



DEPARTMENT OF
ECOLOGY
State of Washington

Technical Support Document for Portable and Stationary Concrete Batch Plants

**General Order of Approval
No. 11AQ-GO-02**

December 6, 2011

TABLE OF CONTENTS

1. SUMMARY	1
2. PURPOSE OF THIS AMENDMENT	1
3. EXISTING GENERAL ORDER	1
4. BACT	3
5. REVIEW OF EXISITING APPROVAL CONDITIONS.....	4
6. EMISSIONS	5
7. AMBIENT IMPACT ANALYSIS	6
8. CONCLUSION.....	8
9. ACRONYMS AND ABBREVIATIONS	9
APPENDIX A. EXCEL SPREADSHEET EVALUATING EMISSIONS	10
APPENDIX B. AERSCREEN ANALYSIS	29

LIST OF TABLES

Table 1. Concrete Batch Plant, Applicability Criteria	2
Table 2. Criteria Pollutant Emissions	5
Table 3. Toxic Air Pollutants.....	6
Table 4. Taps Exceeding the SQER Compared to the ASILs.....	6
Table 5. National Ambient Air Quality Standards (NAAQS)	7
Table 6. Background Values.....	7
Table 7. Ambient Impact Levels.....	7

1. SUMMARY

This General Order of Approval supersedes 08-AQG-002 issued on June 18, 2008. Coverage under the old general order is still valid for stationary concrete batch plants but not portable concrete batch plants. Any new concrete batch plant wishing to gain coverage must comply with the requirements of this General Order. There are few substantive differences between the old and new General Orders. The main difference is that this new general order satisfies the portable relocation requirements discussed below.

2. PURPOSE OF THIS AMENDMENT

On March 1, 2011, the Washington State Department of Ecology (Ecology) revised the General Regulation for Air Pollution Sources Chapter 173-400 Washington Administrative Code (WAC). There is a new section in the rule, Section 036 (Relocation of Portable Sources), which contains a number of relocation requirements. One of those requirements is that “a permitting authority in Washington State issued a notice of construction order of approval for the portable source after July 1, 2010, identifying the emission units as a portable source.” This General Order of Approval satisfies the new requirements contained in WAC 173-400-036, and the requirements for issuing a General Order of Approval as discussed in WAC 173-400-560.

The five main elements of this Technical Support Document (TSD) are: (1) updates to the General Order to be consistent with the revised rule (Chapter 173-400 WAC), (2) Best Available Control Technology (BACT) review, (3) review of ambient impacts analysis, (4) review of approval conditions, and (6) editorial language updates to the Findings and Approval Conditions.

3. EXISTING GENERAL ORDER

The existing General Order was issued on June 18, 2008. No changes are being proposed to the production rates or emission limits. The following is a list of applicability criteria. This table was originally in the original General Order, but it has been modified to allow sources outside Ecology’s jurisdiction to participate in the General Order of Approval.

Table 1. Concrete Batch Plant, Applicability Criteria	
Criterion	Limitation
Location in Washington	Any jurisdiction within which New Source Review requirements are regulated by Ecology's Air Quality Program. At the time of issuance of this General Order, this includes Adams, Asotin, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, San Juan, Stevens, Walla Walla, and Whitman Counties, or any other jurisdiction that participates in the relocation of portable sources allowed by WAC 173-400-066.
Facility description	<p>Permanent or portable facilities that make concrete for off-site use from sand, aggregate¹, Portland cement, mineral admixtures, and water. The ingredients are gravity fed through a weigh hopper. In an in-transit mixing plant, the weigh hopper drops the ingredients into mixer trucks (in-transit mixing). In a central mix plant, the weigh hopper drops the ingredients into a mixer that dumps the pre-mixed concrete into transit trucks (central mix).</p> <p>The concrete batch plant is not part of a new major stationary source or major modification to a major stationary source, which is subject to review under the Prevention of Significant Deterioration program, and the addition of the concrete batch plant to an existing source does not make the source subject to the Air Operating Permit (AOP) program or require a modification in an existing AOP permit.</p>
Size	<p>In-transit mix: Not greater than 150,000 tons per year (74,500 cubic yards) of concrete mixed per year.</p> <p>Central mix: Not greater than 495,000 tons per year (246,000 cubic yards) of concrete mixed per year.</p> <p>Located on a parcel of land that is greater than or equal to one-acre in size.</p>
Design	<p>Facility may either produce truck-mixed or central-mixed concrete.</p> <p>May be stationary or portable.</p>
Equipment	Mobile and stationary conveying equipment for loading sand, aggregate, cementitious material bins and silos, weight hopper, mixer (central mix), and truck charging station.

¹ Fine aggregate: Sand

Coarse aggregate: Gravel, crushed stone, or iron blast furnace slag.

Heavyweight aggregate: Barite, magnetite, limonite, ilmenite, iron, or steel.

Lightweight aggregate: Sintered clay, shale, slate, diatomaceous shale, perlite, vermiculate, slag pumice, cinders, or sintered fly ash.

4. BACT

State law and rule² defines BACT as “an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under the Washington Clean Air Act emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each pollutant.”

Ecology uses the “top-down” process to determine what BACT is for notice of construction reviews. In the “top-down” analysis process, the applicant lists and ranks all potential pollutant control options from highest level of control (lowest emission rate) to the lowest (highest emission rate). Next, those emission control options that are technically infeasible are removed from the list of available controls. The highest level of control remaining is considered technically feasible to implement on the emission unit. An applicant may choose to demonstrate that the highest level of emissions control is not financially feasible (not cost-effective) to implement or has adverse environmental or energy impacts. In this case, the applicant evaluates the economic, environmental, and energy impacts of the next most stringent level of control until a level of control is demonstrated to be economically feasible.

In the case of this General Order of Approval Technical Support Document, there is no identified applicant. Thus, Ecology is responsible for providing this BACT technology analysis comparing the economic feasibility of several of the available emission control options available as add-on emission control technologies as part of our process to determine what BACT should be. A review of EPA’s RACT/BACT/LAER Clearinghouse, the California Air Resources board, and discussions with Ecology regional office permitting staff indicated that permitting agencies were using EPA’s AP-42 emission factors. Ecology has determined that the analysis performed in 2008 is still valid in 2011 and a discussion of the 2008 analysis is presented below.

There are at least five sources of particulate matter (PM) emissions, sometimes referred to as total suspended particulate (TSP) at concrete batch plants. They are maintaining aggregate and sand piles; moving sand and aggregate from the piles to the feed bins; loading the sand, aggregate, and cementitious material bins and silos; loading the concrete trucks (in-transit mixing) or the mixer (central mix); and on-site vehicle traffic. Maintaining aggregate and sand piles, moving sand and aggregate from the piles, and on-site vehicle traffic to the feed bins are sources of fugitive PM emissions. Loading the sand, aggregate, and cementitious material bins and silos cause PM emissions at the top of the bins, and are best characterized as point source emission. Loading the concrete trucks (in-transit mixing) or the mixer (central mix) has properties of both fugitive and point sources. After examining general and specific construction permits from Arizona, California, Idaho, Illinois, Indiana, Montana, North Carolina, New Mexico, South Carolina, Texas, the Puget Sound Clean Air Agency, the Southwest Clean Air Agency, and Ecology’s Central and Eastern Regional Offices, Ecology found:

² RCW 70.94.030(7) and WAC 173-400-030(12).

- PM emissions from maintaining aggregate and sand piles, material transport, and on-site vehicle traffic are normally controlled by water spray.
- PM emissions from sand and aggregate bin loading are normally controlled by water spray.
- PM emissions from loading the cementitious material bin(s) is normally controlled by venting to a fabric filter (bag house).
- PM emissions from in-transit mixing plant truck filling are normally controlled by enclosing the drop chutes and weigh hopper to minimize wind effects, and dropping the concrete components through a flexible boot that fits into the truck mixer.
- For larger central mix plants, PM emissions from mixer filling are normally controlled by sucking up the PM-laden air in the vicinity of the mixer with a blower and venting it to the cement silo or an independent fabric filter.
- Toxic air pollutant emissions from concrete batch plants are controlled by the same methods used to control PM emissions.

5. REVIEW OF EXISTING APPROVAL CONDITIONS

The original concrete batch plant general order was used as a template for creating this General Order. We change the appearance and layout of the order of approval to be consistent with current practices. Changes to the Findings section are intended to aid the permittee in understanding the order of approval. They are not enforceable as a practicable matter.

Specifically, the following changes have been made:

Revise the Findings section to be consistent with current permitting practices. This included:

- a) A new header.
- b) A statement that the General Order supersedes 08-AQG-002.
- c) Removal of the tables and restating the Findings in narrative format.
- d) Removal of the SEPA discussion.
- e) A statement about nonroad engines was added.
- f) The rewording of several Findings.

Revise the Approval Conditions to be consistent with current permitting practices. This included:

- a) Removal of the tables and restating of the Approval Conditions in narrative format.
- b) Creation of an Operations and Emissions Limitations section.
- c) Creation of an Equipment Restriction section.
- d) Differentiating between portable and stationary operational requirements.
- e) The rewording of several Approval Conditions.
- f) Revisions to the Fugitive Dust Control Plan.

6. EMISSIONS

The emissions presented below were quantified based upon a concrete batch plant with aggregate, sand, cement, and cement supplement to silo delivery; two aggregate transfer points and two sand transfer points, weigh hopper loading, truck mixing, central mixing, and fugitive dust from haul roads. Multiple formulas and tables were available for selection of emission factors. They included emissions in lb/ton of concrete, lb/cubic yard of concrete, and two mathematical equations. Table 2 below presents the total projects emissions.

Table 2. Criteria Pollutant Emissions							
		Truck Mix			Central Mix		
		PM	PM₁₀	PM_{2.5}	PM	PM₁₀	PM_{2.5}
Point Source	ton/yr	4.54	1.91	0.20	3.08	2.22	0.06
	lb/hr	19.88	8.39	0.88	13.50	9.72	0.28
Fugitive Emissions	ton/yr	31.79	5.40	--	31.79	8.10	--
	lb/hr	139.26	23.66	--	139.26	35.49	--
TOTAL	ton/yr	36.33	7.32	0.20	34.88	10.32	0.06
	lb/hr	159.14	32.05	0.88	152.76	45.21	0.28

Table 3. Toxic Air Pollutants

Pollutant		Arsenic	Beryllium	Cadmium	Lead	Manganese	Total Phosphorus	Selenium
Averaging Period		Year	Year	Year	Year	24-hr	24-hr	24-hr
Central Mix	lb/yr	1.32E-01	5.56E-02	4.65E-03	7.79E-01	1.17E+01	6.65	5.86E-02
	lb/day	3.61E-04	1.52E-05	1.27E-06	2.14E-03	3.20E-02	1.82E-02	1.61E-04
Truck Mix	lb/yr	3.99E-02	1.68E-02	1.41E-03	2.36E-01	5.54	2.01	1.77E-02
	lb/day	1.09E-04	4.61E-05	5.73E-07	6.47E-04	9.69E-03	5.51E-03	4.86E-05
De Minimis	See averaging period	2.91E-03	4.00E-03	2.28E-03	1.00E+01	2.63E-04	1.31E-01	1.31E-01
SQER	See averaging period	5.81E-02	8.00E-02	4.57E-02	1.60E+01	5.26E-03	2.63	2.63E+00
Below De Minimis	(Yes or No)	No	No	No	Yes	No	Yes	Yes
Below SQER	(Yes or No)	No	Yes	Yes	N/A	No	N/A	N/A

Note: N/A is "not applicable" because the pollutant is below the de minimis level.

Emissions of arsenic, beryllium, cadmium, and manganese were in excess of the de minimis rates contained in WAC 173-460-150. When these four pollutants were compared to the Small Quantity Emission Rates (SQER), arsenic and manganese were retained for ambient modeling.

7. AMBIENT IMPACT ANALYSIS

A screening air dispersion model (BEE-Line AerScreen 2.00) was used to evaluate the impacts against the Ambient Air Quality Standards (AAQS). The fugitive emissions were included in the modeling analysis and all state and federal AAQS were below their standards. All toxic air pollutants were below their Acceptable Source Impact Levels (ASILs) as shown in Table 4 below.

Table 4. Taps Exceeding the SQER Compared to the ASILs

Pollutant	Averaging Period	Maximum Concentration ($\mu\text{g}/\text{m}^3$)	ASIL ($\mu\text{g}/\text{m}^3$)	Above ASIL (Yes or No)
Arsenic	Year	1.80E-06	3.03E-04	No
Manganese	24-hr	5.87E-05	4.00E-02	No

Table 5 lists the state and federal AAQS.

Table 5. National Ambient Air Quality Standards (NAAQS)			
Pollutant	Averaging Period	NAAQS Micrograms Per Cubic Meter ($\mu\text{g}/\text{m}^3$)	Washington State AAQS ($\mu\text{g}/\text{m}^3$)
		Primary	
PM (aka TSP)	Annual	N/A	60
	24-hr	N/A	150
PM ₁₀	Annual	N/A	50
	24-hr	150	150
PM _{2.5}	Annual	15	N/A
	24-hr	35	N/A

Table 6 lists the empirically derived background values.³

Table 6. Background Values		
Pollutant	Averaging Period	Background ($\mu\text{g}/\text{m}^3$)
PM	Annual	20
	24-hr	60
PM ₁₀	Annual	13
	24-hr	28
PM _{2.5}	Annual	7
	24-hr	21

Table 7 compares the maximum ambient concentrations to the AAQS.

Table 7. Ambient Impact Levels		
Plant Type	Truck Mixing	Central Mix
Size	150,000 tons concrete per year	495,000 tons concrete per year
PM: 24-hr avg. plus background	60.25 $\mu\text{g}/\text{m}^3$	60.28 $\mu\text{g}/\text{m}^3$
PM: 24-hr NAAQS	150 $\mu\text{g}/\text{m}^3$	150 $\mu\text{g}/\text{m}^3$
PM: Annual impact plus background	20.25 $\mu\text{g}/\text{m}^3$	20.28 $\mu\text{g}/\text{m}^3$
TSP: Annual WAAQS	60 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
PM ₁₀ : 24-hr impact plus background	28.07 $\mu\text{g}/\text{m}^3$	28.08 $\mu\text{g}/\text{m}^3$

³ These values were developed by the Department of Ecology Air Quality Program and are based upon data collected in Eastern Washington.

Table 7. Ambient Impact Levels		
Plant Type	Truck Mixing	Central Mix
PM ₁₀ : 24-hr NAAQS	150 µg/m ³	150 µg/m ³
PM ₁₀ : Annual impact plus background	13.07 µg/m ³	13.08 µg/m ³
PM ₁₀ : Annual NAAQS	50 µg/m ³	50 µg/m ³
PM _{2.5} : 24-hr impact plus background	21.0 µg/m ³	21.0 µg/m ³
PM _{2.5} : 24-hr NAAQS	35 µg/m ³	35 µg/m ³
PM _{2.5} : Annual impact plus background	7.00 µg/m ³	7.00 µg/m ³
PM _{2.5} : Annual NAAQS	15 µg/m ³	15 µg/m ³

8. CONCLUSION

Ecology's Air Quality Program finds that this evaluation meets all the requirements of New Source Review.

For more information, please contact:

Richard B. Hibbard, P.E.
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Phone: (360) 407-6896
Fax: (360) 407-7534
richard.hibbard@ecy.wa.gov

9. ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standard
ASIL	Acceptable Source Impact Level
aka	Also known as
AOP	Air Operating Permit
BACT	Best Available Control Technology
Ecology	Washington State Department of Ecology
FDCP	Fugitive Dust Control Plan
lb/hr	Pound(s) per hour
NAAQS	National Ambient Air Quality Standard
PM	Particulate matter (aka TSP)
PM ₁₀	PM smaller than 10 microns in diameter
PM _{2.5}	PM smaller than 2.5 microns in diameter
SQER	Small Quantity Emission Rate
tpy	Tons per year
TSD	Technical Support Document
TSP	Total Suspended Particulate (aka PM)
WAAQS	Washington Ambient Air Quality Standard
WAC	Washington Administrative Code

APPENDIX A. EXCEL SPREADSHEET EVALUATING EMISSIONS

Concrete Batch Plant General Order Numerical analysis
 08-AQG-02 Amendment 1
 11/1/2011
 Rich Hibbard 74500
 246000

74,500 Truck Mix number of cubic yards of concrete equates to 149,745
 246,000 Central Mix number of cubic yards of concrete equates to 494,460

Maximum Criteria Emissions

			Truck Mix			Central Mix	
			PM	PM ₁₀	PM _{2.5}	PM	PM ₁₀
Point source	tons/yr		4.54	1.91	0.20	3.08	2.22
	lb/hr		19.88	8.39	0.88	13.50	9.72
fugitive haul road	tons/yr		31.79	5.40	-	31.79	8.10
	lb/hr		139.26	23.66	-	139.26	35.49
TOTAL	tons/yr		36.33	7.32	0.20	34.88	10.32
	lb/hr		159.14	32.05	0.88	152.76	45.21

Maximum Toxic Emissions

	Pollutant	Arsenic	Cadmium	Lead	Manganese	Total Phosphorus	Selenium
Averaging period		year	year	year	24-hr	24-hr	24-hr
Central Mix	lb/yr	3.58E-01	4.65E-03	7.79E-01	1.17E+01	6.65E+00	5.86E-02
	lb/day	9.81E-04	1.27E-05	2.14E-03	3.20E-02	1.82E-02	1.61E-04
Truck Mix	lb/yr	1.08E-01	1.41E-03	2.36E-01	3.54E+00	2.01E+00	1.77E-02
	lb/day	2.97E-04	3.85E-06	6.47E-04	9.69E-03	5.51E-03	4.86E-05
De Minimis		2.91E-03	2.28E-03	1.00E+01	2.63E-04	1.31E-01	1.31E-01
SQER		5.81E-02	4.57E-02	1.60E+01	5.26E-03	2.63E+00	2.63E+00
below DeMinimi (Y or N)		No	No	Yes	No	Yes	Yes
Below SQER (Y or N)		No	N/A	N/A	No	N/A	N/A
ASIL		3.03E-04			4.00E-02		
Max Modeled value ug/m3		1.80E-06			5.87E-05		
Below ASIL (Y or N)		Yes			Yes		

N/A means that the pollutant is below the deMinimis levels and an SEER comparison was not req

Tons of concret
Tons of concret

Mix
PM _{2.5}
0.06
0.28
-
-
0.06
0.28

Beryllium
year
5.56E-02
1.52E-04
1.68E-02
4.61E-05
4.00E-03
8.00E-02
No
Yes

uired

Criteria Concrete Batch Plant Emissions
 11/1/2011 By Rich Hibbard

Emission Factor Source	Emission Points	Emission Factor PM	
		lb/Ton concrete	
		uncontrolled	controlled
AP-42 Tbl 11.12-2 6/06	Aggregate Transfer	0.0069	-
AP-42 Tbl 11.12-2 6/06	Sand Transfer	0.0021	-
AP-42 Tbl 11.12-2 6/06	Cement Unloading to Silo	0.73	0.00099
AP-42 Tbl 11.12-2 6/06	Cement supplement unloading to silo	3.14	0.0089
AP-42 Tbl 11.12-2 6/06	Weigh Hopper loading	0.00392803	-
AP-42 Tbl 11.12-2 6/06	Mixer loading (Central Mix)	0.08017097	0.00257893
AP-42 Tbl 11.12-2 6/06	Truck Loading (Truck mixing) Unpaved Roads	0.15669781	0.01373559

AP-42 Section 11.12
 6/06 Equation 11.12-1

$E = k(0.0032)(U^a/M^b) + c$
 E is emission factor in lb/ton of cement
 k = Particle size multiplier
 U = wind speed in mph
 M = minimum moisture (% by weight)
 a = exponent
 b = exponent
 c = constant

Truck Mix	
9.2	Condition
	Controlled
5	
	Uncontrolled

Central Mix	
	Condition
	Controlled
	Uncontrolled

Emission Factor Source	Emission Points	Truck and Ce	
		Emission Factor PM	
		lb/yd ³ concrete	
		uncontrolled	controlled
AP-42 Tbl 11.12-5 6/06	Aggregate delivery to ground storage	0.0064	0.0064
AP-42 Tbl 11.12-5 6/06	Sand delivery to ground storage	0.0015	0.0015
AP-42 Tbl 11.12-5 6/06	Aggregate transfer to conveyor	0.0064	0.0064
AP-42 Tbl 11.12-5 6/06	Sand Transfer to conveyor	0.0015	0.0015
AP-42 Tbl 11.12-5 6/06	Aggregate Transfer	0.0064	0.0064
AP-42 Tbl 11.12-5 6/06	Sand Transfer	0.0015	0.0015
AP-42 Tbl 11.12-5 6/06	Cement Unloading to Silo	0.0002	0.0002
AP-42 Tbl 11.12-5 6/06	Cement supplement unloading to silo	0.0003	0.0003
AP-42 Tbl 11.12-5 6/06	Weigh Hopper loading	0.0079	0.0079
AP-42 Tbl 11.12-5 6/06	Mixer loading (Central Mix)	-	-
AP-42 Tbl 11.12-5 6/06	Truck Loading (Truck mixing) Unpaved Roads	-	-

AP-42 Section 11.12
 6/06 Equation 11.12-1

$E = k(0.0032)(U^a/M^b) + c$
 E is emission factor in lb/ton of cement
 k = Particle size multiplier
 U = wind speed in mph
 M = minimum moisture (% by weight)
 a = exponent
 b = exponent
 c = constant

Truck Mix	
9.2	Condition
	Controlled
5	Uncontrolled

Central Mix	
	Condition
	Controlled

Uncontrolled

AP-42 Section 11.12
 6/06 Table 11.12-8 METALS

	Arsenic	Beryllium
CAS	---	N/R
Cement silo filling w/fabric filter	4.24E-09	4.86E-10
Cement supplement filling w/fabric filter	1.00E-06	9.04E-08
Central mix batching w/fabric filter	4.3886E-08	N/R
Truck loading w/fabric filter	4.1169E-06	7.1122E-07

AP-42 Section 11.12
 6/06 Table 11.12-8 Average batch is:
 1865 lb course aggregate
 1428 lb sand
 491 lb cement
 73 lb cement supplement
 20 gallons of water
 4024 total lb (one cubic yard of concrete)
 2.01 ton per cubic yard
 2000 lb/ton

Alternate Formula Derived Emission Factors
Truck Mix AP-42 Section 11.12 6/06 Equation 11.12-1

Emission Factor PM ₁₀		Emission Factor PM		Emission Factor PM ₁₀		Emission PM _{2.5}
lb/Ton concrete		lb/Ton concrete		lb/Ton concrete		lb/Ton cc
uncontrolled	controled	uncontrolled	controled	uncontrolled	controled	uncontrolled
0.0033	-	-	-	-	-	-
0.00099	-	-	-	-	-	-
0.47	0.00034	-	-	-	-	-
1.1	0.0049	-	-	-	-	-
0.00229135	-	-	-	-	-	-
0.02186481	0.000771	0.1288	0.0022	0.0418	0.0013	0.0004
0.0434493	0.003686	0.9950	0.0898	0.2780	0.0359	0.0500

Pollutant	k	a	b	c
PM	0.8	1.75	0.3	0.013
PM10	0.32	1.75	0.3	0.0052
PM2.5	0.048	1.75	0.3	0.00078
PM	0.995			
PM10	0.278			
PM2.5	0.05			

Pollutant	k	a	b	c
PM	0.19	0.95	0.9	0.001
PM10	0.13	0.45	0.9	0.001
PM2.5	0.03	0.45	0.9	0.0002
PM	5.9	0.6	1.3	0.12
PM10	1.92	0.4	1.3	0.04
PM2.5	0.38	0.4	1.3	0

Alternate Formula Derived Emission Factors
 Truck and Central Mix AP-42 Section 11.12 6/06 Equation 11.1

Emission Factor PM ₁₀ lb/yd ³ concrete		Emission Factor PM lb/yd ³ concrete		Emission Factor PM ₁₀ lb/yd ³ concrete		Emission PM _{2.5} lb/yd ³ concrete	
uncontrolled	controlled	uncontrolled	controlled	uncontrolled	controlled	uncontrolled	controlled
0.0031	0.0031	-	-	-	-	-	-
0.0007	0.0007	-	-	-	-	-	-
0.0031	0.0031	-	-	-	-	-	-
0.0007	0.0007	-	-	-	-	-	-
0.0031	0.0031	-	-	-	-	-	-
0.0007	0.0007	-	-	-	-	-	-
0.0001	0.0001	-	-	-	-	-	-
0.0002	0.0002	-	-	-	-	-	-
0.0038	0.0038	-	-	-	-	-	-
-	-	0.2589	0.0044	0.0841	0.0025	0.0007	-
-	-	0.9950	0.0898	0.2780	0.0359	0.0500	-
-	-	-	-	-	-	-	-

Pollutant	k	a	b	c
PM	0.8	1.75	0.3	0.013
PM10	0.32	1.75	0.3	0.0052
PM2.5	0.048	1.75	0.3	0.00078
PM	0.995			
PM10	0.278			
PM2.5	0.05			

Pollutant	k	a	b	c
PM	0.19	0.95	0.9	0.001
PM10	0.13	0.45	0.9	0.001
PM2.5	0.03	0.45	0.9	0.0002

PM	5.9	0.6	1.3	0.12
PM10	1.92	0.4	1.3	0.04
PM2.5	0.38	0.4	1.3	0

Cadmium	Total Chromium	Lead	Manganese	Nickel	Total Phosphorus	Selenium
7440-43-9	N/R	----	----	N/R	7723-14-0	----
ND	N/R	1.09E-08	1.17E-07	N/R	ND	ND
1.98E-10	N/R	5.20E-07	2.56E-07	N/R	3.54E-06	7.24E-08
4.8554E-09	N/R	2.50295E-07	2.59E-05	N/R	8.21E-06	ND
6.1958E-08	N/R	1.05E-05	1.42E-04	N/R	8.41E-05	7.73E-07

lb/ton of material loaded

- = No CAS #
 N/R = Not Regulated
 ND = Non Detect

Factor

2.5

Concrete

controlled

-

-

-

-

-

0.0003

0.0054

12-1

Factor

2.5

Concrete

Controlled

-

-

-

-

-

-

-

-

-

0.0005

0.0054

Criteria Concrete Batch Plant Emissions
 11/1/2011 By Rich Hibbard

		PM	
		lb/ton concrete	
		Uncontrolled	Controlled
Truck Mix	Aggregate Transfer	0.0069	-
	Sand Transfer	0.0021	-
	Cement Unloading to Silo	0.73	0.00099
	Cement supplement unloading to silo	3.14	0.0089
	Weigh Hopper loading	0.003928	-
	Mixer loading (Central Mix)	0.1288	0.0026
	Truck Loading (Truck mixing)	0.9950	0.0137
Total Central Mix	(lb/ton concrete)	4.0118	0.0125
	ton/yr	991.83	3.08
	gram/sec	28.532	0.089
Total Truck Mix	(lb/ton concrete)	4.877928	0.023626
	ton/yr	365.22	1.77
	gram/sec	10.506	0.051

		PM	
		lb/yd ³ concrete	
		Uncontrolled	Controlled
Truck and Central Mix	Aggregate delivery to ground storage	0.0064	0.0064
	Sand delivery to ground storage	0.0015	0.0015
	Aggregate transfer to conveyor	0.0064	0.0064
	Sand Transfer to conveyor	0.0015	0.0015
	Aggregate Transfer	0.0064	0.0064
	Sand Transfer	0.0015	0.0015
	Cement Unloading to Silo	0.0002	0.0002
	Cement supplement unloading to silo	0.0003	0.0003
	Weigh Hopper loading	0.0079	0.0079
	Mixer loading (Central Mix)	0.2589	0.0044
	Truck Loading (Truck mixing)	0.9950	0.0898
	Total Central Mix	(lb/yd ³ concrete)	0.2910
ton/yr		35.80	4.49
gram/sec		1.030	0.129
Total Truck Mix	(lb/yd ³ concrete)	1.0271	0.121868
	ton/yr	38.26	4.54
	gram/sec	1.101	0.131

		Arsenic	Cadmium
		year	year
Metals	Averaging period	4.24E-09	ND
	Cement silo filling w/fabric filter	0.000001	1.98E-10
	Central mix batching w/fabric filter	4.389E-08	4.86E-09

Modeling Results
 11/1/2011
 By Rich Hibbard

Bee-Line AERSCREEN Version 11126

	Area source
1 g/sec	Emission Rate
0.00247 g/(s-m2)	Area emission Rate
10 m	Area Height
63.6 m	Area source Long side
63.6 m	Area source short side
3 m	Initial Vertical dimension
1.4 m	Flagpole height
273.15 K	min temp
305.4 K	max temp
0.5 m/s	min wind speed
10 m	anemometer height
0.2	Albedo
2	Bowen Ratio
0.3	Surface roughness

67.01 M MAX CONCENTRATION

1413 ug/m ³	MAX 1-HR
1413 ug/m ³	MAX 24-HR
1413 ug/m ³	MAX ANNUAL

557.4 ug/m3	1 m
976.4 ug/m3	25 m
1305 ug/m3	50 m
1387 ug/m3	75 m
1145 ug/m3	100 m
992 ug/m3	125 m
773 ug/m3	150 m
674 ug/m3	175 m
633 ug/m3	200 m
370 ug/m3	500 m
342 ug/m3	1000 m

Concrete Batch
 Truck Mix

pm

NAAQS=150 24-hr, 60 annual

distance	multiplier output ug/MEE3 concentration	point 0.130590 ug/MEE3 1 hr ave	fugitive 0.61 24-hr ave	emissions 1.83E-04 Annual ave	NAAQS 24-hr NAAQ	Annual NAAQS
67.01	1413.00	0.26	0.26	0.26	60.26	20.26
75.00	1387	0.25	0.25	0.25	60.25	20.25
100.00	1145	0.21	0.21	0.21	60.21	20.21

125.00	992	0.18	0.18	0.18	60.18	20.18
150.00	773	0.14	0.14	0.14	60.14	20.14
175.00	674	0.12	0.12	0.12	60.12	20.12
200.00	633	0.12	0.12	0.12	60.12	20.12
500.00	370	0.07	0.07	0.07	60.07	20.07
1000.00	342	0.06	0.06	0.06	60.06	20.06

Concrete Batch
 Truck Mix

pm10

NAAQS=150 24-hr, annual 50

distance	multiplier output ug/MEE3 concentration	point	fugitive	emissions		
		1 hr ave	24-hr ave	Annual ave	24-hr NAAQS	annual NAAQS
		0.055086	0.1554	5.20E-05		
67.01	1413.00	0.07	0.07	0.07	28.07	13.07
75.00	1387.00	0.07	0.07	0.07	28.07	13.07
100.00	1145.00	0.06	0.06	0.06	28.06	13.06
125.00	992.00	0.05	0.05	0.05	28.05	13.05
150.00	773.00	0.04	0.04	0.04	28.04	13.04
175.00	674.00	0.04	0.04	0.04	28.04	13.04
200.00	633.00	0.03	0.03	0.03	28.03	13.03
500.00	370.00	0.02	0.02	0.02	28.02	13.02
1000.00	342.00	0.02	0.02	0.02	28.02	13.02

Concrete Batch
 Truck Mix

pm2.5

NAAQS=35 24-hr, 15 annual

distance	multiplier output ug/MEE3 concentration	point	fugitive	emissions		
		1 hr ave	24-hr ave	Annual ave	24-NAAQS	annual-NAAQS
		0.005772	0.02	5.27E-06		
67.01	1413.00	0.01	0.01	0.01	21.01	7.01
75.00	1387.00	0.01	0.01	0.01	21.01	7.01
100.00	1145.00	0.01	0.01	0.01	21.01	7.01
125.00	992.00	0.01	0.01	0.01	21.01	7.01
150.00	773.00	0.00	0.00	0.00	21.00	7.00
175.00	674.00	0.00	0.00	0.00	21.00	7.00
200.00	633.00	0.00	0.00	0.00	21.00	7.00
500.00	370.00	0.00	0.00	0.00	21.00	7.00
1000.00	342.00	0.00	0.00	0.00	21.00	7.00

Concrete Batch		pm					
Central mix		NAAQS=150 24-hr, 60 annual					
distance	multiplier output ug/MEE3 concentration	point	fugitive	emissions	NAAQS		
		0.129058 ug/MEE3 1 hr ave	0.91 24-hr ave	2.58E-04 Annual ave	24-hr NAAQ	Annual NAAQS	
67.01	1413.00	0.36	0.36	0.36	60.36	20.36	
75.00	1387.00	0.36	0.36	0.36	60.36	20.36	
100.00	1145.00	0.30	0.30	0.30	60.30	20.30	
125.00	992.00	0.26	0.26	0.26	60.26	20.26	
150.00	773.00	0.20	0.20	0.20	60.20	20.20	
175.00	674.00	0.17	0.17	0.17	60.17	20.17	
200.00	633.00	0.16	0.16	0.16	60.16	20.16	
500.00	370.00	0.10	0.10	0.10	60.10	20.10	
1000.00	342.00	0.09	0.09	0.09	60.09	20.09	

Concrete Batch		pm10					
Central Mix		NAAQS=150 24-hr, annual 50					
distance	multiplier output ug/MEE3 concentration	point	fugitive	emissions	NAAQS		
		0.063843 ug/MEE3 1 hr ave	0.233099 24-hr ave	7.34E-05 Annual ave	24-hr NAAQ	annual NAAQS	
67.01	1413.00	0.10	0.10	0.10	28.10	13.10	
75.00	1387.00	0.10	0.10	0.10	28.10	13.10	
100.00	1145.00	0.08	0.08	0.08	28.08	13.08	
125.00	992.00	0.07	0.07	0.07	28.07	13.07	
150.00	773.00	0.06	0.06	0.06	28.06	13.06	
175.00	674.00	0.05	0.05	0.05	28.05	13.05	
200.00	633.00	0.05	0.05	0.05	28.05	13.05	
500.00	370.00	0.03	0.03	0.03	28.03	13.03	
1000.00	342.00	0.03	0.03	0.03	28.03	13.03	

Concrete Batch		pm2.5		
Central Mix		NAAQS=35 24-hr, 15 annual		

point fugitive emissions

distance	multiplier	0.001858	0.02	4.30E-06		
	output ug/MEE3 concentration	ug/MEE3 1 hr ave	24-hr ave	Annual ave	24-NAAQS	annual-NAAQS
67.01	1413.00	0.01	0.01	0.01	21.01	7.01
75.00	1387.00	0.01	0.01	0.01	21.01	7.01
100.00	1145.00	0.00	0.00	0.00	21.00	7.00
125.00	992.00	0.00	0.00	0.00	21.00	7.00
150.00	773.00	0.00	0.00	0.00	21.00	7.00
175.00	674.00	0.00	0.00	0.00	21.00	7.00
200.00	633.00	0.00	0.00	0.00	21.00	7.00
500.00	370.00	0.00	0.00	0.00	21.00	7.00
1000.00	342.00	0.00	0.00	0.00	21.00	7.00

Concrete Batch
 Central Mix

ASIL= Arsenic
 3.03E-04 annual ave

distance	multiplier	point	fugitive	emissions		
	output ug/MEE3 concentration	ug/MEE3 1 hr ave	24-hr ave	Annual ave	1.27E-09	
67.01	1413.00	1.80E-06	1.80E-06	1.80E-06		
75.00	1387.00	1.77E-06	1.77E-06	1.77E-06		
100.00	1145.00	1.46E-06	1.46E-06	1.46E-06		
125.00	992.00	1.26E-06	1.26E-06	1.26E-06		
150.00	773.00	9.84E-07	9.84E-07	9.84E-07		
175.00	674.00	8.58E-07	8.58E-07	8.58E-07		
200.00	633.00	8.06E-07	8.06E-07	8.06E-07		
500.00	370.00	4.71E-07	4.71E-07	4.71E-07		
1000.00	342.00	4.35E-07	4.35E-07	4.35E-07		

Concrete Batch
 Truck mix

ASIL= Arsenic
 3.03E-04 annual ave

distance	multiplier	point	fugitive	emissions		
	output ug/MEE3 concentration	ug/MEE3 1 hr ave	24-hr ave	Annual ave	3.86E-10	
67.01	1413.00	5.45E-07	5.45E-07	5.45E-07		

125.00	992.00	3.83E-07	3.83E-07	3.83E-07
150.00	773.00	2.98E-07	2.98E-07	2.98E-07
175.00	674.00	2.60E-07	2.60E-07	2.60E-07
200.00	633.00	2.44E-07	2.44E-07	2.44E-07
500.00	370.00	1.43E-07	1.43E-07	1.43E-07
1000.00	342.00	1.32E-07	1.32E-07	1.32E-07

Concrete Batch
 Central Mix

ASIL= Manganese
 4.00E-02 24-hr ave

distance	multiplier output ug/MEE3 concentration	point 0.000168 ug/MEE3 1 hr ave	fugitive 0.00 24-hr ave	emissions 4.15E-08 Annual ave
67.01	1413.00	5.87E-05	5.87E-05	5.87E-05
75.00	1387.00	5.76E-05	5.76E-05	5.76E-05
100.00	1145.00	4.76E-05	4.76E-05	4.76E-05
125.00	992.00	4.12E-05	4.12E-05	4.12E-05
150.00	773.00	3.21E-05	3.21E-05	3.21E-05
175.00	674.00	2.80E-05	2.80E-05	2.80E-05
200.00	633.00	2.63E-05	2.63E-05	2.63E-05
500.00	370.00	1.54E-05	1.54E-05	1.54E-05
1000.00	342.00	1.42E-05	1.42E-05	1.42E-05

Concrete Batch
 Truck mix

ASIL= Manganese
 4.00E-02 24-hr ave

distance	multiplier output ug/MEE3 concentration	point 0.000051 ug/MEE3 1 hr ave	fugitive 0.00 24-hr ave	emissions 1.26E-08 Annual ave
67.01	1413.00	1.79E-05	1.79E-05	1.79E-05

APPENDIX B. AERSCREEN ANALYSIS

(using BEE-Line software)

AERSCREEN 11126 / AERMOD 1110 06/21/11
11:47:58

TITLE: AREA CONCRETE BATCH PLANT

***** AREA PARAMETERS

SOURCE EMISSION RATE: 1.0000 g/s 7.937 lb/hr

AREA EMISSION RATE: 0.247E-03 g/(s-m2) 0.196E-02 lb/(hr-m2)
AREA HEIGHT: 10.00 meters 32.81 feet
AREA SOURCE LONG SIDE: 63.60 meters 208.66 feet
AREA SOURCE SHORT SIDE: 63.60 meters 208.66 feet
INITIAL VERTICAL DIMENSION: 3.00 meters 9.84 feet
RURAL OR URBAN: RURAL

FLAGPOLE RECEPTOR HEIGHT: 1.40 meters 4.59 feet

INITIAL PROBE DISTANCE = 1000. meters 3281. feet

***** BUILDING DOWNWASH PARAMETERS

BUILDING DOWNWASH NOT USED FOR NON-POINT SOURCES

***** FLOW SECTOR ANALYSIS

25 meter receptor spacing: 1. meters - 1000. meters

MAXIMUM IMPACT RECEPTOR

Zo SURFACE 1-HR CONC RADIAL DIST TEMPORAL
SECTOR ROUGHNESS (ug/m3) (deg) (m) PERIOD

1* 0.091 1387. 45 75.0 ANN

* = worst case diagonal

***** MAKEMET METEOROLOGY PARAMETERS

MIN/MAX TEMPERATURE: 273.1 / 305.4 (K)

MINIMUM WIND SPEED: 0.5 m/s

ANEMOMETER HEIGHT: 10.000 meters

SURFACE CHARACTERISTICS INPUT: USER ENTERED

ALBEDO: 0.20

BOWEN RATIO: 2.00

ROUGHNESS LENGTH: 0.091 (meters)

METEOROLOGY CONDITIONS USED TO PREDICT OVERALL MAXIMUM
IMPACT

YR MO DY JDY HR

10 01 01 1 12

H0 U* W* DT/DZ ZICNV ZIMCH M-O LEN Z0 BOWEN ALBEDO REF WS

1.51 0.056 0.100 0.020 22. 30. -9.6 0.091 2.00 0.20 0.50

HT REF TA HT

10.0 273.1 2.0

METEOROLOGY CONDITIONS USED TO PREDICT AMBIENT BOUNDARY
IMPACT

 YR MO DY JDY HR

 10 01 04 1 12

H0 U* W* DT/DZ ZICNV ZIMCH M-O LEN Z0 BOWEN ALBEDO REF WS

 18.99 0.073 0.300 0.020 53. 45. -1.9 0.091 2.00 0.20 0.50

HT REF TA HT

 10.0 305.4 2.0

 ***** AERSCREEN AUTOMATED DISTANCES

OVERALL MAXIMUM CONCENTRATIONS BY DISTANCE

MAXIMUM		MAXIMUM	
DIST	1-HR CONC	DIST	1-HR CONC
(m)	(ug/m3)	(m)	(ug/m3)
1.00	557.4	525.00	354.4
25.00	976.4	550.00	345.6
50.01	1305.	575.00	344.9
75.00	1387.	600.00	343.6
100.00	1145.	625.00	342.0
125.00	922.1	650.00	340.0
150.01	772.9	675.00	338.9
174.99	674.1	700.00	340.3
200.00	633.2	725.00	341.6
225.00	608.5	750.00	342.6
250.00	583.7	775.00	343.3
274.99	556.5	800.00	343.8
300.00	534.2	825.00	344.2
325.00	511.3	850.00	344.3
350.00	488.6	875.00	344.3
375.01	466.3	900.00	344.2
400.00	444.9	925.00	343.9
425.00	424.8	950.00	343.4
450.00	405.5	975.00	342.8

475.00 387.3 1000.00 342.1
 500.00 370.3

 ***** AERSCREEN MAXIMUM IMPACT SUMMARY

3-hour, 8-hour, and 24-hour scaled
 concentrations are equal to the 1-hour concentration as referenced in
 SCREENING PROCEDURES FOR ESTIMATING THE AIR QUALITY
 IMPACT OF STATIONARY SOURCES, REVISED (Section 4.5.4)
 Report number EPA-454/R-92-019
http://www.epa.gov/scram001/guidance_permit.htm
 under Screening Guidance

MAXIMUM 1-HOUR CALCULATION PROCEDURE	SCALED 3-HOUR CONC (ug/m3)	SCALED 8-HOUR CONC (ug/m3)	SCALED 24-HOUR CONC (ug/m3)	SCALED ANNUAL CONC (ug/m3)
FLAT TERRAIN	1413.	1413.	1413.	N/A

DISTANCE FROM SOURCE 67.01 meters

IMPACT AT THE AMBIENT BOUNDARY	557.4	557.4	557.4	557.4	N/A
DISTANCE FROM SOURCE	1.00 meters				