

**INDIVIDUAL NPDES PERMIT APPLICATION  
OHIO RIVER CLEAN FUELS FACILITY  
COAL TO LIQUID FUEL FACILITY  
WELLSVILLE, COLUMBIANA COUNTY, OHIO**

**SUBMITTED TO:**

**OHIO ENVIRONMENTAL PROTECTION AGENCY**

**SUBMITTED BY:**

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**CEC PROJECT 061-933.0003**

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## 1.0 INTRODUCTION

Ohio River Clean Fuels (ORCF) is developing a site near Mile Post 49.5 of the Ohio River in Wellsville, Ohio (Figure 1) for a coal and biomass to liquid fuel project (CTL plant) in response to the increasing demand and price of high quality, clean, domestically produced transportation fuels. Two of the byproducts of the process (F-T process) are heat and tailgas. The tailgas consists primarily of carbon monoxide, hydrogen and methane. ORCF proposes to use this heat and tailgas to produce electricity through a cogeneration station located on the project site both for internal use and sale.

This application seeks a permit for the discharge of process wastewaters and stormwaters from the facility. The CTL plant and the Cogeneration Station will be located in Columbiana County, west of the Ohio River near Wellsville. The CTL plant will occupy approximately 357 acres of an approximate 650 acre site (Figure 2).

The operations of ORCF will utilize approximately 7,000,000 tons/year of coal (Pittsburgh No. 8) and biomass to produce approximately 53,000 barrels per day of synthetic naphtha and diesel fuel. The feed stock operational units include coal and biomass storage facilities, coal/biomass milling and drying and stock transfer facilities. Coal and biomass is then transferred to the coal to liquid process, which consists of gasification that generates a synthetic gas, which is conditioned in the acid gas removal process to recover sulfur and remove mercury. Conditioned syngas is further processed in the Fischer-Tropsch and Product Upgrade Units to produce naphtha and diesel fuel. Liquid fuels are transferred to a tank farm consisting of aboveground storage tanks. The liquid fuels will then be transferred for offsite use. Excess syngas and steam generated by the gasification process will be transferred to a combined cycle plant to produce electricity. The electricity will be used to power plant operations with an excess being sold to the electrical power grid. The block flow diagram for the operations is included as Figure 3. Ancillary operations associated with this process include raw water treatment, air pollution controls, waste gas conditioning, an air separation plant to produce industrial gases (nitrogen and oxygen), waste water treatment units, and other support operations.



The information included in this application has been assembled from existing documents provided by the design team and ORCF. Calculations have been prepared using the modeling information for the CTL process to estimate wastewater flows (Figure 4) and pollutant loadings (Appendix A). The pollutant loadings estimated by the model have also been adjusted, where appropriate, using reference information from the Cooling Tower Institute, USEPA Effluent Limitation Guidelines, and assumptions concerning removal efficiencies for certain wastewater treatment operations, limited analytical data for the water supply from the Ohio River and Buckeye Water. Supporting documentation and other referenced sources are included in Appendix B.



## 2.0 PROJECT DESCRIPTION

The major units of the ORCF project include coal/biomass storage, feedstock milling and drying, gasification and syngas conditioning, sulfur recovery, Fischer-Tropsch (F-T) synthesis, product upgrading and refining, and power generation. A simplified process diagram is included as Figure 3. A block flow diagram providing additional details concerning the CTL process is included as Figure 3A.

### 2.1 PRELIMINARY DESIGN AND MODELING

The consortium of Black & Veatch and Uhde (BVU), Idaho National Laboratory (operated by Battelle Energy Alliance), and AMEC Paragon have worked under contracts to ORCF to establish a Fischer-Tropsch plant (F-T plant) reference design for conceptual engineering (pre-FEED), plot plan layout, technology sizing and validation, and plant integration. AMEC Paragon of Houston, Texas was contracted to provide engineering services for the integration of the Fischer-Tropsch process with the gasification processes (*Plant Modeling & Emissions Comparative Analysis Approach, Coal/Biomass Gasification with Fischer-Tropsch Diesel Production*, Appendix B).

The process designs are based on the engineering design experience of the team. This design team was selected on the basis of their collective expertise and significant relevant experience in design, construction, and operation of integrated gasification combined cycle power generation, liquid fuels synthesis, crude refining, and chemical production plants.

Initial plant layout and modular construction planning has been completed by the team (Figure 2). The first phase of the Project, approximately 17,500 barrels per day of F-T liquid fuel production, will deploy coal/biomass storage, an Air Separation Unit (ASU), gasifiers, F-T battery, and on-site electrical generating capacity with turndown capability to match the gas firing rate generated by two gasifiers. The balance of plant equipment may be sized for the planned plant capacity of 53,000 barrels per day of F-T liquid fuel, depending on the function, range of operation, and cost of each equipment item.



## 2.2 PROCESS OPERATIONS DESCRIPTIONS

The descriptions of the various process operations to be constructed are outlined below:

- **Coal/Biomass Storage** – Coal and biomass will be delivered to a storage area where stackers and reclaimers will operate to stage the coal/biomass and feed the coal/biomass to the feedstock milling and drying. Water will be used for dust control on the piles and any runoff from these sprays, plus stormwater runoff from the area (approximately 61 acres) will be directed to a coal pile runoff pond. No solid wastes are expected from this area. Solids accumulated in the pond will be placed on the piles. Stormwater runoff is expected to contain total suspended solids, oil and grease, and metals. The pH of stormwater is expected to be <7.0 S.U. and contain iron and sulfates. Mercury contained in the coal fines is expected to be present at low levels.
- **Feedstock Milling & Drying** - The coal is pulverized using a roller mill to ensure efficient gasification. Additions of biomass occur at this point and drying is accomplished simultaneously using a heated inert gas stream. No wastes or process wastewaters are generated. The operations are enclosed and dry air pollution controls will be used. Stormwater will include TSS, oil and grease, and metals. Mercury levels are expected to be low, based on content in the coal.
- **Gasification & Syngas Conditioning** – Coal will be gasified using Shell's proprietary SCGP technology (entrained-flow, dry-fed, slagging, oxygen-blown, upflow gasifier) or equivalent. Although some heat is recovered in the membrane wall, the majority of the heat is recovered in the syngas coolers. The syngas is further cooled by water quench. A portion of the quenched syngas is returned to the gasifier. A fraction of the remaining syngas is passed through shift reactors and then remixed with the unshifted syngas. Elemental mercury is also condensed and removed by the acid gas removal process. Because of the extreme sulfur intolerance of the F-T catalyst, sulfur and mercury guard beds are included in the flowsheet as an added measure of protection against poisoning (Figure 3A). Wastes generated will include slag and dry ash solids



from the cooling of the syngas. The materials will be shipped offsite as solid waste for disposal. Process wastewaters from the syngas conditioning scrubber will be treated in a high efficiency reverse osmosis unit and zero liquid discharge wastewater treatment unit (evaporator). Wastewaters are expected to include TSS, oil and grease, metals, semi-volatile compounds, sulfates, chlorides, and mercury. The mercury levels are expected to be low and cannot be estimated as to the partitioning to the syngas versus ash. Mercury contained in the syngas will be processed in downstream units and mercury in the wastewaters will be treated in the high efficiency reverse osmosis (HERO) unit and evaporator; the distillate liquids will be routed to another reverse osmosis (RO) unit (see Section 4.0 for the discussion of mercury emissions).

- Sulfur Plant – Sulfur recovery is based on the Claus process. Tailgas from the Claus unit is hydrogenated to convert remaining sulfur species to H<sub>2</sub>S, and this stream is recycled to maximize sulfur recovery. Elemental sulfur is produced in this process and will be stored inside prior to offsite transfer/sale. Non-contact cooling water will be utilized and process wastewater will be generated from the tail gas treatment unit. These wastewaters will be routed to the ZLD/RO treatment unit.
- Fischer-Tropsch Synthesis – Syngas is converted to liquid synthetic fuels in column reactors using a cobalt catalyst. The resulting product is primarily paraffinic, but also contains some olefins and oxygenates. Carbon chain length in the product stream varies from 1 (methane) to more than 100. Hence, separations are performed to fractionate the product into light gas, crude naphtha, middle distillate, and molten wax. To improve conversion, multiple reactors and/or light gas recycle will be implemented. No solid wastes are generated at this process. Wastewaters will contain alcohols, nitrates, organics, and other solids. The wastewaters will be routed to a biological treatment process for reduction of wastewater concentrations. The treated water from the biological treatment unit will be routed to the cooling tower for re-use, with only a very small volume discharged to the settling basin. No to very low mercury levels are expected since the mercury will have been removed from the syngas stream.



- Product Upgrade & Refining – Middle distillate is hydrotreated to saturate olefinic bonds, and then refined via distillation into diesel fuel and naphtha products. Bottoms product from distillation is mixed with wax from the F-T unit and hydrocracked to improve overall yield of the diesel and naphtha fractions. No wastes are expected. Stormwaters are generated from this area and the product storage tanks. Product storage tanks do not generate wastewaters. The stormwaters will likely contain TSS, oil and grease, and semi-volatile organic compounds.
- Power Production – Light gas from the F-T and refining areas is used to fire gas turbines to produce electricity. Hot exhaust from the gas turbine is routed to the heat recovery steam generator (HRSG) to produce superheated steam. This steam is used in conventional condensing turbines to produce additional power. To further maximize power production, saturated steam produced in the F-T process and in other areas of the plant is fed to saturated steam turbines. The majority of the power produced is used to support electrical demand for the plant; however, some excess power is available for export to the grid.

### 2.3 ANCILLARY OPERATIONS

In addition to the process operations, the facility will include ancillary operations for water supply and wastewater treatment and product storage.

- Air Separation – Oxygen is produced via a standard cryogenic Linde-type ASU that utilizes distillation columns and extensive heat exchange in a cold box. The oxygen product is used primarily for gasification. In order to reduce the inert content in the synthesis gas, an oxygen purity of 99.5% is specified. The nitrogen co-product from the ASU can be used for coal drying, as an inert gas to be used throughout the plant, and as a diluent in the gas turbine. The waste stream from the ASU is an oxygen-enriched air stream, a portion of which can be utilized as an oxidant in the Claus plant.



- Plant Water Pretreatment System - The Plant Water Pre-treatment System treats raw water from the Ohio River to the appropriate quality for use as cooling tower makeup. Pre-treatment of raw water from the Ohio River consists of clarification to reduce suspended solids by use of a clarifier. All components associated with the Plant Water Pre-treatment System will be located indoors, except for the clarifiers, to protect the system from freezing. Solids from the clarifiers will be dewatered and filtrate water returned to the plant. Blowdown waters will be routed to the settling basin. The blowdown wastewaters are expected to contain TSS, oil and grease, pH >6.0 and <9.0 plus low level metals, contained as part of the Ohio River intake waters. Appendix B contains an analysis of the Ohio River waters.
- Potable Water - Potable water is furnished to the site boundary by Buckeye Water District. Potable water is distributed to safety shower/eyewash stations and building plumbing for sanitary use.
- Service Water System - Service water is supplied from Buckeye Water District and is filtered and routed to two service/fire water storage tanks. The Service Water System stores and distributes the filtered water to the Fire Protection System, the Cycle Makeup Treatment System, plant hose connections for washdown, and equipment seals or other equipment requirements. Service water is also used as the cooling medium in the Closed Cycle Cooling Water (CCCW) heat exchangers when the circulating water pumps are not running.
- Plant and Equipment Drains – The plant drains from the CTL process area which collects stormwater to be routed to an oil-water separator. This equipment will be used because there is potential for stormwaters from this area to include oils because liquid fuels are being produced in this area. Additionally, equipment drains from items such as pump seals, blowdown from the air separation units, laboratory waters, and waters from storage areas used for oils will be routed to an oil-water separator.



- Demineralized Water - The Cycle Makeup Treatment System is a two pass, reverse osmosis and electrodeionization unit that provides high quality demineralizer water for makeup to the gasification process, the HRSG steam cycle, and various uses during startup such as hydrostatic testing, chemical cleaning, displacement flushes after cleaning, and charging the glycol water CCCW system.

The effluent quality from the Cycle Makeup Treatment System meets the water quality requirements for the HRSG steam cycle makeup. Potable water from Buckeye Water District is filtered and placed into two service/fire water storage tanks. This service water is used to supply the Cycle Makeup Treatment System.

- Condensate System - The Condensate System consists of the following main components:
  - Steam Surface Condensers
  - Condensate Pumps
  - Heat Recovery Heat Exchanger
  - Deaerator.

The condensate pumps transfer the condensate from the condenser hotwells through a return condensate heat recovery heat exchanger and the economizer sections of the HRSGs to a deaerator for re-use as boiler feed waters. The return condensate heat exchanger cools condensate from the gasification island prior to the condensate being polished and injected into the main condensate flow. Also prior to entering the economizer, a portion of the condensate is routed through the shift conversion process for heat recovery.

- Feedwater System - The Feedwater System consists of the following main components:
  - HRSG Boiler Feedwater Pumps



- Feedwater Pumps

The boiler feedwater pumps take suction from the deaerator and pump the feedwater to the required processes.

The Feedwater Pumps pump the feedwater through the high pressure (HP) economizer. The feedwater supplies also provide the required spray water for steam desuperheaters in the combined cycle steam system.

- Circulating Water Systems - The Circulating Water System consists of parabolic natural draft-cooling towers and separate distribution systems. The first distribution system provides cooling water to the combined cycle steam surface condenser, and the CCCW heat exchangers of the power block. The second distribution system provides cooling water for the process steam turbine surface condenser. The third cooling water distribution system provides cooling water to process cooling needs including the ASU air compressor intercoolers and aftercoolers.

Circulating water flows in a closed loop from the cooling towers to the circulating water pumps, then on to the various heat exchangers and back to the cooling tower. A portion of the water is discharged (blowdown) to control the quantity of dissolved solids in the circulating water. Makeup water is supplied from the Ohio River Water Pretreatment System to replace the water lost due to evaporation, carry-over, and blowdown.

The Circulating Water Chemical Feed System provides protection for the Circulating Water System and the cooling water side of the condenser and heat exchangers against excessive scaling and corrosion. In addition, the Circulating Water Chemical Feed System provides control of biological fouling and algae that could affect surface heat transfer, impair flow distribution, and cause deterioration of cooling tower materials. Chemical storage and feed systems are provided for sulfuric acid, a scale



inhibitor, biocide chemical feed and dechlorination feed, if required. Cooling water treatment chemicals will include the following:

- Sulfuric acid for pH control.
- Sodium hypochlorite for microbiological control.
- Scale control agents such as polyphosphates for control of iron scaling.
- Deposit control agents, low molecular weight polymers, such as acrylate-based polymers.

In addition to this information, the information required by Ohio EPA Policy DSW-0100.022, Revision 2, will be provided.

- Closed Cycle Cooling Water System - The CCCW System supplies glycol water solution for most of the rotating equipment cooling needs of the combined cycle plant and process steam turbine generator. Heat is rejected from the return glycol water solution to the Circulating Water System via the CCCW heat exchangers.

The design of the CCCW System is based on the need to supply cooling water to the various power block heat exchangers. The major equipment of the CCCW system consists of multiple plate and frame type heat exchangers and horizontal, split case, single-stage, double-suction volute type, centrifugal pumps. The heat exchangers will require periodic cleaning with acid/deposit removal agents. These cleaning solutions will be directed to the circulating water system for use. The expected chemical constituents include TSS, oil and grease, silica, calcium, magnesium, and iron.

- Fire Detection and Protection - The Fire Protection System provides fixed water suppression systems, fire extinguishers, independent fire detection systems and fixed carbon dioxide suppression systems to protect the plant buildings and equipment in the event of fire.



Firewater is supplied equally from each of the service water/fire water storage tanks. A standpipe in each service/fire water storage tank assures a portion of the tank is always available for firewater service. A pressure maintenance pump, electric motor driven firewater pumps and engine driven firewater pumps are provided. Normally the pressure maintenance (jockey) pump operates to maintain a pressure in the fire mains above the starting set pressures of the motor and engine driven fire pumps. When a fire suppression system is actuated, or a hydrant is opened, the pressure maintenance pump cannot maintain pressure in the fire mains, and as the fire main pressure drops, the motor driven fire pumps start first, and if the main pressure continues to fall, the diesel fire pumps start.

- General Wastewater Treatment - The plant discharge wastewater includes the following four discharge points.
  - Low volume wastes such as pump seals, compressor waters
  - Cooling tower blowdown
  - Site runoff from the coal to liquid process area and cogeneration facility.

Wastewater is collected from areas where the potential for oil contamination exists and routed by gravity to the oil/water separator. Water discharge from the oil/water separator is routed to the settling basin. Waste sludge from the Plant Water Pretreatment System also is routed to the settling basin. The wastewater from the Cycle Makeup Treatment System is sent to the plant discharge, downstream of the settling basin.

The Cooling Tower blowdown is treated for chlorine removal using sodium bisulfite prior to being routed to the plant discharge.

Stormwater runoff from other areas are collected in the site runoff pond. The pond provides retention time required for the removal of suspended solids prior to release.



Wastes from the sanitary system are collected and pumped to Village of Wellsville Waste Water Treatment Plant under the terms of a permit from the village. Discharge is by gravity drains, pumping, or a combination. Drains and pipes are sized and designed to adequately collect and convey the maximum expected liquid flow requirements.

- Surface Drainage - The site is graded to provide positive drainage for all areas. A system of ditches and culvert or inlets and storm sewers, or a combination, are provided to convey stormwater runoff to the stormwater retention pond or discharge. Secondary containment areas for product and waste storage will be designed for a 25 year, 24 hour rainfall event.
- F-T Process Condensate Treatment System - The F-T Process Condensate Treatment System treats process condensate water from the Fischer-Tropsch unit to remove hydrocarbons in the water. A biological treatment process is utilized to remove the hydrocarbons from the stream. The effluent from this process is sent to the cooling tower as makeup water. All components associated with the F-T Process Condensate Treatment System are located outdoors.
- Process Wastewater Treatment System - The function of the Process Wastewater Treatment System is to collect and treat gasification process wastewater and coal pile runoff by evaporation to produce a salt material for landfill disposal and to return distillate-quality product water for demineralizer makeup. The treatment system is a zero liquid discharge (ZLD) system.

A wastewater storage tank is provided for storage of wastewater when the evaporator is out of service. The wastewater storage tank is sized to contain the maximum wastewater volume produced from 72 hours of operation. The wastewater storage tank is coated with a corrosion-resistant vinyl coating.



Coal gasification process blowdown characteristics are not easily predicted because of variations in coal composition. Typical constituents include numerous heavy metals, formates, cyanides, hydrogen sulfide, ammonia and thio compounds. Separate treatment for metals removal is performed upstream of the ZLD system utilizing a high efficiency reverse osmosis (HERO) process for volume reduction. The HERO system theoretically reduces the volume of wastewater for disposal by approximately 85 %. The concentrated reject stream from the HERO process is reduced to dryness in a triple effect evaporator/crystallizer. Solids from the crystallizer are dewatered in a filter press for off site disposal. Permeate from the HERO process and distillate from the evaporator/crystallizer is recycled for reuse in the facility. It must be recognized that the HERO process has not been demonstrated to perform satisfactorily when treating a gasifier blowdown stream. Pilot testing is planned. Assuming satisfactory testing the HERO process is expected to provide the best overall operation. Should HERO not be satisfactorily demonstrated, treatment by evaporation and crystallization solely for the wastewater stream may be used. This would be expected to result in a higher operating cost for the ZLD system.

The evaporator and associated components are designed for approximately double the treatment capacity required for plant operation at maximum operating conditions. This sizing criterion allows the wastewater storage tank to be emptied after an evaporator outage. Plant low pressure steam is used as the heat source for operation of the evaporator. A salt containing 35 percent by weight solids is produced. Closed cooling water is used to condense the product water. The use and processing of coal will create the potential for mercury to be present in the wastewater stream from this unit.

During gasification of coal, mercury in the feed is mainly converted to volatile species, including oxidized mercury (e.g.,  $\text{HgCl}/\text{HgCl}_2$ ), or it may also be reduced to elemental mercury ( $\text{Hg}^0$ ) depending on a number of factors including the chloride content in the coal, gasification temperature, and gas-phase stoichiometry. The mercury may exit the gasifier with the slag, fly-ash, and syngas, or quench solutions.



That mercury which is contained in the solids streams will be treated in accordance with solid waste disposition regulations. It is possible for most of the speciated mercury to end up in the gasifier quench solution, while most of the elemental mercury will pass through the quench system and reside in the syngas stream.

The exact apportionment of mercury in the quench and syngas cannot be theoretically determined; therefore, unit operations to remove a high partition of the mercury from both the syngas as well as from the quench system shall be provided.

The quench solutions (wastewater) may be treated by any of several commercially viable mercury separations technologies for quench and scrubber solutions, either co-located with the HERO or sequentially following the HERO and prior to the RO/EDI. Separation efficiencies of >99% are possible, depending on stream properties and composition. The ORCF project will conduct a technical evaluation of commercially available options during final engineering and select the best process to achieve required wastewater discharge limits.



## 3.0 WASTEWATER AND STORMWATER SOURCES

### 3.1 PROCESS/COOLING WASTEWATER SOURCES

The CTL plant will generate process and cooling wastewaters from the operations described in Section 2. The final design of the water treatment and wastewater treatment facilities will be completed during final engineering. Utilizing the information from Section 2, the model information prepared by INL and AMEC Paragon and the reference sources noted in Appendix B, the following section provides information concerning the treatment operations and the probable constituents from each of the major treatment systems proposed for the facility.

The order of presentation for the sources is from the discharge point, a.k.a. outfall 001 and proceeding backward through the various process sources. Stormwater sources and contributions are discussed in Section 3.2.

#### 3.1.1 Outfall 001

The proposed outfall 001 will be a combined discharge of process wastewaters, contact cooling wastewaters, non-contact cooling wastewaters and stormwaters. The process wastewaters and cooling waters will be discharged through a direct discharge point source into the Ohio River. Sanitary wastewaters will be directed to the Wellsville Wastewater Treatment Plant.

This outfall will receive stormwaters from the site runoff pond, settling basin, circulating water system and the Reverse Osmosis (RO/EDI) system. The pollutants are expected to include; pH, temperature, total suspended solids, dissolved solids, metals and organic compounds.

#### 3.1.2 Site Runoff Pond

This proposed unit will be designed to manage site stormwater from various areas of the facility and will generally receive stormwaters which are from non-process areas of the site. The pollutants are expected to include; pH, and total suspended solids. The design of the pond will



include inlet and outlet works and a primary and secondary settling chamber to allow for on-line cleaning/removal of accumulated solids. The pond will be sized to accommodate a 10-year, 24-hour rainfall event plus the expected process wastewater flow. In addition to the primary settling capacity, the pond will also include ancillary equipment such as aeration, oil skimming, and polymer addition for solids settling. The polymer selected will be based upon field and/or laboratory testing.

### 3.1.3 Circulating Water System

The circulating water system will provide cooling waters to the various operations within the facility and will also serve as the primary water recycle system. Fresh water make-up will be provided by the Pre-treatment systems and the recycle water streams will include waters from the biological treatment systems servicing the F-T process, blowdown from the streams, drums and boilers and power block. A significant rate of evaporation will occur in the system, requiring significant volumes of fresh make-up water. The pollutants are expected to include; pH, temperature, total suspended solids, dissolved solids, metals and organic compounds. The discharge from the cooling tower will include treatment from dechlorination using a chemical reducing agent such as sodium bisulfite.

### 3.1.4 Settling Basin

The settling basin will be designed to reduce the levels of suspended solids from the water supply systems associated with the facility operations. This basin will receive the majority of the waters from the Pretreatment system blowdown and may also receive waters from the RO system, pending the final design of these water systems. Additionally, wash waters and some stormwaters from the processing areas of the facility will be routed to this unit. The pollutants are expected to include; pH, oil & grease, total suspended solids, dissolved solids, metals and low levels of organic compounds. The pollutants from this area are expected to be relatively low levels due to the sources of the water streams generally being from water supply, rather than process streams. There will be a connection to the process operations as the settling basin may



receive waters from the RO/EDI unit which will receive waters from the ZLD system connected to the coal pile runoff pond and the HERO System connected to the CTL process.

The design of the setting basin will include inlet and outlet works and a primary and secondary settling chamber to allow for on-line cleaning/removal of accumulated solids. The pond will be sized to accommodate a 10-year, 24-hour rainfall event plus the expected process wastewater flow. In addition to the primary settling capacity, the pond will also include ancillary equipment such as aeration, oil skimming, and polymer addition for solids settling. The polymer selected will be based upon field and/or laboratory testing.

### 3.1.5 Oil/Water Separator

This unit will receive wastewaters and stormwaters from the processing areas of the facility. The function of this unit will be to reduce free oil from the wastewaters prior to discharge into the settling basin. The oils removed from the unit will be shipped off site.

### 3.1.6 Reverse Osmosis/EDI

This unit will receive a fresh water supply from Buckeye Water (Analytical Report – Appendix B) and will remove dissolved solids, organics and metals to produce water suitable for the process water supply at the power block. The water requirements of the power block generally include high purity water, which can only be obtained by application of the RO process. The backwash from the unit is expected to contain a concentrated stream of pollutants, which will require further treatment, most likely in the settling basin, prior to discharge. This system will also receive treated waters from the ZLD systems and the HERO unit. These streams will be concentrated solutions form further processing. The reuse of the process waters from the CTL process is designed to reduce the overall discharge of process waters from this facility, thereby attempting to reduce the effluent loading of organic compounds. The pollutants are expected to include; pH, total suspended solids, dissolved solids, metals and organic compounds.



### 3.1.7 Zero Liquid Discharge (ZLD) Wastewater Treatment

This system is essentially an evaporative process for the removal of organic compounds captured by the air pollution controls and stripper process connected to the CTL process. The ZLD will further reduce the loading of organic compounds requiring discharge and is a secondary process to the HERO and coal pile runoff pond, planned for the operations. The pollutants are expected to include; pH, dissolved solids, metals and organic compounds.

### 3.1.8 High Efficiency Reverse Osmosis System (HERO)

This system is described in Section 2. Information concerning the design and function is included in Appendix B.

### 3.1.9 Coal Pile Runoff Pond

The coal pile runoff pond will receive stormwater runoff from the coal and biomass storage area. This area is currently expected to include some 20-30 acres of coal and biomass storage. Stormwater runoff from this area is expected to be similar to that from coal fired electric utility operations. The pollutants are expected to include; pH, total suspended solids, dissolved solids, metals and oil and grease.

### 3.1.10 Biological Treatment

The F-T process produces wastewaters containing inorganic and organic pollutants. The wastewater stream is expected to be similar in nature, although the concentrations are expected to vary significantly, to a by-product recovery coke making facility. The pollutants are expected to include, ammonia, nitrates, cyanide, metals, BOD, COD and totals suspended solids. The treatment system for the wastewaters from the F-T process will be a typical biological treatment system consisting of an equalization tank, aerobic combined carbon oxidation and nitrification, followed by clarifiers. Nutrient addition and pH control compounds plus air and return sludge from the clarifier will be introduced to the aerobic treatment step. Nitrification will be used as a



supplemental technology, if required to meet nitrate discharge requirements. The biological treatment system will be designed to produce waters which can be recycled in the circulating water system and only a very small percentage of the treated waters will be discharged (expected to be <1 gal/min).

### 3.1.11 Pretreatment

The second largest system in the facility, based on water volume, is the Pre-Treatment System. This system will include a water intake at the Ohio River and treatment equipment designed to remove the suspended solids from the waters and make adjustments to pH, so the waters can be used for process and recycle purposes (Analytical Report – Appendix B). The solids generated from these operations will be filtered and dewatered and managed as solid wastes. Filtrate will be directed to the settling basin prior to discharge to the Outfall 001. Expected pollutants will be suspended solids, filtered from the Ohio River intake.

## 3.2 STORMWATER SOURCES

Materials that will be stored at the facility which have the potential to come into contact with stormwater include coal, biomass, fly ash, slag, various chemicals used for production, liquid product and facility operations equipment. The following discussion addresses the treatment, storage, and/or disposal methods of stormwater coming into contact with these materials that will be used at the facility. The total property proposed for the ORCF facility is more than 600 acres, with five stormwater drainage areas. The expected stormwater drainage areas are identified on Figure 5.

### 3.2.1 Raw Waste Materials and Product Storage

This area is expected to comprise approximately 61 acres at an elevation of 1042, and includes a raw materials storage area and a stormwater management pond. Coal and biomass (feedstock) will be delivered to storage piles at the facility via conveyors and transfer towers. Each pile will cover an area of approximately 3 acres. Two areas of approximately 3.5 acres each to the east



and west of the storage piles will be used by bulldozer operators to manage the feedstock piles. The feedstock area will be located on an engineered plateau at the northeast corner of the site at an elevation of approximately 1142 feet above mean sea level (msl). Stormwater coming into contact with the feedstock piles will be directed to the coal run-off pond, which will provide sufficient retention time required for the reduction of total suspended solids (TSS) prior to discharge to the Ohio River or introduction into the ZLD system. Expected pollutants are pH, total suspended solids, sulfates, and metals.

Slag generated during the gasification process will be transported from a slag accumulator at the base of each gasifier through a slag sluicing process. Following sluicing, the slag will be dewatered in silos prior to being conveyed to onsite storage piles. The slag storage/transfer building will provide an enclosure while slag is loaded onto trucks for offsite disposal. Stormwater coming into contact with the stored slag will be routed by a system of ditches and culverts or inlets and storm sewers to the coal run-off pond for reduction of TSS. Expected pollutants from the slag handling activities are pH, suspended solids, and metals.

### 3.2.2 Coal to Liquids Process Combined Cycle Plant and Product Storage

This area is expected to comprise approximately 205 acres at an elevation of 1110, and include materials handling, coal to liquids processing equipment and operations, the combined cycle plant for the onsite generation of electrical power and the Product Storage Area Tank Farm. This area will also include many of the ancillary operations including the wastewater treatment equipment and facilities for process and stormwaters, cooling towers and the air separation facility. These operations include enclosed conveyors for handling of the coal used for process feed ash and slag. This area also includes liquids and gas handling systems which will be enclosed operations along with process vessels and piping, storage tanks and structures associated with the gasification, syngas clean up and F-T areas. The combined cycle plant is also located in this area and will consist of steam turbine generators (STG), combustion turbine generators (CTG), and heat recovery steam generators (HRSG). The sulfur recovery units are also located in this area. These operations will be enclosed and the recovered materials stored in covered areas, not directly exposed to reduce the potential for stormwater impacts.



The combined cycle unit includes a wet STG and an auxiliary boiler with its own stack. The combined cycle unit consists mainly of an STG and two CTG/HRSG trains, each of which contains a CTG that exhausts to a HRSG, which in turn exhausts to a Stack.

Each of the turbine generators is connected electrically, through a circuit breaker, to the low side of its own Generator Step-Up (GSU) Transformer. Electricity is transmitted across the fence to the Switchyard from the high side of the GSUs.

Fly ash from the facility will either be transferred back to the Coal Milling and Drying Unit or to one of the facility's fly ash silos for disposal or use. Fly ash will be pneumatically conveyed from the silos to trucks for transport offsite. A fabric bin vent filter will control particulate emissions associated with the transfer of the fly ash from the silo to the truck. Stormwater coming into contact with the fly ash storage/transfer area will be routed by a system of ditches and culverts or inlets and storm sewers to the site runoff pond for reduction of TSS. Discharge from the site runoff pond will then be combined with process waste water prior to discharge to the Ohio River. Expected pollutants from fly ash handling include pH, TSS, and metals.

The liquid product produced at the facility will be stored in 3-million gallon aboveground storage tanks (AST) equipped with secondary containment structures. Tanks will be dedicated to the storage of diesel fuel and others will be dedicated to the storage of naphtha fuel. Product from the facility will be loaded into barges, railcars, and/or trucks via submerged filling or pressurized transfer. Facilities will be provided for product load-out in a manner that reduces the potential for spills and contact with stormwater. Potential pollutants will include oil/grease and naphthalene.

The air separation units, cooling towers, wastewater treatment and a laydown storage area (primarily for use during construction and for future expansion) are the other major structures located in this area.

Various chemicals used for the CTL process will be stored at the chemical handling and storage area either inside the building or in ASTs that are equipped with secondary containment. Stormwater should not come into contact with these materials.



### 3.2.3 Administrative Areas

The administrative offices will be located along the northwest portion of the site at an elevation of 1042 and comprise approximately 4 acres. The expected pollutants from this area are expected to include suspended solids and oil and grease, primarily from the runoff from paved parking areas. These stormwaters from these areas will be routed to a dedicated outfall and into the Ohio River.

### 3.2.4 Flare

A portion of the air emissions generated from the operations will require destruction of carbon monoxide. This destruction will be accomplished through the use of natural gas and or tail gas from the process. This area is approximately 8 acres and is located to the west of the main operating facility. Stormwaters discharges from this area will be routed to combine with other discharges to the Ohio River.

### 3.2.5 Non-Industrial Stormwater

Approximately 292 acres of the property will be non-industrial. This area generally includes areas to the north, east and west of the site and is composed of graded and vegetated slopes and undisturbed areas of the property. The stormwater runoff from these areas will be routed through various existing unnamed tributaries.

## 3.3 STORMWATER CONTROLS

Stormwater controls at the facility will include physical units such as the coal runoff pond and settling basin. Roadways will include paved and unpaved areas and there will also be lined ditches and channels for the conveyance of stormwaters from the site.



In addition, other practices such as good housekeeping, preventative maintenance, spill prevention and response procedures, and employee training will also be employed throughout all portions of the facility in order to reduce the potential for stormwater contamination at the site.

Stormwater at the site which has a low potential for oil and grease contamination will be directed by a system of ditches and culverts or inlets and storm sewers to the site runoff pond for removal of TSS. Discharge from the site runoff pond will then be combined with process waste water prior to discharge to the Ohio River via Outfall 001 (Figure 4). Stormwater at the site coming into contact with areas that have the potential for oil and grease contamination will be routed by gravity to the oil/water separator. Water discharged from the oil/water separator is then routed to the facility's settling basin. Discharge water from the settling basin will then be combined with process wastewater and discharge from the site runoff pond prior to discharge to the Ohio River via Outfall 001. In addition to the settling basin, site runoff pond, and system of ditches, culverts, inlets, and storm sewers, other structural controls that will be utilized include roof cover at material handling and storage areas, storage silos for waste materials generated at the facility, pneumatic transfer of product and waste materials to reduce the likelihood of spills/leaks, and secondary containment structures to prevent the release of materials from reaching surface waters. Nonstructural controls that will be utilized at the facility include appropriate housekeeping procedures such as the use of spill cleanup kits that can quickly be used to clean up small spills/leaks, preventative maintenance such as the routine inspection of onsite storm drains to remove trash and debris, spill prevention and response procedures, and employee training on the importance of stormwater pollution prevention measures.

### 3.3.1 Stormwater Controls – Raw Material

Stormwater runoff from the coal and biomass (feedstock) storage piles will be routed by a system of ditches and culverts or inlets and storm sewers to the coal pile runoff pond which will provide sufficient retention time to reduce TSS prior to discharge to the Ohio River. Nonstructural controls that will be utilized at the feedstock storage pile include appropriate housekeeping procedures such as the use of spill cleanup kits that can quickly be used to clean up small spills/leaks from feedstock pile equipment, preventative maintenance such as the

