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JAN 05 2011
Bureau of Air Monitoring & Mobile Sources

CONCRETE BATCHING PLANT
AIR GENERAL PERMIT REGISTRATION FORM

Part II. Notification to Permitting Office
(Detach and submit to appropriate permitting office; keep copy onsite)

Instructions: To give notice to the Department of an eligible facility's intent to use this air general permit, the owner or operator of the facility must detach and complete this part of the Air General Permit Registration Form and submit it to the appropriate Department of Environmental Protection or local air pollution control program office which has permitting authority. Please type or print clearly all information, and enclose the appropriate air general permit registration processing fee pursuant to Rule 62-4.050, F.A.C. *($100 as of the effective date of this form)*

0251332-001

Registration Type

Check one:

INITIAL REGISTRATION - Notification of intent to:

- [x] Construct and operate a proposed new facility.
- [ ] Operate an existing facility not currently using an air general permit (e.g., a facility proposing to go from an air operation permit to an air general permit).

RE-REGISTRATION (for facilities currently using an air general permit) - Notification of intent to:

- [ ] Continue operating the facility after expiration of the current term of air general permit use.
- [ ] Continue operating the facility after a change of ownership.
- [ ] Make an equipment change requiring re-registration pursuant to Rule 62-210.310(2)(e), F.A.C., or any other change not considered an administrative correction under Rule 62-210.310(2)(d), F.A.C.

Surrender of Existing Air Operation Permit(s) - For Initial Registrations Only

If the facility currently holds one or more air operation permits, such permit(s) must be surrendered by the owner or operator upon the effective date of this air general permit. In such case, check the first box, and indicate the operation permits being surrendered. If no air operation permits are held by the facility, check the second box.

- [ ] All existing air operation permits for this facility are hereby surrendered upon the effective date of this air general permit; specifically permit number(s): ______
- [x] No air operation permits currently exist for this facility.

2011 JAN -4 PM 2:00

General Facility Information

Facility Owner/Company Name (Name of corporation, agency, or individual owner who or which owns, leases, operates, controls, or supervises the facility.)

Bouygues Civil Works Florida

Site Name (Name, if any, of the facility site; e.g., Plant A, Metropolis Plant, etc. If more than one facility is owned, a registration form must be completed for each.)

Watson Island Site Establishment

Facility Location (Provide the physical location of the facility, not necessarily the mailing address.)
Street Address: 1050 MacArthur Causeway
City: Miami County: Miami-Dade Zip Code: 33132-~~0000~~ 1613

Facility Start-Up Date (Estimated start-up date of proposed **new** facility.)(N/A for existing facility)

September 2011

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DEC 29 2010
Dept of Env Protection
West Palm Beach

Owner/Authorized Representative

Name and Position Title (Person who, by signing this form below, certifies that the facility is eligible to use this air general permit.)
Print Name and Title: Louis Brais, Project Executive

Owner/Authorized Representative Mailing Address
Organization/Firm: BOUYGUES CIVIL WORKS FLORIDA
Street Address: 1050 MAC ARTHUR CAUSEWAY
City: MIAMI County: DADE Zip Code: 33132-0000

Owner/Authorized Representative Telephone Numbers
Telephone: (305) 894-1800 Fax: (305) 374-8586
Cell phone (optional):

Facility Contact (If different from Owner/Authorized Representative)

Name and Position Title (Plant manager or person to be contacted regarding day-to-day operations at the facility.)
Print Name and Title: Luca Pellegrini

Facility Contact Mailing Address
Organization/Firm: SAME
Street Address:
City: County: Zip Code:

Facility Contact Telephone Numbers
Telephone: (305) 613-7709 Fax: (305) 374-8586
Cell phone (optional):

Owner/Authorized Representative Statement

This statement must be signed and dated by the person named above as owner or authorized representative

I, the undersigned, am the owner or authorized representative of the owner or operator of the facility addressed in this Air General Permit Registration Form. I hereby certify, based on information and belief formed after reasonable inquiry, that the facility addressed in this registration form is eligible for use of this air general permit and that the statements made in this registration form are true, accurate and complete. Further, I agree to operate and maintain the facility described in this registration form so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof.

I will promptly notify the Department of any changes to the information contained in this registration form.

Signature: [signature] Date: 12/22/10

2011 JAN -4 PM 2:00
FINANCE & ACCOUNTING REVENUE
FLORIDA DEPARTMENT

Type of Facility

Check one:

☒ **Stationary Facility** ☐ **Relocatable Facility**

Type(s) of Reasonable Precautions Used to Prevent Unconfined Emissions

Check all precautions to be used for the management of roads, parking areas, stock piles and yards:

☒ **Pave Roads**	☒ **Pave Parking Areas**	☒ **Pave Yards**
☒ **Maintain Roads/Parking/Yards**	☒ **Use Water Application**	☒ **Use Dust Suppressant**
☒ **Remove Particulate Matter**	☒ **Reduce Stock Pile Height**	☐ **Install Wind Breaks**

Check all precautions to be used for the management of drop points to trucks:

☐ **Spray Bar**	☒ **Chute**	☐ **Enclosure**
	☒ **Partial enclosure**	

Description of Reasonable Precautions

Below, or as an attachment to this form, provide details of all types of reasonable precautions to be used to prevent unconfined emissions at the facility.

See attached Concrete Batching Plant Engineering Report.

Description of Facility

Below, or as an attachment to this form, provide a description of the concrete batching plant operations at the facility in sufficient detail to demonstrate the facility's eligibility for use of this air general permit and to provide a basis for tracking any future equipment or process changes at the facility. Describe all air pollutant-emitting processes and equipment at the facility, and identify any air pollution control measures or equipment used.

See attached Concrete Batching Plant Engineering Report.

* SEE ATTACHED E-MAILS AS AN ADDENDUM TO THIS FORM DATED 01/17/11 & 0/12/11.

2011 JAN -4 PM 2:00

REVENUE

*ADDENDUM TO 0251332-001
PAGE 10, DESCRIPTION OF FACILITY.

Dibble, Dickson

From: SMITH, Graham [g.smith@bcwf-miami.com]
Sent: Monday, January 17, 2011 7:54 AM
To: Dibble, Dickson
Subject: RE: ARMS Facility #0251332; Port of Miami Tunnel Project, BCWF Ref: BCWF/02938

Dick,

We do have (3) separate silos as it appears below.

Yes, each silo has an individual dedicated Silotop baghouse (1 baghouse per silo).

Please let me know if you need anything else.

Thank you,

Graham

From: Dibble, Dickson [mailto:Dickson.Dibble@dep.state.fl.us]
Sent: Wednesday, January 12, 2011 2:32 PM
To: SMITH, Graham
Cc: Ajhar, Rebecca; PELLEGRINI, Luca
Subject: RE: ARMS Facility #0251332; Port of Miami Tunnel Project, BCWF Ref: BCWF/02938

Graham,

I need just a little more clarification:

1) The schematic attached to the CCB Plant AGP Registration Form depicts one (1) - 3-bin/compartment silo. Is this the case, or do we have three (3) separate silos as it appears in your e-mail below?; or
2) If the plant is one silo with 3 bins, do we have 3 individual baghouses, one for each bin, or do we have one central dedicated unit for all 3 bins?
3) If the silos are separate and individual, does each have an individual dedicated Silotop baghouse, or are all fed into a central baghouse?

Thank you for providing me with some comfort and clarity with respect to the actual configuration.

If you have any questions, comments, or concerns please e-mail or call.

Thank you and have a great day!

Dick

Dickson E. Dibble, ES III
FL Dept of Environmental Protection
Div. of Air Resource Management
Bureau of Air Monitoring & Mobile Sources
Air General Permit Program
Tel. (850) 921-9586
FAX (850) 922-6979
ICG-#345

Dickson.Dibble@dep.state.fl.us

From: SMITH, Graham [mailto:g.smith@bcwf-miami.com]
Sent: Wednesday, January 12, 2011 7:34 AM
To: Dibble, Dickson
Cc: PELLEGRINI, Luca
Subject: RE: ARMS Facility #0251332; Port of Miami Tunnel Project, BCWF Ref: BCWF/02938

Dick,

Please see the information below from our Batch Plant supplier:

Please find below the information required for the dust control.

Silo #1
Cement

1) Make: BMH Systems
2) Model: SI-10-37
3) #1
4) Individual silotop baghouse
    a. WAM SILOTOP dust collector

Silo #2
Slag

1) Make: BMH Systems
2) Model: SI-10-37
3) #2
4) Individual silotop baghouse
    a. WAM SILOTOP dust collector

Silo #3
Fly ash

1) Make: BMH Systems
2) Model: SI-10-38
3) #3
4) Individual silotop baghouse
    a. WAM SILOTOP dust collector

WAM SILOTOP dust collector

1) Make: WAM
2) Model: Silotop
3) Type: Cartridges (7 Polypleats) with pulse jet
4) 250 sq.ft.

Mixer
1) Make: Arcen
2) Model: MD-3000
3) Central dust collector
   a. WAM FC.3J.20

Dust collector WAM FC.3J.20
1) Make: WAM
2) Model: FC.3J.20
3) Type: Cartridges, c/w 1650 cfm fan
4) 200 sq.ft.

Cement/fly ash/slag weigh hopper
1) Make: BMH Systems
2) Model: BC-02

Connected to mixer dust collector

Please let me know if you need more information.

Thank you,

Graham Smith

From: Dibble, Dickson [mailto:Dickson.Dibble@dep.state.fl.us]
Sent: Thursday, January 06, 2011 2:48 PM
To: SMITH, Graham
Cc: Ajhar, Rebecca
Subject: ARMS Facility #0251332; Port of Miami Tunnel Project, BCWF Ref: BCWF/02938

Dear Mr. Smith,

It was a pleasure to speak with you this morning regarding the need for clarification of certain equipment information as presented in your notice of intent to use the Concrete Batching (CCB) Plant Air General Permit Registration for the stationary CCB Plant (grout plant) to be located at the Watson Island Site Establishment.

Since there appears to be conflicting information within the attached supporting documents, I need to have some clarity as to the specific identification of the following process equipment and the emission control units associated with that equipment.

SILOS – Identify and list each silo individually, and indicate method of dust emission control for each
1) Make
2) Model #
3) Identify *(N,S,E, or W, or #1, #2, #3; or by product, i.e.-Cement, flyash, aggregate. etc; or by capacity, expressed in Bbl's or Tons)*
4) Type of emission control unit *(individual silotop baghouse, in-truss dust collector, vent filter, or Central dust collector for all silos)*

EMISSION CONTROL UNITS
1) Make
2) Model #
3) Type (cartridge, bag, and /or bin vent filter
4) Filter area expressed in sq. ft.

MISCELLANEOUS - As in the above, I need similar **IDENTIFIERS of OTHER POLLUTANT EMITTING PROCESS EQUIPMENT** *(i.e.-storage bins, hoppers, open belt conveyors/stackers, weigh hoppers, batcher/mixers)* & their **APPLIED EMISSION CONTROL UNITS/PRACTICES** *(i.e.-baghouses/dust collectors, vent filters, spray rings, shrouds, etc).*

You may respond and provide this information via e-mail and I will simply attach it as an addendum to the initial submitted form.

Thank you for your assistance with helping me to be able to better identify the actual, to be constructed and installed emission units and their controls.

If you have any questions, comments, or concerns please e-mail or call.

Thank you and have a great, but a safe day!

Sincerely yours,

Dickson E. Dibble

Dickson E. Dibble, ES III
FL Dept of Environmental Protection
Div. of Air Resource Management
Bureau of Air Monitoring & Mobile Sources
Air General Permit Program
Tel. (850) 921-9586
FAX (850) 922-6979
ICG-#345

Dickson.Dibble@dep.state.fl.us

COMMUNICATE
in plain language

Please note: Florida has a very broad public records law. Most written communications to or from state officials regarding state business are public records available to the public and media upon request. Your e-mail communications may therefore be subject to public disclosure

The Department of Environmental Protection values your feedback as a customer. DEP Secretary Mimi Drew is committed to continuously assessing and improving the level and quality of services provided to you. Please take a few minutes to comment on the quality of service you received. Simply click on this link to the DEP Customer Survey. Thank you in advance for completing the survey.

Client	Stamps – FDOT
Port of Miami Tunnel Project FM NO. 251156-3-32-01	
Client Florida Department of Transportation	
Concessionaire **MAT** miami access tunnel	Stamps – Concessionaire
Contractor **Bouygues Civil Works Florida** BOUYGUES CIVIL WORKS FLORIDA	Other ES CONSULTANTS, INC. environmental and civil engineering

SKu SSK	JTh	GRd	22Dec2010	00	FA	First issue
Prepared	Reviewed	Approved	Date	Rev	Status	Revision

Specialty Engineer Jeffrey P. Thompson, P.E. — Engineer of Record N/a

Registration No.: FL 69239 — Registration No.: N/a

Issue Status: For Approval

2011 JAN -4 PM 2:00

Document Type	Permit
Area	Port of Miami Tunnel Project
Title	Watson Island Site Establishment
Sub-title	FDEP: Air Permit Application

Document Number

Project	Originator	Doc. Type	Package	Serial	Revision	Submission
POMT	– ES	– TR	– 0001	– 00107	– 00	: PER

BOUYGUES CIVIL WORKS
FLORIDA
General Contractor License No. CGC062569

December 23, 2010

RECEIVED
DEC 29 2010
Dept of Env Protection
West Palm Beach

Florida Department of Environment Protection
Division of Air Resource Management
P.O. Box 3070
Tallahassee, FL 32315-3070

BCWF Ref: BCWF / 02938 **Your Ref:** Click here to enter text.

Re: **Concrete Batching Plant Air General Permit**

To the FDEP Division of Air Resource Management:

In regards to the Port of Miami Tunnel Project, Bouygues Civil Works Florida (BCWF) is issuing this Air General Permit Registration Form for a Concrete Batching Plant. This plant will produce material used during the construction of tunnel. An engineering report has been included along with the registration form to describe the location and use of the batch plant.

If you should have any questions when reviewing the applications, please contact our Permit Coordinator at the information below:

Graham Smith
305-310-5899 or g.smith@bcwf-miami.com

We look forward to continuing to work with the FDEP through the permitting process of the Port of Miami Tunnel Project.

Best Regards,

Louis Brais
Project Executive, BCWF

On behalf of BCWF
Port of Miami Tunnel Project

Enc: 1 – Notification to Permitting Office
2 - Concrete Batching Plant Engineering Report
3 – Permit Fee

Cc int: JFo, PBo, LPe, NDu, GSm

Cc ext.: Jennifer Smith (FDEP), Isa Nunez (FDOT), John Palenchar (FDOT), Mauricio Gomez (FDOT), Dorian Valdez (POM), Patrick Shortal (POM), Becky Hope (POM), Diana Beauchamps Lopez (URS/POM), Guillaume Dubois (MAT), Rick Wilson (MAT)

2011 JAN -4 PM 2:00

<u>LIST OF EXHIBITS</u>

FDEP Concrete Batching Plant Air General Permit
Port of Miami Tunnel Project

EXHIBIT A	Concrete Batching Plant Air General Permit Registration Form DEP Form No. 62-210.920(2)(b)
EXHIBIT B	Concrete Batching Plant Engineering Report

EXHIBIT A

Concrete Batching Plant Air General Permit Registration Form

DEP Form No. 62-210.920(2)(b)

EXHIBIT B

Concrete Batching Plant Engineering Report

Concrete Batching Plant Engineering Report

Port of Miami Tunnel Project
Watson Island Site Establishment

December 2010

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DEC 29 20

Dept of Env Protection
West Palm Beach

ES CONSULTANTS, INC.
environmental and civil engineering

7700 N. KENDALL DRIVE, SUITE 607, MIAMI, FLORIDA 33156
PH 305.412.8185 **FX** 305.412.8105 **WEB** www.esconsultants.net
CA #9043

Jeffrey P. Thompson, P.E.
Lead Engineer
License No. 69239
Date: 12-28-10

Table of Contents

List of Attachments

1.0 Introduction

ES Consultants, Inc. (ESC) has prepared the following Concrete Batching Plant Engineering Report (Report) on behalf of Bouygues Civil Works Florida, Inc. (BCWF) to support the permitting of the concrete batching plant proposed as part of the Port of Miami Tunnel Project (POMT). Specifically, this Report is intended to support applications for a Florida Department of Environmental Protection (FDEP) Concrete Batching Plant Air General Permit and a Miami-Dade Department of Environmental Resources Management (DERM) Air Construction Permit.

The proposed concrete batching plant is required for the project to mix grout for the tunnel construction. Specifically, the grout mixed at the facility will be used for the tunnel base and for the seams of the tunnel's precast concrete sections. The concrete sections used in the tunnel construction will be precast at an offsite facility. The proposed concrete batching plant facility (Facility) will be located on the west end of Watson Island, under the MacArthur Causeway Bridge, and will be part of the overall POMT Site Establishment. The location of the proposed batch plant is shown on **Figure 1.**

2.0 Facility Description

The plant layout and equipment specifications are provided in **Attachment A** (please note the specifications are based off an older proposed layout; therefore, the equipment quantities listed are not accurate). The facility will operate at maximum capacity of approximately 78 cubic yards per hour (combined total) and operate approximately 20 hours per day for the duration of the project. The facility will be electrically powered and will consist of the following major components (among other ancillary equipment):

- Aggregate storage bins (50 ton total capacity)
- Aggregate scale (2 cubic meter capacity)
- Air compressor (15 horsepower)
- Two (2) 50 ton silos and one (1) 70 ton cement silo
- Cement and water scales
- Twin-shaft mixer
- Computerize batch control system

A process flow diagram illustrating the typical operation of concrete batching plants is provided in **Attachment B**.

3.0 Reasonable Precautions to Prevent Unconfined Emissions

As the owner and operator of the Facility, BCWF will take reasonable precautions to control unconfined emissions from hoppers, storage and conveying equipment, conveyor drop points, truck loading and unloading, roads, parking areas, stock piles, and yards. The following reasonable precautions will be implemented:

- The Site Establishment area will be paved with concrete
- Water will be used as necessary to control visible dust emissions
- Utilization of a mechanical dust collector
- Removal of particulate from the Site Establishment Area
- Reduction of stockpile height

4.0 Emission Calculations

Emissions calculations are provided in **Attachment C.** The calculations presented are full for one full year of operation. The following assumptions were made for the attached calculations:

- The Batch Plants will operate approximately 20 hours per day, 7 days a week, and 52 weeks a year.
- The combined output of the two batch plants will be 78 cubic yards per hour.
- Emissions factors based on U.S. EPA AP-42, Compilation of Air Pollutant Emission Factors.

5.0 Emission Testing

Emission testing will be conducted no later than 30 days after commencing concrete batching plant operations and annually thereafter. Testing will be conducted by EPA Method 9, as described in 40 CFR, Part 60, Appendix A; a copy of the testing method is provided in **Attachment D.** Test procedures will conform to the procedures specified in Rule 62-297.310, F.A.C and test results will be reported in accordance with the provisions of the aforementioned rule; a copy of Rule 62-297.310, F.A.C is provided in **Attachment E**. Emission testing results will be submitted to the FDEP no later than 45 days after being conducted and copy will be provided to DERM.

Figures

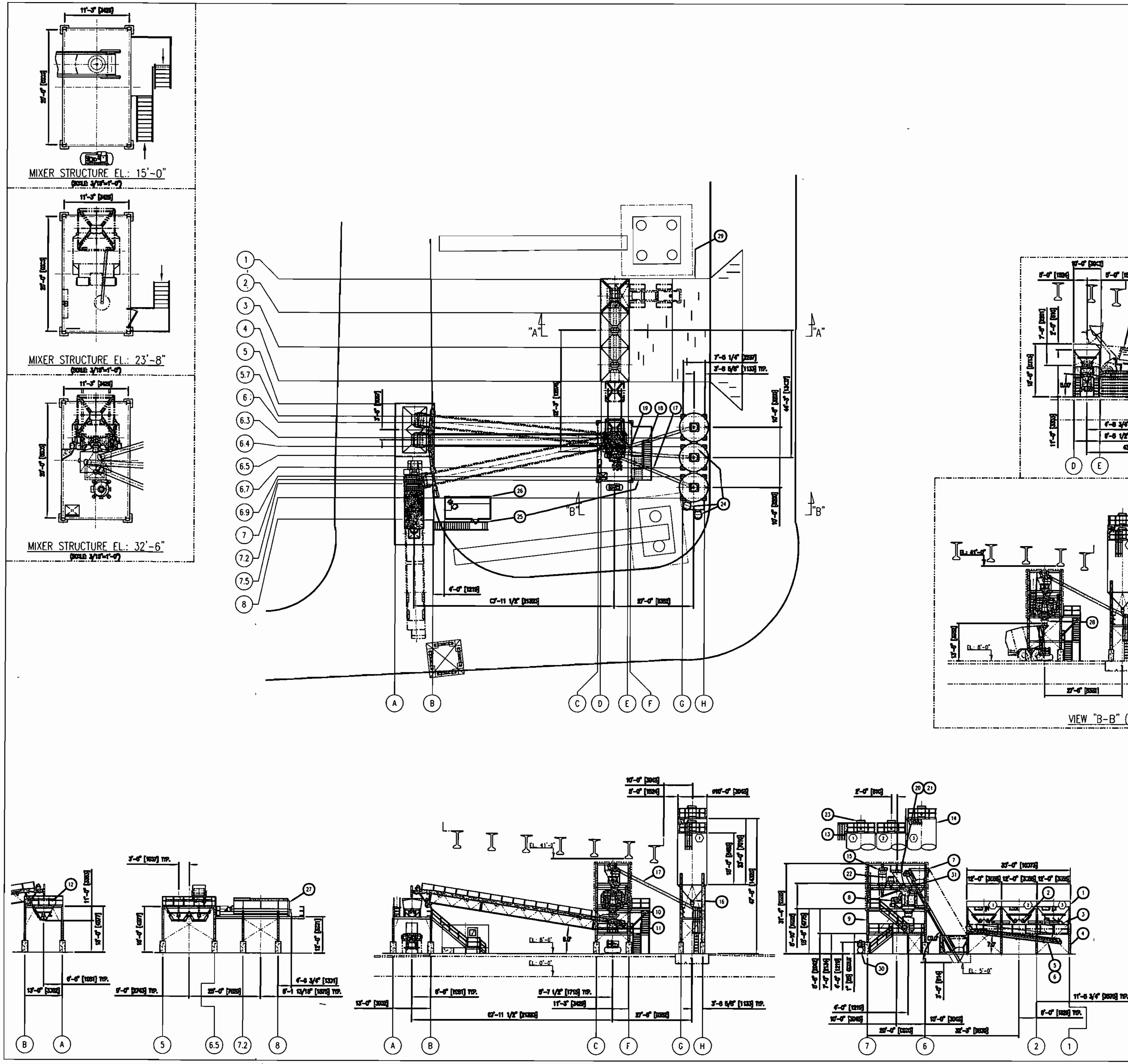
ES CONSULTANTS, INC.
environmental and civil engineering

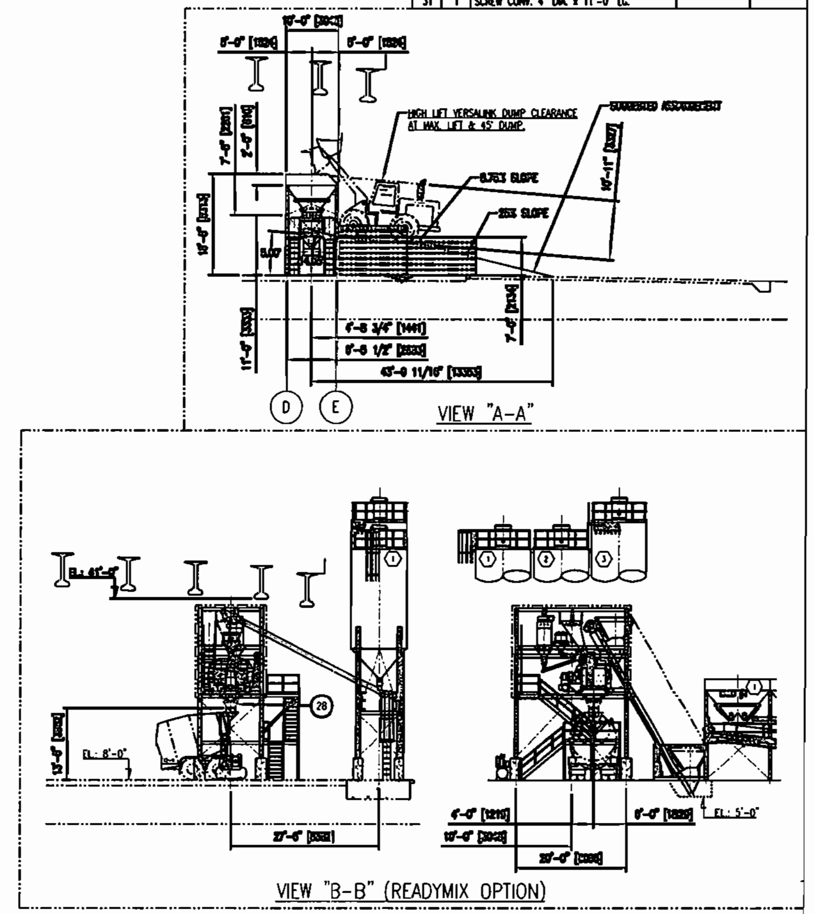
Bouygues Civil Works Florida Miami, Florida	Port of Miami Tunnel Miami, Florida	CONCRETE BATCHING PLANT LOCATION MAP	
ES CONSULTANTS, INC. environmental & civil engineering	Project 2010024	Dec. 2010	Fig. 1

Attachment A

Plant Layout and Equipment Specifications

ES CONSULTANTS, INC.
environmental and civil engineering





BILL OF MATERIAL

ITEM	QTY.	DESCRIPTION	DRAWING. NO.	SUPPLIER
1	1	50 tons AGGREGATE BIN (3 comp.)		
2	4	AGGREGATE CLAMSHELL GATE 10"x24"		
3	1	BELT CONVEYOR 42" x 5'-3" c/c		
4	1	AGGREGATE BIN STRUCTURE		
5	1	2.0 c.m. AGGREGATE WEIGH HOPPER		
6	1	BELT CONVEYOR 36" x 30'-3" c/c		
7	1	SKIP MODEL JMD 3000		ARCEN
8	1	TWIN SHAFT MIXER MODEL JMD 3000		ARCEN
9	1	MIXER STRUCTURE		
10	1	CONCRETE HOPPER		
11	1	RADIAL STACKER BELT CONV. 42" x 71'-6" LG.		
12	1	12 c.m. CONCRETE HOPPER c/w (2) CLAMSHELL 24" x 42"		
13	2	50 Tonnes SILO 10'-0" DIA. (1 comp.)		
14	1	70 Tonnes SILO 10'-0" DIA. (1 comp.)		
15	1	DUST COLLECTOR FC3J20200		WAM
16	3	BUTTERFLY VALVE 12" DIA. (manual)		
17	1	SCREW CONVEYOR 10" DIA. x 31'-8" LG.		
18	1	SCREW CONVEYOR 10" DIA. x 32'-6" LG.		
19	1	SCREW CONVEYOR 10" DIA. x 33'-2" LG.		
20	1	2.0 c.m. CEMENT WEIGH HOPPER		
21	1	BUTTERFLY VALVE 12" DIA. (pneumatic)		
22	1	2.0 c.m. WATER WEIGH HOPPER		
23	3	BIN VENT		WAM
24	3	LADDER & CAGE		
25	3	STAIRWAY		
26	1	CONTROL ROOM 8' x 16'		
27	1	14 c.m. CONCRETE AGITATING HOPPER		SECATOL
28	1	CONCRETE HOPPER EXTENSION FOR READYMIX TRUCK		
29	1	STEEL WALLS SET		
30	1	15 HP COMPRESSOR		
31	1	SCREW CONV. 4" DIA. x 11'-0" LG.		

☐ PRELIMINARY ☐ QUOTATION ☐ ERECTION
☐ APPROVAL ☐ FABRICATION ☐ OFFICE COPY
☐ INFORMATION ☐ REVISION ☐ OTHER:

DATE: BY:

SUBMITTED FOR

#	DATE (YY/MM/DD)	DESCRIPTION	BY
1	10/12/16	FOR APPROVAL	DBD

DRAWING STATUS

#	DESCRIPTION	DRAWING. NO.
1	RCC & GROUT PLANT (MIAMI PROJECT) -ANCHORAGE PLAN-	F_233

REFERENCES

BOUYGUES CIVIL WORKS FLORIDA
RCC & GROUT PLANT (MIAMI PROJECT)
-GENERAL LAYOUT-

BMH SYSTEMS

Date	Scale	Project	Format
2010/12/14	3/32"=1'-0"	JS-4482 BCWF (MIAMI PROJECT)	E128

Drawn by	Checked by	Approved by	Drawing No.	Sheet #	Revision
D. Briand	JF. Barbeau	D. Lapodec	10278-A	1/1	0

BMH
SYSTEMS

Boucherville, August 13, 2010 Quotation S-4482

Mr. Alain Mazzia
Plant Manager
BOUYGUES CIVIL WORKS FLORIDA
3750 NW 87th Avenue
Doral FL 33178

RE: FM # 251156-3-32-01

Dear Sir:

Further to your request, we are pleased to submit our proposal for two (2) BMH concrete batch plants, as per our drawings PR-4482-F, PR-4482-G and PR-4482-G-1. Each plant will include items 1 to 12:

ITEM 1: AGGREGATE STORAGE BIN WITH THREE (3) COMPARTMENTS, 50 TON TOTAL CAPACITY

ITEM 2: AGGREGATE SCALE, 2 M³ (2.7 YD³)

ITEM 3: AIR COMPRESSOR, 7.5 KW (10 HP)

ITEM 4: THREE (3) CEMENT STORAGE SILOS, 70 TON CAPACITY EACH

ITEM 5: CEMENT SCALE

ITEM 6: WATER SCALE

ITEM 7: ARCEN TWIN SHAFT MIXER 2 M³ (2.7 YD³), MODEL MD-3000

ITEM 8: STRUCTURE

ITEM 9: PREWIRING

ITEM 10: THREE (3) MOISTURE PROBES FOR SAND

ITEM 11: COMPUTERIZED BATCH CONTROL SYSTEM

Boucherville, August 13, 2010 Quotation S-4482

ITEM 12:	**EXTERIOR LIGHTING**
ITEM 13:	**CONTROL ROOM**
ITEM 14:	**HOLDING HOPPER FOR RCC, 10 M^3 (13 YD^3)**
ITEM 15:	**SUPERVISION AND TRAINING**
ITEM 16:	**FREIGHT**

OPTION 1:	**WASHING SYSTEM FOR THE MIXER**	**$ 20,550.00**	**.................. USD**
OPTION 2:	**AGITATING HOPPER FOR GROUT, 10 M^3 (13 YD^3)**		**.................. USD**
OPTION3:	**STEEL RETAINING WALLS**		**.................. USD**
OPTION 4:	**140 TON CEMENT SILO**		**..................USD**
OPTION 5:	**ERECTION, MECHANICAL INSTALLATION AND START-UP**		**.................. USD**

I ACCEPT THE TERMS AND GENERAL CONDITIONS OF SALE INCLUDED IN THIS QUOTATION	
Name:	Signature:
Function:	Date:

Boucherville, August 13, 2010 Quotation S-4482

INCLUDED

- Appointment of a project leader
- Six (6) engineers, two (2) electrical and automation experts always available for trouble shooting, assembly, erection and start-up assistance (by phone)
- Two (2) service manuals on CD with spare parts listing and assembly drawings
- One (1) anchor bolt layout with loads for foundation design (foundation design by others)
- Parts available locally (in all major cities in North America)
- Total cooperation with any control system supplier
- Assistance and support by BMH engineers during erection and supervision

AVAILABLE

- Visit by a BMH engineer to verify all measurements
- Assistance and support by BMH engineers at start-up
- 24 hour on-site assistance.

NOTE

Items pricing may vary if not selected with the original contract.

Options pricing and delivery lead time are valid only if selected with the original contract.

Boucherville, August 13, 2010 Quotation S-4482

ITEM 1: AGGREGATE STORAGE BIN, 50 TON CAPACITY

One (1) Aggregate storage bin, three (3) compartments, 3 m (10'-0") x 11 m (36'-0"), with 50 ton (100 lb/pi³) total heaped capacity.

The bin is entirely made of 3/16" steel plates.

Three (3) Electric vibrators.

One (1) Bin bottom, including six (6) clamshell gates with self lubricated bushing, 300 mm (12") x 600 mm (24"), with air cylinders and solenoid valves.

One (1) Support structure with service catwalks at scale level.

ITEM 2: AGGREGATE SCALE

One (1) Aggregate weigh hopper, 2 m³ (2.7 yd³), 4,000 kg (8,800 lb) capacity, including air vibrator with solenoid valve.

1/4" AR 400 BHN liners in the conical sections.

One (1) Set of four (4) load cells with summing box.

One (1) Digital weight readout.

One (1) Weigh conveyor, 900 mm (36") x 10.8 m (35'-4") with 7.5 kW (10 hp) motor and safety guards.

ITEM 3: AIR COMPRESSOR

One (1) Air compressor, 7.5 kW (10 hp), including V-belt guard, automatic air pressure control, air filter, lubricator, pressure regulator with gauge and all on-plant piping installed and adjusted.

ITEM 4: CEMENT STORAGE SILOS, 70 TON CAPACITY EACH

Three (3) Cement storage silos, single compartment, each with 70 ton (1,750 ft³) capacity, each silo will include:

One (1) Set of 125 mm (5") pipe with 1.2 m (4'-0") reinforced radius elbow, coupling and dust cap.

Boucherville, August 13, 2010 Quotation S-4482

ITEM 4: CEMENT STORAGE SILOS, 70 TON TOTAL CAPACITY (CONTINUED)

- One (1) TD-12V dust collector, shaker type, with 19 m² (210 ft²) cloth area.
- One (1) Handrail on silo top with toe plate.
- One (1) Inside ladder with manhole.
- One (1) Set of outside ladder with cage or cross-over platform.
- One (1) Electromatic high-level sensor, capacitance type.
- One (1) Aeration system with eight (8) flow pads (material control, model AD-C).
- One (1) Safety pop-valve (relief valve).
- One (1) Manual butterfly valve, 300 mm (12").
- One (1) Continuous level indicator.

Three (3) Sets of steel structures.

Three (3) Screw feeders, 250 mm (10") x 9.6 m (31'-6") long approximately, with 18.5 kW (25 hp) motors.

One (1) Low pressure aeration blower, 2.2 kW (3 hp).

ITEM 5: CEMENT SCALE

One (1) Cement weigh hopper, 2 m³ (2.7 yd³), 900 kg (1,980 lb) capacity, including air vibrator with solenoid valve, air operated discharge valve and air piping.

- One (1) Bolted inspection door.
- Four (4) Vent bags.
- One (1) Set of three (3) load cells with summing box.
- One (1) Digital weight indicator.

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ITEM 6: WATER SCALE

One (1) Water scale 300 kg (660 lb), with three (3) feed valves 50 mm (2") and one (1) discharge valve 100 mm (4").

One (1) Set of three (3) load cells with summing box.

One (1) Digital weight indicator.

ITEM 7: ARCEN TWIN SHAFT MIXER, 2 M^3 (2.7 YD^3)

The characteristics of the MD-3000 are:

- Powerful gearboxes and electric motors for maximum efficiency.
- Gearboxes with same thermal and mechanical power = no need for extra cooling.
- Cast iron wear tiles (Ni-Hard 1 modify), with 610 BHN for minimum wear.
- Centralized lubrication automatic system (seals and bearings), with working pressure up to 750 bar, for perfect functioning.
- Very low maintenance.

One (1) MD-3000 twin shaft mixer, 2 m^3 (2.7 yd^3) vibrated yield (output), with two (2) motor drives of 37 kW (50 hp). The mixer is fitted as follows:

- 18 mm (11/16") thick wear tiles offering 610 BHN.
- Eight (8) mixing arms with mixing paddles (four (4) on each shaft).
- Four (4) scraper arms with scraping paddles (two (2) on each shaft).
- Paddles and arms in cast of great hardiness and shock resistance.
- Two (2) over-dimensioned gearboxes specially designed for this application.
- Approximately weight of 8,500 kg (18,700 lb).

One (1) Soft start drive for the 37 kW (50 hp) motors, mounted in a Nema 12 cabinet.

One (1) Skip hoist, 2,000 litres, with two (2) 7.5 kW (10 hp) motors.

ITEM 8: STRUCTURE

One (1) Steel structure, 4 m (13'-0") wide x 5.2 m (17'-0") long, to support one (1) Arcen mixer, cement scale and water scale, including steel floor at mixer level. Stairway to mixer floor included.

ITEM 9: PREWIRING

All electrical components will be prewired to junction boxes on each section of the plant, ready for connections to the control panel.

BMH will supply all cables, switches, connectors, hardware for field connection of motors and junction boxes and all necessary drawings.

ITEM 10: MOISTURE PROBES

Three (3) Moisture sand probes, Hydronix Hydro Probe II, complete with terminal boxes, adaptor sleeves and 4 m (13'-0") cables.

ITEM 11: COMPUTERIZED BATCH CONTROL SYSTEM

One (1) Expandable PLC with necessary input/output modules including Nema cabinet and emergency switch.

One (1) IBM compatible workstation Pentium type, including one (1) 17" LCD monitor, two (2) Okidata printers, one (1) mouse, one (1) keyboard, analog inputs and Ethernet network interface card.

Approximately 10% of analog inputs are left available in the system and can be expanded for any additional need of the plant. The manual operation is via mouse and does not include manual terminal. Should you have such a terminal, it is possible to connect from this terminal. The electrical layouts are in 8.5" x 11" AutoCAD format.

The system includes the following softwares:

One (1) Windows XP operating program.

One (1) Microsoft Access (ODBC) data base.

One (1) Tel-Assist telephone support module.

One (1) Data base automatic backup module.

One (1) Marcotte order entry and delivery slip software.

One (1) Marcotte batch control system.

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ITEM 11: COMPUTERIZED BATCH CONTROL SYSTEM (CONTINUED)

This software includes the following specifications:

- 3D man-machine interface with complete plant batching layout
- Automatic start-stop sequences with lock-in of equipment
- Automatic activation of vibrators and aeration
- Unlimited materials and batches
- Materials substitution
- Tachographs with detailed contents of each lot
- Detailed parameters of each piece of equipment
- Detailed reports
- Network access with other computer systems

The system controls the following equipment:

Three (3) Types of aggregate.

Three (3) Types of cement and aeration.

Three (3) Metered admixtures.

One (1) Cement scale.

One (1) Aggregate scale.

One (1) Water scale.

Two (2) Scale vibrators.

Three (3) Screw conveyors.

One (1) Belt conveyor.

One (1) Mixer.

ITEM 12: EXTERIOR LIGHTING

One (1) Set of lighting fixtures with cables and distribution panel, including

Two (2) 400 W on top of silos.

Four (4) 100 W at mixer platform.

Two (2) 100 W at aggregate scale level.

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ITEM 13: CONTROL ROOM

One (1) Control room model SM100, 2.4 m (8'-0") x 4.9 m (16'-0"), pre-assembled wood framed as per following specifications, cross section with lifting logs to facilitate off loading, insulated, with air conditioning, 4.9 m (16'-0") high structure with access stairs from ground.

Potable water and sanitary piping by others at the customer's charge.

One (1) Steel support with stairs, 2.4 m (8'-0").

SM100 SPECIFICATIONS

Design: The SM100 series is an excellent value, designed to provide, efficient quiet interior space with total flexibility.	• Pre-assembled wood framed modular building. • Interior use only. • Forkliftable and easily relocatable. • Ready to use with a simple power connection.
Building: All SM series buildings are fabricated and shipped in a three-dimensional form.	• One (1) building 8'-0" x 16'-0". • Please consider your access when ordering a pre-assembled building. They may be split into sections to suit your overhead doors and access.
Exterior Finishes: Maintenance free.	• In accordance with our "detail" submitted. • Your choice of available colours.
Interior Finishes: Maintenance free.	• In accordance with our "detail" submitted. • Prices are based on our standard stock colours.
Insulation: Sound & thermal control.	• In accordance with our "detail" submitted. • Friction Fit Batt insulation for sound attenuation.
Door:	• One (1) 3'-0" x 6'-8" metal door in a metal frame with • ½ lite of safety glass. • Key in knob lockset, sweep, sill & weatherstrip.
Windows:	• Four (4) 4'-0" wide x 3'-0" high insulglass. • Safety glass is also available. • Available in white or brown aluminum frames.
Electrical: NRB SM100 buildings have CSA electrical wiring certification	• 100 Amp-120/240/1 panel, stubbed out, no main breaker. • Six (6) duplex outlets. • Two (2) telephone conduits stubbed to ceiling space. • Two (2) Fluorescent lights, 1'-0" x 4'-0" - 2 tube surface mounted with acrylic lens, one (1) single pole light switch. • One (1) air conditioning outlet.
Walls, roof & floor:	• In accordance with our "detail" submitted.
Heat, ventilation & air conditioning:	• One (1) 5,000 BTU wall mounted air conditioner. • Two (2) 1.5 kW electric baseboard heaters.

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ITEM 14: HOLDING HOPPER FOR RCC, 10 M³ (13 YD³)

One (1) Holding hopper for RCC, 10 m³ (13 yd³), with supports, 5/8" urethane liners, electric vibrators, air cannons and discharge door, 600 mm (24") x 1,100 mm (42").

ITEM 15: SUPERVISION AND TRAINING

Two (2) Weeks (80 hours approximately) of site supervision during erection and training. Air fare, lodging, meals, transportation, out of pocket expenses and all exceeding expenses will be at the customer's charge.

ITEM 16: FREIGHT

Freight for items 1 to 14 from our shop to job site in Miami, Florida.

OPTION 1: WASHING SYSTEM FOR THE MIXER

The washing system includes:

- Four (4) rotating heads.
- One (1) manual spear.
- Pump unit and pressurization system consisting of high-pressure pistons pump from CATPUMPS connected to the engine by a flexible coupling.
- Security valve, manometer and water filter.
- Pump capacity of 50 l/min.
- Operation pressure is 100 Bar.
- Motor power is 11 kW (15 hp), 480/3/60.
- Minimal pressure of water supply is 2 Bar.
- Pressure sensor on the water supply inlet to control the minimal admission pressure.
- Manual anti-freezing control in order to drain the water from the tubes and rotating heads.
- Board with a PLC to manage the rotating heads operation, operation cycle, etc. as all the electric components installed.

This system requires a compressed air supply. All components are pre-assembled and wired up to a control and power board, mounted on a chassis to be placed by the mixer.

OPTION 2: AGITATING HOPPER FOR GROUT, 10 M³ (13 YD³)

One (1) Secatol model CTM RHV11 for grout.

One (1) Set of steel structure to allow loading of ready mix trucks.

One (1) Charging conveyor, 1,100 mm (42") x 3 m (10'-0") long, reversible, with drip pan and supports, charging chute for ready-mix trucks, and two (2) air operated gates to allow loading of grout on either side.

OPTION 3: STEEL RETAINING WALLS

Two (2) Retaining wall frames, 2.4 m (8'-0") high x 11.5 m (37'-6") long, made of 300 mm (12") highway safety rails.

OPTION 4: CEMENT SILO, 140 TONS

Replace two (2) 70 ton silos with one (1) 140 ton double compartment silo.

OPTION 5: ERECTION, MECHANICAL INSTALLATION AND START-UP

BMH will provide material and labour for erection including:

- Unloading
- Erection on concrete foundations and grouting of base plates.
- Mechanical installation of:
  - Structural steel.
  - Bin, silos and weigh hoppers.
  - Conveyors and hoppers
  - Mixer.
  - Ladders and chutes.
  - Dust collectors.
  - Exterior lighting
  - Control room
- Scales calibration.
- Start-up and commissioning, including:
  - Up to one (1) week of assistance by a BMH engineer during the cold commissioning
  - Up to one (1) week of assistance by a BMH engineer during the hot commissioning
  - One (1) millwright during the hot commissioning

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NOTE

- Customer will prepare erection site (at the customer's charge)
- Installation must be done in one (1) phase
- Job site must be non-union.

NOT INCLUDED

- Permits
- Admixture system
- Concrete foundations
- Anchor bolts and grouting
- Electrical feed connected to our power panels and distribution panels
- Plumbing and heating
- Oiling and greasing
- Ethernet cables
- Purlins and enclosure

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PAINT: Surface preparation: SSPC-SP3. Sherwin Williams; Primer: Macropoxy. Paint: Sherthane urethane.

COLOR: Nickel gray. Safety yellow for safety equipment. White for mixer.

F.O.B.: Your site, Miami, Florida.

DELIVERY: Twenty (20) weeks (subject to prior sales), from receipt of down payment and signed approval drawing.

TAXES: Extra, if applicable.

TERMS: 30% with the order (including tax).
65% on delivery.
5% net 30 days after delivery.

Prices are valid for 30 days from date of quotation.

The general conditions of sale enclosed are an integral part of this quotation.

Should you require any additional information, please do not hesitate to contact us, as it will be a pleasure to help you.

Sincerely,

BMH SYSTEMS

Michel Blais, P. Eng.
President

MB/jd

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GENERAL TERMS AND CONDITIONS OF SALE

1. **DEFINITION:** The term "Company" refers to "BMH Systems Inc.".

2. **AGREEMENT:** The proposal, providing it is accepted within 30 days (or such time as may otherwise be specifically agreed) shall constitute the entire agreement between the parties unless agreed to in writing between the parties subsequent to the date of acceptance of the proposal.

3. **TITLE:** The rights of ownership on the products or any part there of shall pass from the Company to the Purchaser when full payment has been duly received except as otherwise specifically stipulated. The said product shall be and remain personal property, notwithstanding its mode of attachment to realty of other property. Notwithstanding the terms here of, risk will pass to the Purchaser at point of delivery.

4. **DELIVERY:** Shipping dates are approximate and are based upon prompt receipt from the Purchaser of all necessary information. In no event will the Company be liable for any reprocurement costs, nor for delay or non-delivery due to causes beyond our reasonable control. These causes include but are not limited to "Acts of God", acts of civil or military authority, government priorities, fires, strikes, lockouts, slowdowns, factory or labor conditions, manufacturing errors and inability due to causes beyond our reasonable control to obtain necessary labor, materials or manufacturing facilities. In the event of any such delay, the date of delivery shall, at our request, be deferred for a period equal to the time lost by reason of the delay. Shipments will not be made excessively in advance of scheduled dates. When the installation of a product, assembly or component is delayed for more than 30 days after the delivery date, and that the Purchaser has caused such a delay, the Company will be entitled to a fair compensation for any additional costs during this period. When the final start-up is delayed for more than 10 days, the company will forward its invoices on the date the start-up should have been completed. Payments are to follow according to invoice date, and terms of payment.

5. **INSPECTIONS / MODIFICATIONS:** It is understood that the Company will be involved and/or informed about the results of any inspection carried out by the engineering representative(s) of the Purchaser during all phases of this project. Should the Purchaser wish to change plans of make amendments of any kind, he must first inform and/or consult the Company. Any extra costs derived from such changes and/or amendments will be the responsibility of the Purchaser.

6. **WARRANTY:** Unless otherwise specifically agreed in writing, the Company shall replace or repair any defective part, F.O.B. the Company's plant, which proves to be defective under normal and proper use within one year from the date of shipment, provided that the Purchaser gives the company immediate written notice of any such defect. After the expiration date of the warranty the company will no longer be responsible. However, when products, components or parts sold by the Company are also covered by a warranty of a reputable sub-manufacturer, the Company warrants that it will allow as much but no more than the warranty it receives from such sub-manufacturer. The applicable warranty expressed in this paragraph constitutes the only warranty of the Company and no other warranty or condition, statutory or otherwise, shall be implied. The Purchaser must inform the Company in writing of any defect and/or non-compliance of the product within 30 days of discovery of such defect or non-compliance, otherwise the product shall be considered as accepted by the Purchaser.

7. **LIMITATION OF LIABILITY:** Notwithstanding any other provision in this contract or any applicable statutory provision, neither the Company nor the Purchaser shall be liable to the other for special or consequential damages for loss of use arising directly, from any breach of this contract, fundamental or otherwise or from any fortuitous acts or omissions of their respective employees or agents for an amount exceeding the unit price of the defective product of subject to late delivery.

Attachment B

Typical Process Flow Diagram

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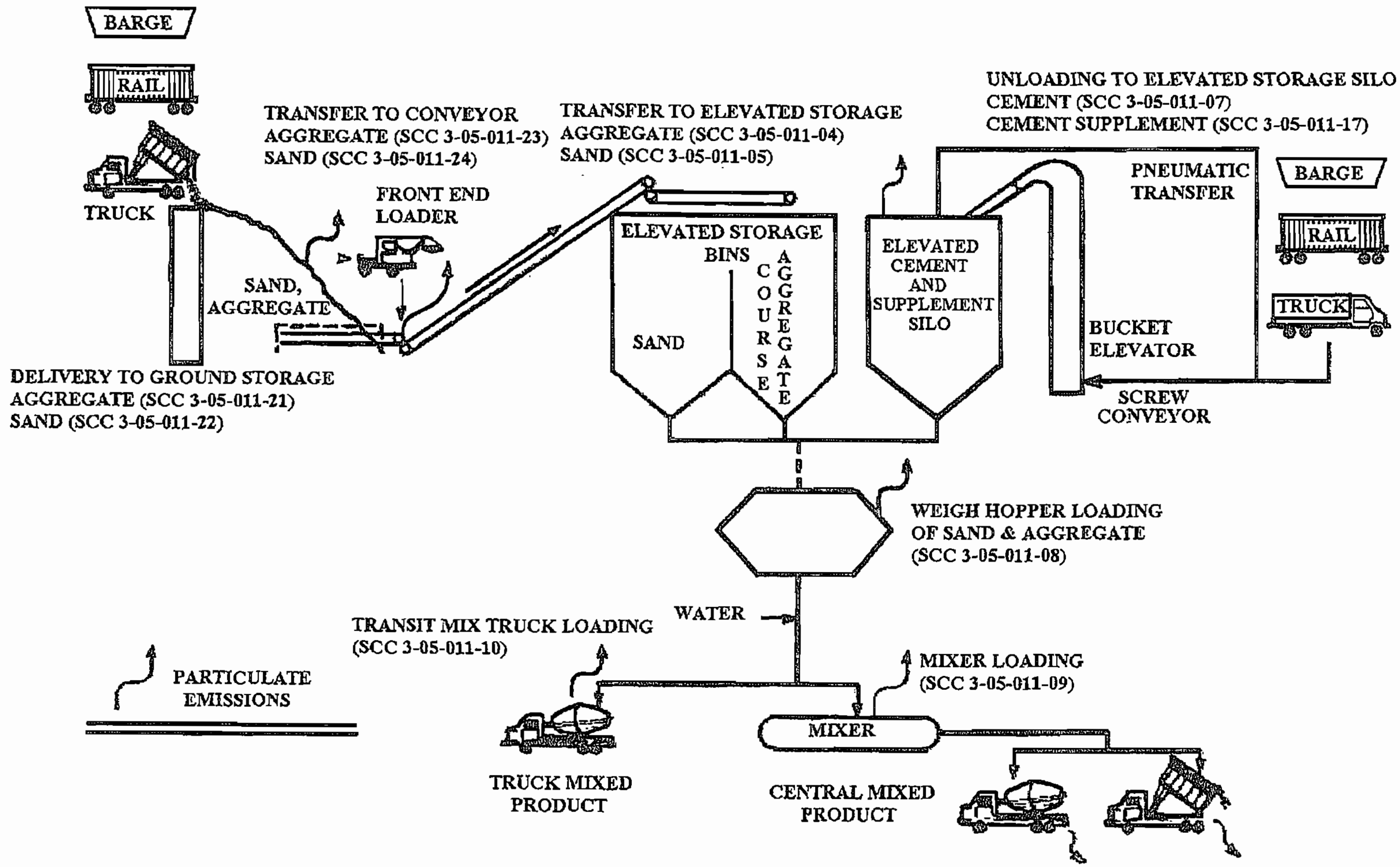

Figure 11.12-1. Typical Concrete Batching Process.

Attachment C

Emission Calculations

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CONCRETE BATCHING SPREADSHEET

Please fill in the yellow boxes and the spreadsheet will calculate the emissions.

Emission Year:	2011	
Permit Limit (cubic yards/yr)		If your construction permit limits your plant to a certain number of cubic yards/year, enter that number here. Or take your cubic yard/day limit and multiply it by 365.
Maximum Capacity (cubic yards/hour):	78	If your construction permit limits your plant to a certain number of cubic yards/hour, enter that number here.
Maximum Capacity (cubic yards/day)		-OR- If your construction permit limits your plant to a certain number of cubic yards/day, enter that number here.
Actual Throughput in emission year (cubic yards):		

EMISSIONS FOR PM-10

SCC Number	Process Description	Emission Factor	Emission Factor Units	Source of Emission Factor	Potential Uncontrolled Emissions (lb/hr)	Control Efficiency If Applicable (Enter As Decimal [ex. - 0.95] If A Controlled EF Wasn't Used)	Potential Controlled Emissions (lb/hr)	Potential Annual Emissions (Tons/Yr)	Actual Emissions (Tons)
30501121	Aggregate delivery to ground storage	0.0031	lbs/cu yd	AP-42 Table 11.12-5	0.24		0.24	1.07	0.00
30501122	Sand delivery to ground storage	0.0007	lbs/cu yd		0.05		0.05	0.24	0.00
30501123	Aggregate transfer to conveyor	0.0031	lbs/cu yd		0.24		0.24	1.07	0.00
30501124	Sand transfer to conveyor	0.0007	lbs/cu yd		0.05		0.05	0.24	0.00
30501104	Aggregate transfer to elevated storage	0.0031	lbs/cu yd		0.24		0.24	1.07	0.00
30501105	Sand transfer to elevated storage	0.0007	lbs/cu yd		0.05		0.05	0.24	0.00
30501107	Cement delivery to silo (controlled factor)	0.0001	lbs/cu yd		0.01		0.01	0.03	0.00
30501117	Cement supplement delivery to silo (controlled factor)	0.0002	lbs/cu yd		0.02		0.02	0.07	0.00
30501108	Weigh hopper loading	0.0038	lbs/cu yd		0.30		0.30	1.31	0.00
30501109	Central mix loading	0.0378	lbs/cu yd	AP-42 Table 11.12-4 & Equation 11.12-2	2.97		2.97	12.99	0.00
30501110	Truck mix loading	0.0784	lbs/cu yd	AP-42 Table 11.12-3 & Equation 11.12-2	6.15		6.15	26.95	0.00

EMISSIONS FOR PM-2.5 - PM-2.5 is assumed to be 15% of PM per AP-42, Appendix B.2, Table B.2-2, Category 3

SCC Number	Process Description	Emission Factor	Emission Factor Units	Source of Emission Factor	Potential Uncontrolled Emissions (lb/hr)	Control Efficiency If Applicable (Enter As Decimal [ex. - 0.95] If A Controlled EF Wasn't Used)	Potential Controlled Emissions (lb/hr)	Potential Emissions (Tons/Yr)	Actual Emissions (Tons)
30501121	Aggregate delivery to ground storage	0.00096	lbs/cu yd	AP-42 Table 11.12-5 & Appendix B.2 Table B.2-2 Cat. 3	0.08		0.08	0.33	0.00
30501122	Sand delivery to ground storage	0.000225	lbs/cu yd		0.02		0.02	0.08	0.00
30501123	Aggregate transfer to conveyor	0.00096	lbs/cu yd		0.08		0.08	0.33	0.00
30501124	Sand transfer to conveyor	0.000225	lbs/cu yd		0.02		0.02	0.08	0.00
30501104	Aggregate transfer to elevated storage	0.00096	lbs/cu yd		0.08		0.08	0.33	0.00
30501105	Sand transfer to elevated storage	0.000225	lbs/cu yd		0.02		0.02	0.08	0.00
30501107	Cement delivery to silo (controlled factor)	0.00003	lbs/cu yd		0.00		0.00	0.01	0.00
30501117	Cement supplement delivery to silo (controlled factor)	0.000045	lbs/cu yd		0.00		0.00	0.02	0.00
30501108	Weigh hopper loading	0.001185	lbs/cu yd		0.09		0.09	0.41	0.00
30501109	Central mix loading	0.023	lbs/cu yd	AP-42 Table 11.12-4 & Equation 11.12-2	1.80		1.80	7.91	0.00
30501110	Truck mix loading	0.0141	lbs/cu yd	AP-42 Table 11.12-3 & Equation 11.12-2	1.11		1.11	4.85	0.00

ACTUAL OPERATING RATE/SCHEDULE				
MONTHS	% OF TOTAL OPERATING TIME	HOURS/DAY	DAYS/WEEK	WEEKS/QUARTER
JAN-MAR	100	20	7	12
APR-JUN	100	20	7	12
JUL-SEP	100	20	7	12
OCT-DEC	100	20	7	12

Attachment D

EPA Method 9

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Title 40 -- Protection of Environment; Revised as of July 1, 1991

CHAPTER I -- ENVIRONMENTAL PROTECTION AGENCY
SUBCHAPTER C -- AIR PROGRAMS

PART 60 -- STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

§ 60. Appendix A to Part 60 -- Test Methods [PART I OF VII]

40 CFR 60. Appendix A to Part 60

APPENDIX A Test Methods

Method 1--Sample and velocity traverses for stationary sources

Method 1A--Sample and velocity traverses for stationary sources with small stacks or ducts

Method 2--Determination of stack gas velocity and volumetric flow rate (Type S pitot tube)

Method 2A--Direct measurement of gas volume through pipes and small ducts

Method 2B--Determination of exhaust gas volume flow rate from gasoline vapor incinerators

Method 2C--Determination of stack gas velocity and volumetric flow rate in small stacks or ducts (standard pitot tube)

Method 2D--Measurement of gas volumetric flow rates in small pipes and ducts

Method 3--Gas analysis for carbon dioxide, oxygen, excess air, and dry molecular weight

Method 3A--Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

Method 4--Determination of moisture content in stack gases

Method 5--Determination of particulate emissions from stationary sources

Method 5A--Determination of particulate emissions from the asphalt processing and asphalt roofing industry

Method 5B--Determination of nonsulfuric acid particulate matter from stationary sources

Method 5C [Reserved]

Method 5D--Determination of particulate emissions from positive pressure fabric filters

Method 5E--Determination of particulate emissions from the wool fiberglass insulation manufacturing industry

Method 5F--Determination of nonsulfate particulate matter from stationary sources

Method 5G--Determination of particulate emissions fromwood heaters from a dilution tunnel sampling location

Method 5H--Determination of particulate emissions from wood heaters from a stack location

Method 6--Determination of sulfur dioxide emissions from stationary sources

Method 6A--Determination of sulfur dioxide moisture, and carbon dioxide emissions from fossil fuel combustion sources

Method 6B--Determination of sulfur dioxide and carbon dioxide daily average emissions from fossil fuel combustion sources

Method 6C--Determination of Sulfur Dioxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)

Method 7--Determination of nitrogen oxide emissions from stationary sources

Method 7A--Determination of nitrogen oxide emissions from stationary sources--Ion chromatographic method

Method 7B--Determination of nitrogen oxide emissions from stationary sources (Ultraviolet spectrophotometry)

Method 7C--Determination of nitrogen oxide emissions from stationary sources--Alkaline-permanganate/colorimetric method

Method 7D--Determination of nitrogen oxide emissions from stationary sources--Alkaline-permanganate/ion chromatographic method

Method 7E--Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)

Method 8--Determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources

Method 9--Visual determination of the opacity of emissions from stationary sources remotely by lidar

Method 10 -- Determination of carbon monoxide emissions from stationary sources

Method 10A --Determination of carbon monoxide emissions in certifying continuous emission monitoring systems at petroleum refineries

Method 10B --Determination of carbon monoxide emissions from stationary sources

Method 11 --Determination of hydrogen sulfide content of fuel gas streams in petroleum refineries

Method 12--Determination of inorganic lead emissions from stationary sources

Method 13A--Determination of total fluoride emissions from stationary sources--SPADNS zirconium lake method

Method 13B--Determination of total fluoride emissions from stationary sources--Specific ion electrode method

Method 14--Determination of fluoride emissions from potroom roof monitors for primary aluminum plants

Method 15--Determination of hydrogen sulfide, carbonyl sulfide, and carbon disulfide emissions from stationary sources

Method 15A--Determination of total reduced sulfur emissions from sulfur recovery plants in petroleum refineries

Method 16--Semicontinuous determination of sulfur emissions from stationary sources

Method 16A--Determination of total reduced sulfur emissions from stationary sources (impinger technique)

Method 16B--Determination of total reduced sulfur emissions from stationary sources

Method 17--Determination of particulate emissions from stationary sources (instack filtration method)

Method 18--Measurment of gaseous organic compound emissions by gas chromatography

Method 19--Determination of sulfur dioxide removal efficiency and particulate, sulfur dioxide and nitrogen oxides emission rates

Method 20--Determination of nitrogen oxides, sulfur dioxide, and diluent emissions from stationary gas turbines

Method 21--Determination of volatile organic compound leaks

Method 22--Visual determination of fugitive emissions from material sources and smoke emissions from flares

Method 23--Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans From Stationary Sources

Method 24--Determination of volatile matter content, water content, density, volume solids,and weight solids of surface coatings

Method 24A--Determination of volatile matter content and density of printing inks and related coatings

Method 25--Determination of total gaseous nonmethane organic emissions as carbon

Method 25A--Determination of total gaseous organic concentration using a flame ionization analyzer

Method 25B--Determination of total gaseous organic concentration using a nondispersive infared analyzer

Method 26--Determination of Hydrogen Chloride Emissions From Stationary Sources

Method 27--Determination of vapor tightness of gasoline delivery tank using pressure-vacuum test

Method 28--Certification and auditing of wood heaters

Method 28A--Measurement of air to fuel ratio and minimum achievable burn rates for wood-fired appliances

The test methods in this appendix are referred to in § 60.8 (Performance Tests) and § 60.11 (Compliance With Standards and Maintenance Requirements) of 40 CFR part 60, subpart A (General Provisions). Specific uses of these test methods are described in the standards of performance contained in the subparts, beginning with Subpart D.

Within each standard of performance, a section title "Test Methods and Procedures" is provided to: (1) Identify the test methods to be used as reference methods to the facility subject to the respective standard and (2) identify any special instructions or conditions to be followed when applying a method to the respective facility. Such instructions (for example, establish sampling rates, volumes, or temperatures) are to be used either in addition to, or as a substitute for procedures in a test method. Similarly, for sources subject to emission monitoring requirements, specific instructions pertaining to any use of a test method as a reference method are provided in the subpart or in Appendix B.

Inclusion of methods in this appendix is not intended as an endorsement or denial of their applicability to sources that are not subject to standards of performance. The methods are potentially applicable to other sources; however, applicability should be confirmed by careful and appropriate evaluation of the conditions prevalent at such sources.

The approach followed in the formulation of the test methods involves specifications for equipment, procedures, and performance. In concept, a performance specification approach would be preferable in all methods because this allows the greatest flexibility to the user. In practice, however, this approach is impractical in most cases because performance specifications cannot be established. Most of the methods described herein, therefore, involve specific equipment specifications and procedures, and only a few methods in this appendix rely on performance criteria.

Minor changes in the test methods should not necessarily affect the validity of the results and it is recognized that alternative and equivalent methods exist. Section 60.8 provides authority for the Administrator to specify or approve (1) equivalent methods, (2) alternative methods, and (3) minor changes in the methodology of the test methods. It should be clearly understood that unless otherwise identified all such methods and changes must have prior approval of the Administrator. An owner employing such methods or deviations from the test methods without obtaining prior approval does so at the risk of subsequent disapproval and retesting with approved methods.

Within the test methods, certain specific equipment or procedures are recognized as being acceptable or potentially acceptable and are specifically identified in the methods. The items identified as acceptable options may be used without approval but must be identified in the test report. The potentially approvable options are cited as "subject to the approval of the Administrator" or as "or equivalent." Such potentially approvable techniques or alternatives may be used at the discretion of the owner without prior approval. However, detailed descriptions for applying these potentially approvable techniques or alternatives are not provided in the test methods. Also, the potentially approvable options are not necessarily acceptable in all applications. Therefore, an owner electing to use such potentially approvable techniques or alternatives is responsible for: (1) assuring that the techniques or alternatives are in fact applicable and are properly executed; (2) including a written description of the alternative method in the test report (the written method must be clear and must be capable of being performed without additional instruction, and the the degree of detail should be similar to the detail contained in the test methods); and (3) providing any rationale or supporting data necessary to show the validity of the alternative in the particular application. Failure to meet these requirements can result in the Administrator's disapproval of the alternative.

METHOD 1--SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method

6.8 Acceptable Results. If 90 percent $<I<$ 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

6.9 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and equations in Sections 5.2 and 5.3 of Method 2.

6.10 Relative Error (RE) for QA Audit Samples. Same as in Method 6, Section 6.4.

7. *Bibliography*

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METHOD 9 -- VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error n1 of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

n1 For a set, positive error = average opacity determined by observers' 25 observations--average opacity determined from transmissometer's 25 recordings.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and Applicability*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures*

The observer qualified in accordance with section 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140 deg. sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

2.2 Field Records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, a sketch of the observer's position relative to the source, and the date on a field data sheet

(Figure 9-1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached Steam Plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached Steam Plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording Observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9-2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a record sheet. (See Figure 9-1 for an example.)

3. *Qualifications and Testing*

3.1 Certification Requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in section 3.2. Smoke generators used pursuant to section 3.2 shall be equipped with a smoke meter which meets the requirements of section 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification Procedure. The certification test consists of showing the candidate a complete run of 50 plumes--25 black plumes and 25 white plumes--generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke Generator Specifications. Any smoke generator used for the purposes of section 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in section 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds +/- 1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1--SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye--Citation 3).
c. Angle of view	15 deg. maximum total angle.
d. Angle of projection	15 deg. maximum total angle.
e. Calibration error	+/- 3% opacity, maximum.
f. Zero and span drift	+/- 1% opacity, 30 minutes
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke Meter Evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light Source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within +/- 5 percent of the nominal rated voltage.

3.3.2.2 Spectral Response of Photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

Figure 9-1 Record of Visual Determination of Opacity

[SEE FIGURE IN ORIGINAL]

FIGURE 9-2--OBSERVATION RECORD

[SEE FIGURE IN ORIGINAL]

FIGURE 9-2--OBSERVATION RECORD--(CONTINUED)

[SEE FIGURE IN ORIGINAL]

3.3.2.3 Angle of View. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15 deg. The total angle of view may be calculated from: theta = 2 tan<-1>d / 2L, where theta = total angle of view; d=the sum of the photocell diameter + the diameter of the limiting aperture; and L = the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of Projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15 deg. The total angle of projection may be calculated from: theta = 2 tan<-1>d/2L, where theta = total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration Error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within +/- 2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and Span Drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response Time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *Bibliography.*

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ALTERNATE METHOD 1-- DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES REMOTELY BY LIDAR

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. *Principle and Applicability*

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR § 60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

Lidar: Acronym for Light Detection and Ranging.

Lidar range: The range or distance from the lidar to a point of interest along the lidar line-of-sight.

Near region: The region of the atmospheric path along the lidar line-of-sight between the lidar's convergence distance and the plume being measured.

Opacity: One minus the optical transmittance of a smoke plume, screen target, etc.

Pick interval: The time or range intervals in the lidar backscatter signal whose minimum average amplitude is used to calculate opacity. Two pick intervals are required, one in the near region and one in the far region.

Plume: The plume being measured by lidar.

Plume signal: The backscatter signal resulting from the laser light pulse passing through a plume.

1/R<2> correction: The correction made for the systematic decrease in lidar backscatter signal amplitude with range.

Reference signal: The backscatter signal resulting from the laser light pulse passing through ambient air.

Sample interval: The time period between successive samples for a digital signal or between successive measurements for an analog signal.

Signal spike: An abrupt, momentary increase and decrease in signal amplitude.

Source: The source being tested by lidar.

Time reference: The time (t[0]) when the laser pulse emerges from the laser, used as the reference in all lidar time or range measurements.

2. *Procedures*

The mobile lidar calibrated in accordance with Paragraph 3 of this method shall use the following procedures for remotely measuring the opacity of stationary source emissions:

2.1 Lidar Position. The lidar shall be positioned at a distance from the plume sufficient to provide an unobstructed view of the source emissions. The plume must be at a range of at least 50 meters or three consecutive pick intervals (whichever is greater) from the lidar's transmitter/receiver convergence distance along the line-of-sight. The maximum effective opacity measurement distance of the lidar is a function of local atmospheric conditions, laser beam diameter, and plume diameter. The test position of the lidar shall be selected so that the diameter of the laser beam at the measurement point within the plume shall be no larger than three-fourths the plume diameter. The beam diameter is calculated by Equation (AM1-1):

D(lidar) = A + R phi </- 0.75 D(Plume) (AM1-1)

Where:

D(Plume)=diameter of the plume (cm),

phi =laser beam divergence measured in radians

R=range from the lidar to the source (cm)

D(Lidar)=diameter of the laser beam at range R (cm),

A=diameter of the laser beam or pulse where it leaves the laser.

The lidar range, R, is obtained by aiming and firing the laser at the emissions source structure immediately below the outlet. The range value is then determined from the backscatter signal which consists of a signal spike (return from source structure) and the atmospheric backscatter signal [Reference 5.1]. This backscatter signal should be recorded.

When there is more than one source of emissions in the immediate vicinity of the plume, the lidar shall be positioned so that the laser beam passes through only a single plume, free from any interference of the other plumes for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume along the line-of-sight (determined from the backscatter signals). The lidar shall initially be positioned so that its line-of-sight is approximately perpendicular to the plume.

When measuring the opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks, etc.), the lidar shall be placed in a position so that its line-of-sight is approximately perpendicular to the longer (major) axis of the outlet.

2.2 Lidar Operational Restrictions. The lidar receiver shall not be aimed within an angle of +/- 15 deg. (cone angle) of the sun.

This method shall not be used to make opacity measurements if thunderstorms, snowstorms, hail storms, high wind, high-ambient dust levels, fog or other atmospheric conditions cause the reference signals to consistently exceed the limits specified in Section 2.3.

2.3 Reference Signal Requirements. Once placed in its proper position for opacity measurement, the laser is aimed and fired with the line-of-sight near the outlet height and rotated horizontally to a position clear of the source structure and the associated plume. The backscatter signal obtained from this position is called the ambient-air or reference signal. The lidar operator shall inspect this signal [Section V of Reference 5.1] to: (1) determine if the lidar line-of-sight is free from interference from other plumes and from physical obstructions such as cables, power lines, etc., for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, and (2) obtain a qualitative measure of the homogeneity of the ambient air by noting any signal spikes.

Should there be any signal spikes on the reference signal within a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, the laser shall be fired three more times and the operator shall inspect the reference signals on the display. If the spike(s) remains, the azimuth angle shall be changed and the above procedures conducted again. If the spike(s) disappears in all three reference signals, the lidar line-of-sight is acceptable if there is shot-to-shot consistency and there is no interference from other plumes.

Shot-to-shot consistency of a series of reference signals over a period of twenty seconds is verified in either of two ways. (1) The lidar operator shall observe the reference signal amplitudes. For shot-to-shot consistency the ratio of R[f] to R[n] [amplitudes of the near and far region pick intervals (Section 2.6.1)] shall vary by not more than +/- 6% between shots; or (2) the lidar operator shall accept any one of the reference signals and treat the other two as plume signals; then the opacity for each of the subsequent reference signals is calculated (Equation AM1-2). For shot-to-shot consistency, the opacity values shall be within +/- 3% of 0% opacity and the associated S[o] values less than or equal to 8% (full scale) [Section 2.6].

If a set of reference signals fails to meet the requirements of this section, then all plume signals [Section 2.4] from the last set of acceptable reference signals to the failed set shall be discarded.

2.3.1 Initial and Final Reference Signals. Three reference signals shall be obtained within a 90-second time period prior to any data run. A final set of three reference signals shall be obtained within three (3) minutes after the completion of the same data run.

2.3.2 Temporal Criterion for Additional Reference Signals. An additional set of reference signals shall be obtained during a data run if there is a change in wind direction or plume drift of 30 deg. or more from the direction that was prevalent when the last set of reference signals was obtained. An additional set of reference signals shall also be obtained if there is an increase in value of S[In] (near region standard deviation, Equation

AM1-5) or S[If] (far region standard deviation, Equation AM1-6) that is greater than 6% (full scale) over the respective values calculated from the immediately previous plume signal, and this increase in value remains for 30 seconds or longer. An additional set of reference signals shall also be obtained if there is a change in amplitude in either the near or the far region of the plume signal, that is greater than 6% of the near signal amplitude and this change in amplitude remains for 30 seconds or more.

2.4 Plume Signal Requirements. Once properly aimed, the lidar is placed in operation with the nominal pulse or firing rate of six pulses/minute (1 pulse/10 seconds). The lidar operator shall observe the plume backscatter signals to determine the need for additional reference signals as required by Section 2.3.2. The plume signals are recorded from lidar start to stop and are called a data run. The length of a data run is determined by operator discretion. Short-term stops of the lidar to record additional reference signals do not constitute the end of a data run if plume signals are resumed within 90 seconds after the reference signals have been recorded, and the total stop or interrupt time does not exceed 3 minutes.

2.4.1 Non-hydrated Plumes. The laser shall be aimed at the region of the plume which displays the greatest opacity. The lidar operator must visually verify that the laser is aimed clearly above the source exit structure.

2.4.2 Hydrated Plumes. The lidar will be used to measure the opacity of hydrated or so-called steam plumes. As listed in the reference method, there are two types, i.e., attached and detached steam plumes.

2.4.2.1 Attached Steam Plumes. When condensed water vapor is present within a plume, lidar opacity measurements shall be made at a point within the residual plume where the condensed water vapor is no longer visible. The laser shall be aimed into the most dense region (region of highest opacity) of the residual plume.

During daylight hours the lidar operator locates the most dense portion of the residual plume visually. During nighttime hours a high-intensity spotlight, night vision scope, or low light level TV, etc., can be used as an aid to locate the residual plume. If visual determination is ineffective, the lidar may be used to locate the most dense region of the residual plume by repeatedly measuring opacity, along the longitudinal axis or center of the plume from the emissions outlet to a point just beyond the steam plume, The lidar operator should also observe color differences and plume reflectivity to ensure that the lidar is aimed completely within the residual plume. If the operator does not obtain a clear indication of the location of the residual plume, this method shall not be used.

Once the region of highest opacity of the residual plume has been located, aiming adjustments shall be made to the laser line-of-sight to correct for the following: movement to the region of highest opacity out of the lidar line-of-sight (away from the laser beam) for more than 15 seconds, expansion of the steam plume (air temperature lowers and/or relative humidity increases) so that it just begins to encroach on the field-of-view of the lidar's optical telescope receiver, or a decrease in the size of the steam plume (air temperature higher and/or relative humidity decreases) so that regions within the residual plume whose opacity is higher than the one being monitored, are present.

2.4.2.2 Detached Steam Plumes. When the water vapor in a hydrated plume condenses and becomes visible at a finite distance from the stack or source emissions outlet, the opacity of the emissions shall be measured in the region of the plume clearly above the emissions outlet and below condensation of the water vapor.

During daylight hours the lidar operators can visually determine if the steam plume is detached from the stack outlet. During nighttime hours a high-intensity spotlight, night vision scope, low light level TV, etc., can be used as an aid in determining if the steam plume is detached. If visual determination is ineffective, the lidar may be used to determine if the steam plume is detached by repeatedly measuring plume opacity from the outlet to the steam plume along the plume's longitudinal axis or center line. The lidar operator should also observe color differences and plume reflectivity to detect a detached plume. If the operator does not obtain a clear indication of the location of the detached plume, this method shall not be used to make opacity measurements between the outlet and the detached plume.

Once the determination of a detached steam plume has been confirmed, the laser shall be aimed into the region of highest opacity in the plume between the outlet and the formation of the steam plume. Aiming adjustments shall be made to the lidar's line-of-sight within the plume to correct for changes in the location of the most dense region of the plume due to changes in wind direction and speed or if the detached steam plume moves closer to the source outlet encroaching on the most dense region of the plume. If the detached steam plume should move too close to the source outlet for the lidar to make interference-free opacity measurements, this method shall not be used.

2.5 Field Records. In addition to the recording recommendations listed in other sections of this method the following records should be maintained. Each plume measured should be uniquely identified. The name of the facility, type of facility, emission source type, geographic location of the lidar with respect to the plume, and plume characteristics should be recorded. The date of the test, the time period that a source was monitored, the time (to the nearest second) of each opacity measurement, and the sample interval should also be recorded. The wind speed, wind direction,air temperature, relative humidity, visibility (measured at the lidar's position), and cloud cover should be recorded at the beginning and end of each time period for a given source. A small sketch depicting the location of the laser beam within the plume should be recorded.

If a detached or attached steam plume is present at the emissions source, this fact should be recorded. Figures AM1-I and AM1-II are examples of logbook forms that may be used to record this type of data. Magnetic tape or paper tape may also be used to record data.

Figure AM1-I Lidar Log Control Number Tabulation

[SEE FIGURE IN ORIGINAL]

[SEE FIGURE IN ORIGINAL]

[SEE FIGURE IN ORIGINAL]

(a) Reference signal, 1/R<2>-corrected. This reference signal is for plume signal (b). R[n], R[f] are chosen to coincide with I[n], I[f].

(b) Plume signal, 1/R<2>-corrected. The plume spike and the decrease in the backscatter signal amplitude in the far region are due to the opacity of the plume. I[n], I[f] are chosen as indicated in Section 2.6.

SOURCE: [36 FR 24877, Dec. 23, 1971]

AUTHORITY: 42 U.S.C. 7401, 7411, 7414, 7416, and 7601.

Title 40 -- Protection of Environment; Revised as of July 1, 1991

CHAPTER I -- ENVIRONMENTAL PROTECTION AGENCY
SUBCHAPTER C -- AIR PROGRAMS

PART 60 -- STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES

Figure AM1-III. Plots of Lidar Backscatter Signals

2.6 Opacity Calculation and Data Analysis. Referring to the reference signal and plume signal in Figure AM1-III, the measured opacity (O_p) in percent for each lidar measurement is calculated using Equation AM1-2. ($O_p = 1 - T_p$; T_p is the plume transmittance.)

$$O_p = (100\%) \times [1 - (I_f / R_f \times R_n / I_n)^{1/2}], \quad \text{(AM1-2)}$$

Where:

I_n=near-region pick interval signal amplitude, plume signal, $1/R^2$ corrected,

I_f=far-region pick interval signal amplitude, plume signal, $1/R^2$ corrected,

R_n=near-region pick interval signal amplitude, reference signal, $1/R^2$ corrected, and

R_f =far-region pick interval signal amplitude, reference signal, $1/R^2$ corrected.

The $1/R^2$ correction to the plume and reference signal amplitudes is made by multiplying the amplitude for each successive sample interval from the time reference, by the square of the lidar time (or range) associated with that sample interval [Reference 5.1].

The first step in selecting the pick intervals for Equation AM1-2 is to divide the plume signal amplitude by the reference signal amplitude at the same respective ranges to obtain a "normalized" signal. The pick intervals selected using this normalized signal, are a minimum of 15 m (100 nanoseconds) in length and consist of at least 5 contiguous sample intervals. In addition, the following criteria, listed in order of importance, govern pick interval selection. (1) The intervals shall be in a region of the normalized signal where the reference signal meets the requirements of Section 2.3 and is everywhere greater than zero. (2) The intervals (near and far) with the minimum average amplitude are chosen. (3) If more than one interval with the same minimum average amplitude is found, the interval closest to the plume is chosen. (4) The standard deviation, S_o, for the calculated opacity shall be 8% or less. (S_o is calculated by Equation AM1-7).

If S_o is greater than 8%, then the far pick interval shall be changed to the next interval of minimal average amplitude. If S_o is still greater than 8%, then this procedure is repeated for the far pick interval. This procedure may be repeated once again for the near pick interval, but if S_o remains greater than 8%, the plume signal shall be discarded.

The reference signal pick intervals, R_n and R_f, must be chosen over the same time interval as the plume signal pick intervals, I_n and I_f, respectively [Figure AM1-III]. Other methods of selecting pick intervals may be used if they give equivalent results. Field-oriented examples of pick interval selection are available in Reference 5.1.

The average amplitudes for each of the pick intervals, I_n, I_f, R_n, R_f, shall be calculated by averaging the respective individual amplitudes of the sample intervals from the plume signal and the associated reference signal each corrected for $1/R^2$. The amplitude of I_n shall be calculated according to Equation (AM-3).

I[n] = 1/n X <m> SIGMA [i = 1] X I[ni], (AM1-3)

Where:

I[ni]=the amplitude of the ith sample interval (near-region),

SIGMA=sum of the individual amplitudes for the sample intervals,

m=number of sample intervals in the pick interval, and

I[n]=average amplitude of the near-region pick interval.

Similarly, the amplitudes for I[f], R[n], and R[f] are calculated with the three expressions in Equation (AM1-4).

I[f] = 1/m X <m> SIGMA [i = 1] X I[fi], R[n] = 1/m X <m> SIGMA [i = 1] X R[ni], R[f] = 1/m X <m> SIGMA [i = 1] X R[fi].

(AM1-4)

The standard deviation, S[In], of the set of amplitudes for the near-region pick interval, I[n], shall be calculated using Equation (AM1-5).

Similarly, the standard deviations S[If],S[Rn], and S[Rf] are calculated with the three expressions in Equation (AM1-6).

S[In] = [<m> SIGMA [i = 1] X (I[ni] - I[n])<2> / (m - 1)]<1/2> * S[If] = [<m> SIGMA [i = 1] X (I[fi] - I[f])<2> / (m - 1)]<1/2>

(AM1-5)

S[Rn] = [<m> SIGMA [i = m] X (R[ni] - R[n])<2> / (m - 1)]<1/2>,

S[Rf] = [<m> SIGMA [i = m] X (R[fi] - R[f]<2> / (m - 1)]<1/2>.

(AM1-6)

The standard deviation, S[o], for each associated opacity value, O[p], shall be calculated using Equation (AM1-7).

S[o] = (100%) / 2 X (I[f] / R[f] X R[n] / I[n])<1/2> X [S[In]<2> / I[n]<2> + S[If]<2> / I[f]<2> + S[Rn]<2> / R[n]<2> + S[Rf]<2> / R[f]<2>]<1/2>

(AM1-7)

The calculated values of I[n], I[f], R[n], R[f], S[In], S[If], S[Rn], S[Rf], O[p], and S[o] should be recorded. Any plume signal with an S[o] greater than 8% shall be discarded.

2.6.1 Azimuth Angle Correction. If the azimuth angle correction to opacity specified in this section is performed, then the elevation angle correction specified in Section 2.6.2 shall not be performed. When opacity is measured in the residual region of an attached steam plume, and the lidar line-of-sight is not perpendicular to the plume, it may be necessary to correct the opacity measured by the lidar to obtain the opacity that would be measured on a path perpendicular to the plume. The following method, or any other method which produces equivalent results, shall be used to determine the need for a correction, to calculate the correction, and to document the point within the plume at which the opacity was measured.

Figure AM1-IV(b) shows the geometry of the opacity correction. L' is the path through the plume along which the opacity measurement is made. P' is the path perpendicular to the plume at the same point. The angle epsilon is the angle between L' and the plume center line. The angle (pi /2- epsilon), is the angle between the L' and P'. The measured opacity, O[p], measured along the path L' shall be corrected to obtain the corrected opacity, O[pc], for the path P', using Equation (AM1-8).

O[pc] = (100%) X [1-(1 - 0.01 O[p])<Cos X (pi / 2 - epsilon)>] = (100%) X [1 - 0.01 O[p]<Sin epsilon >]

(AM1-8)

The correction in Equation (AM1-8) shall be performed if the inequality in Equation (AM1-9) is true.

epsilon >/= Sin<-1> X [1[n] (101 - O[p]) / 1[n] (100 - O[p])]

AM1-9)

Figure AM1-IV(a) shows the geometry used to calculate epsilon and the position in the plume at which the lidar measurement is made. This analysis assumes that for a given lidar measurement, the range from the lidar to the plume, the elevation angle of the lidar from the horizontal plane, and the azimuth angle of the lidar from an arbitrary fixed reference in the horizontal plane can all be obtained directly.

[SEE FIGURE IN ORIGINAL]

R[s]=range from lidar to source n*

BETA[s]=elevation angle of R[s] n*

R[p]=range from lidar to plume at the opacity measurement point n*

BETA[p]=elevation angle of R[p] n*

R[a]=range from lidar to plume at some arbitrary point, P[a], so the drift angle of the plume can be determined n*

BETA[a]=elevation angle of R[a] n*

alpha=angle between R[p] and R[a]

n* Obtained directly from lidar. These values should be recorded.

R's=projection of R[s] in the horizontal plane

R'p=projection of R[p] in the horizontal plane

R's=projection of R[a] in the horizontal plane

PSI'=angle between R'[s] and R'[p] n*

alpha'=angle between R'[p] and R'[a] n*

R</= =distance from the source to the opacity measurement point projected in the horizontal plane

R THETA =distance from opacity measurement point P[p] to the point in the plume P[a].

n* Obtained directly from lidar. These values should be recorded.

O[pc] = 1 - (1 - O[p]<Cos> X (pi /2- epsilon) = 1 - (1 - O[p])<Sin epsilon>

(AMI-8)

The correction angle epsilon shall be determined using Equation AMI-10.

Where:

alpha - Cos <-1> (COS BETA[p] COS BETA[a] COS alpha' + Sin BETA[p] Sin BETA[a], and

R THETA =(R[p]<2> + R[a]<2>-2 R[p]R[a] Cos alpha)<1/2>

R</=, the distance from the source to the opacity measurement point projected in the horizontal plane, shall be determined using Equation AM1-11.

R(sigma) = (R'[s]<2> + R'[p]<2> - 2R'[s] R'[p] Cos PSI)<1/2>,

(AM1-11)

Where:

R'[s]=R[s] COS BETA[s], and

R'[p]=R[p] COS BETA[p].

In the special case where the plume centerline at the opacity measurement point is horizontal, parallel to the ground, Equation AM1-12 may be used to determine epsilon instead of Equation AM1-10.

epsilon = Cos<-1> X [R[p]<2> + R[sigma]<2> - R"[s]<2> / 2 R[p] R[sigma]

(AM1-12)

Where:

R"[s]=(R'[p]<2> Sin<2> beta[p])<1/2>.

If the angle epsilon is such that epsilon </- 30 deg. or epsilon >/- 150 deg., the azimuth angle correction shall not be performed and the associated opacity value shall be discarded.

2.6.2 Elevation Angle Correction. An individual lidar-measured opacity, O[p], shall be corrected for elevation angle if the laser elevation or inclination angle, BETA[p] [Figure AM1-V], is greater than or equal to the value calculated in Equation AM1-13.

Beta[p] >/- Cos<-1> X [1n X (101 - O[p]) / 1n X (100 - O[p]]

(AM1-13)

The measured opacity, O[p], along the lidar path L, is adjusted to obtain the corrected opacity, O[pc], for the actual plume (horizontal) path, P, by using Equation (AM1-14).

O[pc] = (100%) X [1 - (1 -).01 O[p])<Cos beta >[p]],

(AM1-14)

Where:

BETA[p]=lidar elevation or inclination angle,

O[p]=measured opacity along path L, and

O[pc]=corrected opacity for the actual plume thickness P.

The values for BETA[p], O[p] and O[pc] should be recorded.

[SEE FIGURE IN ORIGINAL]

2.6.3 Determination of Actual Plume Opacity. Actual opacity of the plume shall be determined by Equation AM1-15.

O[pa] = O[pc] - [2S[o] + 5%].

(AM1-15)

2.6.4 Calculation of Average Actual Plume Opacity. The average of the actual plume opacity, O[pa], shall be calculated as the average of the consecutive individual actual opacity values, O[pa], by Equation AM1-16.

O[pa] = 1 / n X <n> SIGMA [k = 1] X (O[pa])[k],

(AM1-16)

Where:

(O[pa])[k]=the kth actual opacity value in an averaging interval containing n opacity values; k is a summing index.

SIGMA =the sum of the individual actual opacity values.

n=the number of individual actual opacity values contained in the averaging interval.

O[pa]=average actual opacity calculated over the averaging interval.

3. *Lidar Performance Verification*

The lidar shall be subjected to two types of performance verifications that shall be performed in the field. The annual calibration, conducted at least once a year, shall be used to directly verify operation and performance of the entire lidar system. The routine verification, conducted for each emission source measured, shall be used to insure proper performance of the optical receiver and associated electronics.

3.1 Annual Calibration Procedures. Either a plume from a smoke generator or screen targets shall be used to conduct this calibration.

If the screen target method is selected, five screens shall be fabricated by placing an opaque mesh material over a narrow frame (wood, metal extrusion, etc.). The screen shall have a surface area of at least one square meter. The screen material should be chosen for precise optical opacities of about 10, 20, 40, 60, and 80%. Opacity of each target shall be optically determined and should be recorded. If a smoke generator plume is selected, it shall meet the requirements of Section 3.3 of Reference Method 9. This calibration shall be performed in the field during calm (as practical) atmospheric conditions. The lidar shall be positioned in accordance with Section 2.1.

The screen targets must be placed perpendicular to and coincident with the lidar line-of-sight at sufficient height above the ground (suggest about 30 ft) to avoid ground-level dust contamination. Reference signals shall be obtained just prior to conducting the calibration test.

The lidar shall be aimed through the center of the plume within 1 stack diameter of the exit, or through the geometric center of the screen target selected. The lidar shall be set in operation for a 6-minute data run at a nominal pulse rate of 1 pulse every 10 seconds. Each backscatter return signal and each respective opacity value obtained from the smoke generator transmissometer, shall be obtained in temporal coincidence. The data shall be analyzed and reduced in accordance with Section 2.6 of this method. This calibration shall be performed for 0% (clean air), and at least five other opacities (nominally 10, 20, 40, 60, and 80%).

The average of the lidar opacity values obtained during a 6-minute calibration run shall be calculated and should be recorded. Also the average of the opacity values obtained from the smoke generator transmissometer for the same 6-minute run shall be calculated and should be recorded.

Alternate calibration procedures that do not meet the above requirements but produce equivalent results may be used.

3.2 Routine Verification Procedures. Either one of two techniques shall be used to conduct this verification. It shall be performed at least once every 4 hours for each emission source measured. The following parameters shall be directly verified.

1) The opacity value of 0% plus a minimum of 5 (nominally 10, 20, 40, 60, and 80%) opacity values shall be verified through the PMT detector and data processing electronics.

2) The zero-signal level (receiver signal with no optical signal from the source present) shall be inspected to insure that no spurious noise is present in the signal. With the entire lidar receiver and analog/digital electronics turned on and adjusted for normal operating performance, the following procedures shall be used for Techniques 1 and 2, respectively.

3.2.1 Procedure for Technique 1. This test shall be performed with no ambient or stray light reaching the PMT detector. The narrow band filter (694.3 nanometers peak) shall be removed from its position in front of the PMT detector. Neutral density filters of nominal opacities of 10, 20, 40, 60, and 80% shall be used. The recommended test configuration is depicted in Figure AM1-VI.

[SEE FIGURE IN ORIGINAL]

Figure AM1-VI. Test Configuration for Technique 1.

The zero-signal level shall be measured and should be recorded, as indicated in Figure AM1-VI(a). This simulated clear-air or 0% opacity value shall be tested in using the selected light source depicted in Figure AM1-VI(b).

The light source either shall be a continuous wave (CW) laser with the beam mechanically chopped or a light emitting diode controlled with a pulse generator (rectangular pulse). (A laser beam may have to be attenuated so as not to saturate the PMT detector). This signal level shall be measured and should be recorded. The opacity value is calculated by taking two pick intervals [Section 2.6] about 1 microsecond apart in time and using Equation (AM1-2) setting the ratio R[n]/R[f]=1. This calculated value should be recorded.

The simulated clear-air signal level is also employed in the optical test using the neutral density filters. Using the test configuration in Figure AM1-VI(c), each neutral density filter shall be separately placed into the light path from the light source to the PMT detector. The signal level shall be measured and should be recorded. The opacity value for each filter is calculated by taking the signal level for that respective filter (I[f]), dividing it by the 0% opacity signal level (I[n]) and performing the remainder of the calculation by Equation (AM1-2) with R[n]/R[f]=1. The calculated opacity value for each filter should be recorded.

The neutral density filters used for Technique 1 shall be calibrated for actual opacity with accuracy of +/- 2% or better. This calibration shall be done monthly while the filters are in use and the calibrated values should be recorded.

3.2.2 Procedure for Technique 2. An optical generator (built-in calibration mechanism) that contains a light-emitting diode (red light for a lidar containing a ruby laser) is used. By injecting an optical signal into the lidar receiver immediately ahead of the PMT detector, a backscatter signal is simulated. With the entire lidar receiver electronics turned on and adjusted for normal operating performance, the optical generator is turned on and the simulation signal (corrected for 1/R<2>) is selected with no plume spike signal and with the opacity value equal to 0%. This simulated clear-air atmospheric return signal is displayed on the system's video display. The lidar operator then makes any fine adjustments that may be necessary to maintain the system's normal operating range.

The opacity values of 0% and the other five values are selected one at a time in any order. The simulated return signal data should be recorded. The opacity value shall be calculated. This measurement/calculation shall be performed at least three times for each selected opacity value. While the order is not important, each of the opacity values from the optical generator shall be verified. The calibrated optical generator opacity value for each selection should be recorded.

The optical generator used for Technique 2 shall be calibrated for actual opacity with an accuracy of +/- 1% or better. This calibration shall be done monthly while the generator is in use and calibrated value should be recorded.

Alternate verification procedures that do not meet the above requirements but produce equivalent results may be used.

3.3.1 Annual Calibration Deviation.

3.3.1.1 Smoke Generator. If the lidar-measured average opacity for each data run is not within +/- 5% (full scale) of the respective smoke generator's average opacity over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.1.2 Screens. If the lidar-measured average opacity for each data run is not with +/- 3% (full scale) of the laboratory-determined opacity for each respective simulation screen target over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.2 Routine Verification Error. If the lidar-measured average opacity for each neutral density filter (Technique 1) or optical generator selection (Technique 2) is not within +/- 3% (full scale) of the respective laboratory calibration value then the lidar shall be considered non-operational.

4. *Performance/Design Specification for Basic Lidar System*

4.1 Lidar Design Specification. The essential components of the basic lidar system are a pulsed laser (transmitter), optical receiver, detector, signal processor, recorder, and an aiming device that is used in aiming the lidar transmitter and receiver. Figure AM1-VII shows a functional block diagram of a basic lidar system.

[SEE FIGURE IN ORIGINAL]

4.2 Performance Evaluation Tests. The owner of a lidar system shall subject such a lidar system to the performance verification tests described in Section 3, prior to first use of this method. The annual calibration shall be performed for three separate, complete runs and the results of each should be recorded. The requirements of Section 3.3.1 must be fulfilled for each of the three runs.

Once the conditions of the annual calibration are fulfilled the lidar shall be subjected to the routine verification for three separate complete runs. The requirements of Section 3.3.2 must be fulfilled for each of the three runs and the results should be recorded. The Administrator may request that the results of the performance evaluation be submitted for review.

5. *References*

5.1 The Use of Lidar for Emissions Source Opacity Determination, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA-330/1-79-003-R, Arthur W. Dybdahl, current edition [NTIS No. PB81-246662].

5.2 Field Evaluation of Mobile Lidar for the Measurement of Smoke Plume Opacity, U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA/NEIC-TS-128, February 1976.

5.3 Remote Measurement of Smoke Plume Transmittance Using Lidar, C. S. Cook, G. W. Bethke, W. D. Conner (EPA/RTP). Applied Optics 11, pg 1742. August 1972.

5.4 Lidar Studies of Stack Plumes in Rural and Urban Environments, EPA-650/4-73-002, October 1973.

5.5 American National Standard for the Safe Use of Lasers ANSI Z 136.1-176, March 8, 1976.

5.6 U.S. Army Technical Manual TB MED 279, Control of Hazards to Health from Laser Radiation, February 1969.

5.7 Laser Institute of America Laser Safety Manual, 4th Edition.

5.8 U.S. Department of Health, Education and Welfare, Regulations for the Administration and Enforcement of the Radiation Control for Health and Safety Act of 1968, January 1976.

5.9 Laser Safety Handbook, Alex Mallow, Leon Chabot, Van Nostrand Reinhold Co., 1978.

METHOD 10--DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

Attachment E

Rule 62-297.310, F.A.C

ES CONSULTANTS, INC.
environmental and civil engineering

62-297.310 General Compliance Test Requirements.

The focal point of a compliance test is the stack or duct which vents process and/or combustion gases and air pollutants from an emissions unit into the ambient air.

(1) Required Number of Test Runs. For mass emission limitations, a compliance test shall consist of three complete and separate determinations of the total air pollutant emission rate through the test section of the stack or duct and three complete and separate determinations of any applicable process variables corresponding to the three distinct time periods during which the stack emission rate was measured; provided, however, that three complete and separate determinations shall not be required if the process variables are not subject to variation during a compliance test, or if three determinations are not necessary in order to calculate the unit's emission rate. The three required test runs shall be completed within one consecutive five-day period. In the event that a sample is lost or one of the three runs must be discontinued because of circumstances beyond the control of the owner or operator, and a valid third run cannot be obtained within the five day period allowed for the test, the Secretary or his or her designee may accept the results of the two complete runs as proof of compliance, provided that the arithmetic mean of the results of the two complete runs is at least 20% below the allowable emission limiting standard.

(2) Operating Rate During Testing. Unless otherwise stated in the applicable emission limiting standard rule, testing of emissions shall be conducted with the emissions unit operating at permitted capacity as defined below. If it is impracticable to test at permitted capacity, an emissions unit may be tested at less than the maximum permitted capacity; in this case, subsequent emissions unit operation is limited to 110 percent of the test rate until a new test is conducted. Once the unit is so limited, operation at higher capacities is allowed for no more than 15 consecutive days for the purpose of additional compliance testing to regain the authority to operate at the permitted capacity.

(a) Combustion Turbines. (Reserved)

(b) All Other Sources. Permitted capacity is defined as 90 to 100 percent of the maximum operation rate allowed by the permit.

(3) Calculation of Emission Rate. The indicated emission rate or concentration shall be the arithmetic average of the emission rate or concentration determined by each of the three separate test runs unless otherwise specified in a particular test method or applicable rule.

(4) Applicable Test Procedures.

(a) Required Sampling Time.

1. Unless otherwise specified in the applicable rule, the required sampling time for each test run shall be no less than one hour and no greater than four hours, and the sampling time at each sampling point shall be of equal intervals of at least two minutes.

2. Opacity Compliance Tests. When either EPA Method 9 or DEP Method 9 is specified as the applicable opacity test method, the required minimum period of observation for a compliance test shall be sixty (60) minutes for emissions units which emit or have the potential to emit 100 tons per year or more of particulate matter, and thirty (30) minutes for emissions units which have potential emissions less than 100 tons per year of particulate matter and are not subject to a multiple-valued opacity standard. The opacity test observation period shall include the period during which the highest opacity emissions can reasonably be expected to occur. Exceptions to these requirements are as follows:

a. For batch, cyclical processes, or other operations which are normally completed within less than the minimum observation period and do not recur within that time, the period of observation shall be equal to the duration of the batch cycle or operation completion time.

b. The observation period for special opacity tests that are conducted to provide data to establish a surrogate standard pursuant to paragraph 62-297.310(5)(k), F.A.C., Waiver of Compliance Test Requirements, shall be established as necessary to properly establish the relationship between a proposed surrogate standard and an existing mass emission limiting standard.

c. The minimum observation period for opacity tests conducted by employees or agents of the department to verify the day-to-day continuing compliance of a unit or activity with an applicable opacity standard shall be twelve minutes.

(b) Minimum Sample Volume. Unless otherwise specified in the applicable rule, the minimum sample volume per run shall be 25 dry standard cubic feet.

(c) Required Flow Rate Range. For EPA Method 5 particulate sampling, acid mist/sulfur dioxide, and fluoride sampling which uses Greenburg Smith type impingers, the sampling nozzle and sampling time shall be selected such that the average sampling rate will be between 0.5 and 1.0 actual cubic feet per minute, and the required minimum sampling volume will be obtained.

(d) Calibration of Sampling Equipment. Calibration of the sampling train equipment shall be conducted in accordance with the schedule shown in Table 297.310-1.

(e) Allowed Modification to EPA Method 5. When EPA Method 5 is required, the following modification is allowed: the heated filter may be separated from the impingers by a flexible tube.

TABLE 297.310-1 CALIBRATION SCHEDULE

ITEM	MINIMUM CALIBRATION FREQUENCY	REFERENCE INSTRUMENT	TOLERANCE
Liquid in glass thermometer	Annually	ASTM Hg in glass ref. thermometer or equivalent, or thermometric points	+/-2%
Bimetallic thermometer	Quarterly	Calib. liq. in glass thermometer	5 degrees F
Thermocouple	Annually	ASTM Hg in glass ref. thermometer, NBS calibrated reference and potentiometer	5 degrees F
Barometer	Monthly	Hg barometer or NOAA station	+/-1% scale
Pitot Tube	When required or when damaged	By construction or measurements in wind tunnel D greater than 16" and standard pitot tube	See EPA Method 2, Fig. 2-2 & 2-3
Probe Nozzles	Before each test or when nicked, dented, or corroded	Micrometer	+/-0.001'' mean of at least three readings Max. deviation between readings, .004''
Dry Gas Meter and Orifice Meter	1. Full Scale: When received, When 5% change observed, Annually 2. One Point: Semiannually	Spirometer or calibrated wet test or dry gas test meter	2%
	3. Check after each test series	Comparison check	5%

(5) Determination of Process Variables.

(a) Required Equipment. The owner or operator of an emissions unit for which compliance tests are required shall install, operate, and maintain equipment or instruments necessary to determine process variables, such as process weight input or heat input, when such data are needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards.

(b) Accuracy of Equipment. Equipment or instruments used to directly or indirectly determine process variables, including devices such as belt scales, weight hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to allow the applicable process variable to be determined within 10% of its true value.

(6) Required Stack Sampling Facilities. Sampling facilities include sampling ports, work platforms, access to work platforms, electrical power, and sampling equipment support. All stack sampling facilities must meet any Occupational Safety and Health Administration (OSHA) Safety and Health Standards described in 29 CFR Part 1910, Subparts D and E.

(a) Permanent Test Facilities. The owner or operator of an emissions unit for which a compliance test, other than a visible emissions test, is required on at least an annual basis, shall install and maintain permanent stack sampling facilities.

(b) Temporary Test Facilities. The owner or operator of an emissions unit that is not required to conduct a compliance test on at least an annual basis may use permanent or temporary stack sampling facilities. If the owner chooses to use temporary sampling facilities on an emissions unit, and the department elects to test the unit, such temporary facilities shall be installed on the emissions unit within 5 days of a request by the department and remain on the emissions unit until the test is completed.

(c) Sampling Ports.

1. All sampling ports shall have a minimum inside diameter of 3 inches.

2. The ports shall be capable of being sealed when not in use.

3. The sampling ports shall be located in the stack at least 2 stack diameters or equivalent diameters downstream and at least 0.5 stack diameter or equivalent diameter upstream from any fan, bend, constriction or other flow disturbance.

4. For emissions units for which a complete application to construct has been filed prior to December 1, 1980, at least two sampling ports, 90 degrees apart, shall be installed at each sampling location on all circular stacks that have an outside diameter of 15 feet or less. For stacks with a larger diameter, four sampling ports, each 90 degrees apart, shall be installed. For emissions units for which a complete application to construct is filed on or after December 1, 1980, at least two sampling ports, 90 degrees apart, shall be installed at each sampling location on all circular stacks that have an outside diameter of 10 feet or less. For stacks with larger diameters, four sampling ports, each 90 degrees apart, shall be installed. On horizontal circular ducts, the ports shall be located so that the probe can enter the stack vertically, horizontally or at a 45 degree angle.

5. On rectangular ducts, the cross sectional area shall be divided into the number of equal areas in accordance with EPA Method 1. Sampling ports shall be provided which allow access to each sampling point. The ports shall be located so that the probe can be inserted perpendicular to the gas flow.

(d) Work Platforms.

1. Minimum size of the working platform shall be 24 square feet in area. Platforms shall be at least 3 feet wide.

2. On circular stacks with 2 sampling ports, the platform shall extend at least 110 degrees around the stack.

3. On circular stacks with more than two sampling ports, the work platform shall extend 360 degrees around the stack.

4. All platforms shall be equipped with an adequate safety rail (ropes are not acceptable), toeboard, and hinged floor-opening cover if ladder access is used to reach the platform. The safety rail directly in line with the sampling ports shall be removable so that no obstruction exists in an area 14 inches below each sample port and 6 inches on either side of the sampling port.

(e) Access to Work Platform.

1. Ladders to the work platform exceeding 15 feet in length shall have safety cages or fall arresters with a minimum of 3 compatible safety belts available for use by sampling personnel.

2. Walkways over free-fall areas shall be equipped with safety rails and toeboards.

(f) Electrical Power.

1. A minimum of two 120-volt AC, 20-amp outlets shall be provided at the sampling platform within 20 feet of each sampling port.

2. If extension cords are used to provide the electrical power, they shall be kept on the plant's property and be available immediately upon request by sampling personnel.

(g) Sampling Equipment Support.

1. A three-quarter inch eyebolt and an angle bracket shall be attached directly above each port on vertical stacks and above each row of sampling ports on the sides of horizontal ducts.

a. The bracket shall be a standard 3 inch × 3 inch × one-quarter inch equal-legs bracket which is 1 and one-half inches wide. A hole that is one-half inch in diameter shall be drilled through the exact center of the horizontal portion of the bracket. The horizontal portion of the bracket shall be located 14 inches above the centerline of the sampling port.

b. A three-eighth inch bolt which protrudes 2 inches from the stack may be substituted for the required bracket. The bolt shall be located 15 and one-half inches above the centerline of the sampling port.

c. The three-quarter inch eyebolt shall be capable of supporting a 500 pound working load. For stacks that are less than 12 feet in diameter, the eyebolt shall be located 48 inches above the horizontal portion of the angle bracket. For stacks that are greater than or equal to 12 feet in diameter, the eyebolt shall be located 60 inches above the horizontal portion of the angle bracket. If the eyebolt is more than 120 inches above the platform, a length of chain shall be attached to it to bring the free end of the chain to within safe reach from the platform.

2. A complete monorail or dualrail arrangement may be substituted for the eyebolt and bracket.

3. When the sample ports are located in the top of a horizontal duct, a frame shall be provided above the port to allow the sample probe to be secured during the test.

(7) Frequency of Compliance Tests. The following provisions apply only to those emissions units that are subject to an emissions limiting standard for which compliance testing is required.

(a) General Compliance Testing.

1. The owner or operator of a new or modified emissions unit that is subject to an emission limiting standard shall conduct a compliance test that demonstrates compliance with the applicable emission limiting standard prior to obtaining an operation permit for such emissions unit.

2. For excess emission limitations for particulate matter specified in Rule 62-210.700, F.A.C., a compliance test shall be conducted annually while the emissions unit is operating under soot blowing conditions in each federal fiscal year during which soot blowing is part of normal emissions unit operation, except that such test shall not be required in any federal fiscal year in which a fossil fuel steam generator does not burn liquid and/or solid fuel for more than 400 hours other than during startup.

3. The owner or operator of an emissions unit that is subject to any emission limiting standard shall conduct a compliance test that demonstrates compliance with the applicable emission limiting standard prior to obtaining a renewed operation permit. Emissions units that are required to conduct an annual compliance test may submit the most recent annual compliance test to satisfy the requirements of this provision. In renewing an air operation permit pursuant to sub-subparagraph 62-210.300(2)(a)3.b., c., or d., F.A.C., the department shall not require submission of emission compliance test results for any emissions unit that, during the year prior to renewal:

a. Did not operate; or

b. In the case of a fuel burning emissions unit, burned liquid and/or solid fuel for a total of no more than 400 hours,

4. During each federal fiscal year (October 1 – September 30), unless otherwise specified by rule, order, or permit, the owner or operator of each emissions unit shall have a formal compliance test conducted for:

a. Visible emissions, if there is an applicable standard;

b. Each of the following pollutants, if there is an applicable standard, and if the emissions unit emits or has the potential to emit: 5 tons per year or more of lead or lead compounds measured as elemental lead; 30 tons per year or more of acrylonitrile; or 100 tons per year or more of any other regulated air pollutant; and

c. Each NESHAP pollutant, if there is an applicable emission standard.

5. An annual compliance test for particulate matter emissions shall not be required for any fuel burning emissions unit that, in a federal fiscal year, does not burn liquid and/or solid fuel, other than during startup, for a total of more than 400 hours.

6. For fossil fuel steam generators on a semi-annual particulate matter emission compliance testing schedule, a compliance test shall not be required for any six-month period in which liquid and/or solid fuel is not burned for more than 200 hours other than during startup.

7. For emissions units electing to conduct particulate matter emission compliance testing quarterly pursuant to paragraph 62-296.405(2)(a), F.A.C., a compliance test shall not be required for any quarter in which liquid and/or solid fuel is not burned for more than 100 hours other than during startup.

8. Any combustion turbine that does not operate for more than 400 hours per year shall conduct a visible emissions compliance test once per each five-year period, coinciding with the term of its air operation permit.

9. The owner or operator shall notify the department, at least 15 days prior to the date on which each formal compliance test is to begin, of the date, time, and place of each such test, and the test contact person who will be responsible for coordinating and having such test conducted for the owner or operator.

10. An annual compliance test conducted for visible emissions shall not be required for units exempted from air permitting pursuant to subsection 62-210.300(3), F.A.C.; units determined to be insignificant pursuant to subparagraph 62-213.300(2)(a)1., F.A.C., or paragraph 62-213.430(6)(b), F.A.C.; or units permitted under the General Permit provisions in paragraph 62-210.300(4)(a) or Rule 62-213.300, F.A.C., unless the general permit specifically requires such testing.

(b) Special Compliance Tests. When the department, after investigation, has good reason (such as complaints, increased visible emissions or questionable maintenance of control equipment) to believe that any applicable emission standard contained in a department rule or in a permit issued pursuant to those rules is being violated, it shall require the owner or operator of the emissions unit to conduct compliance tests which identify the nature and quantity of pollutant emissions from the emissions unit and to provide a report on the results of said tests to the department.

(c) Waiver of Compliance Test Requirements. If the owner or operator of an emissions unit that is subject to a compliance test requirement demonstrates to the department, pursuant to the procedure established in Rule 62-297.620, F.A.C., that the compliance of the emissions unit with an applicable weight emission limiting standard can be adequately determined by means other than the designated test procedure, such as specifying a surrogate standard of no visible emissions for particulate matter sources equipped with a bag house or specifying a fuel analysis for sulfur dioxide emissions, the department shall waive the compliance test requirements for such emissions units and order that the alternate means of determining compliance be used, provided, however, the provisions of paragraph 62-297.310(7)(b), F.A.C., shall apply.

(8) Test Reports.

(a) The owner or operator of an emissions unit for which a compliance test is required shall file a report with the department on the results of each such test.

(b) The required test report shall be filed with the department as soon as practical but no later than 45 days after the last sampling run of each test is completed.

(c) The test report shall provide sufficient detail on the emissions unit tested and the test procedures used to allow the department to determine if the test was properly conducted and the test results properly computed. As a minimum, the test report, other than for an EPA or DEP Method 9 test, shall provide the following information:

1. The type, location, and designation of the emissions unit tested.

2. The facility at which the emissions unit is located.

3. The owner or operator of the emissions unit.

4. The normal type and amount of fuels used and materials processed, and the types and amounts of fuels used and material processed during each test run.

5. The means, raw data and computations used to determine the amount of fuels used and materials processed, if necessary to determine compliance with an applicable emission limiting standard.

6. The type of air pollution control devices installed on the emissions unit, their general condition, their normal operating parameters (pressure drops, total operating current and GPM scrubber water), and their operating parameters during each test run.

7. A sketch of the duct within 8 stack diameters upstream and 2 stack diameters downstream of the sampling ports, including the distance to any upstream and downstream bends or other flow disturbances.

8. The date, starting time and duration of each sampling run.

9. The test procedures used, including any alternative procedures authorized pursuant to Rule 62-297.620, F.A.C. Where optional procedures are authorized in this chapter, indicate which option was used.

10. The number of points sampled and configuration and location of the sampling plane.

11. For each sampling point for each run, the dry gas meter reading, velocity head, pressure drop across the stack, temperatures, average meter temperatures and sample time per point.

12. The type, manufacturer and configuration of the sampling equipment used.

13. Data related to the required calibration of the test equipment.

14. Data on the identification, processing and weights of all filters used.

15. Data on the types and amounts of any chemical solutions used.

16. Data on the amount of pollutant collected from each sampling probe, the filters, and the impingers, are reported separately for the compliance test.

17. The names of individuals who furnished the process variable data, conducted the test, analyzed the samples and prepared the report.

18. All measured and calculated data required to be determined by each applicable test procedure for each run.

19. The detailed calculations for one run that relate the collected data to the calculated emission rate.

20. The applicable emission standard, and the resulting maximum allowable emission rate for the emissions unit, plus the test result in the same form and unit of measure.

21. A certification that, to the knowledge of the owner or his authorized agent, all data submitted are true and correct. When a compliance test is conducted for the department or its agent, the person who conducts the test shall provide the certification with respect to the test procedures used. The owner or his authorized agent shall certify that all data required and provided to the person

conducting the test are true and correct to his knowledge.

(9) The terms stack and duct are used interchangeably in this rule.

Specific Authority 403.061 FS. Law Implemented 403.031, 403.061, 403.087 FS. History–Formerly 17-2.700(1)(b), 17-297.310, Amended 11-23-94, 3-13-96, 10-28-97, 3-2-99.