOC	50
NOx	100
PM2.5:	
Direct emissions	100
PB: All NAA's	25

Table 2. Total direct and indirect emission rate limits for nonattainment areas {40 CFR 93.153 (b)(1)}

For purposes of calculating expected air emissions, four sets of calculations were completed. These sets can be further separated into one-time emissions and those expected to occur annually for the lifetime of the project. The one-time sources include particulate matter from concrete batch plant site development and engine exhaust from concrete batch plant set up. The emissions expected to occur annually are engine exhaust and particulate matter from the operation of the concrete batch plant. The following sections outline the assumptions made for each set of calculations, the process of developing the emission estimates, and the results of the calculations.

Particulate Matter

Particulate matter (PM) is solid or liquid matter that is dispersed in a gas, or insoluble solid matter dispersed in a liquid, that gives a heterogeneous mixture. The sum of all PM emissions accounts for total PM (PMT). PM with a diameter larger than 2.5 microns and less than 10 microns is referred to as the coarse PM fraction (PM10), while PM2.5 is the fine-grained fraction. Two distinct sources of particulate matter emissions for this project are those from construction activities associated with site development of the concrete batch plants and also operation of the concrete batch plant itself.

Central Mix Concrete Batch Plant Site Development

Particulate emissions from building and road construction may substantially affect local air quality for a temporary period. Construction activities include land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and construction of a given facility. The amount of particulate emissions is proportional to the area of land being worked on and the level of construction activity. Equipment traffic is a major contributor of emissions. The particulate emission factor for construction activity operations provided in AP-42, chapter 13.2.3 is:

EF = 1.2 tons/acre/months of activity

In order to use this emission factor the area of the construction site and the duration of construction activities must be known. Construction will occur during set up of the concrete batch plants and for construction support areas associated with the lock construction. The UONS proposes to utilize one property for both the concrete batch plant construction and the construction support area for each of the three locks, with an estimated area of 5-10 acres each. Table 3 shows the estimates of area and duration expected from the development of each concrete batch plant site.

Site Development - Total Particulates		
	Area (acres)	**Duration (months)**
Maximum	10	12
Minimum	5	2.5
Average	7.5	7

Table 3. Estimated site area and duration of activity for development of each concrete batch plant site.

Using the emission factor and the estimates from Table 3, total particulate (PMT) emission can be calculated for the development of each concrete batch plant site by using the following equation:

PM-T= (EF*Area)/Duration

Particulate matter that is less than 2.5 microns in diameter (PM2.5) is a default factor utilized for fugitive dust derived from construction and demolition activities, and represents a fraction of total PM (PM-T). In order to obtain figures for PM2.5, the calculated PM-T value is multiplied by an estimated PM2.5 fraction (f) listed in Appendix A of FMPM2.5. Table 4 presents the results for scenarios described above.

EF (tons/acre/month)	Area (acres)	Duration (months)	PMT (tons)	f	PM2.5 (tons)
1.2	5	2.5	15.0	0.102	1.53
1.2	5	7	42.0	0.102	4.28
1.2	5	12	72.0	0.102	7.34
1.2	7.5	2.5	22.5	0.102	2.30
1.2	7.5	7	63.0	0.102	6.43
1.2	7.5	12	108.0	0.102	11.02
1.2	10	2.5	30.0	0.102	3.06
1.2	10	7	84.0	0.102	8.57
1.2	10	12	144.0	0.102	14.69

Table 4. Calculated particulate emissions for all scenarios of concrete batch plant site development.

Central Mix Concrete Batch Plant Operation

Particulate matter, consisting primarily of cement and pozzolan dust but including some aggregate and sand dust emissions, is the primary pollutant of concern. In addition, there are emissions of metals that are associated with this particulate matter. All but one of the emission points are fugitive in nature with the only point sources being the transfer of cement and pozzolan material to silos, and these are usually vented to a fabric filter or “sock”. Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials. The extent of fugitive emission control varies widely from plant to plant.

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, central duct collection systems, and the like. A major source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the plant, can be controlled by good maintenance and wetting of the road surface. These controls are currently in use at USACE concrete batching operation, and as such, emission factors for controlled sources were used where possible.

To calculate emissions from the proposed concrete batching, AP-42, chapter 11.12 was consulted and supplemented with FMPM2.5. There are several methods and emission factors discussed. It was determined that due to the nature and scope of this analysis that the most direct method should be utilized, even as it may result in overestimation due to lack of site specific calculations. The table below gives the plant-wide emissions factors (lb of pollutant emission/cubic yard (cy) of concrete produced) given in AP-42, which were used for calculations.

Manufacturing Step	PMT	PM10	Pb
Aggregate delivery to ground storage	0.0064	0.0031	
Sand delivery to ground storage	0.0015	0.0007	
Aggregate transfer to conveyor	0.0064	0.0031	
Sand transfer to conveyor	0.0015	0.0007	
Aggregate transfer to elevated storage	0.0064	0.0031	
Sand transfer to elevated storage	0.0015	0.0007	
Cement delivery to Silo	0.0002	0.0001	1.03-07
Cement supplement delivery to Silo	0.0003	0.0002	7.28E-08
Weigh hopper loading	0.0079	0.0038	
Central mix loading	0.002576	0.00077	5.12E-09

Table 5. Emission factors for concrete batching operations. Source: AP-42, chapter 11.12, Tables 11.12-2, 11.12-6 & 11.12-8.

Potential emissions were calculated based upon the maximum possible days contractors would be operating the concrete batch plants as well as the maximum design production. As these plants are not commercial and will be utilized for project specific work, it is unreasonable to assume “round-the-clock” operation. Actual emissions data were compiled from currently operating U.S. Army Corps central mix concrete batch plants, and were used as an analogue for the UONS. The table below summarizes the assumptions made for this calculation.

Batch Plant Operation - Annual Particulates			
	Production (cy/day)	**Operation (days/yr)**	**Annual Production (cy/year)**
Potential Emissions	1200	260	312,000
Actual Emissions	190	50	9,500

Table 6. Assumptions used to calculate annual particulate matter emissions from concrete batching.

Using the above information, two scenarios for production at one concrete batch plant were derived; 312,000 cy/year and 9,500 cy/year. As done for concrete batch plant site development calculations above, the PM2.5 fraction (f) for both PMT and PM10 were multiplied by the calculated totals, respectively. Table 7 shows the calculated particulate matter emissions using the emissions factors in Table 5 and production and operation rates from Table 6.

Batch Plant Operation - Annual Particulates				
	PMT (tons/year)	**PM10 (tons/year)**	**PM2.5 (tons/year)**	**Pb (tons/year)**
Potential Operation	5.41	0.88	0.26	9.75E-06
Actual Operation	0.53	0.18	0.05	8.60E-07

Table 7. Calculated emissions of particulate matter and lead (tons/yr).

Engine Exhaust

There are two methods for calculating annual emissions from internal combustion units. If the engine's brake horsepower (bhp) and annual hours of operation are available, the following equation can be used:

$$AE = EF \times bhp \times t$$

Where:

AE = Annual emissions of chemical (lb/yr)

EF = Chemical emission factor (lb/bhp-hr)

t = Total annual number of hours of operation (hr/yr)

bhp = Unit brake horse power (bhp)

Emission factors from AP-42 Section 3.3 for gasoline and 3.4 for diesel-fired internal combustion engines were used and are shown in Table 8. As nearly all particulate matter from engine exhaust is less than 1 micrometer in diameter, all calculated values of particulate matter are grouped as PM2.5 although they may represent larger fractions as well. In addition, emission factors are given for "total organic compounds" (TOC). This term is used in AP-42 to indicate all VOCs and all exempted organic compounds including methane, ethane, chlorofluorocarbons, toxics and hazardous air pollutants, aldehydes, and semi-volatile compounds. As UONS is located in a nonattainment for ozone, and VOCs and NOx are precursors to ozone, TOC (in lieu of VOCs) and NOx emissions were calculated for site activities. Please note that the estimates in the following sections reflect the worse-case scenario of possible emissions for the UONs.

	Diesel Fuel EF	Gasoline Fuel EF
NOx	0.013	0.011
PM-10	7.00E-04	0.000721
TOC	7.05E-04	0.021591

Table 8. Engine exhaust emission factors.

Concrete Batch Plant Set up

During the first phase of the project, the concrete batch plant sites will be developed and the plant itself will be assembled using cranes with components brought in by flatbed truck. Table 9 denotes the equipment that is projected to be used along with the rate of usage.

Batch Plant Set Up - Total Engine Exhaust							
Task	**Equipment**	**Net Power (bhp)**	**Fuel**	**Daily Operation (hr)**	**Number per day**	**Timeframe (months)**	**Total Operation (hr)**
Site Development	Excavator[1]	360	Diesel	4	2	6	960
	Triaxle[2]	387	Diesel	4	2	6	960
	Bulldozer[3]	139.5	Diesel	4	1	6	480
	Grader[4]	185	Diesel	4	1	6	480
Plant Assembly	Flatbed truck[5]	550	Diesel	4	0.415*	6	199.2
	Crawler crane[6]	340	Diesel	4	1	3	240
	Truck crane[7]	51	Diesel	4	1	3	240
	Man-lift[8]	75	Gasoline	4	2	6	960
Initial Material Delivery	Triaxle	387	Diesel	8	28*	0.5	2240

*These numbers were calculated based on a fixed number of vehicles used in the given timeframe.

Table 9. Equipment and usage estimates for set up of one concrete batch plant.

[1] Catepillar 245B Series II
[2] Kenworth T300/400/800
[3] Caterpillar D-6
[4] Caterpillar 140H
[5] Caterpillar C15
[6] Manitowoc 777
[7] Broderson IC20G
[8] Genie S-40/45

Using the equation given above, emission factors from AP-42, and the estimates from Table 9, Table 10 shows the calculated emissions from central mix concrete batch plant during set up activities.

Batch Plant Set Up - Total Engine Exhaust		
	Per Plant (tons/year)	**Project Total (tons/year)**
NOx	13.48	40.43
PM2.5	0.73	2.19
VOC	1.49	4.46

Table 10. Calculated engine exhaust emissions from central mix concrete batch plant set up.

Central Mix Concrete Batch Plant Operation

In addition to the equipment utilized for constructing the plant itself, the operation of the plant will involve the equipment listed in Table 11 below.

Batch Plant Set Up - Total Engine Exhaust						
Equipment	**Net Power (bhp)**	**Fuel**	**Daily Operation (hr)**	**Amount**	**Timeframe (months)**	**Total Operation (t(hr))**
Large track loader[9]	189	Diesel	4	1	2.5	200
Skid loader[10]	22.5	Gasoline	4	1	2.5	200
Tri-axle	387	Diesel	4	8	2.5	1600
Man-lift	75	Gasoline	4	1	2.5	200

9Caterpillar 963D
[10] Bobcat 463

Table 11. Equipment projected to be used for routine operation of a concrete batch plant.

Using the equation above, and the estimates from Table 11, Table 12 shows the total calculated emissions from the routine operation of central mix concrete batch plants.

Batch Plant Operation - Total Engine Exhaust		
	Per Plant (tons/year)	**Project Total (tons/year)**
NOx	4.38	13.13
PM2.5	0.24	0.71
VOC	0.44	1.33

Table 12. Engine exhaust emissions associated with the routine operation of the concrete batch plants.

[9] Caterpillar 963D
[10] Bobcat 463

Discussion

To determine the total emissions associated with the UONS a timeline of work must be established. To provide the most comprehensive estimate possible the summary tables utilizes the highest value calculated above where a range was presented. Tables 13 and 14 show the total emissions for each activity included in 1) site development and plant construction and 2) annual operation of the central mix concrete batch plant.

Construction - Total Potential to Emit-Annually (tons/year)				
Activity	**VOC**	**NOx**	**Lead**	**PM 2.5**
Site Development	0	0	0	14.69
Engine exhaust site development	0.34	6.30	0	0.34
Engine exhaust plant assembly	0.84	1.54	0	0.09
Engine exhaust initial material delivery	0.31	5.63	0	0.30
Total	**1.49**	**13.48**	**0.00**	**15.41**

Table 13. Total calculated emissions from construction of a central mix concrete batch plant.

Operation - Total Potential to Emit-Annually (tons/year)				
Activity	**VOC**	**NOx**	**Lead**	**PM 2.5**
Concrete Production	0	0	9.75E-06	0.26
Engine Exhaust Plant Operation	1.33	13.13	0	0.71
Total	**1.33**	**13.13**	**9.75E-06**	**0.97**

Table 14. Total calculated emissions from operation of a central mix concrete batch plant.

For ease of calculation the six year construction schedule presented in the UONS will be used. Based on the information above the first year will consist of site development and set up of all three concrete batch plants, including initial material delivery to each site. Years 2 through 5 do not include site set up, only emissions from the routine operation of the three batch plants. Table 15 below shows the annual emissions for each criteria pollutant based on this schedule.

Non-Attainment Area Emission Rates		**Calculated Project Emissions**					
		Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
NOx	100	40.43	39.40	39.40	39.40	39.40	39.40
PM-2.5	100	46.24	2.92	2.92	2.92	2.92	2.92
VOC	50	4.46	3.98	3.98	3.98	3.98	3.98
Pb	25	0.00	2.92E-05	2.92E-05	2.92E-05	2.92E-05	2.92E-05

Table 15. Total emissions from UONS proposed action.

As can be seen from Table 15 above, no constituents will exceed the levels established by the CAA. When considered with the fact that these numbers represent the highest possible estimates and the work will most likely take place over a much longer timeline, there is no need to perform a conformity determination for the UONS. This evaluation demonstrates that the federal action at

UONS does not exceed the emission levels in 40 CFR 93.153 (b), which are outlined both in Tables 2 and 15. As such, there is an exemption for UONS, as conformity determinations do not apply to the federal actions as per 40 CFR 93.153 (c)(1). This section of the Clean Air Act discusses the applicability of conformity determinations and states, “[t]he requirements of this subpart shall not apply to the following Federal Actions: (a) [a]ctions where the total of direct and indirect emissions are below the emissions levels specified in paragraph (b) of this section.

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