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

LIST OF TABLES

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 sustentative 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	Permanent or portable facilities that make concrete for off-site use from sand, aggregate[1], 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).
	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.
Size	In-transit mix: Not greater than 150,000 tons per year (74,500 cubic yards) of concrete mixed per year.
	Central mix: Not greater than 495,000 tons per year (246,000 cubic yards) of concrete mixed per year.
	Located on a parcel of land that is greater than or equal to one-acre in size.
Design	Facility may either produce truck-mixed or central-mixed concrete.
	May be stationary or portable.
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 rule[2] 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 EXISITING 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	PM_{10}	$PM_{2.5}$	PM	PM_{10}	$PM_{2.5}$
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 (µg/m^3)**	**ASIL (µg/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 (µg/m^3)**	**Washington State AAQS (µg/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 (µg/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 µg/m^3	60.28 µg/m^3
PM: 24-hr NAAQS	150 µg/m^3	150 µg/m^3
PM: Annual impact plus background	20.25 µg/m^3	20.28 µg/m^3
TSP: Annual WAAQS	60 µg/m^3	60 µg/m^3
PM_{10}: 24-hr impact plus background	28.07 µg/m^3	28.08 µg/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	Centrial Mix number of cubic yards of concrete equates to	494,460

Maximum Criteria Emissions

			Truck Mix			Centrial M	
			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
Centrial 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
elow 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		
ax Modeled valu	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 compairson was not req

Tons of concret
Tons of concret

lix
$PM_{2.5}$
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	
		uncontroled	controled
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 (Centrial 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	
	Condition
9.2	Controlled
5	
	Uncontrolled

Central Mix
Condition
Controlled
Uncontrolled

Truck and Ce

Emission Factor Source	Emission Points	Emission Factor PM lb/yd^3 concrete uncontroled	controled
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 (Centrial 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

	Condition
9.2	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
Centrial 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 Formulia 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
lb/Ton concrete		lb/Ton concrete		lb/Ton concrete		lb/Ton cc
uncontroled	controled	uncontroled	controled	uncontroled	controled	uncontroled
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 Formulia Derived Emission Factors				
entral Mix		Truck and Central Mix		AP-42 Section 11.12 6/06 Equation 11.		
Emission Factor PM_{10}		Emission Factor PM		Emission Factor PM_{10}		Emission PM_2
lb/yd^3 concrete		lb/yd^3 concrete		lb/yd^3 concrete		lb/yd^3 co
uncontroled	controled	uncontroled	controled	uncontroled	controled	uncontroled
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
ncrete
controled
-
-
-
-
-
0.0003
0.0054

12-1

Factor

2.5

ncrete

controled

-

-

-

-

-

-

-

-

-

0.0005

0.0054

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

		PM lb/ton concrete Uncontroled	PM lb/ton concrete Controled
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 Uncontroled	PM lb/yd^3 concrete Controled
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	0.0365
	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

	Averaging period	Arsenic year	Cadmium year
Metals	Cement silo filling w/fabric filter	4.24E-09	ND
	Cement supplement 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	Inital 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

		point	fugitive	emissions		
	multiplier	0.130590	0.61	1.83E-04		
	output ug/MEE3	ug/MEE3				
distance	concentration	1 hr ave	24-hr ave	Annual ave	24-hr NAA(	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 — pm10
Truck Mix — NAAQS=150 24-hr, annual 50

		point	fugitive	emissions		
	multiplier	0.055086	0.1554	5.20E-05		
	output ug/MEE3	ug/MEE3 1 hr ave	24-hr ave	Annual ave	24-hr NAA(	annual NAAQS
distance	concentration					
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 — pm2.5
Truck Mix — NAAQS=35 24-hr, 15 annual

		point	fugitive	emissions		
	multiplier	0.005772	0.02	5.27E-06		
	output ug/MEE3	ug/MEE3 1 hr ave	24-hr ave	Annual ave	24-NAAQS	annual-NAAQS
distance	concentration					
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
Centrial mix

pm
NAAQS=150 24-hr, 60 annual

		point	fugitive	emissions		
	multiplier	0.129058	0.91	2.58E-04		
	output ug/MEE3	1 hr ave	24-hr ave	Annual ave	NAAQS 24-hr NAA	Annual NAAQS
distance	concentration					
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
Centrial Mix

pm10
NAAQS=150 24-hr, annual 50

		point	fugitive	emissions		
	multiplier	0.063843	0.233099	7.34E-05		
	output ug/MEE3	1 hr ave	24-hr ave	Annual ave	24-hr NAA	annual NAAQS
distance	concentration					
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
Centrial Mix

pm2.5
NAAQS=35 24-hr, 15 annual

		point	fugitive	emissions

	multiplier	0.001858	0.02	4.30E-06		
	output ug/MEE3	1 hr ave	24-hr ave	Annual ave	24-NAAQS	annual-NAAQS
distance	concentration					
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

		point	fugitive	emissions	
	multiplier	0.000005	0.00	1.27E-09	
	output ug/MEE3	1 hr ave	24-hr ave	Annual ave	
distance	concentration				
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

		point	fugitive	emissions	
	multiplier	0.000002	0.00	3.86E-10	
	output ug/MEE3	1 hr ave	24-hr ave	Annual ave	
distance	concentration				
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
Centrial Mix

Manganese
ASIL= 4.00E-02 24-hr ave

		point	fugitive	emissions
	multiplier	0.000168	0.00	4.15E-08
	output ug/MEE3	ug/MEE3		
distance	1 hr ave concentration	24-hr ave	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

Manganese
ASIL= 4.00E-02 24-hr ave

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

			Unpaved Roads			PM^{10}		
Source		AP-42 13.2.2-1		by Rich Hibbard		6/23/2011		
		December 2003						
$E=k(s/12)^a(W/3)^b$								
E= emissions in lb/Vehicle Miles Traveled (VMT)								
k= constant, for industrial roads					1.5	PM^{10}		
s= surface material silt content					4.8			
a= constant for industrial roads					0.9	PM^{10}		
W= mean vehicle weight (tons)			loaded	66000	lbs	unloaded	26000	lbs
b= constant for industrial roads					0.45	PM_{10}		
E (PM^{10})		1.644441	pounds per vehical mile travled					
			Note: this assumes that half of the time the truck is loaded					
Assumptions:								
weight of soil		2.01	tons/cubic yard					
1 Truck		10	cubic yards					
length of haul road		1/4mile	1/8 mile loaded and 1/8 mile un-loaded plus another 1/4 mile driving around					
Water control		85%	effective					
	g/sec		Pounds of		Tons of		# trucks/hr	lb/hr
			PM10 per year		PM10 per year			
	0.310799		21,608		10.8		20.0	2.5
	0.233099		16,206		8.1		15.0	1.8
	0.1554		10,804		5.4		10.0	1.2
					conversions			
					2000	lb/ton		
					365	day/yr		
					8760	hr/yr		
					453.6	g/lb		
					3600	sec/hr		

			Unpaved Roads			PM		

Source		AP-42 13.2.2-1		by Rich Hibbard		6/23/2011		
		December 2003						
$E=k(s/12)^a(W/3)^b$								
E= emissions in lb/Vehicle Miles Traveled (VMT)								
k= constant, for industrial roads					4.9	PM		
s= surface material silt content					4.8			
a= constant for industrial roads					0.7	PM		
W= mean vehicle weight (tons)			loaded	66000	lbs	unloaded	26000	lbs
b= constant for industrial roads					0.45	PM		
E (PM)		6.452248	pounds per vehical mile travled					
			Note: this assumes that half of the time the truck is loaded					
Assumptions:								
weight of soil		2.01	tons/cubic yard					
1 Truck		10	cubic yards					
length of haul road		1/4mile	1/8 mile loaded and 1/8 mile un-loaded plus another 1/4 mile driving around					
Water control		85%	effective					
	g/sec		Pounds of PM per year		Tons of PM per year		# trucks/hr	lb/hr
	1.219475		84,783		42.4		20.0	9.7
	0.914606		63,587		31.8		15.0	7.3
	0.609737		42,391		21.2		10.0	4.8
					conversions			
					2000	lb/ton		
					365	day/yr		
					8760	hr/yr		
					453.6	g/lb		
					3600	sec/hr		
			Unpaved Roads			$PM^{2.5}$		
Source		AP-42 13.2.2-1		by Rich Hibbard		11/1/2011		
		December 2003						

$E=k(s/12)^a(W/3)^b$								
E= emissions in lb/Vehicle Miles Traveled (VMT)								
k= constant, for industrial roads					0.15	$PM_{2.5}$		
s= surface material silt content					4.8			
a= constant for industrial roads					0.9	$PM_{2.5}$		
W= mean vehicle weight (tons)			loaded	66000	lbs	unloaded	26000	lbs
b= constant for industrial roads					0.45	$PM_{2.5}$		
E (PM^{10})		0.164444	pounds per vehical mile travled					
			Note: this assumes that half of the time the truck is loaded					
Assumptions:								
weight of soil		2.01	tons/cubic yard					
1 Truck		10	cubic yards					
length of haul road		1/4mile	1/8 mile loaded and 1/8 mile un-loaded plus another 1/4 mile driving around					
Water control		85%	effective					
	g/sec		Pounds of		Tons of		# trucks/hr	lb/hr
			PM2.5 per year		PM2.5 per year			
	0.03108		2,161		1.1		20.0	0.2
	0.02331		1,621		0.8		15.0	0.2
	0.01554		1,080		0.5		10.0	0.1
					conversions			
					2000	lb/ton		
					365	day/yr		
					8760	hr/yr		
					453.6	g/lb		
					3600	sec/hr		

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

DIST (m)	MAXIMUM 1-HR CONC (ug/m3)	DIST (m)	MAXIMUM 1-HR CONC (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

CALCULATION PROCEDURE	MAXIMUM 1-HOUR CONC (ug/m3)	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.	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