GEOENERGY
A DIVISION OF
A.H. LUNDBERG ASSOCIATES, INC.

P.O. Box 597
Bellevue, Washington 98009

13201 Bel-Red Road
Bellevue, Washington 98005
tel: 425.283.5070

fax: 425.283.5081

June 22, 2012
Reference: P-125387

Domtar Industries, Inc.
285 Highway 71 S
Ashdown, AR 71822-8356

Attention: Ms. Andrea Dieterle

Subject: Emission Controls for Power Boiler No. 2

Dear Ms. Dieterle:

The Geoenergy Division of A. H. Lundberg Associates, Inc. is pleased to submit the following budget proposal for the supply of a wet ESP emission control system for the No. 2 power boiler at the Ashdown Mill.

In summary, the proposal is to supply an add-on spray scrubber/wet ESP to operate downstream of the existing venturi scrubbers. The spray scrubber will utilize sodium hydroxide to absorb SO_2 and the wet ESP will collect particulate matter.

We offer the following comments for your consideration.

DESIGN GOAL

The goal for this proposed equipment is to 1) meet the anticipated MACT standards for particulate matter and 2) provide 90% SO_2 reduction to comply with BART requirements.

To meet the anticipated MACT standards we have designed for an outlet particulate emission rate of less than 0.015 lb/MM BTU. As you know, the re-considered MACT requirement proposed by the EPA is presently 0.029 lb/MM BTU. However, as of this date a final requirement has not been issued by the EPA. If the final requirement is significantly different than 0.029 lb/MM BTU the wet ESP can probably be re-sized without a major impact on the scope of the project.

With regard to the BART regulation, as discussed, there has been no guidance from the regulatory authorities. Given this, we have selected 90% SO_2 reduction as a common-sense approach to the situation. As in the case of the MACT requirements discussed above, if higher removal rates are required the equipment offered can probably be re-designed without a major impact on the project.

PROCESS CONSIDERATIONS

An add-on spray scrubber/wet ESP is a logical choice because the gas stream is already being treated with a wet scrubber. Unlike the previous wet ESP project at the Ashdown Mill no new upstream water recycle equipment would be required. Also, there would be no additional process water requirement because spent water from the spray scrubber/wet ESP could "feed forward" to the scrubber system as make-up. A process flow diagram showing this scheme is included in the appendix of the proposal.

Another advantage of add-on equipment would be that installation could be completed off line with final tie-in to be accomplished in a very short period of time. In contrast a modification to the existing scrubber to increase pressure drop to enhance efficiency would require substantial down time and, in all likelihood a new boiler fan. The new wet ESP could use the existing fan for the necessary forced draft requirement. In similar installations we have actually reduced the pressure drop on the upstream scrubber to more than make up for any additional pressure drop across the wet ESP.

If you have any questions about the proposal, please feel free to me a call at 425/283-5070.

Thank you for the opportunity to present this proposal. We look forward to working with you on this project.

Sincerely,

GEOENERGY DIVISION/A.H. LUNDBERG ASSOCIATES, INC.

Steven A. Jaasund, P.E.
Manager

enc: Proposal

copy: Mr. Rudi Miksa, A.H. Lundberg Associates/Monroe, LA

A.H. LUNDBERG ASSOCIATES, INC.
P-125387
June 25, 2012

BUDGET PROPOSAL

SPRAY SCRUBBER/ WET ESP SYSTEM

FOR

DOMTAR INDUSTRIES, INC.

ASHDOWN, ARKANSAS

Our Representative in Your Area:
Mr. Rudi Miksa
A. H. Lundberg Associates, Inc.
Monroe, LA
318/361-0165

TABLE OF CONTENTS

INTRODUCTION

The Geoenergy® Division of A.H. Lundberg Associates, Inc. (AHLA) proposes to supply an add-on spray scrubber/wet ESP system for the control of SO_2 and particulate emissions from the No. 2 power boiler at the Domtar Industries Pulp Mill in Ashdown, Arkansas.

The proposal includes two identical gas cleaning trains each including a spray scrubber followed be an E-Tube® Wet Electrostatic Precipitator.

PROCESS DESCRIPTION

The spray scrubber/wet ESP trains will be installed downstream of the existing venturi scrubbers and will utilize the main boiler fan on a forced draft basis. We anticipate a maximum of 3 inches w.c. will be necessary to overcome the added resistance of the add-on equipment. If this additional pressure is not available from the existing fan, the capacity can be gained by reducing the pressure drop through your existing scrubber an appropriate amount. This pressure drop reduction will not have a significant effect on the size requirements of the new wet ESP.

The spray scrubbers will be a downflow design utilizing upward facing spray headers to maximize liquid to gas contact. The unit will operate at a liquid to gas ratio of 20 gal/1000 acf and will utilize a pH adjusted scrubbing solution to affect a minimum of 90% SO_2 absorption. Sodium hydroxide will be used to maintain pH at the required level.

After exiting the spray scrubbers, the gas streams will enter the bottom of the two wet ESP units. Directional baffles in the bottom of each unit will evenly distribute the gas as it turns upward. The gas will then pass through a perforated plate for gas distribution prior to entering the electrostatic zone of the wet ESP.

The electrostatic zone of the wet ESP is comprised of two parallel collection sections. Each section is made up of the collection tubes with discharge electrodes supported from above. As the gas passes upward through these collection tubes, the entrained particles are charged by high voltage and collected on the inner surface of the tubes.

To promote condensation and wetting of the tube walls, ambient air is blown across the wet ESP tube bundle in the manner of a cross-flow air-to-air heat exchanger. This air is then directly discharged to the atmosphere. The resultant reduction in the emission stream temperature below the saturation temperature (wet bulb temperature) will cause condensation. This condensation forms on the internal tube walls thus maintaining wet collection walls, which allows for easy removal of the collected particulate through automatic flush cycles.

After exiting the tubes, the cleaned gas passes through the power grid housing, then the outlet plenum at the top of the wet ESP unit. The gases from the unit be discharged through individual 30-foot stacks mounted on top of each unit.

Heated purge air is provided to each of the insulators supporting the power grid. The heating of the purge air is required to maintain the cleanliness of the insulators. The purge air is heated by passing ambient air through the outside of the wet ESP tube bundle. This method of heating the purge air also results in condensation forming on the inside wall of the collection tubes for improved wetting.

Each collection section is periodically and independently flushed with clean water to remove the collected particulate matter. The flush water cascades from the collection tubes to flush the inlet perforated air distribution plate. It then falls down through the inlet plenum to be collected in the sump at the bottom of each unit. The water in this sump will then be pumped upstream to act as make-up water for the upstream scrubber.

A process flow diagram and a general arrangement drawings for the system proposed are included in the appendix of this proposal. Also included is a summary of the features of the E-Tube Wet Electrostatic Precipitators.

DESIGN BASE

The following process information will be used for the design of the spray scrubber/wet ESP system.

No. 2 Power Boiler Design Conditions	
Fuel	Coal, bark, natural gas, TDF, (planning on fuel oil in future)
Boiler Type	Stoker
Volumetric Gas Flow (scfm dry)	142,737
Scrubber Exit Gas Temp. (°F)	136
Exit Moisture (% wt)	12.3
PM Loading (lb/hr)	44.6
SO_2 Concentration (ppmv)	235.9

The

The spray scrubber/wet ESP equipment offered will be designed to reduce the SO_2 concentration by 90% and the particulate matter to less than 0.015 lb/MM BTU at the outlet.

PROPOSED SUPPLY

The following list summarizes the major components of the systems offered to treat the emissions from the power boiler.

Item	Quantity	Description
1	One (1) lot	System Engineering, including process flow diagrams, process and instrument diagrams, general arrangement drawings, functional narrative of the logic, assembly drawings, instrument specifications, pump specifications, and operation and maintenance manual complete with spare parts lists
2	Two (2) only	Spray scrubbers; T-316L SS, downflow design with recycle pump, tank and piping
3	Two (2) only	Model 1010-378 E-Tube® Wet ESP units; T-316L SS wetted parts, tubular type upflow with rigid mast discharge electrodes
4	Four (4) only	High Voltage Power Supplies, IGBT forced air cooled, 480 volt/3 phase/60 Hz
5	Two (2) only	Purge Air System, including fan with 5 hp motor, inlet filter and ductwork
6	Two (2) only	Flush System, including flush tank and piping system in carbon steel and pump in ductile iron with stainless steel trim
7	Two (2) lots	Support and access steel
8	Two (2) lots	Field instrumentation
9	One (1) lot	Commissioning, start-up and training
10	One (1) lot	Local wiring of all electrical elements
11	One (1) lot	Complete mechanical installation

ENERGY REQUIREMENTS

The following table shows the expected energy demands of the wet ESP system described in this proposal.

Spray Scrubber/Wet ESP Energy Requirements	
Scrubber pumps (kW)	108
High voltage power supplies (kW)	266
Insulator purge air fans (kW)	2.2
Insulator heaters (kW)*	48
Tube cooling fans (kW)	140
Flange to flange pressure drop (in. w.c.)	3

*Note: Insulator electric heaters only operate during start up.

COMMERCIAL TERMS AND CONDITIONS

CLARIFICATIONS AND WORK BY OTHERS

1. Ducting from the existing scrubber to the inlet flange of the spray scrubbers is not included
2. The cost of a crane to lift the equipment offered to the top of the No. 2 boiler building is not included
3. Structural steel to the bottom of the wet ESPs is not included. Structural and access steel above this level is included.
4. Civil work or improvements to existing structures is not included. AHLA will provide foundation-loading information.
5. Performance testing is not included
6. The performance guarantee includes a flush cycle averaged into the results.
7. AHLA will require access to mill drawings and records required to design the proposed system.
8. The client is responsible for obtaining all necessary building/environmental permits, taxes and professional engineering fees.
9. The client is to provide a lay down area close to the work site, as well as field fabrication area for piping, etc.
10. The client is to supply steam and process water as required by the erection crew free of charge. Also parking area, trailer space(s), and access to phone lines. Phone line hookup will be by AHLA. AHLA is to supply electrical power for construction.
11. Construction crews may be union or non-union.
12. The client is responsible for the removal, handling, disposal, or replacement of all asbestos materials, lead paint, or contaminated soils that may be encountered.
13. The client is to provide an on-site location for construction debris.
14. Any required demolition work is not included in our bid.

PRICES

The budget price for the spray scrubber/wet ESP system, Items 1-11, is:

Five million two hundred seventy thousand dollars

$5,270,000.00

These prices are FOB mill site. Prices do not include applicable taxes. All prices are in U.S. dollars.

The purchaser assumes liability for payment to the state of any Sales or Use tax if he uses or consumes the property herein purchased in such a way as to render the sale subject to tax.

TERMS OF PAYMENT

The terms of payment shall be:

5%	with purchase order.
10%	with submittal of approval drawings (process flow sheets, equipment drawings and general arrangements
25%	with order placed for major equipment (WESP)
10%	on delivery of 10″ diameter collection electrodes to the shop
5%	on construction mobilization
15%	on delivery of WESP to the mill; partial shipment allowed
25%	on monthly percent completion of construction
5%	on satisfaction of performance warranty on each unit, not to exceed six (6) months from shipment. This may be secured by a letter of credit at AHLA's option, and due at shipment.

Payment will be due thirty (30) days after date of invoice.

ERECTION ADVISOR

If the Buyer elects to be responsible for the installation of the wet ESP equipment the services of a qualified erection advisor can be made available at a rate of $1350.00 per man day (man day being ten (10) hours) plus expenses. Charges after ten (10) hours will be $170.00 per hour. Expenses are to include first class food and lodging, economy travel to and from plant site to lodging, and travel to and from project from the normal domicile of the engineer.

TRAINING SERVICES

Training is included as a part of the equipment package. The additional services of a trainer can be made available at a rate of $1,500.00 per man day (man day being eight (8) hours) plus expenses. Charges after eight (8) hours will be $210.00 per hour. Expenses are to include first class food and lodging, economy travel to and from plant site to lodging, and travel to and from project from the normal domicile of the engineer.

START-UP SERVICES

Start-up services are included as a part of the equipment package. The additional services of an engineer can be made available at a rate of $1350.00 per man day (man day being ten (10) hours), plus expenses. Charges after ten (10) hours will be $170.00 per hour. Expenses are to include first class food and lodging, economy travel to and from plant site to lodging, and travel to and from project from the normal domicile of the engineer.

SHIPMENT

Shipment will be made twenty-six (26) weeks after receipt of order. Shipment schedule requires that approval drawings, when submitted, will be returned within two (2) weeks. The time to complete erection is very dependent on site conditions. Normally equipment of this size can be installed in less than 8 weeks.

CANCELLATION

Should Purchaser place an order for the equipment proposed and later find it necessary to cancel, Purchaser shall pay the full amount for any equipment, portions thereof, or orders for which Vendor is liable, plus charges for engineering work completed at that time, plus fifteen (15) percent of the total costs incurred.

PERFORMANCE WARRANTY

A.H. Lundberg Associates, Inc. (AHLA) will provide the equipment and process engineering as specified in this proposal for a complete and operable system and guarantee that

1) the inlet SO_2 concentration will be reduced by 90% but no lower than 20 ppmv and,

2) the particulate emissions at the outlet of the two wet ESP trains will be less than 0.015 pounds/million BTU.

These guarantees are in effect when the system is operated in and supplied with the service conditions in general accordance with the Design Base of this proposal.

US EPA Method 1, 2, 3, 4, and 6 shall be used to quantify the SO_2 concentration at the outlet of the equipment.

US EPA Methods 1, 2, 3, 4 and 5 shall be used to quantify the particulate emissions at the outlet of the wet ESP units. The basis for conversion of measured PM emission concentration values to lb/MMBtu units shall be per EPA Method 19.

Acceptance tests must be performed within three (3) months after initial start-up of the equipment, not to exceed six (6) months after final shipment. The testing shall be performed by an independent third party that is acceptable to both Buyer and Seller.

The warranty shall be fully satisfied and AHLA discharged there from upon the earlier of: (a) obtaining guaranteed performance by the testing described above, (b) the expiration of three (3) months from initial start-up with no testing being made, (c) the expiration of six (6) months from final shipment without a test being made.

If the guaranteed performance is not obtained, then AHLA shall have the right, and if required by the Owners, the obligation, to visit the installation to determine the cause of such failure. It is a condition of this guarantee that the Owner will cooperate with AHLA in the making of further tests and make available necessary personnel, feed and operating conditions to enable AHLA to conduct such tests. The tests will be paid for by the purchaser.

If failure to obtain guaranteed performance on the above is due to defect in AHLA-supplied equipment, design, or engineering, then AHLA will, at its expense, supply the equipment or process engineering it deems necessary until such performance is met, up to a limit of the contract price. Any remedy includes an equivalent scope of installation as outlined elsewhere in this proposal.

If failure to obtain guaranteed performance is due to the Purchaser's fault in operation, or in not providing proper feed or other specified operating conditions, the Owner shall pay the living and traveling expenses of AHLA personnel visiting the installation. In addition, the Owner shall pay the sum of $1,300.00 per man-day or fraction thereof for such personnel. Nevertheless, such personnel will, on request, work with the Owner at the Owner's expense in making necessary corrections to accommodate the changed conditions.

MATERIAL AND WORKMANSHIP

We guarantee every part of the apparatus delivered in accordance with this proposal will be of proper material and workmanship, and agree to repair any part or parts which may prove defective in material or workmanship within twelve months from start up of equipment but not to exceed eighteen months from date of shipment on each unit, it being agreed that such replacement is the full extent of our liability in this connection. Corrosion or wear from abrasion shall not be considered as defective materials. The best engineering practice will always be followed and materials used will be clearly specified. We shall not be held liable or responsible for work done or expense incurred in connection with repairs, replacements, alterations, or additions made, except on our written authority.

VENDOR'S RESPONSIBILITY

In the course of design of processes and/or equipment where the Vendor provides process flow diagrams, layouts, and installation diagrams, it is anticipated that Vendor furnished design will be followed. Changes in design without written approval of the Vendor will relieve the Vendor of responsibility for performance of the supplied equipment.

DRAWINGS LIMITATION

All Vendor drawings supplied to the customer or his engineer under an order resulting from this proposal will remain the property of the Vendor and are conditionally loaned with the understanding that they will not be copied or used except as authorized by us. Reuse of the designs as shown on the drawings for another project is specifically prohibited.

CONFIDENTIALITY OF PROPOSAL INFORMATION

This proposal contains confidential information and remains the property of A.H. Lundberg Associates, Inc., and is conditionally loaned. The information contained herein is not to be shared with any party except those within the Buyer's company who are involved in its evaluation or outside consultants who are assisting the Buyer with this specific project. Specifically prohibited is the distribution of such information to any individual or business deemed to be a competitor by AHLA

SECURITY INTEREST

AHLA reserves the right to request a security interest in the materials provided as a part of this proposal, and Buyer agrees to provide information needed to assist AHLA in obtaining a security interest and to execute such documents AHLA reasonably requests to create a security interest. Security interest language is available on request.

We appreciate the opportunity to present this proposal and look forward to your favorable consideration.

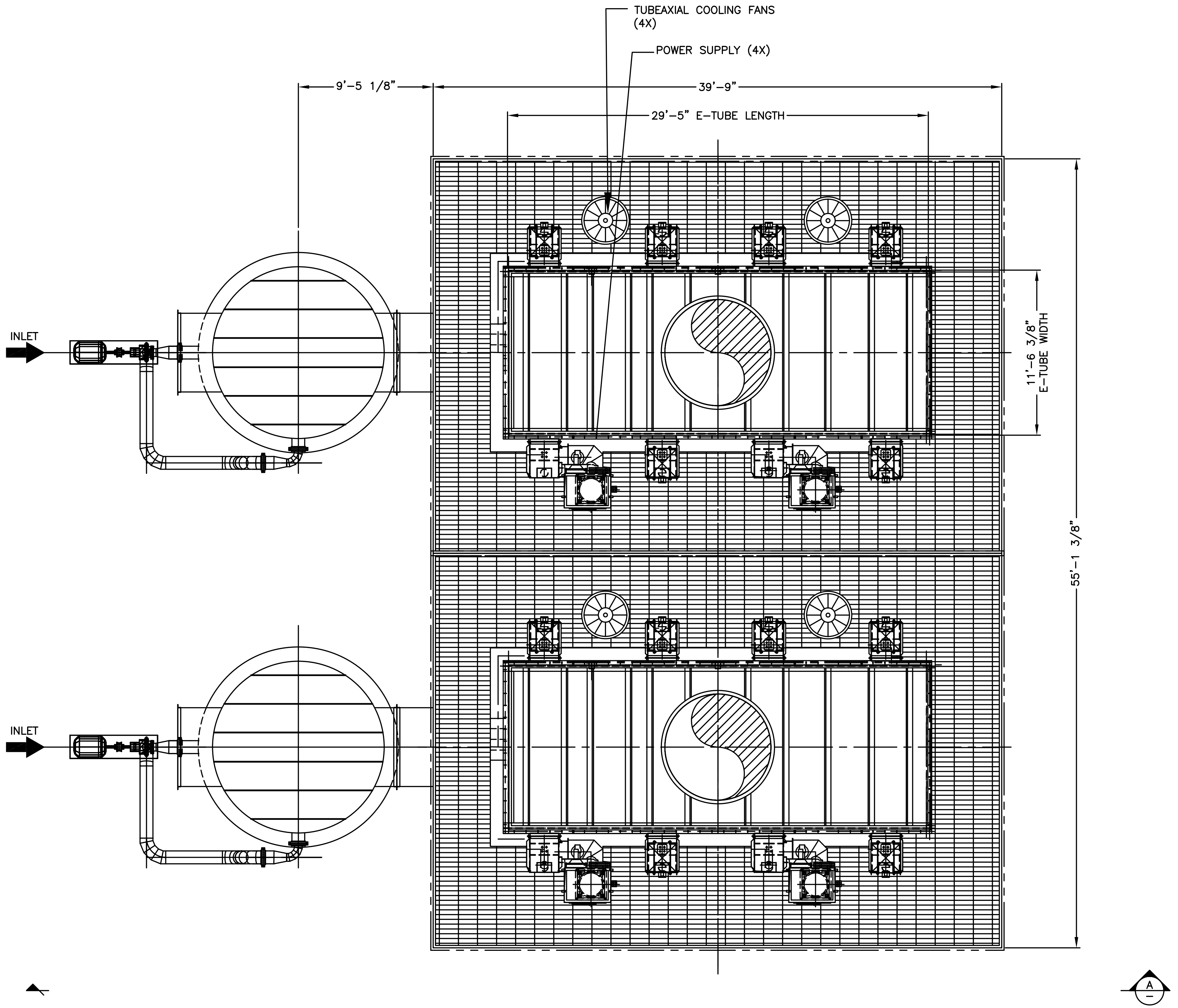
Sincerely,

GEOENERGY DIVISION/A.H. LUNDBERG ASSOCIATES, INC.

Steven A. Jaasund, P.E.

Attachments: General Arrangement Drawings
Process Flow Diagram
Wet ESP Features

ATTACHMENTS



MODEL 1010-378 E-TUBE® WESP
PLAN VIEW
BOILER # 2 EMISSIONS

ITEM	NO. REQ'D.	DESCRIPTION	MAT'L.	REFERENCE

GEOENERGY® A DIVISION OF A.H. LUNDBERG ASSOCIATES, INC.
www.lundbergassociates.com Bellevue, Washington

DOMTAR
ASHDOWN, ARKANSAS
#2 BOILER EMISSIONS

GENERAL ARRANGEMENT - PLAN
MODEL 1010-378 E-TUBE WESP

DWN. BY	AJS
DATE:	06/27/12
CHK. BY	
DATE:	
APP. BY	
DATE:	

SCALE:	EQUIP. NO.	DRAWING NO.	SHT.	REV.
1/4"-1'-0"		AL-125389-P03	1/2	00

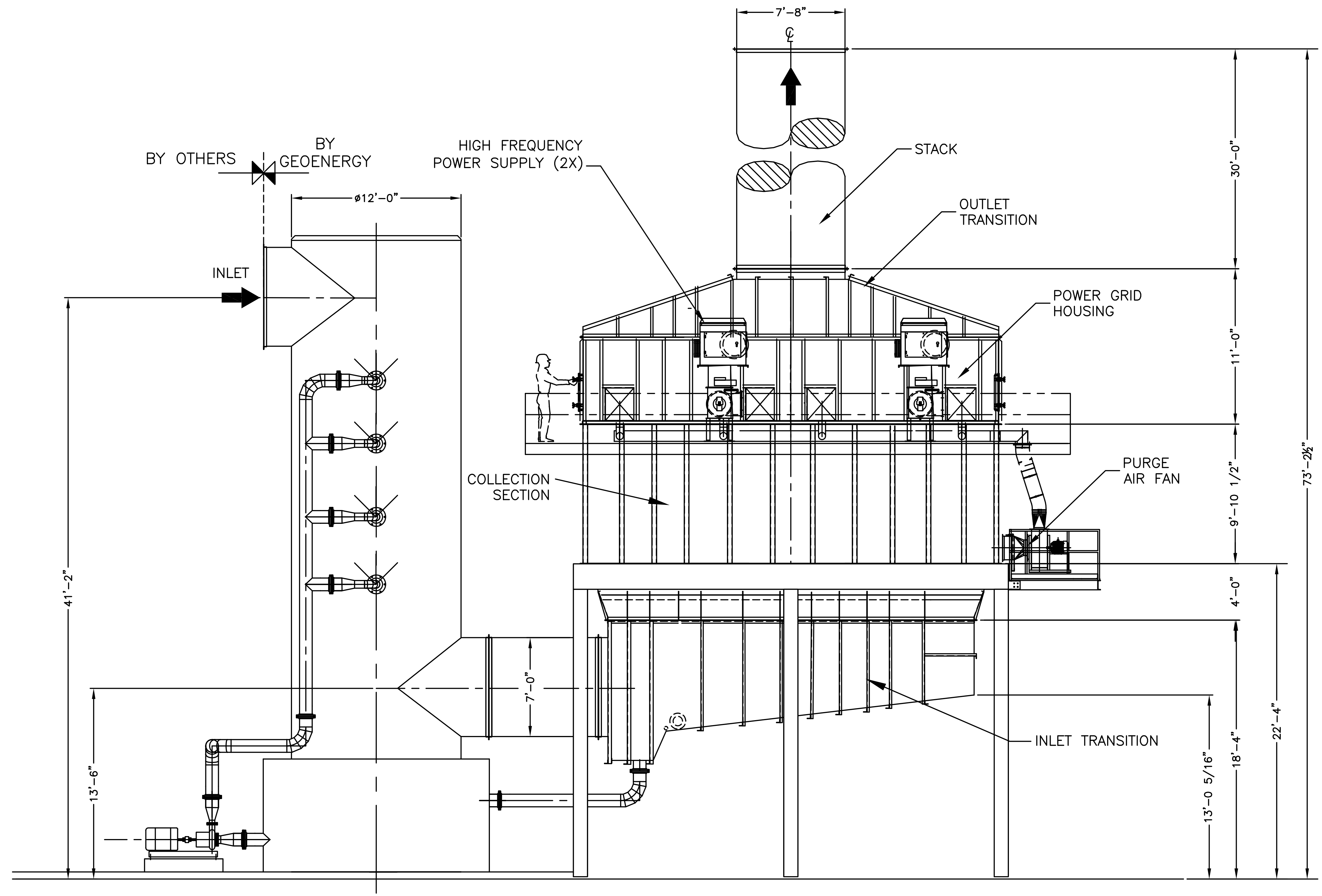
REV.	DESCRIPTION	BY	DATE	CHK	DATE	REV.	DESCRIPTION	BY	DATE	CHK	DATE

REVISIONS REVISIONS

DESCRIPTION	DRAWING NO.

REFERENCE

SPEC.
AL-125389-P03 SHT. 1/2



MODEL 1010–378 E–TUBE® WESP

VIEW (A / S1)

ITEM	NO. REQ'D.	DESCRIPTION	MAT'L.	REFERENCE

GEOENERGY® A DIVISION OF
A.H. LUNDBERG ASSOCIATES, INC.
www.lundbergassociates.com
Bellevue, Washington

DOMTAR
ASHDOWN, ARKANSAS
#2 BOILER EMISSIONS

GENERAL ARRANGEMENT – ELEV
MODEL 1010–378 E–TUBE WESP

DWN. BY AJS
DATE 06/27/12
CHK. BY
DATE:
APP. BY
DATE:

SCALE:	EQUIP. NO.	DRAWING NO.	SHT.	REV.
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REVISIONS

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AL–125389–P03 SHT. 2/2

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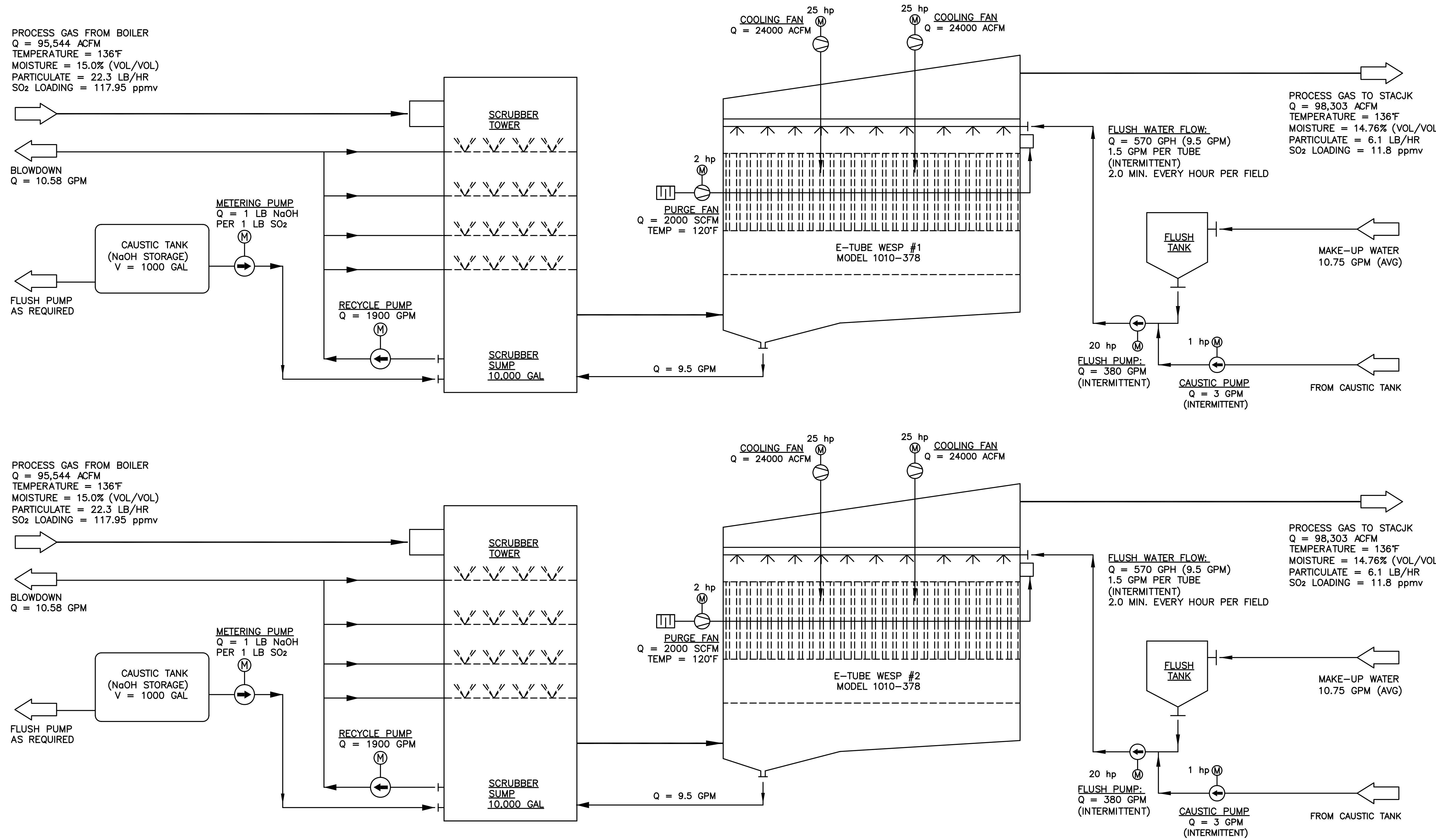

AL-125389-P01 SHT. 1/1

SPEC.

DESCRIPTION	DRAWING NO.
REFERENCE	

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	REVISIONS						REVISIONS				

ITEM	NO. REQ'D.	DESCRIPTION	MAT'L	REFERENCE

GEOENERGY®
A DIVISION OF
A.H. LUNDBERG ASSOCIATES, INC.
www.lundbergassociates.com
Bellevue, Washington

AHL

DOMTAR
ASHDOWN, ARKANSAS
#2 BOILER EMISSIONS

DWN. BY AJS
DATE 06/27/12
CHK. BY
DATE:
APP. BY
DATE:

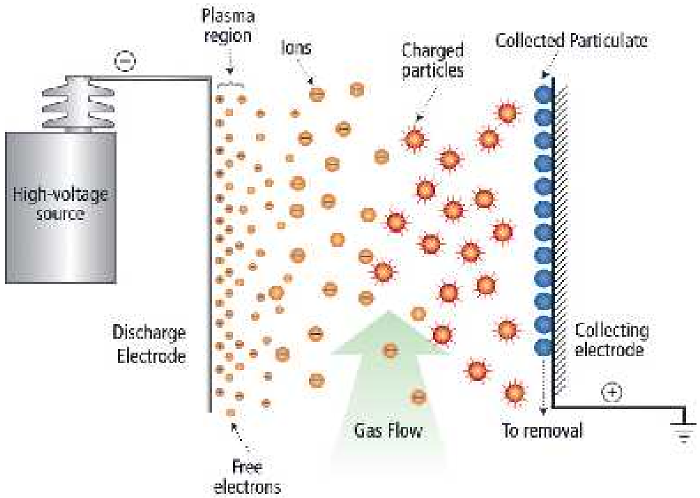
PROCESS FLOW DIAGRAM
2 – MODEL 1010-378 E-TUBE WESP

SCALE:	EQUIP. NO.	DRAWING NO.	SHT.	REV.
NONE		AL-125389-P01	1/1	00

WET ESP FEATURES

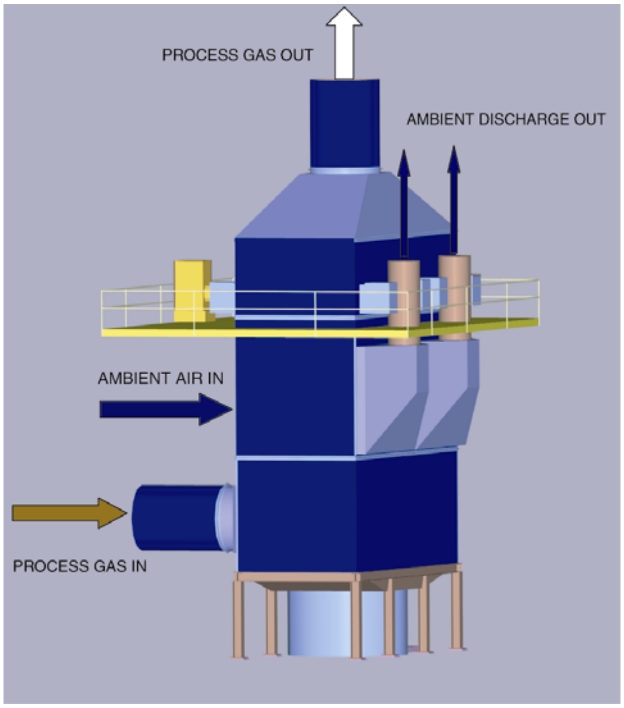
The E-Tube® wet ESP design is an extremely efficient and cost effective device for the removal of particulate from a solid fuel fired boiler. Below is a discussion of the various design elements of the E-Tube contributing to this performance.

Upflow



Due to the benign nature of the particulate being collected in this application, the **upflow arrangement** provides certain benefits. In the upflow configuration, the inlet plenum acts as a quiescent zone, allowing entrained water droplets to fall out of the gas stream. As the inlet plenum is at the bottom of the wet ESP, the water does not fall into the tube collection section as it would in a downflow arrangement. Thus, there is no need for an inlet droplet separator. (With the downflow configuration, these water droplets raining into the collection section adversely affect the performance of the system and need to be removed prior to entering the wet ESP. A cyclone separator is most commonly used for this service. The cyclone adds capital cost to the project and more importantly, additional operating costs due to its pressure drop.)

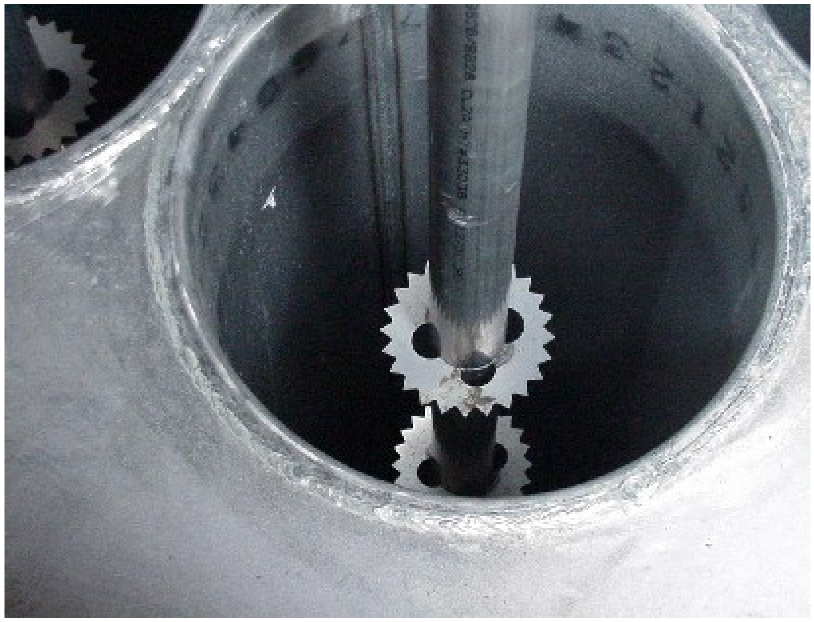
Tube Cooling



The wet ESP systems offered will include an innovative tube cooling feature to further enhance performance and operability. The tube cooling feature works like this.

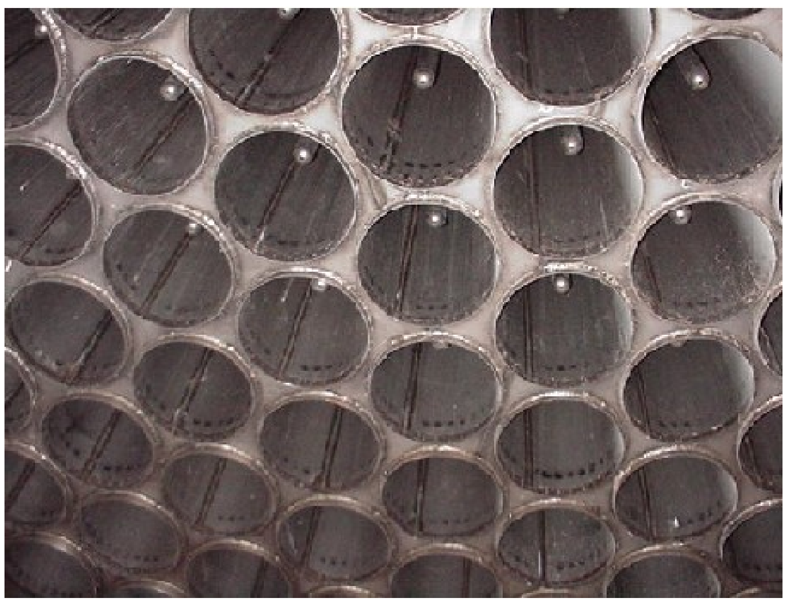
The gas stream leaving the existing scrubbers and entering the wet ESP collection sections is saturated with water vapor. This saturated gas stream has small water droplets entrained in it. In the up-flow mode, the wet ESP preferentially removes the water droplets prior to removing the smaller sub micron particles. This occurs in the lower portion of the tube bundle. In order to wet the entire length of the collection tube, ambient air is pulled across the tube bundle in the manner of a shell and tube, air-to-air heat exchanger. The axial fans and hoods shown on the right side of this illustration ensure proper air distribution.

Star II Electrode



Extensive research culminated with the development of the **Star II discharge electrode**. The high performance discs increase the corona discharge to maximize the particle charging capacity. This ability to discharge more current at voltage results in less required collection surface. This greater discharging capacity is coupled with ability to deliver more power to the Star II discharge electrode. The high frequency, high voltage power supply, discussed further below, delivers significantly more power to the discharge probes.

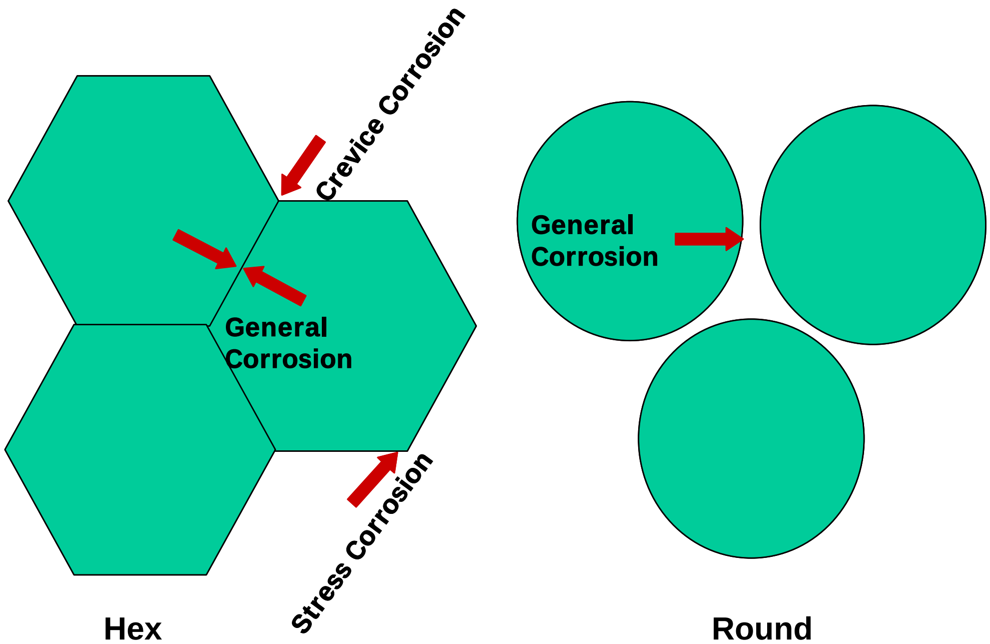
Round Tubes



The **collection electrodes are round tubes**. The discrete, round-tube construction offers a distinct advantage in corrosive applications (see comparison to hex-tube arrangement below). Per the diagram, both systems experience **general corrosion**. On the hex tube design, it occurs on both sides of the collection plate, whereas on the round tube it occurs only on the inside surface that is in contact with the process. Due to the difficulties in manufacturing the hex bundle, the plate material is similar thickness to the round tube, resulting in a shorter life.

Additional corrosion mechanisms occurring in the hex bundle, but not on the round tube include **crevice and stress corrosion**. These are set up with the construction of the hex bundle, including bending the metal in some corners (stress) and skip welding where other corners come together (crevice).

Finally, the round tube also has the most uniform electrical field for the highest efficiency.



Corrosion Mechanisms in Tubes

High Frequency Power Supply

The **efficiency of the wet ESP** is dependent on the migration velocity of a particle and the amount of collection area. The migration velocity is a function of the square of the voltage applied. Thus, more area can be provided or a higher voltage can be applied. The transformer/rectifiers on a Geoenergy® E-Tube® wet ESP are **high frequency, high voltage units**. The high frequency units maximize the voltage to the system, providing the highest voltage and highest efficiency for a given design and collection area.

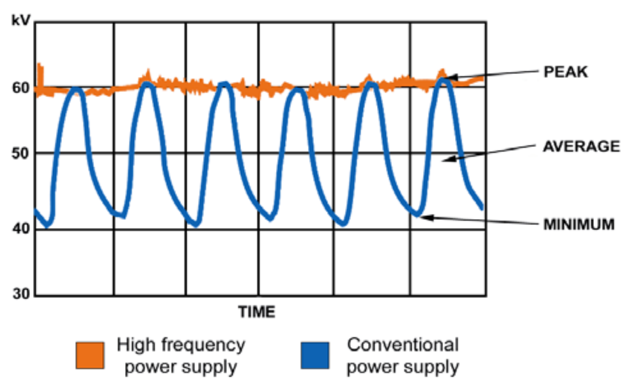
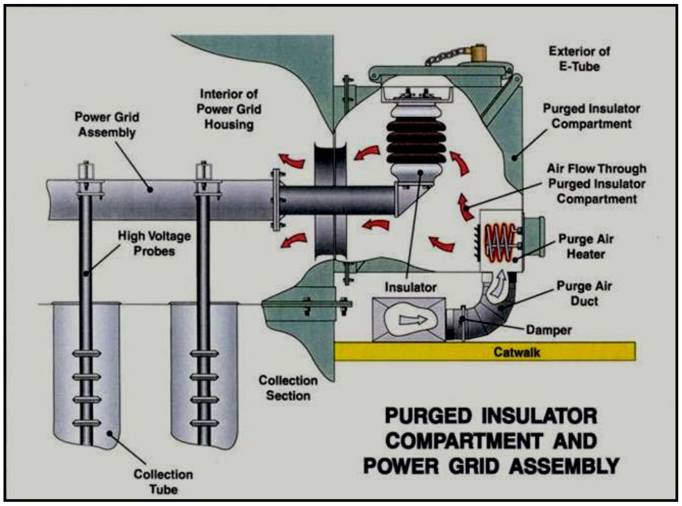


Figure 2 - Voltage Wave Forms

Innovative Purge Air System

Heated purge air is provided to each of the insulators supporting the power grid. The heating of the purge air is required to maintain the dryness and cleanliness of the insulators. The purge air is heated by passing ambient air through the outside of the wet ESP tube bundle. An auxiliary electric heater is also included for start-up. We have significant experience with the design of the compartments holding the insulators. They are outboard of the wet ESP units, designed to avoid any aspirating of dirty gas back into the compartment to provide long life on the insulators.



SUMMARY OF BENEFITS

The E-Tube® wet ESP technology provides for a smaller, more efficient system relative to dry ESP technology.

- The wet system eliminates the fire potential present in dry systems.
- Upflow configuration eliminates the need for an inlet water droplet separation device, removing both the initial capital and the ongoing operational costs due to increased pressure drops.
- Tube cooling insures collecting surface cleanliness and maximum voltage
- The Star II discharge probes maximize the corona discharge and thus the particle charging capacity of the system.
- Round tubes for the collection surface provide the best performance and longevity.
- High frequency, high voltage power supply provides the highest voltage to the system to maximize the efficiency.
- The heat from the process gases supplies the heating of the insulator purge air; the energy requirement from outside sources is minimized.

In total, the E-Tube wet ESP provides the highest performance possible to maximize collection efficiency.