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June 11, 2012

Mr. Darrin Pampaian, P.E.
Idaho DEQ - Air Quality Division
1410 North Hilton
Boise, Idaho 83706-1255

Re: Facility ID No. 001-00252, Dynamis Energy, LLC, Boise
Permit to Construct Application Incompleteness, Installation of a New Waste-to-Energy Facility to be Located at the Hidden Hollow Landfill

On April 25, 2012, JBR Environmental Consultants, Inc. (JBR), on behalf of Dynamis Energy, LLC (Dynamis) submitted a 15-Day Pre-Permit Construction Approval (15-Day) Application and Permit to Construct (PTC) Application for the proposed Dynamis Waste-to-Energy (WTE) facility at the Hidden Hollow Landfill in Ada County, ID. DEQ reviewed the application materials and determined that the application is incomplete. The purpose of this letter is to provide the requested information for DEQ to determine the application complete.

Items requested from DEQ, along with response from JBR and Dynamis are shown below.

Bullet Item #1: The basis and methodology used to establish emissions from the Thermal Conversion Unit.

JBR provided, via email on 5/24/2012, an Excel spreadsheet documenting the source test information and emission factor calculations used to establish emissions from the Thermal Conversion Unit.

Bullet Item #2: The nitrogen dioxide (NO_2) Significant Impact Level (SIL) the modeling group received on May 8th contained ambient impacts based on the refined Tier 3 NO_2 modeling methods. The maximum daily 1-hr average NO_2 impacts were predicted to exceed the 7.5 $\mu g/m^3$, 1-hr average SIL at the outermost eastern and northern portions of the receptor grid. The receptor grid used does not capture the extent of the area where the project is expected to cause a significant impact. This comment also applies to the SO_2, 1-hr average,

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SIL analysis. Comment 5 of the modeling protocol requested that this project's modeling use a receptor grid that covers all areas where the proposed project causes a significant ambient impact.

Revised modeling files are included with this submittal. The revised modeling files include the use of an expanded receptor grid to ensure that all impacts above the SIL are captured.

Bullet Item #3: The NO_2 SIL modeling used a value of 0.15 for the in-stack NO_2 to NO_X ratio for all sources at the facility. However, the facility-wide analysis used an in-stack ratio of 0.5 for the Dynamis Energy emergency IC engine. Please confirm the in-stack ratios of NO_2 to NO_X for all sources in the analysis.

The revised 1-hr NO_x modeling files use corrected NO_2 to NO_x in-stack ratios as follows:

- Thermal Unit NO_2 to NO_x ratio: 0.15
- Dynamis Emergency Generator NO_2 to NO_x ratio: 0.20
- ACLF Diesel Generators NO_2 to NO_x ratio: 0.20
- All other sources NO_2 to NO_x ratio: 0.50 (default)

Bullet Item #4: The exhaust parameters for the emergency IC engine appear to have a high exhaust temperature and flow rate for a 40 feet high release height as proposed (assuming the emergency IC engine itself is located at base elevation of the site). Stack temperatures provided by the IC engine manufacturer are representative of the "stack height" as-delivered prior to any stack height increases. Additional validation is needed for the exhaust parameters for this source or remodel with more conservative assumptions, if remodeling is performed.

Dynamis and JBR reviewed the information provided by the generator manufacturer. As stated by DEQ, stack temperatures provided by the engine manufacturer are representative of the 'as-delivered' stack height; the 'as-delivered' stack height of the Caterpillar emergency generator is five feet. The generator will sit on a skid approximately feet off the ground, for a total stack height of 10 feet above ground surface. Revised modeling files are included with this submittal, which reflect the change in stack height as well as a revised stack diameter of five inches.

Bullet Item #5: DEQ requests that the exhaust parameters—specifically the stack exit temperatures and volumetric flow rates--for the thermal conversion unit/boiler/scrubber stack be provided in the application materials for each set of operating conditions for the source. A simple scaling of operating capacity to the exhaust flow rate does not appear to apply.

A detailed description of the effects of varying the short-term processing rate of used tires, as municipal solid waste feedstock, versus the typical refuse feedstock of municipal solid waste, from the baseline of no tires processed up to the maximum requested allowable short term rate of used tires, is requested. If Dynamis has determined that the type of materials gasified in the *thermal conversion unit chambers has no effect on exhaust parameters and potential emission rates, please provide an explanation. Any effects caused by fuel variability must be represented in the significant and cumulative impact analyses. Averaging the daily throughput of a material that causes high emissions is not representative of potential to emit for the short term one hour average National Ambient Air Quality Standards (NAAQS), unless the constraint is noted. The issued permit will reflect the modeled emissions rates used in the impact analyses.*

In the event the worst-case emission scenario and exhaust parameter scenario has been modeled, a detailed description of how the worst-case conditions were determined is still needed. Supporting calculations and assumptions need to be included.

The 'baseline' emissions estimate provided in the PTE calculations is representative of a mixed waste stream of both tires and MSW as described below; DEQ's statement of '*the baseline of no tires*', stated above, is inaccurate. Waste batches loaded into the primary chambers will consist of a mixture of MSW and tires; burns may consist of MSW only, but there will be no waste batches that consist 100% of tires. The maximum percentage of tires that can be processed, based on system design and fuel heating value, is 15%. Emissions factors for the thermal conversion unit were developed using source test data from test burns conducted on municipal solid waste (MSW), tires, and combined municipal solid waste and tire feedstocks. The table below shows the number of tests for each type of feedstock for criteria pollutants and TAPs.

Pollutant	# of Tire Burn Source Tests	# of MSW Burn Source Tests	# of Combined MSW/Tire Burn Source Tests
CO2	3	2	1
NOx	3	2	1
PM	2	2	1
HCl	2	2	1
Metals	2	2	1
Dioxin/Furan	1	2	1
SO2	2	1	0
CO	2	1	0
Ash	2	2	1

Data from a total of six test burns was used to develop the emissions factors; the average of the six test burns was calculated giving each of the source tests equal weighting. With the exception of dioxin/furan data, the number of tire burn source tests was equal to or greater than the number of MSW source tests. Because emission factors were developed using at least an equal number of tire test burns as MSW test burns, with each test burn given equal weight, the emission factors developed are appropriate for a waste stream of at least 50% tires.

In addition, source test data from tire burns indicates higher emissions from tire combustion than MSW combustion for all criteria pollutants. Therefore, by developing emissions factors based on equal weighting of both MSW and tire tests burns, emissions estimates are conservative and likely higher than actual emissions from the facility will be.

Some concern has been expressed regarding SO_2 emissions from the sulfur content in tires. However, because emission factors were developed using two tire burn tests and one MSW burn, emissions of SO_2 represented in the emissions inventory and model are conservative, as the emission factor is essentially representative of a waste stream consisting of two-thirds tires and one-third MSW. However, due to design constraints, the amount of tires combusted in the Ada County facility will not exceed 15%.

Exhaust parameters for the thermal unit are based on lower heating value, moisture content, and non-combustible content of the fuel source. The Ada county WTE facility has been designed to operate safely at a maximum peak flow condition of 570,000 lbm/hr. There are two types of conditions that will create this maximum system flow. Wet, moderate-energy fuel and dry, high-energy fuel will both require a large input of combustion air and will generate the highest flow conditions. If other fuel conditions occur, then less or more fuel will be used to insure the system maintains safe, proper operation within the design range.

Wet fuel generates flows of approximately 545,000 lbm/hr of gas. Combustion air is supplied at a rate of about 485,000 lbm/hr with the remaining mass flow coming from the fuel. There will be a high percentage of water in the flue gas (~15%); this pure water vapor will remain in the flue gas that will exit the stack with an approximate flow of 151,000 acfm at 125F. Dry fuel generates flows of approximately 569,000 lbm/hr of gas. Combustion air is supplied at a rate of about 518,000 lbm/hr with the remaining mass flow coming from the fuel. The flue gas exiting the stack will have a low percentage of water (~10%) but increased dry gas so the resulting stack flow volume will be still be approximately 151,000 acfm at 125F.

Off peak flow conditions are significantly lower than peak conditions so the system has been designed such that portions of the system are isolated to improve gas flow and system efficiency. Gas flow during off peak is only required to maintain 60,000 lb/hr of steam from the heat recovery steam generator (HRSG) to the turbine. Primary chambers that have fuel still remaining at the end of the peak period will provide gas flow during off peak operation. Primary chambers with fuel remaining will be combined with combustion air and will generate approximately 127,000lbm/hr. Combustion air is supplied at approximately 112,000 lbm/hr with the remaining mass flow from the fuel. Due to the fact that the scrubber is designed for approximately five times this flow, the gas can be scrubbed very efficiently and exhausted at a range of temperatures and moisture content. The set point for typical operation exhausts the gas at a volume flow of approximately 39,100 acfm at 135 F. For further description on the design and operation of the system, please see the system mass balance description included as Attachment 1.

During review of exhaust parameters and facility design conditions, it was determined that the thermal unit/scrubber exhaust flows and temperatures should be adjusted to allow the unit to operate with increased efficiency. Based on revised optimization of the system, the following exhaust parameters have been updated in the emissions calculations (where applicable) and all modeling has been revised:

Thermal Unit Peak Operation:
Exhaust flow rate: 150,865 acfm
Exhaust temperature: 125.4 F

Thermal Unit Off-Peak Operation:
Exhaust flow rate: 39,100 acfm
Exhaust temperature: 134.5 F

A revised control guarantee including the above listed flow rates and temperatures, from the scrubber manufacturer, Direct Contact LLC, is included as Attachment 2.

Bullet Item #6: Please submit the AERMAP files for the project to allow DEQ to verify the extent of terrain used to generate the hill height scales for the modeling domain.

Revised AERMAP files for all receptors are included with this submittal. As described in the modeling report, receptors along the facility fenceline and roadway were manually revised per the site grading plan.

Bullet Item #7: Hour of day operational factors were applied to the NO_2 annual, SO_2 annual, and $PM_{2.5}$ annual average modeled emission rates. The hour-of-day operating factors on the thermal conversion unit stack, in combination with the reduced emission rates for the annual ambient impacts scenario, appear to represent emissions below the project's requested potential to emit. Refer to the pollutant IDs "NO2ANN", "SO2ANN", and "PM2.5ANN." Multiplying the hourly emission rates by the operating schedule provides annual emissions below the levels listed in Table 1 of the application's modeling report. These conclusions were based on the May 1, 2012 submittal for the annual modeling scenarios.

The annual modeling analyses included with this submittal were revised to reflect the project's requested PTE for annual NO_2, annual SO_2 and annual $PM_{2.5}$. The maximum lb/hr emission rate requested for both the peak and off-peak operation of the thermal unit were used in combination with the hour of day operating factor option in AERMOD.

Bullet Item #8: Areas of steep terrain should be covered with more densely-spaced discrete receptors where significant ambient impacts are predicted to occur. Note: If DEQ performs *verification modeling with a tighter receptor grid, the results must demonstrate compliance with the NAAQS.*

(No response)

Bullet Item #9: Are startup and shut down emissions higher than have been proposed for normal steady-state operation during peak and off-peak operations? If so, startup and shut down emissions during peak and off-peak operations need to be accounted for in the modeling analysis as well as in the Potential to Emit calculations.

After initial startup, the system will only be shutdown/restarted for occasional maintenance. Startup procedures include pre-heating of the secondary chamber. During startup, the secondary chamber and ducting downstream must be purged to remove any un-combusted gases. The un-combusted gases will be of the same composition as the syngas that is combusted during normal operations, therefore purging emissions are expected to be equivalent emission during normal peak operation. The turbulent air blowers and induced draft fans must run at 100% flow (150,000 scfm) for a minimum of 2 minutes. This airflow provides five air exchanges within the secondary chamber, boiler, scrubber and ducting. These air exchanges insure only ambient air is present in these chambers prior to ignition and prevents potential flare or explosion conditions. After the purge sequence has been completed secondary chamber preheating can occur.

Secondary chamber pre-heating is accomplished with natural gas burners. Each burner is equipped with its own combustion air supply so turbulent air blowers are turned off and the induced draft fans slowed to prevent excess cooling of the chamber. Secondary combustion chamber burners are fired in sequence starting with the burners closest to the turbulent air inlet until each section of the chamber reaches at least 1800F. The fully combusted natural gas exhaust travels down the length of the secondary chamber pre-heating the next section, boiler and scrubber. A significant amount of the heat exiting the secondary chamber is transferred into the boiler water so very little heat is wasted during this pre-heat process. The total pre-heat cycle time will vary depending on the startup conditions. A “cold start,” such as during plant commissioning will take longer than a “warm start,” such as when the chambers have not cooled to ambient conditions. After proper secondary preheating is complete, primary chamber ignition can occur. The maximum natural gas usage expected during secondary chamber pre-heating is approximately 112,000 scf/day; which is the amount of natural gas included in the PTE calculation previously submitted to DEQ. The PTE calculation assumes the natural gas usage to occur concurrently with Thermal Unit operation.

Each primary chamber is purged sequentially with ambient air (~6000 scfm) for a minimum of 2 minutes prior to ignition to remove possible combustible gases. This purge air travels through the primary chambers and into the secondary chamber to insure any gases are combusted in the secondary chamber prior to entry to the boiler, scrubber and exhausted to the stack. After proper purging of a primary chamber has occurred the burners are fired and run until no oxygen is measured exiting the primary chamber. When 0% O_2 is measured, the gas exiting the primary chamber is considered “syn-gas” and full system operation can begin.

Syn-gas is slowly added to the secondary combustion chamber and properly combusted with the addition of turbulent air. With proper addition of syn-gas to the secondary combustion chamber the secondary burners can be turned off and the retained heat of the chamber walls cause auto combustion of the syn-gas. Syn-gas and turbulent air are steadily increased until all required primary chambers are in full syn-gas production and sufficient heat is being generated to produce electric power from the turbine. Both syn-gas and airflow are throttled to maintain a specified production of steam from the boiler to the turbine to generate the required MW’s to the power grid.

Emissions during startup will consist of emissions from natural gas combustion and purging of un-combusted syngas; combustion of MSW will not occur until the primary chambers are fully pre-heated and operating and normal conditions, therefore startup emissions will not exceed the requested PTE emissions. During shutdown, MSW in the primary chambers and syngas in the secondary chambers will be allowed to combust and will exhaust under conditions similar to the off-peak operation of the Thermal Unit. Therefore, shutdown emissions are not expected to exceed the requested PTE emissions.

In addition to the responses above, JBR is also submitting a revised emissions inventory (Attachment 3). The scrubber manufacturer guarantees 41% control of $PM_{2.5}$ and smaller, with higher control efficiency expected for larger particulates. Metals emissions (with the exception of Mercury) from the thermal unit (including primary ignition system) will be in particulate form. The revised emissions inventory reflects updated metals emissions estimates to include a conservative 20% control of particulate metals. A revised Modeling Report is also included with this submittal.

Sincerely,

Shannon Manoulian, P.E.

Enclosures

Cc: Dynamis Energy, LLC

ATTACHMENT 1

System Mass Balance

Dynamis Energy, LLC Ada County WTE-System Mass Balance

The exact mass flow balance through the Ada county WTE system was calculated using a proprietary modeling program developed by Christopher Durand, PE and Dynamis Energy, LLC. The specific numbers and equations used in this program are intellectual property and not available for general distribution. The general methodology and final values are available for distribution and have been included.

The MSW is analyzed to determine the estimated low heating value (LHV), moisture content, and incombustible (metal, glass, dirt)/ash component. Typical MSW in the United States, within Idaho and Ada county has a LHV between 5000 and 7000 btu/lbm. Moisture content ranges from 25-40% depending on the source and environmental conditions and incombustibles account for 10-20% of the total MSW mass. The values determined from the MSW analysis are then combined with similar well-documented and published values for tires and compressed natural gas (CNG). A total LHV, moisture content and incombustible component are calculated from these combined material sources and are referred to as the "fuel source." After the fuel source composition has been determined the amount of dry air required for stoichiometric combustion (100% O2 consumption) is calculated. An amount of excess dry air required to insure complete combustion of unexpected components and provide approximately 5-7% extra oxygen exiting the stack is then calculated. The Dynamis Energy, LLC system utilizes relatively low values of excess air due the proprietary mixing process used during combustion. Typical excess air values are only 40-60% above stoichiometric requirements compared to 100-200% used by other processes. The two dry air components are added and the total amount of additional water due to relative humidity is calculated. The total combustion mass flow is calculated by adding these values to the mass of the incoming fuel. Once an air to fuel ratio has been estimated the temperature of combustion is calculated to verify proper heating of the system will occur. If the combustion temperature exceeds the desired temperature (2000F) additional air is added to cool the combustion gas and the rate of fuel supplied is maintained. If the combustion temperature is below the desired temperature then excess air is reduced (maintaining a minimum excess oxygen level of 5%). Multiple iterations of this process are carried out to converge on the optimal fuel to air ratio for the specified fuel composition. After combustion has occurred and heat has been transferred from the flue gas to the heat recovery steam generator (HRSG) the flue gas undergoes final cooling in the wet scrubber. The scrubber may add or remove pure water to the flue gas depending on the gas composition in order to optimize the cleaning of the flue gas. This last stage results in a very consistent mass flow and temperature exiting the scrubber and stack.

The Ada county WTE facility has been designed to operate safely at a maximum peak flow condition of 570,000 lbm/hr. There are two types of conditions that will create this maximum system flow. Wet, moderate-energy fuel and dry, high-energy fuel will both require a large input of combustion air and will generate the highest flow conditions. If other fuel conditions occur, then less or more fuel will be used to insure the system maintains safe, proper operation within the design range.

Wet fuel with a LHV of 6,600 btu/lbm, 45% moisture, and 20% incombustibles (10% ash, 10% other by weight) generates flows of approximately 545,000 lbm/hr of gas (472,000 lbm/hr dry gas and 73,000 lbm/hr of water vapor). Combustion air is supplied at a rate of about 485,000 lbm/hr with the remaining mass flow coming from the fuel. The high percentage of water in the flue gas (~15%) greatly improves the efficiency of the scrubbing system and presents the opportunity to reduce overall water needs. However, significant pure water vapor will still remain in the flue gas that will exit the stack with an approximate flow of 151,000 acfm at 125F.

Dry fuel with a LHV of 7,100 btu/lbm, 24% moisture and 20% incombustibles (10% ash, 10% other by weight) generates flows of approximately 569,000 lbm/hr of gas (517,000 lbm/hr dry gas and 51,000 lbm/hr of water vapor). Combustion air is supplied at a rate of about 518,000 lbm/hr with the remaining mass flow coming from the fuel. The high heating content of the fuel reduces the total fuel required to power the turbine thus increasing the overall system efficiency. The flue gas exiting the stack will have a low percentage of water (~10%) but increased dry gas so the resulting stack flow volume will be still be ~151,000 acfm at 125F.

Off peak flow conditions are significantly lower than peak conditions so the system has been designed such that portions of the system are isolated to improve gas flow and system efficiency. Gas flow during off peak is only required to maintain 60,000 lb/hr of steam from the HRSG to the turbine. Primary chambers that have fuel still remaining at the end of the peak period will provide gas flow during off peak operation. These chambers combined with combustion air will generate approximately 127,000lbm/hr (110,000 lbm/hr dry gas and 17,000lbm/hr water vapor). Combustion air is supplied at approximately 112,000 lbm/hr with the remaining mass flow from the fuel. Due to that the scrubber is designed for approximately five times this flow, the gas can be scrubbed very efficiently and exhausted at a range of temperatures and moisture content. The set point for typical operation exhausts the gas at a volume flow of ~ 39,000 acfm at 135F.

ATTACHMENT 2

Scrubber Manufacturer Guarantee

DIRECT CONTACT LLC P.O. Box 2969 Renton, WA 98056 ♦ Ph (425) 235-1723 ♦ Fax (425) 277-5780

June 7, 2012

Dynamis Energy, LLC
776 E. Riverside
Eagle, Idaho 83616

Attention: **Chris Durand, PE Project Engineer**

Reference: **DC062 ADA County, ID – MSW to Energy Project's Heat Recovery/pollution Abatement System**

Subject: **Equipment Supply and Engineering Proposal Revision A**

Dear Chris,

Direct Contact LLC (**DC**) appreciates the opportunity to work with Dynamis Energy LLC (**DE**) on the ADA County MSW to Energy Heat Recovery/Pollution Abatement System.

Background

DE is converting Municipal Solid Waste to Energy in ADA County, ID. The facility generates a bio-syngas via pyrolysis; the syngas is burned in a boiler to produce steam with the steam used to spin a turbine and generate electric power.

The steam exhausting the turbine is condensed and returned to the boiler. The condensate leaving the condenser needs to be heated substantially before returning to the boiler.

The syngas includes some entrained particulates, with a small fraction of acid gases (hydrochloric acid and sulfur dioxide).

DC has the technology and experience to capture a great deal of the waste heat leaving with the flue gas and returning its energy to the plant. In addition to recovering heat, DC can absorb a portion of the acid gases and scrub a portion of the particulates.

Design Conditions

Dynamis and Evergreen Engineering (EE) have developed three cases to be considered: 'Peak' and 'Off Peak'. These conditions are thoroughly described below. The Site Elevation is 3000-feet above sea level. The Peak condition is the design condition. The gross pollutant loading is proportional to the flue gas mass flow rate using the Peak as a basis.

Peak
Flue Gas Generated - Mass Flow Rate = 542,257.91-lb/hr
Flue Gas Stack Temperature = 350°F

Design Conditions (Continued)

Flue Gas Analysis: (Mole-fraction)

Oxygen	0.0579
Nitrogen	0.6797
Carbon Dioxide	0.1058
Argon	0.0083
Water Vapor	0.1484

Gross Pollutants

Sulfur Dioxide	40-lb/hr
Hydrochloric Acid	10-lb/hr
10 Micron & Smaller	7-lb/hr
2.5Micron & Smaller	7-lb/hr

Turbine Exhaust Condenser Condensate
Volumetric Flow = 433-gpm @105°F
Mass Flow = 215,042-lb/hr

Boiler Makeup Water
Volumetric Flow = 6-gpm @60°F
Mass Flow = 3,045 lb/hr

OFF Peak
Flue Gas Generated - Mass Flow Rate = 127,350.73-lb/hr
Flue Gas Stack Temperature = 350°F (assumed)

Flue Gas Analysis: (Mole-fraction)

Oxygen	0.0573
Nitrogen	0.6889
Carbon Dioxide	0.1068
Argon	0.0084
Water Vapor	0.1386

Gross Pollutants

Sulfur Dioxide	9.4-lb/hr
Hydrochloric Acid	2.3-lb/hr
10 Micron & Smaller	1.6-lb/hr
2.5Micron & Smaller	1.6-lb/hr

Turbine Exhaust Condenser Condensate

Design Conditions (Continued)

Gross Pollutants (Continued)

Volumetric Flow = 100-gpm @105°F
Mass Flow = 50,000-lb/hr

Boiler Makeup Water

Volumetric Flow = 1.7-gpm @60°F
Mass Flow = 856-lb/hr

Scope

DC will provide equipment for a 'heat recovery/pollution abatement system' (HRPAS) that will use the exhaust flue gas as a heat source to add thermal energy to the condensate and boiler makeup water feeding the DA tank. The HRPAS will remove acid gases and particulates from the flue gas. Caustic soda will need to be added to the HRPAS to neutralize hydrolysis products generated or the absorption of acid gases will be limited. Water must be added to the HRPAS. The HRPAS will be a net evaporator of water and liquid water blow down will be necessary to purge salts generated in the hydrolysis of acid gases and the solid particulates scrubbed from the flue gas. The boiler blow down is directed through the vessels (V-01 and V-02) which should be enough water to adequately maintain salt concentrations in the contact water to a point that viscosity and surface tension does not affect mass transfer coefficients adversely. The method of achieving this heat recovery is described below. Please use the process flow diagrams D062-F-01A, -F-01B & -F-01C (for Peak (Design), and Off Peak Conditions respectively) and the Piping & Instrumentation Diagram provided (drawings D062-F03 through F-05) as well as the General Arrangement drawings (D062-G-01 & G-02) to help with the process description.

DC's HRPAS will consist of several unit operations, duct & piping systems, instrumentation with control logic & interlocks performed in a PLC with a HMI. The system will be transparent to the operation of the Boiler.

The project scope for DC is broken into two categories: Engineering and Equipment Supply. Using the process flow diagram as a reference, the scope breaks down as follows:

Component Description	Engineering Responsibility	Equipment Supply
Inlet Gas Duct	DC	Others
HA-01	DC	DC
HA-01's Associated Components Duct and Plenum with wash headers	DC	Others
HX-01	DC	DC
HX-02	DC	Others
F-01 & F-02 Induction Fan &	DC	DC

4160-VAC motors		
V-01 & V-02 HRPA	DC	DC
Interconnecting Duct between V-01& V-02 Stack	DC	Others
Pump P-01	DC	Others
Pumps P-02, P-03 & P-04	DC	DC
Valves: All shown on P&I Ds	DC	DC
Piping System inside target shown on P& I Ds	DC	DC
Stack	DC	Others
S-01 Filtration Equipment	Others	Others
All HRPAS Associated Supports and Platforms, Hand Rails & Ladders &/or Stairs	DC	Others
All Concrete Foundation and below grade systems	Others	Others
Electrical: All motor control and Variable Speed driver and lighting Conduit routing	Others	Others
Controls and Instrument (including modulated control valves) Package including PCL and HMI	DC	Others
CEMS Flow and Opacity Meters	Others	Others

Gas Flow

Syngas is generated in pyrolysis modules, then combusted in a second combustion unit (by-others). The very hot flue gas passes through a diversion stack (by-others). The flue gas then passes through a boiler with an economizer (by-others). The cooled flue gas leaves the economizer passes through a duct which directs the flue gas to the HRPAS. The flue gas first flows into transition TR-01 where it is evenly distributed, then passes through the washdown header and then enters the indirect heating coil (HA-01), which heats condensate while cooling the exhaust gas. The gas is only cooled to within 30°F or 40°F of its dew point; hence, although very cool, there is no concern of condensation occurring in normal operation. Downstream of HA-01, there is an exhaust wash water separation plenum, which splits the gas flow into two equal streams which are drawn into the induction Fans (F-01 and F-02). From the fans, the exhaust gas passes into two (2) [12.5 ft diameter x 33 ft straight wall with their major axis vertical] DCLLC Hydrothermal Recovery Vessels, (V-01 and V-02).

These vessels are of a special design as not only do they recover heat but they also absorb acid gases & remove particulates. First the flue gas is saturated and adiabatically cooled before entering the gas absorption section of the vessel. Then it passes to the heat recovery section of the vessel and the gas is further cooled before entering the scrubbing section where solid particulate is combined (via impaction and interception) in a coalescing mesh pad that captures solid material within liquid droplets. Most of these droplets are entrained in the gas flow leaving the coalescing mesh pad but captured in the mist elimination mesh pad above. The flue gas leaving the vessel is saturated with most of the acid gases and particulate removed. This cool saturated and relatively clean flue gas from each vessel recombines in the stack and is discharged to atmosphere. As the flue gas flows out the stack, it is monitored for effluent conditions (CEMS, flow and opacity meters are beyond the scope of DC).

Liquid Flow

The heat recovery system heats both turbine condensate (softened water - SW) and reverse osmosis water (RO - boiler feed water). Contact water (named because it is in direct contact with the exhaust gas) is a third flow stream that is part of the system. The contact water (CW) is initially made up of DI water, but as described above, water vapor generated in the combustion of syngas that drives the turbine, condenses in the vessels becoming a major constituent of CW. The contact water will have sodium hydroxide added to maintain a specific pH, approximately 10.5. The acid gas will absorb into the contact water and hydrolyze. The formation of sodium chloride and sodium sulfite will occur as well as sodium carbonate. Although makeup water (boiler blow down) will vaporize and leave with the flue gas, most of the makeup will flow out of the system purging the salts.

Contact water is circulated around & through the DCLLC Hydrothermal Recovery Vessels. The level of contact water in each vessel's reservoir is equalized using a 10" diameter line between vessels which maintains a common level in both vessels. One vessel has a 'common' overflow and the other vessel has a common reservoir level sensor. The two (2) circulation pumps draw water from both vessels via the equalization line. While either P-02 or P-03 can draw and circulate contact water to either vessel at off peak conditions, at normal flow conditions both pumps operate together. A portion of the contact water is circulated directly to the lower spray headers on the vessels absorption section. The remainder of the circulated contact water passes through a plate & frame heat exchanger (HX-01), cooling the contact water and heating condensate. The cooled contact water is again split: a portion going directly to the spray header on the heat recovery section on the vessels, and the remainder going to the filtering (S-01) system. The filtering system (by others) removes most of the collected particulates. The filtered contact water is used to wash the mist eliminator mesh pad & periodically washing the coalescing mesh pad with its waste stream being directed to the cooling tower (piping, etc is beyond the scope of this offering) . The coalescing mesh pad wash cycle is initiated on high differential pressure across the coalescing mesh pad.

Equipment Details

The heat recovery vessels are designed for non-pressurized service. The vessel's internals will be accessible via standard manways. The vessel shell is to have 1.5-inches of field-installed insulation covered with aluminum sheathing (insulation and sheathing is considered part of the installation service installed in the field by others and is outside the scope of this equipment proposal). All ductwork upstream of HA-01 is carbon steel (between HA-01 & F-01 it is stainless steel). All materials downstream & including the fan's casings & wheels are stainless steel. All piping material for RO water and contact water are stainless steel while softened water piping is carbon steel.

A skid will be located in the vicinity of the heat recovery vessels. The proposed skid system includes: one (1) 50-HP circulating water pump (P-02), one (1) 50-HP circulating water pump (P-03), with associated inlet & outlet piping. It is recommended a plate & frame heat exchanger (HX-01) be located indoors or be insulated completely. The contact lines running between V-01 & V-02 and the skid will be supplied be others.

The boiler makeup water heater HX-02 its condensate circulation pump P-01 are a part of the heat recovery system, but remote to the vessel's and skid. All items associated with boiler makeup heating will be supplied by others. DC will have process design responsibility, but piping design for freeze protection and maintenance accessibility is the responsibility of others.

The contact water in the reservoir of the vessels is maintained at a pH of 10.5 to 11. This is achieved by continuous sampling the pH of contact water exiting the circulation pumps and adding sodium hydroxide solution at P-02 and P-03 suction. The sodium hydroxide solution is presumed at a concentration of 50% water. Others will provide insulated/heat traced piping between the sodium hydroxide storage tank (by others) and the metering pump (P-04). P-04 and the pH sensor will be mounted on the DC skid. The pH sensor will be supplied by others and the pump will be supplied by DC.

The instrumentation & controls process design will be by DC. DC will generate a process description & loop list so the customer's PLC integrator/provider can specify, design & program the PLC. The Motor Control Center and Control Panel, PLC and HMI will be designed and supplied by others. The electrical equipment shall include motor starters for the pumps (P-01 (1-Hp motor @ 460-VAC), P-02 (50-Hp motor @ 460-VAC), & P-03 (50-Hp motor @ 460-VAC)) and variable speed drives for the fans (F-01 (400-Hp motor @ 4160-VAC) & F-02 (400Hp motor @ 4160-VAC)) & metering pump P-04 (.333-Hp motor @ 460-VAC). Others will provide a control panel will include an RS View HMI providing supervisory & process control with the associated PLC (AB Contrologix) and DC will assist in theses efforts. The location of loop tuning will be decided by the provider.

Power distribution and local disconnects will be supplied (by others) for field distribution to the six (6) usage points: the pumps P-01, P-02, P-03 and P-04 at 480 VAC, the induced draft fans F-01 & F-02 (both of which are 400 HP) at 4160-VAC and 120-volt single phase transformer (30 amps) to be field routed to the control panel.

Process Engineering:

DCLLC will select, size or specify all components shown on the flow diagram with the exception of the filtration system.

Mechanical Engineering:

DCLLC will design / layout all equipment components with the exception of the filtration system and the remote skid for HX-02 & P-01.

Specific Exclusions

- *Electrical:* Supply of specified power requirements to the customer's Motor Control Center (MCC) with its associated motor starters/VFDs for P-01, P-02, P-03, P-04, F-01 & F-02 and from there to the motors, local controls and monitoring instrumentation is by others. All power wiring, conduit, tray, etc. and installation of same is by others.
- *Controls:* Supply of the PLC, HMI, any local control panels and all local instrumentation is by others. All control wiring & conduit as well as all installation of same is by others.
- *Foundation:* Design & supply of the foundation(s) required for the heat recovery vessels, equipment skid(s), etc are by others.
- *Structural:* All structural supports other than the unitary skid underneath the pump/heat exchanger module are by others. This includes vessel access ladders & platforms.
- *Mechanical:* Field items required as part of a complete installation will include the following items by others:
  - Insulated pipe lines used for supply and return hot condensate. The design requires isolation & check valves at the loop connection points, which are to be supplied by the installing contractor.
  - Insulation of V-01 & V-02 (described earlier).
  - Insulated pipe lines used for cool supply and hot return RO water. The design requires isolation & check valves at the connection points to the makeup supply & these are to be included by the installing contractor.
  - Drain/overflow lines from V-01 & V-02 to a client-specified sewer connection.
  - Design & supply of the S-01 Filtration system for contact water with the associated interconnecting piping, vales, etc.
  - Supply of the P-01, HX-02 and all interconnecting piping & valving, etc.
  - Low-pressure flue gas inlet ducting for:
    - 1) hot flue gas from the economizer to DCLLC system inlet (with insulation),
    - 2) Cool flue gas from the V-01 & V-02 discharge to atmosphere (via the stack).
- *Permits:* All required permits (building, etc.) are specifically outside the scope of this proposal and to be provided by the client.

Utility Requirements

- Makeup water (RO) must have sufficient pressure to overcome 12-psi across the DCLLC system.
- RO & Softened Water must have sufficient pressure to overcome 20-psi across the DCLLC system's piping & heat exchangers.
- Electrical power (see scope): Transfer Pump P-01: 1-HP, Circulation Pump P-02: 50 HP, Circulation Pump P-03: 50-HP: Sodium Hydroxide Pump P-04: 1/3 HP, Induced Draft Fans F-01 & F-02: 400 HP each.
- Clean (low volume), dry air (90-psig) for pneumatic actuation for control dampers and valves.

Summary of Conditionally Guaranteed Emissions to Atmosphere with operational notes:

Peak Load:

Heat Recovery	31.00-Million BTU/hr
Stack Exhaust Flow	150,865-ACFM @ 125.4°F

Pollutant Reductions

Sulfur Dioxide	71.25%
Hydrochloric Acid	94.0%
2.5 Micron Particle & Small	41.0%

Off Peak:

Heat Recovery	8.43-Million BTU/hr
Stack Exhaust Flow	39,100-ACFM @ 134.5°F

Pollutant Reductions

Sulfur Dioxide	71.25%
Hydrochloric Acid	94.0%
2.5 Micron Particle & Small	41.0%

We have assumed: that the constituents, noted above, exist proportionally to the mass flow of flue gas leaving the boiler and that the particulate material in the flue gas is generally a solid material, and is not gelatinous or tacky. DCLLC conditionally guaranteed the above reductions based on flows up to the 'Peak Loading" conditions, given the earlier assumptions.

Corrosion Guarantee:
All stainless steel non-rotating components are guaranteed for a period of two years from the date of startup or 30 months from date of delivery, whichever is shortest, based on the attached customer provided flue gas chemistry. This guarantee is applicable should significant evidence of corrosion appear while performing its intended purpose. DCLLC will repair or replace these items including parts and labor. The repair and or replacement of the items are the sole remedy provided in this Corrosion Guarantee. All repaired or replaced parts will have the balance of the initial warranty period remaining. All rotating equipment will be limited to the manufacturer's Corrosion Guarantee language, which will be provided upon final selection.

Direct Contact LLC is uniquely qualified to provide our patented equipment designs and complete engineering and project oversight experience as proven at other operations. I look forward to furthering this discussion as soon as your schedule allows. Should you have any questions, please don't hesitate to contact my office.

Thank you for your interest and continued consideration of **Direct Contact LLC.** We look forward to working with you and your colleagues on a project that will enable you to maximize the energy efficiency of the customer's operation.

With *Warmest* Regards,

Bill Carson

Chief Engineer
Direct Contact LLC

Cc: Curt Rothman (DCLLC)
Jim Shields (DCLLC)

ATTACHMENT 3

Emissions Inventory

FACILITY POTENTIAL TO EMIT - CRITERIA POLLUTANTS

	Criteria Pollutants											
	NOx Emissions		CO Emissions		PM-10/PM-2.5 Emissions		SOx Emissions		VOC Emissions		Lead Emissions	
Description	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr	lb/hr	T/yr
Thermal Conversion Unit - Peak	29.93	87.38	10.90	31.83	3.66	10.68	8.54	24.94			0.03	0.09
Thermal Conversion Unit - OffPeak	4.41	6.44	1.61	0.54	0.54	0.79	1.26	1.84			0.00	0.01
Cooling Tower					0.02	0.08						
Ash System					0.45	1.97					5.10E-04	2.23E-03
Emergency Generator	1.30	0.33	0.26	0.07	0.03	0.01	0.98	0.25	1.19	0.30		
Ignition Systems	0.47	2.04	0.39	1.72	0.02	0.09	0.00	0.00	0.03	0.11	2.33E-06	1.02E-05
Total	**36.104**	**96.188**	**13.164**	**34.149**	**4.720**	**13.616**	**10.786**	**27.030**	**1.211**	**0.409**	**0.0358**	**0.099**

FACILITY POTENTIAL TO EMIT - TAPS

NON-CARCINOGENS (POUNDS PER HOUR)						
Pollutant	CAS #	TAP Emissions - Max (lb/hr)	TAP Emissions - Average (lb/hr)	TAP Emissions (tpy)	Screening Level (lb/hr)	Modeling? (Y/N)
Acrolein	107-02-8	1.13E-04	1.13E-04	2.82E-05	1.70E-02	No
Aluminum	7429-90-5	1.05E-01	1.02E-01	4.48E-01	6.67E-01	No
Antimony	7440-36-0	7.86E-04	5.63E-04	2.46E-03	3.30E-02	No
Barium	7440-39-3	7.92E-04	7.32E-04	3.21E-03	3.30E-02	No
Chromium	7440-47-3	1.85E-03	1.35E-03	5.92E-03	3.30E-02	No
Cobalt	7440-48-4	1.71E-03	1.62E-03	7.09E-03	3.30E-03	No
Copper	7440-50-8	1.12E-03	9.08E-04	3.98E-03	6.70E-02	No
Fluoride (as F) (Hydrogen Fl)	16984-48-8	2.84E-03	2.03E-03	8.91E-03	1.67E-01	No
Hexane	110-54-3	8.40E-03	8.40E-03	3.68E-02	1.20E+01	No
Hydrogen Chloride	7647-01-0	5.95E-01	5.95E-01	2.61E+00	5.00E-02	See Footnote 1
Manganese	7439-96-5	6.96E-03	5.23E-03	2.29E-02	3.33E-01	No
Mercury*	7439-97-6	3.10E-03	2.22E-03	9.72E-03	N/A	*
Molybdenum	7439-98-7	2.24E-03	1.61E-03	7.06E-03	3.33E-01	No
Naphthalene**	91-20-3	3.04E-06	3.04E-06	1.25E-05	9.10E-05	No
Pentane	109-66-0	1.21E-02	1.21E-02	5.31E-02	1.18E+02	No
Phosphorous	7723-14-0	2.66E-03	2.66E-03	1.17E-02	7.00E-03	No
Selenium	7782-49-2	2.22E-03	1.59E-03	6.95E-03	1.30E-02	No
Silver	7440-22-4	2.92E-07	2.92E-07	1.28E-06	7.00E-03	No
Toluene	108-88-3	5.15E-04	5.15E-04	1.94E-04	2.50E+01	No
o-Xylene	1330-20-7	3.48E-04	3.48E-04	8.70E-05	2.90E+01	No
Zinc	7440-66-6	3.42E-01	3.09E-01	1.35E+00	6.67E-01	No

*Mercury is not listed under IDAPA 58.01.01 Section 585 as a TAP. However, it is listed here to show compliance with the MBACT rule under Section 215.

**Although listed as a noncarcinogen in the Rules, DEQ has determined that naphthalene is a possible/probable carcinogen. Compliance for naphthalene emissions should be based on the EL or AACC listed in Section 586 for PAH.

1. Regulated under NSPS Subpart Eb, excluded from modeling under IDAPA 58.01.01 210.20.

CARCINOGENS (POUNDS PER HOUR)						
Pollutant	CAS #	TAP Emissions - Max (lb/hr)	TAP Emissions - Average (lb/hr)	TAP Emissions (tpy)	Screening Level (lb/hr)	Modeling? (Y/N)
Acetaldehyde	75-07-0	9.37E-04	9.37E-04	5.35E-05	3.00E-03	No
Arsenic	7440-38-2	7.46E-07	7.46E-07	3.27E-06	1.50E-06	No
Benzene	71-43-2	1.15E-03	1.15E-03	3.28E-04	8.00E-04	Yes
Beryllium	7440-41-7	4.48E-08	4.48E-08	1.96E-07	2.80E-05	No
Cadmium	7440-43-9	3.48E-03	2.50E-03	1.09E-02	3.70E-06	See Footnote 1
Dioxin/Furan	1746-01-6	1.35E-06	9.65E-07	4.23E-06	1.50E-10	See Footnote 1
Formaldehyde	50-00-0	1.79E-03	1.79E-03	1.89E-03	5.10E-04	Yes
Nickel	7440-02-0	1.51E-02	8.69E-03	3.81E-02	2.70E-05	Yes
Benzo(a)pyrene	50-32-8	5.60E-09	5.60E-09	2.45E-08	2.00E-06	No
Benz(a)anthracene	56-55-3	8.40E-09	8.40E-09	3.68E-08	2.00E-06	No
Benzo(b)fluoranthene	205-82-3	8.40E-09	8.40E-09	3.68E-08	2.00E-06	No
Benzo(k)fluoranthene	205-99-2	8.40E-09	8.40E-09	3.68E-08	2.00E-06	No
Chrysene	218-01-9	8.40E-09	8.40E-09	3.68E-08	2.00E-06	No
Dibenzo(a,h)anthracene	53-70-3	5.60E-09	5.60E-09	2.45E-08	2.00E-06	No
Indeno(1,2,3-cd)pyrene	193-39-5	8.40E-09	8.40E-09	3.68E-08	2.00E-06	No
Total PAHs		2.45E-07	2.45E-07	1.07E-06	9.10E-05	No

Dynamis Energy WTE Facility
Thermal Conversion System
Thermal Conversion Unit

Total MSW Throughput =	367.2	tpd
Total MSW Throughput =	15.30	ton/hr
Total MSW Throughput =	30600	lb/hr
Peak Operating Hours =	5840	hr/yr
Off-Peak Operating Hours =	2920	hr/yr
Peak Exhaust Flow =	150,865	acfm @ 125.4F
Off-Peak Exhaust Flow =	39,100	acfm @ 134.5F

Hours	7am - 11pm	11pm-7am
Throughput (tpd)	342	25.2
Throughput (tph)	21.375	3.15
Percent of day	0.67	0.33

Pollutant Emission Factors	PM/PM10/ PM2.5 lb/ton	SO2 lb/ton	NOx lb/ton	CO lb/ton	Lead lb/ton
Thermal Conversion Unit Exhaust	0.29	1.39	1.4	0.51	1.44E-03

PM, NOx, CO, SO2, Lead Emission factor from source test averages
*SO2 Emission rate based on scrubber manufacturer guarantee of 71.25% control. PM2.5 emission rate based on scrubber manufacturere guarantee of 41%.

7am-11pm - PEAK

	PM/PM10/PM2.5		**SO_2**		**NOx**		**CO**		**Lead**	
Pollutant	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
Thermal Conversion Unit Exhaust - Uncontrolled	6.20	18.10	29.71	86.76	29.93	87.38	10.90	31.83	0.03	0.09
Thermal Conversion Unit Exhaust - Controlled	3.66	10.68	8.54	24.94	29.93	87.38	10.90	31.83	0.03	0.09
Controlled Boiler Stack Emissions (Thermal Unit + Ignition System)	3.68	10.74	8.54	24.94	30.39	88.74	11.29	32.98	0.03	0.09

11pm-7am - OFF PEAK

	PM/PM10/PM2.5		**SO_2**		**NOx**		**CO**		**Lead**	
Pollutant	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**	**lb/hr**	**tpy**
Thermal Conversion Unit Exhaust - Uncontrolled	0.91	1.33	4.38	6.39	4.41	6.44	1.61	0.54	0.00	0.01
Thermal Conversion Unit Exhaust - Controlled	0.54	0.79	1.26	1.84	4.41	6.44	1.61	0.54	0.00	0.01
Controlled Boiler Stack Emissions (Thermal Unit + Ignition System)	0.56	0.82	1.26	1.84	4.88	7.12	2.00	1.11	0.00	0.01

TOXIC AIR POLLUTANTS (TAPs) CALCULATIONS

NON-CARCINOGENS (POUNDS PER HOUR)

Pollutant	CAS #	TAP Emission Factor (lb/ton)	Peak TAP Emissions (lb/hr)	Off-Peak TAP Emissions (lb/hr)	Average TAP Emissions (lb/hr)	Screening Level (lb/hr)	Modeling (based on peak)? (Y/N)	Modeling (based on Average)? (Y/N)
Aluminium	7429-90-5	4.74E-04	8.11E-03	1.19E-03	5.80E-03	6.67E-01	No	No
Antimony	7440-36-0	4.60E-05	7.86E-04	1.16E-04	5.63E-04	3.30E-02	No	No
Barium	7440-39-3	1.23E-05	2.11E-04	3.10E-05	1.51E-04	3.30E-02	No	No
Chromium	7440-47-3	1.03E-04	1.76E-03	2.60E-04	1.26E-03	3.30E-02	No	No
Copper	7440-50-8	4.33E-05	7.41E-04	1.09E-04	5.30E-04	6.70E-02	No	No
Cobalt	7440-48-4	1.77E-05	3.03E-04	4.47E-05	2.17E-04	3.30E-03	No	No
Hydrogen Chloride	7647-01-0	See Note 1 Below	5.95E-01	5.95E-01	5.95E-01	5.00E-02	Modeling not required (IDAPA 58.01.01 210.20)	
Hydrogen Flouride	NA	1.33E-04	2.84E-03	4.19E-04	2.03E-03	1.67E-01	No	No
Manganese	7439-96-5	3.56E-04	6.08E-03	8.96E-04	4.35E-03	3.33E-01	No	No
Mercury	7439-97-6	1.45E-04	3.10E-03	4.57E-04	2.22E-03	N/A	See Note 2 Below	
Molybdenum	7439-98-7	1.30E-04	2.22E-03	3.27E-04	1.59E-03	3.33E-01	No	No
Selenium	7782-49-2	1.30E-04	2.22E-03	3.27E-04	1.59E-03	1.30E-02	No	No
Zinc	7440-66-6	6.68E-03	1.14E-01	1.68E-02	8.18E-02	6.67E-01	No	No

TAPs Emission factor from source test averages.
1. HCl emission rate of 0.595 lb/hr based on baghouse manufacturer guarantee

2. Mercury is not listed under IDAPA 58.01.01 Section 585 as a TAP. However, it is listed here to show compliance with the MBACT rule under Section 215
The scrubber manufacturer guarantees 41% control of PM2.5 and smaller, with higher control efficiency expected for larger particulates. Metals emissions (with the exception of Mercury) from the thermal unit (including primary ignition system) will be in particulate form. Metals emissions estimates include a conservative 20% control of particulate metals.

CARCINOGENS (POUNDS PER HOUR)

Pollutant	CAS #	TAP Emission Factor (lb/ton)	Peak TAP Emissions (lb/hr)	Off-Peak TAP Emissions (lb/hr)	Average TAP Emissions (lb/hr)	Screening Level (lb/hr)	Modeling (based on peak)? (Y/N)	Modeling (based on Average)? (Y/N)
Cadmium	7440-43-9	2.02E-04	3.46E-03	5.10E-04	2.48E-03	3.7E-06	Modeling not required (IDAPA 58.01.01 210.20)	
Dioxin/Furan		6.31E-08	1.35E-06	1.99E-07	9.65E-07	1.50E-10	Modeling not required (IDAPA 58.01.01 210.20)	
Nickel	7440-02-0	8.81E-04	1.51E-02	2.22E-03	8.63E-03	2.70E-05	Yes	Yes

Stack Emissions (Thermal Unit + Ignition System)

PEAK		OFF PEAK	
lb/hr	tpy	lb/hr	tpy
1.51E-02	4.40E-02	2.23E-03	3.25E-03

TAPs Emission factor from source test averages.
The scrubber manufacturer guarantees 41% control of PM2.5 and smaller, with higher control efficiency expected for larger particulates. Metals emissions (with the exception of Mercury) from the thermal unit (including primary ignition system) will be in particulate form. Metals emissions estimates include a conservative 20% control of particulate metals.

Dynamis Energy WTE Facility
Thermal Conversion System - Hidden Hollow Landfill
Thermal Conversion Units - Ignition Systems HAPs

TOXIC AIR POLLUTANTS (TAPs) COMBUSTION CALCULATIONS
NATURAL GAS

Emission Unit	Fuel Usage
Primary Chamber Ignition	4,664.71 scf/hr

NON-CARCINOGENS (POUNDS PER HOUR)

Pollutant	CAS #	EF for NG Combustion ($lb/10^6$ scf)[a]	TAP Emissions (lb/hr)	Screening Level (lb/hr)	Modeling? (Y/N)
Barium	7440-39-3	4.4E-03	1.64E-05	3.3E-02	No
Chromium	7440-47-3	1.4E-03	5.22E-06	3.3E-02	No
Cobalt	7440-48-4	8.4E-05	3.13E-07	3.3E-03	No
Copper	7440-50-8	8.5E-04	3.17E-06	6.7E-02	No
Hexane	110-54-3	1.8E+00	8.40E-03	1.2E+01	No
Manganese	7439-96-5	3.8E-04	1.42E-06	3.33E-01	No
Mercury	7439-97-6	2.6E-04	1.21E-06	N/A	See Note 1 Below
Molybdenum	7439-98-7	1.1E-03	4.10E-06	3.33E-01	No
Naphthalene*	91-20-3	6.1E-04	2.85E-06	3.33E+00	No
Pentane	109-66-0	2.6E+00	1.21E-02	1.18E+02	No
Selenium	7782-49-2	2.4E-05	8.96E-08	1.3E-02	No
Toluene	108-88-3	3.4E-03	1.59E-05	2.5E+01	No
Zinc	7440-66-6	2.9E-02	1.08E-04	6.67E-01	No

1. Mercury is not listed under IDAPA 58.01.01 Section 585 as a TAP. However, it is listed here to show compliance with the MBACT rule under Section 215

*Although listed as a noncarcinogen in the Rules, DEQ has determined that naphthalene is a possible/probable carcinogen. Compliance for naphthalene emissions should be based on the EL or AACC listed in Section 586 for PAH.

The scrubber manufacturer guarantees 41% control of PM2.5 and smaller, with higher control efficiency expected for larger particulates. Metals emissions (with the exception of Mercury) from the thermal unit (including primary ignition system) will be in particulate form. Metals emissions estimates include a conservative 20% control of particulate metals.

CARCINOGENS (POUNDS PER HOUR)

Pollutant	CAS #	EF for Natural Gas Combustion ($lb/10^6$ scf)[a]	TAP Emissions (lb/hr)	Screening Level (lb/hr)	Modeling? (Y/N)	Peak (tpy)	Off peak (tpy)
Arsenic	7440-38-2	2.0E-04	7.46E-07	1.5E-06	No		
Benzene	71-43-2	2.1E-03	9.80E-06	8.0E-04	No	2.86E-05	1.43E-05
Beryllium	7440-41-7	1.2E-05	4.48E-08	2.8E-05	No		
Cadmium	7440-43-9	1.1E-03	4.10E-06	3.7E-06	Modeling not required (IDAPA 58.01.01 210.20)		
Formaldehyde	50-00-0	7.5E-02	3.50E-04	5.1E-04	No	1.02E-03	5.11E-04
Nickel	7440-02-0	2.1E-03	7.8E-06	2.7E-05	No	2.29E-05	1.14E-05
Benzo(a)pyrene	50-32-8	1.2E-06	5.60E-09	2.0E-06	No		
Benz(a)anthracene	56-55-3	1.8E-06	8.40E-09	NA	No		
Benzo(b)fluoranthene	205-82-3	1.8E-06	8.40E-09	NA	No		
Benzo(k)fluoranthene	205-99-2	1.8E-06	8.40E-09	NA	No		
Chrysene	218-01-9	1.8E-06	8.40E-09	NA	No		
Dibenzo(a,h)anthracene	53-70-3	1.2E-06	5.60E-09	NA	No		
Indeno(1,2,3-cd)pyrene	193-39-5	1.8E-06	8.4E-09	NA	No		
Total PAHs		1.1E-05	5.32E-08	2.00E-06	No		

[a]EFs from AP-42, Tables 1.4-3 and 1.4-4, 7/98
[b]EFs from AP-42, Table 1.3-10, 9/98

The scrubber manufacturer guarantees 41% control of PM2.5 and smaller, with higher control efficiency expected for larger particulates. Metals emissions (with the exception of Mercury) from the thermal unit (including primary ignition system) will be in particulate form. Metals emissions estimates include a conservative 20% control of particulate metals.

IDEQ PTC Forms
Toxic Air Pollutant Emissions Inventory

Table 1. PRE- AND POST PROJECT NON-CARCINOGENIC TAP EMISSIONS SUMMARY POTENTIAL TO EMIT

Non-Carcinogenic Toxic Air Pollutants (sum of all emissions)	Pre-Project 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Post Project 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Change in 24-hour Average Emissions Rates for Units at the Facility (lb/hr)	Non-Carcinogenic Screening Emission Level (lb/hr)	Exceeds Screening Level? (Y/N)
Acrolein	0.00E+00	1.13E-04	1.13E-04	1.70E-02	No
Aluminum	0.00E+00	1.02E-01	1.02E-01	6.67E-01	No
Antimony	0.00E+00	5.63E-04	5.63E-04	3.30E-02	No
Barium	0.00E+00	7.32E-04	7.32E-04	3.30E-02	No
Chromium	0.00E+00	1.35E-03	1.35E-03	3.30E-02	No
Cobalt	0.00E+00	1.62E-03	1.62E-03	3.30E-03	No
Copper	0.00E+00	9.08E-04	9.08E-04	6.70E-02	No
Fluoride (as F) (Hydrogen Fl)	0.00E+00	2.03E-03	2.03E-03	1.67E-01	No
Hexane	0.00E+00	8.40E-03	8.40E-03	1.20E+01	No
Hydrogen Chloride	0.00E+00	5.95E-01	5.95E-01	5.00E-02	See Footnote 1
Manganese	0.00E+00	5.23E-03	5.23E-03	3.33E-01	No
Molybdenum	0.00E+00	1.61E-03	1.61E-03	3.33E-01	No
Naphthalene**	0.00E+00	3.04E-06	3.04E-06	9.10E-05	No
Pentane	0.00E+00	1.21E-02	1.21E-02	1.18E+02	No
Phosphorous	0.00E+00	2.66E-03	2.66E-03	7.00E-03	No
Selenium	0.00E+00	1.59E-03	1.59E-03	1.30E-02	No
Silver	0.00E+00	2.92E-07	2.92E-07	7.00E-03	No
Toluene	0.00E+00	5.15E-04	5.15E-04	2.50E+01	No
o-Xylene	0.00E+00	3.48E-04	3.48E-04	2.90E+01	No
Zinc	0.00E+00	3.09E-01	3.09E-01	6.67E-01	No

See spreadsheets prepared by JBR (included in Appendix F of the permit application for further information regarding emission factors and calculation assumptions.

1. Regulated under NSPS Subpart Eb, excluded from modeling under IDAPA 58.01.01 210.20.

**Although listed as a noncarcinogen in the Rules, DEQ has determined that naphthalene is a possible/probable carcinogen. Compliance for naphthalene emissions should be based on the EL or AACC listed in Section 586 for PAH.

Table 2. PRE- AND POST PROJECT CARCINOGENIC TAP EMISSIONS SUMMARY POTENTIAL TO EMIT

Carcinogenic Toxic Air Pollutants (sum of all emissions)	Pre-Project Annual Average Emissions Rates for Units at the Facility (lb/hr)	Post Project Annual Average Emissions Rates for Units at the Facility (lb/hr)	Change in Annual Average Emissions Rates for Units at the Facility (lb/hr)	Carcinogenic Screening Emission Level (lb/hr)	Exceeds Screening Level? (Y/N)
Acetaldehyde	0.00E+00	9.37E-04	9.37E-04	3.00E-03	No
Arsenic	0.00E+00	7.46E-07	7.46E-07	1.50E-06	No
Benzene	0.00E+00	1.15E-03	1.15E-03	8.00E-04	Yes
Beryllium	0.00E+00	4.48E-08	4.48E-08	2.80E-05	No
Cadmium	0.00E+00	2.50E-03	2.50E-03	3.70E-06	See Footnote 1
Dioxin/Furan	0.00E+00	9.65E-07	9.65E-07	1.50E-10	See Footnote 1
Formaldehyde	0.00E+00	1.79E-03	1.79E-03	5.10E-04	Yes
Nickel	0.00E+00	8.69E-03	8.69E-03	2.70E-05	Yes
Benzo(a)pyrene	0.00E+00	5.60E-09	5.60E-09	2.00E-06	No
Benz(a)anthracene	0.00E+00	8.40E-09	8.40E-09	2.00E-06	No
Benzo(b)fluoranthene	0.00E+00	8.40E-09	8.40E-09	2.00E-06	No
Benzo(k)fluoranthene	0.00E+00	8.40E-09	8.40E-09	2.00E-06	No
Chrysene	0.00E+00	8.40E-09	8.40E-09	2.00E-06	No
Dibenzo(a,h)anthracene	0.00E+00	5.60E-09	5.60E-09	2.00E-06	No
Indeno(1,2,3-cd)pyrene	0.00E+00	8.40E-09	8.40E-09	2.00E-06	No
Total PAHs	0.00E+00	2.45E-07	2.45E-07	9.10E-05	No

1. Regulated under NSPS Subpart Eb, excluded from modeling under IDAPA 58.01.01 210.20.

See spreadsheets prepared by JBR (included in Appendix F of the permit application for further information regarding emission factors and calculation assumptions.

IDEQ PTC Forms
Facility Wide Hazardous Air Pollutant Potential to Emit

Table 1 HAP POTENTIAL TO EMIT EMISSIONS SUMMARY

HAP Pollutants	PTE (T/yr)
Acrolein	4.95E-04
Antimony	2.46E-03
Chromium	5.92E-03
Cobalt	7.09E-03
Fluoride (as F) (Hydrogen Fl)	8.91E-03
Hexane	3.68E-02
Hydrogen Chloride*	2.61E+00
Manganese	2.29E-02
Mercury	9.72E-03
Naphthalene	1.33E-05
Phosphorous	1.17E-02
Selenium	6.95E-03
Toluene	2.26E-03
o-Xylene	1.52E-03
Acetaldehyde	4.10E-03
Arsenic	3.27E-06
Benzene	5.04E-03
Beryllium	1.96E-07
Cadmium	1.09E-02
Dioxin/Furan	4.23E-06
Formaldehyde	7.85E-03
Nickel	3.81E-02
Total	2.79E+00

* Maximum Individual HAP

** See spreadsheets prepared by JBR (included in Appendix F of the permit application for further information regarding emission factors and calculation assumptions.