#2 Rec

glass/plastic

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: Sam
Truck ID Number: 436 **Arrival Number:** 2
Hauler: City Alb DGS **Truck Type:** Recycling
Location:
Arrival Time: 7:50 **A.M.** _____ **P.M.**
Origin (Municipality):

PET #1 Non Bottle
(1) 10.1/5.0
(2) 10.9/5.0

HDPE #2
(1) 8.8/5.2
(2) 7.6/5.2

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	4.7	4.7	
Magazines	4.9	4.7	
Corrugated	4.9	4.7	
Gable Top Cartons & Drink Boxes	6.9	5.0	
Paper Board	8.2	5.0	
Books (including phone directories)	8.6	4.7	
Mixed Office Paper		4.7	
Other Paper	4.8	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill		5.0	
Plastic #1 (Bottle Bill Containers)	6.5	5.0	
Plastic Containers (HDPE) #2		5.2	
Other Plastic Containers	8.4	5.0	
Film Plastic & Plastic Bags	5.1	4.7	
Other Plastics	6.4	4.7	
FOOD WASTE		5.2	
TEXTILES & LEATHER		4.9	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	15.5	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal	6.0	4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)	5.2	5.0	
Aluminum Cans (Bottle Bill)	5.4	4.7	
Other Non-Ferrous Metal	6.3	4.9	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	7.9	4.8	
Glass Bottle - Clear	36.7	4.8	
Glass Bottle - Amber	11.3	4.7	
Glass Bottle - Green	18.9	4.7	
Flat Glass & Other Glass	5.6	4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#3 Rec

paper

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: Sam
Truck ID Number: 434 **Arrival Number:** 3
Hauler: city Alb DGS **Truck Type:** Recycling
Location:
Arrival Time: 9:15 **A.M.** _____ **P.M.**
Origin (Municipality):

News
① 88.2 / 4.7
② 27.6 / 4.7

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper		4.7	
Magazines	24.3	4.7	
Corrugated	16.8	4.8	
Gable Top Cartons & Drink Boxes	5.1	5.0	
Paper Board	14.6	5.0	
Books (including phone directories)	44.1	4.7	
Mixed Office Paper	23.2	4.7	
Other Paper	7.3	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill		5.0	
Plastic #1 (Bottle Bill Containers)		5.0	
Plastic Containers (HDPE) #2	5.4	5.3	
Other Plastic Containers	5.3	5.0	
Film Plastic & Plastic Bags	4.8	4.7	
Other Plastics		4.7	
FOOD WASTE		5.7	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans		5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		5.0	
Aluminum Cans (Bottle Bill)		4.7	
Other Non-Ferrous Metal		4.8	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	5.3	4.8	
Glass Bottle - Clear		4.8	
Glass Bottle - Amber		4.7	
Glass Bottle - Green		4.7	
Flat Glass & Other Glass		4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#3 Rec

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Plastic/Glass

Day/Date: Wed 3/4/09
CHA Staff Name: Same
Truck ID Number: 434 **Arrival Number:** 3
Hauler: City 116 DGS **Truck Type:** Recycling
Location:
Arrival Time: 9:15 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper		4.7	
Magazines	6.9	4.8	
Corrugated		4.8	
Gable Top Cartons & Drink Boxes	6.6	5.0	
Paper Board	7.8	5.0	
Books (including phone directories)		4.7	
Mixed Office Paper	5.1	4.7	
Other Paper	5.9	4.8	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	10.9	5.0	
Plastic #1 (Bottle Bill Containers)	5.5	4.9	
Plastic Containers (HDPE) #2	7.9	5.3	
Other Plastic Containers	9.1	5.0	
Film Plastic & Plastic Bags	5.0	4.7	
Other Plastics	8.6	~~4.8~~ 4.7	
FOOD WASTE		5.2	
TEXTILES & LEATHER	5.5	4.9	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	25.1	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)	~~10.9~~	5.0	
Aluminum Cans (Bottle Bill)	5.5	4.8	
Other Non-Ferrous Metal	6.1	4.9	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	21.1	4.8	
Glass Bottle - Clear	33.5	4.8	
Glass Bottle - Amber	8.1	4.7	
Glass Bottle - Green	17.1	4.7	
Flat Glass & Other Glass	5.3	4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#4 Roe

Paper

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

News
① 91.4/4.7
② 14.2/4.7

Day/Date: Wednesday 3/4/09
CHA Staff Name: Sam
Truck ID Number: 5314 1432 **Arrival Number:** 4
Hauler: City Alb 1065 **Truck Type:** Recycling
Location:
Arrival Time: 10:00 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper		4.7	
Magazines	10.2	4.8	
Corrugated	15.7	4.8	
Gable Top Cartons & Drink Boxes	5.2	5.0	
Paper Board	14.3	5.0	
Books (including phone directories)	5.4	4.7	
Mixed Office Paper	6.7	4.7	
Other Paper	6.8	4.8	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill		5.0	
Plastic #1 (Bottle Bill Containers)		5.0	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers		5.0	
Film Plastic & Plastic Bags	4.8	4.7	
Other Plastics		4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans		5.0	
Aerosol Cans		4.7	
Other Ferrous Metal		4.7	
NON-FERROUS METALS		~~5.0~~	
Aluminum Cans (Non-Bottle Bill)		~~4.7~~ 5.0	
Aluminum Cans (Bottle Bill)		4.8	
Other Non-Ferrous Metal		4.8	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)		4.8	
Glass Bottle - Clear		4.8	
Glass Bottle - Amber		4.7	
Glass Bottle - Green		4.7	
Flat Glass & Other Glass		4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#4 Rec

glass/ plastic

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wednesday 3/4/09
CHA Staff Name: Same
Truck ID Number: 53,4/432 **Arrival Number:** 4
Hauler: City Alb DGS **Truck Type:** Recycling
Location:
Arrival Time: 10:00 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	7.4	4.7	
Magazines		4.7	
Corrugated	4.9	4.7	
Gable Top Cartons & Drink Boxes	6.6	4.9	
Paper Board	6.4	5.0	
Books (including phone directories)		4.7	
Mixed Office Paper	5.8	4.7	
Other Paper	5.1	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	~~6.7~~	5.0	
Plastic #1 (Bottle Bill Containers)	5.6	5.0	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers	7.7	5.0	
Film Plastic & Plastic Bags	5.3	4.7	
Other Plastics	5.6	4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	17.7	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS		~~5.0~~	
Aluminum Cans (Non-Bottle Bill)	5.3	5.0	
Aluminum Cans (Bottle Bill)	5.5	4.7	
Other Non-Ferrous Metal	6.0	4.8	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	11.1	4.8	
Glass Bottle - Clear	44.7	4.8	
Glass Bottle - Amber	11.0	4.7	
Glass Bottle - Green	22.9	4.7	
Flat Glass & Other Glass	8.3	4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

HDPE
) 9.7/5.3
) 7.0/5.3

Plas- Non Bott.
) 11.4/5.0
) 6.7/5.0

#5 Roe

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

paper

Day/Date: Wed. 3/4/09
CHA Staff Name: Sam
Truck ID Number: 436 **Arrival Number:** 5
Hauler: City D/6 DGS **Truck Type:** Recycling
Location:
Arrival Time: 11:00 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	79.4	4.7	
Magazines	26.2	4.7	
Corrugated	13.2	4.7	
Gable Top Cartons & Drink Boxes	5.4	4.9	
Paper Board	13.5	5.0	
Books (including phone directories)	39.1	4.7	
Mixed Office Paper	19.8	4.7	
Other Paper	6.3	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	5.4	5.0	
Plastic #1 (Bottle Bill Containers)		4.9	
Plastic Containers (HDPE) #2	5.4	5.2	
Other Plastic Containers	5.4	5.0	
Film Plastic & Plastic Bags	4.8	4.7	
Other Plastics		4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	5.5	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		4.9	
Aluminum Cans (Bottle Bill)		4.8	
Other Non-Ferrous Metal		5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	5.2	4.8	
Glass Bottle - Clear		4.9	
Glass Bottle - Amber		4.8	
Glass Bottle - Green	5.9	4.7	
Flat Glass & Other Glass		4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#5 Rec

glass/plastics

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wednesday 3/4/09
CHA Staff Name: Sam
Truck ID Number: 436 **Arrival Number:** 5
Hauler: City Alb Pos **Truck Type:** Recycling
Location:
Arrival Time: 11:00 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	9.2	4.7	
Magazines		4.7	
Corrugated		4.7	
Gable Top Cartons & Drink Boxes	7.2	4.9	
Paper Board	9.7	5.0	
Books (including phone directories)	9.0	4.7	
Mixed Office Paper	5.2	4.7	
Other Paper		4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	10.8	5.0	
Plastic #1 (Bottle Bill Containers)	5.3	4.9	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers	8.2	5.0	
Film Plastic & Plastic Bags	5.1	4.7	
Other Plastics	6.2	4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	15.9	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		4.9	
Aluminum Cans (Bottle Bill)	5.1	4.7	
Other Non-Ferrous Metal	7.1	5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	6.1	4.8	
Glass Bottle - Clear	43.7	4.8	
Glass Bottle - Amber	15.8	4.8	
Glass Bottle - Green	34.6	4.7	
Flat Glass & Other Glass		4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.8	

HDPE
① 9.7/5.3
② 8.2/5.3

#6 Rec

paper

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wednesday 3/4/09
CHA Staff Name: 3 Ame
Truck ID Number: 434 **Arrival Number:** 6
Hauler: City DIG DGS **Truck Type:** Recycling
Location:
Arrival Time: 11:30 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper		4.7	
Magazines	24.9	4.7	
Corrugated	14.5	4.7	
Gable Top Cartons & Drink Boxes	5.3	5.0	
Paper Board		5.0	
Books (including phone directories)	31.0	4.7	
Mixed Office Paper	15.8	4.7	
Other Paper	8.8	4.7	
PLASTICS		~~4.7~~	
Plastic Containers (PET) #1 Non-Bottle Bill		5.0	
Plastic #1 (Bottle Bill Containers)		4.9	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers	5.3	5.0	
Film Plastic & Plastic Bags	4.9	4.7	
Other Plastics		4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER	5.0	5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	5.5	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		5.0	
Aluminum Cans (Bottle Bill)		4.7	
Other Non-Ferrous Metal	5.4	5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	5.8	4.8	
Glass Bottle - Clear		4.8	
Glass Bottle - Amber		4.7	
Glass Bottle - Green		4.8	
Flat Glass & Other Glass		4.8	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

Newspaper
76.8/4.7
20.5/4.7

Paperboard
15.3/5.0
5.5/5.0

#6 Rec

plastic/glass

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: Jane
Truck ID Number: 434 **Arrival Number:** 6a
Hauler: DGS **Truck Type:** Recycling
Location:
Arrival Time: 11:31 **A.M.** _____ **P.M.**
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	5.3	4.7	
Magazines	5.6	4.7	
Corrugated		4.7	
Gable Top Cartons & Drink Boxes	6.6	4.9	
Paper Board	7.9	5.0	
Books (including phone directories)	5.3	4.7	
Mixed Office Paper	4.7	4.7	
Other Paper		4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	12	5.1	
Plastic #1 (Bottle Bill Containers)	6.8	4.9	
Plastic Containers (HDPE) #2		5.2	
Other Plastic Containers	8.2	5.0	
Film Plastic & Plastic Bags	5.0	4.7	
Other Plastics	6.2	4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	16.3	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)	5.3	4.9	
Aluminum Cans (Bottle Bill)	5.2	4.8	
Other Non-Ferrous Metal	7.3	5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	9.6	4.8	
Glass Bottle - Clear	40.0	4.9	
Glass Bottle - Amber	10.1	4.8	
Glass Bottle - Green	37.3	4.7	
Flat Glass & Other Glass	7.0	4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

Plastic Non bottle
① 10.3/5.1
③ 12.3/5.1

HDPE
① 9.1/5.2
③ 8.2/5.3

87 Rec

paper

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: Same 430/5312
Truck ID Number: ~~435/5323~~ **Arrival Number:** 87
Hauler: DGS **Truck Type:** Recycling
Location:
Arrival Time: _____ A.M. ~~1:30~~ 1:05 P.M.
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	59.2	4.7	
Magazines	28.5	4.7	
Corrugated	11.5	4.8	
Gable Top Cartons & Drink Boxes	5.4	4.9	
Paper Board		5.0	
Books (including phone directories)	9.7	4.7	
Mixed Office Paper	33.4	4.7	
Other Paper	7.9	4.8	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill		5.1	
Plastic #1 (Bottle Bill Containers)		5.0	
Plastic Containers (HDPE) #2	5.3	5.3	
Other Plastic Containers	5.1	5.0	
Film Plastic & Plastic Bags	4.7	4.7	
Other Plastics		4.7	
FOOD WASTE		5.1	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	52	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		4.9	
Aluminum Cans (Bottle Bill)		4.7	
Other Non-Ferrous Metal		5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)		4.8	
Glass Bottle - Clear		4.8	
Glass Bottle - Amber		4.8	
Glass Bottle - Green		4.8	
Flat Glass & Other Glass		~~4.8~~ 4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

paperboard
~~15.0~~ 16.0/5.0
11.8/5.0

#7 Rec

glass/plastic

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: Sam
Truck ID Number: 430 / 5312 **Arrival Number:** 7
Hauler: **Truck Type:**
Location:
Arrival Time: ~~A.M.~~ **A.M.** 1:05 **P.M.**
Origin (Municipality):

PET - Non Bottle
(1) 10.8/5.0
(2) 7.5/5.0

HDPE
(1) 8.4/5.3
(2) 10.5/5.3

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	5.2	4.7	
Magazines	6.7	4.7	
Corrugated	6.4	4.7	
Gable Top Cartons & Drink Boxes	6.3	4.9	
Paper Board	6.0	5.0	
Books (including phone directories)		4.7	
Mixed Office Paper		4.8	
Other Paper	5.1	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	~~7.5~~	5.0	
Plastic #1 (Bottle Bill Containers)	5.7	4.9	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers	8.2	5.0	
Film Plastic & Plastic Bags	5.2	4.7	
Other Plastics	6.8	4.7	
FOOD WASTE		5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	15.1	5.1	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)	5.4	5.0	
Aluminum Cans (Bottle Bill)	5.3	4.7	
Other Non-Ferrous Metal	8.7	5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	8.0	4.7	
Glass Bottle - Clear	38.0	4.8	
Glass Bottle - Amber	9.1	4.7	
Glass Bottle - Green	18.7	4.8	
Flat Glass & Other Glass		4.8	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

#8 Rec

Paper

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name:
Truck ID Number: 435/5323 **Arrival Number:** 8
Hauler: DGS **Truck Type:** Recycling
Location:
Arrival Time: _____ A.M. 1:30 P.M.
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper		4.7	
Magazines	43.0	4.7	
Corrugated	11.8	4.7	
Gable Top Cartons & Drink Boxes	4.9	5.0	
Paper Board	9.5	5.0	
Books (including phone directories)	27.7	4.7	
Mixed Office Paper	28.5	4.7	
Other Paper	6.8	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	5.1	5.1	
Plastic #1 (Bottle Bill Containers)	5.1	5.0	
Plastic Containers (HDPE) #2		5.3	
Other Plastic Containers	5.1	5.0	
Film Plastic & Plastic Bags	4.8	4.7	
Other Plastics		4.9	
FOOD WASTE		5.1	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS	5.3	4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans		5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)		4.9	
Aluminum Cans (Bottle Bill)		4.7	
Other Non-Ferrous Metal		5.0	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)		4.8	
Glass Bottle - Clear		4.8	
Glass Bottle - Amber		4.8	
Glass Bottle - Green		4.8	
Flat Glass & Other Glass		4.7	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE		~~4.7~~	
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

News ① 76.9/4.7
② 11.0/4.7

6/3
2 5x11

8 Rec

glass/plastic

CITY OF ALBANY
WASTE CHARACTERIZATION ANALYSIS
SORT DATA SHEET

Day/Date: Wed 3/4/09
CHA Staff Name: 435 5323
Truck ID Number: 430/5372 **Arrival Number:** ~~7~~ 8
Hauler: DGS **Truck Type:**
Location:
Arrival Time: _____ A.M. ~~1:05~~ 1:30 P.M.
Origin (Municipality):

Material Components	Gross Weight (Lbs.)	Tare Weight Of Sort Container	Net Weight (Lbs.)
PAPER			
Newspaper	8.2	4.7	
Magazines	5.6	4.7	
Corrugated		4.8	
Gable Top Cartons & Drink Boxes	5.9	5.0	
Paper Board	8.0	5.0	
Books (including phone directories)	8.5	4.7	
Mixed Office Paper	6.5	4.8	
Other Paper	5.1	4.7	
PLASTICS			
Plastic Containers (PET) #1 Non-Bottle Bill	10.6	5.0	
Plastic #1 (Bottle Bill Containers)	5.3	5.0	
Plastic Containers (HDPE) #2	7.6	5.3	
Other Plastic Containers	7.1	5.0	
Film Plastic & Plastic Bags	5.4	4.8	
Other Plastics	8.9	4.7	
FOOD WASTE	5.6	5.3	
TEXTILES & LEATHER		5.0	
RUBBER		4.8	
DISPOSABLE DIAPERS		4.8	
FERROUS METALS			
Ferrous Metal/Bimetal Cans	17.5	5.0	
Aerosol Cans		4.9	
Other Ferrous Metal		4.9	
NON-FERROUS METALS			
Aluminum Cans (Non-Bottle Bill)	5.1	5.0	
Aluminum Cans (Bottle Bill)	5.1	4.8	
Other Non-Ferrous Metal	8.6	5.1	
ELECTRONICS			
GLASS			
Glass Bottles (Bottle Bill)	18.7	4.8	
Glass Bottle - Clear	103.1	4.9	
Glass Bottle - Amber	19.4	4.7	
Glass Bottle - Green	96.9	4.8	
Flat Glass & Other Glass	5.1	4.8	
WOOD		4.8	
RUBBLE		4.8	
YARD WASTE		4.7	
DIRT/FINES		4.8	
HAZARDOUS WASTE			
Household Hazardous Waste (HHW)		4.7	
Lead Acid Batteries		4.7	
Other Batteries		4.7	
MEDICAL OR PHARMACEUTICAL WASTE		5.0	
MISCELLANEOUS		4.7	

APPENDIX D
SOLID WASTE SORTING PROTOCOL

Detailed Protocol for the Waste Characterization Field Study
Capital Region Solid Waste Management Plan

1.0 Introduction and Summary

The purpose and objective of this field study is to characterize the constituents of the solid waste and recycled materials stream for the Capital Region Solid Waste Planning Unit. Characterizing the local waste stream will provide valuable information for planning future improvements to local recycling efforts as well as for evaluating the feasibility of alternative solid waste management systems. Another purpose of the study is to examine differences in solid waste composition collected by a municipal agency (such as the City of Albany DGS) and commercial haulers servicing commercial, industrial or institutional customers as well as multi-family dwellings.

The field study will be done over a 5 day work week Monday through Friday during the week of February 23rd. The week will be used to sample and characterize solid waste deliveries to the Rapp Road Landfill as well as sample and characterize curbside recyclables collected by the City of Albany DGS. .

The program will generally follow the American Society of Testing Materials Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste, ASTM D5231-92 (Reapproved 2003). This test method describes procedures for measuring the composition of unprocessed municipal solid waste (MSW) by employing manual sorting. This test method applies to determination of the mean composition of MSW based on the collection and manual sorting of a number of samples of waste over a selected time period covering a minimum of one week. This test method includes procedures for the collection of a representative sorting sample of unprocessed waste, manual sorting of the waste into individual waste components, data reduction, and reporting of the results.

Waste and recyclable delivery vehicles will be selected randomly from eligible collection routes and representative samples will be secured from each of load. Samples will be sorted into separate containers for each of the designated categories, after which the constituents will be weighed and the results tallied. The following 39 waste and recyclable categories will be sorted as part of this study:

Newspaper
Magazines
Corrugated
Gable top cartons and drink boxes
Paperboard
Books, including phone directories
Mixed Office paper
Other Paper
Plastic containers (PET) #1 Non-bottle bill

Plastic #1 - bottle bill containers
Plastic containers (HDPE) #2
Other Plastic containers
Film Plastic and plastic bags
Other Plastics
Food Waste
Textiles and leather
Rubber
Disposable Diapers
Ferrous metal/bi-metal cans
Aerosol cans
Other ferrous metal
Aluminum cans – non bottle bill
Aluminum cans – bottle bill
Other non-ferrous metal
Electronics
Glass bottles - bottle bill
Glass bottles - non bottle bill sorted by color:

- Clear
- Amber
- Green

Flat Glass and other Glass
Wood
Rubble
Yard Waste
Fines
HHW
Lead Acid Batteries
Other batteries
Medical or Pharmaceutical waste
Miscellaneous

It is anticipated that the sorting and sampling crew will consist of 7 people, including one Site Supervisor responsible for vehicle sampling and oversight, one Crew Chief responsible for oversight of the manual sorting effort, and 5 sorting staff. Detailed work protocols have been developed for the crew with respect to sample selection, sorting, weighing, and clean-up, and these are presented in Sections 2 and 3, below. Appropriate health and safety protocols have been developed for the sorting and sampling crew to minimize exposures to environmental and physical hazards. The health and safety plan is presented in Section 3.

2.0 MSW Characterization

The existing building at the Rapp Road Landfill site formerly used for waste tipping and processing will be used for sample collection, sorting and weighing of the MSW (hereafter called the processing building). Waste sample collection and sorting will commence on Monday February 23rd and continue through Friday February 27th, 2009.

2.1 Sampling and Sorting Protocol

In the week prior to commencing the field study, the City of Albany DGS will inform haulers using of its landfill that the study will be in progress during the following week.

Preparation for the sampling and sorting program will be conducted as follows:

During the week preceding the first sample collection and sorting, the site supervisor and/or crew chief will:

- complete arrangements for the purchase and rental of the necessary equipment and protective gear;
- visit the landfill site and processing building and finalize any site logistical issues, including location of the exact areas where the waste discharge, sampling, and sorting operations will be conducted, and clean-up an waste disposal arrangement (including contingency for disposal of any hazardous materials discovered during the process);
- Using a random number generator, determine the vehicle numbers that will be sampled on each day, in accordance with the procedure described below.

On Friday February 20th, 2009 a crew training and orientation session will be conducted at a CHA training room to cover the following topics:

- Description of vehicle unloading and collection of samples
- Discussion of components to be sorted
- Discussion of equipment and data collection methods.
- Review of Health and Safety Plan
- Next weeks work schedule and equipment set-up.

This meeting will run from 2 pm to 4 pm. Representatives of the City of Albany DGS who will be participating in some of the study activities will be invited to attend this session.

On Monday, February 23rd, 2009, the entire work crew will arrive at the landfill site at 6:30 AM to commence equipment set up as follows:

- Deliver equipment and supplies to the processing building
- Position the scale on a clean, flat surface and calibrate the scale
- Secure a label to each barrel or receptacle indicating the sorted component to be placed in the receptacle;
- Weigh all empty barrels and receptacles and record tare weights;
- Set up the sorting table on a 10'X10' tarp, and place the receptacles at convenient locations around the table.

During each day starting on Monday February 23rd, randomly selected vehicles carrying MSW will be diverted to the processing building by the Site Supervisor, who will be situated at the scale house. The Site Supervisor will then interview the driver to determine the eligibility of the vehicle for sampling. Eligible vehicles will then be diverted to the processing building for the

sampling and sorting procedure, indicated below. Ineligible vehicles will include vehicles delivering cover soil, contaminated soils, full loads of construction and demolition debris, or full loads of MSW originating outside of the municipalities which are members of the Planning Unit.

The sampling protocol conducted by the site supervisor will then proceed as follows:

1) Inform the DGS scale house attendant of the vehicle diverted to the processing building.
2) As the selected vehicle moves off the scale the driver will be directed to pull off onto the right shoulder, adjacent to the leachate storage tank. The driver will be interviewed using the Waste Origin Survey Form (Attachment 1).
3) As a result of the information received during the interview a determination is then made if the vehicle is suitable for sorting.
   a. If the vehicle is not acceptable for sorting, the driver will be directed to proceed to the left up the access road to the working face of the landfill. In this case the Site Supervisor will return to the scale house and select the next available vehicle.
   b. If the vehicle is eligible, the driver will be directed to drive to the processing building.
4) After entering the processing building, the driver will be directed to discharge its load in one contiguous pile in a designated area on the tipping floor.
5) After discharging, the driver will be directed to leave the processing building and return to the scale house to weigh out.
6) Under the direction of the Crew Chief, DGS personnel operating a front end loader or skid steer loader (1 CY minimum bucket size) will remove material longitudinally along one side of the entire pile. The mass of this removed material should be sufficient to form a mass of material which on a visual basis is at least 1,000 lbs, or approximately 4 CY. This removed material shall be mixed, coned and quartered. The Crew chief will randomly select one of the quarters and the front end loader will collect the selected material.
7) If the diverted truck is a compartmentalized recyclables truck (i.e. if a truck is delivering separate loads of mixed paper and containers), the sample should be obtained from each of the loads from that truck, approximately 2 CY from each. This removed material shall be mixed, coned and quartered. The Crew chief will randomly select one of the quarters and the front end loader will collect the selected material.
8) The selected sample will be transported by front end loader and deposited at a designated location in the sorting area.
9) The sorters will transfer the sample to the sort table, and will generally open all containers and remove the contents prior to sorting. An exception will be in the case of a container containing a household hazardous waste (HHW). In this case both the container and its contents will be sorted as the HHW.
10) Composite items will be observed to judge the major component in the composite by weight, and will then be sorted according to its component constituent.
11) Continue sorting all items until the maximum remaining particle size is approximately ½ inch. These particles will fall through a ½ inch screen will be collected on a tarp beneath the screen.

12) After sorting is complete, record the gross weight of each storage container and of any waste items sorted but not stored in containers. Gross weight and tare weight should be recorded for each material component and container on the Sort Data Sheet.
13) Reweigh empty containers if they appear wet and record new tare weights if necessary.
14) Clean up the sorting area and the designated vehicle discharge area of any waste material. HHW, Electronic Waste, and Lead Acid Batteries will be segregated from other remaining waste stream components so that they can be properly handled.
15) These procedures will be documented by a sufficient photographic record taken by a member of the sorting crew.

After sorting of the sample from a collection vehicle is nearly complete, the Crew Chief will inform the Site Manager (via two-way radio) that a new vehicle may be selected for sampling.

2.2 Personnel Responsibilities

Assigned DGS Employee – Operate front end loader to select waste samples at the direction of CHA Crew Chief, and to move waste and sampled material to designated area after samples are complete, so that the waste material can be transferred for disposal in the landfill.

CHA Site Supervisor – Overall supervision of the waste characterization field study. Also responsible for interviewing drivers and completing the Waste Origin Survey Forms.

CHA Crew Chief – Responsible for supervision of the waste sorting effort and staff, and compilation of the sort data sheets.

CHA Staff – responsible for set-up, sample loading, sorting, weighing, and clean-up.

3.0 Health and Safety Plan

CLOUGH HARBOUR & ASSOCIATES LLP

SITE HEALTH AND SAFETY PLAN

PROJECT INFORMATION

Project Name: Albany Landfill Solidwaste Characterization Study	**CHA Project No.** 19283
Project Start Date: 2/23/09 **Completion Date:** 2/27/09	**Weather:**
Project Location: 2/23/09 - landfill	**Project Task:** 2/23/09 - Classification of Solid Waste per ASTM procedure

Description of Work: The field crew will be sorting solid waste into 39 different classifications from randomly selected loads. Loads will be approximately 250 lbs and will be transferred from the concrete floor onto work tables using rakes and shovels. Solid waste will be sorted into classifications and placed in corresponding bins.

Key Personnel:	Ken Gallagher	Sarah Johnston	Jamie Herrick
Responsibilities:	*Project Manager*	*Field Team Leader*	*Site Safety Officer*

Description of Hazards: heavy equipment, wet/slippery floors, use of rakes and shovels, climatic conditions, household hazardous waste, biomedical waste, human and animal waste, glass and other sharp objects.

TASK HAZARDS				TASK SAFETY MEASURES & PPE	
Eye	Chemical Exposure	Yes ☐	No ☐	☒ Safety Glasses	
	High Heat/Cold	Yes ☐	No ☐	☐ Safety Goggles	
	Dust/Flying Debris	Yes ☒	No ☐	☐ Face Shield	
	Impact	Yes ☐	No ☐	☐ Shaded Lenses	
	Light/Radiation	Yes ☐	No ☐		
Head	Impact	Yes ☐	No ☐	☒ Hard Hat: ☒ Orange or ☐ White or ☐ Blue	
	Electrical Shock	Yes ☐	No ☐	☐ Reflector Tape (Required for night operations)	
	Lack of Visibility	Yes ☒	No ☐		
Foot	Chemical Exposure	Yes ☐	No ☐	☒ Work Boots	☒ Steel Toed Boots
	High Heat/Cold	Yes ☒	No ☐	☐ Ankle Protection	☐ I/75 C/75 (Impact/Compression)
	Impact/Compression	Yes ☐	No ☐	☐ Rubber Boots	☐ Cd Type 1 or 2 (Conductive)
	Slips/Trips	Yes ☒	No ☐	☒ Insulated Boots	☐ PR (Puncture Resistant)
	Puncture	Yes ☒	No ☐	☒ Non-slip Soles	☐ Mt/70 or 50 or 30 (Metatarsal)
	Slippery/Wet Surface	Yes ☒	No ☐	☐ Chemical resistant	☐ EH (Electrical Hazard)
	Explosive/Flammable Atmospheres	Yes ☐	No ☐		☐ SD Type I or II (Static Dissipative)
	Electrical	Yes ☐	No ☐		
Hand	Chemical Exposure	Yes ☐	No ☐	☐ Work Gloves	☐ Rubber Gloves
	High Heat or Cold	Yes ☒	No ☐	☐ Leather Gloves	☐ Nitrile Gloves
	Cuts/Abrasion	Yes ☒	No ☐	☒ Latex Gloves	☐ Insulated Gloves
	Puncture	Yes ☒	No ☐	☐ Vinyl Gloves	☒ Kevlar Gloves
	Electrical Shock	Yes ☐	No ☐	☒ Neoprene Gloves	
	Bloodborne Pathogen	Yes ☒	No ☐	☐ Butyl Gloves	
Body/Torso	Chemical Exposure	Yes ☐	No ☐	☒ Tyvek Suits: ☐ White or ☒ Yellow	
	Extreme Heat/Cold	Yes ☐	No ☐	☐ UV Protection	☒ First Aid Kit
	Abrasion	Yes ☐	No ☐	☐ Coveralls	☐ Traffic Cones
	Impact	Yes ☐	No ☐	☒ Reflective Vest	☐ Signage
	Electrical Arc	Yes ☐	No ☐	☐ Insect Repellent	☒ 2- Way Radios

	Biological Hazards	Yes ☒	No ☐	☐ Tick Removal Kit ☐ Flashlight
Fall	Fall Hazard	Yes ☐	No ☒	☐ Harness ☐ Fall Protection Lanyard
Noise	Noise Hazard	Yes ☐	No ☒	☐ Ear Plugs ☐ Ear Muffs
Respiratory	Chemical Exposure	Yes ☐	No ☐	☐ Respirator: ☐ ½ Face or ☐ Full Face
	Confined Spaces	Yes ☐	No ☐	☐ Cartridge: ☐ P or ☐ OV or ☐ C
	Particulate Exposure	Yes ☐	No ☐	
	Welding Hazard	Yes ☐	No ☐	

SITE CONTROL

Site Control/Site Security[1]: *Describe Measures*	NA	M & PT: ☐ Y ☒ N *If yes, sketch information on separate sheet*
Confined Space Entry: *If Yes, Attach Permit*	☐ Y ☒ N	
Decontamination: *If Yes, Describe Procedures*	☒ Y ☐ N cleaning solution will be available to clean the rubber gloves, glasses, tools, etc.	
Site Monitoring[2]: *If Yes, Describe Procedures*	☒ Y ☐ N a four gas meter will be used to monitor the air throughout the duration of the project.	

CONTINGENCY PLAN

Emergency Contacts: *Provide Telephone Numbers*	Police: 911 Ambulance: 911 Fire: 911 Hospital: St. Peters/ER–525-1324 AMC ER – 262-3131	Client Contact: Joe Giebelhaus, Solid Waste Manager, Client Phone #: cell 229-7806 ; office 869-3651 CHA PM Phone #: Frank LaVardera 424-3420 cell Ken Gallagher 201-232-3407 cell Poison Control: 800 336-6997
Route to Hospital:	see attachment for directions	
Communication:	☒ Cell Phone ☐ Nearest Pay Phone ☐ Pager	

Comments: Dust masks and scented products will be provided for odor control if necessary (optional). Anti-bacterial lotion will be on-site. Drinking water will be located in a convenient location.

PLAN SIGN-OFF

Name:	Name:	Name:	Name:
X:	X:	X:	X:
Date:	Date:	Date:	Date:
Name:	Name:	Name:	Name:
X:	X:	X:	X:
Date:	Date:	Date:	Date:

1 Who is providing site control/site security, if any, for this task? Examples of Site Control/Site Security include police, client representative(s), owner(s), CHA or client supervisors

2 What are you monitoring on site, if any, for this task? Examples of Site Monitoring include air monitoring, like carbon monoxide or oxygen levels or wet bulb temperatures

APPENDIX E
ASSESSMENT OF EMERGING SOLID WASTE MANAGEMENT TECHNOLOGIES

1.0 INTRODUCTION AND DEFINITIONS

As part of the New SWMP process, the City of Albany is identifying and evaluating solid waste management technologies that could potentially reduce the amount of solid waste requiring landfill disposal. The SWMP will consider both established and emerging technologies for possible inclusion in the region's long-term solid waste program.

This assessment of emerging solid waste management technologies was prepared as part of the SWMP. This comparative evaluation is not intended to result in the selection of any particular technology or any particular company. Rather, it is intended to facilitate a conclusion about whether continued consideration of one or more of these technologies is appropriate as an on-going element of the New SWMP.

For the purposes of this evaluation, "emerging" solid waste management technologies are defined as technologies with the potential to provide commercial-scale, effective means of municipal solid waste processing and disposal, but which currently have little or no commercial application in the United States. Technologies that have only recently been introduced to the U.S. in a demonstration or commercial capacity qualify as emerging. Emerging technologies with existing commercial applications in other countries, but which have not been implemented in the U.S, are also included in this analysis.

Proven technologies with widespread commercial use in the U.S. are not included in the definition of emerging technologies. Waste-to-energy facilities (including both mass-burn and mechanically processed refuse derived fuel), stand-alone material recovery facilities (MRF), composting facilities for organic waste and conventional landfills do not qualify as new or emerging technologies, and are not included in this assessment.

This analysis includes information provided by respondents to a Request for Information, as further described in Section 2.0, as well as information about other new and emerging technologies derived from recent studies conducted in other jurisdictions and from other sources. A summary description of the details of many of the emerging technologies is presented in Section 3.0, where they are characterized by type of process and other factors. Information provided in the RFI responses is summarized in this section.

Section 4.0 describes some recent assessments of emerging technologies conducted by other jurisdictions who are evaluating these alternatives. Section 5.0 presents the findings and conclusions of this analysis in the context of the Capital Region Solid Waste Management Plan.

2.0 REQUEST FOR INFORMATION

As part of this process, a Request for Information (RFI) was prepared and distributed to solicit preliminary statements of interest and background information from parties wishing to participate in the evaluation process. The availability of the RFI was advertised in national publications (Waste Age and Waste and Recycling News) and began being distributed on February 16, 2009. Responses were requested on or before March 27, 2009.

Interested parties were invited to provide basic information regarding their sponsored technologies, including measures of actual or anticipated performance in each of the following categories of criteria:

- Experience of Project Sponsors
- Facility Sizing
- Costs of Ownership and Operation
- Environmental Impacts
- Readiness and Reliability
- Beneficial Reuse of MSW Byproducts
- Residues Requiring Landfill Disposal

A copy of the RFI is presented in Appendix A.

Fifteen (15) companies provided submittals in response to the RFI. Table 1 provides a summary of the RFI respondents.

Table 1 –Summary of Respondents to RFI

Name	Primary Treatment Type	Primary Product	Reference Facilities	Comment
Biogold	Thermal	Electricity or Biofuel/gasification	No MSW reference facility	Produces electricity and/or ethanol biofuel, depending on market for these commodities.
Carbon Diversion, Inc.	Thermal	Electricity from pyrolytic syngas	50 tpd facility in Dunlop TN	
Casella Waste Systems, Inc.	Mechanical/Thermal	Electricity from pyrolytic syngas	3 reference facilities for single stream. WTE demonstration unit under acceptance testing.	Final element of a 4 stage approach. Single stream recycling and processed waste feedstock in previous stages
Covanta Energy Corp.	Thermal	Electricity from Mass Burn	5 operating facilities in NY, 15 others in Northeast US.	Export to existing WTE facilities through B-3 transfer station in Columbia County.
Dongara Pellet Factory	Mechanical	Solid Fuel Pellets	110,000 tpy facility in Woodbridge, ON.	Fuel pellets are to be used for energy production.
Ecodeco	Biological/ Mechanical	Aerobic Biodrying with Solid Fuel Product	Several facilities in, Italy, Spain and U.K.	Solid Fuel product could potentially be used to generate electricity.
Energy Answers International	Mechanical/ Thermal	Electricity from Processed Refuse Fuel	3,000 tpd SEMASS facility in Rochester, MA	Company was affiliated w/ reference facility from 1988 - 1996
Green Conversion	Thermal	Electricity from Mass Burn	1,100 tpd facility in Hamburg, GE	

Name	Primary Treatment Type	Primary Product	Reference Facilities	Comment
Nature's Fuel	Thermal	Electricity from pyrolytic syngas	86,000 tpy facility in Atwood, IN.	
NORTERRA Organics	Biological	Compost	20,000 tpy facility in Joyceville, ON.	SSOW only
Organic Waste Remediation	Thermal	Electricity from pyrolytic syngas	250 tpd facility seeking approval in CT.	
Plasco Energy Group	Thermal	Electricity from Plasma syngas	110 tpd demonstration facility in Ottawa, Canada	
Powers Energy	Thermal	Biofuel from gasification	2,000 tpd facility being developed in Lake County, IN.	
StarTech Environmental	Thermal	Plasma-converted Syngas	2 facilities under contract in Europe	
Taylor Biomass Energy	Thermal	Electricity/ gasification	Facility under development	

Five of the submittals provided information about technologies that are considered commercially proven, including mass burn waste to energy, mechanically processed refuse derived fuel (RDF), and the composting of source separated organic waste. The 10 remaining respondents presented information about new and emerging technologies for waste treatment with recovery of materials, energy or both. Information from these submittals was summarized and is presented in the discussion of emerging technologies in Section 3.0.

A more detailed summary of each submittal is presented in Appendix B.

3.0 EMERGING SOLID WASTE MANAGEMENT TECHNOLOGIES

3.1 Thermal Processing

Thermal processing technologies encompass a variety of processes that use or produce heat, under controlled conditions, to convert MSW to usable products such as recyclable materials and/or electrical output. The organic content of MSW is converted to energy, and the inorganic content is recovered as products such as metals.

Thermal technologies can potentially convert all organic components of MSW into energy (i.e., all carbon and hydrogen-based materials, including plastic, rubber, textiles, and other organic materials that are not converted in biological processes). Thermal processing occurs in a high-temperature reaction vessel; reactor temperatures vary among technologies, but can range from approximately 800°F to as high as 8,000°F.

Generally speaking, thermal processing of MSW consists of two primary steps (DSNY 2006):

Pre-processing requirements are typically minimal for thermal processing technologies. Many thermal technologies require no MSW size reduction or separation by component, although some do require waste to be shredded prior to processing. While recyclables such as metals can be recovered in a pre-processing step, many thermal technologies recover recyclable metals after the thermal conversion process.

In ***thermal conversion***, the organic fraction of the MSW is converted to a gas form by processing at a high temperature within the reaction vessel. Gas products are typically composed of hydrogen, carbon monoxide and carbon dioxide gases, and may be called “syngas” or “fuel gas”, depending on the technology. The gas may be converted to electricity by using it as a fuel in traditional boilers, reciprocating engines and combustion turbines. Net electricity is reportedly on the order of 400-500 kWh/ton for most thermal processing technologies.

Processing temperatures, the means of maintaining elevated temperatures, and the degree of decomposition of the organic fraction of MSW, vary among thermal processing technologies. Several types of thermal processing technologies have been or are being developed to a level of commercial feasibility, and are described in detail below.

3.1.1 Pyrolysis

Pyrolysis systems use a drum, kiln-shaped structure, or pyrolysis tube, which is heated using recycled syngas or another fuel or heat source. Existing pyrolysis systems can typically process up to 300 tpd of MSW; systems are modular and can be installed in parallel to increase throughput. MSW must be pre-processed to separate non-degradable materials, and the organic MSW content is essentially "cooked" in an externally heated oven at temperatures of 750°F to 1,650°F, *in the absence or near absence of free oxygen.* At high temperatures, the organic compounds volatilize and bonds thermally crack, breaking larger molecules into gases and liquids composed of smaller molecules, including hydrocarbon gases and hydrogen gas.

The temperature, pressure, reaction rates, and internal heat transfer rates are used to control pyrolytic reactions in order to produce specific products. Syngas products are composed primarily of hydrogen (H_2), carbon monoxide (CO), carbon dioxide (CO_2), and methane (CH_4). The syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity, or alternatively can be used in the production of chemicals. Some of the volatile components of MSW form tar and oil, and can be removed for reuse as a fuel. The balance of the organic materials that are not volatile, or liquid that is left as a char material, can be further processed or used for its adsorption properties (activated carbon). Inorganic materials form a bottom ash that requires disposal, although some pyrolysis ash can be used for manufacturing brick materials.

Most pyrolysis systems are closed systems, and there are no waste gases or air emission sources. However, subsequent power generation using syngas does have air emissions that can be filtered through a stack and air emission control system. The volume of MSW feedstock entering a pyrolysis reactor can be reduced by as much as 90% (City of LA 2005).

Four of the RFI respondents have developed or are developing thermal processing facilities utilizing pyrolysis. These respondents are Carbon Diversion, Inc., Casella Waste Systems, Inc., Nature's Fuel, and Organic Waste Remediation, LLC. A brief summary of these technologies or facilities, based on information provided in each of the RFI responses, is presented below.

Carbon Diversion, Inc.

Carbon Diversion Inc. is a Hawaiian corporation that was formed in 2004. CDI creates small-scale systems that can process MSW to generate electricity and bio-char products. The company identifies a pilot plant and two commercial facilities, located in Hawaii and Tennessee. CDI will

break ground on the first of three planned manufacturing facilities in April 2009, which will allow the company to produce and deliver its systems.

CDI has built a pilot plant at Campbell Industrial Park in Hawaii. The plant consists of three 1-ton processors, and the main product is a petroleum product in the kerosene range. A second system is located in Dunlop, Tennessee as part of a sustainable community development, and consists of two 3.5 ton/hr. units. The Dunlop facility is designed to operate 10 hours/day and generate 2 MW of electricity. Bio-char byproducts are bagged and sold under the Eterna Green trade name as a soil amendment. Work has begun on a third site in Hawaii; four additional sites have been identified at transfer stations in Hawaii, pending final bond passage with a start date in July 2009.

Incoming waste, including tires, animal waste and green waste, is pre-processed (briquetted) and fed into the processors. A pressurized partial pyrolysis gasification process is used to produce a liquid fuel and syngas, which are used to generate electricity. Bio-char can be used for water filtration or as a soil amendment. Units can be remote-started by local power providers, and can be used for emergency power generation if provided access to natural gas utilities.

More information about this RFI response is presented in Appendix B.

Casella Waste Systems, Inc.

Casella Waste Systems, Inc. is a vertically integrated resource management company that operates primarily in the northeastern U.S, and was founded in 1975. The company operates a number of collection divisions, transfer stations, disposal facilities, recycling facilities, and landfill gas to energy facilities. FCR, Inc. is a wholly owned subsidiary of Casella that designs, builds and operates recycling facilities throughout the U.S.

Casella proposes a four-phased waste management approach for the Planning Unit. The first three phases include a single stream MRF, a multimaterial processing platform to recover additional recyclables and manufacture engineered feedstock for co-firing in solid fuel boilers. These first three phases are considered conventional technologies. It is the fourth phase which is considered an emerging technology because it includes the establishment of a waste-to-energy facility accepting the non-recoverable portion of the waste stream and thermally reducing it by means of pyrolysis and gasification. Syngas products would be used to produce electricity, liquid fuels or chemicals. Casella has a commercial demonstration unit currently in acceptance

testing, which would serve as a reference facility upon completion; other reference facilities are operated by Eco Technology, a project partner.

More information about this RFI response is presented in Appendix B.

Nature's Fuel

Nature's Fuel (NF) was founded in 2005 and is an Indiana Corporation; the company is owned by private equity investors. NF owns and operates one commercial facility in Atwood, Indiana, and is developing a second commercial facility in Huntington, Indiana.

The NF system uses a pyrolysis process to generate electricity, bio-oil, bio-char, and bio-gas. Bio-char residue can be used as a soil amendment or high-grade source of activated carbon. Bio-oil can be sold to blenders and used to reduce the sulfur content and viscosity of #6 heating oil.

NF operates an 86,000 tpy facility in Atwood, Indiana – this plant began as a solid fuel R&D facility and was converted into a full-production pyrolyzation operation in 2007. The Atwood facility does not accept MSW, but does accepts wood waste, C&D waste, and other waste streams (plastics, waste oils, etc.) to produce sulfur-free bio-oil, high quality bio-char, and will begin to generate electricity later in 2009.

NF is in the process of developing a new facility in Huntington, Indiana that will accept MSW as feed stock. This facility will have an anticipated waste throughput of 200,000 tpy in Year 1, and will increase to 400,000 tpy by Year 3. Air permit approval is anticipated in July 2009.

Representatives of Nature's Fuel attended the SWMP Steering Committee meeting on August 18, 2009 give a presentation about their technology and facilities. As of that time, the facility planned for the Huntington Landfill was not yet operating. When it is operating the anticipated fee at Huntington will be $20/ton. Nature's Fuel indicated they anticipate that biogas generated at the Huntington facility would be used to fire internal combustion engines, and they expected a facility processing 500,000 TPY to generate about 50 MW. At the presentation NF clarified that the operating facility in Atwood primarily accepts wood waste from recreational vehicle manufactures including particle board, paints and sealants, laminates, and all kinds of wood and adhesives. That facility operates at 55,000 tons per year.

More information about this RFI response is presented in Appendix B.

Organic Waste Remediation, LLC

Organic Waste Remediation, LLC (OWR) is based in Orlando, FL and offers the OWR Process for disposal of MSW. The OWR Process combines single-stream recycling and pyrolysis technologies, and includes three modules. The *Recycling Module* separates non-organic material into ferrous, aluminum, other non-ferrous metals and clear, green and amber glass, washed and delabeled with ceramics removed. Unrecycled organic material is shredded, dried and fed to the Remediation Module. The *Remediation Module* uses a pyrolysis process to break organic materials down into a relatively consistent synfuel. Synfuel products are conveyed to the Power Module. The *Power Module* uses generic fluid bed burner/steam generation equipment to drive a steam turbine electric generator.

As of the RFI submittal date, OWR has not constructed or operated a MSW processing facility. OWR has commenced the approval process to construct and operate a commercial facility in Bozrah, CT. This facility will have a proposed maximum capacity of 250 TPD (~90,000 tpy), and contractual arrangements have been made to secure a 1,500 tons per week supply of MSW feedstock.

More information about this RFI response is presented in Appendix B.

3.1.2 Gasification

Gasification involves the thermal conversion of organic carbon-based materials in the presence of internally produced heat, typically at temperatures of 1,400°F to 2,500°F, and *in a limited supply of air/oxygen* to produce a syngas composed primarily of H_2 and CO. Inorganic materials are converted either to bottom ash or to a solid, vitreous slag, depending on the conditions materials are processed under. Most gasification systems are closed systems and do not generate waste gases or air emission sources during the gasification phase. After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity, or to make chemicals. Subsequent power generation using syngas does have air emissions that can be filtered through a stack and air emission control system.

Gasification has reportedly been used to process MSW since the 1980s, primarily in Europe and Japan (City of LA 2005). Existing gasification systems operate at throughputs up to 1,000 tpd;

gasifiers and the pre-processing, emission control, and power generation systems can be installed in parallel to increase throughput and power generation. Gasification and pyrolysis technologies are sometimes coupled, with char products resulting from pyrolysis used as feedstock for the follow-up gasification process.

Three of the RFI respondents, have developed or are developing thermal processing facilities utilizing this type of gasification technology. These respondents are BioGold Fuels Corporation, Powers Energy of America, Inc., and Taylor Biomass Energy, LLC. A brief summary of these technologies or facilities, based on information provided in each of the RFI responses, is presented below.

BioGold Fuels Corporation

BioGold Fuels Corporation is a Nevada corporation based in New York City, was formed as a result of a merger with Full Circle Industries, Inc. in April 2007, and became a publicly traded company in October 2007. With the BioGold process, MSW is unloaded from trucks and conveyed to a sterilizer where it is sterilized, reduced in size, and mechanically sorted to remove recyclable metals and other inorganic material from the organic fraction of the waste. The sterilized organic and energy-containing materials are then fed into a thermo-chemical gasifier, where they are transformed at high temperature into compounds that produce a syngas composed mostly of hydrogen and carbon monoxide. Remaining solid residue can be vitrified into a glass-like solid that can be used for various construction applications.

Syngas can be used to generate electricity using commercial electricity-generating equipment, or converted to a biofuel using a standard gas-to-liquid catalytic process. BioGold would build infrastructure to generate both electricity and transportation biofuels, and would shift production according to the relative market value of these commodities.

According to its RFI response, BioGold has successfully implemented the front-end processing aspect of its technology using MSW to create a marketable recycled long-fiber product sold for liner-board manufacture. As of March 2009, the company has not constructed or operated a MSW processing facility.

More information about this RFI response is presented in Appendix B.

Powers Energy of America, Inc.

Powers Energy is a national firm headquartered in Evansville, Indiana, and presents a process to produce biofuels and electricity from MSW feedstock. MSW would be delivered, handled and contained within the indoor facility. Carbon-based MSW/feedstock materials are mixed, crushed or shredded and fed into a gasification plant for bioethanol production. Feedstock materials are converted to a syngas product in the gasifiers by heating the materials in different stages to temperatures in excess of 2,000 degrees Fahrenheit. Heat recovered from the gasifier is used to generate steam and electricity. Syngas leaving the gasifier is refined, cooled and passed through the biological fermenter, where 70-90% of the gas will be converted to bioethanol through microbial activity. Off-gas from the fermenter is routed for use in steam generation. Bioethanol products go through a refining process and are marketed for use as a fuel. Ash from the gasifier is sent to a landfill for disposal.

The Lake County Indiana Solid Waste Management District approved a contract on November 20, 2008 to develop a biofuels facility with a minimum capacity of 2,000 tpd. The facility is anticipated to generate 36 million gallons of bioethanol fuel, 42,600 tons of recyclable metals and 20 MW of power on annual basis. As of March 2009, facility design plans were being prepared, but construction of this facility has not yet begun. Powers Energy is also pursuing agreements for development of a facility in northwestern Kentucky, and has begun design and permitting for this facility.

More information about this RFI response is presented in Appendix B.

Taylor Biomass Energy, LLC

Taylor Biomass Energy (TBE) is headquartered in Montgomery, NY where a related company has owned and operates a C&D recycling and processing facility since 1989. TBE has a project underway to couple a gasification process with the existing sorting and recycling process at the Montgomery facility. Permitting is currently underway for this action and permitting documents have been submitted to DEC for review.

As part of that project, sorted feedstock will be fed into the gasification reactor, where it will undergo a rapid thermal breakdown to produce a syngas product. The Taylor gasification process produces a medium Btu gas with a heating value of approximately half that of natural gas. This gas will have the ability to be directly substituted for natural gas or used as a fuel for

engines and gas turbines, or to be used as a synthesis gas for production of biofuels or chemicals. For the Montgomery project, the syngas will be conditioned and used to generate electricity. A combustion reactor will be used to further process char products, and final ash products will be disposed of at a landfill.

More information about this RFI response is presented in Appendix B.

3.1.3 Plasma Arc Gasification

Plasma technology uses an electrical discharge to heat gas, typically air, oxygen, nitrogen, hydrogen, or argon, or combinations of these gases, to temperatures above 7,000°F. The heated gas, or plasma, can then be used for welding, cutting, melting, or treating waste materials. Most past uses of plasma arc technology have been for melting incinerator ash or for thermally decomposing hazardous or medical wastes, and only recently has plasma technology integrated with gasification technologies to process MSW. This technology has potential to convert MSW to electricity more efficiently than conventional pyrolysis and gasification systems, due to its high heat flux, high temperature, almost complete conversion of carbon-based materials to syngas, and conversion of inorganic materials to a glassy, non-hazardous slag. Existing systems operate at throughputs of up to 83 tpd on MSW/auto shredder residue combination; plasma torches can be added to the reactors, and multiple reactors can be included to increase total capacity (City of LA 2005).

Plasma arc gasification typically occurs in a closed, pressurized reactor. Following pre-processing, the feedstock enters the reactor and comes into contact with the hot plasma gas. This system converts MSW and other organic carbon-based materials, including tar, oil, and char, to a syngas composed primarily of H_2 and CO. Inorganic materials are converted to a solid, vitreous slag. Like pyrolysis and conventional gasification, plasma arc gasification is a closed system; therefore there are no waste gases and no emission sources in the plasma gasification conversion process. After cooling and cleaning in emission control systems, the syngas produced by plasma arc gasification can either be burned immediately in a close-coupled combustion chamber or boiler, or can be cleaned of contaminants and used in a reciprocating engine or gas turbine to generate electricity.

Two of the RFI respondents have developed, or are developing, thermal processing facilities utilizing plasma arc gasification technology. These respondents are Plasco Energy Group and

Startech Environmental Corporation. A brief summary of these technologies or facilities, based on information provided in each of the RFI responses, is presented below.

Plasco Energy Group

Plasco Energy Group is an Ottawa, Canada company that offers a system based on plasma arc technology. Plasco has built a 110 tpd commercial-scale demonstration facility in Ottawa that uses MSW from the city as feedstock. This facility has been in operation since January 2008. Discussions for commercial facilities are in progress in Canada, the U.S, Europe and Asia.

Plasco's waste conversion process begins with any materials with high reclamation value being removed from the waste stream and recovered for recycling. The remaining MSW is shredded and conveyed to a conversion chamber where it is converted into a crude syngas using recycled heat; this crude syngas flows to a refinement chamber and is refined using plasma torches to create a fuel called PlascoSyngas. The PlascoSyngas is cleaned and used to generate electricity. Waste heat is recovered and used to produce steam, which can be used to generate additional electricity or for industrial purposes.

Solid residue from the conversion chamber is sent to a separate high-temperature Carbon Recovery Vessel, where plasma heat is used to stabilize the solids and convert any remaining volatile compounds and fixed carbon into syngas. Remaining solids are cooled into small slag pellets. The process also yields other products including commercial salt, agricultural sulfur and water. In its response to the RFI, Plasco suggested a 440 TPD facility for the Capital region, using four of the 110 TPD units of the type currently operating at the demonstration facility in Ottawa.

More information about this RFI response is presented in Appendix B.

According to the company website (http://www.plascoenergygroup.com/), in June 2008 the Ottawa City Council issued a letter of intent for Plasco to build, own, and operate a 440 TPD facility and the Central Waste Management Commission of Red Deer, Alberta has signed a contract for a 220 TPD Plasco facility.

Startech Environmental Corporation

Startech is a Wilton, Connecticut based public company that offers a plasma processing technology for MSW disposal. The company was founded in 1993 and was established in 1995 as a public company. In 1996-1997, Startech built and delivered a 7 TPD system to the U.S. Army's Aberdeen Proving Ground in Maryland. In 2001, the company opened a facility in Bristol, Connecticut which houses a 5 TPD system used for customer training, marketing and demonstration purposes. In 2001 Startech delivered a 5 TPD system to Japan for the processing of PCBs and hazardous incinerator ash. The company has a 30,000 sf manufacturing facility in Bristol where its systems are built, and is in the process of developing several facilities in overseas markets.

The Plasma Converter System utilizes plasma – an electrically charged, ionized gas – to process waste materials at extremely high temperatures. Organic components of the incoming waste are used to create a plasma-converted syngas, which in turn can be used to produce electricity, recover hydrogen, and to make industrial materials. Outputs include a Plasma Converted Gas (PCG) fuel consisting of primarily hydrogen and carbon monoxide, and a glassy black obsidianite material. PCG can be reused or recycled as a fuel or as a synthesis gas to produce electricity, recover hydrogen, or to make industrial products. The Startech technology can be used to process a variety of hazardous and non-hazardous waste materials.

To date, Startech has no full-scale commercial MSW facilities in operation. The company has signed contracts for two 300 TPD MSW facilities in Europe with additional orders pending for MSW facilities in Panama (200 and 350 TPD) and Europe (100 TPD). Startech is currently manufacturing multiple systems for Puerto Rico and Poland.

More information about this RFI response is presented in Appendix B.

3.2 Biological and Chemical Processing

Biological and chemical technologies operate at lower temperatures and lower reaction rates than thermal technologies. Biological technologies can convert only the biodegradable organic content of MSW, and chemical processes can potentially convert any organic content. Neither type of technology can be used to effectively process inorganic waste materials. Some technologies involve the multiple stages of biochemical processing; byproducts vary among technologies but can include electricity, compost and chemicals.

Several of these technologies also include one or more mechanical processing components to remove inorganic materials from the feed stock or the residue stream. These are often referred to a **Mechanical -Biological Treatment** facilities, or **MBT** facilities. The biological treatment can be either aerobic or anerobic, as will be described further below. MSW composting facilities, such as the facility that operates in Delaware County NY, can be considered an MBT facility. But because the are 13 MSW composting facilities operating in the United States, its is not considered among the emerging technologies that are being evaluated here.

Motivated by European Union mandates that limit the amount of organic waste that may be landfilled, MBT facilities have been developed in Europe which utilize an aerobic process to dry the organic fraction of the waste. MBT reduces the mass and volume of wastes, due to the removal of materials for recycling and both carbon and moisture losses. The amount of reduction is very dependent on the design and characteristics of each plant. For every ton of input to a bio-stabilization MBT facility, around 0.6 tons will be left as residue (Friends of the Earth, 2008).

There are two main outputs for MBT residues, with the output type determining how the plant is operated:

- As a low quality soil, or to landfill, also known as 'biostabilization', or
- As a refuse derived fuel (RDF), for burning (sometimes called 'biodrying')

One respondent to the RFI, ECODECO, has developed an MBT technology that uses both biological (biodrying) and mechanical processes to recover recyclable materials and produce a refuse derived fuel. A brief summary of this technology/facility, based on information provided in the RFI response, is presented below.

Two other specific technology groups, anaerobic digestion and ethanol production were not included in any of the RFI responses. These technologies are discussed in section 3.2.1 and 3.2.2 below.

ECODECO

ECODECO is an international company with headquarters in Italy, and has recently established a cooperative arrangement with International Center for Commercial Affairs (ICCA) to assist in the pursuit of opportunities in the U.S. market. The company has developed the Biocubi Process, an aerobic biological treatment method, to remove moisture and improve the heating efficiency of products to be used as fuel inputs for subsequent processes. Processing takes place in the company's ITS (Intelligent Transfer Station). The putrescible fraction of MSW undergoes an aerobic treatment, and the released heat is used to dry and thermally hygienize the feedstock. Separation occurs following the bio-drying phase, and recyclable materials are removed from the feedstock. The bio-dried material is then mechanically refined to produce a solid fuel which can be used to generate electricity or as a fuel source by cement kilns.

ECODECO's technology has been successfully implemented in Europe for more than a decade. They have identified several facilities in Italy, Spain and England, and report that there are 17 ITS facilities in total throughout the world. To date, none of these facilities have been constructed in the U.S.

The response to the RFI noted a capital cost of $56.7 million for a facility capable of serving the Capital Region Planning Unit and processing 230,000 TPY. Operational costs for a facility in the U.S. were not estimated by ECODECO, but tipping fees of €95 to €125 (euros) per ton were noted for some European facilities.

Representatives of ECODECO attended the SWMP Steering Committee meeting on July 21, 2009 and gave a presentation about their technology and facilities. At that meeting an estimated capital cost of $64 million and an estimated operating cost of $38 per ton were noted. ECODECO representatives were accompanied by representatives from Buzzi Unichem, a large Cement manufacturer with facilities in the U.S., who expressed a keen interest in utilizing the solid fuel from the ECODECO process to displace the use of coal in cement kilns.

More information about this RFI response is presented in Appendix B.

3.2.1 Anaerobic Digestion

Anaerobic digestion is a biological process by which microorganisms digest organic material in the absence of oxygen, producing a solid byproduct (digestate) and a gas (biogas). In the past, anaerobic digestion has been used extensively to stabilize sewage sludge, but has been adapted

more recently to process the organic fraction of MSW. In anaerobic digestion, biodegradable material is converted by a series of bacterial groups into methane and CO_2. In a primary step called hydrolysis, a first bacterial group breaks down large organic molecules into small units like sugars. In the acidification process, another group of bacteria converts the resulting smaller molecules into volatile fatty acids, mainly acetate, but also hydrogen (H_2) and CO_2. A third group of bacteria, the methane producers or methanogens, produce a medium-Btu biogas consisting of 50-70% methane, as well as CO_2.

This biogas can be used to fuel boilers or reciprocating engines to generate electricity, and requires minimal pretreatment. It can also be upgraded to pipeline quality and used as compressed natural gas (CNG), a vehicular fuel. In addition to biogas, anaerobic bioconversion generates a residue consisting of inorganics, non-degradable organics, non-degraded biodegradables, and bacterial biomass. If the feedstock entering the process is sufficiently free of materials like colored plastics, this residue can have market value as a compost material. Anaerobic digestion facilities are able to process up to 800 tpd of MSW.

None of the respondents to the RFI proposed the use of anaerobic digestion technology. This technology has been employed with MSW feedstock in Europe by companies that have responded to recent solicitations by other jurisdictions, such as New York City and Los Angeles. NorthEast Biogas, a New York based company, is seeking to develop projects using anaerobic digestion, but this company did not respond to the RFI. Discussions with representatives of this company indicated their interest in projects with organic waste feedstock, but not MSW feedstock.

3.2.2 Ethanol Production

Various ethanol production processes have been developed at pilot scales, and some at demonstration scales, to generate ethanol from paper and vegetative matter in the MSW stream. In these processes, a purified lignocellulosic material – which is able to break cellulose-based plant material down to its component sugar molecules – is chopped up and introduced into a hydrolysis reactor. The effluent of this reactor is mostly a sugar solution, which is prepared for fermentation. This solution is detoxified and introduced to a fermenter, in which microorganisms convert the sugar to ethanol and CO_2. Next, the solution is introduced into an energy-intensive, combined distillation and dehydration process to bring the ethanol concentration up to fuel grade (99%) ethanol. A solid residue of unfermented solids and microbial biomass is recovered through the anaerobic digestion process, and its marketability as a compost material depends on the

purity of feedstock as well as its visual quality. Solid residues can be burned or gasified if alternative methods of reuse are not feasible.

A commercial scale facility had been permitted for development in Middletown NY. The $285-million waste-to-ethanol processing plant is said to be capable of processing and converting up to 960 tpd of MSW to ethanol for commercial sale and use. The facility has been in the development stages since 1996, and received its required permits from the NYSDEC. However the facility has never been developed (news archive from the Middletown Times Herald-Record at http://archive.recordonline.com/news/masada/masada_list.htm), and given the delays and reported legal issues, is believed to be unlikely to move forward.

At its September 2009 meeting, the SWMP Steering Committee heard a presentation from a representative of Enerkem, a Canadian company which has a contract with the City of Edmonton, Alberta to develop a waste-to-biofuels facility. The City of Edmonton will supply 100,000 metric tons of post recyclable waste to the facility, which will produce approximately 9.5 million gallons of ethanol and has an expected construction cost of CDN$70 million. The company has operated a pilot plant in Sherbrooke Quebec since 2003 and has also built a commercial scale facility in Westbury, Quebec.

4.0 RECENT ASSESSMENTS CONDUCTED BY OTHER JURISDICTIONS

Several municipalities, counties and solid waste authorities have conducted recent assessments of alternative technologies. Three of the more comprehensive efforts are reviewed and summarized here.

4.1 New York City

In 2004, the New York City Department of Sanitation (DSNY) presented the first phase of its New Solid Waste Management Plan (New SWMP). The planning process was initiated following the 2001 closure of the Fresh Kills Landfill in Staten Island, which had accepted much of the City's solid waste for years. Since the closure of this facility, New York City's solid waste management system has relied predominantly on truck-based transportation and utilizes a combination of local, land-based transfer stations and long-haul shipping to remote, out-of-state landfills.

New York City's system is considered unsustainable over the long term, due to the heavy costs associated with the transport and disposal of solid waste at remote landfills, as well as the environmental impacts of a system so reliant on long-haul trucking. Thus, the City's New SWMP cites "dramatically reducing the number of truck trips and miles associated with disposal of New York City's waste" as a primary goal.

Waste containerization, and intermodal barge and rail transport of the containerized solid waste, are key components of the New SWMP's strategy to decrease reliance on truck transport and improve the overall efficiency of the City's waste management system. Additionally, the plan provides mechanisms to expand and improve the City's recycling program in an effort to promote the beneficial reuse of recyclable materials and decrease the quantity of materials requiring landfill disposal.

The New SWMP investigated several emerging technologies in order to evaluate their potential contributions to New York City's program.

As part of its solid waste management planning and ongoing effort to reduce the quantity of waste exported from the City, in 2004 the DSNY completed the ***Phase 1 Evaluation of New and***

Emerging Solid Waste Management Technologies (NYC Economic Development Corporation and NYC Department of Sanitation, 2004). The Phase 1 Study involved three steps of analysis.

In Step 1 technologies were identified that met the City's definition of "new and emerging", and which had a sponsor who provided sufficient information to allow an evaluation of the technology. Of the 43 technologies reviewed, 33 met the Step 1 screening criteria and were subsequently evaluated in Step 2 of the process. These 33 technologies included 21 thermal (gasification) technologies, 7 anaerobic digestion technologies, 1 aerobic digestion technology, 3 hydrolysis technologies, 1 chemical and 1 mechanical processing technology.

In Step 2 a number of second-level screening criteria were developed to perform a preliminary review of the 33 technologies. These second-level screening criteria included the following:

- Readiness to be operational within a ten-year timeframe
- The facility must be able to accept and process at least 50,000 tons per year (137 tons per day), which is the minimal capacity required to provide meaningful benefit to New York City's waste management system
- Reliability, as evidenced by successful commercial or pilot facilities
- Environmental performance of the technology must meet or exceed New York State permit and regulatory requirements
- Beneficial use of waste must be demonstrated through a technology's production of a useful and marketable product
- Residual waste requiring landfill disposal must not exceed 35% by weight of incoming waste.

Of the 33 technologies subjected to the second-level screening criteria, 19 did not meet these criteria and were removed from further consideration in the evaluation process. One technology did not meet the residual waste criterion, and 18 did not meet the reliability criterion.

Following Step 2, the 14 remaining technologies are shown below in Table 2.

Table 2
Technologies Remaining after Step 2 Screening

Anaerobic Digestion	***Thermal Processing***	***Hydrolysis***
Arrow Ecology & Engineering Canada Composting Orgaworld Organic Waste Systems Waste Recovery Systems	Dynecology EBARA GEM America Global Energy Solutions Interstate Waste Technologies Pan American Resources Rigel Resource Recovery Taylor Recycling Facility	Masada Oxynol

In Step 3, a final set of specific criteria were applied to the 14 technologies that had met first- and second-level screening criteria. Whereas Steps 1 and 2 sought to exclude technologies unsuited to meet the City's needs, Step 3 offered a more detailed evaluation of each of the 14 technologies and provided general findings relative to the emerging technologies by category, without eliminating any individual technologies from consideration. The Step 3 criteria included:

- Readiness and reliability
- Facility size and design flexibility
- Utilization of the existing city solid waste collection system
- Utility needs
- Extent of beneficial use of waste
- Marketability of products
- Quantity and quality of residuals requiring landfill disposal
- Environmental impacts
- Facility siting
- Public acceptability
- Estimated cost
- Opportunities for economic growth
- Experience and resources of project sponsor
- Willingness to develop publicly or privately owned facility
- Risk profile

Following the application of these Step 3 criteria, the Phase 1 Study concluded that anaerobic digestion and thermal processing (gasification) technologies are suitable to be considered for use in the U.S., including New York City. These technologies have been successfully implemented outside of the U.S. Hydrolysis technology is also offered as a potential alternative, and the

report noted that a recently permitted hydrolysis facility in Middletown, NY could be monitored to verify its efficacy. If New York City seriously considers investing in a thermal processing, anaerobic digestion, or hydrolysis technology, the Phase 1 Study suggests that the City may wish to implement a pilot project in order to mitigate the risk of its investment.

The Phase 1 Study noted that, relative to manufacturers of conventional waste-to-energy (WTE) technologies, the overall experience of manufacturers of the emerging technologies is not as extensive. However, the thermal technologies (gasification) and anaerobic digestion offer certain advantages over conventional WTE technologies. Emissions of pollutants would potentially be lower for these emerging technologies, particularly the emissions of dioxins and heavy metals. Additionally, the volume of residuals would potentially be lower with the emerging technologies than with conventional WTE technologies. Based on the information available for review, the cost to operate innovative technologies is potentially comparable to conventional technologies. The Phase 1 Study recommended a focused, detailed review to supplement and verify information provided for the Phase 1 Study, to help determine if a demonstration facility would warrant consideration for New York City's solid waste system.

As a follow-up to the recommendations of the Phase 1 Study, DSNY prepared the ***Phase 2 Focused Verification and Validation of Advanced Solid Waste Management Conversion Technologies*** (2006). This Phase 2 study represents a more detailed evaluation of the 14 technologies identified through the Phase 1 Evaluation, which are believed to be among the most advanced in their respective categories.

Questionnaires were distributed to the sponsors of these 14 technologies, and preliminary interviews were conducted with sponsors to determine whether sufficient information could be made available for the City to consider a technology in the Phase 2 Study. Based on the information available for the study, 2 anaerobic digestion technologies and 4 thermal processing technologies were selected for detailed review in the full Phase 2 analysis, as shown in Table 3.

Table 3
Phase 2 Solid Waste Conversion Technologies

Anaerobic Digestion	***Thermal Processing***
Arrow Ecology & Engineering Waste Recovery Systems	EBARA GEM America Interstate Waste Technologies Rigel Resource Recovery

The detailed Phase 2 process consisted of the following:

- The *Technical Review and Evaluation* process sought to validate process schematics and major system components, confirm mass and energy balances, review site layout and arrangement, and review operating data and related information for reference facilities.
- *Environmental Review and Evaluation* consisted of independent calculations and review of environmental performance, including air pollutant emissions, water usage, wastewater discharge, residue requiring landfill disposal, and quality of products.
- An *Economic Evaluation* was performed to project the order-of-magnitude costs that could be expected from the technologies for commercial-scale projects.

Findings and Conclusions

The Phase 2 Study built upon information gained during the Phase 1 process, and evaluated a number of specific technologies at an advanced level of detail. Important findings of the analytical process include the following:

- *Technical Findings* confirm that anaerobic digestion and thermal processing technologies could potentially be applied successfully in New York City. Independent reviews were performed relative to mass and energy balances, energy-generating efficiency of the technologies, recovery rates of recyclable materials, quantities of residue requiring landfill disposal, and siting requirements of each technology. The evaluation verified information obtained during the Phase 1 study and provided by manufacturers.
- *Environmental Findings* show that anaerobic digestion and thermal processing technologies could potentially offer better environmental performance than conventional waste-to-energy technologies. Environmental benefits include the decreased emission of air pollutants, increased beneficial use of waste, and reduced reliance on landfill disposal.
- *Economic Findings* for the Phase 2 Study indicate that on a commercial scale, anaerobic digestion and thermal processing technologies are less costly or comparable in cost to New York City's current exporting practices.

The study found that – among the emerging technologies evaluated – Anaerobic Digestion and Thermal Processing technologies were best suited for commercial implementation in the New York City waste management system.

New York City's Phase 2 Study suggests that issues related to the transfer of design and operational experience from existing overseas facilities to the U.S. may present difficulties as new technologies transition to commercial operations in the U.S. Preparation of an Implementation Plan is recommended as a next step in the implementation of a demonstration facility. The Implementation Plan would lay the groundwork necessary to provide design, construction, performance, and cost information that would be used to develop a commercial-scale facility.

Since completion of the Phase 2 Study, New York City's implementation efforts for the New SWMP have focused on establishing an improved network of marine transfer stations to export solid waste from the city. The City has not yet prepared an Implementation Plan for the introduction of emerging solid waste technologies and/or facilities, and has not initiated a development process for any such facility. DSNY representatives identify difficulty in siting such a facility locally as an obstacle in the implementation of emerging solid waste technologies (as well as conventional solid waste processing facilities).

4.2 City of Los Angeles

According to the 2005 ***RENEW LA*** report, the Los Angeles basin, which is comprised of Los Angeles, Orange and western San Bernardino and Riverside counties, disposes of approximately 70,000 TPD of MSW. Several landfills have recently closed, and the Puente Hills Landfill – which has the highest daily capacity of any landfill in the U.S. – is planned for closure by the year 2013. The Puente Hills closure could displace as much as 13,200 tons per day of MSW disposal capacity, and other disposal options will be required to serve the region's needs (Smith, 2005).

The California Integrated Waste Management Act of 1989 (AB 939) mandated a 50% diversion from landfill disposal by the year 2000 as well as the creation of various plans, programs, and facilities that cities and counties throughout California should adopt in order to achieve these goals (Smith, 2005). In 1994, the City Council of Los Angeles declared the goal of 70% diversion of MSW from landfills by the year 2010. The RENEW LA plan provides a vision to move beyond that 70% goal to a zero waste system. To do so, the City prepared a study entitled ***Evaluation of Alternative Solid Waste Processing Technologies*** to review alternative MSW processing technologies that process post-source separated MSW.

The highest-level objective of the evaluation is to:

> Identify alternative MSW processing technologies that will increase landfill diversion in an environmentally sound manner, while emphasizing options that are energy efficient, socially acceptable, and economical. (URS, 2005)

This objective is subdivided into three lower-level objectives:

- Maximize Environmental (Siting) Feasibility (i.e., minimize impacts to the environment and citizens);
- Maximize Technical Feasibility (i.e., search for technologies that are commercially available within the development timeframe of 2005-2010 and will significantly increase diversion from landfills); and
- Maximize Economic Feasibility (i.e., provide an overall cost that is competitive with other solid waste processing methods).

Various screening criteria were applied in order to identify potential technologies that could meet the project objectives. The first set of screening criteria helped determine the initial list of technologies to be reviewed and included:

- Meet 200 tons/day capacity (throughput) requirement;
- Consider technologies at the commercial or late-emerging stage;
- Include technologies that produce marketable byproducts; and
- Include technologies that are compatible with post-source separated MSW.

Based on these criteria, sixteen technologies were identified and are broken down into three categories as outlined in Table 4 below.

Table 4-Technologies Evaluated for Renew LA by Category

Thermal Technologies	***Biological/Chemical Technologies***	***Physical Technologies***
Advanced Thermal Recycling	Anaerobic Digestion	Refuse-Derived Fuel (RDF)
Pyrolysis	Aerobic Digestion/Composting	Densification/Pelletization
Pyrolysis/Gasification	Ethanol Fermentation	
Pyrolysis/Steam Reforming	Syngas-to-Ethanol	
Conventional Gasification-Fluid	Biodiesel	
Conventional Gasification-Fixed	Thermal Depolymerization	
Plasma Arc Gasification	Catalytic Cracking	

Next, the technologies were reviewed to determine if they meet the following criteria:

- *Waste Treatability* - ability of the alternative MSW processing technology to efficiently treat the organic portion of the waste stream;
- *Conversion Performance* - ability of the conversion technology to convert the organic portion of the post-source separated MSW stream into useful products;
- *Throughput Requirement* - ability of the alternative processing technology to treat at least 200 tons/day of post-source separated MSW in 2008-2010;
- *Commercial Status* - conversion technology that can be developed on a commercial scale within the project development period (2008-2010); and
- *Technology Capability* - Can support the development of conversion technology at commercial scale and can demonstrate the conversion technology with MSW at a scale of at least 25 tons/day.

The ten technologies listed in Table 5 met these criteria.

Table 5 - Technologies Advancing for Further Consideration in Renew LA

Thermal Technologies	***Biological/Chemical Technologies***
Advanced Thermal Recycling	Anaerobic Digestion
Pyrolysis	Aerobic Digestion/Composting
Pyrolysis/Gasification	Thermal Depolymerization
Pyrolysis/Steam Reforming	
Conventional Gasification-Fluid	
Conventional Gasification-Fixed	
Plasma Arc Gasification	

Next, a life cycle study was conducted using supplier data to develop a comparative analysis of the remaining ten technologies. The life cycle study focused on the issues that demonstrate the greatest differentiation between advanced thermal recycling or conversion technologies and existing traditional solid waste management processes, including: energy consumption, criteria pollutants, and carbon emissions. When compared to landfilling of post-source separated MSW, the results of the life cycle analysis showed that three of the waste processing technologies (advanced thermal recycling, gasification, and anaerobic digestion) will provide substantial savings/reductions with respect to energy consumption, air emissions of criteria pollution, and carbon emissions/climate change issues.

Suppliers were then surveyed to create a "short list" from the ten technologies. About 225 suppliers were screened, and only twenty-six met the criteria to submit their detailed qualifications to the City. Of the twenty-six suppliers requested to submit qualifications, seventeen provided responses. The seventeen suppliers and their technologies were thoroughly evaluated in order to create a short list. Table 6 below identifies the seventeen suppliers.

Table 6 - List of Seventeen Suppliers that Submitted Qualifications for Renew LA

Technology Group	*Company Name*	*Technology*
Thermal	Ebara	Fluid Bed Gasification
Thermal	Interstate Waste Technologies	Pyrolysis/Gasification
Thermal	Omnifuel	Fluid Bed Gasification
Thermal	Primenergy	Fixed Bed Gasification
Thermal	Taylor Recycling	Circulating Fluid Bed Pyrolysis
Thermal	WasteGen	Pyrolysis
Thermal	Whitten	Fixed Bed Gasification
Thermal	Pan American Resources	Pyrolysis
Thermal	Covanta	Thermal Recycling
Thermal	Waste Recovery Seattle Inc.	Thermal Recycling
Thermal	Seghers Keppel	Thermal Recycling
Biological	Arrow Ecology	Anaerobic digestion
Biological	Canada Composting	Anaerobic digestion
Biological	Global Renewables	Anaerobic digestion
Biological	Organic Waste Systems	Anaerobic digestion
Biological	Wright Environmental	Aerobic Composting (Biodryer)
Biological	Waste Recovery Systems Inc.	Anaerobic Digestion

The supplier data were used to conduct a comparative analysis of technologies and rank suppliers for further assessment. The comparative analysis addressed a number of technical, environmental, and cost issues, including:

- Throughput (respondents provided data for different throughput rates);
- Electricity production;
- Net efficiency in kWh/ton feedstock;
- Diversion rate/solid wastes;
- Air emissions;
- Regulatory issues;
- Capital cost;
- Revenues; and
- Estimated tipping fees.

Once the comparisons were complete, each technology was ranked using the criteria below.

- *Ability to Market Byproducts* - Experience selling byproducts with strong markets is desired;
- *Visual Impact of Facility* - Facilities with higher stacks or structures will exhibit greater visual impacts;
- *Operational Experience* - The number of operating plants is an indication of overall experience;
- *Economics* - Worst Case Breakeven Tipping Fee;
- *Supplier Credibility* - Suppliers must have organizations (including partners) with sufficient technical and financial resources;
- *Landfill Diversion* - Percent by weight of inlet MSW sent to landfill (includes rejects and unmarketable materials – worst case);
- *Engineering the Complete System* - Demonstrated ability to design the complete facility; and
- *Permitability* - This is a function of expected environmental impacts, and the potential for a difficult regulatory process or pathway.

The ranking process concluded that thermal technologies (thermal conversion - and advanced thermal recycling) would best satisfy the project's highest level objective, i.e. to maximize landfill diversion. The following conclusions were made regarding the two technologies:

- An alternative MSW processing facility can be successfully developed in the City of Los Angeles.
- The technologies best suited for processing post-source separated MSW on a commercial level are the thermal technologies. These include advanced thermal recycling and thermal conversion (pyrolysis and gasification).
- The biological/chemical conversion technologies and physical technologies present significant technical challenges for treatment of the post-source separated MSW. While biological conversion technologies show the most promise in this group, they also bring significant challenges.

In summary, the advantages of the thermal technologies over biological conversion are:

- Higher landfill diversion rates, which is a primary objective of the project;
- Lower production of solid byproducts and correspondingly greater production of electricity, a higher value product with a more well-developed market;
- Less risk with regard to byproduct marketability;
- Significantly higher thermal efficiencies and, therefore, higher revenue/ton because thermal processes convert essentially all organics to energy; and
- More operational experience at higher throughputs.

The Evaluation recommended that the City should proceed with the following activities to continue development of an alternative MSW processing facility for post-source separated MSW utilizing a thermal technology:

- Initiate public outreach;
- Develop short list of suppliers;
- Conduct an initial siting study;
- Prepare RFP and Select preferred suppliers;
- Conduct Facility Permitting and Conceptual Design; and
- Perform Detailed Design and Construction.

As a result of the recommendations, the City issued an RFP in February 2007 for both commercial and emerging technology facilities to process post-source separated municipal solid waste (City of Los Angeles, 2008). Twelve proposals were received on August 22, 2007 from the companies listed in Table 7.

Table 7 - Companies that Responded to City of LA RFP

#	***Company Name***
1	Zia Metallurgical Processes, Inc.
2	Interstate Waste Technologies (IWT)
3	Covanta Energy Corp.
4	Wheelabrator Technologies Inc.
5	WRSI / DESC
6	Plasco Energy Group
7	Community Recycling
8	Carbon Sequestation
9	CA Renewable Technologies LLC
10	Urbaser & Keppel Seghers
11	CA Renewable Technologies LLC (emerging)
12	Rainbow Disposal

As of November 2009, the City of Los Angeles had identified a preferred emerging technology provider, CA Renewable Technologies LLC (CART), and the parties have commenced contract negotiations. California Renewable Technologies has proposed a 150 tpd sorting and biological processing system that utilizes dry mechanical pre-sorting and a water bath sorting system; following these sorting processes, the remaining organic materials are ground up and processed through two-stage anaerobic digestion. CART has proposed to site the facility outside of the City of Los Angeles boundaries. Contract negotiations with CART will provide an opportunity to define the costs and terms of an agreement before the potential development of a facility moves forward.

In addition to the CART emerging technology facility, the City of Los Angeles will also enter into contract negotiations to develop a commercial-scale, conventional solid waste processing facility. This facility will process approximately 1,000 tpd of MSW. As of November 2009, the City was in the final stages of selecting a preferred candidate from among a short list including two conventional waste-to-energy proposals and two "hybrid" proposals combining mechanical/biological/thermal processes. Contract negotiations for this commercial-scale project are expected to begin early in 2010.

4.3 Delaware Solid Waste Authority

The Solid Waste Management Technical Working Group was established by the Secretary of Delaware's Department of Natural Resources and Environmental Control (DNREC), and was commissioned to:

> …perform a feasibility review of available municipal solid waste management alternatives and recommend a municipal solid waste management program or programs capable of being implemented that would best serve Delaware's long-term and short-term municipal solid waste management needs (Working Group 2005).

The State of Delaware has experienced population growth at a rate higher than the national average, concurrent with a per-capita waste generation rate that is likely increasing faster than the national average. Delaware's recycling rate stands well below the national average.

These trends in waste generation, combined with a limited capacity for solid waste disposal, present imminent capacity issues for solid waste management throughout Delaware, and particularly for Northern Delaware. The disposal of sludge from the Wilmington Waste Water

Treatment Plant and the disposal of waste tires present additional solid waste management issues. The Working Group's 2005 ***Solid Waste Management Alternatives for Delaware*** was prepared to help address these issues.

In the Working Group's judgment, the primary challenge related to Delaware's solid waste management is to preserve the valuable, low-cost landfill capacity it currently has. The Plan offers a two-pronged approach to meet this primary objective. First, it emphasizes the need for Delaware to adopt an aggressive and effective recycling or materials recovery to divert materials from its landfills. Second, the Plan evaluates a number of new processing technologies with potential to reduce the volume of waste requiring landfill disposal and convert waste materials into useable products, and recommends a course of action to pursue their implementation in Delaware.

The Working Group considered a full range of solid waste technologies, most of which were considered new or emerging. The study included 7 thermal, biological, or mechanical processing technologies, as shown in Table 8 below.

Table 8 - Technologies evaluated by the Delaware Working Group.

Thermal Processing	*Biological Processing*	*Mechanical Processing*
Waste-to-Energy (WTE) Gasification Plasma Arc Conversion	Aerobic Composting Anaerobic Digestion Bioreactor Landfills	Autoclave with Mechanical Processing

A set of 7 technical criteria was selected to evaluate the solid waste management technologies being considered for potential implementation in the State of Delaware. These criteria are as follows:

- **Readiness and Reliability –** Addresses the question of how confident the state can be that if a full-size facility were built, it would operate effectively. The number and length of tenure of successfully operating commercial facilities were used to rate the readiness of technologies, and an assessment of reliability was based upon a technology's susceptibility to process interruptions in commercial operations.
- **Inputs and Pre-Processing** - Focused on what inputs the system would process, and how those inputs had to be pre-processed in order for them to be converted (or disposed of) effectively by the technological process. Each technology was rated according to the types of

wastes it had demonstrated the ability to process, and according to the method and degree of pre-processing required.

- **Potential Public Health and Nuisance, Environmental, and Worker Safety Risks** – Emissions of criteria and other air pollutants, the composition and safety of residual materials left over from processing, resource consumption required for operations, and worker safety were among the items considered for this criterion.
- **Energy Balance** – The percentage of total energy inputs (including the energy value of the waste stream) represented by total usable energy outputs was used as a measure of energy balance.
- **Materials Balance** - The percentage of the waste stream that is converted into useful products and, therefore, does not have to be disposed of in a landfill, was used as a measure of materials balance.
- **Economics** – Costs and revenues were projected for each technology to evaluate its economic feasibility.
- **Legal and Policy Issues** - For any technology ultimately constructed in Delaware, local, state and federal laws and regulations would impose significant restrictions. Local zoning ordinances would impact site selection and approval; state and federal laws impose a variety of permitting obligations and restrictions. Additionally, community acceptance is key to the implementation of waste management technologies. The characteristics and requirements of each technology were considered in the context of legal compliance and community acceptance.

For each of the 7 technologies, the Working Group assigned a summary rating value to each of the 7 evaluation criteria. These ratings subjectively integrate all factors considered in the evaluation.

Table 9 summarizes the average ratings assigned to each technology for each of the 7 criteria, as well as for conventional landfills. Ratings have been rounded to the nearest whole number. Please note these ratings are not on a mathematical scale. For instance, a rating of 8, although significantly better, is not necessarily twice as good as a rating of 4. Nor can the ratings be added together to provide a summary score. However, the ratings *do* allow comparisons to be made among technologies for each criterion.

Table 9 – Delaware Working Group Criteria Rankings

	Readiness and Reliability	Inputs and Pre-Processing	Public Health, Environment, Worker Safety	Energy Balance	Materials Balance	Economics	Legal and Policy Issues
Waste to Energy	8	8	7	10	8	7	2
Gasification	5	8	8	8	10	5	6
Plasma Arc Conversion	5	8	7	8	10	4	6
Aerobic Composting	7	4	6	2	6	8	8
Anaerobic Digestion	8	5	8	5	8	8	8
Bioreactor	8	9	8	5	4	9	6
Autoclave with Mechanical Processing	6	4	5	NA	8	1	8
Landfill	9	9	7	3	2	10	6

Of the 7 technologies evaluated, one, the bioreactor landfill, is an approach that is already in use at 2 Delaware facilities. This process accelerates the decomposition of waste in the landfills thereby increasing their effective capacity, while generating increased amounts of methane, which is a valuable energy source. The Working Group recommends that the Delaware Solid Waste Authority continue to pursue and enhance this approach, and supports its efforts to convert the landfill gas to electricity.

Two technologies – Autoclave with Mechanical Processing and Aerobic Composting – were not rated highly because the market for their products in Delaware is very uncertain. Products from both processes could be used to enhance soil quality, but, without substantial pre-processing, they would most likely contain too much contamination to allow other than very restricted use. The products from either could be also used as a feedstock for a combustion or conversion process that results in the generation of electricity, but the Working Group was unconvinced that this would be more economical or generate fewer risks than using the waste materials themselves for these purposes.

Two of the thermal processes – Gasification and Plasma Arc Conversion – were also rated relatively low. Both of these technologies would substantially reduce the amount of waste requiring landfill disposal (by over 90%) and would both be used to produce a synfuel product that can be used to generate electricity. However, no commercial sized facilities employing either technology have been built in the United States (and no commercial sized facilities using the plasma arc process with an MSW feedstock anywhere in the world), which led the Working Group to conclude that their readiness and reliability has not been adequately demonstrated.

Anaerobic Digestion and Waste-to-Energy were rated highest of the 7 technologies. Both significantly reduce the amount of waste requiring landfill disposal, and both produce a useful product.

Compared to a Waste-to-Energy facility, the Anaerobic Digestion process has the following advantages:

- It does not generate hazardous air emissions which subsequently have to be captured by pollution control equipment,
- Because it does not generate hazardous pollutants, it is likely to be less controversial, and the construction of a facility would not require that current Delaware statutes be amended or repealed,
- Its product has alternative uses, and
- It can also handle sewage sludge in the feed stream.

The waste-to-energy process, on the other hand, has the following advantages over the anaerobic digestion process:

- Its effectiveness in processing solid wastes and reliably generating electricity has been clearly demonstrated in the United States in facilities processing 1,000 tons per day or more,
- It has among the most positive energy balances,
- It requires comparatively little acreage to process 1,000 tons per day, and
- It can process whole tires in limited quantities.

The Working Group expressed its reservations regarding the Waste-to-Energy technology's potential to generate dioxin and furan byproducts, and suggests that its support of this technology is contingent upon the results of a National Academy of Sciences assessment of the toxicology of these compounds. With this caveat, the Working Group recommends that Delaware focus its decision making process on the Anaerobic Digestion and Waste-to-Energy technologies.

5.0 CONCLUSIONS

Of the emerging technologies, only the MBT facilities have been successfully developed for the management of MSW at multiple locations in industrialized countries in Europe or in Canada. These include both MBT facilities utilizing and aerobic treatment process, such as that used by RFI respondent ECODECO, as well as MBT facilities that utilize a process of anaerobic digestion.

Several of the RFI respondents and other these companies with gasification technologies have reportedly developed demonstration facilities in the U.S. or Canada. However, only one of these demonstration facilities routinely operates with MSW feedstock at a daily volume on the same order of magnitude as is needed to service the needs of the Planning Unit. Several of the companies are in the process of developing commercial scale facilities in the U.S. or are in the advanced stages of a procurement process to develop a commercial facility on behalf of a municipality or other local or regional solid waste agency in the United States.

All of the emerging technologies have potentially negative attributes, when compared to conventional technologies for solid waste management. These include:

- Lack of well-established performance history creates risk in several categories as noted below. These negative attributes are not necessarily applicable to MBT technologies that have established performance histories in Europe.
    - True cost of construction and operation are not yet known. As a result these costs may be initially underestimated, and if so, the resulting financial distress of higher than expected costs may cause the project to fail.
    - Environmental performance and impacts of full scale operations may not be fully examined. This may result in extended review time to secure facility permits, delaying project implementation and increasing the cost of the project. Further, compared to conventional technologies, the risk of unexpected environmental contamination is greater.
- Marketability of recovered materials, bio-fuels, and byproducts presents a financial risk to the projects. This risk occurs as a result of uncertainty with the technical efficacy of the process (at full commercial scale) as well as because of potential fluctuations in market prices for the commodities being recovered and produced. This is especially true with respect to the anticipated use of byproducts, such as the vitreous slag produced by the plasma gasification technology, or the residues from other gasification technologies. Since widespread markets for these materials may not currently exist, stable long-term

markets may need to be developed. If these efforts are not successful, and the material is not marketable, it will need to be disposed of, and this unanticipated cost will result in a negative financial impact on the project and its sponsors.

These potentially negative attributes can be overcome by a company with sufficient financial resources to assure successful completion and operation of facilities utilizing one of these emerging technologies.

In addition, most of the emerging technologies have potentially positive attributes which make them attractive for further consideration. These potentially positive attributes include:

- Significantly less residue for disposal than conventional waste-to-energy technology;
- Lower emissions and higher level of material recovery than conventional waste-to-energy technology;
- Lower capital and operating costs than conventional waste-to-energy technology;

Because several of these technologies are still emerging, these potentially positive attributes remain to be proven through commercial operations at a scale similar to what would be required to service the Planning Unit. While MBT technologies for MSW have been developed in many European countries, they are relatively expensive, and their use in Europe is prompted by national policies which limit the amount of organic material that can be landfilled. The lack of such policy in the United States could put these technologies at an economic disadvantage.

Nevertheless, all of these emerging technologies will warrant continued attention during the course of the review process for the SWMP, as it is possible that more of these technologies will establish widespread full-scale commercial operations, either in the United States or elsewhere, by the time the new SWMP is formally adopted and approved and it is time to commence procurement of new facilities.

6.0 REFERENCES

Brickner, Robert. "*Current and Near-term Technologies for Converting Wood Waste to Bioenergy"* . Presented at Conference on Bioenergy in New Jersey New Brunswick, NJ. October 2007.

Binder, James J. and Steven Torres. "*Evaluating Innovative Technology for Municipal Waste Management".* Presented to Northeast Waste Management Officials' Association. November 27, 2007

City of Los Angeles, CA Department of Public Works and Department of Sanitation. *"Evaluation of Alternative Solid Waste Processing Technologies."* URS Corporation. September 2005.

Delaware Solid Waste Management Technical Working Group. *"Solid Waste Management Alternatives for Delaware."* May 15, 2006.

Friends of the Earth. *Briefing on Mechanical and Biological Treatment*. London, UK. September 2008.

New York City Economic Development Corporation and New York City Department of Sanitation. *Evaluation of New and Emerging Solid Waste Management Technologies.* September 16, 2004.

New York City Economic Development Corporation and New York City Department of Sanitation. *Focused Verification and Validation of Advanced Solid Waste Management Conversion Technologies - Phase 2 Study.* Alternative Resources, Inc. March 2006.

APPENDICES

Appendix A – Request for Information

Appendix B – RFI Response Summaries

APPENDIX A

REQUEST FOR INFORMATION

The City of Albany, NY
Capital Region Solid Waste Management Plan
Evaluation of Municipal Solid Waste Technologies

REQUEST FOR INFORMATION

I. INTRODUCTION

The City of Albany, New York is preparing a New Long-Term Solid Waste Management Plan (SWMP) for the Capital Region Solid Waste Management Partnership Planning Unit (the Planning Unit). This new SWMP will define the key elements of the future solid waste management program for the Planning Unit, for the period through the year 2030.

The Capital Region Partnership Planning Unit operates as an informal consortium of 13 municipalities with a jurisdiction of approximately 450 square miles in the Albany, New York region. Planning Unit participants currently include 3 cities, 7 towns, and 3 villages located in Albany and Rensselaer Counties. The City of Albany acts as the lead participant. The total population of Planning Unit communities is approximately 220,000 persons.

The City of Albany presently operates the Rapp Road landfill facility, which accepts waste from the Planning Unit communities and other local sources. During the year 2007, the Rapp Road landfill accepted approximately 253,300 tons of waste for disposal. The vast majority of this waste (97%) is characterized as Municipal Solid Waste (MSW). The Rapp Road landfill accepts some waste from communities located outside of the Planning Unit, and some waste from the Planning Unit is disposed of at other facilities. Net waste disposal from the Planning Unit in 2007 is estimated at approximately 238,100 tons. Another 118,500 tons of waste material were reported recycled in the Planning Unit in 2007, yielding an overall diversion rate of 33%.

The City of Albany and the member municipalities operate mandatory source separation and recycling programs for a variety of mixed paper streams, for commingled bottles, cans and plastic containers (Nos. 1&2), and yard waste, among other materials. The implementation of the most recent SWMP Modification will result in the expansion of local recycling programs across all sectors (residential, commercial, institutional and industrial) beyond these current levels. If the 47% reduction and recycling goal contained in the most recent SWMP Modification is achieved, estimated net disposal requirements in the year 2011 will be reduced to 227,000 tons per year.

For purposes of this RFI, this should be considered the baseline waste quantity. No detailed data are currently available on the quality of the post-recyclable waste that is delivered for disposal, so for purposes of this RFI, responders should assume that MSW quality is as per recent estimates available from the United States Environmental Protection Agency.

Assuming the approval of a pending expansion application, the Rapp Road Landfill will near its full capacity during the year 2016. As part of the New SWMP process, the City of Albany is

identifying and evaluating solid waste management technologies that could potentially reduce the amount of solid waste requiring landfill disposal. The evaluation will consider both established and emerging technologies for possible inclusion in the region's long-term solid waste program.

This Request for Information (RFI) is being distributed to solicit preliminary statements of interest and background information from parties wishing to participate in the evaluation process. Interested parties are invited to provide basic information regarding their sponsored technologies, including measures of actual or anticipated performance in each of the following categories of criteria:

- Experience of Project Sponsors
- Facility Sizing
- Costs of Ownership and Operation
- Environmental Impacts
- Readiness and Reliability
- Beneficial Reuse of MSW Byproducts
- Residues Requiring Landfill Disposal

Section II of the RFI specifies the information requested for this evaluation.

Responses to the RFI will be compiled, and the suitability of technologies for further consideration will be evaluated within the context of the Planning Unit's future needs and priorities. The current solicitation marks a preliminary measure in the ongoing process of SWMP preparation. Should the Planning Unit decide to pursue a more detailed evaluation of solid waste technologies, parties identified as potentially suited to contribute to the Planning Unit's future solid waste management program may be invited to participate in further discourse. Advanced levels of evaluation may include the solicitation of detailed technical documentation and verifiable statements of qualification from technology sponsors, to be evaluated at a more resolute level of detail for possible implementation.

Actual implementation of a facility and/or technology, if any, by or on behalf of the City or the Planning Unit, would be conducted under a formal procurement process, pursuant to the requirements of applicable law.

II. RESPONSE REQUIREMENTS

Potential project sponsors shall provide a statement of interest describing their desire and qualification to participate in the evaluation of solid waste management technologies for the Capital Region Solid Waste Management Partnership Planning Unit's New SWMP. Responses to this RFI must address each component of the following criteria.

Experience of Project Sponsors

Provide background information on the project sponsor, including:

- Name, address and contact information for the Company;
- Type of company and brief history;
- Management team including brief biographies of key personnel;
- Qualifications and experience with similar projects;
- Brief description of the proprietary technology owned by or licensed to the company that is proposed for consideration.

If the sponsor has experience with reference facilities similar to one that may be appropriate for the Planning Unit, please provide background information for those existing facilities which have been constructed and/or operated under the sponsorship of your party. For each reference facility, provide the following information:

- Location;
- Date of facility's commencement of operations;
- Type(s) of feedstock and average daily throughput (tpd);
- Initial capital cost in U.S. dollars, including the costs of planning, design, construction, materials and machinery;
- Current cost of operations in U.S. dollars per ton of material processed including the costs of labor, equipment and facility maintenance, residue disposal, and other costs associated with routine facility operations on an annual basis;
- Current tipping fee (in U.S. dollars per ton) for contractually committed waste deliveries from sponsoring or host municipality, if applicable;
- Quantity (tpd) and composition of residuals requiring landfill disposal.

Potential project sponsors who do not own or operate reference facilities should provide comparable information about their proposed technology, along with the specific basis of the information (i.e. operating histories, pending proposal, etc.)

Facility Sizing

Potential project sponsors should provide information related to facility sizing. Potential sponsors may propose a facility sized to accommodate all or a portion of the baseline waste quantity (227,000 tpy) . Because the New SWMP process will also involve assessing the potential expansion of the Planning Unit to include other communities in the region, potential

sponsors are asked to provide information regarding the size of a larger facility or an optimally-sized facility.

The following information should be provided regarding the anticipated characteristics of a proposed facility designed to serve the Planning Unit.

- Types of feedstock (MSW, C&D, etc);
- Unacceptable wastes;
- Annual processing capacity (tpy) and average daily throughput (tpd);
- Site acreage required to support a proposed facility;
- Alternate size for larger or optimally-sized facility (tpy and tpd);
- Minimum feasible facility size (tpy and tpd).

Costs of Ownership and Operation

Recognizing that these are planning level estimates, potential project sponsors should provide anticipated cost information regarding a facility designed and constructed to serve the Planning Unit.

- Initial capital cost in U.S. dollars, including the costs of planning, design, construction, materials and machinery;
- If applicable, alternative capital cost estimates for optimally-sized and minimum sized facilities;
- Estimated cost of operations in U.S. dollars per ton of material processed;including the costs of labor, equipment and facility maintenance, residue disposal, and other costs associated with routine facility operations on an annual basis;
- If applicable, the net value of any energy or material recovery resulting from the process, in U.S. dollars per ton of material processed.

Environmental Impacts

Please characterize, and quantify to the degree possible, the anticipated environmental impacts of a facility designed to serve the Planning Unit.

- *Air Emissions- provide a summary description of process air emissions and controls, including:*
    - Anticipated greenhouse gas emissions (tpy of CO2 equivalent) resulting from MSW processing and/or associated energy generation
    - Anticipated emissions of Criteria Pollutants (tpy)
    - Air pollution control equipment and odor control

- *Water – provide a summary description of process water use and wastewater discharges, including:*
    - Process water consumption (gpd)
    - Wastewater discharge (gpd)
    - Wastewater pre-treatment requirements

- *Utility Requirements – provide a summary description of the utility consumption necessary to sustain facility operations, including:*
    - Anticipated gross and net electrical consumption (kWh per ton of MSW)
    - Natural gas requirements
    - Other types of fuel and anticipated consumption (in units per ton of MSW)

Readiness and Reliability

- Please describe the status of your sponsored technology in terms of its maturity and readiness for commercial implementation, as well as its suitability for permitting in the State of New York;
- Describe how construction and operational performance guarantees would be provided;
- Describe the timeframes necessary for each of the following:
    - Facility Design
    - Facility "permitting"
    - Facility construction
    - Start-up and Acceptance Testing
    - Total time from Facility Design through Acceptance Testing

Beneficial Reuse of MSW Byproducts

- If applicable, quantify the gross and net generation of energy (in kWh or other appropriate measure per ton of waste processed) anticipated from the processing of waste at a facility designed to serve the Planning Unit.
- Describe the composition and quantify the production of marketable solid or gaseous byproducts generated as outputs of a facility designed to serve the Planning Unit. Responses should be expressed in units per ton of waste processed.

Residue Requiring Landfill Disposal

Briefly describe any solid residue from the process which might require landfill disposal, including:

- The anticipated percentage (by weight of incoming waste processed) of solid residue requiring land disposal;
- Anticipated hazardous waste characterization as per TCLP or other applicable procedure:
- Potential beneficial uses of solid residue.

III. SUBMITTAL OF RESPONSES

Due Date

One copy of each submittal should be received by CHA, III Winners Circle, Albany NY ***no later than 4:30 p.m. Eastern Time on Friday, March 27, 2009***. Responses may be submitted via standard or overnight mail, or by hand in accordance with the time and date noted. Responses should be addressed to:

Ms. Suzanne Christopher
CHA
III Winners Circle
Albany, NY 12205-0269

Questions or comments should be submitted in written format to Ms. Suzanne Christopher at schristopher@chacompanies.com .

APPENDIX B

RFI RESPONSE SUMMARIES

Company Name: Bigold Fuels Corporation
Technology Category: Front-End Sterilization, Gasification

BioGold Fuels Corporation is a Nevada corporation based in New York City, and was formed as a result of a merger with Full Circle Industries, Inc. in April 2007, and became a publicly traded company in October 2007.

The BioGold process takes place entirely within its building. MSW is unloaded from trucks and conveyed to a sterilizer where it is sterilized, reduced in size, and mechanically sorted to remove recyclable metals and other inorganic material from the organic fraction of the waste. The sterilized organic and energy-containing materials are then fed into a thermo-chemical gasifier, where they are transformed at high temperature into compounds that produce a syngas composed mostly of hydrogen and carbon monoxide. Remaining solid residue can be vitrified into a glass-like solid that can be used for various construction applications.

Syngas can be used to generate electricity using commercial electricity-generating equipment, or converted to a biofuel using a standard gas-to-liquid catalytic process. BioGold would build infrastructure to generate both electricity and transportation biofuels, and would shift production according to the relative market value of these commodities.

Biogold responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects:
BioGold has "successfully implemented the front-end processing aspect of its technology using MSW to create a marketable recycled long-fiber product sold for liner-board manufacture". To date, the company has not constructed or operated a MSW processing facility.

Facility Sizing
Types of feedstock: MSW; can also accommodate certain specialty waste streams such as dewatered sewage sludge and other organic waste streams.
Unacceptable wastes: Information not provided.
Proposed processing capacity to serve Planning Unit: BioGold would propose a facility to accommodate 290,000 tpy with an expected average throughput of 880 tpd. The facility would operate 24 hours/day, 7 days/week and waste acceptance would be tailored to local needs.
Site requirements: Approximately 20 acres.
Alternate size for larger or optimally-sized facility: A larger facility could be designed if market analysis indicates a need. Additional sterilizing units could be deployed at satellite locations, with the sterilized processed waste being delivered to the main facility.
Minimum feasible facility size: 300 tpd (100,000 tpy).

Costs of Ownership and Operation
Initial capital cost: Approximately $230 million or $261,364/tpd of installed capacity.
Operating cost: $83.55/ton; includes costs of labor, equipment and facility maintenance, residue disposal, and other routine annual costs. Excludes debt service.
Tipping fee: Information not provided.
Electric revenues: Based on the information provided by BioGold, CHA calculates estimated electrical revenues of $24.50/ton at a price of $0.07/kWh.

Environmental Impacts
Greenhouse gas emissions: Information not provided.
Criteria pollutant emissions: Information not provided.

Air pollution control equipment and odor control: The sterilization process eliminates odors, and all processing is contained within a negative-pressure building. Gasification process emissions are entirely captured in the syngas, which is processed to neutralize any remaining pollutants. Air emissions from the catalytic production of biofuels are captured and processed through the gasifier, where they are broken down and rendered inert. Air emissions from electric generation are less than those from other similarly sized generation facilities; standard controls and exhaust treatment are applied.
Process water consumption: Volume of water consumption not provided. The sterilization process yields water as 10-15% of the feedstock by weight is purged as excess water. This purged water is treated and reintroduced as a reagent. Net result is "small" water usage.
Wastewater discharge: Volume of wastewater discharge is not provided. Purged water is treated and recycled in the process.
Electrical consumption: 612 MWh/day generated; 334 MWh/day consumed; net generation of 278 MWh/day or 350 kWh/ton. Alternatively, 47,790 gpd of ethanol produced.
Natural gas requirements: 500,000,000 scf/annum or 1,724 scf/ton.

Readiness and Reliability
Maturity and suitability for permitting: The facility would combine commercially proven technologies that are ready for implementation on the scale required for the Planning Unit. Anticipated to meet all NYS permitting and approval requirements.
Construction and performance guarantees: To be provided under a standard engineering/procurement/construction (EPC) arrangement. Process efficacy insurance will likely be required by financial backers. BioGold will incorporate storage technology and space for prepared materials, for use in the event of short-term outages of the gasification units. The company would enter into arrangements for alternate use, sale or disposal of the prepared sterilized material in the event of an extended outage of the gasification units, and for alternate disposal of MSW in the event of an extended outage of the sterilizer units.
Timeframes:

Facility design: 6 months
Facility "permitting": 1 year
Facility construction: 7 months
Start-up and acceptance testing: 2 months
Total timeframe: 2 ½ years.

Beneficial Reuse of MSW Byproducts
Energy generation: Syngas can be used to produce a net 278 MW/day of electricity or up to 86 gallons of second generation ethanol per dry ton of sterilized processed waste. Based on the information provided by BioGold, CHA calculates a net electrical output of 350 kWh/ton of waste processed.
Solid or gaseous byproducts: Recyclable materials recovered by the separation process would be sold to market. Remaining solid residue material is stabilized through a vitrification process and can be used as an aggregate material.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: Maximum 7% to 15% of the MSW waste stream.
Anticipated hazardous waste characterization: Residual material is inert. No characterization or testing information provided.

Company Name: Carbon Diversion, Inc.
Technology Category: Pyrolysis/Gasification

Carbon Diversion Inc. is a Hawaiian corporation that was formed in 2004. CDI creates small-scale systems that can process MSW to generate electricity and bio-char products. The company identifies a pilot plant and two commercial facilities, located in Hawaii and Tennessee. CDI will break ground on the first of three planned manufacturing facilities in April 2009, which will allow the company to produce and deliver its systems.

Incoming waste, including tires, animal waste and green waste, is pre-processed (briquetted) and fed into the processors. A pressurized partial pyrolysis gasification process is used to produce a liquid fuel and syngas, which are used to generate electricity. Bio-char can be used for water filtration or as a soil amendment. Units can be remote-started by local power providers, and can be used for emergency power generation if provided access to natural gas utilities.

CDI responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: CDI has built a pilot plant at Campbell Industrial Park in Hawaii. The plant consists of three 1-ton processors, and the main product is a petroleum product in the kerosene range.

A second system is located in Dunlop, Tennessee as part of a sustainable community development, and consists of two 3.5 ton/hr. units. The Dunlop facility is designed to operate 10 hours/day and generate 2 MW of electricity. Bio-char byproducts are bagged and sold under the Eterna Green trade name as a soil amendment.

Work has begun on a third site in Hawaii; four additional sites have been identified at transfer stations in Hawaii, pending final bond passage with a start date in July 2009.

Facility Sizing
Types of feedstock: Various waste streams.
Unacceptable wastes: Information not provided.
Proposed processing capacity to serve Planning Unit: Dual 3.5 ton/hour processing system capable of processing 50 tons of waste per 8-hour day.
Site acreage required: As little as 0.5 acre, designed to be co-located at an existing transfer station.
Alternate size for larger or optimally-sized facility: Information not provided, but submittal notes that plants are scalable by adding modular units.
Minimum feasible facility size: Information not provided.

Costs of Ownership and Operation
Initial capital cost: $6.25 million or $125,000/tpd installed capacity calculated using information provided by CDI.
Operating cost: $240/ton.
Tipping fee: $65/ton.
Electric revenues: Approximately $160/day (2 MWh x $0.08/kWh). Bio-char revenue is estimated at $350/ton of incoming waste.

Environmental Impacts
Greenhouse gas emissions: CDI describes its system as a "carbon negative system".
Criteria pollutant emissions: "…complies with all relevant EPA and local emission standards". Emissions data not provided.

Air pollution control equipment and odor control: Emissions from electrical generation are passed through catalysis; a carbon filter is used in both the exhaust gas and secondary exhaust systems.
Process water consumption: The process recycles 80% of all water used. Typical consumption is less than 500-1,000 gallons/day with onsite water conditioning.recycling system.
Wastewater discharge: Information not provided.
Electrical consumption: Little energy required to run the process; 2 MW electricity generated.
Natural gas requirements: Natural gas can be used to operate facility for emergency power generation.

Readiness and Reliability
Maturity and suitability for permitting: CDI's new manufacturing facilities will allow it to produce a two-processor system every six weeks. The company will offer maintenance, training and support for the system.
Construction and performance guarantees: Information not provided.
Timeframes: Information not provided.

Beneficial Reuse of MSW Byproducts
Energy generation: 2 MWh/day or 40 kWh/ton as calculated by CHA..
Solid or gaseous byproducts: Bio-char can be marketed as a soil amendment to enhance crop yields, a steel additive or for water filtration.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: No landfill disposal.
Anticipated hazardous waste characterization: NA.

Company Name: Casella Waste Systems, Inc.
Technology Category: Single-Stream Recycling, WTE

Casella Waste Systems, Inc. is a vertically integrated resource management company that operates primarily in the northeastern U.S, and was founded in 1975. The company operates a number of collection divisions, transfer stations, disposal facilities, recycling facilities, and landfill gas to energy facilities. FCR, Inc. is a wholly owned subsidiary of Casella that designs, builds and operates recycling facilities throughout the U.S.

Casella proposes a four-phased waste management approach for the Planning Unit.

Phase 1 includes:

- Introduction of a single-stream recycling system, coupled with commodity marketing.
- Piping landfill gas that is currently flared at the Rapp Road Landfill to the SUNY-Albany campus as a direct-use application.[1]

Phase II includes:

- Establishment of a multi-material processing system platform, located at Rapp Road Landfill, to recover additional recyclables and develop engineered feedstocks for subsequent conversion processes.[2]

Phase III includes:

- Manufacturing engineered feedstocks from non-recoverable waste streams for co-firing and direct hydrocarbon fuel substitution for boilers, kilns, and similar energy uses.

Phase IV includes:

- Establishment of a waste-to-energy facility operating by means of pyrolysis and gasification to process MSW. Syngas products would be used to produce electricity, liquid fuels or chemicals.

Casella responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Casella is a well-established waste management company with experience in constructing and operating solid waste disposal and other facilities throughout the northeastern U.S. The company operates 32 collection divisions, 31 transfer stations, 11 disposal facilities, 37 recycling facilities, and 5 landfill gas to energy facilities. Casella operates recycling facilities located in 10 states.

Casella's Camden, NJ, Philadelphia, PA and Ontario, NY MRFs have each been constructed since 2005, and serve as reference facilities for recycling. The Ontario County, NY direct-use landfill gas pipeline project powers the only office complex in the U.S. fueled directly by landfill gas. The company's Charlestown, MA facility serves as a multi-material processing platform reference project. Casella has a WTE commercial demonstration unit currently in acceptance testing, which would serve as a reference facility upon completion; other reference facilities are operated by Eco Technology, a project partner.

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[1] *Note: This element may not be feasible because the City of Albany has committed its landfill gas to another user.*
[2] *Note: This location may not be feasible because the City of Albany has committed the Rapp Road site for Pine Bush habitat preservation.*

Facility Sizing

Types of feedstock:

Phase I: Acceptable recyclables include various papers, cardboard, and metal, glass and plastic (MGP) containers. The Direct-use landfill gas pipeline would utilize landfill gases from the Rapp Road Landfill that are currently flared.

Phase II: All dry recoverable materials from the waste stream.

Phase III: Non-recyclable MSW.

Phase IV: Engineered Phase III output.

Site Requirements:

Unacceptable wastes:

Phase III: Wet recoverable organics and non-convertible material.

Phase IV: Wet organics and non-convertible material.

Proposed processing capacity to serve Planning Unit: Casella would propose facilities to accommodate the Planning Unit's 227,000 tpy baseline waste quantity:

- Phase I MRF capacity up to 120,000 tpy (460 tpd assuming 260-day operating year).
- Phase II Multi-material processing platform capacity 150,000-200,000 tpy (575-750 tpd assuming 260-day operating year).
- Phase III Feedstock engineering capacity 35,000-50,000 tpy (135 tpd assuming 260-day operating year)or more.
- Phase IV WTE capacity 100,000 tpy (385 tpd assuming 260-day operating year).

Alternate size for larger or optimally-sized facility: Information not provided.

Minimum feasible facility size: Phase III Feedstock engineering minimum capacity 35,000-50,000 tpy.

Costs of Ownership and Operation

Initial capital cost:

- Phase I MRF equipment capital costs $8 million; operating costs $45-75/ton.
- Phase I landfill gas pipeline estimated capital costs $2 million; operating costs $400,000/year ($1/MMBtu).
- Phase II multi-material processing platform equipment capital costs $12 million assuming use of existing building located at Rapp Road Landfill; operating costs $45/ton.
- Phase III feedstock engineering equipment capital costs $2 million; operating costs $25/ton.
- Phase IV WTE equipment capital costs $24 million; operating costs $75/ton.
- CHA calculates the total capital cost at

Operating cost:

- Phase I MRF operating costs $45-75/ton.
- Phase I landfill gas pipeline operating costs $400,000/year ($1/MMBtu).
- Phase II multi-material processing platform operating costs $45/ton.
- Phase III feedstock engineering operating costs $25/ton.
- Phase IV WTE operating costs $75/ton

Tipping fee: Information not provided. Anticipated net profit sharing revenues of $15/ton to the Planning Unit.

Electric revenues: Anticipated $2 million/year in additional revenue share to the Planning Unit.

Environmental Impacts

Greenhouse gas emissions:

- Phase I MRF greenhouse gas emissions reduced by 170,840 tons/year CO_2 equivalent.
- Phase I landfill gas pipeline greenhouse gas emissions reduced by 215,220 tons/year CO_2 equivalent.
- Phase II greenhouse gas emissions reduced by 83,317 tons/year CO_2 equivalent.

- Phase III feedstock engineering avoided greenhouse gas emissions 129,540 tons/year CO_2 equivalent.
- Phase IV WTE avoided greenhouse gas emissions 198,171 tons/year CO_2 equivalent.

Criteria pollutant emissions:
- Phase III feedstock engineering, "below coal or traditional fuel".
- Phase IV WTE, no SO_x and trace NO_x.

Air pollution control equipment and odor control:
- Phase II multi-material processing platform, none.
- Phase III feedstock engineering, information not provided.
- Phase IV WTE, syngas scrubbing towers.

Process water consumption: Required for scrubbing towers; volume of consumption not provided.
Wastewater discharge: Yes for scrubbing towers; wastewater volume not provided.
Electrical consumption: Information not provided.
Natural gas requirements: Information not provided. Phase I direct-use landfill gas pipeline would displace 375,000 MMBtu of natural gas consumption at SUNY-Albany annually.

Readiness and Reliability
Maturity and suitability for permitting:
Facilities and technologies are proven with commercial reference facilities in the U.S. Casella has permitting experience in the northeastern U.S., including New York State.
Construction and performance guarantees: Casella would finance and operate the proposed facilities.
Timeframes:
If the process were initiated in 2009, Phases I-IV would be completed by 2016.

Beneficial Reuse of MSW Byproducts.
Energy generation:
Phase I landfill gas pipeline to provide 375,000 MMBtu energy to SUNY-Albany; Casella indicates that Phase IV WTE would generate 98,000,000 MWh/year, but this value likely overstates the electrical generation.
Solid or gaseous byproducts: Recyclables recovered by Phase I and Phase II facilities will be sold to market, and fuel pellets will be produced by the Phase III feedstock engineering facility.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: An estimated 20% of incoming MSW would require landfill disposal upon completion of Phases I-IV.
Anticipated hazardous waste characterization: Information not provided.

Company Name: Covanta Energy Corporation
Technology Category: WTE

Covanta is the largest independent owner and operator of WTE facilities in North America, and operates a network of waste management facilities in the vicinity of the Capital District.

Covanta proposes to accept solid waste from the Planning Unit at its nearby WTE facilities in order to relieve the pressure to address the closure of the Rapp Road Landfill by 2016. Available transfer capacity at Covanta's B3 Transfer Station in Columbia County would allow the transfer and delivery of waste to WTE facilities that may include the nearby Covanta facilities in Pittsfield, MA and Springfield, MA. As an option, the Planning Unit could deliver waste to Covanta for processing at its WTE facilities and take the inert process ash back to the Rapp Road Landfill at a volume reduced by 90%.

Covanta responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Covanta is recognized as a leader in the WTE industry. The company provides integrated WTE design, engineering, construction and operation and maintenance services. Covanta operates more than 20 WTE facilities in the Northeast, including 5 in New York State and several others in Massachusetts and Connecticut.

Experience with similar projects: Noting that Covanta does not propose to build a WTE facility in the Capital Region, the company has provided a list of more than 35 WTE facilities that it owns and operates in the U.S. Covanta operates a number of transfer stations, and is experienced in managing the logistics of solid waste transport.

Facility Sizing
Types of feedstock: MSW
Unacceptable wastes: Waste materials posing a threat to public health, are too large or bulky for disposal, or are present in concentrations or quantities that could negatively impact the facility's operational or environmental performance.
Proposed processing capacity to serve Planning Unit: Existing Covanta facilities could accept all or a portion of the Planning Unit's solid waste.
Alternate size for larger or optimally-sized facility: NA
Minimum feasible facility size: NA

Costs of Ownership and Operation
The Planning Unit would not incur the costs associated with introducing a new waste disposal facility in the Capital Region. The Planning Unit would pay a per-ton tipping fee to drop off waste at the B3 Transfer Station. Covanta does not provide a proposed tipping fee.

Initial capital cost: NA.
Operating cost: NA
Tipping fee: Information not provided.
Electric revenues: NA

Environmental Impacts
Greenhouse gas emissions: Information not provided.
Criteria pollutant emissions: Covanta provides emission data for pollutants including VOC, NO_x, CO, particulates, SO_2, Pb and NH_3 at four reference facilities.
Air pollution control equipment and odor control: Information not provided.

Process water consumption: Information not provided.
Wastewater discharge: 327.9 gallons/day (0.92 gallons/ton MSW) at Agawam, MA facility in 2008.
Electrical consumption: Net electrical generation of 380 kWh/ton based on reference facilities.
Natural gas requirements: 292 cuft/ton based on reference facilities.

Readiness and Reliability
Maturity and suitability for permitting: No permitting would be necessary, and the plan utilizes existing Covanta facilities.
Construction and performance guarantees: NA
Timeframes: Covanta could begin accepting solid waste from the Planning Unit immediately.

Beneficial Reuse of MSW Byproducts
Energy generation: NA
Solid or gaseous byproducts: NA

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: Inert ash representing approximately 10% of incoming MSW by volume or 25-30% by weight.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Dongara Pellet Factory, Inc.
Technology Category: Mechanical Processing -Engineered Fuel Pellets

Dongara is a Canadian company based in Woodbridge, Ontario, and uses the Dongara Process to convert MSW into an engineered pellet product with energy content similar to that of bituminous coal.

In the Dongara Process, MSW is delivered to the plant and passes through a series of processes to remove recyclable and unacceptable materials from the feedstock. Materials to be used for pellet production are shredded, fiberized and stored, and later mixed with high-BTU materials such as carpet waste and some plastic derivatives. The materials are transferred through pellet mills to produce the fuel pellets.

The fuel pellets may be used in various solid fuel systems, including solid fuel boilers or gasification processes, which in turn generate electricity and/or steam. It is possible to co-locate a fuel pellet facility with electrical generation equipment in order to produce electricity onsite.

Dongara responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Dongara has operated a commercial fuel pellet facility in Woodbridge, Ontario, Canada since July 2008. The company has a 20-year contract to receive 110,000 tpy of MSW from York Region, with the option to increase its capacity to 220,000 tpy. The fuel pellets are presently used in the heating systems of large commercial greenhouses in Ontario, and are also used to fuel kilns in cement plants.

Facility Sizing
Types of feedstock: MSW
Unacceptable wastes: Hazardous, large and inorganic materials.
Proposed processing capacity to serve Planning Unit: 240,000 tpy. CHA estimates daily design capacity at 750 tpd.
Site acreage required: 8-11 acres
Alternate size for larger or optimally-sized facility: A 400,000 tpy facility would allow cost-saving efficiencies and reduce tipping fees.
Minimum feasible facility size: 200,000 tpy

Costs of Ownership and Operation
Dongara would propose a build-own-operate arrangement.

Initial capital cost: Approximately $80 million U.S., pre-tax for 240,000 tpy facility. Based on the assumed 750 tpd design capacity, CHA estimates an initial capital cost of $106,700/tpd of design capacity.
Operating cost: $55-$75/ton
Tipping fee: Woodbridge, Ontario reference facility tipping fee is currently $78/ton U.S.
Electric revenues: NA; pellets would be sold as a fuel source and/or potentially used to generate electricity, but no revenue information is provided.

Environmental Impacts
Greenhouse gas emissions: None from fuel pellet production.
Criteria pollutant emissions: None from fuel pellet production.

Air pollution control equipment and odor control: Tipping floor is located inside the facility. A negative pressure system is used to contain odor, dust and debris within the facility. Air filtration and scrubbing equipment would be used to treat exhaust from the plant.
Process water consumption: Water is generated in the process; approximately 3,000 gpd of wash-down water is required. CHA calculates water consumption at 4 gallons per ton of input MSW.
Wastewater discharge: A biological treatment system is used to ensure that effluent meets regional requirements before being discharged. 25% of the process wastewater is recycled to the wash-down system. Approximately 20-24% by weight of incoming MSW is moisture content. 50-60% of this moisture content is lost to evaporation; the remainder is combined with wash-down water to arrive at approximately 3,000 gpd wastewater discharge. CHA calculates wastewater discharge at 4 gallons per ton of input MSW.

Electrical consumption: Net electricity demand is expected to be 81-83 kWh/ton per day. If fuel pellet products are used in an energy production facility, the ratio of energy produced by such a facility vs. the energy used to produce the pellets would be approximately 15:1.
Natural gas requirements: Natural gas would be used primarily to heat the facility, with minimal natural gas used in the MSW drying process. Waste heat generated by equipment is used to offset natural gas usage.

Readiness and Reliability
Maturity and suitability for permitting: The technology to be employed has been developed based on a review of similar European commercial facilities. The Toronto facility has been operational since July 2008; operations of this facility and U.S. waste streams have been evaluated to guide the development of future facilities. Dongara provides a patented process that depends on an arrangement of well-proven equipment that has been used in the solid waste industry for years.
Construction and performance guarantees: Dongara is "comfortable in saying that they believe the fuel pellets will be within a 95-96% consistency, for both energy and chemistry". Contingency plans would be put in place for an outage that could interrupt MSW flow to the facility; Dongara would assume any such costs.
Timeframes:

Facility design: 4-5 months following site selection
Facility "permitting": depends on local requirements
Facility construction: 13-15 months
Start-up and acceptance testing: 4 months following construction
Total timeframe: 22-24 months for proposed (240,000 tpy) facility; 26-28 months for alternate (400,000 tpy) facility

Beneficial Reuse of MSW Byproducts
Energy generation: Fuel pellets are used as a source of energy.
Solid or gaseous byproducts: Stone, gravel and glass removed from MSW are issued to companies in the brick and concrete industries. Recyclable metals and plastics are recovered and sold to market.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: Small fractions of glass, sand and gravel representing approximately 5-8% of incoming MSW. 17,000-19,000 tpy residue requiring landfill disposal for a 240,000 tpy facility.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Ecodeco
Technology Category: Biodrying Process

Ecodeco is an international company with headquarters in Italy, and has recently established a cooperative arrangement with International Center for Commercial Affairs (ICCA) to assist in the pursuit of opportunities in the U.S. market.

The company presents the Biocubi Process, an aerobic biological treatment, to remove moisture and improve the heating efficiency of products to be used as fuel inputs for subsequent processes. Processing takes place in the company's ITS (Intelligent Transfer Station). The putrescible fraction of MSW undergoes an aerobic treatment, and the released heat is used to dry and thermally hygienise the feedstock. Separation occurs following the biodrying phase, and recyclable materials are removed from the feedstock. The biodried material is mechanically refined to produce a solid recovered fuel (SRF), which can be used to generate electricity or as a fuel source by cement kilns.

Ecodeco responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Ecodeco's technology has been successfully implemented in Europe for more than a decade. The ITS (Intelligent Transfer Station) technology has been assigned a "Fully Proven" rating in a survey conducted by the Juniper consulting agency, indicating that it "has been used in active plants for at least two years and that the requirements set by the customer have been met by reaching the performance levels demanded by international standards". Ecodeco identifies several facilities in Italy, Spain and England, and states that there are 17 ITS facilities in total. To date, no facilities have been constructed in the U.S.

Facility Sizing
Types of feedstock: MSW
Unacceptable wastes: Information not provided.
Proposed processing capacity to serve Planning Unit: 230,000 tpy (2 lines x 115,000 tpy each). CHA estimates daily design capacity at 750 tpd.
Site acreage required: approximately 7 acres
Alternate size for larger or optimally-sized facility: No alternate plant size provided.
Minimum feasible facility size: 230,000 tpy

Costs of Ownership and Operation
In Italy, Ecodeco generally installs and manages its own plants, and in other European countries it designs, erects and tests plants for third parties. The company feels its best approach in the U.S. is to act as technology provider for authorities or local operators depending on local requirements.

Initial capital cost: Approximately $56,700,000 U.S. Based on the assumed 750 tpd design capacity, CHA estimates an initial capital cost of $106,700/tpd of design capacity.
Operating cost: Ecodeco is working to calculate operational costs for the U.S. market. Information not provided.
Tipping fee: 95 to 125 euros at existing European facilities ($126-$165 U.S.)
Electric revenues: NA; solid recovered fuel (SRF) product would be sold as a fuel source and/or potentially used to generate electricity, but no revenue information is provided.

Environmental Impacts
Greenhouse gas emissions: 85,500-171,000 tpy biogenic CO_2 process emissions; additionally, 50% of total CO_2 generated in SRF combustion (no value provided).
Criteria pollutant emissions: Information not provided.

Air pollution control equipment and odor control: Tipping floor is located inside the facility. A negative pressure system is used to contain odor, dust and debris within the facility. Process emissions pass through biofiltration and dedusting systems.
Process water consumption: 6,340-9,510 gallons/day depending on weather and local climate conditions.
Wastewater discharge: Approximately 3,170 gpd depending on weather and local climate conditions.
Electrical consumption: 30 kWh/ton for biodrying process, 55 kWh/ton for material refinement.
Natural gas requirements: Information not provided.

Readiness and Reliability
Maturity and suitability for permitting: Ecodeco had constructed and operated a number of facilities in Europe, but has no experience with permitting or operations in the U.S. Substantial work would be required in adapting operations to U.S. and local standards, and Ecodeco would work with local consultants to meet all requirements.
Construction and performance guarantees: Ecodeco would work with a local consultant to ensure all requirements are met. The facility would be equipped with a remote control system that allows monitoring of the process and equipment, to ensure prompt response to technical issues.
Timeframes:

Facility design: 15 months
Facility "permitting": 12 months (in EU)
Facility construction: 16 months
Start-up and acceptance testing: 4 months
Total timeframe: 35 months

Beneficial Reuse of MSW Byproducts
Energy generation: SRF product is used as a source of energy.
Solid or gaseous byproducts: Recyclable metals and plastics are recovered and sold to market.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: 33.8% of incoming waste.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Energy Answers
Technology Category: WTE

Energy Answers was founded in Albany in 1981 and has operated in the Albany region for 28 years under the same ownership. Energy Answers is actively developing projects in the U.S., Caribbean and the European Union, and is in the early development stages of projects in other regions.

Energy Answers presents the Processed Refuse Fuel (PRF) technology. The Mechanical Treatment Facility is designed to accept and process incoming MSW to create a shredded, readily combustible PRF material. PRF is fed into the combustor and produces minimal ash residue. Steam generated by combustion is used to generate electricity. Bottom ash is processed in a materials recovery facility in order to recover metals and solid aggregate material.

Energy Answers responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Energy Answers was the conceptual designer, developer, technology provider, co-operator and General Manager of the SEMASS WTE facility in Rochester, MA from its commencement of operations in 1988 until 1996. This WTE facility utilizes the PRF system. The base plant has a 2,000 tpd capacity and a subsequent 1,000 tpd expansion was created in 1993. The SEMASS facility received several awards for environmental performance under Energy Answers management.

Energy Answers also identifies WTE reference facilities in Pittsfield, MA and Springfield, MA. The company lists experience in managing and operating transfer stations.

Facility Sizing
Types of feedstock: MSW; could also process wood waste, tires, sludge, FOG (fats, oil, grease), and auto shredder residue.
Unacceptable wastes: Specific materials not identified; less than 1% of incoming waste.
Proposed processing capacity to serve Planning Unit: Facility would have two, 500 tpd boilers for a design capacity of 365,000 tpy (1,000 tpd).
Site acreage required: 10 acres in an industrial zone or 15 acres for a stand-alone facility.
Alternate size for larger or optimally-sized facility: Depending on opportunities to import MSW, a larger facility could be accommodated.
Minimum feasible facility size: 500 tpd.

Costs of Ownership and Operation
Energy Answers proposes a private ownership model, whereby the Planning Unit would pay a fixed tip fee for MSW delivered to the facility, and Energy Answers would assume full operational and financial risk for the ultimate disposal of the waste.

Initial capital cost: Information not provided.
Operating cost: Approximately $50/ton.
Tipping fee: Information not provided.
Electric revenues: Assuming a purchase agreement of $0.10/KWh, electric revenue would be $59.20/ton of incoming MSW.

Environmental Impacts
Greenhouse gas emissions: 67% of CO_2 emissions are biogenic, and 33% are anthropogenic. Anthropogenic CO_2 emissions are offset by the avoided emissions that would be produced by fossil fuel powered electric generation, avoided methane emissions that would otherwise be generated by

landfill disposal, and by the recovery of metal materials. Using these assumptions, Energy Answers states that the WTE facility would produce electricity at a negative net CO_2 emission rate of -3,636 lbs. CO_2/MWh. For every ton of MSW processed, approximately 1 ton of CO_2 equivalents would be eliminated.
Criteria pollutant emissions: Energy Answers has provided a table with recorded average emissions recorded at its SEMASS facility in April 2004, November 2005 and July 2006, for the following pollutants: particulates, SO_2, HCL, NO_x, CO, Cd, Pb, Hg and PCDD/F. The reference facility meets its permit limits and USEPA Maximum Achievable Control Technology (MACT) standards for emissions of these pollutants.
Air pollution control equipment and odor control: The gases generated by the combustion of MSW are passed through air quality control equipment consisting of: urea injection to remove nitrogen oxides, activated carbon injection to remove mercury, dioxins and furans, spray dryer absorbers using lime to neutralize any acids forming during the combustion process, and a fabric filter system (bag house) to capture particles in the gas.
Process water consumption: The WTE facility could utilize either an air-cooled condenser or a cooling tower. With an air-cooled condenser, industrial and water usage would be about 21,000 gallons/day based on a facility capacity of 1,000 tpd. Water usage for a cooling tower would be ten times greater. Hower, if adequate water supply is available, cooling towers are less expensive than air-cooled condensers and can operate on secondary treated effluent from a wastewater treatment facility.
Wastewater discharge: Aside from sanitary wastewater, there would be no discharge of water into the sewers.
Electrical consumption: Gross electric generation 696 kwh/ton; 104 kwh/ton internal usage; net electric generation 592 kwh/ton.
Natural gas requirements: No natural gas requirements.

Readiness and Reliability
Maturity and suitability for permitting: The Energy Answers PRF technology has been used in large-scale commercial operations at the SEMASS and other WTE facilities since 1989. The technology has been upgraded over the years.
Construction and performance guarantees: Energy Answers can:

- design, construct, test for acceptance, own, operate and maintain the proposed facility
- comply with all contract, federal, state and local laws, regulations and policies
- comply with Good Industry Practice and Good and Accepted Construction Practice
- be responsible for obtaining local construction permits.

Timeframes:
Total timeframe: 24 months

Beneficial Reuse of MSW Byproducts
Energy generation: Net 592 kWh/ton of MSW.
Solid or gaseous byproducts: Bottom ash (aggregate material) 10% by weight of waste fed; ferrous metal 4% of waste fed; nonferrous metal 0.4% of waste fed.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: 10% of incoming waste.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Green Conversion Systems (GCS)
Technology Category: WTE

GCS is a European company with existing operations in Germany; GCS has created a Delaware Limited Liability Company created for the purpose of purpose of pursuing WTE opportunities in the U.S. Morgan Stanley Biomass LLC, a subsidiary of the Morgan Stanley investment banking firm, owns the majority of the equity in GCS. The company has an exclusive license with Fisia Babcock Environment GmbH (FBE) to promote its WTE technology.

The GCS process has been proven to exceed environmental standards in the EU. Existing GCS facilities do not need to pre-process MSW prior to combustion, thereby eliminating the costs and risks associated with additional pre-processing measures. In addition to generating steam/electricity, the process byproducts include processed and size-classified aggregate, ferrous and non-ferrous metals, technical grade hydrochloric acid, gypsum, and salts suitable for industrial use.

GCS responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: GCS has provided information for two reference facilities located in Germany. The more recent facility, the 1,100 tpd (350,000 tpy) Muellverwertung Rugenberger Damm (MVR) waste treatment facility in Hamburg, Germany, has processed MSW in commercial operations since 1999. Emissions from the MVR facility surpass all EU environmental standards.

Facility Sizing
Types of feedstock: MSW
Unacceptable wastes: Oversized materials, C&D wastes, hazardous materials.
Proposed processing capacity to serve Planning Unit: 230,000 tpy (700 tpd) of MSW.
Site acreage required: Approximately 8 acres
Alternate size for larger or optimally-sized facility: For an annual capacity of more than 250 tpy, GCS would propose 2 lines with total 300,000 tpy capacity; this alternate facility would require an 11 acre site.
Minimum feasible facility size: Information not provided.

Costs of Ownership and Operation
Initial capital cost: Approximately $300 million U.S. Based on the 700 tpd design capacity, CHA estimates an initial capital cost of $429,000/tpd of design capacity.
Operating cost: Initial cost to operate and maintain the facility is approximately $75/ton including labor, maintenance materials, consumables, auxiliary fuel, selling of marketable byproducts, residual disposal, utilities, repair and replacement of equipment, bonds and insurance. Cost is anticipated to decrease to approximately $60/ton after the market for specially treated bottom ash for use as an aggregate has been established.
Tipping fee: Tipping fee at the existing MVR facility is approximately $159 U.S./ton.
Electric revenues: The proposed 700 tpd facility would generate 16-17 MW of net electrical power with a value of $50-60/ton of MSW.

Environmental Impacts
Greenhouse gas emissions: CO_2 emissions would be approximately 1 to 1.2 ton CO_2 per ton MSW. About 60% of the carbon contained in MSW is biogenic, and the CO_2 emitted to the atmosphere from this portion of the waste is CO_2 neutral.
Criteria pollutant emissions: GSC has provided a table with recorded average emissions recorded at its MVR facility from 1999-2007, for the following pollutants: NO_x, CO, particulates, C_{total}, HCL,

SO_2, HF, Cd, Th, Hg, Pb and PCDD/F. Emission values exceed USEPA 40CFR60 Subpart Eb regulations for these pollutants.

Air pollution control equipment and odor control: Tipping floor is located inside the facility, and a negative pressure system is used to contain odor, dust and debris within the facility. NO_x emissions are reduced by spraying aqueous ammonia into the combustion chamber at several levels in the furnace. An adsorbent material is added to the flue gas leaving the boiler, thereby separating any heavy metals and organic pollutants. The flue gas is routed through a 2-stage HCl-scrubber where process water is added to separate any readily soluble halogen compounds. Sulfur oxides are separated by a neutral single-stage scrubber. A second baghouse filter is applied to ensure minimal emissions of heavy metals and organic pollutants.

Process water consumption: Process water (50 kgal/day) does not have to be potable water; grey water from a water pollution control plant or water taken from a river or groundwater would be sufficient. Water required for the process would be filtered and stored before process use. Most process water would be evaporated in the wet scrubbers of the flue gas treatment system and released into the atmosphere as water vapor.

Wastewater discharge: Aside from sanitary waste (2,000 gpd), there would be no discharge of water into the sewers. Measures would be taken to minimize stormwater runoff, possibly including green roofs on some buildings.

Electrical consumption: Gross electric generation 680 kWh/ton; 95 kWh/ton internal usage; net electric generation 585 kWh/ton.
Natural gas requirements: 64,000 decatherms/year.

Readiness and Reliability
Maturity and suitability for permitting: The mass burn technology offered by GCS is manufactured by FBE, and there are over 500 facilities worldwide that use FBE proprietary technology. Existing GCS facilities using these technologies exceed the emissions standards set by New York State, and are expected to be suitable for permitting.
Construction and performance guarantees: The contractual obligations under the service agreement would be first guaranteed by the construction contractor, and upon startup of the facility and acceptance, this guarantee would be replaced by a guarantee from the operator.
Timeframes:

Facility design: 12 to 15 months
Facility "permitting": 8 to 10 months
Facility construction: 24 to 26 months
Start-up and acceptance testing: 6 to 9 months
Total timeframe: 50 to 60 months

Beneficial Reuse of MSW Byproducts
Energy generation: Net 585 kWh/ton of MSW.
Solid or gaseous byproducts: Bottom ash (aggregate material) 22% by weight of waste fed; ferrous metal 2.3% of waste fed; nonferrous metal 0.2% of waste fed; HCl 1.5% of waste fed; gypsum 0.3% of waste fed.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: 2% of incoming waste.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Nature's Fuel
Technology Category: Pyrolysis; Biofuel Production

Nature's Fuel (NF) was founded in 2005 and is an Indiana Corporation; the company is owned by private equity investors. Shaw Environmental is identified as a consulting party that would be involved in the development of a NF facility for the Planning Unit. NF owns and operates one commercial facility in Atwood, Indiana, and is developing a second commercial facility in Huntington, Indiana.

The NF process uses a pyrolysis process to generate electricity, bio-oil, bio-char, and bio-gas. Bio-char residue can be used as a soil amendment or high-grade source of activated carbon. Bio-oil can be sold to blenders and used to reduce the sulfur content and viscosity of #6 heating oil.

Nature's Fuel responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: NF operates an 86,000 tpy facility in Atwood, Indiana – this plant began as a solid fuel R&D facility and was converted into a full-production pyrolyzation operation in 2007. The Atwood facility accepts wood waste, C&D waste, and other waste streams (plastics, waste oils, etc.) to produce sulfur-free bio-oil, high quality bio-char, and will begin to generate electricity later in 2009.

NF is in the process of developing a new facility in Huntington, Indiana. The facility will have an anticipated waste throughput of 200,000 tpy in Year 1, and will increase to 400,000 tpy by Year 3. Air permit approval is anticipated in July 2009.

Facility Sizing
Types of feedstock: MSW, C&D wastes, tires, ASR, oil sludge and tank ottoms, non-hazardous industrial wastes and sludges, yard and tree waste, computer waste except for CRTs, carpeting, and white goods that do not contain freon.
Unacceptable wastes: Medical and hazardous wastes.
Proposed processing capacity to serve Planning Unit: The Albany market meets NF's throughput requirements. CHA assumes that a facility designed to serve the Planning Unit would have a capacity of 300,000 tpy (970 tpd).
Site acreage required: 15 acres; sites offering 25-30 acres allow space for potential expansion. Ideal sites are located near electric infrastructure such as a power substation.
Alternate size for larger or optimally-sized facility: A modular system allows NF to expand capacity in increments of 100,000 tpy.
Minimum feasible facility size: Information not provided; NF's preferred market is approximately 300,000 tpy.

Costs of Ownership and Operation
NF investors would assume all costs of ownership and operation. If desired, NF would give the municipality the option to purchase the plant and license it the intellectual property after 15 years.

Initial capital cost: Information not provided. The 400,000 tpy Huntington, Indiana facility will cost an anticipated $38 million with no electric generation. CHA estimates an initial capital cost of $52,713/tpd of design capacity. Power generation equipment may be added at a cost of approximately $30 million.
Operating cost: Information not provided.
Tipping fee: Information not provided.
Electric revenues: Information not provided.

Environmental Impacts
Greenhouse gas emissions: Information not provided.
Criteria pollutant emissions: Air permit applications for the Atwood and Huntington facilities demonstrate that the NF facilities' "PTE (potential to emit) is extremely low as measured before our environmental controls."
Process water consumption: The process utilizes water in a clean, closed-loop cooling mode. A retention pond may be considered as a source of cooling water, as would rain water. Other water usage would include restroom water and for cleaning of the tipping room floor.
Wastewater discharge: Drainage systems would capture wastewater in the building and tip room floors. Water would be treated by a triple trap and either discharged into municipal sanitary sewers or taken to a permitted facility for disposal. Wastewater discharge volume would be similar to that of a similarly sized transfer station.
Electrical consumption: Facility could generate its own electricity, but would prefer to purchase 1 to 3 MW from the local power utility.
Natural gas requirements: Natural gas would be used to start the process, and CHA estimates natural gas consumption at 100 btu-hr/ton of MSW.

Readiness and Reliability
Maturity and suitability for permitting: Pyrolysis technology has been used for decades in Europe, but its implementation is not as widespread in the U.S. NF has met permitting requirements for its Atwood facility, and expects approval for its Huntington facility later in 2009.
Construction and performance guarantees: NF and its investors would assume financial risk for the proposed facility.
Timeframes: Information not provided.

Beneficial Reuse of MSW Byproducts
Energy generation: The proposed facility could be used to generate electricity. The Huntington facility could potentially generate up to 40 MW of electricity from 400,000 tpy throughput.
Solid or gaseous byproducts: Bio-oil and bio-char are generated by the process. Quantity information is not provided.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: As little as 0% landfill disposal is possible, depending on the market for products. Less than 10% is likely.
Anticipated hazardous waste characterization: Information not provided.

Company Name: Norterra Organics
Technology Category: Composting

Norterra New York is a joint venture between Norterra (a fully owned subsidiary of Scott Environmental of Kingston, Ontario, Canada) and Nextek GBL, Inc. of Macedon, NY. Norterra currently operates a compost facility near Kingston, Ontario.

Norterra proposes a composting system that features the Gore Cover System as an operating platform. The system uses a membrane laminate technology similar to that of the well-known Gore-Tex fabrics. The system shields process materials from vectors and can achieve 99% microbe reduction. Operating costs are reduced because the system allows operators to use prositive pressure air. The system is considered an in-vessel technology by many regulatory authorities because the cover encapsulates all process materials.

Organic material spends six weeks under the Gore covers, followed by an additional two weeks of curing on an aerated pad. After the eight weeks of composting, the material is ready to be screened and stockpiled for further aging, and is then ready for sale.

Norterra responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Norterra of Canada has a commercial compost facility located in Joyceville, Ontario, Canada, just east of Kingston. This facility is owned and was developed by the Scott Environmental Group. Construction of the facility began in Summer 2008 and operations began in Fall 2008. The Joyceville facility's initial capacity is 20,000 tpy, and Norterra plans to double this initial capacity before the end of 2009. The company has not developed any facilities in the U.S.

Facility Sizing
Types of feedstock: Organic materials, including: yard waste, institutional and restaurant food waste, food processing wastes, manures, low-grade papers, greases and oils, waxed corrugated cardboard, woody or other lignocellulosic wastes.
Unacceptable wastes: Information not provided.
Proposed processing capacity to serve Planning Unit: Assuming that approximately 30% of the baseline waste quantity could be compostable, and this entire fraction can be captured, a facility for the Planning Unit would require a 75,000 tpy capacity. Norterra would develop a modular system with initial 20,000 tpy capacity which can be expanded in 10,000 tpy increments to meet demand. At the initial 20,000 tpy design capacity, CHA estimates a daily design capacity of 75 tpd.
Site acreage required: Minimum 6 acres for 20,000 tpy module. 20 acres required for 75,000 tpy capacity.
Alternate size for larger or optimally-sized facility: Modular system allows for expansion.
Minimum feasible facility size: 20,000 tpy initial module.

Costs of Ownership and Operation
Initial capital cost: $3 million U.S. initial startup cost for Joyceville facility (20,000 tpy). CHA estimates an initial capital cost of $40,000/tpd of design capacity.
Operating cost: Information not provided.
Tipping fee: $65/ton U.S. for Joycetown facility.
Electric revenues: NA

Environmental Impacts
Greenhouse gas emissions: Information not provided.

Criteria pollutant emissions: Information not provided.
Air pollution control equipment and odor control: Potential odors are minimized by the Gore Cover System. The facility will include a leachate containment and recirculation system, and will be designed to withstand a 100-year flood event.
Process water consumption: Information not provided.
Wastewater discharge: Leachate collected during the composting process is recirculated.
Electrical consumption: Information not provided.
Natural gas requirements: Information not provided.

Readiness and Reliability
Maturity and suitability for permitting: Norterra operates one commercial facility in Canada, none in the U.S. The Gore Cover System has been installed in more than 170 plants in 26 countries worldwide.
Construction and performance guarantees: Information not provided.
Timeframes: Reference facility construction began in Summer 2008 and facility operations began in Fall 2008.

Beneficial Reuse of MSW Byproducts
Energy generation: NA
Solid or gaseous byproducts: Organic compost product.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: "Negligible" landfill disposal.
Anticipated hazardous waste characterization: Information not provided.

Company Name: Organic Waste Remediation, LLC
Technology Category: Recycling/Pyrolysis

Organic Waste Remediation, LLC (OWR) is based in Orlando, FL and offers the OWR Process for disposal of MSW. The OWR Process combines single-stream recycling and pyrolysis technologies, and includes three modules.

The *Recycling Module* separates non-organic material into ferrous, aluminum, other non-ferrous metals and clear, green and amber glass, washed and delabeled with ceramics removed. Unrecycled organic material is shredded, dried and fed to the Remediation Module.

The *Remediation Module* uses a pyrolysis process to break organic materials down into a relatively consistent synfuel. Synfuel products are conveyed to the Power Module.

The *Power Module* uses generic fluid bed burner/steam generation equipment to drive a steam turbine electric generator.

OWR responses to the evaluation criteria include the following:

Experience of Project Sponsor:
OWR is a startup company that has been established for over two years, and has patents pending for its pyrolitic breakdown process, recycling process and the use of its recycling process in combination with other disposal methods such as incineration and plasma. To date, OWR has not fully constructed or operated a MSW processing facility.

Experience with similar projects: OWR has commenced the approval process to construct and operate a commercial facility in Bozrah, CT. This facility will have a proposed 250 tpd (~90,000 tpy) maximum capacity, and contractual arrangements have been made to secure a 1,500 tpw supply of MSW feedstock. An electric sales agreement has been made with the local electric authority. The facility will cost an anticipated $30 million and will be located on a 25-acre property in a Heavy Industrial district. OWR has commenced the formal approval process in the State of Connecticut, and once initiated, construction of the facility is expected to take 10-16 months with tentative commencement of operations in mid-2010.

Facility Sizing
Types of feedstock: Curbside recyclables, MSW, yard waste
Unacceptable wastes: C&D
Proposed processing capacity to serve Planning Unit: OWR would propose a facility to accommodate the Planning Unit's 227,000 tpy baseline waste quantity plus curbside recycling. CHA estimates a daily design capacity of 900 tpd.
Site acreage required: Less than 12 acres.
Alternate size for larger or optimally-sized facility: As proposed, the facility can accommodate additional capacity up to 1,100 tpd without design adjustments.
Minimum feasible facility size: 250 tpd or 63,750 tpy.

Costs of Ownership and Operation
OWR proposes to finance and own the operation, operate the facility, pay all bills and collect the revenues from tipping fees, electric sales and sales of recycled materials.
Initial capital cost: Approximately $60 million. Based on the assumed 900 tpd design capacity, CHA estimates an initial capital cost of $66,700/tpd of design capacity.
Operating cost: approximately $19.20/ton.
Tipping fee: approximately $55/ton.
Electric revenues: estimated $64/input ton of MSW.

Environmental Impacts
Greenhouse gas emissions: "similar to that of an incinerator".
Criteria pollutant emissions: Anticipated reduction of mercury, heavy metals and dioxins/furan emissions.
Air pollution control equipment and odor control: Typical scrubbing equipment is being included in the CT facility. Ventilation system draws outside air in when doors are opened to control odors.
Process water consumption: 36,000 gpd for 140 tpd facility. Assuming a linear relationship between daily capacity and water consumption, CHA estimates that a 900 tpd facility would consume 230,000 gpd.
Wastewater discharge: Process waste water is collected and recycled; approximately 90% is reused for process water feed.
Electrical consumption: 197 tpd of dry organics generates 7.8 MWh electricity; 1.9 MWh consumed; net generation of 5.9 MWh. Based on this information, CHA estimates electric consumption of approximately 100 kWh/ton.
Natural gas requirements: None.

Readiness and Reliability
Maturity and suitability for permitting: Anticipated to exceed all NYS requirements; approval process is currently underway for CT facility.
Construction and performance guarantees: OWR to finance and operate facility, so municipal bodies have no financial investment.
Timeframes:
- *Facility design:* Less than 2 months
- *Facility "permitting":* 2 months to 2 ½ years
- *Facility construction:* 18 months
- *Start-up and acceptance testing:* Information not provided.
- *Total timeframe:* Anticipated 2 years.

Beneficial Reuse of MSW Byproducts
Energy generation: For 1,500 tpw, electric generation would range between 350-950 MWh/week, depending on the percentage of MSW diverted for recycling. Using the value of 350 MWh/week, CHA estimates gross electric generation of 233 kWh/ton and net electric generation of 223 kWh/ton.
Solid or gaseous byproducts: Recycling system will always recycle glass and metals; flexible process can adjust diversion of paper and plastic. 2% of input is inorganic solid material that can be used as aggregate material.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: Response claims no landfill disposal, assuming marketability of all solid byproducts. 2% residue if inorganic slag material is landfilled.
Anticipated hazardous waste characterization: No anticipated hazardous waste characterization.

Company Name: Plasco Energy Group Inc.
Technology Category: Plasma

Plasco is an Ottawa, Canada based company that offers a system based on plasma arc technology. The company currently operates a commercial-scale demonstration facility in Ottawa.

Plasco's waste conversion process begins with any materials with high reclamation value being removed from the waste stream and collected for recycling. MSW is shredded and enters a conversion chamber where it is converted into a crude syngas using recycled heat; this crude syngas flows to a refinement chamber and is refined using plasma torches to create a fuel called PlascoSyngas. The PlascoSyngas is cleaned and used to generate electricity. Waste heat is recovered and used to produce steam, which can be used to generate additional electricity or for industrial purposes.

Solid residue from the conversion chamber is sent to a separate high-temperature Carbon Recovery Vessel, where plasma heat is used to stabilize the solids and convert any remaining volatile compounds and fixed carbon into syngas. Remaining solids are cooled into small slag pellets. The process also yields other products including commercial salt, agricultural sulfur and water.

Plasco responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: Plasco has built a 110 tpd commercial-scale demonstration facility in Ottawa, Canada. This demonstration facility uses MSW from the city as feedstock, and has been in operation since January 2008. Discussions for commercial facilities are in progress in Canada, the U.S, Europe and Asia.

Facility Sizing
Types of feedstock: MSW
Unacceptable wastes: Information not provided.
Proposed processing capacity to serve Planning Unit: 440 tpd (160,000 tpy) facility consisting of four 110 tpd lines.
Site acreage required: 8 acres.
Alternate size for larger or optimally-sized facility: Additional 110 tpd modules could be added to the facility.
Minimum feasible facility size: Information not provided.

Costs of Ownership and Operation
Plasco uses a build, own and operate model. The company would assume all financial responsibility and risk with regard to the construction, commissioning, and ongoing operation of the facility.
Initial capital cost: Information not provided.
Operating cost: Information not provided.
Tipping fee: Information not provided.
Electric revenues: Information not provided.

Environmental Impacts
Greenhouse gas emissions: Emissions of 0.6 tons CO_2 equivalent per ton of MSW.
Criteria pollutant emissions: Plasco provides an emissions profile for the production of electricity, including the following pollutants: particulate matter, organic matter (CH_4), HCl, SO_2, NO_x, Hg, Cd, Pb, dioxins and furans. The company provides guaranteed "Plasco Regulated Limit" and more stringent "Plasco Target" emission values for these pollutants, and the company is committed to achieving these limits.

Air pollution control equipment and odor control: Information not provided.
Process water consumption: Information not provided.
Wastewater discharge: Information not provided.
Electrical consumption: Gross electric generation 27 MW; internal usage 6 MW; net electric generation 21 MW. CHA calculates this internal usage as 300 kWh/ton of MSW.
Natural gas requirements: Information not provided.

Readiness and Reliability
Maturity and suitability for permitting: To date, Plasco does not operate any commercial facilities. Its commercial-scale demonstration facility in Ottawa has been operating since January 2008.
Construction and performance guarantees: Plasco would assume all financial risk for the development and operation of the facility. As a performance guarantee, Plasco offers the following: If a facility does not meet its "Plasco Regulated Limit" for emissions, the company will remove the plant at no cost and return the land to its original state, and end the supply agreement without penalty.
Timeframes: Plasco would develop an operational facility within 18 months of acquiring permits.

Beneficial Reuse of MSW Byproducts
Energy generation: Net 1.1 MWh/ton.
Solid or gaseous byproducts: Materials recovered from 1 ton of waste include the following: 330 lbs. slag; 10-20 lbs. salt, 10 lbs. sulfur, 80 gallons potable quality water, 15-35 lbs. recyclable metals.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: The response claims that less than 1% of incoming waste (3 lbs./ton) would require landfill disposal. This residual waste consists of the segregated heavy metals caught by filter media. If slag is landfilled, then 17% residue.
Anticipated hazardous waste characterization: Information not provided.

Company Name: Powers Energy of America
Technology Category: Gasification, Biofuel Production

Powers Energy is a national firm headquartered in Evansville, Indiana, and presents a process to produce biofuels and electricity from MSW. Two Powers Energy operating companies are established: Powers Energy One of Indiana has been established to develop an MSW facility in Lake County, Indiana, and Powers Energy Two of Kentucky, LLK has been established to develop a facility in northwestern Kentucky. INEOS Bio and Kellog Brown and Root (KBR) provide technical, design and construction support for Powers Energy facilities.

MSW feedstock would be delivered, handled and contained within the indoor facility. Carbon-based MSW/feedstock materials are mixed, crushed or shredded and fed into a gasification plant for bioethanol production. Feedstock materials are converted to a syngas product in the gasifiers by heating the materials in to different stages to temperatures in excess of 2,000 degrees Fahrenheit. Heat recovered from the gasifier is used to generate steam and electricity. Syngas leaving the gasifier is refined, cooled and passed through the biological fermenter, where 70-90% of the gas will be converted to bioethanol through microbial activity. Off-gas from the fermenter is routed for use in steam generation. Bioethanol products are go through a refining process and market for use as a fuel. Ash from the gasifier is sent to a landfill for disposal.

Powers Energy responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects:
Powers Energy is involved in a project in Lake County, Indiana that involves, to date, the financing, site evaluation and engineering of a gasification/biofuel production facility with a minimum capacity of 2,000 tpd. The facility is anticipated to generate 36 million gallons of bioethanol fuel, 42,600 tons of recyclable metals and 20 MW of power on annual basis, and may continue to expand in response to future market demand. Powers Energy is also pursuing agreements for development of a facility in northwestern Kentucky, and has begun design and permitting for this facility.

Facility Sizing
Types of feedstock: MSW, food waste, paper, textiles, wood, yard waste, plastics, leather, rubber, oil-derived materials, agricultural residues, tires, coal, organic sludge.
Unacceptable wastes: Hazardous materials, C&D debris.
Proposed processing capacity to serve Planning Unit: Modular gasification units are designed to process 150 tpd of feedstock. Accounting for the recovery of recyclable materials and moisture content, this equates to approximately 450 tpd per two gasifiers. Powers energy would install four gasifiers (~900 tpd capacity) to process waste for the Planning Unit.
Site requirements: 60 acres to accommodate facility and space for potential future expansion. 100-150 acres for a site with rail service.
Alternate size for larger or optimally-sized facility: A larger facility could be designed if needed; the company realizes little gain beyond 2,000 tpd.
Minimum feasible facility size: 4 gasifiers/200,000 tpy, such as needed for the Planning Unit.

Costs of Ownership and Operation
Initial capital cost: Approximately $100 million.
Operating cost: $72.23/ton; includes costs of facility maintenance, labor, landfill and recyclables hauling, and landfill disposal. Additional expenses including insurance, depreciation, interest, technology licensing, municipal and county host fees, management fee, administration, contractual and contingency costs represent a total $71.02.
Tipping fee: Information not provided.

Electric and other revenues: Ethanol sales would be approximately 13 million gallons at 211,000 tpy. Total projected revenue from all sources (recovered materials, ethanol biofuels, electric sales) is estimated at $189/gross ton of feedstock.

Environmental Impacts

Greenhouse gas emissions: Greenhouse gas emissions of 0.54 tons CO_2 equivalent per ton of MSW.
Criteria pollutant emissions: Air and water emissions data are provided for a Powers Energy pilot facility. Information is provided for airborne emissions of particulate matter, CO, NOx, SO_2, VOC, Pb, Hg, Cd, HCl, PCB and CDD/CDF. Emissions would meet all EPA and state requirements.
Air pollution control equipment and odor control: Odors and emissions from MSW off-loading will be contained within the waste handling facility. The handling floor will be designed to capture any leakage from incoming feedstock. A dry gas cleaning system injects lime and activated carbon into syngas products to capture HCl and any volatile metals. Bag filtering is used to capture solid particulates. The biological fermenter provides additional scrubbing, and off-gas passes through further cleaning measures to remove any remaining contaminants.

Process water consumption: Fresh water consumption is approximately 1.5 gallons per gallon of ethanol produced. Approximately 13 million gpy of water would be required to process 211,000 tons MSW. This equates to about 62 gallons per ton of MSW processed. Process water is reused.
Wastewater discharge: Wastewater is treated onsite and reused. Volume of discharge not provided.
Electrical consumption: Approximately 1/3 of electricity generated will be sold; presumably, this means that 2/3 of this electricity would be used by the facility. Gross and net generation information not provided; a 2,000 tpd facility has 20 MW output. Based on this information, CHA estimates gross output of 240 kWh/ton, internal consumption of 160 kWh/ton and net generation of 80 kWh/ton.
Natural gas requirements: A small amount of natural gas is required for startup.

Readiness and Reliability

Maturity and suitability for permitting: INEOS Bio is identified as a partner and has operated a pilot plant for over 5 years. The proposed facility would use equipment, materials and technology that is currently available to the chemical and petroleum industries. All technologies are proven, and Powers Energy anticipates no risks associated with a scaled-up facility relative to the pilot facility. All equipment will be field tested prior to commercial production of the facility. Overall system reliability is expected to be 95% or higher.
Timeframes:

Information not provided.

Beneficial Reuse of MSW Byproducts

Energy generation: 2,000 tpd facility has 20 MW electrical output. A 211,000 tpy facility would generate 13 million gpy of bioethanol.
Solid or gaseous byproducts: Recovered materials, including ferrous and non-ferrous metals, would be sold on the commodities market.

Residue Requiring Landfill Disposal

Percent residue requiring landfill disposal: Maximum 10% of the raw MSW feedstock.
Anticipated hazardous waste characterization: TCLP analysis from the pilot facility shows metal concentrations below EPA standards.

Company Name: Startech Environmental Corp.
Technology Category: Plasma Technology

Startech is a Wilton, Connecticut based public company that offers a plasma processing technology for MSW disposal. The company was founded in 1993 and was established in 1995 as a public company. Startech has built and delivered two small (5-7 tpd) units to customers in the U.S. and Japan, and operates a 5 tpd system at its Bristol location. The company has a 30,000 sf manufacturing facility where its systems are built, and is in the process of developing several facilities in overseas markets.

The Plasma Converter System utilizes plasma – an electrically charged, ionized gas – to process waste materials at extremely high temperatures. Organic components of the incoming waste are used to create a plasma-converted syngas, which in turn can be used to produce electricity, recover hydrogen, and to make industrial materials. Outputs include a Plasma Converted Gas (PCG) fuel consisting of primarily hydrogen and carbon monoxide, and a glassy black obsidianite material. PCG can be reused or recycled as a fuel or as a synthesis gas to produce electricity, recover hydrogen, or to make industrial products. The Startech technology can be used to process a variety of hazardous and non-hazardous waste materials.

Startech responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: In 1996-1997 Startech built and delivered a 7 tpd system to the U.S. Army's Aberdeen Proving Ground in Maryland. In 2001, the company opened a facility in Bristol, Connecticut which houses a 5 tpd system used for customer training, marketing and demonstration purposes. In 2001 Startech delivered a 5 tpd system to Japan for the processing of PCBs and hazardous incinerator ash.

To date, Startech has no full-scale commercial MSW facilities in operation. The company has signed contracts for two 300 tpd MSW facilities in Europe with additional orders pending for MSW facilities in Panama (200 and 350 tpd) and Europe (100 tpd). Startech is currently manufacturing multiple systems for Puerto Rico and Poland.

Facility Sizing
Types of feedstock: The Plasma Converter can process virtually any waste materials. Following is a partial list of materials: MSW, PCBs, asbestos, municipal sludge, biomedical waste, spent pot linings from aluminum smelters, solvents and paints, contaminated soils, waste oil, filters, insect/pesticides, explosives, munitions, spent activated charcoal, hazardous incinerator ash, electronic waste, petroleum sludge, confiscated drugs, tires, C&D materials.
Unacceptable wastes: None listed.
Proposed processing capacity to serve Planning Unit: The facility would accommodate the baseline 227,000 tpd waste quantity.
Site acreage required: Minimum 5 acres.
Alternate size for larger or optimally-sized facility: Modular design allows for future expansion.
Minimum feasible facility size: Information not provided.

Costs of Ownership and Operation
Initial capital cost: Information not provided.
Operating cost: Information not provided.
Tipping fee: Information not provided.
Electric revenues: Information not provided.

Environmental Impacts
Greenhouse gas emissions: Information not provided.
Criteria pollutant emissions: "The Startech system's environmental performance is safer than the United States EPA standards and regulations."
Air pollution control equipment and odor control: Information not provided.
Process water consumption: Information not provided.
Wastewater discharge: Information not provided.
Electrical consumption: Depending on the wastes or feedstocks being processed, the converter will produce more energy than it uses.
Natural gas requirements: Information not provided.

Readiness and Reliability
Maturity and suitability for permitting: Startech does not identify any full-scale commercial MSW processing facilities operating in the U.S. or abroad.

The company indicates that "There are many Startech Plasma Converter projects both in the United States and abroad that have had their environmental impact assessments and permit applications approved by the regulating authorities for operations".

Construction and performance guarantees: Because the system is electrically driven, its operation is easily controlled and therefore safe. Typically, individual chambers will be shut down for routine maintenance for one half hour of every 300 hours of operation.
Timeframes:
Information not provided.

Beneficial Reuse of MSW Byproducts
Energy generation: Information not provided.
Solid or gaseous byproducts: Component materials of feedstock can be recovered in from one to three distinct phases: Synthesis gas, inorganic glasslike silicates, and liquid metallic elements which collect and are discharged at the base of the vessel.

Residue Requiring Landfill Disposal
Percent residue requiring landfill disposal: Information not provided.
Anticipated hazardous waste characterization: The solid obsidianite product is inert and non-leachable when subjected to Toxicity Characteristic Leachate Procedures (TCLP) protocols.

Company Name: Taylor Biomass Energy
Technology Category: Gasification

Taylor Biomass Energy (TBE) is headquartered in Montgomery, NY and currently operates a C&D sorting and recycling process in the Town of Montgomery. TBE plans to expand this existing system and couple it with biomass gasification.

Sorted feedstock is fed into the gasification reactor, where it undergoes a rapid thermal breakdown to produce a syngas product. The syngas is conditioned and used to generate electricity. A combustion reactor is used to further process char products, and final ash products are disposed of at a landfill.

Taylor Biomass Energy responses to the evaluation criteria include the following:

Experience of Project Sponsor:
Experience with similar projects: TBE owns and operates a C&D sorting and recycling facility in Montgomery, NY, which opened in 1989. This facility produces approximately 300 tpd (dry basis) of a biomass mix that would be appropriate for gasification feedstock. The process also removes various non-biomass materials for recycling or disposal. 97% of the incoming material is converted into useful products.

TBE has a project underway to couple a gasification process with the existing sorting and recycling process at the Montgomery facility. Permitting is currently underway for this action; all permitting documents have been submitted to DEC for review, and action on the final Part 360 permit document was expected within 3 to 6 months of TBE's March 2009 response date.

Facility Sizing
Types of feedstock: MSW, C&D waste, wood.
Unacceptable wastes: Painted and pressure-treated lumber, PVC plastics, hazardous or radioactive materials including lead-based paints and solvents, tires, batteries, electronics, electrical motors/transformers/ballasts, asbestos-containing materials.
Proposed processing capacity to serve Planning Unit: The facility would accommodate the Planning Unit's 227,000 tpy baseline waste quantity, and CHA estimates a design capacity of 750 tpd. .
Site acreage required: 8-12 acres; a compact 5-6 acre layout could potentially be implemented. TBE anticipates that the proposed facility could be located at the Rapp Road Landfill.
Alternate size for larger or optimally-sized facility: Information not provided.
Minimum feasible facility size: Information not provided.

Costs of Ownership and Operation
Initial capital cost: Approximately $100 million including engineering, equipment purchase and installation for the sorting and separating, gasification, power, electric interconnection and initial site preparation. Based on the assumed 750 tpd design capacity, CHA estimates an initial capital cost of $133,000/tpd of design capacity.
Operating cost: Approximately $15 million annually ($137/dry ton): $5.5 million for sorting and separation, $4.8 million for gasification, $4.7 million for power production. These costs include labor, maintenance and ash disposal. Based on this information, CHA calculates a total operating cost of $66/ton.
Tipping fee: Information not provided.
Electric revenues: TBE expects to be cost-competitive with current avoided costs in the Albany region. The company would expect to execute a long-term power purchase agreement using a front-end-loaded, levelized avoided cost basis.

Environmental Impacts

Greenhouse gas emissions: The process is CO_2 neutral, meaning that all CO_2 discharged by the system is consumed in the production of new fuel for the system. The gasification based system has an overall efficiency of 40%, which compares favorably to the efficiency of a combustion-based power system. VOC emissions are eliminated from the stack. CO_2 emissions would be reduced by approximately 47% relative to direct combustion, on a lb/MW basis. Approximately 2.5 tons/MW of CO_2 equivalent emissions are avoided by eliminating the need for biomass landfilling.

Criteria pollutant emissions: NO_x emissions approximately 0.5 lb/MW; CO emissions approximately 0.2 lb/MW; particulate emissions less than 0.1 lb/MW; SO_2, hydrocarbon emissions near zero.

Air pollution control equipment and odor control: Nitrogen oxides are controlled by the use of SCRs in the turbine exhaust as well as in the process combustor. CO levels are kept low by the use of oxidation catalysts in the exhaust streams.

Process water consumption: Use of a water-cooled condenser would require 187,000 gpd. If water supplies are restricted, this requirement could be virtually eliminated by using an air-cooled condenser.

Wastewater discharge: Approximately 10 gallons/minute or 14,400 gpd. Discharged water will be treated by filtration and active charcoal to remove contaminants.

Electrical consumption: Gross electric generation 0.85 MW/ton; internal usage 0.15 MW/ton; net electric generation 0.7 MW/ton.

Natural gas requirements: Natural gas is used for startup of the gasification process and gas turbine. Startup period is approximately 12 hours in duration and will occur once or twice annually during normal operations.

Readiness and Reliability

Maturity and suitability for permitting: A number of technologies utilizing this gasifier technology are under development; these include the FICFB gasifier in Gussig, Austria, the SilvaGas facility in Burlington, Vermont, the ENSYN pyrolysis process, the Thremochem process and other processes being developed in Europe and China. TBE is awaiting permit approval for the application of a similar process in Montgomery, NY.

Construction and performance guarantees: Performance guarantees and any potential risks will be addressed in the same manner as in Montgomery, NY. An efficacy insurance policy will be acquired to provide sufficient resources to cover these issues.

Timeframes:

- *Facility design:* 6 months
- *Facility "permitting":* 9 to 12 months (parallel activity)
- *Facility construction:* 12 to 18 months
- *Start-up and acceptance testing:* 6 months
- *Total timeframe:* 30 months

Beneficial Reuse of MSW Byproducts

Energy generation: Net 0.7 MW/ton of raw MSW.

Solid or gaseous byproducts: Potential reuse of ash as an ingredient in concrete manufacturing or as a component of alternative daily cover at landfills.

Residue Requiring Landfill Disposal

Percent residue requiring landfill disposal: 15-20% of incoming waste as ash requiring landfill disposal.

Anticipated hazardous waste characterization: Based on experimental data, process ash will be non-leachable and readily disposed of at a standard landfill.

DRAFT SWMP
APPENDIX F
COST ESTIMATES FOR ALTERNATIVES

Sensitivity Analysis Comparison

	20 year NPV 2009$ $/ton		Savings from Base Case	
Base Case	$	51.85	$	-
Case 2 25% Residue	$	47.89	$	3.96
Case 3 25% Residue and Local Disposal	$	42.89	$	8.96
Case 4 - Full Plant Capacity Utilization	$	44.08	$	7.77
Case 5 - Full Utilization w/ 25% residue and local disposal	$	40.25	$	11.60
Case 6 - 10% Increase in Electricity Rate	$	47.54	$	4.31
Case 7 - 10% Reduction in Waste Delivery	$	59.49	$	(7.64)

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Base Case Conditions

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage residue by weight [1]	32%		
Unacceptable Waste as % by weight of GAT	3%		
Operating and Maintenance Cost [2]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [3]	$ 68.33	$68.33	$ 81.59
Residue transport and disposal fee ($/ton) [3]	$ 58.33	$58.33	$ 69.65
Ferrous recovery by% [4]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [5]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Non-processible and residue disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700
Non processible or by-pass waste (tpy)	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300
Net electricity Generated (kwH)	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500
Electric revenue to Authority ($) [6]	$ 27,361,237.50	$ 28,182,074.63	$ 29,027,536.87	$ 31,719,173.28	$ 36,771,215.24	$ 42,627,916.50	$ 49,417,438.45	$ 57,288,355.21	$ 64,478,548.50
Residue Generation (tpy)	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304
Ferrous Metal Recovery (tpy)	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894
Ferrous Revenue to Authority [6]	$ 708,837	$ 730,102	$ 752,005	$ 821,737	$ 952,618	$ 1,104,345	$ 1,280,239	$ 1,484,148	$ 1,670,421
Non-ferrous recovery (tpy)	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474
Non-Ferrous Revenue to Authority [6]	$ 354,419	$ 365,051	$ 376,003	$ 410,868	$ 476,309	$ 552,173	$ 640,119	$ 742,074	$ 835,211
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304
Total non-processible and residue for disposal (tons)	173,604	173,604	173,604	173,604	173,604	173,604	173,604	173,604	173,604
Landfill Disposal Cost [6]	$ 12,274,047	$ 12,642,269	$ 13,021,537	$ 14,228,985	$ 16,495,293	$ 19,122,566	$ 22,168,295	$ 25,699,129	$ 28,924,596
Facility Operating and Maintenance Costs [6]	$ 18,127,386	$ 18,671,207	$ 19,231,343	$ 21,014,608	$ 24,361,690	$ 28,241,876	$ 32,740,075	$ 37,954,720	$ 42,718,371
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 70,638,598	$ 71,550,641	$ 72,490,045	$ 75,480,758	$ 81,094,148	$ 87,601,607	$ 95,145,534	$ 103,891,014	$ 111,880,133
Total SW Treatment Facility Revenues	$ 30,033,980	$ 30,886,715	$ 31,765,032	$ 34,561,265	$ 39,809,629	$ 45,893,921	$ 52,947,283	$ 61,124,063	$ 68,593,667
Net SW Treatment Facility Expenses	**$ 40,604,618**	**$ 40,663,926**	**$ 40,725,013**	**$ 40,919,493**	**$ 41,284,520**	**$ 41,707,685**	**$ 42,198,251**	**$ 42,766,950**	**$ 43,286,466**
Net Expenses per ton of Waste Input	$ 79.62	$ 79.73	$ 79.85	$ 80.23	$ 80.95	$ 81.78	$ 82.74	$ 83.86	$ 84.88
Present Value in 2009$	$ 66.68	$ 64.83	$ 63.04	$ 57.96	$ 50.45	$ 43.96	$ 38.37	$ 33.54	$ 30.16
20 Year average NPV in 2009$	**$ 51.85**								
30 year average NPV in 2009$	$ 45.93								

Notes
1. Based on Annual throughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. See separate calculation sheet for O&M Cost
3. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
4. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
5. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements
6. Escalated annually at rate of inflation

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 2 Conditions - 25% Ash residue

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage Ash residue by weight [2]	25%		
Unacceptable Waste as % by weight of GAT	3%		
Operating and Maintenance Cost [3]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [4]	$ 68.33	$68.33	$ 81.59
Residue transport and disposal fee ($/ton) [4]	$ 58.33	$58.33	$ 69.65
Ferrous recovery by% [5]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [6]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Residue and Ash Disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700
Non processible or by-pass waste (tpy)	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300
Net electricity Generated (kwH)	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500
Electric revenue to Authority ($) [7]	$ 27,361,237.50	$ 28,182,074.63	$ 29,027,536.87	$ 31,719,173.28	$ 36,771,215.24	$ 42,627,916.50	$ 49,417,438.45	$ 57,288,355.21	$ 64,478,548.50
Residue Generation (tpy)	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675
Ferrous Metal Recovery (tpy)	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894
Ferrous Revenue to Authority [7]	$ 708,837	$ 730,102	$ 752,005	$ 821,737	$ 952,618	$ 1,104,345	$ 1,280,239	$ 1,484,148	$ 1,670,421
Non-ferrous recovery (tpy)	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474
Non-Ferrous Revenue to Authority [7]	$ 354,419	$ 365,051	$ 376,003	$ 410,868	$ 476,309	$ 552,173	$ 640,119	$ 742,074	$ 835,211
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675
Total non-processible and residue for disposal (tons)	138,975	138,975	138,975	138,975	138,975	138,975	138,975	138,975	138,975
Landfill Disposal Cost [7]	$ 9,862,170	$ 10,158,035	$ 10,462,776	$ 11,432,957	$ 13,253,931	$ 15,364,939	$ 17,812,175	$ 20,649,193	$ 23,240,849
Facility Operating and Maintenance Costs [7]	$ 18,127,386	$ 18,671,207	$ 19,231,343	$ 21,014,608	$ 24,361,690	$ 28,241,876	$ 32,740,075	$ 37,954,720	$ 42,718,371
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 68,226,720	$ 69,066,407	$ 69,931,284	$ 72,684,730	$ 77,852,786	$ 83,843,980	$ 90,789,415	$ 98,841,078	$ 106,196,385
Total SW Treatment Facility Revenues	$ 30,033,980	$ 30,886,715	$ 31,765,032	$ 34,561,265	$ 39,809,629	$ 45,893,921	$ 52,947,283	$ 61,124,063	$ 68,593,667
Net SW Treatment Facility Expenses	**$ 38,192,740**	**$ 38,179,692**	**$ 38,166,252**	**$ 38,123,466**	**$ 38,043,158**	**$ 37,950,059**	**$ 37,842,131**	**$ 37,717,014**	**$ 37,602,718**
Net Expenses per ton of Waste Input	$ 74.89	$ 74.86	$ 74.84	$ 74.75	$ 74.59	$ 74.41	$ 74.20	$ 73.95	$ 73.73
Present Value in 2009$	$ 62.72	$ 60.87	$ 59.08	$ 54.00	$ 46.48	$ 40.00	$ 34.41	$ 29.58	$ 26.20
20 Year average NPV in 2009$	**$ 47.89**								
30 year average NPV in 2009$	$ 41.97								

Notes
1. Based on Annual thriloughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. Based on OCRRA facility Ash residue rate of 25%
3. See separate calculation sheet for O&M Cost
4. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
5. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
6. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements
7. Escalated annually at rate of inflation

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 3 Conditions - 25% Ash residue with Local Disposal Site

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage Ash residue by weight [2]	25%		
Unacceptable Waste as % by weight of GAT	3%		
Operating and Maintenance Cost [3]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [4]	$ 50.00	$50.00	$ 59.70
Residue transport and disposal fee ($/ton) [4]	$ 40.00	$40.00	$ 47.76
Ferrous recovery by% [5]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [6]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Residue and Ash Disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700
Non processible or by-pass waste (tpy)	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300
Net electricity Generated (kwH)	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500
Electric revenue to Authority ($) [7]	$ 27,361,237.50	$ 28,182,074.63	$ 29,027,536.87	$ 31,719,173.28	$ 36,771,215.24	$ 42,627,916.50	$ 49,417,438.45	$ 57,288,355.21	$ 64,478,546.50
Residue Generation (tpy)	123,675	123,675	123,575	123,675	123,675	123,675	123,675	123,675	123,675
Ferrous Metal Recovery (tpy)	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894
Ferrous Revenue to Authority [7]	$ 708,837	$ 730,102	$ 752,005	$ 821,737	$ 952,618	$ 1,104,345	$ 1,280,239	$ 1,484,148	$ 1,670,421
Non-ferrous recovery (tpy)	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474
Non-Ferrous Revenue to Authority [7]	$ 354,419	$ 365,051	$ 376,003	$ 410,868	$ 476,309	$ 552,173	$ 640,119	$ 742,074	$ 835,211
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675	123,675
Total non-processible and residue for disposal (tons)	138,975	138,975	138,975	138,975	138,975	138,975	138,975	138,975	138,975
Landfill Disposal Cost [7]	$ 6,820,427	$ 7,025,040	$ 7,235,791	$ 7,906,744	$ 9,166,083	$ 10,626,003	$ 12,318,449	$ 14,280,459	$ 16,072,782
Facility Operating and Maintenance Costs [7]	$ 18,127,386	$ 18,671,207	$ 19,231,343	$ 21,014,608	$ 24,361,690	$ 28,241,876	$ 32,740,075	$ 37,954,720	$ 42,718,371
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 65,184,977	$ 65,933,411	$ 66,704,299	$ 69,158,517	$ 73,764,938	$ 79,105,043	$ 85,295,689	$ 92,472,344	$ 99,028,319
Total SW Treatment Facility Revenues	$ 30,033,980	$ 30,886,715	$ 31,765,032	$ 34,561,265	$ 39,809,629	$ 45,893,921	$ 52,947,283	$ 61,124,063	$ 68,593,667
Net SW Treatment Facility Expenses	**$ 35,150,997**	**$ 35,046,697**	**$ 34,939,267**	**$ 34,597,252**	**$ 33,955,310**	**$ 33,211,122**	**$ 32,348,406**	**$ 31,348,280**	**$ 30,434,652**
Net Expenses per ton of Waste Input	$ 68.92	$ 68.72	$ 68.51	$ 67.84	$ 66.58	$ 65.12	$ 63.43	$ 61.47	$ 59.68
Present Value in 2009$	$ 57.72	$ 55.87	$ 54.08	$ 49.01	$ 41.49	$ 35.01	$ 29.41	$ 24.59	$ 21.21
20 Year average NPV in 2009$	**$ 42.89**								
30 year average NPV in 2009$	$ 36.98								

Notes
1. Based on Annual thrioughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. Based on OCRRA facility Ash residue rate of 25%
3. See separate calculation sheet for O&M Cost
4. Based on CHA estimate of local disposal fee for non-processibles. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
5. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
6. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 4 - Full Plant Capacity Utilization

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage residue by weight [1]	32%		
Unacceptable Waste as % by weight of GAT	0%		
Operating and Maintenance Cost [2]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [3]	$ 68.33	$68.33	$ 81.59
Residue transport and disposal fee ($/ton) [3]	$ 58.33	$58.33	$ 69.65
Ferrous recovery by% [4]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [5]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Non-processible and residue disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Non processible or by-pass waste (tpy)	-	-	-	-	-	-	-	-	-
Net electricity Generated (kwH)	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000
Electric revenue to Authority ($) [6]	$ 28,207,461.34	$ 29,053,685.18	$ 29,925,295.74	$ 32,700,178.64	$ 37,908,469.32	$ 43,946,305.68	$ 50,945,812.83	$ 59,060,160.01	$ 66,472,730.41
Residue Generation (tpy)	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200
Ferrous Metal Recovery (tpy)	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200
Ferrous Revenue to Authority [6]	$ 730,760	$ 752,683	$ 775,263	$ 847,151	$ 982,080	$ 1,138,500	$ 1,319,834	$ 1,530,049	$ 1,722,084
Non-ferrous recovery (tpy)	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550
Non-Ferrous Revenue to Authority [6]	$ 365,380	$ 376,341	$ 387,632	$ 423,576	$ 491,040	$ 569,250	$ 659,917	$ 765,025	$ 861,042
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200
Total non-processible and residue for disposal (tons)	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200	163,200
Landfill Disposal Cost [6]	$ 11,366,728	$ 11,707,730	$ 12,058,962	$ 13,177,153	$ 15,275,932	$ 17,708,992	$ 20,529,576	$ 23,799,405	$ 26,786,440
Facility Operating and Maintenance Costs [6]	$ 15,181,400	$ 15,636,842	$ 16,105,947	$ 17,599,403	$ 20,402,532	$ 23,652,127	$ 27,419,297	$ 31,786,480	$ 35,775,964
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165

Total SW Treatment Facility Expenses	$ 66,785,293	$ 67,581,737	$ 68,402,074	$ 71,013,722	$ 75,915,629	$ 81,598,284	$ 88,186,038	$ 95,823,050	$ 102,799,568
Total SW Treatment Facility Revenues	$ 30,913,088	$ 31,792,196	$ 32,697,677	$ 35,580,392	$ 40,991,076	$ 47,263,543	$ 54,535,050	$ 62,964,720	$ 70,665,343
Net SW Treatment Facility Expenses	**$ 35,872,205**	**$ 35,789,541**	**$ 35,704,397**	**$ 35,433,330**	**$ 34,924,553**	**$ 34,334,741**	**$ 33,650,987**	**$ 32,858,330**	**$ 32,134,225**
Net Expenses per ton of Waste Input	$ 70.34	$ 70.18	$ 70.01	$ 69.48	$ 68.48	$ 67.32	$ 65.98	$ 64.43	$ 63.01
Present Value in 2009$	$ 58.91	$ 57.06	$ 55.27	$ 50.19	$ 42.67	$ 36.19	$ 30.60	$ 25.77	$ 22.39
20 Year average NPV in 2009$	**$ 44.08**								
30 year average NPV in 2009$	$ 38.16								

Notes
1. Based on Annual throughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. See separate calculation sheet for O&M Cost
3. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
4. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
5. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements
6. Escalated annually at rate of inflation

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 5 - Full Plant Capacity Utilization w/ 25% residue and local disposal

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage Ash residue by weight [2]	25%		
Unacceptable Waste as % by weight of GAT	0%		
Operating and Maintenance Cost [3]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [4]	$ 50.00	$50.00	$ 59.70
Residue transport and disposal fee ($/ton) [4]	$ 40.00	$40.00	$ 47.76
Ferrous recovery by% [5]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [6]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Residue and Ash Disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Non processible or by-pass waste (tpy)	-	-	-	-	-	-	-	-	-
Net electricity Generated (kwH)	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000	323,850,000
Electric revenue to Authority ($) [7]	$ 28,207,461.34	$ 29,053,685.18	$ 29,925,295.74	$ 32,700,178.64	$ 37,908,469.32	$ 43,946,305.68	$ 50,945,812.83	$ 59,060,160.01	$ 66,472,730.41
Residue Generation (tpy)	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500
Ferrous Metal Recovery (tpy)	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200	10,200
Ferrous Revenue to Authority [7]	$ 730,760	$ 752,683	$ 775,263	$ 847,151	$ 982,080	$ 1,138,500	$ 1,319,834	$ 1,530,049	$ 1,722,084
Non-ferrous recovery (tpy)	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550	2,550
Non-Ferrous Revenue to Authority [7]	$ 365,380	$ 376,341	$ 387,632	$ 423,576	$ 491,040	$ 569,250	$ 659,917	$ 765,025	$ 861,042
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500
Total non-processible and residue for disposal (tons)	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500	127,500
Landfill Disposal Cost [7]	$ 6,089,667	$ 6,272,357	$ 6,460,527	$ 7,059,593	$ 8,184,003	$ 9,487,502	$ 10,998,615	$ 12,750,410	$ 14,350,699
Facility Operating and Maintenance Costs [7]	$ 18,127,386	$ 18,671,207	$ 19,231,343	$ 21,014,608	$ 24,361,690	$ 28,241,876	$ 32,740,075	$ 37,954,720	$ 42,718,371
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 64,454,217	$ 65,180,729	$ 65,929,036	$ 68,311,366	$ 72,782,858	$ 77,966,543	$ 83,975,855	$ 90,942,294	$ 97,306,235
Total SW Treatment Facility Revenues	$ 30,913,088	$ 31,792,196	$ 32,697,677	$ 35,580,392	$ 40,991,076	$ 47,263,543	$ 54,535,050	$ 62,964,720	$ 70,665,343
Net SW Treatment Facility Expenses	**$ 33,541,129**	**$ 33,388,533**	**$ 33,231,358**	**$ 32,730,974**	**$ 31,791,782**	**$ 30,703,000**	**$ 29,440,805**	**$ 27,977,574**	**$ 26,640,892**
Net Expenses per ton of Waste Input	$ 65.77	$ 65.47	$ 65.16	$ 64.18	$ 62.34	$ 60.20	$ 57.73	$ 54.86	$ 52.24
Present Value in 2009$	$ 55.08	$ 53.23	$ 51.44	$ 46.36	$ 38.85	$ 32.36	$ 26.77	$ 21.94	$ 18.56
20 Year average NPV in 2009$	**$ 40.25**								
30 year average NPV in 2009$	$ 34.33								

Notes
1. Based on Annual thrioughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. Based on OCRRA facility Ash residue rate of 25%
3. See separate calculation sheet for O&M Cost
4. Based on CHA estimate of local disposal fee for non-processibles. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
5. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
6. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 6 - 10% increase in initial price of electric energy

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.077	$ 0.077	$ 0.092
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage residue by weight [1]	32%		
Unacceptable Waste as % by weight of GAT	3%		
Operating and Maintenance Cost [2]	$ 29.77	$ 29.77	$ 35.54
Non-processible transport and disposal fee ($/ton) [3]	$ 68.33	$68.33	$ 81.59
Residue transport and disposal fee ($/ton) [3]	$ 58.33	$58.33	$ 69.65
Ferrous recovery by% [4]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [5]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Non-processible and residue disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000	510,000
Waste Processed (tpy)	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700	494,700
Non processible or by-pass waste (tpy)	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300	15,300
Net electricity Generated (kwH)	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500	314,134,500
Electric revenue to Authority ($) [6]	$ 29,986,888.65	$ 30,886,495.31	$ 31,813,090.17	$ 34,763,022.58	$ 40,299,870.82	$ 46,718,595.44	$ 54,159,656.48	$ 62,785,885.63	$ 70,666,067.42
Residue Generation (tpy)	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304
Ferrous Metal Recovery (tpy)	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894	9,894
Ferrous Revenue to Authority [6]	$ 708,837	$ 730,102	$ 752,005	$ 821,737	$ 952,618	$ 1,104,345	$ 1,280,239	$ 1,484,148	$ 1,670,421
Non-ferrous recovery (tpy)	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474	2,474
Non-Ferrous Revenue to Authority [6]	$ 354,419	$ 365,051	$ 376,003	$ 410,868	$ 476,309	$ 552,173	$ 640,119	$ 742,074	$ 835,211
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304	158,304
Total non-processible and residue for disposal (tons)	173,604	173,604	173,604	173,604	173,604	173,604	173,604	173,604	173,604
Landfill Disposal Cost [6]	$ 12,274,047	$ 12,642,269	$ 13,021,537	$ 14,228,985	$ 16,495,293	$ 19,122,566	$ 22,168,295	$ 25,699,129	$ 28,924,596
Facility Operating and Maintenance Costs [6]	$ 18,127,386	$ 18,671,207	$ 19,231,343	$ 21,014,608	$ 24,361,690	$ 28,241,876	$ 32,740,075	$ 37,954,720	$ 42,718,371
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 70,638,598	$ 71,550,641	$ 72,490,045	$ 75,480,758	$ 81,094,148	$ 87,601,607	$ 95,145,534	$ 103,891,014	$ 111,880,133
Total SW Treatment Facility Revenues	$ 32,659,631	$ 33,591,135	$ 34,550,585	$ 37,605,114	$ 43,338,284	$ 49,984,600	$ 57,689,501	$ 66,621,594	$ 74,781,186
Net SW Treatment Facility Expenses	**$ 37,978,967**	**$ 37,959,505**	**$ 37,939,460**	**$ 37,875,644**	**$ 37,755,864**	**$ 37,617,007**	**$ 37,456,033**	**$ 37,269,420**	**$ 37,098,947**
Net Expenses per ton of Waste Input	$ 74.47	$ 74.43	$ 74.39	$ 74.27	$ 74.03	$ 73.76	$ 73.44	$ 73.08	$ 72.74
Present Value in 2009$	$ 62.37	$ 60.52	$ 58.73	$ 53.65	$ 46.13	$ 39.65	$ 34.06	$ 29.23	$ 25.85
20 Year average NPV in 2009$	**$ 47.54**								
30 year average NPV in 2009$	$ 41.62								

Notes
1. Based on Annual throughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. See separate calculation sheet for O&M Cost
3. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
4. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
5. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements
6. Escalated annually at rate of inflation

Captial Region SWMP
Life Cycle Cost and Revenue
Solid Waste Treatment Facility
Case 7 - 10% Reduction in Annual Waste Input

Assumptions		2009 $	2015$
Facility Design Capacity (TPD)	1500		
Anticipated Throughput Guarantee	92%		
Guaranteed Annual Throughput (tons) [1]	510,000		
Net Electricity generated per processed ton (kwH) [1]	635		
Electric Energy price ($/kwH)	$ 0.07	$ 0.070	$ 0.084
Electric Capacity payment ($/Kw/yr)	$ 25.80	$ 25.800	$ 30.807
Authority Share of Energy Revenue %	100%		
Percentage residue by weight [1]	32%		
Unacceptable Waste as % by weight of GAT	3%		
Operating and Maintenance Cost [2]	$ 31.92	$ 31.92	$ 38.11
Non-processible transport and disposal fee ($/ton) [3]	$ 68.33	$68.33	$ 81.59
Residue transport and disposal fee ($/ton) [3]	$ 58.33	$58.33	$ 69.65
Ferrous recovery by% [4]	2%		
Ferrous sale price ($/ton)	$60	$60.00	$ 71.64
Authority Share of Ferrous Revenue %	100%		
Non ferrous metal recovery by % [5]	0.50%		
Non-Ferrous sale price ($/ton)	$ 120.00	$ 120.00	$ 143.29
Authority Share of Ferrous Revenue %	100%		
Annual Inflation Rates			
Electricity Revenue inflation rate	3.0%		
Ferrous and Non-Ferrous Revenue inflation rate	3.0%		
Non-processible and residue disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount Rate	3.0%		

	2015	2016	2017	2020	2025	2030	2035	2040	2044
	1	2	3	6	11	16	21	26	30
Authority Waste input (tpy)	459,000	459,000	459,000	459,000	459,000	459,000	459,000	459,000	459,000
Waste Processed (tpy)	445,230	445,230	445,230	445,230	445,230	445,230	445,230	445,230	445,230
Non processible or by-pass waste (tpy)	13,770	13,770	13,770	13,770	13,770	13,770	13,770	13,770	13,770
Net electricity Generated (kwH)	282,721,050	282,721,050	282,721,050	282,721,050	282,721,050	282,721,050	282,721,050	282,721,050	282,721,050
Electric revenue to Authority ($) [6]	$ 24,625,113.75	$ 25,363,867.16	$ 26,124,783.18	$ 28,547,255.95	$ 33,094,093.71	$ 38,365,124.85	$ 44,475,694.60	$ 51,559,519.69	$ 58,030,693.65
Residue Generation (tpy)	142,474	142,474	142,474	142,474	142,474	142,474	142,474	142,474	142,474
Ferrous Metal Recovery (tpy)	8,905	8,905	8,905	8,905	8,905	8,905	8,905	8,905	8,905
Ferrous Revenue to Authority [6]	$ 637,953	$ 657,092	$ 676,805	$ 739,563	$ 857,356	$ 993,911	$ 1,152,215	$ 1,335,733	$ 1,503,379
Non-ferrous recovery (tpy)	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226	2,226
Non-Ferrous Revenue to Authority [6]	$ 318,977	$ 275,152	$ 283,407	$ 309,686	$ 359,011	$ 416,192	$ 482,481	$ 559,328	$ 629,528
Interest on Debt Service Reserve Account	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487	$ 1,609,487
Residue for disposal (tons)	142,474	142,474	142,474	142,474	142,474	142,474	142,474	142,474	142,474
Total non-processible and residue for disposal (tons)	156,244	156,244	156,244	156,244	156,244	156,244	156,244	156,244	156,244
Landfill Disposal Cost [6]	$ 11,046,643	$ 11,378,042	$ 11,719,383	$ 12,806,086	$ 14,845,764	$ 17,210,309	$ 19,951,465	$ 23,129,216	$ 26,032,137
Facility Operating and Maintenance Costs [6]	$ 17,494,060	$ 18,018,882	$ 18,559,448	$ 20,280,410	$ 23,510,554	$ 27,255,176	$ 31,596,219	$ 36,628,677	$ 41,225,899
Debt Service	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165	$ 40,237,165
Total SW Treatment Facility Expenses	$ 68,777,868	$ 69,634,089	$ 70,515,996	$ 73,323,662	$ 78,593,483	$ 84,702,650	$ 91,784,849	$ 99,995,058	$ 107,495,200
Total SW Treatment Facility Revenues	$ 27,191,531	$ 27,905,598	$ 28,694,481	$ 31,205,992	$ 35,919,948	$ 41,384,714	$ 47,719,877	$ 55,064,067	$ 61,773,088
Net SW Treatment Facility Expenses	**$ 41,586,337**	**$ 41,728,491**	**$ 41,821,515**	**$ 42,117,670**	**$ 42,673,535**	**$ 43,317,935**	**$ 44,064,972**	**$ 44,930,991**	**$ 45,722,113**
Net Expenses per ton of Waste Input	$ 90.60	$ 90.91	$ 91.11	$ 91.76	$ 92.97	$ 94.37	$ 96.00	$ 97.89	$ 99.61
Present Value in 2009$	$ 75.88	$ 73.92	$ 71.93	$ 66.29	$ 57.94	$ 50.73	$ 44.52	$ 39.15	$ 35.40
20 Year average NPV in 2009$	**$ 59.49**								
30 year average NPV in 2009$	$ 52.92								

Notes
1. Based on Annual throughput Guarantee @ HHV = 5,000 BTU/lb from Frederick Co. Agreement
2. See separate calculation sheet for O&M Cost
3. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets. Assumes a $10/ton discount for residue disposal relative to non-processible waste.
4. Field study of waste composition showed 2.8% ferrous : anticipated to decline to 2% with recycling program improvements
5. Field study of waste composition showed 1.3% non-ferrous : anticipated to decline to 0.5% with recycling program improvements
6. Escalated annually at rate of inflation

Construction Fund Drawdown

Months after notice to proceed	Beginning Balance in Construction Fund	Monthly Drawdown (%) [1]		Drawdown	Ending Balance in Construction Fund	Interest Earned (4%)
1	$ 420,885,364.00	2.7%	2.7%	$ 11,363,904.83	$ 409,521,459.17	$ 1,365,071.53
2	$ 409,521,459.17	3.3%	6.0%	$ 13,889,217.01	$ 395,632,242.16	$ 1,318,774.14
3	$ 395,632,242.16	3.7%	9.7%	$ 15,572,758.47	$ 380,059,483.69	$ 1,266,864.95
4	$ 380,059,483.69	4.9%	14.6%	$ 20,623,382.84	$ 359,436,100.86	$ 1,198,120.34
5	$ 359,436,100.86	2.4%	17.0%	$ 10,101,248.74	$ 349,334,852.12	$ 1,164,449.51
6	$ 349,334,852.12	1.3%	18.3%	$ 5,471,509.73	$ 343,863,342.39	$ 1,146,211.14
7	$ 343,863,342.39	4.3%	22.6%	$ 18,098,070.65	$ 325,765,271.74	$ 1,085,884.24
8	$ 325,765,271.74	4.2%	26.8%	$ 17,677,185.29	$ 308,088,086.45	$ 1,026,960.29
9	$ 308,088,086.45	5.5%	32.3%	$ 23,148,695.02	$ 284,939,391.43	$ 949,797.97
10	$ 284,939,391.43	4.2%	36.5%	$ 17,677,185.29	$ 267,262,206.14	$ 890,874.02
11	$ 267,262,206.14	5.2%	41.7%	$ 21,886,038.93	$ 245,376,167.21	$ 817,920.56
12	$ 245,376,167.21	4.6%	46.3%	$ 19,360,726.74	$ 226,015,440.47	$ 753,384.80
13	$ 226,015,440.47	5.2%	51.5%	$ 21,886,038.93	$ 204,129,401.54	$ 680,431.34
14	$ 204,129,401.54	5.5%	57.0%	$ 23,148,695.02	$ 180,980,706.52	$ 603,269.02
15	$ 180,980,706.52	4.7%	61.7%	$ 19,781,612.11	$ 161,199,094.41	$ 537,330.31
16	$ 161,199,094.41	4.8%	66.5%	$ 20,202,497.47	$ 140,996,596.94	$ 469,988.66
17	$ 140,996,596.94	3.4%	69.9%	$ 14,310,102.38	$ 126,686,494.56	$ 422,288.32
18	$ 126,686,494.56	4.2%	74.1%	$ 17,677,185.29	$ 109,009,309.28	$ 363,364.36
19	$ 109,009,309.28	5.0%	79.1%	$ 21,044,268.20	$ 87,965,041.08	$ 293,216.80
20	$ 87,965,041.08	4.3%	83.4%	$ 18,098,070.65	$ 69,866,970.42	$ 232,889.90
21	$ 69,866,970.42	4.0%	87.4%	$ 16,835,414.56	$ 53,031,555.86	$ 176,771.85
22	$ 53,031,555.86	3.9%	91.3%	$ 16,414,529.20	$ 36,617,026.67	$ 122,056.76
23	$ 36,617,026.67	3.6%	94.9%	$ 15,151,873.10	$ 21,465,153.56	$ 71,550.51
24	$ 21,465,153.56	4.0%	98.9%	$ 16,835,414.56	$ 4,629,739.00	$ 15,432.46
25	$ 4,629,739.00	1.1%	100.0%	$ 4,629,739.00	$ (0.00)	$ (0.00)
		100.0%				$ 16,972,903.78

Notes:
1. Drawdown percentage as per table 10-1 Construction Payment Schedule from Appendix 10 of Draft Agreement for Frederick County Facility 7/13/09

Captial Region SWMP
Sources and Uses of Funds
SW Treatment Facility

Assumptions

Facility Design Capacity (TPD)		1500	
Facility Construction Price $2009 [1]	$	332,000,000	
Facility Construction Price in $2012 [2]	$	362,785,364	
Project development Expenses @ 7.5% [3]	$	24,900,000	
Contingency @ 10%		33,200,000	
Total Construction Costs	**$**	**420,885,364**	
Sources of Funds			
Bond Proceeds	$	553,857,780	553857780
Uses of Funds			
Construction Fund	$	420,885,364	
Underwriters discount @ 0.75 % of Bond Proceeds	$	4,153,933	
Cost of Bond Issuance @ 1.0 % of Bond proceeds	$	5,538,578	
Capitalized Interest	$	108,002,267	
Debt service reserve Fund	$	40,237,165	
Resident Engineer CQA/QC @ 0.75% of Construction Fund	$	3,156,640	
Bond Insurance @ 0.2% of bond proceeds	$	1,107,716	
Less Interest earned during construction:			
Debt service reserve Fund	$	(5,230,831)	
Capitalized Interest	$	(7,020,147)	
Construction Fund	$	(16,972,904)	
Total Uses of Funds	$	553,857,780	

Construction period	39 months
Bond Term	30 yrs
Interest rates	
Tax exempt Bonds	6.00%
Debt Service reserve Fund	4.00%
Capitalized interest Fund	4.00%
Construction Fund	4.00%

Notes:
1. Based on proposed Facility in Frederick County MD
2. Assumes 3% annual inflation of the 2009 Facility Construction Price
3. Includes siting studies, acquisition, preliminary environmental review, RFP preparation, review, negotiations of project agreements

Estimated Operating and Maintenance Cost
1500 TPD SW Treatment Facility

	Unit		Unit Cost		Item Total in 2009$
Labor and Salary 1		60	$ 60,000.00	$	3,600,000.00
Fringe Benefits			35%	$	1,260,000.00
Maintenance 2	$ per ton		$ 5.00	$	2,550,000.00
Utillty Charges 3	$ per ton		$ 1.00	$	510,000.00
Chemicals 4	$ per ton		$ 2.00	$	1,020,000.00
Contract Services 5	$ per year			$	520,000.00
Insurance 6	$ per year			$	308,000.00
Fuel 7	$ per year			$	50,000.00
Equipment Rental 8	$ per year			$	200,000.00
Equipment Replacement Fund	% of construction Cost		0.5%	$	1,660,000.00
Subtotal				$	11,678,000.00
Management Fee			20%	$	2,335,600.00
Contingency			10%	$	1,167,800.00
Total				$	15,181,400.00
Cost per ton 9				$	29.77

1. 60 Full time operating employees based on Covanta Presentation to SWMP Committee
2. Includes recurring maintenance on all fixed and mobile equipment
3. Includes water, sewer, internet and telephone
4. Includes allowance for chemicals to operate air pollution control equipment
5. Professional, laboratory and other contract services
6. Based on% of wages plus $200,000 for workers comp, vehicle insurance and CGL insurance
7. Fuel for operating equipment and auxiliary fuel for furnace start-up.
8. Allowance for equipment rental used for facility maintenance

9. Based on facility receipt of 510,000 tons per year

Excludes ash and nonprocessible waste disposal cost

Sources:
Covanta Presentation
MOSA Summary Report by GBB march 2009

Estimated Operating and Maintenance Cost
1500 TPD SW Treatment Facility

	Unit	Unit Cost		Item Total in 2009$	
Labor and Salary 1		60	$ 60,000.00	$	3,600,000.00
Fringe Benefits			35%	$	1,260,000.00
Maintenance 2	$ per ton	$	5.00	$	2,295,000.00
Utillty Charges 3	$ per ton	$	1.00	$	459,000.00
Chemicals 4	$ per ton	$	2.00	$	918,000.00
Contract Services 5	$ per year			$	520,000.00
Insurance 6	$ per year			$	308,000.00
Fuel 7	$ per year			$	50,000.00
Equipment Rental 8	$ per year			$	200,000.00
Equipment Replacement Fund	% of construction Cost		0.5%	$	1,660,000.00
Subtotal				$	11,270,000.00
Management Fee			20%	$	2,254,000.00
Contingency			10%	$	1,127,000.00
Total				$	14,651,000.00
Cost per ton 9					31.91938998

1. 60 Full time operating employees based on Covanta Presentation to SWMP Committee
2. Includes recurring maintenance on all fixed and mobile equipment
3. Includes water, sewer, internet and telephone
4. Includes allowance for chemicals to operate air pollution control equipment
5. Professional, laboratory and other contract services
6. Based on% of wages plus $200,000 for workers comp, vehicle insurance and CGL insurance
7. Fuel for operating equipment and auxiliary fuel for furnace start-up.
8. Allowance for equipment rental used for facility maintenance

9. Based on facility receipt of 459,000 tons per year

Excludes ash and nonprocessible waste disposal cost

Sources:
Covanta Presentation
MOSA Summary Report by GBB march 2009

Captial Region SWMP
Life Cycle Cost and Revenue
SSOW Facility

Assumptions		
Facility Throughput Capacity (TPY)		40000
Anticipated Annual Throughput (tons)		40,000
Estimated Mass Reduction (% of throughput)		50%
Compost produced per processed ton		50%
Compost Price assumption ($/ton)	$	30.00
Authority Share of Compost Revenue %		100%
Percentage residue by weight [1]		5%
Annual SSOW O&M Cost (2009$) [2]	$	1,010,000.00
Non-processible disposal fee ($/ton, 2009) [3]	$	68.33
Annual Inflation Rates		
Compost Revenue rate		3.0%
Ferrous and Non-Ferrous Revenue rate		3.0%
Non-processible and residue disposal fee inflation rate		3.0%
Facility operating cost inflation rate		3.0%
Present Value Discount Rate		3.0%

Calendar Year				2013				2015				2020				2025				2030				2032
Inflation Year				4				6				11				16				21				23
Facility Operating Year				1				3				8				13				18				20
SSOW input (tpy)				40,000				40,000				40,000				40,000				40,000				40,000
SSOW Processed (tpy)				40,000				40,000				40,000				40,000				40,000				40,000
Net compost Generated (tpy)				19,000				19,000				19,000				19,000				19,000				19,000
Compost revenue to Authority ($) [4]			$	641,540.02			$	680,609.81			$	789,013.31			$	914,682.67			$	1,060,367.91			$	1,124,944.31
Interest on Debt Service Reserve Account			$	40,156			$	40,156			$	40,156			$	40,156			$	40,156			$	40,156
Residue for disposal (tons)				2,000				2,000				2,000				2,000				2,000				2,000
Landfill Disposal Cost [4]			$	153,812			$	163,179			$	189,169			$	219,299			$	254,228			$	269,710
Annual Operating Cost [4]			$	1,136,764			$	1,205,993			$	1,398,076			$	1,620,754			$	1,878,898			$	1,993,322
Debt Service			$	1,003,907			$	1,003,907			$	1,003,907			$	1,003,907			$	1,003,907			$	1,003,907
Total SSOW Facility Expenses			$	2,294,483			$	2,373,079			$	2,591,153			$	2,843,960			$	3,137,032			$	3,266,940
Total SSOW Facility Revenue			$	681,696			$	720,766			$	829,170			$	954,839			$	1,100,524			$	1,165,101
Net SSOW Facility Expenses			**$**	**1,612,787**			**$**	**1,652,313**			**$**	**1,761,983**			**$**	**1,889,121**			**$**	**2,036,508**			**$**	**2,101,839**
Net Expenses per ton of Waste Input			$	40.32			$	41.31			$	44.05			$	47.23			$	50.91			$	52.55
Present Value in 2009$			$	35.82			$	34.59			$	31.82			$	29.43			$	27.37			$	26.62
20 year average NPV in 2009$	$	30.82																						

Notes
1. Conservative increase of Norterra's note of 2% residue at Joyceville
2. As per SSOW Facility O&M Cost sheet
3. Based on CHA calculations provided in Transfer Station Alternative 1 spreadsheets.
4. Escalated annually at rate of inflation

SSOW Facility
Operating Cost Estimate
150 TPD

	Units	Unit Cost	Extended Cost			Avg per employee
1) LABOR						
(a) Foreman	1	$ 60,000.00	$ 60,000.00			
(b) Scale Attendant	1	$ 31,000.00	$ 31,000.00			
(c) equipment operators	2	$ 57,000.00	$ 114,000.00			
(d) Mechanics	1	$ 50,000.00	$ 50,000.00			
(e) Laborers	2	$ 27,000.00	$ 54,000.00			
Labor Subtotal			**$ 309,000.00**			
(f) Overtime	10%		$ 30,900.00			
(g) Replacement labor	10%		$ 30,900.00			
(h) Fringe Benefits	31%		$ 95,790.00			
(i) Management	5%		$ 15,450.00			
Labor and Fringe Total				**$**	**482,040.00**	$ 68,862.86
2) EQUIPMENT OPERATIONS						
(a) Fuel for Mobile Equipment	12,500.00	$ 3.00	$ 37,500.00			
(b) equipment maintenance	LS		$ 10,000.00			
(c) equipment replacement fund	LS	$ -	$ 50,000.00			
				$	**97,500.00**	
3) MISC. O&M EXPENSES						
(a) Utilities	LS		$ 40,000.00			
(b)Other insurance	LS		$ 30,000.00			
(c) Building and grounds	1.5%		$ 98,345.43			
				$	**168,345.43**	
			O&M Subtotal	**$**	**747,885.43**	
Contingency @ 15%	15%		$ 112,182.81			
Administrative Overhead @ 20%	20%		$ 149,577.09			
O&M Cost Total				**$**	**1,010,000.00**	Rounded to the nearest thousand.

Captial Region SWMP
Sources and Uses of Funds
SSOW Facility

Assumptions

Annual Inflation Rate for Construction Price		3%	
Facility Throughput Capacity (TPY)		40,000	
Facility Construction Price $2009 [1]	$	6,000,000	
Facility Construction Price $2012 [2]	$	6,556,362	
Project development Expenses @ 15% [3]	$	983,454	
Property Acquisition - 15 acres @ $75K/acre	$	1,125,000	
Contingency @ 10%		866,482	
Total Construction Costs	**$**	**9,531,298**	
Sources of Funds			
Bond Proceeds	$	11,514,735	11514735
Uses of Funds			
Construction Fund	$	9,531,298	
Underwriters discount @ 0.75 % of Bond Proceeds	$	86,361	
Cost of Bond Issuance @ 1.0 % of Bond proceeds	$	115,147	
Capitalized Interest	$	690,884	
Debt service reserve Fund	$	1,003,907	
Resident Engineer CQA/QC @ 2.5% of Construction Fund	$	238,282	
Bond Insurance @ 0.2% of bond proceeds	$	23,029	
Less Interest earned during construction:			
Debt service reserve Fund	$	(40,156)	
Capitalized Interest	$	(13,818)	
Construction Fund	$	(120,200)	
Total Uses of Funds	$	11,514,735	

Construction period	12 months
Bond Term	20 yrs
Interest rates	
Tax exempt Bonds	6.00%
Debt Service reserve Fund	4.00%
Capitalized interest Fund	4.00%
Construction Fund	4.00%

Notes:
1. Based on RFI response from Nortera noting Merchant Facility Cost in Joyceville ON of $3Million US$ for a 20,000 TPY facility.
2, Assumes 3% annual infaltion rate from 2009 to 2012.
3. Includes siting studies, preliminary environmental review, Bid preparation, review, negotiations of project agreements

Construction Fund Drawdown
Equivalent Monthly Drawdown

Months after notice to proceed	Beginning Balance in Construction Fund	Drawdown	Ending Balance in Construction Fund	Interest Earned (4%)
1	$ 6,556,362.00	$ 546,363.50	$ 6,009,998.50	$ 20,033.33
2	$ 6,009,998.50	$ 546,363.50	$ 5,463,635.00	$ 18,212.12
3	$ 5,463,635.00	$ 546,363.50	$ 4,917,271.50	$ 16,390.91
4	$ 4,917,271.50	$ 546,363.50	$ 4,370,908.00	$ 14,569.69
5	$ 4,370,908.00	$ 546,363.50	$ 3,824,544.50	$ 12,748.48
6	$ 3,824,544.50	$ 546,363.50	$ 3,278,181.00	$ 10,927.27
7	$ 3,278,181.00	$ 546,363.50	$ 2,731,817.50	$ 9,106.06
8	$ 2,731,817.50	$ 546,363.50	$ 2,185,454.00	$ 7,284.85
9	$ 2,185,454.00	$ 546,363.50	$ 1,639,090.50	$ 5,463.64
10	$ 1,639,090.50	$ 546,363.50	$ 1,092,727.00	$ 3,642.42
11	$ 1,092,727.00	$ 546,363.50	$ 546,363.50	$ 1,821.21
12	$ 546,363.50	$ 546,363.50	$ -	$ -
		$ 6,556,362.00		$ 120,199.97

Captial Region SWMP
Life Cycle Cost and Revenue
Transfer Station - Alternative Scenario #1

Assumptions		2009$	2015$
Nominal Facility Throughput Capacity (TPD)	1000		
Anticipated Annual Throughput (tons)	213,000		
Landfill Disposal Fee ($/ton)	$25	25 $	29.85
Annual Inflation Rates			
Disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present value discount rate	3.0%		

Calendar Year	2009	2010	2015	2020	2025	2030	2034
Inflation Year	0	1	6	11	16	21	25
Facility Operating Year	-5	-4	1	6	11	16	20
			213,000	213,000	213,000	213,000	213,000
			213,000	213,000	213,000	213,000	213,000
Landfill Disposal Cost	$ -	$ -	$ 6,358,328	$ 7,371,045	$ 8,545,062	$ 9,906,069	$ 11,149,367
Facility Operating Cost [4]	$ 1,519,379	$ 1,564,960	$ 1,814,218	$ 2,103,176	$ 2,438,157	$ 2,826,493	$ 3,181,242
Transportation O&M Cost	$ 7,083,411	$ 7,295,913	$ 8,457,963	$ 9,805,097	$ 11,366,795	$ 13,177,231	$ 14,831,090
Facility Debt Service			$ 1,441,655	$ 1,441,655	$ 1,441,655	$ 1,441,655	$ 1,441,655
Transportation Debt Service			$ 2,562,696	$ 2,562,696	$ 2,562,696	$ 2,562,696	$ 2,562,696
Total Facility Operating and Debt Service			$ 3,255,873	$ 3,544,831	$ 3,879,813	$ 4,268,148	$ 4,622,898
Facility Operating and Debt Service per ton			**$ 15.29**	**$ 16.64**	**$ 18.22**	**$ 20.04**	**$ 21.70**
Total Transportation O&M, Debt Service & Disposal			$ 17,378,988	$ 19,738,839	$ 22,474,553	$ 25,645,996	$ 28,543,153
Total T&D per ton			**$ 81.59**	**$ 92.67**	**$ 105.51**	**$ 120.40**	**$ 134.01**
Total Facility Operating,Transport &Disposal Cost ($/ton)			$ 96.88	$ 109.31	$ 123.73	$ 140.44	$ 155.71
Present Value in 2009$			$ 81.13	$ 78.97	$ 77.10	$ 75.49	$ 74.37
20 year average NPV in 2009$	**$ 77.22**						

Notes
1
2
3. Assumption includes transport and Disposal
4. Escalated annually at rate of inflation

Estimated Capital Cost
1000 TPD Transfer Station
2009 Cost

	Unit		Unit Cost		Extended Cost
Building and Site Development					
Land Purchase [1]	5 acres	$	75,000	$	375,000
Site Preparation and Development [2]	5 acres	$	175,000	$	875,000
Transfer Building [3]	40000 sq. ft.	$	175	$	7,000,000
Scale House and Scales [4]	2 scales	$	250,000	$	500,000
		Subtotal		**$**	**8,750,000**
Mobile Transfer Equipment					
Wheel Loader	2	$	250,000	$	500,000
Excavator w/ Grapple	2	$	350,000	$	700,000
Tools and Spare Parts @ 8%				$	96,000
Contingency	15%			$	194,400
		Subtotal		**$**	**1,490,400**
Total Transfer Station Facility Capital Cost				**$**	**10,240,400**

Notes
1 - assumes land acquisition cost of 75,000 per acres
2 - Includes estimates for earthwork, paved roadways, site utilities and landscaping
3 - Pre-engineered buiding, concrete floors, push walls, foundation, load out scales, ventilation and electromechanical equipment
4 - Pre-engineered building, 2 truck scales and office furnishings

Captial Region SWMP
Sources and Uses of Funds
Transfer Station Facility
Nominal Capacity 1000TPD

Assumptions

GO Bond financing

Annual Inflation Rate for Construction Price		3%		Construction period	12 months
Facility Construction Price $2009 [1]	$	10,240,400			
Facility Construction Price $2015 [2]	$	12,227,573		Bond Term	20 yrs
Project development Expenses @ 15% [3]	$	1,536,060		**Interest rates**	
Property Acquisition - 5 acres @ $75K included in Facility construc	$	-			
Contingency @ 10%		1,376,363		Tax exempt Bonds	6.00%
Total Construction Costs	**$**	**15,139,996**		Debt Service reserve Fund	4.00%
				Capitalized interest Fund	4.00%
Sources of Funds				Construction Fund	4.00%
Bond Proceeds	$	16,535,673	16535673		

Uses of Funds

Construction Fund	$	15,139,996
Underwriters discount @ 0.75 % of Bond Proceeds	$	124,018
Cost of Bond Issuance @ 1.0 % of Bond proceeds	$	165,357
Capitalized Interest	$	992,140
Debt service reserve Fund [4]	$	-
Resident Engineer CQA/QC @ 2.5% of Construction Fund	$	378,500
Bond Insurance @ 0.2% of bond proceeds	$	33,071
Less Interest earned during construction:		
Debt service reserve Fund	$	-
Capitalized Interest	$	(19,843)
Construction Fund	$	(277,567)
Total Uses of Funds	$	16,535,673
Annual Debt service payment		$1,441,655.32

Notes:
1. Based on RFI response from Nortera noting Merchant Facility Cost in Joyceville ON of $3Million US$ for a 20,000 TPY facility.
2, Assumes 3% annual infaltion rate from 2009 to 2012.
3. Includes siting studies, preliminary environmental review, Bid preparation, review, negotiations of project agreements
4. Debt service reserve not required for GO Bond financing

Transfer Station Cost Estimate
Capital Cost Estimate
1,000 TPD

	Units	Unit Cost	Extended Cost 2009$	Estimated Cost 2015$
Open Top Trailer - 105CY [1]	40	$ 75,000	$ 3,000,000	**3,582,156.89**
Tractors [1]	40	$ 125,000	$ 5,000,000	**5,970,261.48**
Tools and Spare Parts @ 1%	1%		$ 80,000	**95,524.18**
Contingency @15%	15%		$ 1,212,000	$ 1,447,191
Rolling Stock Capital Cost Total			**$ 9,292,000**	**11,095,133.94**
Total Annualized Capital Cost Amortization	5.0%	5 years		**$2,562,696**
Assumed Annual Tonnage	213,000			
Amortized Facility Cost per ton	$ 12.03			

Notes:
1 - assumes capacity for transporting 1000 TPD, w/ 25 ton payload, and 1 round trip per day.

Transfer Station Cost Estimate
~~Operating Cost Estimate~~
1,000 TPD

Assumptions:

Annual tonnage		213,000
Round trip travel time	7 hrs	
turnaround time at LF	.5 hrs	
turnaround time at TS	.5 hrs	
Round trip mileage to High Acres		415
trailer payload		25
Annual Round trips		8,520
Annual VMT		3,535,800
Thruway tolls (round trip)	$	60.00
Road Fuel Cost $/gallon	$	3.00
Road Fuel economy MPG		7
Fuel Cost $/VMT	$	0.43

	Units	Unit Cost	Extended Cost			
1) LABOR						
(d) Truck Drivers	40	$ 40,000.00	$ 1,600,000.00			
Labor Subtotal			$ 1,600,000.00			
(g) Overtime	10%		$ 160,000.00			
(h) Replacement labor	10%		$ 160,000.00			
(i) Fringe Benefits	31%		$ 496,000.00			
(j) Management	5%		$ 80,000.00			
Labor and Fringe Total				$ 2,496,000.00		
2) EQUIPMENT OPERATIONS						
(b) Fuel for tractors	3,535,800	$ 0.43	$ 1,515,342.86			
© Tires @ $/VMT	3,535,800	$ 0.28	$ 972,345.00			
(d) equipment maintenance	5%		$ 464,600.00			
(e) equipment replacement	0%		$ -			
(f) tolls	8,520	$ 60.00	$ 511,200.00			
				$ 3,463,487.86		
3) MISCELLANEOUS EXPENSES						
(b) Vehicle license and insurance [1]	40	$ 5,000.00	$ 200,000.00			
				$ 200,000.00		
4) CONTINGENCIES	15%			$ 923,923.18		
O&M Cost Total				$ 7,083,411.04	$ 33.26	$/ton
Total Amortized capital cost for Rolling Stock				$2,562,696.32	$ 12.03	$/ton
Total Annual Transfer and Transport Cost				$9,646,107.36		
Transport Cost per ton				**$ 45.29**		
(NOT INCLUDING DISPOSAL COST)						

Notes:
1- Based on 2.5% of vehicle cost

Captial Region SWMP
Life Cycle Cost and Revenue
Transfer Station - Alternative Scenario #2

Assumptions		2009$	2015%
Nominal Facility Throughput Capacity (TPD)	750		
Anticipated Annual Throughput (tons)	148,000		
Landfill Disposal Fee ($/ton)	$25	25	$ 29.85
Annual Inflation Rates			
Disposal fee inflation rate	3.0%		
Facility operating Cost inflation rate	3.0%		
Present Value Discount rate	3.0%		

Calendar Year	2009	2010	2015	2020	2025	2030	2034
Inflation Year	0	1	6	11	16	21	25
Facility Operating Year	-5	-4	1	6	11	16	20
Annual Waste Delivery			148,000	148,000	148,000	148,000	148,000
Annual Waste for Disposal			148,000	148,000	148,000	148,000	148,000
Landfill Disposal Cost	$ -	$ -	$ 4,417,993	$ 5,121,665	$ 5,937,414	$ 6,883,090	$ 7,746,978
Facility Operating Cost	$ 1,519,379	$ 1,564,960	$ 1,814,218	$ 2,103,176	$ 2,438,157	$ 2,826,493	$ 3,181,242
Transportation O&M Cost	$ 4,763,512	$ 4,763,512	$ 5,687,882	$ 6,593,815	$ 7,644,038	$ 8,861,535	$ 9,973,736
Facility Debt Service			$ 1,585,643	$ 1,585,643	$ 1,585,643	$ 1,585,643	$ 1,585,643
Transportation Debt Service			$ 1,922,022	$ 1,922,022	$ 1,922,022	$ 1,922,022	$ 1,922,022
Total Facility Operating and Debt Service			$ 3,399,862	$ 3,688,820	$ 4,023,801	$ 4,412,136	$ 4,766,886
Facility Operating and Debt Service per ton			**$ 22.97**	**$ 24.92**	**$ 27.19**	**$ 29.81**	**$ 32.21**
Total Transportation O&M, Debt Service & Disposal			$ 12,027,898	$ 13,637,502	$ 15,503,474	$ 17,666,648	$ 19,642,737
Total T&D per ton			**$ 81.27**	**$ 92.15**	**$ 104.75**	**$ 119.37**	**$ 132.72**
Total Facility Operating,Transport &Disposal Cost ($/ton)			$ 104.24	$ 117.07	$ 131.94	$ 149.18	$ 164.93
Present Value in 2009$			$ 87.30	$ 84.57	$ 82.22	$ 80.19	$ 78.77
20 year average NPV in 2009$	**$ 82.38**						

Notes
1
2

Estimated Capital Cost
750-1000 TPD Transfer Station
2009 Cost

	Unit		Unit Cost		Extended Cost
Building and Site Development					
Land Purchase [1]	5 acres	$	75,000	$	375,000
Site Preparation and Development [2]	5 acres	$	175,000	$	875,000
Transfer Building [3]	40000 sq. ft.	$	175	$	7,000,000
Scale House and Scales [4]	2 scales	$	250,000	$	500,000
		Subtotal		**$**	**8,750,000**
Mobile Transfer Equipment					
Wheel Loader	2	$	250,000	$	500,000
Excavator w/ Grapple	2	$	350,000	$	700,000
Tools and Spare Parts @ 8%				$	96,000
Contingency	15%			$	194,400
		Subtotal		**$**	**1,490,400**
Total Transfer Station Facility Capital Cost				**$**	**10,240,400**

Notes
1 - assumes land acquisition cost of 75,000 per acres
2 - Includes estimates for earthwork, paved roadways, site utilities and landscaping
3 - Pre-engineered buiding, concrete floors, push walls, foundation, load out scales, ventilation and electromechanical equipment
4 - Pre-engineered building, 2 truck scales and office furnishings

Construction Fund Drawdown
Equivalent Monthly Drawdown

Months after notice to proceed	Beginning Balance in Construction Fund	Drawdown	Ending Balance in Construction Fund	Interest Earned (4%)
1	$ 15,139,996.45	$ 1,261,666.37	$ 13,878,330.08	$ 46,261.10
2	$ 13,878,330.08	$ 1,261,666.37	$ 12,616,663.71	$ 42,055.55
3	$ 12,616,663.71	$ 1,261,666.37	$ 11,354,997.34	$ 37,849.99
4	$ 11,354,997.34	$ 1,261,666.37	$ 10,093,330.97	$ 33,644.44
5	$ 10,093,330.97	$ 1,261,666.37	$ 8,831,664.60	$ 29,438.88
6	$ 8,831,664.60	$ 1,261,666.37	$ 7,569,998.23	$ 25,233.33
7	$ 7,569,998.23	$ 1,261,666.37	$ 6,308,331.85	$ 21,027.77
8	$ 6,308,331.85	$ 1,261,666.37	$ 5,046,665.48	$ 16,822.22
9	$ 5,046,665.48	$ 1,261,666.37	$ 3,784,999.11	$ 12,616.66
10	$ 3,784,999.11	$ 1,261,666.37	$ 2,523,332.74	$ 8,411.11
11	$ 2,523,332.74	$ 1,261,666.37	$ 1,261,666.37	$ 4,205.55
12	$ 1,261,666.37	$ 1,261,666.37	$ -	$ -
		$ 15,139,996.45		$ 277,566.60

Captial Region SWMP
Sources and Uses of Funds
Transfer Station Facility
Nominal Capacity 750TPD

Assumptions

GO Bond financing			
Annual Inflation Rate for Construction Price		3%	
Facility Construction Price $2009 [1]	$	10,240,400	
Facility Construction Price $2015 [2]	$	12,227,573	
Project development Expenses @ 15% [3]	$	1,536,060	
Property Acquisition - 5 acres @ $75K included in Facility construc	$	-	
Contingency @ 10%		1,376,363	
Total Construction Costs	**$**	**15,139,996**	
Sources of Funds			
Bond Proceeds	$	18,187,206	18187206
Uses of Funds			
Construction Fund	$	15,139,996	
Underwriters discount @ 0.75 % of Bond Proceeds	$	136,404	
Cost of Bond Issuance @ 1.0 % of Bond proceeds	$	181,872	
Capitalized Interest	$	1,091,232	
Debt service reserve Fund [4]	$	1,585,643	
Resident Engineer CQA/QC @ 2.5% of Construction Fund	$	378,500	
Bond Insurance @ 0.2% of bond proceeds	$	36,374	
Less Interest earned during construction:			
Debt service reserve Fund	$	(63,426)	
Capitalized Interest	$	(21,825)	
Construction Fund	$	(277,567)	
Total Uses of Funds	$	18,187,206	

Construction period	12 months
Bond Term	20 yrs
Interest rates	
Tax exempt Bonds	6.00%
Debt Service reserve Fund	4.00%
Capitalized interest Fund	4.00%
Construction Fund	4.00%

Notes:
1. Based on RFI response from Nortera noting Merchant Facility Cost in Joyceville ON of $3Million US$ for a 20,000 TPY facility.
2, Assumes 3% annual infaltion rate from 2009 to 2012.
3. Includes siting studies, preliminary environmental review, Bid preparation, review, negotiations of project agreements
4. Debt service reserve equal to 1 years debt service payment.

Transfer Station Cost Estimate
Capital Cost Estimate
750 TPD

	Units	Unit Cost	Extended Cost 2009$	Estimated Cost 2015$
Open Top Trailer - 105CY [1]	30	$ 75,000	$ 2,250,000	**2,686,617.67**
Tractors [1]	30	$ 125,000	$ 3,750,000	**4,477,696.11**
Tools and Spare Parts @ 1%	1%		$ 60,000	**71,643.14**
Contingency @15%	15%		$ 909,000	$ 1,085,394
Rolling Stock Capital Cost Total			**$ 6,969,000**	**8,321,350.45**
Total Annualized Capital Cost Amortization	5.0%	5 years		**$1,922,022**
Assumed Annual Tonnage	167,000			
Amortized Facility Cost per ton	$ 11.51			

Notes:
1 - assumes capacity for transporting 750 TPD, w/ 25 ton payload, and 1 round trip per day.

Transfer Station Cost Estimate
Operating Cost Estimate
750TPD Nominal Capacity

Assumptions:

Annual tonnage		148,000
Diesel Fuel Cost($/gal)	$	3.00

	Units	Unit Cost	Extended Cost		
1) LABOR					
(a) Foreman	1	$ 60,000.00	$ 60,000.00		
(b) Scale Attendant	1	$ 31,000.00	$ 31,000.00		
© equipment operators	2	$ 57,000.00	$ 114,000.00		
(e) Mechanics	1	$ 50,000.00	$ 50,000.00		
(f) Laborers	4	$ 27,000.00	$ 108,000.00		
Labor Subtotal			**$ 363,000.00**		
(g) Overtime	10%		$ 36,300.00		
(h) Replacement labor	10%		$ 36,300.00		
(i) Fringe Benefits	31%		$ 112,530.00		
(j) Management	5%		$ 18,150.00		
Labor and Fringe Total				**$**	**566,280.00**
2) EQUIPMENT OPERATIONS					
(a) Fuel for TS Equipment	12,500.00	$ 3.00	$ 37,500.00		
(d) equipment maintenance	5%		$ 74,520.00		
(e) mobile equipment replacement fund	15%	$ -	$ 223,560.00		
				$	**335,580.00**
3) MISC. O&M EXPENSES					
(a) Utilities	LS		$ 40,000.00		
© Other insurance	LS		$ 30,000.00		
(d) Building and grounds	1.5%		$ 153,606.00		
				$	**223,606.00**
			O&M Subtotal	**$**	**1,125,466.00**
Contingency @ 15%	15%		$ 168,819.90		
Administrative Overhead @ 20%	20%		$ 225,093.20		
O&M Cost Total				**$**	**1,519,379.10**

$ 10.27 $/ton

Transfer Station Cost Estimate
Operating Cost Estimate
750 TPD

Assumptions:

Annual tonnage		148,000
Round trip travel time	7 hrs	
turnaround time at LF	.5 hrs	
turnaround time at TS	.5 hrs	
Round trip mileage to High Acres		415
trailer payload		25
Annual Round trips		5,920
Annual VMT		2,456,800
Thruway tolls (round trip)	$	60.00
Road Fuel Cost $/gallon	$	3.00
Road Fuel economy MPG		7
Fuel Cost $/VMT	$	0.43

	Units	Unit Cost	Extended Cost		
1) LABOR [1]					
(d) Truck Drivers	25	$ 40,000.00	$ 1,000,000.00		
Labor Subtotal			$ 1,000,000.00		
(g) Overtime	10%		$ 100,000.00		
(h) Replacement labor	10%		$ 100,000.00		
(i) Fringe Benefits	31%		$ 310,000.00		
(j) Management	5%		$ 50,000.00		
Labor and Fringe Total				$	1,560,000.00
2) EQUIPMENT OPERATIONS					
(b) Fuel for tractors	2,456,800	$ 0.43	$ 1,052,914.29		
© Tires @ $/VMT	2,456,800	$ 0.28	$ 675,620.00		
(d) equipment maintenance	5%		$ 348,450.00		
(e) equipment replacement	0%		$ -		
(f) tolls	5,920	$ 60.00	$ 355,200.00		
				$	2,432,184.29
3) MISCELLANEOUS EXPENSES					
(b) Vehicle license and insurance [2]	30	$ 5,000.00	$ 150,000.00		
				$	150,000.00
4) CONTINGENCIES	15%			$	621,327.64
O&M Cost Total				$	4,763,511.93 $ 32.19 $/ton

Notes:
1- Labor based on annual tonnage averaged over 250 operating days per year
2- Based on 2.5% of vehicle cost