State of Idaho
Department of Environmental Quality
Air Quality Division

AIR QUALITY PERMIT
STATEMENT OF BASIS

Permit to Construct No. P-2008.0198

Final

Clements Concrete Company

Notus, Idaho (initial location)

Facility ID No. 777-00447

July 1, 2009

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The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.et seq, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

Table of Contents

ACRONYMS, UNITS, AND CHEMICAL NOMENCLATURE 3

1. FACILITY INFORMATION 4

2. APPLICATION SCOPE AND APPLICATION CHRONOLOGY 4

3. TECHNICAL ANALYSIS 5

4. REGULATORY REVIEW 8

5. PERMIT FEES 10

6. PUBLIC COMMENT 11

APPENDIX A – AIRS INFORMATION

APPENDIX B – EMISSIONS INVENTORY

APPENDIX C – AMBIENT AIR QUALITY IMPACT ANALYSIS

Acronyms, Units, and Chemical Nomenclature

AAC/AACC	acceptable ambient concentration
acfm	actual cubic feet per minute
AFS	AIRS Facility Subsystem
AIRS	Aerometric Information Retrieval System
atm	atmosphere as unit of pressure
CAM	Compliance Assurance Monitoring
CFR	Code of Federal Regulations
CO	carbon monoxide
Clements	Clements Concrete Company
cy	cubic yards
DEQ	Department of Environmental Quality
gr	grain (1 lb = 7,000 grains)
dscf	dry standard cubic feet
sdcfm	dry standard cubic feet per minute
EPA	U.S. Environmental Protection Agency
HAP	hazardous air pollutant
hp	horsepower
hr	hour(s)
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
lb/hr	pounds per hour
lb/quarter	pounds per quarter
MACT	Maximum Achievable Control Technology
$\mu g/m^3$	micrograms per cubic meter
MMBtu/hr	million British thermal units per hour
NAAQS	National Ambient Air Quality Standard
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
PC	permit condition
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
PSD	Prevention of Significant Deterioration
PTC	permit to construct
PTE	potential to emit
Rules	Rules for the Control of Air Pollution in Idaho
SIP	State Implementation Plan
SO_2	sulfur dioxide
SO_x	sulfur oxides
TAP	toxic air pollutant
T/yr	tons per year
VOC	volatile organic compound
Wt %	weight percentage

1. FACILITY INFORMATION

1.1 Facility Description

Clements Concrete Company (Clements) operates a portable truck-mix concrete batch plant manufactured by Ross. It is a Rustler 160 and was manufactured in 1979. The plant's maximum capacity is 160 cubic yards (cy) of concrete per hour. The concrete batch plant consisting of three aggregate storage bins with bin cover, an internal cement/fly ash hopper (in-frame cement/fly ash silo), weigh batcher, conveyors, a truck-loading module, cement/fly ash silo (an auxiliary silo), a cement/fly ash guppy (a temporary storage silo), a 2.9 MMBtu/hr boiler used to heat the water, and a 120hp Ford engine powering the air compressor of the guppy. The concrete batch plant uses line power for electricity supply. The plant combines sand, gravel, cement, and cement supplement; and transfers the mixture into a truck along with a measured amount of water for in-transit mixing of the concrete.

1.2 Permitting Action and Facility Permitting History

This permitting action is for issuing an initial Permit to Construct (PTC) to a portable truck-mix concrete batch plant of Clements initially located at Notus.

2. APPLICATION SCOPE AND APPLICATION CHRONOLOGY

2.1 Application Scope

Clements has requested authorization to operate the portable concrete batch plant in Idaho and has requested that this portable plant be allowed to operate at 160 cubic yards per hour (design capacity), 2,400 cubic yards per day, and 400,000 cubic yards per year. The applicant has also requested to operate a 2.9 MMBtu/hr diesel-fired boiler for a maximum of 15 hours per day and 1,250 hours per year and a 120hp Ford engine for a maximum of three hours per day and 500 hours per year.

The facility has requested to use DEQ's generic modeling for this project. In DEQ's generic modeling, the SO_2 emissions are limited to be less than modeling threshold of 0.9 lb/hr. The imposed sulfur content limit of the diesel used in the boiler is for staying below this threshold. Should the permittee choose to run plant-specific modeling in the future, this sulfur content limit can be revised accordingly.

2.2 Application Chronology

December 2, 2008	DEQ received the application
December 30, 2008	DEQ declared the application incomplete
January 23, 2009	DEQ received application supplement
February 17, 2009	DEQ received additional application information
February 20, 2009	DEQ declared the application complete
April 4, 2009	DEQ received additional application information
April 20, 2009	DEQ issued draft permit for applicant review
May 11, 2009	The applicant met with DEQ staff to discuss the draft permit and to provide revised process description
May 15, 2009	DEQ issued draft permit for public comment to the facility
May 27, 2009	DEQ received the PTC processing fee

3. TECHNICAL ANALYSIS

3.1 Emission Unit and Control Device

Table 3.1 EMISSION UNIT AND CONTROL DEVICE INFORMATION

Emissions Unit(s)/Processes	Emissions Control Device	Emissions Point
Cement/fly ash Silo (a cement/fly ash auxiliary silo) Fruehauf 4100cf cement/fly ash guppy (a temporary storage silo) In-frame cement/fly ash silo (an internal cement/fly ash hopper)	Baghouse (process equipment, with secondary function as a control device) Manufacturer: Ross Model: Rustler 160 14 bags 8'x 4' baghouse	Baghouse stack Stack height: 40 feet Exit diameter: 4 feet Exit air flow rate: 4,000 acfm Control efficiency: 99.9% (0.01 gr/dscf)
Weigh batcher	Baghouse/cartridge filter system (process equipment, with secondary function as a control device) 8 bags 8'x 4' bin-vent	8 bags 8'x 4' bin-vent Stack height: > 12 feet Exit diameter: 4 feet Control efficiency: 99.9%
Materials transfer: truck loading	Boot, enclosure, or equivalent	Truck loadout transfer point Estimated control efficiency: 95%
Materials transfer	Manual water sprays or water spray bars, or equivalent	Aggregate dump to ground, Sand dump to ground, Aggregate dump to conveyor, Sand dump to conveyor, Aggregate conveyor to elevator storage, and Sand conveyor to elevated storage. Estimated control efficiency: 75%
2.9 MMBtu/hr diesel-fired boiler	none	Stack height: 28.5 feet Stack diameter 20 inches
Guppy inline 120 hp Ford engine	none	Stack height: 9 feet Stack diameter 1.5 inches

3.2 Emissions Inventory

The emissions inventory of this portable concrete batch plant was developed by DEQ based on AP-42 Section 11.12 emission factors for a truck-mix concrete batch plant and the following assumptions: 160 cy per hour concrete production capacity and concrete production limits of 2,400 cy per day and 400,000 cy per year. Baghouse/cartridge filter capture efficiencies were presumed to be 99.6% in DEQ's generic emissions estimation. The facility's baghouses/cartridge have control efficiency of 99.9% as provided in the application. The emissions inventory for the 2.9 MMBtu/hr diesel-fired boiler and the 120hp diesel-fired Ford engine were developed by the applicant using emissions factors in AP-42 Section 3.3 Gasoline and Diesel Industrial Engines and AP-42 Section 1.3 Fuel Oil Combustion and operating hour limits of 15 hours per day and 1,250 hours per year for the boiler and a maximum of three hours per day and 500 hours per year for the 120 hp Ford engine.

Fugitive emissions of particulate matter (PM) and PM_{10} from batch plant material transfer points were assumed to be controlled by manual water sprays, sprinklers, or spray bars, or an equivalent method (e.g., enclosing the entire process inside a building) that reduce the emissions by an estimated 75%. Aggregate is washed before delivery to the batch plant site, and water is used on-site to control the temperature of the aggregate. Particulate matter and PM_{10} emissions from the weigh batcher transfer

point are controlled by a baghouse/cartridge, and truck mix loadout emissions are controlled by a boot. Capture efficiency of the truck mix loadout boot or equivalent was estimated at 95%. Fugitive emissions from vehicle traffic and wind erosion from storage piles were not estimated.

Controlled emissions of toxic air pollutants (TAPs) were estimated based on the presence of a baghouse on the cement/cement supplement silos, a baghouses/cartridge on the weigh batcher, and 95% control for truck loadout emissions. Hexavalent chromium content was estimated at 20% of total chromium for cement, and 30% of total chromium for the cement supplement/fly ash.

A summary of potential to emit of this plant after this permitting action is listed in Tables 3.2 and 3.3. The potential to emit of hazardous air pollutants is 0.001 ton per year. Detailed emissions calculations can be found in Appendix B of this document.

Table 3.2 EMISSIONS ESTIMATES OF CRITERIA POLLUTANTS POTENTIAL TO EMIT

Emissions Unit	PM_{10}		SO_2		NOx		CO		VOC		LEAD
	lb/hr, Max.	T/yr	lb/hr, Max.	T/yr	lb/hr, Max.	T/yr	lb/hr, Max.	T/yr	lb/hr, Max.	T/yr	lb/quarter
Guppy inline 6-cylinder 120 hp Ford Engine	0.087 (limited to 3 hr/day)	0.022	0.071	0.018	1.320	0.330	52.680	13.170	1.800	0.450	---
2.9 MMBtu/hr Diesel-fired Boiler	0.068 (limited to 15 hr/day)	0.043	1.471	0.919	0.414	0.259	0.104	0.065	0.007	0.004	0.033[a]
Aggrgate and Sand Transfers	0.456	0.571	---	---	---	---	---	---	---	---	---
Cement delivery to Silo	0.013	0.017	---	---	---	---	---	---	---	---	5.86E-04 [b]
Cement supplement delivery to Silo	0.029	0.036	---	---	---	---	---	---	---	---	4.16E-03 [c]
Truck mix loading	0.627	0.784	---	---	---	---	---	---	---	---	1.12E-2 [d]
Weigh hopper loading	6.32E-04	7.90E-04	---	---	---	---	---	---	---	---	---
Total, Non-fugitive Sources	---	1.47	---	0.94	---	0.59	---	13.24	---	0.45	0.05

a max hourly emissions rate* annual operating hour (assume total annual operating hours of 1,250 happening at the winter quarter) = 2.61×10^{-5} lb/hr, max * 1,250 hr/yr = 0.033 lb/quarter

b max hourly emissions rate from DEQ's calculation * 365/4 * 15 hr/day = 4.28×10^{-7} lb/hr, max * 365/4 day/yr * 15 hrs/day = 5.86×10^{-4} lb/quarter

c max hourly emissions rate from DEQ's calculation * 365/4 * 15 hr/day = 3.04×10^{-6} lb/hr, max * 365/4 day/yr * 15 hrs/day = 4.16×10^{-3} lb/quarter

d max hourly emissions rate from DEQ's calculation * 365/4 * 15 hr/day = 8.17×10^{-6} lb/hr, max * 365/4 day/yr * 15 hrs/day = 1.12×10^{-2} lb/quarter

Table 3.3 EMISSIONS ESTIMATES OF TAP AND HAP POTENTIAL TO EMIT

TAPs	24-hour Average[a]	Annual Average[a]
	lb/hr	lb/hr
Arsenic [c]	---	5.327E-06
Beryllium	---	1.555E-06
Cadmium	---	1.302E-06
Chromium	2.668E-05	---
Copper	1.088E-05	---
Manganese	1.010E-04	---
Mercury	5.438E-06	---
Nickel	---	1.317E-05
Phosphorus	6.707E-05	---
Selenium	3.115E-05	---
Zinc	7.250E-06	---
Chromium VI [c]	---	2.238E-06

a. 24-hour average only applies to non-carcinogenic TAPs. Annual average only applies to carcinogenic TAPs.
b. NA = not applicable.
c. Emissions exceed screen level. Ambient impact is conducted. Refer to Table 3.5.

3.3 Ambient Air Quality Impact Analysis

The facility has demonstrated compliance to DEQ's satisfaction that emissions from this facility will not cause or significantly contribute to a violation of any ambient air quality standard. The facility has also demonstrated compliance to DEQ's satisfaction that emissions increments due to this permitting action will not exceed any AAC or AACC for TAPs. Tables 3.4 and 3.5 provide a summary of ambient impact from the facility. Detailed ambient analysis can be found in the modeling analysis included as Appendix C.

Table 3.4 FULL IMPACT ANALYSIS RESULTS FOR CRITERIA POLLUTANTS

Pollutant	Throughput	Facility Ambient Impact (µg/m3)	Background Concentration (µg/m^3)	Total Ambient Concentration (µg/m^3)	NAAQS (µg/m^3)	Percent of NAAQS
PM_{10}	24-hour 1,500cy/day	45.1	73	118	150	78.7%
	24-hour 2,400cy/day	54.7	73	128	150	85.1%
	24-hour 3,6 00cy/day	56.0	73	129	150	86.0%
	24-hour 4,800cy/day	48.7	73	122	150	81.1%
	Annual 400,000 cy/yr	7.9	26	33.9	50	67.9%

Table 3.5 FULL IMPACT ANALYSIS RESULTS FOR TAPS

Pollutant	Average Period	Concentration ($\mu g/m^3$)	Regulatory AAC/AACC ($\mu g/m^3$)	Percent of Limit
Arsenic	Annual	1.28E-4	2.3E-04	55.5%
Chromium VI	Annual	6.10E-5	8.3E-5	73.5%
Nickel	Annual	3.12E-4	4.23E-3	7.4%

Note: AACs are in units of milligrams per meter cubed whereas AACCs are in units of micrograms per meter cubed. Convert AACs from milligrams per meter cubed to micrograms per meter cubed.

4. REGULATORY REVIEW

4.1 Attainment Designation (40 CFR 81.313)

The facility will initially be located in Canyon County which is designated as attainment or unclassifiable for PM_{10}, $PM_{2.5}$, CO, NO_2, SO_X, and Ozone. Reference 40 CFR 81.313.

4.2 Permit to Construct (IDAPA 58.01.01.201)

The facility's proposed project does not meet the permit to construct exemption criteria contained in Sections 220 through 223 of the Rules; therefore, a PTC is required.

4.3 Tier II Operating Permit (IDAPA 58.01.01.401)

The facility does not apply for Tier II operating permit. This section does not apply.

4.4 Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

The facility is classified as a natural minor source because without limits on the potential to emit, the emissions of all regulated pollutants are less than major source thresholds; therefore, the facility is not subject to the Title V program. The AIRS classification is "B."

4.5 PSD Classification (40 CFR 52.21)

The facility is classified as a minor source for PSD because without limits on the potential to emit, all emissions are less than PSD major source thresholds; therefore, it is not subject to PSD.

4.6 NSPS Applicability (40 CFR 60)

The 120hp Ford engine is not subject to 40 CFR 60, Subpart IIII – Standard of Performance for stationary Compression Ignition Internal Combustion Engines. The engine was taken from an old Ford truck, and was build way before the applicable dates in this regulation.

The provisions of Subpart OOO, Standards of Performance for Nonmetallic Mineral Processing Plants, do not apply to stand-alone screening operations at plants without crushers or grinding mills. The facility is therefore not subject to this NSPS.

4.7 NESHAP Applicability (40 CFR 61)

The facility is not subject to any NESHAP requirements.

4.8 MACT Applicability (40 CFR 63)

The facility is not subject to any MACT requirements.

4.9 CAM Applicability (40 CFR 64)

The facility is not a title V source; therefore, it is not subject to CAM requirements.

4.10 Permit Conditions Review

This section describes the permit conditions (PC) for this initial PTC.

Section 1 of the permit provides the purpose of this permitting action and a summary of regulated sources in this permit.

Section 2 of the permit contains permit conditions to ensure that the facility complies with air Rules in Idaho.

4.10.1 Permit Conditions 2.1 and 2.2 describe the concrete batch plant and the control of emissions from the plant.

4.10.2 Permit Condition 2.3 establishes PM grain loading standard for the diesel-fired boiler in accordance with IDAPA 58.01.01.675. The boiler is in compliance with the limit as long as it is fired by distillate fuel oil as specified in PC 2.8. The permittee is required to keep records of the fuel used as specified in PC 2.19.

The grain loading compliance calculation:

(0.068 lb/hr, max from EI) / 548.1 (calculated flue gas volume at dscfm@3%O_2, see Appendix B) x (7,000 gr/lb, unit conversion factor) x (1hr/60 min, unit conversion factor) = 0.014 gr/dscf at 3% O_2 < 0.050 gr/dscf at 3% O_2 (the standard)

4.10.3 Permit Condition 2.4 lists the opacity limit in accordance with IDAPA 58.01.01.625. To compliance with the limit, the permittee is required to:

- use fuel type as specified in PC 2.8
- operate and inspect baghouse/cartridge filter system as specified in PCs 2.9 and 2.10
- conduct monthly visible emissions monitoring as specified in PC 2.14
- monitor fuel type as specified in PC 2.19

4.10.4 Permit Condition 2.5 establishes daily and annual production limits of the concrete batch plant and respective setback distance. PCs 2.6 and 2.7 establish daily and annual operating hour limits for the 120hp Ford engine and the 2.9 MMBtu/hr diesel-fired boiler, respectively. PC 2.8 specifies the fuel type of the boiler. PCs 2.9 and 2.10 require operating and inspecting of baghouse/cartridge filter system of the plant. These operating requirements are established to ensure that the facility complies with 24-hr and annual NAAQS for PM_{10} and acceptable ambient concentration for Arsenic and Chromium VI. To demonstrate compliance with these operating requirements, the permittee is required to:

- monitor production rates as specified in PC 2.15
- measure and record the setback distance as specified in PC 2.16
- monitor and record operating hours of the engine and the boiler as specified in PCs 2.17 and 2.18, respectively
- monitor fuel type as specified in PC 2.19

4.10.5 Permit Condition 2.8 establishes the sulfur content limit of diesel fuel used in the boiler. The facility has requested to use DEQ's generic modeling for this permitting action. In DEQ's generic modeling, the SO_2 emissions are limited to be less than modeling threshold of 0.9 lb/hr. The sulfur content limit of diesel used in the boiler is for staying below this threshold. Should the permittee choose to run plant specific modeling in the future, this sulfur content limit can be revised accordingly. To demonstrate compliance with sulfur content limit, the permittee is required to keep the documentation as specified in PC 2.19.

4.10.6 Permit Conditions 2.11, 2.12, and 2.13 require the permittee to control and monitor fugitive emissions.

4.10.7 Permit Condition 2.20 states that the permit does not allow for the plant to be operated at PM_{10} non-attainment area because no analysis was conducted for PM_{10} non-attainment area for this permitting action.

4.10.8 Permit Condition 2.21 states that the permit does not allow for the plant to be collocated with other source of emissions with exemptions as specified in PC 2.21.3.

4.10.9 Permit Condition 2.22 requires the permittee to fill out a relocation form prior to the plant relocation.

Section 3 of the permit contains general provisions that apply to the plant.

5. PERMIT FEES

Table 5.1 lists the processing fee associated with this permitting action. In accordance with IDAPA 58.01.01.225, the facility is subject to a processing fee of $5,000 because its permitted emissions are greater than 10 tons and less than 100 tons per year. Refer to the chronology for fee receipt dates.

Table 5.1 PROCESSING FEE TABLE

Emissions Inventory			
Pollutant	**Annual Emissions Increase (T/yr)**	**Annual Emissions Reduction (T/yr)**	**Annual Emissions Change (T/yr)**
NO_X	0.59	0	0.59
SO_2	0.94	0	0.94
CO	13.24	0	13.24
PM_{10}	1.47	0	1.47
VOC	0.45	0	0.45
HAPs	0.001	0	0.001
Total:	16.69	0	16.69
Fee Due	**$ 5,000**		

6. PUBLIC COMMENT

An opportunity for public comment period on the PTC application was provided from December 15, 2009, to December 30, 2009, in accordance with IDAPA 58.01.01.209.01.c. During this time, there were no comments on the application and there was a request for a public comment period on DEQ's proposed action.

A public comment period was made available to the public from May 26, 2009, to June 26, 2009. During this time, comments were not submitted in response to DEQ's proposed action.

Appendix A – AIRS Information

AIRS/AFS Facility-wide Classification Form

Facility Name: Clements Concrete Company

Facility Location: Notus, Idaho (initial location)

Facility ID: 777-00447 **Date:** 07-01-09

Project/Permit No.: P-2008.0198 **Completed By:** Shawnee Chen

☐ Check if there are no changes to the facilitywide classification resulting from this action. (compare to form with last permit)

☐ Yes, this facility is an SM80 source.

Identify the facility's area classification as A (attainment), N (nonattainment), or U (unclassified) for the following pollutants:

	SO_2	PM_{10}	VOC	
Area Classification:	A/U	A/U	A/U	DO NOT LEAVE ANY BLANK

Check one of the following:

☒ **SIP** [0] - Yes, this facility is subject to SIP requirements. (do not use if facility is Title V)

OR

☐ **Title V** [V] - Yes, this facility is subject to Title V requirements. (If yes, do not also use SIP listed above.)

For SIP or TV, identify the classification (A, SM, B, C, or ND) for the pollutants listed below. Leave box blank if pollutant is not applicable to facility.

	SO_2	NOx	CO	PM_{10}	PT (PM)	VOC	THAP
Classification:	B	B	B	B	B	B	B

☐ **PSD** [6] - Yes, this facility has a PSD permit.

If yes, identify the pollutant(s) listed below that apply to PSD. Leave box blank if pollutant does not apply to PSD.

	SO_2	NOx	CO	PM_{10}	PT (PM)	VOC	THAP
Classification:	☐	☐	☐	☐	☐	☐	☐

☐ **NSR - NAA** [7] - Yes, this facility is subject to NSR nonattainment area (IDAPA 58.01.01.204) requirements.

Note: As of 9/12/08, Idaho has no facility in this category.

If yes, identify the pollutant(s) listed below that apply to NSR-NAA. Leave box blank if pollutant does not apply to NSR - NAA.

	SO_2	NOx	CO	PM_{10}	PT (PM)	VOC	THAP
Classification:	☐	☐	☐	☐	☐	☐	☐

☐ **NESHAP** [8] - Yes, this facility is subject to NESHAP (Part 61) requirements. (THAP only)

If yes, what CFR Subpart(s) is applicable?

☐ **NSPS** [9] - Yes, this facility is subject to NSPS (Part 60) requirements.

If yes, what CFR Subpart(s) is applicable?

If yes, identify the pollutant(s) regulated by the subpart(s) listed above. Leave box blank if pollutant does not apply to the NSPS.

	SO_2	NOx	CO	PM_{10}	PT (PM)	VOC	THAP
Classification:	☐	☐	☐	☐	☐	☐	☐

☐ **MACT** [M] - Yes, this facility is subject to MACT (Part 63) requirements. (THAP only)

If yes, what CFR Subpart(s) is applicable?

Appendix B – Emissions Inventory

Emission Inventory
Clements Concrete Company

Pollutant	Geppy Engine		Boiler		Aggregate and Sand Transfers		Cement delivery to Silo (controlled EF)		Cement supplement delivery to Silo (controlled EF)		Weigh hopper loading		Truck mix loading		Total	
	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)	(lb/hr)	(tons/yr)
PM	0.0865	0.0216	0.0584	0.0427											0.1549	0.0644
PM-10	0.0865	0.0216	0.0584	0.0427	0.4565	0.5706	1.355E-02	1.569E-02	2.861E-02	3.576E-02	6.323E-04	7.904E-04	0.627	0.784	1.2811	1.4721
SO2	0.0709	0.0177	1.4707	0.9192											1.5416	0.9369
NOx	1.3200	0.3300	0.4145	0.2589											1.7345	0.5889
CO	52.6800	13.1700	0.1036	0.0647											52.7836	13.2347
VOC	1.8000	0.4500	7.045E-03	4.402E-03											1.8070	0.4544
Lead			2.610E-05	1.631E-05			4.28E-07	1.88E-05	8.04E-06	1.33E-05			8.17E-06	0.00E+00	3.773E-05	3.149E-05
TAPS																
Arsenic			1.160E-05	7.250E-06			1.67E-07	2.08E-07	5.84E-06	7.30E-06			6.86E-06	8.57E-06	2.446E-05	2.933E-05
Beryllium			8.700E-06	5.438E-06			1.91E-08	2.39E-08	5.23E-07	6.66E-07			5.50E-07	6.88E-07	9.797E-06	6.809E-06
Cadmium			8.700E-06	5.438E-06			1.91E-08	2.39E-08	1.16E-07	1.48E-07			7.72E-08	9.64E-08	8.912E-06	5.702E-06
Chromium			8.700E-06	5.438E-06			1.14E-06	1.42E-06	7.12E-06	8.91E-06			2.57E-05	3.21E-05	4.268E-05	4.792E-05
Copper			1.740E-05	1.088E-05											1.74E-05	1.088E-05
Manganese			1.740E-05	1.088E-05			4.60E-06	5.74E-06	1.50E-05	1.87E-05			1.38E-04	1.73E-04	1.616E-04	1.911E-04
Mercury			8.700E-06	5.438E-06											8.70E-06	5.438E-06
Nickel			8.700E-06	5.438E-06			1.64E-06	2.05E-06	1.33E-05	1.66E-05			2.68E-05	1.66E-05	5.03E-05	4.078E-05
Phosphorus									2.07E-05	2.58E-05			8.66E-05	1.08E-04	1.073E-04	1.613E-04
Selenium			4.350E-05	2.719E-05					4.23E-07	5.28E-07			5.91E-06	7.39E-06	4.933E-05	3.510E-05
Zinc			1.160E-05	7.250E-06											1.16E-05	7.250E-06
Chromium VI							2.28E-07	2.85E-07	2.14E-06	2.67E-06			5.48E-06	6.85E-06	7.843E-06	9.802E-06

Summary of Averaged lb/hr Emission Rates
And Toxic Air Pollutant Screening Emission Level Analysis

Daily Operating Hours:		3	15	15				
Annual Operating Hours:		500	1250	2500				
Criteria Pollutant	Averaging Period	Geppy Engine (Ave. lb/hr)	Boiler (Ave. lb/hr)	Batch Plant (Ave. lb/hr)	Facility Total (Ave. lb/hr)			
PM-10	24-hr	0.0108	0.0427	0.7039	0.7574			
	Annual	0.0049	0.0086	0.3214	0.3351			
SO2	3-hr	0.0709	1.4707		1.5416			
	24-hr	0.0089	0.9192		0.9281			
	Annual	0.0040	0.2099		0.2139			
NOx	Annual	0.0753	0.0591		0.1345			
CO	1-hr	52.6800	0.1036		52.7836			
	8-hr	19.7550	0.1036		19.8586			
Lead	Quarterly		1.65125E-05	7.27E-06	2.358E-05			
Toxic Air Pollutant						Screening Level (lb/hr)	Percent of Screening Level	Exceeds Screening Level?
Arsenic	Annual		1.655E-06	3.671E-06	5.327E-06	1.50E-06	355.11%	YES
Beryllium	Annual		1.241E-06	3.153E-07	1.555E-06	2.80E-05	5.55%	NO
Cadmium	Annual		1.241E-06	6.047E-06	1.502E-06	3.70E-06	39.15%	NO
Chromium	24-hr		5.438E-06	2.124E-05	2.668E-05	3.30E-02	0.08%	NO
Copper	24-hr		1.088E-05		1.088E-05	6.70E-02	0.02%	NO
Manganese	24-hr		1.088E-05	9.010E-05	1.010E-04	3.35E-01	0.03%	NO
Mercury	24-hr		5.438E-06	0.00E+00	5.438E-06	5.00E-03	0.18%	NO
Nickel	Annual		1.241E-06	1.193E-05	1.317E-05	2.70E-05	48.78%	NO
Phosphorus	24-hr			6.707E-05	6.707E-05	0.007	0.96%	NO
Selenium	24-hr		2.719E-05	3.955E-06	3.115E-05	0.013	0.24%	NO
Zinc	24-hr		7.250E-06		7.250E-06	0.657	0.00%	NO
Chromium VI	Annual			2.238E-06	2.238E-06	5.60E-07	399.64%	YES

Emission Inventory
Clements Concrete Company

Guppy Ford Inline 6 cylinder engine

Maximum Power Output (hp)	120
Daily Operating Hours (hrs/day)	5
Annual Operating Hours (hr/yr)	500

Assumes Guppy engine operates 20% of the time based on plant operating capacity of 160 cu yrds/hr and production limits of 2,400 cu yrds/day (15 hrs) and 400,000 cu yrds/year (2,500 hrs).

Pollutant	Emission Factor (lb/hp-hr)	Actual Emission Rate (lb/hr)	(tons/yr)
PM	7.21E-04	0.0865	0.0216
PM10	7.21E-04	0.087	0.0216
SOx	5.91E-04	0.071	0.0177
NOx	0.011	1.320	0.3500
CO	0.439	52.680	13.1700
TOC	0.015	1.800	0.4500

Emission Factors From AP-42 Table 3.3-1

Boiler Operating Parameters

Maximum Operating Rate (MMBtu/hr)	2.9
Fuel consumption (1,000 gal/hr)	0.020714
Daily Operating Hours (hrs/day)	15
Annual Operating Hours (hr/yr)	1,250

Assumes boiler operates 50% of the plant's annual operating hours.

Criteria Air Pollutant	Emission Factor (lb/10^3 gal)	Actual Emission Rate (lb/hr)	(tons/yr)
PM[1]	3.3	0.0684	0.0427
PM-10[1]	3.3	0.0684	0.0427
SO2[2]	142(S)	1.4707	0.9192
NOx[2]	20	0.4143	0.2589
CO[2]	5	0.1036	0.0647
VOC[3]	0.34	0.0070	4.402E-03
Lead[4]	1.26E-03	2.610E-05	1.631E-05
Toxic Air Pollutant			
Arsenic[4]	5.60E-04	1.160E-05	7.250E-06
Beryllium[4]	4.20E-04	8.700E-06	5.438E-06
Cadmium[4]	4.20E-04	8.700E-06	5.438E-06
Chromium[4]	4.20E-04	8.700E-06	5.438E-06
Copper[4]	8.40E-04	1.740E-05	1.088E-05
Manganese[4]	8.40E-04	1.740E-05	1.088E-05
Mercury[4]	4.20E-04	8.700E-06	5.438E-06
Nickel[4]	4.20E-04	8.700E-06	5.438E-06
Selenium[4]	2.10E-03	4.350E-05	2.719E-05
Zinc[4]	5.60E-04	1.160E-05	7.250E-06

[1]Emission Factors From AP-42 Tables 1.3-1 (Filterable PM) and 1.3-2 (Condensable PM)

[2]Emission Factors From AP-42 Table 1.3-1

[3]Emission Factors From AP-42 Table 1.3-3 Non Methane Total Organic Compounds (NMTOC) Comercial/Institutional/Residential Combustors

[4]Emission Factors From AP-42 Table 1.3-10 and Converted to lb/10^3 gal using 140,000 Btu/gal of Fuel

CRITERIA POLLUTANT EMISSION INVENTORY for Truck Mix Portable Concrete Batch Plant

Emission Inventory 2/18/09 12:56

Company:	
Facility ID:	
Permit No.:	
Source Type:	Portable Concrete Batch Plant
Manufacturer/Model:	

Assumptions Implied or Stated in Application:

See control assumptions

Truck Mix (T) or Central Mix (C)? T

INCREASE IN Production[1]

Maximum Hourly Production Rate	180	cy/hr	Per manufacturer
Proposed Daily Production Rate	2,400	cy/day	16.00 Hours of operation per day at max capacity
Proposed Maximum Annual Production Rate	400,000	cy/year	
Cement Storage Silo Capacity	4540	ft³ of stored cement	
Cement Storage Silo Large Compartment Capacity for cement only	85%	of the silo capacity	
Cement Storage Silo small Compartment Capacity for cement or ash	35%	of the silo capacity	

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Change In PM_{10} Emissions due to this PTC

Emissions Point	PM_{10} Emission Factor[2] (lb/cy)		Controlled Emission Rate, Max.	Controlled Emission Rate, 24-hour average		Controlled Emission Rate, annual average		Control Assumptions:	
	Controlled	Uncontrolled	lb/hr[2]	lb/hr[3]	lb/day[3]	lb/hr[4]	T/yr[4]		
Aggregate delivery to ground storage		0.00310	0.1240	0.07750	1.86	0.035	0.155	75%	Water Sprays at Operator's Discretion
Sand delivery to ground storage		0.00070	0.0282	0.018	0.42	0.008	0.035	75%	Water Sprays at Operator's Discretion
Aggregate transfer to conveyor		0.00310	0.1240	0.078	1.86	0.035	0.155	75%	Water Sprays at Operator's Discretion
Sand transfer to conveyor		0.00070	0.0282	0.018	0.42	0.008	0.035	75%	Water Sprays at Operator's Discretion
Aggregate transfer to elevated storage		0.00310	0.1240	0.078	1.86	0.035	0.155	75%	Water Sprays at Operator's Discretion
Sand transfer to elevated storage		0.00070	0.0282	0.018	0.42	0.008	0.035	75%	Water Sprays at Operator's Discretion
Cement delivery to Silo (controlled EF)	0.0001		0.0134	8.35E-03	2.00E-01	3.81E-03	1.67E-02	0.00%	Baghouse is process equipment
Cement supplement delivery to Silo (controlled EF)	0.0002		0.0268	1.78E-02	4.29E-01	8.16E-03	3.58E-02	0.00%	Baghouse is process equipment
Weigh hopper loading (sand & aggregate batcher loading)		0.00395	6.323E-04	3.95E-04	9.48E-03	1.80E-04	7.90E-04	88.9%	Baghouse is process equipment
Truck mix loading, Table 11.12-2, "0.275 lb/ton of cement/flyash" x ((491 lb cement + 73 lb flyash)/cy concrete) / 2000 lb = 0.0784 lb/cy		0.07840	0.6272	0.39	9.41	0.18	0.78	96.00%	Control, Transit mixer shroud, adjustable rubber skirting
Central Mix loading, Table 11.12-2, "0.04 lb/ton of cement/flyash" x ((491 lb cement + 73 lb flyash)/cy concrete) / 2000 lb = 0.0078 lb/cy		0.0000	0.00	0.00	0.00	0.00	0.00	0.00%	N/A
Point Sources Total Emissions		**4.21E-03**	**4.256E-02**	**2.66E-02**	**6.39E-01**	**1.22E-02**	**5.32E-02**		
Process Fugitive Emissions		0.0998	1.08	0.59	16.26	0.31	1.35		
Facility Wide Total: Point Sources + Process Fugitives (Except for Road Dust and Windblown Dust)		0.0940	1.1262	0.70	16.89	0.32	1.41		

POINT SOURCE EMISSIONS for FACILITY CLASSIFICATION[5]		Controlled EF	at 1,401,600 cy/yr	T/yr
Facility Classification Total PM[5]		**6.01E-03**		**3.51E+00**
Facility Classification Total PM10[5]		**2.68E-04**		**1.57E-01**

[1] The EFs were calculated using EFs in lb/ton of material handled from Table 11.12-2, typical composition per cubic yard of concrete (1865 lb aggregate, 1428 lbs sand, 491 lbs cement, 73 lbs cement supplement, and 20 gallons of water = 4024 lb/cy), and cl

[2] Max. hourly rate includes reductions associated with control assumptions

[3] Hourly emissions rate (24-hr average) = Max hourly emissions rate x (hrs per day) / 24.
Daily emissions rate = max emissions rate (1-hr average) x proposed hrs/day

[4] Annual average hourly emissions rate = EF (lb/cy) x proposed annual production rate (cy/yr) / (8760 hr/yr).
Annual emissions rate = EF (lb/cy) x proposed annual production rate (cy/yr) /(2000 lb/T)

[5] Controlled EFs for PM = 0.0002 (cement silo) + 0.0003 (flyash silo) +0.0078(weigh batcher)*(1-controlWB)
for PM10 = 0.0001 (cement silo) + 0.0002 (flyash silo) +0.0040 (weigh batcher)*(1-controlWB)

[6] Emissions for Facility Classification are based on baghouses as process equipment, 24-hr day, 8760 hr/yr = 3,840 cy/day, and 1,401,600 cy/yr

Lead emissions

Emissions Point	Lead Emission Factor[1] (lb/ton of material loaded)		Increase in Emissions from this PTC: Emission Rate, Max	Emissions for Comparison with DEQ Modeling Threshold		Emission Rate, Quarterly Avg.	Emissions for Facility Classification	
	Controlled with fabric filter	Uncontrolled	lb/hr, 1-hr avg[2]	lb/month[3]	T/yr[4]	lb/hr qtrly avg[5]		T/yr
Cement delivery to silo [6]	**1.09E-08**	7.36E-07	4.2915E-07	1.95E-04	1.07E-03	2.69E-07	Point Source	1.88E-06
Cement supplement delivery to Silo [6]	**5.20E-07**	ND	3.04E-06	1.39E-03	7.59E-03	1.90E-06	Point Source	1.33E-05
Truck Loadout (with 25% control)		**8.82E-08**	8.17E-06	3.73E-03	2.04E-02	5.10E-06	Fugitive	
Central Mix (with 25% control)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Fugitive	
Total			**1.16E-05**	**5.31E-03**	**0.029**	**7.270E-06**	**Point Sources**	**1.62E-05**
DEQ Modeling Threshold				100	0.6			
Modeling Required?				No	No			

[1] The emissions factors are from AP-42, Table 11.12-5 (version 06/06)
[2] Max. hourly rate = EF x pound of cement/yd³ of concrete x max. hourly concrete production rate/2000 lb/T
[3] lb/mo = EF x pound of material/yd³ of concrete x max. daily concrete production rate x (365/12)/2000 lb/T
[4] T/yr = EF x pound of material/yd³ of concrete x max. annual concrete production rate/2000 lb/T
[5] lb/hr, qtrly avg = lb/mo x 3 months per qtr / (8760/4)hrs per qtr

Toxic Air Pollutant (TAPs) EMISSIONS INVENTORY, Truck Mix Concrete Batch Plant

2/16/2009 12:56

Emission Inventory

Company: 0
Facility ID: 0
Permit No.: 0
Source Type: Portable Concrete Batch Plant
Manufacturer: 0

Emissions estimates are based on EFs in AP-42, Table 11.12-8 (version 06/06) and the following composition of one yard of concrete:

Coarse aggregate		1866 pounds
Sand		1428 pounds
Cement		491 pounds
Cement supplement		73 pounds
Water		30 gallons
Concrete		4024 pounds

Truck Mix Loadout Factor: 1
Central Mix Batching Factor: 0

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Review these before you change them.

Increase in Production

Maximum Hourly Production Rate:	160	cy/hr	
Proposed Daily Production Rate:	2,400	cy/day	
Proposed Maximum Annual Production Rate:	400,000	cy/year	

Uncontrolled (Unlimited Production Rate)

3,840 cy/day	24 hrs/day; 7 day/wk;
1,401,600 cy/year	52 wks/year

TAP Emission Factors from AP-42, Table 11.12-8 (Version 06/06)

Emissions Point	Arsenic EF (lb/ton of material loaded)		Beryllium EF (lb/ton of material loaded)		Cadmium EF (lb/ton of material loaded)		Chromium EF (lb/ton of material loaded)		Manganese EF (lb/ton of material loaded)		Nickel EF (lb/ton of material loaded)		Phosphorus EF (lb/ton of material loaded)		Selenium EF (lb/ton of material loaded)		Chromium VI
	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Controlled with Fabric filter	Uncontrolled	Percent of total Cr that is Cr+6
Cement delivery to silo (with baghouse)	**4.24E-09**	1.58E-06	**4.86E-10**	1.79E-08	**4.86E-10**	2.34E-07	**2.80E-08**	2.82E-07	**1.17E-07**	2.02E-04	**4.18E-08**	1.76E-05	ND	**1.18E-05**	ND	ND	20%
Cement supplement delivery to Silo (with baghouse)	**1.00E-06**	ND	**9.04E-08**	ND	**1.98E-08**	ND	**1.22E-06**	ND	**2.66E-07**	ND	**2.28E-06**	ND	**5.64E-08**	ND	**7.24E-08**	ND	30%
Truck Loadout (no boot or shroud)	1.16E-06	**3.04E-08**	1.04E-07	**2.44E-07**	9.36E-09	**3.42E-08**	4.10E-06	**1.14E-05**	3.29E-05	**6.12E-06**	4.78E-06	**1.19E-05**	1.23E-05	**0.84E-05**	1.13E-07	**2.82E-08**	**21.29%**
Central Mix Batching(NO boot or shroud)	0.00E+00	**0.00E+00**	ND	ND	0.00E+00	**0.00E+00**	0.00E+00	**0.00E+00**	0.00E+00	**0.00E+00**	0.00E+00	**0.00E+00**	0.00E+00	**0.00E+00**	ND	ND	**21.29%**

UNCONTROLLED TAP EMISSIONS Note: Includes baghouses as process equipment. 3,840 cy/day, and 1,401,600 cy/yr

Emissions Point	Arsenic		Beryllium		Cadmium		Chromium		Manganese		Nickel		Phosphorus		Selenium		Chromium VI	
	lb/hr annual avg.	T/yr[5]	lb/hr annual avg.	T/yr	lb/hr annual avg.	T/yr	lb/hr 24-hr avg.	T/yr[5]	lb/hr 24-hr avg.	T/yr	lb/hr annual avg.	T/yr	lb/hr 24-hr avg.	T/yr	lb/hr 24-hr avg.	T/yr	lb/hr annual avg.	
Cement delivery to silo (with baghouse)	1.67E-07	7.29E-07	1.91E-08	8.36E-08	1.91E-08	8.36E-08	1.14E-06	4.34E-05	4.60E-06	2.01E-05	1.64E-06	7.19E-06	**4.64E-04**	2.03E-03	ND	ND	2.28E-07	
Cement supplement delivery to Silo (with baghouse)	5.84E-06	2.56E-05	5.28E-07	2.31E-06	1.15E-07	5.06E-07	7.1248E-06	3.12E-05	1.55E-06	6.55E-06	1.33E-05	5.83E-05	2.07E-06	9.06E-06	4.23E-07	**1.85E-06**	2.14E-06	
Truck Loadout (NO boot or shroud)	1.3716E-04	6.01E-04	1.10E-05	4.82E-05	1.54E-05	6.76E-05	5.144E-04	2.25E-03	2.76E-03	1.21E-02	5.37E-04	2.35E-03	1.73E-03	7.59E-03	1.18E-04	5.16E-04	1.10E-04	
Central Mix Batching (NO boot or shroud)	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	Control Technique: Other Control Efficiency
Sources Total	**1.40E-04**	**6.27E-04**	**1.16E-06**	**5.05E-05**	**1.68E-06**	**7.35E-05**	**6.28E-04**	**2.33E-03**	**2.77E-03**	**1.21E-02**	**5.52E-04**	**2.42E-03**	**2.22E-03**	**9.71E-03**	**1.19E-04**	**5.20E-04**	**1.12E-04**	**2.75E-02** Tons per year
IDAPA Screening EL (lb/hr)	1.50E-06		2.80E-05		3.70E-06		3.30E-02		3.33E-01		2.70E-05		7.00E-03		1.30E-02		5.60E-07	
EXCEEDS EL?	Yes		No		No		No		No		Yes		No		No		Yes	

CONTROLLED TAP EMISSIONS Note: Includes baghouses as process equipment. 2,400 cy/day, and 400,000 cy/year

Emissions Point	Arsenic		Beryllium		Cadmium		Chromium		Manganese		Nickel		Phosphorus		Selenium		Chromium VI	
	lb/hr annual avg.	T/yr[5]	lb/hr annual avg.	T/yr	lb/hr annual avg.	T/yr	lb/hr 24-hr avg.	T/yr[5]	lb/hr 24-hr avg.	T/yr	lb/hr annual avg.	T/yr	lb/hr 24-hr avg.	T/yr	lb/hr 24-hr avg.	T/yr	lb/hr annual avg.	
Cement delivery to silo (with baghouse)[1]	4.76E-08	2.09E-07	5.45E-09	2.39E-08	5.45E-09	2.39E-08	7.12E-07	1.42E-05	2.87E-06	5.74E-06	4.69E-07	2.05E-06	ND	ND	ND	ND	6.50E-08	
Cement supplement delivery to Silo (with baghouse)[2]	1.67E-06	7.30E-06	1.51E-07	6.60E-07	3.30E-08	1.45E-07	4.45E-06	8.91E-06	9.34E-07	1.67E-06	3.80E-06	1.66E-05	1.29E-06	2.68E-05	2.64E-07	5.29E-07	6.10E-07	
Truck Loadout (WITH boot or shroud)	1.96E-06	8.57E-06	1.57E-07	6.88E-07	2.20E-08	9.64E-08	1.6074E-05	3.2148E-05	8.63E-05	1.73E-04	7.66E-06	3.36E-05	5.41E-05	1.08E-04	3.69E-06	7.39E-06	1.56E-06	**95.00%** Control Technique: Water shroud, adjustable rubber skirting
Central Mix Batching (WITH boot or shroud)	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00% Wet
Sources Total	**3.671E-06**	**1.61E-05**	**3.13E-07**	**1.37E-06**	**6.05E-08**	**2.65E-07**	**2.12E-05**	**4.25E-05**	**9.61E-06**	**1.92E-04**	**1.19E-05**	**5.23E-05**	**6.71E-06**	**1.34E-04**	**3.98E-06**	**7.92E-06**	**2.24E-06**	**4.35E-04** Tons per year
IDAPA Screening EL (lb/hr)	1.50E-06		2.80E-05		3.70E-06		3.30E-02		3.33E-01		2.70E-05		7.00E-03		1.30E-02		5.60E-07	
Percent of EL	244.75%		1.12%		1.63%		0.06%		0.0271%		44.19%		0.09%		0.0304%		399.54%	
EXCEEDS EL?	Yes		No		No		No		No		No		No		No		Yes	

[1] lb/hr, annual average = EF x pound of cement / Yd^3 of concrete x annual concrete production rate / 2000lb/Ton / 8760 hr/yr; lb/hr, 24-hr = EF x pound of cement / Yd3 of concrete x daily concrete production rate / 2000lb/Ton / 24 hr/day

[2] lb/hr, annual average = EF x pound of cement supplement / Yd^3 of concrete x annual concrete production rate / 2000lb/Ton / 8760 hr/yr; lb/hr, 24-hr average = EF x pound of cement supplement / Yd3 of concrete x daily concrete production rate / 2000lb/Ton

[3] lb/hr, annual average = EF x pound of (cement + cement supplement) / Yd^3 of concrete x annual concrete production rate / 2000lb/Ton / 8760 hr/yr; lb/hr, 24-hr average = EF x pound of (cement + cement supplement) / Yd3 of concrete x daily concrete produc

[4] T/yr = lb/hr, annual avg x 8760 hr/yr x (1T/2000 lb)

[5] T/yr = EF x pound of cement, or cement supplement, or cement + cement supplement x annual concrete production rate /2000 lb/ton / 2000 lb/ton

Boiler Flue Gas Calculation

Combustion Evaluation

No.2 Distillate Oil-fired Boiler

Heat input rate = 2,900,000 Btu/hr 2.9 MMBtu/hr
Fuel heating value (1)= 141,000 Btu/gallon
Fuel Density (1) = 7.206 lb/gallon @ 60 F

Fuel Data (% by weight)
No 2 distillate oil

S	0.7
N2	0
C	86.4
H2	12.7
H20	0
O2	0.2
	100

Fuel burned (lb/hr)	148.2
Excess air (%)[4]	3
Stk temp (F)	450
Stk press (atm)	0.92
Elevation (ft)	2,316

Combustion Air Required

	O2 lb.mole	N2 lb.mole
S	0.03	0.12
N2	0.00	0
C	10.66	40.11
H2	4.67	17.57
O2	-0.01	
	15.35	57.80

stoic. comb air = 77.903401 lb.mole/hr
stoic. dry comb air = 66.49216035 lb.mole/hr

Flue Products

	lb.mole	lb/hr
SO2	0.03	2.07
N2	59.53	1666.91
CO2	10.66	469.09
H2O(combustion)	9.41	169.40
O2	0.46	14.74
H20(fuel)	0.00	0.00
dry	70.69	
wet	80.10	

	Flow[2]	IDAPA Flow[3]
Volume of flue gas (acfm)	961.5	
Volume of flue gas (sdcfm)	447.3	
Volume of flue gas (dscfm@7%O2)	660.2	704.7
Volume of flue gas (dscfm@15%O2)	1617.1	1644.3
Volume of flue gas (dscfm@8%02)	700.2	758.9
Volume of flue gas (dscfm@3%02)	505.7	548.1
Volume of flue gas (dscfm@10%02)	827.5	896.9

1) Data from EPA, Combustion Evaluation in Air Pollution Control, Student Manual, March 1994, No.2 fuel oil, Table 5-3
2) Standard conditions based on a pressure of 1.0 atmospheres
3) Standard conditions corrected for altitude per IDAPA 58.01.01.680
4) Data from EPA, Combustion Evaluation in Air Pollution Control, Student Manual, March 1994, for fuel oil register type burners, 3-15% Table 4-4

Stack Diameter (feet) = 1.7
Stack velocity (ft/s) = 7.35

DEQ developed

Appendix C – Ambient Air Quality Impact Analysis

MEMORANDUM

DATE: May 14, 2009

TO: Shawnee Chen, P.E., Senior Permit Engineer, Air Quality Division

FROM: Cheryl Robinson, P.E., Air Quality Engineer/Modeling Analyst, Air Quality Division

PROJECT NUMBER: P-2008.0198

SUBJECT: **Modeling Review for Clements Concrete Company, Boise**
Project: Initial PTC for a Portable Concrete Batch Plant, Initial Location: Notus

1.0 Summary

Clements Concrete Company (Clements) submitted an application for an initial Permit to Construct (PTC) for a 160 cubic yard per hour (cy/hr) portable concrete batch plant in December 2008. After additional information was provided by Clements, the application was determined to be complete on February 20, 2009.

The application materials received by DEQ on December 2, 2008 included a completed copy of the *Air Dispersion Modeling Protocol: Request to use DEQ Generic Modeling Results to Demonstrate Preconstruction Compliance with Idaho Air Quality Rules.* This protocol was developed by DEQ as part of a streamlined permitting approach for concrete batch plants. For this streamlined approach, DEQ conducted dispersion modeling for a typical concrete batch plant layout for a range of daily and annual concrete production rates. If a proposed concrete batch plant project meets the criteria specified in the protocol, the applicant may be allowed to use the DEQ modeling results in lieu of conducting dispersion modeling. This provides preconstruction assurance that the proposed project will comply with the applicable National Ambient Air Quality Standards (NAAQS) and state toxic air pollutant (TAP) rules. At the same time, this approach reduces the level of effort for DEQ's review of such applications, the cost and resources needed for the applicant to prepare the PTC application, and can result in a significant reduction in the time needed to review and process the application.

Based on the information provided by the applicant in their request to use the generic modeling (the pre-application "modeling protocol" review), DEQ determined that the project met the criteria for using DEQ's "generic" modeling to demonstrate preconstruction compliance with ambient air quality standards. The applicant requested concrete production limits of a maximum of 2,400 cubic yards per day and 400,000 cubic yards per year. Collocation with another facility was not requested. A copy of that request is attached to this memo.

The proposed project differs from the minimum requirements in the following ways:

- A re-purposed gasoline-powered Ford engine may be used to power the air compressor for the cement guppies. Operation of the engine is proposed for a maximum of 3 hours per day and 500 hours per year.
- A diesel-fueled boiler rated at 2.9 million British thermal units per hour (MMBtu/hr) may be used to heat the process water (water to be mixed with the dry cement and aggregate) during cold weather. Operation of the boiler is proposed for a maximum of 15 hours per day and 1,250 hours per year.

DEQ estimated the potential additional ambient impact from these two small sources as described below, and determined that additional modeling was not required. Based on the results of that evaluation, combined with the attached DEQ modeling analysis, DEQ determined that the predicted

pollutant concentrations from emissions associated with the facility, when combined with representative background concentrations, were below applicable ambient air quality standards at all locations outside the "facility's property boundary." For this portable facility, the actual property boundary must include the area defined by the applicable minimum setback, which is set based on the maximum daily concrete production at that location. See the attached modeling analysis.

Key assumptions that should be considered in the development of the permit are presented in Table 1.

Table 1. KEY ASSUMPTIONS USED IN MODELING ANALYSES

Criteria/Assumption/Result	Explanation/Consideration
No operations in PM_{10} or $PM_{2.5}$ nonattainment areas.	New sources in a nonattainment area must not "significantly contribute" to the violation of the NAAQS. IDAPA 58.01.01.006 defines a PM_{10} impact increase of 5 $\mu g/m^3$ (24-hour average) or 1 $\mu g/m^3$ (annual average) as a "significant contribution." The predicted ambient impacts for each of the modeled daily and annual concrete production rates exceed these thresholds. The EPA has not yet defined a significant contribution level for $PM_{2.5}$ (use PM_{10} as a surrogate).
Daily concrete production is limited based on the setback distance available at that location.	The setback for each modeled daily production rate is defined by the minimum distance needed to meet the 24-hour PM_{10} NAAQS.
Annual concrete production is limited based on the setback distance available at that location, but should not exceed a maximum of 400,000 cy/yr.	Preconstruction compliance with state toxic air pollutant (TAP) rules was demonstrated using controlled carcinogenic TAP emissions, so per IDAPA 58.01.01.210.08, an emission limit must be imposed. The annual production limit inherently limits the TAPs emissions, so a pollutant-specific pound per hour or pound per year limit is not needed.
Operational requirements for particulate matter control ensure a high level of control is consistently achieved and maintained for baghouse/cartridge filters and for fugitive emissions.	Modeled emissions reflect a high level of control.
No Collocation. No other pollutant-emitting facility (e.g., a crusher, another concrete batch plant, or a hot mix asphalt plant) will be located within 200 meters (656 feet) of this concrete batch plant.	PM_{10} background values used were "typical" background levels in rural/agricultural areas. Co-contributing sources of PM_{10} were not evaluated in the modeling.
Stack parameters used in the modeling analysis are representative of the parameters described in the application.	The dispersion characteristics and resulting estimated ambient impact depend on these stack parameters. Pre-application approval to use the DEQ "generic" modeling analysis was based in part on the similarity of the facility stack parameters with the modeled parameters.
160 hp Gasoline-fueled Ford engine • Operations are limited to a maximum of 3 hours per day and 500 hours per year.	Limit short-term CO and annual NO_2 and SOx emissions. Modeling of CO, NO_2, and SOx ambient impacts was not required based on keeping emissions below DEQ modeling threshold (by limiting the daily and annual hours of operation). Line power will be available and presumably could be used to power the air compressor instead of using the Ford engine.
2.9 MMBtu/hr Diesel-fired boiler • Operations are limited to a maximum of 15 hours per day and 1,250 hours per year. • Fuel sulfur content is limited to a maximum of 0.05% by weight.	Limit ground-level short-term concentrations of SO_x and annual NO_2 and SOx emissions. Modeling of CO, NO_2, and SOx ambient impacts was not required based on keeping emissions below DEQ modeling threshold (by limiting the hours or operation and the fuel sulfur content).

1.1 Modeling Evaluation for Additional Small Sources

1.1.1 Comparison of CO, NO_2, and SO_x Emissions with DEQ Modeling Thresholds

The DEQ generic modeling was conducted only for PM_{10} because there are typically no emissions of CO, NO_2, or SO_x from concrete batch plant operations served by line power.

The worst-case hourly emissions from the Ford engine and the boiler were taken from the application. Annual emissions taken from the application are based on operating the Ford engine for a maximum of 500 hours per year and the boiler for a maximum of 1,250 hours per year. As shown in Table 2, emissions of carbon monoxide (CO) and nitrogen dioxide (NO_2) from the proposed project do not exceed modeling thresholds. The 70 lb/hr CO threshold was used because there are no other sources of CO emissions associated with the project, and modifying the Ford engine to reduce the CO emissions is not technically feasible.

Modeling for sulfur oxides (SO_x) is not required only if the proposed project is revised to reduce the SO_x emissions from the diesel-fired boiler. The 0.2 lb/hr SO_x modeling threshold was used because although the Ford engine and the boiler are the only sources of SO_x associated with this project, it would be feasible to either replace the boiler with a natural gas-fired unit or use low-sulfur diesel fuel to reduce SO_x emissions from the diesel-fired boiler.

Additional modeling for these criteria pollutant emissions from the engine and boiler is not required.

Table 2. COMPARISON OF EMISSIONS WITH MODELING THRESHOLDS

	CO		NO_2		SOx		
	lb/hr, 1-hour average	**T/yr**	**lb/hr, 1-hour average**	**T/yr**	**lb/hr, 1-hour average**	**lb/hr, 1-hour average**	**T/yr**
Ford engine	52.68	13.17	1.32	0.330	0.0709	0.0709	0.0177
Diesel-fueled Boiler	0.104	0.065	0.414	0.259	1.47 (0.5% sulfur)	0.147 (0.05% sulfur)	0.919
Total	52.8	13.24	1.73	0.59	1.54	0.22	0.94
DEQ Modeling Threshold [a]	14 lb/hr **70 lb/hr**	n/a	n/a	1 T/yr	**0.2 lb/hr** 0.9 lb/hr	**0.2 lb/hr** 0.9 lb/hr	1 T/yr
Modeling Required?	**No**	**n/a**	**n/a**	**No**	Yes [b]	**No**	**No**

[a] The top number listed is from the State of Idaho Air Quality Modeling Guideline, Doc. ID AQ-011 (Revision 1, December 31, 2002). The bottom number listed is a value that may be used on a case-by-case basis only with DEQ review and approval.

[b] SOx modeling would be required unless the sulfur content for the boiler fuel is limited to a maximum of 0.05%.

1.1.2 Estimated Change to "Generic" PM_{10} Modeled Ambient Impacts

Additional Emissions from Engine and Boiler

The worst-case hourly PM_{10} emissions from the Ford engine and the boiler were taken from the application and converted to 24-hour and annual averages based on the requested hours of operation:

0.0865 $lb/hr_{1\text{-hour average}}$(Ford engine) + 0.0684 $lb/hr_{1\text{-hour average}}$ (Boiler)

0.011 $lb/hr_{24\text{-hr avg}}$ (Ford engine @ 3 hr/day) + 0.043 $lb/hr_{24\text{-hr avg}}$(Boiler @ 15 hr/day) = 0.054 $lb/hr_{24\text{-hr average}}$

0.005 $lb/hr_{Annual\ avg}$(Ford engine @ 500 hr/yr) + 0.0098 $lb/hr_{Annual\ avg}$ (Boiler @ 1,250 hr/yr) = 0.015 $lb/hr_{Annual\ avg}$

Estimated Change to Ambient Impact

The potential increase in the ambient impact was estimated by presuming a linear relationship between the emission rate and the ambient PM_{10} impact predicted for the modeled daily concrete production rates and the requested maximum annual rate of 400,000 cy/year. As shown in Table 3, the total estimated ambient impacts including the proposed operation of the engine and boiler, combined with representative background concentrations, are well below the NAAQS.

Table 3. ESTIMATED PM_{10} AMBIENT IMPACT INCLUDING ENGINE AND BOILER

Pollutant	Modeled Emissions (lb/hr) [a]	Modeled Impact ($\mu g/m^3$) [b]	Linear Factor ($\mu g/m^3$ per lb/hr)	Engine and Boiler Emissions (lb/hr)	Additional Ambient Impact ($\mu g/m^3$)	Background ($\mu g/m^3$) [b]	Total Ambient Impact ($\mu g/m^3$)	Percent of NAAQS [c]
PM_{10} (24-hr avg)	0.437 (1,500 cy/day)	40.1 (63.2)	91.8	0.054	4.96	73	118	78.7%
PM_{10} (24-hr avg)	0.705 (2,400 cy/day)	50.8 (79.8)	72.1	0.054	3.89	73	128	85.1%
PM_{10} (24-hr avg)	1.06 (3,600 cy/day)	53.3 (83.8)	50.3	0.054	2.72	73	129	86.0%
PM_{10} (24-hr avg)	1.41 (4,800 cy/day)	46.9 (73.8)	33.3	0.054	1.80	73	122	81.1%
PM_{10} (annual avg)	0.339 (400,000 cy/yr)	7.6 (10.8)	22.4	0.015	0.34	26	33.9	67.9%

[a] See Tables 6A and 6B of the attached modeling analysis.

[b] See Table 8 of the attached modeling analysis. 24-hr ISCST3 results (in parentheses) were converted to "equivalent" AERMOD results by multiplying by (53.3/83.8) = 0.636. Annual ISCST3 result (in parentheses) were converted by multiplying by (5.53/7.91) = 0.699.

[c] 24-hour PM_{10} NAAQS = 150 $\mu g/m^3$, Annual PM_{10} NAAQS = 50 $\mu g/m^3$.

1.1.2 Estimated Change to "Generic" TAPs Modeled Ambient Impacts

Additional Emissions from Engine and Boiler

AP-42 Section 3.3 does not include a list of speciated hazardous air pollutants for gasoline-fueled engines. DEQ estimated the TAPs emissions from the diesel-fired boiler, however, using AP-42 Section 1.3 emission factors, and calculated the 24-hour and annual pound per hour averages based on the requested hours of operation. As shown in the attached spreadsheet, except for arsenic, none of the TAPs emissions from the boiler exceeded the applicable screening emission level. The worst-case hourly emissions from the boiler from the DEQ spreadsheet are consistent with the maximum arsenic emissions estimated in the application: 1.66E-06 $lb/hr_{Annual\ average}$ (Boiler @ 1,250 hr/yr).

Estimated Change to Ambient Impact

The potential increase in the ambient impact was estimated by presuming a linear relationship between the emission rate and the ambient impact predicted for the modeled annual production rate of 400,000 cy/year. As shown in Table 4, the total estimated ambient impact for arsenic including the proposed operation of the boiler, is well below the acceptable ambient concentration for carcinogens (AACC).

Table 4. ESTIMATED TAPS AMBIENT IMPACT INCLUDING ENGINE AND BOILER

Pollutant	Modeled Emissions (lb/hr) [a]	Modeled Impact ($\mu g/m^3$) [b]	Linear Factor ($\mu g/m^3$ per lb/hr)	Engine and Boiler Emissions (lb/hr)	Additional Ambient Impact ($\mu g/m^3$)	Total Ambient Impact ($\mu g/m^3$)	AACC ($\mu g/m^3$)	Percent of AACC
Arsenic (annual avg)	3.68E-06 (400,000 cy/yr)	8.79E-05	23.9	1.66E-06	3.97E-05	1.28E-04	2.3E-04	55.5%

[a] See Tables 7A and 7B of the attached modeling analysis.
[b] See Table 9 of the attached modeling analysis. ISCST3 results were used to demonstrate compliance.

DIESEL COMBUSTION, AP-42 SECTION 1.3 (9/98)

2.9 MMBtu/hr / 140 MMBtu/10^3 gal = 2.07E-02 10^3 gal/hr Fuel Use:

Operating Assumptions: 15 hr/day 310.71 gal/day

1,250 hr/yr 25,893 gal/year

0.050% sulfur

Criteria Air Pollutants	Emission Factor	Emissions			Modeling Threshold		Modeling Required ?	Modeling Threshold		Modeling Required ?
	lb/10^3 gal	lb/hr	T/yr		2002 Guidance			Case-by-Case		
NO2	24	4.97E-01	3.11E-01		1	T/yr	No	7	T/yr	No
CO	5	1.04E-01	6.47E-02		14	lb/hr	No	70	lb/hr	No
PM10 (filterable + condensat	3.3	6.84E-02	4.27E-02		0.2	lb/hr	No	0.9	lb/hr	No
		6.84E-02	4.27E-02		1	T/yr	No	7	T/yr	No
SOx (SO2 + SO3)	7.95	1.65E-01	1.03E-01		0.2	lb/hr	No	0.9	lb/hr	No
		1.65E-01	1.03E-01		1	T/yr	No	7	T/yr	No
VOC (TOC)	0.556	1.15E-02	7.20E-03		40	T/yr	No			
Lead EF = 9 lb/10^{12} Btu	9	2.61E-05	1.63E-05		0.6	T/yr	No			
Lead, continued			8.16E-03	lb/quarter	10	lb/mo	No			
		TOTAL	5.28E-01	T/yr						

Note: 100 lb/mo Pb in guidance reduced by factor of 10 based on latest Pb NAAQS (reduced in 2008 from 1.5 ug/m3 to 0.15 ug/m3)

Hazardous Air Pollutants (HAPs) and Toxic Air Pollutants (TAPs)				Exceeds EL/ Modeling Required?
	lb/10^3 gal	lb/hr	EL (lb/hr)	
PAH HAPs				
Acenaphthene	2.11E-05	6.24E-08	9.10E-05	No
Acenaphthylene	2.57E-07	7.60E-10	9.10E-05	No
Anthracene	1.22E-06	3.61E-09	9.10E-05	No
Benzo(a)anthracene	4.01E-06	1.19E-08	9.10E-05	See POM
Benzo(a)pyrene			2.00E-06	See POM
Benzo(b,k)fluoranthene	1.48E-06	4.37E-09		See POM
Benzo(g,h,i)perylene	2.26E-06	6.68E-09	9.10E-05	No
Benzo(k)fluoranthene	0.00E+00	0.00E+00		See POM
Chrysene	2.38E-06	7.03E-09		See POM
Dibenzo(a,h)anthracene	1.67E-06	4.94E-09		See POM
Dichlorobenzene			9.10E-05	No
Fluoranthene	4.84E-06	1.43E-08	9.10E-05	No
Fluorene	4.47E-06	1.32E-08	9.10E-05	No
Indeno(1,2,3-cd)pyrene	2.14E-06	6.33E-09		See POM
Naphthalene	1.13E-03	3.34E-06	3.33	No
Naphthalene	1.13E-03	3.34E-06	9.10E-05	No
Phenanathrene	1.05E-05	3.10E-08	9.10E-05	No
Pyrene	4.25E-06	1.26E-08	9.10E-05	No
Polycyclic Organic Matter (POM)	7-PAH	3.45E-08	2.00E-06	No
Non-PAH HAPs				
Benzene	2.14E-04	6.33E-07	8.00E-04	No
Ethyl benzene	6.36E-05	8.23E-07	2.90E+01	No
Formaldehyde	3.30E-02	9.75E-05	5.10E-04	No
Hexane	1.80E+00	2.33E-02	12	No
Toluene	6.20E-03	8.03E-05	25	No
o-Xylene	1.09E-04			
Metals (HAPs)	lb/10^{12} Btu			
Arsenic	4.00E+00	1.66E-06	1.50E-06	YES
Barium			0.033	No
Beryllium	3.00E+00	1.24E-06	2.80E-05	No
Cadmium	3.00E+00	1.24E-06	3.70E-06	No
Chromium	3.00E+00	5.44E-06	0.033	No
Cobalt			0.0033	No
Copper	6.00E+00	1.09E-05	0.013	No
Manganese	6.00E+00	1.09E-05	0.067	No
Mercury	3.00E+00	5.44E-06	0.003	No
Molybdenum			0.333	No
Nickel	3.00E+00	1.24E-06	2.70E-05	No
Selenium	1.50E+01	2.72E-05	0.013	No
Vanadium			0.003	No
Zinc	4.00E+00	7.25E-06	0.667	No

Case-by-Case Modeling Thresholds may be used ONLY with DEQ Approval

NOTE: TAPs lb/hr emissions are 24-hour averages unless shown in bold. Bold emissions are annual averages for carcinogens.

1,1,1-Trichloroethane 2.36E-04 Not a HAP (1,1,2 TCA is a HAP). Not a 585 or 586 TAP.

Idaho DEQ DEQ CEP - Diesel Boiler EI including TAPs.XLS

AIR DISPERSION MODELING PROTOCOL : REQUEST TO USE DEQ GENERIC MODELING RESULTS TO DEMONSTRATE PRECONSTRUCTION COMPLIANCE WITH IDAHO AIR QUALITY RULES.

Proposed Project: **Portable Concrete Batch Plant,** 160 cy/HR 400000 cy/YR

Location: E. of Notus Road 1/2 mile on Dixie River road in section 2, T4N, R4e

1) An emissions inventory (EI) based on the plant's capacity and proposed maximum daily and annual operations will be included with the application, and will comply with the following:

   a. Emissions will be calculated using AP-42 emission factors and good engineering judgment.
   b. Fugitive emissions sources will be included in the EI, except for emissions resulting from vehicle traffic and wind erosion from storage piles.
   c. The level of emissions control assumed for each source will be clearly specified.
   d. Cr+6 will be presumed to comprise 20% of the total chromium emissions from cement silo filling, and 30% of the total chromium emissions from cement supplement (flyash) silo filling.

2) The proposed project will meet all of the criteria specified below, and Clements Concrete Company agrees to accept permit conditions requiring continuing compliance with the physical parameters and setback distance(s) described in Table 1. Clements Concrete Company is requesting that the DEQ generic model results be used to demonstrate preconstruction compliance with NAAQS and TAPs for this project. No additional modeling analysis will be submitted for this project.

Table 1. CRITERIA FOR USING DEQ's CONCRETE BATCH PLANT GENERIC MODELING RESULTS FOR AIR IMPACT ANALYSES

Parameter	DEQ Generic Modeling Assumptions				Proposed Project
Concrete batch plant type and capacity	Truck mix (redi-mix or dry mix) or Central mix				**Tuck mix**
Operation in any PM_{10} nonattainment area	Not proposed.				**No**
Presence of an electric generator.	No generator. Line power is available.				**Line Power is Available**
No Collocation. Minimum distance from nearest edge of any emissions source to any other source of emissions, including another concrete batch plant, hot mix asphalt plant, or rock crushing plant.	200 meters (656 feet)				**200 meters**
Number of cement and/or cement supplement storage silos 1	Not limited. The model layout assumes all silo emissions are from the same point, and that cement/supplement is not transferred between storage silos.				
Maximum daily concrete production (cy/day)	1,500	2,400	3,600	4,800	**2400**
Minimum Setback Distance. Minimum distance from nearest edge of any emissions source to a receptor.[2]	**40 m (131 ft)**	**60 m (197 ft)**	**100 m (328 ft)**	**150 m (492 ft)**	**60 M**
Maximum annual concrete production (cy/year)	300,000	400,000	500,000	500,000	400000
Cement and supplement storage silo baghouse(s) Minimum stack height (height above ground) Minimum PM/PM_{10} control	10 meters (32.8 ft) 99%				**10 meters 99.9%**
Weigh hopper loading baghouse, or equivalent Minimum stack height (height above ground) Minimum PM/PM_{10} control	10 meters (32.8 ft) 99%				**10 meters 99.9%**
Truck-mix loadout or Central Mix loading. Minimum PM/PM_{10} control.	95% Boot enclosure, shroud, water sprays, or baghouse/cartridge filter				95% Boot Enclosure
Transfer Point Fugitives. Minimum PM/PM_{10} control.	75% Water sprays, enclosures, shrouds, or aggregate/sand is damp on an as-received basis and used before significantly drying out.				Aggregate/ Sand is damp

Dave Clements — Print Name

Clements Concrete — Company

208 939 2000 — Telephone/E-mail

Signature

Business Manager — Title/Position

1/23/09 — Date

MEMORANDUM

DATE: September 18, 2007

Prepared by: Cheryl Robinson, P.E., Staff Engineer/Permit Writer, Air Quality Division

Reviewed by: Kevin Schilling, Modeling Coordinator, Air Quality Division

SUBJECT: Portable Concrete Batch Plants – Generic Modeling Results for Typical Plant

1. Summary

Most ready-mix concrete batch plants share many characteristics with each other such as equipment design, fugitive dust control practices, emissions quantities for a given processing rate, general facility layout, and emission release parameters. These shared characteristics allow the development of generic methods to assess the air quality impact of these batch plants. The appropriateness of using generic methods is particularly justifiable for ready-mix concrete batch plants because most are permitted as portable sources, and specific equipment configurations will change somewhat from site to site.

1.1 Generic Modeling Applicability

Use of this generic method to demonstrate preconstruction compliance with National Ambient Air Quality Standards (NAAQS) and Idaho toxic air pollutant (TAP) rules from operation of concrete batch plants is designed to generate reasonably conservative results, and may not be applicable to all batch plants.

The key criteria for determining the applicability of the generic modeling results are summarized in Table 1. In cases where the proposed operations differ from these assumptions (e.g., stack heights are lower, or emissions controls do not meet the minimum criteria), the applicant shall provide additional explanation in their modeling protocol to justify use of the generic modeling results. This information, along with DEQ's approval of the modeling protocol shall be included in the statement of basis for the permit.

The appropriateness of this method to specific conditions will be made on a case-by-case basis considering the following:

- Equipment used at the batch plant, especially considering the type and effectiveness of emissions control equipment and practices.
- Proposed location for the facility, considering the presence of any sensitive receptors near the property boundary and the distance from pollutant emitting equipment to the property boundary.
- The presence of other pollutant emitting activities occurring at the site, including collocation with another concrete batch plant, rock crushing equipment and/or hot mix asphalt plants.

Table 1. CRITERIA FOR USING DEQ's CONCRETE BATCH PLANT GENERIC MODELING RESULTS FOR AIR IMPACT ANALYSES

Parameter	DEQ Generic Modeling Assumptions			
Concrete batch plant type and capacity	Truck mix (redi-mix or dry mix) or Central mix Maximum 300 cy per hour capacity			
Operation in any PM_{10} nonattainment area	Not proposed.			
Presence of an electric generator.	No generator. Line power is available.			
No Collocation. Minimum distance from nearest edge of any emissions source to any other source of emissions, including another concrete batch plant, hot mix asphalt plant, or rock crushing plant.	200 meters (656 feet)			
Number of cement and/or cement supplement storage silos	Not limited. The model layout assumes all silo emissions are from the same point, and that cement/supplement is not transferred between storage silos.			
Maximum daily concrete production (cy/day)	1,500	2,400	3,600	4,800
Minimum Setback Distance. Minimum distance from nearest edge of any emissions source to any area outside of a building where the general public has access.[a]	**40 m (131 ft)**	**60 m (197 ft)**	**100 m (328 ft)**	**150 m (492 ft)**
Maximum annual concrete production (cy/year)	300,000	400,000	500,000	500,000
Cement and supplement storage silo baghouse(s) Minimum stack height (height above ground) Minimum PM/PM_{10} control	10 meters (32.8 ft) 99%			
Weigh hopper loading baghouse, or equivalent Minimum stack height (height above ground) Minimum PM/PM_{10} control	10 meters (32.8 ft) 99%			
Truck-mix loadout or Central Mix loading. Minimum PM/PM_{10} control.	95% Boot enclosure, shroud, water sprays, or baghouse/cartridge filter			
Transfer Point Fugitives. Minimum PM/PM_{10} control.	75% Water sprays, enclosures, shrouds, or aggregate/sand is damp on an as-received basis and used before significantly drying out.			

[a] The general public will be considered to have access to any facility area that is not fenced, posted with no trespassing signs and regularly patrolled or observable by facility staff during plant operations, or separated from the facility by a natural barrier such as a steep cliff. This distance shall be measured from the nearest edge of any storage pile, silo, weigh batcher, transfer point, or conveyor associated with this concrete batch plant.

1.2 Applicable Permit Conditions

The following permit conditions should be included in any permit using the generic modeling to demonstrate preconstruction compliance with NAAQS and TAPs:

- A prohibition on operating this plant in any PM_{10} nonattainment area. IDAPA 58.01.01.006 defines a PM_{10} impact increase of 5 µg/m3 (24-hour average) or 1 µg/m3 (annual average) as a "significant contribution." The predicted ambient impacts for each of the modeled daily and annual production rates exceed these thresholds.
- Daily concrete production limits based on the setback distance available that day. The setback for each modeled daily production rate is defined by the minimum distance needed to meet the 24-hour PM_{10} NAAQS standard.

- Annual concrete production limits based on the setback distance available at any location. Preconstruction compliance with state TAPs rules was demonstrated using controlled TAPs emissions, so per IDAPA 58.01.01.210.08, an emission limit must be imposed. The production limit inherently limits the TAPs emissions, so a pollutant-specific lb/yr limit is not needed.
- O & M manual and operational requirements that will ensure that a high level of control is consistently achieved and maintained for baghouse/cartridge filters and for control of fugitive emissions from material transfer points.

2. Background Information

2.1 Applicable Air Quality Impact Limits and Modeling Requirements

This section identifies applicable ambient air quality limits and analyses used to demonstrate compliance.

2.1.1 Area Classification

The concrete batch plant is a portable facility that may operate in any attainment or unclassifiable area anywhere in the State of Idaho.

2.1.2 Significant and Full Impact Analyses

If estimated maximum criteria pollutant impacts to ambient air from the emissions sources at this facility exceed the significant contribution levels (SCLs) of IDAPA 58.01.01.006, then a full impact analysis is necessary to demonstrate compliance with IDAPA 58.01.01.203.02. A full impact analysis for attainment area pollutants involves adding ambient impacts from facility-wide emissions to DEQ-approved background concentration values that are appropriate for the criteria pollutant/averaging time at the facility location and the area of significant impact. The resulting maximum pollutant concentrations in ambient air are then compared to the National Ambient Air Quality Standards (NAAQS) listed in Table 2. Table 2 also lists SCLs and specifies the modeled value that must be used for comparison to the NAAQS.

The generic modeling does not currently include emissions from any generators (line power is required to be available), so PM10 and lead are the only criteria pollutants emitted by this facility.

Table 2. CRITERIA AIR POLLUTANTS APPLICABLE REGULATORY LIMITS

Pollutant	Averaging Period	Significant Contribution Levels[a] ($\mu g/m^3$)[b]	Regulatory Limit[c] ($\mu g/m^3$)	Modeled Value Used[d]
PM_{10}[e]	Annual	1.0	50[f]	Maximum 1st highest[g]
	24-hour	5.0	150[h]	Maximum 6th highest[i]
Carbon Monoxide (CO)	8-hour	500	10,000[j]	Maximum 2nd highest[g]
	1-hour	2,000	40,000[j]	Maximum 2nd highest[g]
Sulfur Dioxide (SO_2)	Annual	1.0	80[f]	Maximum 1st highest[g]
	24-hour	5	365[j]	Maximum 2nd highest[g]
	3-hour	25	1,300[j]	Maximum 2nd highest[g]
Nitrogen Dioxide (NO_2)	Annual	1.0	100[f]	Maximum 1st highest[g]
Lead	Quarterly	NA	1.5[h]	Maximum 1st highest[g]

[a] IDAPA 58.01.01.006
[b] Micrograms per cubic meter
[c] IDAPA 58.01.01.577 for criteria pollutants
[d] The maximum 1st highest modeled value is always used for significant impact analysis
[e] Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
[f] Never expected to be exceeded in any calendar year
[g] Concentration at any modeled receptor
[h] Never expected to be exceeded more than once in any calendar year
[i] Concentration at any modeled receptor when using five years of meteorological data
[j] Not to be exceeded more than once per year

2.1.3 *Toxic Air Pollutant Analyses*

Toxic Air Pollutant (TAP) requirements for PTCs are specified in IDAPA 58.01.01.210. If the increase associated with a new source or modification exceeds screening emission levels (ELs) contained in IDAPA 58.01.01.585 or 586, then the ambient impact of the emissions increase must be estimated. If ambient impacts are less than applicable Acceptable Ambient Concentrations (AACs) for non-carcinogens listed in IDAPA 58.01.01.585 and Acceptable Ambient Concentrations for Carcinogens (AACCs) listed in IDAPA 58.01.01.586, then compliance with TAP requirements has been demonstrated.

2.2 Background Concentrations

Ambient background concentrations were revised for all areas of Idaho by DEQ in March 2003[1]. Background concentrations in areas where no monitoring data are available were based on monitoring data from areas with similar population density, meteorology, and emissions sources. Background concentrations used in these analyses are listed in Table 3. These are the default rural/agricultural background concentrations, which were used because concrete batch plants are typically located outside of urban areas.

Table 3. BACKGROUND CONCENTRATIONS

Pollutant	Averaging Period	Background Concentration (µg/m3)[a]
PM_{10}[b]	24-hour	73
	annual	26
Carbon monoxide (CO)	1-hour	3,600
	8-hour	2,300
Sulfur dioxide (SO2)	3-hour	34
	24-hour	26
	Annual	8
Nitrogen dioxide (NO2)	Annual	17

[a] Micrograms per cubic meter

[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers

3. Modeling Impact Assessment

3.1 Modeling Methodology

3.1.1 *Model Selection and Key Parameters*

Atmospheric dispersion modeling was used to evaluate the air quality impacts from point sources and process fugitive sources. Table 4 provides a summary of the model selection and modeling parameters used in the modeling analyses.

Table 4. MODELING PARAMETERS

Parameter	Description/ Values	Documentation/Additional Description
Model	AERMOD, Version 04300	The Gaussian dispersion model AMS/EPA Regulatory Model (AERMOD) was run for a single case (3,600 cy/day, 500,000 cy/year, with a 100-meter ambient air boundary). This case was used to demonstrate that ambient impacts predicted using AERMOD are lower than impacts predicted using ISCST3 for the same emission points and parameters. This is consistent with results reported by the EPA, which found that AERMOD typically predicted lower concentrations than ISCST3 for rural, low-level stacks; and short term urban, low-level stacks.[2]

[1] Hardy, Rick and Schilling, Kevin. *Background Concentrations for Use in New Source Review Dispersion Modeling*. Memorandum to Mary Anderson, March 14, 2003.

[2] U.S. EPA, Comparison of Regulatory Design Concentrations, AERMOD vs. ISCST3, CTDMPLUS, ISC-PRIME, Staff Report, EPA-454/R-03-002, June 2003 (see page 29).

Table 4. MODELING PARAMETERS		
Parameter	**Description/ Values**	**Documentation/Additional Description**
Model	ISCST3, Version 02035	Due to DEQ schedule and resource constraints, and because ISCST3 results are generally higher (conservative) than AERMOD for these types of near-field analyses, DEQ determined that the Industrial Source Complex Short Term (ISCST3), air dispersion model was acceptable at this time for predicting ambient impacts for all cases.
Meteorological data	Surface Data & Upper Air Data Boise, Idaho 1988-1992 (AERMOD) 1987-1991 (ISCST3)	Previous DEQ analyses showed that using Boise meteorological data generated the highest modeled values at typical concrete batch plant "fenceline" distances, in part because of the well-defined prevailing wind direction at the Boise monitoring location. For the AERMOD run, AERMET pulled the station anemometer height of 6.1 meters directly from the met data files. For the ISCST3 runs, the station anemometer height of 6.1 meters was used.
Land Use (urban or rural)	Rural	Urban area surface heating was not used in this analysis based on typical land use at concrete batch plant locations.
Terrain	Flat/Level	Flat (level) terrain was used because the results must be reasonably applicable to all locations for this portable facility. Maximum impacts from near ground-level emissions sources, such as those at typical concrete batch plants, are very near the emissions source. This assumption was deemed to be appropriate and is not a substantial limitation of this method.
Building downwash	Considered	To account for plume downwash effects from any buildings present, or equipment that may cause downwash, a 20-meter square building, 10 meters tall and positioned at the center of the plant layout, was used as a representation of structures associated with this concrete batch plant. For ISCST3, the building profile input program (BPIP) was used. The PRIME algorithm was not used because building cavity effects are not expected to be significant.
Receptor grid	Grid 1	10-meter spacing along a "fenceline" described by a circle with a radius of 40, 60, 100, or 150 meters.
	Grid 2	25-meter spacing for distances between the "fenceline" and 200 meters.
	Grid 3	50 meter spacing for distances between 200 meters and 500 meters.

3.1.2 Facility Layout and Ambient Air Boundary ("Fenceline")

Portable concrete batch plants are somewhat unique compared to other stationary sources in that the equipment layout may change at each new location. Because of this, a generic approach that reflects a typical batch plant layout is appropriate. The layout used for the modeling is shown in Figure 3-1.

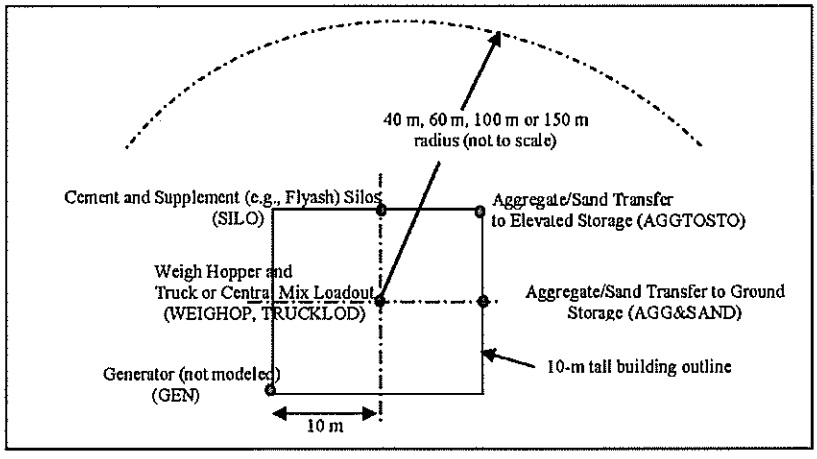

Figure 3-1. Typical Concrete Batch Plant Modeling Layout

For the generic modeling, the ambient air boundary or "fenceline" was taken to be along the perimeter of a circle with a radius of 40, 60, 100, and 150 meters from the center of a 20 meter by 20 meter "typical" plant layout shown in Figure 3-1. The boundaries of the 10-meter tall building added to the model to account for plume downwash effects are also defined by this 20 meter by 20 meter square.

3.1.3 Emissions Release Parameters

Emissions from the handling of aggregate/sand and tuck loading were each modeled as volume sources. Table 5 provides parameters used for modeling these sources as well as point source parameters.

Emissions from the handling of aggregate and sand to ground storage and from ground storage to a ground-level conveyor were modeled together as a volume source in a 20-meter square area at the center of the plant. A 2-meter release height was used to represent the average transfer height. Emissions from conveyor transfer to elevated storage were modeled as an elevated volume source on the 20-meter square building, using a 5-meter release height.

Standard modeling guidance for volume sources on or adjacent to structures suggests setting initial dispersion coefficients as follows:

$$\sigma_{y0} = \text{horizontal dimension} / 4.3$$
$$\sigma_{z0} = \text{vertical dimension} / 2.15$$

Miscellaneous ground-level aggregate and sand handling was assumed to occur from activities in a 20-meter square area. Standard modeling guidance for volume sources not on or adjacent to structures suggests setting initial dispersion coefficients as follows:

$$\sigma_{y0} = \text{horizontal dimension} / 4.3$$
$$\sigma_{z0} = \text{vertical dimension} / 4.3$$

Point sources were conservatively modeled in the generic analyses assuming a horizontal release or a rain-capped stack. A stack gas exit velocity of 0.001 meters per second was used to eliminate momentum-induced plume rise, which would only occur from an uninterrupted vertical release.

Table 5. EMISSIONS RELEASE PARAMETERS FOR SOURCES

Point Sources						
Source	**UTM Coord. (m)**		**Stack Height (m)[a]**	**Stack Gas Temp. (K)[b]**	**Stack Dia. (m)**	**Flow Rate (m/sec)[c]**
	Easting	**Northing**				
Silo baghouse(s) stack	0	10	10	0, 298.15[d]	1.0	0.001[e]
Weigh hopper baghouse stack	0	0	10	0, 298.15[d]	1.0	0.001[e]
Volume Sources						
Source	**UTM Coord. (m)**		**Release Height (m)**	**Initial Horizontal Coefficient σ_{y0} (m)**	**Initial Vertical Coefficient σ_{z0} (m)**	
	Easting	**Northing**				
Aggregate/sand transfers at ground level	10	10	2	4.65	0.70	
Aggregate/sand transfers at elevated level	10	0	5	4.65	4.65	
Truck loading	0	0	5	4.65	4.65	

[a] Meters
[b] Kelvin
[c] Meters per second
[d] When a value of 0 K is used, the AERMOD model uses the ambient air temperature. This value was set to 77 degrees Fahrenheit (298.15 K) for the ISCST3 runs. This is not expected to result in a measurable difference in the ambient impact results.
[e] Set to 0.001 m/sec for a horizontal release or release from a rain-capped vertical stack.

3.1.4 Wind Speed Adjustments for Fugitive Emissions

The dispersion model AERMOD has an option by which emissions can be varied as a function of wind speed. There are six wind speed categories, and adjustment factors can be assigned for each category. Emissions for each hour modeled are calculated by multiplying the base rate by the appropriate adjustment factor, as determined by the wind speed specified for the hour within the meteorological data file.

For the AERMOD run, base emissions rates were calculated using a wind speed of 10 miles per hour. Wind speed adjustment factors were then developed for each of the six wind speed categories corresponding to the default wind speed categories within the model. The mean wind speed of each category was calculated, and emissions associated with that mean wind speed were calculated. An adjustment factor was calculated for each wind speed category by dividing the emissions rate for that category by the base emissions rate calculated at a 10 mile per hour wind speed. Table 6 summarizes the wind speed categories and the calculated adjustment factors.

Table 6. WIND SPEED ADJUSTMENT FACTORS FOR MATERIAL HANDLING EMISSIONS

Wind Speed Category	ISCST3 Default Upper Wind Speed for Category (m/sec[a])	Median Wind Speed for Category (m/sec (mph[b]))	Emissions Rate for Category (lb/ton[c])	Adjustment Factor[d]
1	1.54	0.77 (1.72)	3.32E-4	0.101
2	3.09	2.32 (5.18)	1.39E-3	0.425
3	5.14	4.12(9.20)	2.94E-3	0.897
4	8.23	6.69 (14.95)	5.52E-3	1.69
5	10.8	9.52 (21.28)	8.73E-3	2.67
6	Not Defined	12.4[e] (27.74)	1.23E-2	3.77

[a] Meters per second
[b] Miles per hour
[c] Pounds of emissions per ton of material handled
[d] Calculated by dividing the emissions rate for the category by the emissions rate for a 10 mph wind (3.27E-3 lb/ton)
[e] An upper value wind speed of 14 m/sec was used, based on highest values observed in the meteorological files used in the modeling analyses.

3.2 Emission Rates

The emissions inventories (EIs) used for the generic modeling were based on AP-42 Section 11.12 (dated 06/06) emission factors for a truck-mix concrete batch plant. Based on AP-42 factors, estimated emissions from central mix plants would be the same, except that emissions from loadout to a central mixer are expected to be lower.

Hexavalent chromium [Cr+6 or Cr(VI)] was presumed to comprise 20% of the total chromium emissions from cement silo filling, 30% of the total chromium emissions from cement supplement (e.g., flyash) silo filling, and 21.3% of the total chromium emissions from truck loadout.

Point source emissions from the cement and flyash storage silos were presumed to be controlled by baghouses or cartridge filters with minimum capture efficiencies of 99%.

Uncontrolled fugitive emissions of PM_{10} from material transfer points were based on minimum moisture contents taken from AP-42 Table 11.12-2 of 1.77% for aggregate and 4.17% for sand. Fugitive emissions from material transfer points were assumed to be further controlled by 1) receiving sand and aggregate in a wetted condition and using the stockpile before significant drying out occurs, and/or 2) using manual water sprays or water spray bars to control fugitive emissions that reduce the uncontrolled emissions by an estimated 75%.

Fugitive emissions from truck mix loadout or central mixer loading are controlled by a boot, shroud, or water sprays that reduce the uncontrolled emissions by an estimated 95%.

Fugitive emissions resulting from vehicle traffic and wind erosion from storage piles were excluded from the analysis.

Uncontrolled emissions of TAPs from cement and flyash silo filling and truck mix loadout were based on operation of a 300 cy per hour concrete batch plant for 8,760 hours per year. Cement and flyash silo baghouses/cartridge filters were treated as process equipment, i.e., the uncontrolled TAPs emissions from these sources have been reduced by the capture efficiency associated with the baghouse/cartridge filters.

Emissions were estimated for each of the four daily and annual production combinations (described above in Table 1). The 24-hour and annual average PM_{10} emission rates for each case, and the values used for the modeled source input are summarized in Tables 6A and 6B. The emission rates used for the AERMOD analysis were developed using the equations contained in Section 11.12 of AP-42, rather than using the emission factors from Table 11.12-5, so differ slightly due to rounding or as noted in the table. A sample detailed emissions calculation worksheet is included as Attachment 1 to this memorandum.

Table 6A. EMISSIONS RATES FOR SOURCES - PM_{10}

Source	Emission Factor	Control	ISCST3 1,500 cy/day [b] 300,000 cy/yr [b]		ISCST3 2,400 cy/day 400,000 cy/yr	
	lb/cy [a]		lb/hr_{24} [c]	lb/hr_{YR} [c]	lb/hr_{24}	lb/hr_{YR}
Aggregate to ground	0.0031	75%	0.048	0.027	0.078	0.035
Sand to ground	0.0007	75%	0.011	0.006	0.018	0.008
Aggregate to conveyor	0.0031	75%	0.048	0.027	0.078	0.035
Sand to conveyor	0.0007	75%	0.011	0.006	0.018	0.008
AGG&SAND			**0.119**	**0.065**	**0.190**	**0.086**
Aggregate to elevated storage	0.0031	75%	0.048	0.027	0.078	0.035
Sand to elevated storage	0.0007	75%	0.011	0.006	0.018	0.008
AGGTOSTO			**0.059**	**0.033**	**0.095**	**0.043**
Cement to silo (controlled)	0.0001	--	5.22E-03	2.86E-03	8.35E-03	3.81E-03
Flyash to silo (controlled)	0.0002	--	1.12E-02	6.12E-03	1.79E-02	8.16E-03
SILO			**1.64E-02**	**8.98E-03**	**2.62E-02**	**1.20E-02**
Weigh hopper baghouse stack	0.0040	99%	2.47E-03	1.35E-03	3.95E-03	1.80E-03
WEIGHOP			**2.47E-03**	**1.35E-03**	**3.95E-03**	**1.80E-03**
Truck loadout	0.0784	95%	0.24	0.13	0.39	0.18
TRUCKLOD			**0.24**	**0.13**	**0.39**	**0.18**

[a] Pounds per cubic yard of concrete.
[b] Cubic yards of concrete per day and per year.
[c] Pounds per hour on a 24-hour average and annual average.

Table 6B. EMISSIONS RATES FOR SOURCES - PM_{10}

Source	Emission Factor	Control	AERMOD 3,600 cy/day [b]	ISCST3 3,600 cy/day	ISCST3 4,800 cy/day	AERMOD 500,000 cy/yr [b]	ISCST3 500,000 cy/yr [b]
	lb/cy [a]		lb/hr_{24}	lb/hr_{24} [c]	lb/hr_{24} [c]	lb/hr_{YR}	lb/hr_{YR}
Aggregate to ground	0.0031	75%		0.116	0.155		0.044
Sand to ground	0.0007	75%		0.026	0.035		0.010
Aggregate to conveyor	0.0031	75%		0.116	0.155		0.044
Sand to conveyor	0.0007	75%		0.026	0.035		0.010
AGG&SAND			**0.2814**	**0.285**	**0.380**	**0.1071**	**0.109**
Aggregate to elevated storage	0.0031	75%		0.116	0.155		0.044
Sand to elevated storage	0.0007	75%		0.026	0.035		0.010
AGGTOSTO			**0.1407**	**0.143**	**0.190**	**0.0535**	**0.054**
Cement to silo (controlled)	0.0001	--		1.25E-02	1.67E-02		4.76E-03
Flyash to silo (controlled)	0.0002	--		2.68E-02	3.58E-02		1.02E-02
SILO			**3.939E-02[g]**	**3.93E-02**	**5.25E-02**	**1.497E-02[g]**	**1.50E-02**
Weigh hopper baghouse stack **WEIGHOP**	0.0040	99%	**2.964E-02[h]**	**5.93E-03**	**7.90E-03**	**1.128E-02[h]**	**2.26E-03**
Truck loadout **TRUCKLOD**	0.0784	95%	**0.588**	**0.59**	**0.78**	**0.2234**	**0.22**

[a] Pounds per cubic yard of concrete.
[b] Cubic yards of concrete per day and per year.
[c] Pounds per hour on a 24-hour average and annual average.

The AERMOD analysis for a 300 cy/hr concrete batch plant demonstrated preconstruction compliance for TAPs using uncontrolled emissions and a 100-meter fenceline radius. The uncontrolled emissions, however, were estimated using an older version of AP-42 Table 11.12-8. Using AP-42 factors from the most recent 06/06 edition, uncontrolled emissions of all TAPs for a 300 cy/hr plant were below the applicable screening emission level except for arsenic, nickel, and hexavalent chromium (see page 2 of the example calculation in Attachment 1. Each of these TAPs is a carcinogen, and is subject to an annual AACC. For the ISCST3 analyses, dispersion modeling was done for the controlled emissions of each of these three TAPs. The controlled TAPs emissions used in the ISCST3 analyses are summarized in Tables 7A and 7B.

Table 7A. EMISSIONS RATES FOR SOURCES – CONTROLLED TAPs EMISSIONS

Modeling Case	ISCST3 300,000 cy/yr			ISCST3 400,000 cy/yr		
Pollutant	**Arsenic**	**Nickel**	**Cr (VI)**	**Arsenic**	**Nickel**	**Cr (VI)**
Source	lb/hr_{YR} [a]	lb/hr_{YR}	lb/hr_{YR}	lb/hr_{YR}	lb/hr_{YR}	lb/hr_{YR}
Cement delivery to silo (with baghouse)	3.56E-08	3.51E-07	4.88E-08	4.75E-08	4.69E-07	6.50E-08
Supplement delivery to silo (with baghouse)	1.25E-06	2.85E-06	4.58E-07	1.67E-06	3.80E-06	6.10E-07
SILO	**1.286E-06**	**3.004E-06**	**5.068E-07**	**1.718E-06**	**4.269E-06**	**6.75E-07**
Truck loadout: Cement and supplement delivery to silo (no controls) **TRUCKLOD**	**1.47E-06**	**5.75E-06**	**1.17E-06**	**1.96E-06**	**7.66E-06**	**1.56E-06**

[a] Pounds per hour, annual average.

Table 7B. EMISSIONS RATES FOR SOURCES – CONTROLLED TAPs EMISSIONS

Modeling Case	ISCST3 500,000 cy/yr			[Reserved]		
Pollutant	**Arsenic**	**Nickel**	**Cr (VI)**	**Arsenic**	**Nickel**	**Cr (VI)**
Source	lb/hr$_{YR}$ [a]	lb/hr$_{YR}$	lb/hr$_{YR}$	lb/hr$_{YR}$	lb/hr$_{YR}$	lb/hr$_{YR}$
Cement delivery to silo (with baghouse)	5.94E-08	5.86E-07	8.13E-08			
Supplement delivery to silo (with baghouse)	2.08E-06	4.75E-06	7.63E-07			
SILO	**2.139E-06**	**5.33E-06**	**8.443E-07**			
Truck loadout: Cement and supplement delivery to silo (no controls) **TRUCKLOD**	**2.45E-06**	**9.58E-06**	**1.95E-06**			

[a] Pounds per hour, annual average.

3.3 *Results for Significant and Full Impact Analyses*

A significant contribution analysis was not submitted for this application. Aspen submitted a full impact analysis for the proposed modification project. The results of the facility-wide modeling for criteria pollutants are shown in Table 8.

Table 8. RESULTS OF FULL IMPACT ANALYSES – PM_{10}

Pollutant	Averaging Period	Modeled Design Concentration[a] (µg/m^3)[b]	Background Concentration (µg/m^3)	Total Ambient Impact[a] (µg/m^3)	NAAQS[c] (µg/m^3)	Percent of NAAQS
ISCST3 Case 1. Low Production:		1,500 cy/day, 300,000 cy/yr, Fenceline at radius of 40 meters				
PM_{10}[d]	24-hour	63.2	73	136.2	150	90.8% (73.2%)[e]
	Annual	11.2	26	37.2	50	74.4%
ISCST3 Case 2. Moderate Production:		2,400 cy/day, 400,000 cy/yr, Fenceline at radius of 60 meters				
PM_{10}[d]	24-hour	79.8	73	152.8	150	102% (82.1%)[e]
	Annual	10.8	26	36.8	50	73.4%
AERMOD Case 3. Moderate Production:		**3,600 cy/day, 500,000 cy/yr, Fenceline at radius of 100 meters**				
PM_{10}[d]	24-hour	53.3	73	126	150	**84.2%**
	Annual	5.53	26	31.5	50	**63.1%**
ISCST3 Case 3. Moderate Production:		**3,600 cy/day, 500,000 cy/yr, Fenceline at radius of 100 meters**				
PM_{10}[d]	24-hour	83.8	73	156.8	150	**104.5% (84.2%)[e]**
	Annual	7.91	26	33.9	50	**67.8%**
ISCST3 Case 4. High Production:		4,800 cy/day, 500,000 cy/yr, Fenceline at radius of 150 meters				
PM_{10}[d]	24-hour	73.8	73	146.8	150	97.9% (78.9%)[e]
	Annual	4.86	26	30.9	50	61.7%

[a] Maximum 6th highest value (24-hour standard) for five years of meteorological data.
[b] Micrograms per cubic meter
[c] National ambient air quality standards
[d] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
[e] AERMOD results for Case 3 indicate that using the currently approved AERMOD model would result in significantly lower predicted ambient impact than the ISCST3 analysis (about 20% lower, based on Case No.3 results). The estimated ambient impact for this case had AERMOD been run instead of ISCST3 is shown in brackets. This result was deemed acceptable to demonstrate preconstruction compliance with the 24-hr PM_{10} NAAQS standard.

The results of the ISCST3 results for the controlled ambient impact for TAPs emissions are shown in Table 9.

Table 9. RESULTS OF TAPs ANALYSIS - CONTROLLED EMISSIONS				
TAP	**Averaging Period**	**Modeled Design Concentration[a] ($\mu g/m^3$)[b]**	**AACC[c] ($\mu g/m^3$)**	**Percent of AACC**
Case 1	**1,500 cy/day**	**300,000 cy/year**	**40 meters**	
Arsenic	Annual	7.51E-05	2.3E-04	32.7%
Chromium (VI)	Annual	4.54E-05	8.3E-05	54.7%
Nickel	Annual	2.67E-04	4.23E-03	6.4%
Case 2	**2,400 cy/day**	**400,000 cy/year**	**60 meters**	
Arsenic	Annual	8.79E-05	2.3E-04	38.2%
Chromium (VI)	Annual	6.10E-05	8.3E-05	73.5%
Nickel	Annual	3.12E-04	4.23E-03	7.4%
Case 3	**3,600 cy/day**	**500,000 cy/year**	**100 meters**	
Arsenic	Annual	6.78E-05	2.3E-04	29.5%
Chromium (VI)	Annual	4.63E-05	8.3E-05	55.8%
Nickel	Annual	2.38E-04	4.23E-03	5.6%
Case 4	**4,800 cy/day**	**500,000 cy/year**	**150 meters**	
Arsenic	Annual	4.38E-05	2.3E-04	39.1%
Nickel	Annual	2.98E-05	8.3E-05	35.9%
Chromium (VI)	Annual	1.53E-04	4.23E-03	3.6%

[a] Maximum 1st highest value for five years of meteorological data.
[b] Micrograms per cubic meter
[c] Acceptable ambient concentration for carcinogens

4.0 Conclusions

The ambient air impact analysis conducted by DEQ demonstrated to DEQ's satisfaction that emissions from a concrete batch plant facility that meets the criteria specified in Table 1 will not cause or significantly contribute to a violation of any air quality standard.

Attachment 1.
Sample Emissions Calculation – 3,600 cy/day and 500,000 cy/year

CRITERIA POLLUTANT EMISSION INVENTORY for Truck Mix Portable Concrete Batch Plant

3/20/07 17:37

Facility Information

Company:	DEQ GENERIC MODEL - 3,600 cy/day and 500,000 cy/year
Facility ID:	777-xxxxxx
Permit No.:	P-2007.xxxx
Source Type:	Portable Concrete Batch Plant
Manufacturer/Model:	

Assumptions Implied or Stated in Application:
Presumes this is an initial permit, not a modification
See control assumptions

Truck Mix (T) or Central Mix (C)? T

INCREASE IN Production[1]

Maximum Hourly Production Rate:	300	cy/hr		
Proposed Daily Production Rate:	3,600	cy/day	12.00	Hours of operation per day at max capacity
Proposed Maximum Annual Production Rate:	500,000	cy/year		
Cement Storage Silo Capacity:		ft^3 of aerated cement		
Cement Storage Silo Large Compartment Capacity for cement only:		of the silo capacity		
Cement Storage Silo small Compartment Capacity for cement or ash:		of the silo capacity		

DEQ EI VERIFICATION WORKSHEET v. 032007
Tip: Purple text or numbers are meant to be changed.
Black text or numbers indicates it's hard-wired or calculated.
Review these before you change them.

Change in PM_{10} Emissions due to this PTC

Emissions Point	PM_{10} Emission Factor[1] (lb/cy)		Controlled Emission Rate, Max	Controlled Emission Rate, 24-hour average		Controlled Emission Rate, annual average		Control Assumptions:	
	Controlled	Uncontrolled	lb/hr[2]	lb/hr[3]	lb/day[3]	lb/hr[4]	T/yr[4]		
Aggregate delivery to ground storage		0.0031	0.23	0.116	2.79	0.044	0.194	75%	Control: Water sprays
Sand delivery to ground storage		0.0007	0.05	0.026	0.63	0.010	0.044	75%	Control: Water sprays
Aggregate transfer to conveyor		0.0031	0.23	0.116	2.79	0.044	0.194	75%	Control: Water sprays
Sand transfer to conveyor		0.0007	0.05	0.026	0.63	0.010	0.044	75%	Control: Water sprays
Aggregate transfer to elevated storage		0.0031	0.23	0.116	2.79	0.044	0.194	75%	Control: Water sprays
Sand transfer to elevated storage		0.0007	0.05	0.026	0.63	0.010	0.044	75%	Control: Water sprays
Cement delivery to Silo (controlled EF)	**0.0001**		**2.50E-02**	**1.25E-02**	**3.00E-01**	**4.76E-03**	**2.09E-02**	**0.00%**	Baghouse is process equipment
Cement supplement delivery to Silo (controlled EF)	**0.0002**		**5.36E-02**	**2.68E-02**	**6.44E-01**	**1.02E-02**	**4.47E-02**	**0.00%**	Baghouse is process equipment
Weigh hopper loading (sand & aggregate batcher loading)		**0.0040**	**1.19E-02**	**5.93E-03**	**1.42E-01**	**2.26E-03**	**9.88E-03**	99.00%	Baghouse is process equipment
Truck mix loading,Table 11.12-2, "0.278 lb/ton of cement+flyash" x ((491 lb cement + 73 lb flyash)/cy concrete) / 2000 lb = 0.0784 lb/cy		0.0784	1.18	0.59	14.11	0.22	0.98	95.00%	Control: Automatic load in equivalent
Central mix loading,Table 11.12-2, "0.134 lb/ton of cement+flyash" x ((491 lb cement + 73 lb flyash)/cy concrete) / 2000 lb = 0.0378 lb/cy		0.0000	0.00	0.00	0.00	0.00	0.00	95.00%	Control: Automatic load in equivalent
Point Sources Total Emissions		**4.21E-03**	**9.05E-02**	**4.53E-02**	1.09E+00	**1.72E-02**	**7.54E-02**		
Process Fugitive Emissions		0.0698	2.03	1.02	24.38	0.39	1.69		
Facility Wide Total: Point Sources + Process Fugitives (Except for Road Dust and Windblown Dust)		0.0940	2.12	1.06	25.47	0.40	1.77		

POINT SOURCE EMISSIONS for FACILITY CLASSIFICATION[4]	Controlled EF	at 2,628,000 cy/yr	T/yr
Facility Classification Total PM[5]	**5.08E-03**		**6.67E+00**
Facility Classification Total PM10[5]	**3.02E-04**		**3.97E-01**

[1] The EFs were calculated using EFs in lb/ton of material handled from Table 11.12-2, typical composition per cubic yard of concrete (1865 lb aggregate, 1428 lbs sand, 491 lbs cement, 73 lbs cement supplement, and 20 gallons of water = 4024 lb/cy), and closely match Table 11.12-5 values (version 6/06) when rounded to the same number of figures. AP-42 lists the same EFs for uncontrolled and controlled emissions, so control estimates are based on the assumed control levels input on the right hand side of the table.

[2] Max. hourly rate includes reductions associated with control assumptions.

[3] Hourly emissions rate (24-hr average) = Max.hourly emissions rate x (hrs per day) / 24.
Daily emissions rate = max emissions rate (1-hr average) x proposed hrs/day.

[4] Annual average hourly emissions rate = EF (lb/cy) x proposed annual production rate (cy/yr) / (8760 hr/yr)
Annual emissions rate = EF (lb/cy) x proposed annual production rate (cy/yr) /(2000 lb/T)

[5] Controlled EFs for PM = 0.0002 (cement silo) + 0.0003 (flyash silo) + 0.0079(weigh batcher)*(1-control/WB)
for PM10 = 0.0001 (cement silo) + 0.0002 (flyash silo) + 0.0040 (weigh batcher)*(1-control/WB)

[6] Emissions for Facility Classification are based on baghouses as process equipment, 24 hr day, 8760 hr/yr = 7,200 cy/day, and 2,628,000 cy/yr

Lead emissions			Increase in Emissions from this PTC				Emissions for Facility Classification	
Emissions Point	Lead Emission Factor[1] (lb/ton of material loaded)		Emission Rate, Max.	Emissions for Comparison with DEQ Modeling Threshold		Emission Rate, Quarterly		
	Controlled with fabric	Uncontrolled	lb/hr, 1-hr avg.[2]	lb/month[3]	T/yr[4]	lb/hr qtrly avg[5]		T/yr
Cement delivery to silo [3]	1.09E-08	7.26E-07	8.03E-07	2.93E-04	1.34E-03	4.01E-07	Point Source	3.52E-06
Cement supplement delivery to Silo [3]	5.20E-07	ND	5.69E-06	2.08E-03	9.49E-03	2.85E-06	Point Source	2.49E-05
Truck Loadout (with 129% control)		3.62E-06	1.53E-05	5.59E-03	2.55E-02	7.66E-06	Fugitive	
Central Mix (with 130% control)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	Fugitive	
Total			**2.18E-05**	**7.96E-03**	**0.036**		Point Sources	**2.86E-05**
DEQ Modeling Threshold				100	0.6			
Modeling Required?				No	No			

[1] The emissions factors are from AP-42, Table 11.12-8 (version 06/06)
[2] Max. hourly rate = EF x pound of cement/yd^3 of concrete x max. hourly concrete production rate/(2000 lb/T)
[3] lb/mo = EF x pound of material/yd^3 of concrete x max. daily concrete production rate x (365/12)/(2000 lb/T)
[4] T/yr = EF x pound of material/yd^3 of concrete x max. annual concrete production rate/(2000 lb/T)
[5] lb/hr, qtrly avg = lb/mo x 3 months per qtr / (8760/4)hrs per qtr

lb/hr 24-hr Annual
3.75E-02 0.143 0.285
1.50E-02 0.054 0.109

Toxic Air Pollutant (TAPs) EMISSIONS INVENTORY, Truck Mix Concrete Batch Plant

3/27/2007 17:37

Facility Information

Company:	DEQ GENERIC MODEL - 3,600 cy/day and 500,000 cy/year
Facility ID:	777-xxxxxx
Permit No.:	P-2007.xxxx
Source Type:	Portable Concrete Batch Plant
Manufacturer:	0

Emissions estimates are based on EFs in AP-42, Table 11.12-8 (version 06/06) and the following composition of one yard of concrete:

Coarse aggregate		1865 pounds
Sand		1428 pounds
Cement		491 pounds
Cement supplement		73 pounds
Water		29 gallons
Concrete		4324 pounds

Truck Mix Loadout Factor: 1

Central Mix Batching Factor: 0

DEQ EI VERIFICATION WORKSHEET Version 032007
Tip: Purple text or numbers are meant to be changed.
Black text or numbers and cells it's hard-wired or calculated.
Review these before you change them.

Increase in Production

Maximum Hourly Production Rate	200	cy/hr	
Proposed Daily Production Rate	3,600	cy/day	
Proposed Max Yearly Annual Production Rate	500,000	cy/year	

Uncontrolled (Unlimited Production Rate)

	24 hr/day
7,200 cy/day	7 days/wk
2,628,000 cy/yr	52 wks/year

TAP Emission Factors from AP-42, Table 11.12-8 (Version 06/06)

Emissions Point	Arsenic EF (lb/ton of material loaded)		Beryllium EF (lb/ton of material loaded)		Cadmium EF (lb/ton of material loaded)		Chromium EF (lb/ton of material loaded)		Manganese EF (lb/ton of material loaded)		Nickel EF (lb/ton of material loaded)		Phosphorus EF (lb/ton of material loaded)		Selenium EF (lb/ton of material loaded)		Chromium VI
	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Controlled with Fabric Filter	Uncontrolled	Percent of total Cr that is Cr+6
Cement delivery to silo	4.24E-05		4.85E-10		4.85E-10		2.90E-05		1.17E-07		4.16E-08			1.15E-05			20%
Cement supplement delivery to Silo	1.63E-06		9.84E-08		1.98E-08		1.22E-05		2.64E-07		2.36E-06		3.54E-06	7.24E-05			20%
Truck Loadout		3.04E-06		3.44E-07		3.43E-08		1.14E-05		5.12E-05		1.15E-05		3.84E-05		2.62E-06	21.29%
Central Mix Batching	0.00E+00	0.00E+00				0.00E+00		0.00E+00		0.00E+00		0.00E+00		0.00E+00			21.29%

UNCONTROLLED TAP EMISSIONS Note: Includes baghouses as process equipment. 7,200 cy/day, and 2,628,000 cy/yr

Emissions Point	Arsenic		Beryllium		Cadmium		Chromium		Manganese		Nickel		Phosphorus		Selenium		Chromium VI	
	lb/hr annual avg	Tpy[1]	lb/hr annual avg	Tpy	lb/hr annual avg	Tpy	lb/hr 24-hr avg	Tpy[2]	lb/hr 24-hr avg	Tpy	lb/hr annual avg	Tpy	lb/hr 24-hr avg	Tpy	lb/hr 24-hr avg	Tpy	lb/hr annual avg	
Cement delivery to silo	3.12E-07	1.37E-06	3.56E-09	1.57E-07	3.56E-09	1.57E-07	2.14E-06	8.83E-05	8.62E-06	3.77E-05	3.06E-06	1.35E-05	8.53E-04	3.81E-02	ND	ND	4.27E-07	
Cement supplement delivery to Silo	1.19E-06	4.80E-05	9.84E-07	4.34E-06	2.17E-07	9.50E-07	1.34E-06	5.85E-05	2.83E-06	1.21E-05	2.59E-06	1.05E-04	3.89E-05	1.70E-04	7.53E-07	3.47E-06	4.91E-08	
Truck Loadout	2.57E-04	1.13E-03	2.90E-05	3.04E-05	2.85E-06	1.27E-05	9.64E-04	4.22E-03	5.10E-03	2.27E-02	1.61E-03	4.41E-03	3.25E-03	1.42E-02	2.22E-04	9.71E-04	2.03E-04	
Central Mix Batching	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00			0.00E+00	
Sources Total	2.64E-04	1.18E-03	2.97E-05	3.49E-05	3.35E-06	1.39E-05	9.86E-04	4.33E-03	5.11E-03	2.27E-02	1.63E-03	4.50E-03	4.10E-03	1.80E-02	2.12E-04	9.74E-04	2.10E-04	
ADAPA Screening EL (lb/hr)	1.50E-05		2.80E-05		3.70E-06		3.33E-02		3.33E-01		2.70E-03		7.00E-03		1.50E-02		5.60E-07	
EXCEEDS EL?	Yes		No		No		No		No		Yes		No		No		Yes	

Facility Classification, Total Annual HAPs Emissions: 5.21E-02 Tons per year

CONTROLLED TAP EMISSIONS Note: Includes baghouses as process equipment. 3,600 cy/day, and 500,000 cy/year

Emissions Point	Arsenic		Beryllium		Cadmium		Chromium		Manganese		Nickel		Phosphorus		Selenium		Chromium VI	
	lb/hr annual avg	Tpy[1]	lb/hr annual avg	Tpy	lb/hr annual avg	Tpy	lb/hr 24-hr avg	Tpy[2]	lb/hr 24-hr avg	Tpy	lb/hr annual avg	Tpy	lb/hr 24-hr avg	Tpy	lb/hr 24-hr avg	Tpy	lb/hr annual avg	
Cement delivery to silo	5.94E-08	2.60E-07	6.61E-09	2.90E-08	6.61E-09	2.90E-08	1.07E-06	1.76E-05	4.31E-06	7.10E-06	5.66E-07	2.47E-06	ND	ND	ND	ND	8.15E-08	
Cement supplement delivery to Silo	2.04E-06	8.12E-06	1.65E-07	6.25E-07	4.13E-08	1.61E-07	4.43E-05	1.11E-03	9.43E-06	2.24E-05	4.75E-06	2.05E-05	1.30E-04	3.22E-04	3.94E-07	6.61E-07	7.62E-07	
Truck Loadout	2.45E-06	1.37E-05	1.55E-07	6.60E-07	2.75E-08	1.21E-07	2.41E-05	4.22E-05	1.30E-04	2.16E-04	9.66E-06	4.19E-05	8.12E-05	1.34E-04	5.54E-06	9.24E-06	1.95E-06	
Central Mix Batching	0.00E+00	0.00E+00	ND	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND	ND	0.00E+00	
Sources Total	4.51E-06	2.31E-05	3.52E-07	1.71E-06	7.56E-08	3.31E-07	7.01E-05	5.31E-05	1.43E-04	2.53E-04	1.49E-05	6.53E-05	2.12E-04	1.68E-04	5.94E-06	9.50E-06	2.83E-06	
ADAPA Screening EL (lb/hr)	1.50E-06		2.80E-05		3.70E-06		3.33E-02		3.33E-01		2.70E-03		7.00E-03		1.50E-02		5.60E-07	
Percent of EL	300.99%		1.42%		2.04%		0.21%		0.043%		0.55%		3.02%		0.040%		499.55%	
EXCEEDS EL?	Yes		No		No		No		No		No		No		No		Yes	

Control: 95.00% Automatic shut or equivalent

Control: 95.00% Automatic shut or equivalent

5.42E-04 Tons per year

[1] lb/hr, annual average = EF x pound of cement / Yd³ of concrete x annual concrete production rate / 2000lb/Ton / 8760 hr/yr; lb/hr, 24-hr average = EF x pound of cement / Yd3 of concrete x daily concrete production rate / 2000lb/Ton / 24 hr/day

[2] lb/hr, annual average = EF x pound of cement supplement / Yd³ of concrete x annual concrete production rate / 2000 lb/Ton / 8760 hr/yr; lb/hr, 24-hr average = EF x pound of cement supplement / Yd3 of concrete x daily concrete production rate / 2000lb/Ton

[3] lb/hr, annual average = EF x pound of (cement + cement supplement) x Yd³ of concrete x annual concrete production rate / 2000lb/Ton / 8760 hr/yr; lb/hr, 24-hr average = EF x pound of (cement + cement supplement) / Yd3 of concrete x daily concrete production

[4] Tpy = lb/hr, annual avg x 8760 hr/yr x (1TON/2000 lb)

[5] Tpy = EF x pound of cement, or cement supplement, or cement + cement supplement x annual concrete production rate /2000 lb/ton / 2000 lb/ton

Attachment 2.
"Fenceline" Radius Calculations

Concrete Batch Plant - Typical Plant Layout Modeling 3/9/2007

"Fenceline" or Ambient Air Boundary Coordinates

Radians = deg * PI/180
x = Xoffset + c cos (Angle)
y= Yoffset + c sin(Angle)

CASE 1, 40 meter RADIUS			CASE 2, 60 meter RADIUS			CASE 3, 100 meter RADIUS			CASE 4, 125 meter RADIUS		
Radius c	40	(meters)	Radius c	60	(meters)	Radius c	75	(meters)	Radius c	125	(meters)
Origin Offset	0	(meters)	Origin Offset	0	(meters)	Origin Offset	0	(meters)	Origin Offset	0	(meters)
Origin Offset	0	(meters)	Origin Offset	0	(meters)	Origin Offset	0	(meters)	Origin Offset	0	(meters)

Angle (degrees)	EAST (x)	NORTH (y)	Angle (degrees)	EAST (x)	NORTH (y)	Angle (degrees)	EAST (x)	NORTH (y)	Angle (degrees)	EAST (x)	NORTH (y)
10	39.39	6.95	10	59.09	10.42	10	73.86	13.02	10	123.10	21.71
20	37.59	13.68	20	56.38	20.52	20	70.48	25.65	20	117.46	42.75
30	34.64	20.00	30	51.96	30.00	30	64.95	37.50	30	108.25	62.50
40	30.64	25.71	40	45.96	38.57	40	57.45	48.21	40	95.76	80.35
50	25.71	30.64	50	38.57	45.96	50	48.21	57.45	50	80.35	95.76
60	20.00	34.64	60	30.00	51.96	60	37.50	64.95	60	62.50	108.25
70	13.68	37.59	70	20.52	56.38	70	25.65	70.48	70	42.75	117.46
80	6.95	39.39	80	10.42	59.09	80	13.02	73.86	80	21.71	123.10
90	0.00	40.00	90	0.00	60.00	90	0.00	75.00	90	0.00	125.00
100	-6.95	39.39	100	-10.42	59.09	100	-13.02	73.86	100	-21.71	123.10
110	-13.68	37.59	110	-20.52	56.38	110	-25.65	70.48	110	-42.75	117.46
120	-20.00	34.64	120	-30.00	51.96	120	-37.50	64.95	120	-62.50	108.25
130	-25.71	30.64	130	-38.57	45.96	130	-48.21	57.45	130	-80.35	95.76
140	-30.64	25.71	140	-45.96	38.57	140	-57.45	48.21	140	-95.76	80.35
150	-34.64	20.00	150	-51.96	30.00	150	-64.95	37.50	150	-108.25	62.50
160	-37.59	13.68	160	-56.38	20.52	160	-70.48	25.65	160	-117.46	42.75
170	-39.39	6.95	170	-59.09	10.42	170	-73.86	13.02	170	-123.10	21.71
180	-40.00	0.00	180	-60.00	0.00	180	-75.00	0.00	180	-125.00	0.00
190	-39.39	-6.95	190	-59.09	-10.42	190	-73.86	-13.02	190	-123.10	-21.71
200	-37.59	-13.68	200	-56.38	-20.52	200	-70.48	-25.65	200	-117.46	-42.75
210	-34.64	-20.00	210	-51.96	-30.00	210	-64.95	-37.50	210	-108.25	-62.50
220	-30.64	-25.71	220	-45.96	-38.57	220	-57.45	-48.21	220	-95.76	-80.35
230	-25.71	-30.64	230	-38.57	-45.96	230	-48.21	-57.45	230	-80.35	-95.76
240	-20.00	-34.64	240	-30.00	-51.96	240	-37.50	-64.95	240	-62.50	-108.25
250	-13.68	-37.59	250	-20.52	-56.38	250	-25.65	-70.48	250	-42.75	-117.46
260	-6.95	-39.39	260	-10.42	-59.09	260	-13.02	-73.86	260	-21.71	-123.10
270	0.00	-40.00	270	0.00	-60.00	270	0.00	-75.00	270	0.00	-125.00
280	6.95	-39.39	280	10.42	-59.09	280	13.02	-73.86	280	21.71	-123.10
290	13.68	-37.59	290	20.52	-56.38	290	25.65	-70.48	290	42.75	-117.46
300	20.00	-34.64	300	30.00	-51.96	300	37.50	-64.95	300	62.50	-108.25
310	25.71	-30.64	310	38.57	-45.96	310	48.21	-57.45	310	80.35	-95.76
320	30.64	-25.71	320	45.96	-38.57	320	57.45	-48.21	320	95.76	-80.35
330	34.64	-20.00	330	51.96	-30.00	330	64.95	-37.50	330	108.25	-62.50
340	37.59	-13.68	340	56.38	-20.52	340	70.48	-25.65	340	117.46	-42.75
350	39.39	-6.95	350	59.09	-10.42	350	73.86	-13.02	350	123.10	-21.71
360	40.00	0.00	360	60.00	0.00	360	75.00	0.00	360	125.00	0.00