AIR PERMITING OF NEW WTE PROJECTS

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Imagine the result

ARCADIS

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WTE Emissions have been dramatically reduced…

Emissions From Large and Small MSC Units (tpy)			
Pollutant	***1990 Emissions***	***2005 Emissions***	***Percent Reduction***
Dioxins/Furans*	4400	15	99+%
Mercury	57	2.3	96%
Cadmium	9.6	0.4	96%
Lead	170	5.5	97%
Particulate	18,600	780	96%
HCl	57,400	3,200	94%
SO_2	38,300	4,600	88%
NO_x	**64,900**	**49,500**	**24%**

* Dioxin/furan emissions are in units of grams per year toxic equivalent quantity (TEQ), using 1989 NATO toxicity factors.

Source: Walt Stevenson, USEPA Memorandum; Large MSC Docket (EPA-HQ-OAR-20050117); August 10, 2007.

Average Emissions of US WTE Facilities

Pollutant	*EPA Cb Standard*	*Average Emission*	*% of EPA Standard*	*Unit*
Dioxins/Furans*	0.26	0.05	19.2%	ng/dscm
Mercury	0.08	0.01	12.5%	mg/dscm
Cadmium	0.020	0.001	5%	mg/dscm
Lead	0.02	0.02	10%	mg/dscm
Particulate	24	4	16.7	mg/dscm
HCl	25	10	40%	ppmvd
SO_2	30	6	20%	ppmvd
NO_x	**180**	**170**	**94.4%**	**ppmvd**

* Dioxin/furan emissions are in units of grams per year toxic equivalent quantity (TEQ), using 1989 NATO toxicity factors.

Source: J.D. Lauber et al; Waste-to-Energy vs. Long Distance Disposal of Municipal Waste; AWMA Conference, New Orleans, Louisiana; June 12, 2007.

Evolving Emission Limits

Pollutant	***Units***	***Emission Rate***		***Recent Expansions***
		EPA Cb Standard	***EPA Eb Standard***	
Dioxins/Furans	ng/dscm	30	13	13
Mercury (Hg)	ug/dscm	50	50	28
Cadmium (Cd)	ug/dscm	35	10	10
Lead (Pb)	ug/dscm	400	140	140
Particulate	mg/dscm	25	20	12
HCl	ppmvd	29	25	25
SO_2	ppmvd	30	30	26
NOx	ppmvd	180-250	150	110-90

PALM BEACH RENEWABLE ENERGY FACILITY NUMBER 2

Three Unit, 3,000tpd Mass Burn 100MW Facility

SPONSOR/OWNER:
Palm Beach County (Florida) Solid Waste Authority

PSD PERMITTING ENGINEER:
ARCADIS-US

DESIGN/BUILD/OPERATOR:
Babcock & Wilcox Power Generation Group

STATUS: Under Construction with Commercial Operations Scheduled for May 2015

PALM BEACH RENEWABLE ENERGY FACILITY NUMBER 2

Three Unit, 3,000tpd Mass Burn 100MW Facility

DESIGNER/CONTRATOR:
KBR Engineering & Construction

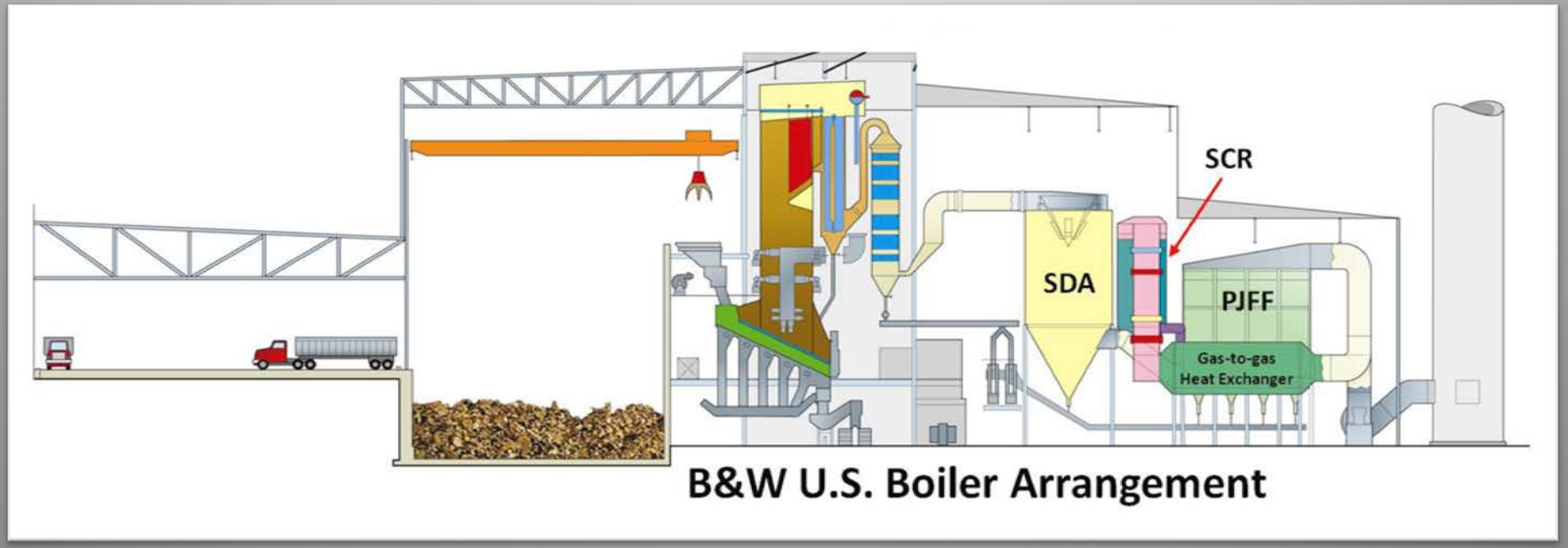
STOCKER:
B&W Vølund DynaGrate®

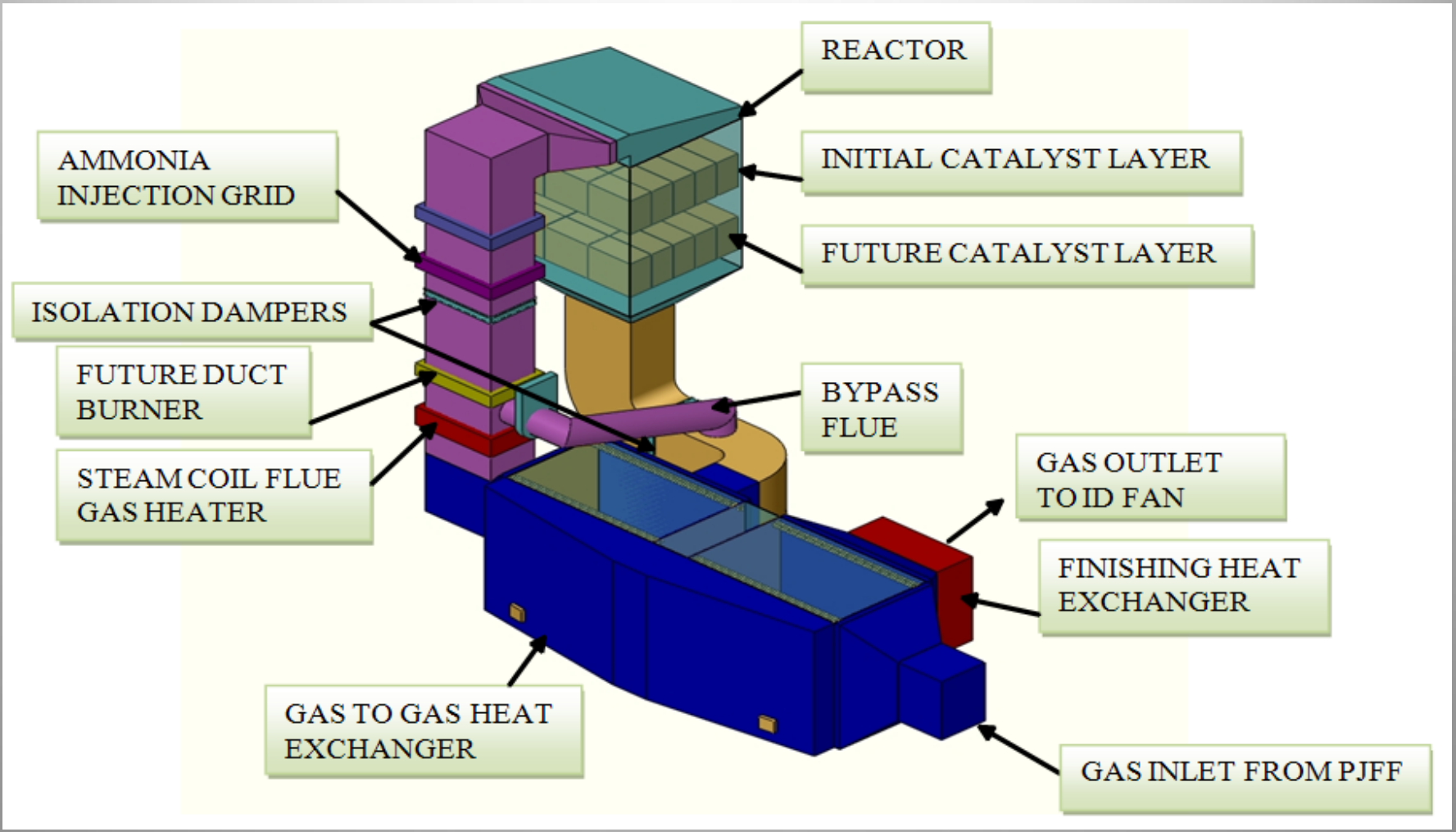
BOILER:
Babcock & Wilcox

EMISSION CONTROLS:
PAC: Babcock & Wilcox
SDA: Babcock & Wilcox
GEA Niro Atomizer
FFBH: Babcock & Wilcox
SCR: Babcock & Wilcox

Palm Beach Renewable Energy Facility No. 2

Typical US Mass Burn Facility with Spray Dry Absorber and Fabric Filter Baghouse plus Selective Catalytic Reduction





Selective Catalytic Reduction (SCR) Schematic

Palm Beach Renewable Energy Facility No. 2
PSD Permit Limits

Pollutant	*Units*	*Emission Rate*		*Control Technology*
		EPA Eb Standard	*Permit*	
NOx	**ppmvd**	**150**	**45**	**SCR**
CO	ppmvd	100	100	D-GCP
SO_2	ppmvd	30	24	SDA
HCl	ppmvd	25	20	SDA
VOC	ppmvd	-	7	D-GCP
PM	mg/dscm	20	12	FFBH
Lead (Pb)	ug/dscm	140	125	FFBH
Mercury (Hg)	ug/dscm	50	25	ACI/FFBH
Cadmium (Cd)	ug/dscm	10	10	FFBH
Opacity	percent	10	10	-
Ammonia Slip	ppmvd	-	10	-
Dioxins/Furans	ng/dscm	13	10	D-GCP

FAIRFIELD (Baltimore, Maryland) RENEWABLE ENERGY POWER PLANT

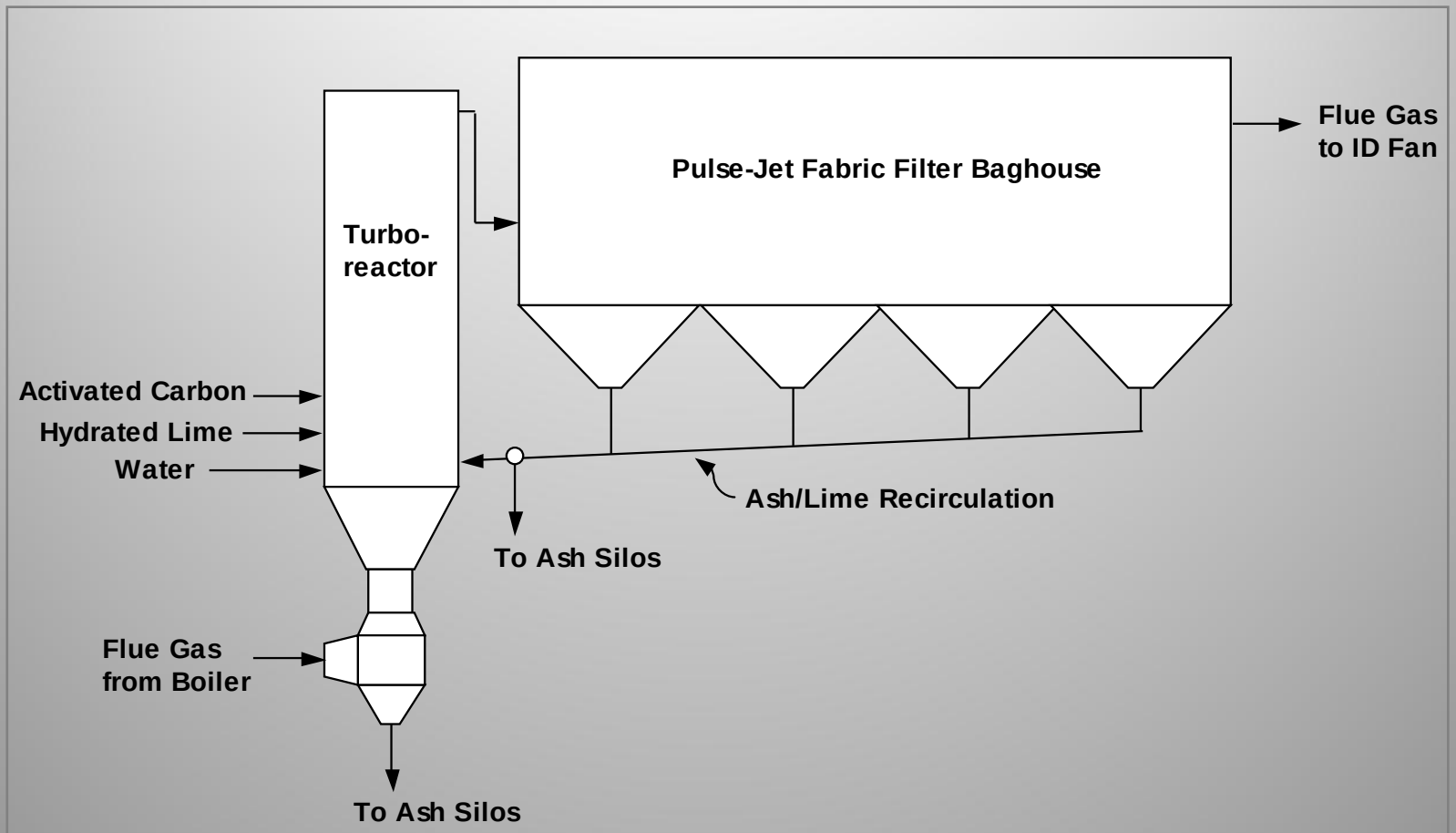
SPONSOR/OWNER:
Energy Answers International

PSD PERMITTING ENGINEER:
ARCADIS-US

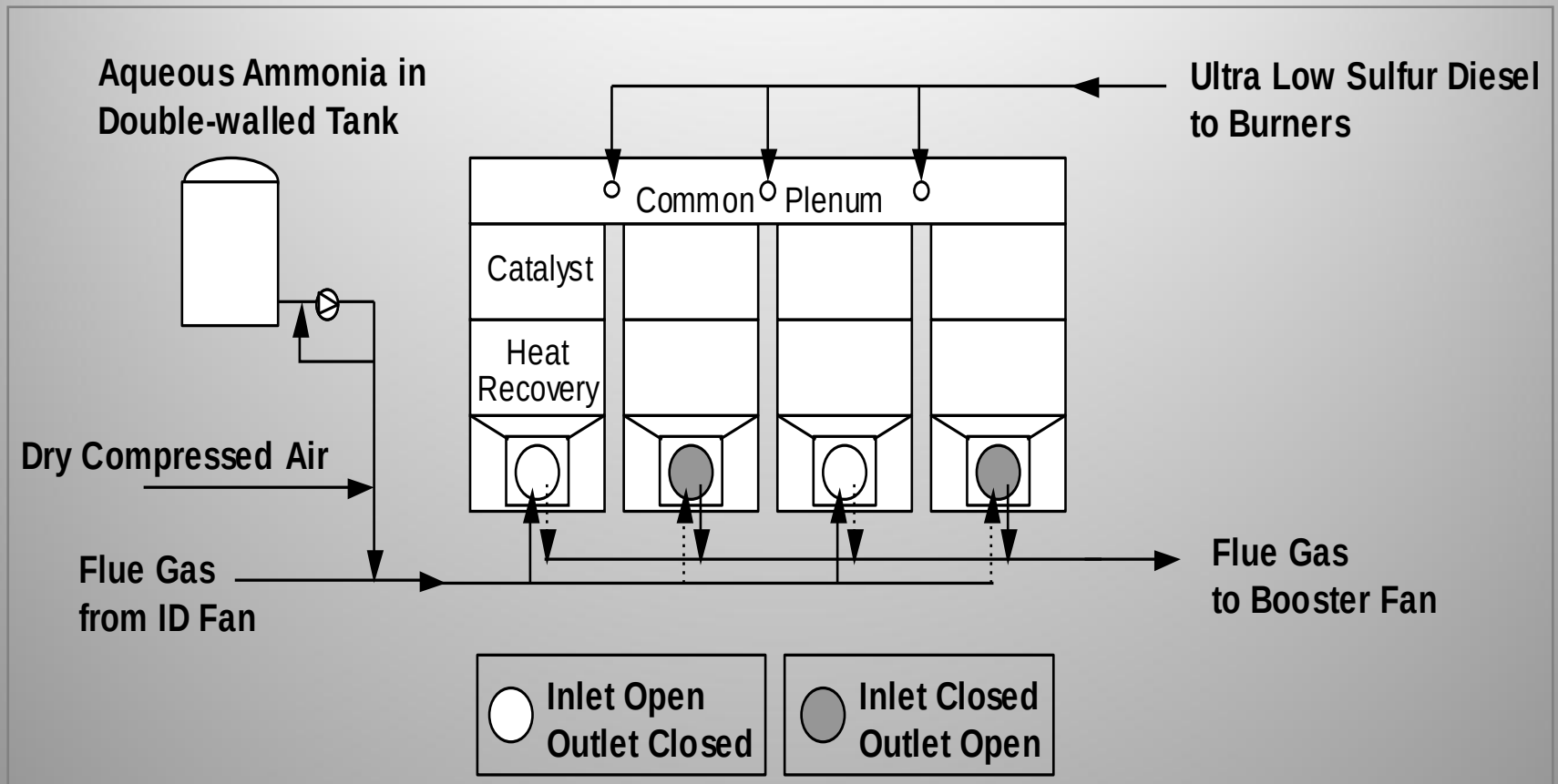
DESIGN/BUILD/OPERATOR:
Energy Answers International

STATUS: Pre-Construction

Four Unit, 4,212 tpd Refuse Derived Fuel Steam and Electricity Plant



Turbosorp® and Baghouse Schematic



Regenerative Selective Catalytic Reduction (RSCR®) Schematic

Fairfield Renewable Energy
Permit Limits

Pollutant	Units	Emission Rate		Control Technology
		Eb Standards	Fairfield Permit	
NOx	**ppmvd**	**150**	**45**	**RSCR**
CO	ppmvd	150	150	D-GCP
SO_2	ppmvd	30	24	Turbosorp
HCl	ppmvd	25	25	Turbosorp
VOC	ppmvd	-	10	Turbosorp
PM	mg/dscm	20	10	FFBH
PM_{10}	mg/dscm	-	24*	FFBH
$PM_{2.5}$	mg/dscm	-	10	FFBH
Lead (Pb)	ug/dscm	14	75	FFBH
Mercury (Hg)	ug/dscm	50	17	ACI/FFB
Cadmium (Cd)	ug/dscm	10	10	FFBH
Opacity	percent	10	10	-
Ammonia Slip	ppmvd	-	-	-
Dioxins/Furans	ng/dscm	13	13	ACI/Turbosorp
Fluoride (HF)	mg/dscm	-	3.6	Turbosorp
H_2SO_4	lb/MMBtu	-	0.014	Turbosorp

*Limit is for filterable and calculated condensable particulate matter.

AERCIBO (Puerto Rico) RENEWABLE ENERGY POWER FACILITY

Two Unit, 2,106tpd Refuse Derived Fuel Facility

SPONSOR/OWNER:
Energy Answers International

PSD PERMITTING ENGINEER:
ARCADIS-US

DESIGN/BUILD/OPERATOR:
Energy Answers International

STATUS: Permitting

GHG BACT ANALYSIS

Control Technologies	*Effective*	*Feasible*	*Adopted*
Utilization of Recycling	No	Yes	No
Utilization of Biomass	**Yes**	**Yes**	**Yes**
Capture/Sequestration	Yes	No	No
Energy Efficiency	**Yes**	**Yes**	**Yes**

GHG Emissions Summary

(tons/yr)

Emissions Source	*Total GHG*	*Total CO_2e*
Energy Answers Facility*	**767,858**	**767,858**
Transportation to Facility	**1,187**	**1,187**
Displaced Landfill	**(208,015)**	**(1,319,354)**
Displaced Oil Power Plant	**(697,673)**	**(697,706)**
Displaced Transport to Landfill	**(1,722)**	**(1,722)**
Total Change In Emissions	**(138,365)**	**(1,249,737)**

*GHG emissions were calculated to use worst case using fuel mix including tire, automobile shredder waste and urban wood waste.

Proposed GHG Emissions Limits

- The CO_2e emission limits shall include combined emissions of CO_2, CH_4 and N_2O, and shall not include biogenic CO_2 emission.
- The CO_2e emissions during normal operation shall not exceed 0.15 lb /lb of steam.
- The CO_2e emissions during normal operation, shall not exceed 454,706 tpy.
- The CO_2e emissions during periods of startup and shut down shall not exceed 4,847 tpy.
- The net heat rate shall not exceed 12.99 MMBTU/MWh.

Aercibo Renewable Energy
Proposed Permit Limits

Pollutant	Units	Emission Rate		Control Technology
		Eb Standards	Aercibo Permit	
NOx	**ppmvd**	**150**	**45**	**RSCR**
CO	**ppmvd**	**150**	**75**	**D-GCP**
SO_2	ppmvd	30	24	Turbosorp
HCl	ppmvd	25	20	Turbosorp
VOC	ppmvd	-	7	Turbosorp
PM	mg/dscm	20	10	FFBH
PM_{10}	**mg/dscm**	**-**	**24***	**FFBH**
$PM_{2.5}$	**mg/dscm**	**-**	**22***	**FFBH**
Lead (Pb)	ug/dscm	14	75	FFBH
Mercury (Hg)	ug/dscm	50	17	ACI/FFB
Cadmium (Cd)	ug/dscm	10	10	FFBH
Opacity	percent	10	10	-
Ammonia Slip	ppmvd	-	10	-
Dioxins/Furans	ng/dscm	13	13	ACI/Turbosorp
Fluoride (HF)	mg/dscm	-	3.2	Turbosorp
H_2SO_4	lb/MMBtu	-	1	Turbosorp

*Limit is for filterable and calculated condensable particulate matter.

Conclusions

- Future US WTE facilities will be required to use SCR.
- SCR will increase Capital and Operating Costs but not prohibitively (about 10% each).
- NO_x Emissions will be reduced by 75% compared to existing US WTE facilities.
- Meeting New One-Hour NO_x and SO_2, GHG and $PM_{2.5}$ Standards present significant but not insurmountable challenges.
- PSD Permitting will take longer and cost more.

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