

TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

APPENDIX 1

Water Management - Using Ranney Well Structure
instead of a River Intake Structure. (Case 15
Basis)

APPENDIX 1

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Rev A 3-3-82
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APPENDIX 1

A1.1 PRELIMINARY WATER MANAGEMENT DESIGN BASIS

A1.1.1 Design Objective

Water management for the Kentucky Coal to gasoline project encompasses the treatment of raw water entering the plant and treatment of the plant water and waste streams to make them suitable for continuous use and safe disposal. The philosophy of the water management scheme is based on:

- a) A qualitatively adequate water supply from the Ranney Well.
- b) Discharge of treated plant waste water to the Ohio River.

This design basis presents an overall general description and principle design parameters of the processes that have been selected to make the raw water suitable for its intended use, plant water acceptable for reuse, treatment of plant effluent for allowable discharge to the river. Detailed descriptions and design considerations of each system are covered separately in the design basis for each as listed under Section 2.0. The design basis presented in this document is based on Case 15.

A1.1.2 Scope

The following water treatment systems are included in the water management design:

- o Potable water treatment
- o Raw water treatment
- o Boiler makeup water treatment
- o Condensate treatment
- o Utility cooling tower makeup treatment
- o Process cooling tower makeup treatment
- o Boiler blowdown treatment

A1.1.2 Scope (Continued)

- o MTG waste treatment
- o Stripped gas liquor treatment
- o Storm water and oily water treatment
- o Sanitary waste treatment
- o FGD System waste handling
- o Coal Handling system effluent treatment
- o Ash Handling system makeup water treatment
- o TDS Reduction Evaporator

A1.1.3 Design Criteria

A1.1.3.1 Major design criteria for the water management scheme are the following:

- o The water management scheme is based on Ranney Well water only.
- o Design the equipment for treatment of the well water based on Ranney's water analysis dated February 9, 1982. (See Attachment 1).
- o Ray water supply is unlimited for overall usage, including requirements for coal and ash handling as well as FGD system operation and cooling tower makeup.
- o Provide raw water storage within the plant boundary with a seven day capacity based on average raw water consumption rate.
- o Biologically treat and process plant waste water utilizing a two stage aeration/clarification system followed by sand and activated carbon filtration. Plant waste water consists predominantly of stripped gas liquor and MTG reaction water, and pretreated oily water sewer effluent.
- o The waste waters that will be discharged from the plant into the Ohio River will be treated and monitored to the extent that safe discharge to the Ohio River will be assured.

A1.1.4 Process Description

The overall water management configuration is represented in block flow diagram. Details of each treatment process are as follows:

A1.1.4.1 Raw Water Supply - Ranney well water is pumped into a seven-day capacity storage pond located within the plant boundary.

A1.1.4.2 Raw Water Treatment - Water from the raw water storage pond is pumped through a sand filter to remove suspended solids. The water is chlorinated prior to filtration by in-line chlorination to remove organic material. The filtered water is collected at the filtered water reservoir for use as boiler feed water makeup, cooling tower makeup, utility water, process water, firewater, and solids handling system makeup.

A1.1.4.3 Potable Water - The potable water supply is drawn upstream from the raw water storage pond and treated in the following manner prior to distribution within the plant:

1. In-Line Chlorination
2. Filtration (sand)
3. Filtration (activated carbon)
4. Post Chlorination

The sand filters remove suspended material from the water. The activated carbon filters remove residual free chlorine and organics. Following the filtration, the water is post chlorinated and pumped to potable water storage tanks for distribution.

A1.1.4.4 Boiler Feed Makeup Treatment System (Demineralizer) - The boiler feedwater treatment system encompasses activated carbon filtration and demineralization by ion exchange. The treatment system proceeds as follows:

1. Filtration (activated carbon)
2. Reverse Osmosis
3. Cation Exchange
4. Anion Exchange

Al.1.4.4 Boiler Feed Makeup Treatment System
(Demineralizer) (Continued)

The ion exchange demineralizers consist of strong acid cation exchangers, and strong basic anion exchangers which contain a mixture of strong acid cation resin and strong basic anion resin. The water initially flows through activated carbon filters before flowing through the reverse osmosis unit for ion removal. The next unit is the cation exchanger where the remaining cations are exchanged with hydrogen ions. The water is then pumped through the anion unit for the removal of the remaining anions, CO₂, and silica in exchange for hydroxyl ions.

Demineralized water is routed to a storage tank for boiler makeup.

Al.1.4.5 Condensate Mixed Bed Polishing - Condensate will be treated in a mixed bed ion exchange polishing system. The condensate polishing system is a high flow rate, externally regenerated mixed bed design sized to treat 100 percent of the boiler condensate flow on a continuous basis. Each mixed bed polisher contains a mixture of strong acid cation resin and strong basic anion resin. The condensate polishers perform a dual function:

- o By retaining suspended material, mainly corrosion products, they function as filter units.
- o By exchanging dissolved ions against hydrogen and hydroxyl ions, they function as demineralizers.

The condensate is then sent to the treated condensate storage tank for reuse as boiler makeup.

These polishers may become exhausted due to the high pressure drop caused by the suspended material removed from the condensate, or by a rise in effluent conductivity or silica levels due to depletion of hydrogen and/or hydroxyl ions from the ion-exchange resin.

To restore the polishers to their intended function, the resin is sluiced from the service vessels into appropriate regeneration columns. The resin is then restored to its service function by backwashing only or by complete regeneration depending on the cause of the unit exhaustion. Regeneration is accomplished by application of sulfuric acid and sodium hydroxide to the appropriate resin.

A1.1.4.6 Raw Water/Condensate Treatment System Wastes - Various wastes are generated in operating the raw water and condensate treatment system. The individual wastes from these systems are handled with a sludge thickener that is provided to receive the backwash and rinse water from the potable and raw water activated carbon filters and sand filters. The clean supernatant from the thickener is routed to the supernatant collection sump where it is pumped back to the filtering system.

Reverse osmosis concentrate, regeneration waste from the ion-exchanger and condensate polishing unit are combined with the clean storm water that is discharging to the treated effluent pond. Backwash water from the activated carbon filters is also recovered and pumped back to backwash and supernatant collection sump.

Sludge resulting from the operation of the potable water treatment system and the raw water pretreatment system is classified nonhazardous and will be sent to landfill following dewatering.

A1.1.4.7 Utility and Process Cooling Tower Makeup - Makeup requirement for the cooling towers is filtered well water and is drawn from the filtered water reservoir mentioned under 4.1. Blowdown from the process and the utility cooling tower is discharged to the effluent treatment pond.

A1.1.4.8 Effluent Treatment - Oily water is initially treated in API separators and dissolved Air Flotation Units (DAF) to remove free oil and suspended material. The DAF effluent is then combined with the other process plant waste streams in the equalization pond. Other process plant waste streams include stripped gas liquor, Mobil MTG reaction water, Texaco POX water, SNG condensate, and miscellaneous plant process effluents such as equipment leakage, wash water, boiler blowdown, etc. The pond serves to absorb any flow and chemical composition swings prior to the biological treatment. Off-spec waste is diverted to the off-spec collection pond and recycled back to the equalization pond. The collected water is initially pumped to a primary aeration basin, where Biological Oxygen Demand for the water is reduced. Phosphate is added at the aeration tank, then the aerated waste is pumped into a clarifier where suspended solids are collected. Next, the partially treated waste flows to a secondary aeration basin, where it will be further aerated. After extended aeration/contact time, the water is pumped to a secondary clarifier unit, where polyelectrolyte is added to obtain more efficient suspended solids removal.

A1.1.4.8 Effluent Treatment (Continued)

Effluent from the second clarifier will be recycled to the off-spec collection pond if it is not acceptable. The clarifier overflow is routed through sand filters for the removal of residual suspended carbon material. The waste water is then treated by activated carbon filters for further removal of residual organics and toxic substances. Then it is pumped to the effluent treatment pond where it is blended with other plant wastes for pH adjustment, monitoring, and eventual discharge to the Ohio River. Part of the biosludge from the primary and secondary clarifier is routed to a sludge thickener for concentration. The balance of the sludge is recycled to the aeration tanks.

A1.1.4.9 Sanitary Wastewater Treatment - The sanitary sewage, comprised primarily of human liquid and solid wastes, is discharged to a biological treatment facility. The solid wastes are grinded to pulp prior to biological aeration in which the sewage is decomposed by an aerobic digestion process. A portion of the biological sludge is dewatered and incinerated and the remaining is recycled. The final effluent after sand filtration and post chlorination is discharged to the effluent treatment pond.

A1.1.4.10 Unit 46 - FGD Unit - The sludge from the Flue Gas Desulfurization system is concentrated in the thickener. The slurry from the bottom of the thickener is pumped to vacuum filters where a filter cake of approximately 60 percent solids is discharged to the Fly Ash Stabilization system of the Boiler Ash Handling Unit (Unit 03).

Blowdown from the scrubbing water surge tank is combined with the blowdown from ash handling and discharged to TDS concentrator.

A1.1.4.11 Coal Wet Screening and Wash Water Handling (Unit 20) - Several wet screens are employed to wash down any fines (minus 1/4") from the coarse coal (2" x 1/4") which is fed directly to Lurgi gasifiers.

The wash down water from the wet screening system is sent to a clarifier to settle the sludge. The sludge is further concentrated in the thickener. A portion of thickener overflow is pumped to the biological treatment system, the remaining is recycled back to wet screening. The thickener sludge is sent to dewatering centrifuges where minus 1/4" size fines are collected.

A1.1.4.11 Coal Wet Screening and Wash Water Handling
(Unit 20) (Continued)

The centrifuge discharge is collected in the clarified water head tank for recirculation. Makeup water is added to compensate for waste retained with the coal particulates and blowdown.

A1.1.4.12 Ash Handling Effluent Treatment -

1. Gasifier Effluent Treatment - The quenched gasifier ash and its sluiced water are collected in a holding sump. The coarse ash is directly conveyed to landfill. The slurry is pumped to dewatering cyclones and then to plate thickeners for further clarification. The thickened sludge is filtered and discharged to landfill. The clarified water from the plate clarifier and dewatering cyclone is recirculated. Makeup water is added for water losses due to evaporation by quenching, retained water is sludge and blowdown.
2. Boiler Effluent Treatment - The fly ash from the boilers is discharged dry to stabilize the sludge from FGD unit before disposing to landfill.

The fine ash is thickened in a plate clarifier and dewatered for eventual discharge to the landfill.

The effluent water from the clarifier and dewatering press is recycled back to the system. makeup water is continuously added due to water losses and blowdown.

A1.1.4.13 Utility Water - The utility water requirements for the plant are drawn from the filtered water reservoir. Utility water is primarily required for area washdown water. Utility water so used will be collected by the oily water runoff system and eventually returned to the biological treatment system.

A1.1.4.14 Storm and Oily Water Separation System - The plot is divided into clean and contaminated drainage areas for the purpose of collecting and segregating clean and contaminated storm runoff.

A1.1.4.14 Storm and Oily Water Separation System
(Continued)

The clean storm sewer (CSS) collects all runoff from clean areas and impounds it for discharge to the river if the water quality is environmentally acceptable. The two clean storm ponds provided are sized on the basis of impounding the runoff resulting from a 10-year frequency, one day duration storm event equivalent to 4.9 inches total rainfall collected over the surface of the clean storm sewer watershed.

The oily water storm sewer (OWS) collects oily storm runoff and washdown from contaminated process areas and tankage. The oily water process sewer (OPS) collects equipment drains and washdown. Oily water from both sewers flows to the oily water separation system where free oil is skimmed off and sludge is collected and removed. The overflow from the oily water separator is routed through an air flotation unit for final oil removal prior to being pumped to biological treatment. Two oily water ponds are provided to impound oily water during a storm event. The ponds are sized to impound the runoff resulting from a 25-year frequency, one day duration, storm event equivalent to 5.7 inches total rainfall collected over the surface of the oily water storm sewer watershed plus storm event.

Normally, under dry weather conditions, the OWS flow is to the oily water separator. During a storm event, the initial flush of the CSS is automatically diverted to the oily water ponds. During an extended storm event, the OWS may be manually diverted to the clean storm ponds. Oily water impounded in the oily water ponds during a storm event is pumped to biotreating through oily water separator and air flotation unit.

APPENDIX 1

ATTACHMENT 1 - RAW WATER ANALYSIS

<u>CONSTITUENT</u>	<u>PPM</u>	
Total Dissolved Solids		451
Total Alkalinity	CaCO ₃	68
Total Hardness	CaCO ₃	332
pH		7.05
Total Suspended Solids		10
Calcium (Ca ⁺⁺)	CaCO ₃	216
Magnesium (Mg ⁺⁺)	CaCO ₃	-
Sodium (Na ⁺)	CaCO ₃	-
Hydrogen (H ⁺)	CaCO ₃	-
Potassium (K ⁺)	CaCO ₃	-
Ammonium (NH ₄ ⁺)	CaCO ₃	-
TOTAL CATIONS	CaCO ₃	332
Bicarbonate (HCO ₃)	CaCO ₃	68
Carbonate (CO ₃)	CaCO ₃	-
Hydroxide (OH)	CaCO ₃	-
Chloride (Cl)	CaCO ₃	7
Sulfate (SO ₄)	CaCO ₃	254
Nitrate (NO ₃) [*]	CaCO ₃	1
Fluoride (F)	CaCO ₃	1.9
Phosphate (PO ₄)	CaCO ₃	0.14
Sulfite (SO ₃)	CaCO ₃	-
Thiocyanide (CNS)	CaCO ₃	-
Organic Acids	CaCO ₃	-
Cyanide (CN)	CaCO ₃	-
TOTAL ANIONS	CaCO ₃	332
Iron Total	Fe	0.78
Carbon Dioxide, Free	CO ₂	12
Silica	SiO ₂	2.1
Residual Chlorine	Cl ₂	-
Organic Chemicals		-
Manganese	Mn	0.15
Copper	Cu	<0.01

* Sulfate ppm has been increased to make the ions balanced.

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ATTACHMENT 2

AVERAGE COMPOSITION OF AQUEOUS PRODUCT
FROM FIXED-BED MTG PROCESS

Formic Acid	<5 ppm (=Wt/ml MTG H ₂ O)
Acetic Acid	525
Propanic Acid	90
Isobutyric Acid	<5
Sutyric Acid	10
Methanol	150
Ethanol	20
1-Propanol	5
2-Propanol	15
1-Butanol	<5
t-Butanol	5
2-Butanol	<5
2-Methylpropanol	<5
Acetaldehyde	70
Propanol	5
Acetone	550
Methylethyketone	125
3-Methyl-2-Butanone	5
2-, +3-Pentanones	15
Dimethylether	Trace (10 ppm)
Acid Number (mg KOH/gm)	0.56
Dissolved gasoline range hydrocarbons =	100 ppm
BOD (mg O ₂ /l)	1,400
COD (mg O ₂ /l)	2,200
pH	3.8

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APPENDIX 1

ATTACHMENT 3

STRIPPED GAS LIQUOR ANALYSIS
(Biological Treatment System Influent)

pH Value	6.1
Conductivity in micro S cm ⁻¹	2,600
Chemical Oxygen Demand, mg/l	980
Volatile Acids, mg/q, Acetic Acid	216
Phenols, mg/l, m-cresol	0.5
Ammonia, mg/l as Nitrogen	344
Fluoride, mg/l as F-	46
Oxygen absorbed, mg/l	300
Sulphides, mg/l as S=	5
Thiocyanates, mg/l as CNS-	134
Cyanides, mg/l as CN-	1
Chlorides, mg/l as Cl-	485
Phosphates, mg/l as PO ₄ =	5.4
Sulphur, mg/l as S	140
Sulphates, mg/l as SO ₄ =	70
Silicates, mg/l as SiO ₃	12
Potassium, mg/l as K+	0.3
Sodium, mg/l as Na+	4.3
Nitrites, mg/l as NO ₂	0.6
Total Solids, mg/l	548
Calcium, mg/l as Ca++	2.0
Magnesium, mg/l as Mg++	0.8
Iron, mg/l as Fe++	6.8
Copper, mg/l as Cy++	<0.1
Nickel, mg/l as Ni++	<0.1
Phenol, mg/l	11
Organic Acid	241
Organic Basis, mg/l	<150

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FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

APPENDIX 1

A1.2 WATER AND IONIC BALANCES FOR BFD
No. 835504-00-R-043 Rev. A (Case 15)

WATER SOURCE

WATER & IONIC BALANCE - BFD 835504-00-R-043 REVA

Date 3-8-82

Cont. No. 835504

By 1/10

S T R E A M	1	RAN WATER FROM RAINNEY WELL
	2	FAVORITE TO REAR WATER SYSTEM
	3	COLEEN FEED WATER MAKEUP
	4	WATER TREATMENT TOWER MAKEUP
	5	DEMINERALIZED WATER

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		1	2	3	4	5
Total Dissolved Solids		451	451	443	443	2
Total Alkalinity	CaCO ₃	68	68	54	54	0
Total Hardness	CaCO ₃	332	332	332	332	0
pH		7.05	7.05	6.61	6.64	
Total Suspended Solids		10	10	0	0	0
Calcium (Ca++)	CaCO ₃	216	216	216	216	0
Magnesium (Mg++)	CaCO ₃	116	116	116	116	3
Sodium (Na+)	CaCO ₃	-	-	-	-	4.5
Hydrogen (H+)	CaCO ₃	-	-	-	-	0
Potassium (K+)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ +) TOTAL CATIONS	CaCO ₃	-	-	-	-	-
	CaCO ₃	332	332	332	332	4.5
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	68	68	54	54	0
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	4.5
Chloride (Cl ⁻)	CaCO ₃	7	7	21	21	0
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254	254	0
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	1	1	0
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9	1.9	0
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14	0.14	0
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	332	332	4.5
Iron Total	Fe	0.78	0.78	0	0	0
Carbon Dioxide, Free	CO ₂	12	12	25	25	0
Silica	SiO ₂	2.1	2.1	2.1	2.1	20.01
Residual Chlorine	Cl ₂	-	-	1.5	1.5	0
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0.15	0.15	0.15	0
Copper	Cu	<0.01	<0.01	<0.01	<0.01	0
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-

USE OR DISCLOSURE OF REP. DATA IS SUBJECT TO THE RESTRICTIONS OF THE NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE

WATER & IONIC BALANCE - BFD 855504-00-R-043 REV. A

S
T
R
E
A
M

- 6 PROCESS COOLING TOWER MAKEUP
- 7 STEAM CONDENSATE
- 8 NEUTRALIZED SLAG EFFLUENT
- 9 BOILER FEED WATER
- 10 PROCESS WATER INLETS

Date 3-8-82
 Cont. No. 83502
 By 2/10

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		6	7	8	9	10
Total Dissolved Solids		443	2		20.1	443
Total Alkalinity	CaCO ₃	54	2		20.1	54
Total Hardness	CaCO ₃	332	0		0	332
pH		6.64		7		6.64
Total Suspended Solids		0	0		0	0
Calcium (Ca++)	CaCO ₃	216	-		0	216
Magnesium (Mg++)	CaCO ₃	116	-		0	116
Sodium (Na+)	CaCO ₃	-	2		20.1	-
Hydrogen (H+)	CaCO ₃	-	-		-	-
Potassium (K+)	CaCO ₃	-	-		-	-
Ammonium (NH ₄ +))	CaCO ₃	-	-		-	-
TOTAL CATIONS	CaCO ₃	332	2		20.1	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	0		0	54
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-		-	-
Hydroxide (OH ⁻)	CaCO ₃	-	2		20.1	-
Chloride (Cl ⁻)	CaCO ₃	21	0		0	21
Sulfate (SO ₄ ⁻)	CaCO ₃	254	0		0	254
Nitrate (NO ₃ ⁻)	CaCO ₃	1	0		0	1
Fluoride (F ⁻)	CaCO ₃	1.9	0		0	1.9
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0		0	0.14
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-		-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-		-	-
Organic Acids	CaCO ₃	-	-		-	-
Cyanide (CN ⁻)	CaCO ₃	-	-		-	-
TOTAL ANIONS	CaCO ₃	332	2		20.1	332
Iron Total	Fe	0	0		0	0
Carbon Dioxide, Free	CO ₂	25	0		0	25
Silica	SiO ₂	2.1	20.05		0.05	2.1
Residual Chlorine	Cl ₂	1.5	0		0	1.5
Organic Chemicals		-	-		-	-
Manganese	Mn	0.15	0		0	0.15
Copper	Cu	2.01	0		0	2.01
Hydrogen Sulfide	H ₂ S	-	-		-	-
Other Trace Metals		-	-		-	-
Phenol	C ₆ H ₆	-	-		-	-
Sulfur	S	-	-		-	-
Volatile Acid		-	-		-	-
TOC		-	-		-	-
Oil & Grease		-	-		-	-
Temperature	°F	-	-		-	-
COD		-	-		-	-
BOD		-	-		-	-
Flow Rate	GPM	5284	7234	1086	12391	200

USE OR INCLUSION OF TEST DATA
 IS SUBJECT TO THE AGREEMENT IN THE
 PRICE PAGE AT THE TIME OF THIS REPORT

WATER SOURCE	
WATER & IONIC BALANCE - BFO 835604 - 00-R-043 REV. A	
S T R E A M	11 FIRE WATER
	12 TITTY WATER
	13 MAKEUP WATER FOR D.J.H. NAVIGATION
	14 LARGE STEEL GAL 21210R
	15 EQUALIZATION POND EFFLUENT

Date 3-8-82
 Cont. No. 835501
 By 3/10

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		11	12	13	14	15
Total Dissolved Solids		443	443	443	1335	1045
Total Alkalinity	CaCO ₃	54	54	54	-	12
Total Hardness	CaCO ₃	332	332	332	9.3	67
pH		6.64	6.64	6.64	6.1	7.5
Total Suspended Solids		0	0	0	-	-
Calcium (Ca++)	CaCO ₃	216	216	216	5	43
Magnesium (Mg++)	CaCO ₃	116	116	116	3.3	24
Sodium (Na+)	CaCO ₃	-	-	-	9.4	144
Hydrogen (H+)	CaCO ₃	-	-	-	-	-
Potassium (K+)	CaCO ₃	-	-	-	0.4	7.3
Ammonium (NH ₄ +)	CaCO ₃	-	-	-	1229	858
TOTAL CATIONS	CaCO ₃	332	332	332	1247	1069
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	54	-	12
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	21	21	684	483
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254	73	105
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	1	86	68
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9	122	66
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14	9	5.9
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	38	26.1
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	115	80.6
Organic Acids	CaCO ₃	-	-	-	208	209
Cyanide (CN ⁻)	CaCO ₃	-	-	-	1.9	1.3
TOTAL ANIONS	CaCO ₃	332	332	332	1336	1069
Iron Total	Fe	0	0	0	6	4
Carbon Dioxide, Free	CO ₂	25	25	25	-	0.4
Silica	SiO ₂	2.1	2.1	2.1	12	8.7
Residual Chlorine	Cl ₂	1.5	1.5	1.5	-	7.3
Organic Chemicals		-	-	-	-	117
Manganese	Mn	0.15	0.15	0.15	-	-
Copper	Cu	0.01	0.01	0.01	0.1	0.1
Hydrogen Sulfide	H ₂ S	-	-	-	5	3.2
Other Trace Metals		-	-	-	32	26
Phenol	C ₆ H ₆	-	-	-	16	11
Sulfur	S	-	-	-	140	98
Volatile Acid		-	-	-	216	15.1
TOC		-	-	-	337	23.1
Oil & Grease		-	-	-	-	13
Temperature	°F	-	-	-	-	-
COD		-	-	-	980	959
BOD		-	-	-	650	622
Flow Rate	CPM	0	1.02	1210	3711	1017

USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTION ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE	
WATER & IONIC BALANCE - BFD 835504-CO-R-043 REV. A	
S T R E A M	16 BID SLUDGE RECYCLE
	17 FILTER WATER PROVIDED BY DISINFECTION
	18 EFFLUENT TO THE T-12 RIVER
	19 ACT. CARB. FILTER EFFLUENT
	20 MIDDLE "M.T.S." CONDENSATE

Date 3-8-82
 Cont. No. 933504
 By 4/10

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		16	17	18	19	20
Total Dissolved Solids					143	-
Total Alkalinity	CaCO ₃		191	137	54	-
Total Hardness	CaCO ₃		1173	1534	332	-
pH			7.1	7	6.64	3.8
Total Suspended Solids			0	-	0	-
Calcium (Ca++)	CaCO ₃		743	1314	216	-
Magnesium (Mg++)	CaCO ₃		207	227	116	-
Sodium (Na+)	CaCO ₃		137	125	-	-
Hydrogen (H+)	CaCO ₃		-	-	-	-
Potassium (K+)	CaCO ₃		-	-	-	-
Ammonium (NH ₄ +))	CaCO ₃		-	-	-	-
TOTAL CATIONS	CaCO ₃		1220	1666	332	-
Bicarbonate (HCO ₃ ⁻)	CaCO ₃		128	127	54	-
Carbonate (CO ₃ ⁻)	CaCO ₃		-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃		-	-	-	-
Chloride (Cl ⁻)	CaCO ₃		90	284	21	-
Sulfate (SO ₄ ⁻)	CaCO ₃		1094	652	299	-
Nitrate (NO ₃ ⁻)	CaCO ₃		35	515	1	-
Fluoride (F ⁻)	CaCO ₃		6.7	46	1.9	-
Phosphate (PO ₄ ⁻)	CaCO ₃		0.6	15	0.14	-
Sulfite (SO ₃ ⁻)	CaCO ₃		-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃		-	-	-	-
Organic Acids	CaCO ₃		-	-	-	529
Cyanide (CN ⁻)	CaCO ₃		-	-	-	-
TOTAL ANIONS	CaCO ₃		1323	-	332	-
Iron Total	Fe		-	-	0	-
Carbon Dioxide, Free	CO ₂		19	24	25	-
Silica	SiO ₂		-	8	2.1	-
Residual Chlorine	Cl ₂		-	2	0	-
Organic Chemicals			-	-	-	990
Manganese	Mn		-	0.2	0	-
Copper	Cu		-	-	0	-
Hydrogen Sulfide	H ₂ S		-	-	-	-
Other Trace Metals			-	-	-	-
Phenol	C ₆ H ₆		-	-	-	-
Sulfur	S		-	-	-	-
Volatile Acid			-	-	-	-
SLUDGE	lb/hr		900	-	-	-
Oil & Grease			-	-	-	100
Temperature	°F		-	-	-	-
COD			-	10-15	-	2200
BOD			-	<5	-	1400
Flow Rate	GPM		5	4727	9371	5809
						497

USE TO OBTAIN SLUDGE RATE
 IS SUBJECT TO THE REFINER'S ENGINE
 NOTICE PAGE AT THE TIME OF THIS REPORT

WATER SOURCE	
WATER & IONIC BALANCE - BFD B35504-00-R-043 REV. A	
S T R E A M	21 LIQUIDIFIED MANURE W/ 1:1 EFFluent
	22 BIO-TREATED EFFLUENT AFTER FILTER
	23 RAW SEWAGE INFLUENT
	24 MAKE-UP WATER TO BOILER ASH HANDLING
	25 MAKE-UP WATER TO GASIFIER ASH HANDLING

Date 3-8-82
 Cont. No. B35504
 By 5/10

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		21	22	23	24	25
Total Dissolved Solids		528	2873	535	443	443
Total Alkalinity	CaCO ₃	68	160	65	54	54
Total Hardness	CaCO ₃	332	1903	305	332	332
pH		7.0	7.5	6.7	6.6	6.6
Total Suspended Solids		-	25	100	0	0
Calcium (Ca++)	CaCO ₃	216	1879	205	216	216
Magnesium (Mg++)	CaCO ₃	112	24	116	116	116
Sodium (Na+)	CaCO ₃	42	14	25	-	-
Hydrogen (H+)	CaCO ₃	-	-	-	-	-
Potassium (K+)	CaCO ₃	-	0.5	-	-	-
Ammonium (NH ₄ +))	CaCO ₃	-	-	40	-	-
TOTAL CATIONS	CaCO ₃	297	2042	386	332	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	68	160	65	54	54
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	423	25	21	21
Sulfate (SO ₄ ⁻)	CaCO ₃	297	172	274	254	254
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1039	20	1.0	1.0
Fluoride (F ⁻)	CaCO ₃	2	85	1.9	1.9	1.9
Phosphate (PO ₄ ⁻)	CaCO ₃	0.1	30	0.14	0.14	0.14
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	25	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	390	2252	386	332	332
Iron Total	Fe	-	-	0	0	0
Carbon Dioxide, Free	CO ₂	1.3	10	25	25	25
Silica	SiO ₂	2.1	8.7	2.1	2.1	2.1
Residual Chlorine	Cl ₂	1.5	-	0	1.5	1.5
Organic Chemicals		-	-	-	-	-
Manganese	Mn	-	-	0	<0.15	<0.15
Copper	Cu	-	-	0	<0.01	<0.01
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	210	-	-	-
Oil & Grease		10	21	-	-	-
Temperature	°F	-	-	75	75	75
COD		90	30-45	300	-	-
BOD		20	10	200	-	-
Flow Rate	GPM	795	4106	40	22	250

USE OR DISCLOSURE OF REPORT DATA
 IS SUBJECT TO THE RESTRICTIONS ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE

WATER & IONIC BALANCE - BFD 835504-00-R-043 REV. A

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- 26 MAKE-UP WATER TO COAL WASH HANDLING
- 27 MAKE-UP WATER TO FLUE GAS DESULFURIZATION
- 28 TOTAL BIOLOGICAL & OILY SLUDGE TO INCINERATION
- 29 COARSE ASH TO LANDFILL
- 30 BOILER BOTTOM ASH TO LANDFILL

Date 3-8-82
Cont. No. 835504
By 6/10

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		26	27	28	29	30
Total Dissolved Solids		443	443	-	-	-
Total Alkalinity	CaCO ₃	54	54	-	-	-
Total Hardness	CaCO ₃	332	332	-	-	-
pH		6.6	6.6	-	-	-
Total Suspended Solids		0	0	-	-	-
Calcium (Ca++)	CaCO ₃	216	216	-	-	-
Magnesium (Mg++)	CaCO ₃	116	116	-	-	-
Sodium (Na+)	CaCO ₃	-	-	-	-	-
Hydrogen (H+)	CaCO ₃	-	-	-	-	-
Potassium (K+)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ +))	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	332	-	-	-
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	-	-	-
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	21	-	-	-
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	-	-	-
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0	1.0	-	-	-
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	-	-	-
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	-	-	-
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	-	-	-
Iron Total	Fe	0	0	-	-	-
Carbon Dioxide, Free	CO ₂	25	25	-	-	-
Silica	SiO ₂	2.1	2.1	-	-	-
Residual Chlorine	Cl ₂	1.5	1.5	-	-	-
Organic Chemicals		-	-	-	-	-
Manganese	Mn	<0.15	<0.15	-	-	-
Copper	Cu	<0.01	<0.01	-	-	-
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
SLUDGE (BIOLOGICAL)	LBS./HR.	-	-	11985	-	-
TOC		-	-	-	-	-
ASH	LBS./HR.	-	-	-	161,300	13160
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	200	742	19.0	30	2.5

USE OF CONCENTRATIONS OF METALS DATA IS SUBJECT TO THE RESTRICTIONS ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE	
WATER & IONIC BALANCE - BFD 835504-00-R-043 REV. A	
S T R E A M	31 TOTAL NON-HAZARDOUS SLUDGE TO LANDFILL
	32 TOTAL BLOWDOWN TO TDS CONCENTRATOR
	33 PROCESS COOLING TOWER BLOWDOWN
	34 UTILITY COOLING TOWER BLOWDOWN
	35 OILY WATER PRE-TREATMENT SYS. FEED

Date 3-8-82
 Cont. No. 835504
 By 7/15

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		31	32	33	34	35
Total Dissolved Solids		—	2579	1297	1297	441
Total Alkalinity	CaCO ₃	—	68	39	39	54
Total Hardness	CaCO ₃	—	1563	996	996	332
pH		—	6.8	7.4	7.4	6.7
Total Suspended Solids		—	0	0	0	150
Calcium (Ca ⁺⁺)	CaCO ₃	—	871	648	648	216
Magnesium (Mg ⁺⁺)	CaCO ₃	—	627	342	342	110
Sodium (Na ⁺)	CaCO ₃	—	325	—	—	—
Hydrogen (H ⁺)	CaCO ₃	—	—	—	—	—
Potassium (K ⁺)	CaCO ₃	—	100	—	—	—
Ammonium (NH ₄ ⁺)	CaCO ₃	—	—	—	—	—
TOTAL CATIONS	CaCO ₃	—	1923	996	996	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	—	68	39	39	54
Carbonate (CO ₃ ⁻)	CaCO ₃	—	—	—	—	—
Hydroxide (OH ⁻)	CaCO ₃	—	—	—	—	—
Chloride (Cl ⁻)	CaCO ₃	—	34	63	63	21
Sulfate (SO ₄ ⁻)	CaCO ₃	—	1817	885	885	252
Nitrate (NO ₃ ⁻)	CaCO ₃	—	1.5	3	3	1
Fluoride (F ⁻)	CaCO ₃	—	2.5	5.7	5.7	2
Phosphate (PO ₄ ⁻)	CaCO ₃	—	0.18	0.4	0.4	0.1
Sulfite (SO ₃ ⁻)	CaCO ₃	—	—	—	—	—
Thiocyanide (CNS ⁻)	CaCO ₃	—	—	—	—	—
Organic Acids	CaCO ₃	—	—	—	—	—
Cyanide (CN ⁻)	CaCO ₃	—	—	—	—	—
TOTAL ANIONS	CaCO ₃	—	1923	996	996	330
Iron Total	Fe	—	0	0	0	—
Carbon Dioxide, Free	CO ₂	—	23	3	3	25
Silica	SiO ₂	—	65	6.3	6.3	2.1
Residual Chlorine	Cl ₂	—	—	2	2	1.5
Organic Chemicals		—	—	—	—	—
Manganese	Mn	—	0.15	0.45	0.45	3.2
Copper	Cu	—	0.01	0.03	0.03	0.1
Hydrogen Sulfide	H ₂ S	—	—	—	—	—
Other Trace Metals		—	5.04	—	—	—
Phenol	C ₆ H ₆	—	—	—	—	—
Sulfur	S	—	—	—	—	—
Volatile Acid		—	—	—	—	—
TOC		—	—	—	—	—
SLUDGE (ASH)	LBS./HR.	435052	—	—	—	—
OIL & GREASE	°F	—	—	—	—	200
COD		—	—	—	—	300
BOD		—	—	—	—	200
Flow Rate	GPM	213	237	1586	2055	800

USE OF DISCLOSURE OF REPORT DATA
 IS SUBJECT TO THE PROVISIONS OF THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE
WATER & IONIC BALANCE - BFD 835504-00-R-043 REV. A

STREAM	36 CLEAN STORM WATER
	✓ FGD SLUDGE
	39 TREATED SANITARY EFFLUENT
	40 EFFLUENT TO TREATMENT POND

Date 3-2-22
 Cont. No. 835534
 By 2/17

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.			
		36	38	39	40
Total Dissolved Solids			-	492	
Total Alkalinity	CaCO ₃		-	53	137
Total Hardness	CaCO ₃		-	314	1532
pH			-	6.5	7.3
Total Suspended Solids			-	0	
Calcium (Ca++)	CaCO ₃		-	196	1314
Magnesium (Mg++)	CaCO ₃		-	116	227
Sodium (Na+)	CaCO ₃		-	52	124
Hydrogen (H+)	CaCO ₃		-	-	-
Potassium (K+)	CaCO ₃		-	-	-
Ammonium (NH ₄ +))	CaCO ₃		-	3	-
TOTAL CATIONS	CaCO ₃		-	367	1200
Bicarbonate (HCO ₃ ⁻)	CaCO ₃		-	53	137
Carbonate (CO ₃ ⁻²)	CaCO ₃		-	-	-
Hydroxide (OH ⁻)	CaCO ₃		-	-	-
Chloride (Cl ⁻)	CaCO ₃		-	27	284
Sulfate (SO ₄ ⁻²)	CaCO ₃		-	274	643
Nitrate (NO ₃ ⁻)	CaCO ₃		-	10	515
Fluoride (F ⁻)	CaCO ₃		-	1.9	46
Phosphate (PO ₄ ⁻³)	CaCO ₃		-	1.1	15
Sulfite (SO ₃ ⁻²)	CaCO ₃		-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃		-	-	63
Organic Acids	CaCO ₃		-	-	-
Cyanide (CN ⁻)	CaCO ₃		-	-	-
TOTAL ANIONS	CaCO ₃		-	367	1200
Iron Total	Fe		-	0	1
Carbon Dioxide, Free	CO ₂		-	31	15
Silica	SiO ₂		-	2.1	8
Residual Chlorine	Cl ₂		-	0.5	2
Organic Chemicals			-	-	-
Manganese	Mn		-	-	-
Copper	Cu		-	-	-
Hydrogen Sulfide	H ₂ S		-	-	-
Other Trace Metals			-	-	-
Phenol	C ₆ H ₆		-	-	-
Sulfur	S		-	-	-
Volatile Acid			-	-	-
TOC			-	-	-
SLUDGE	lbs. / hr.		206,000	-	-
Temperature	°F		-	75	-
COD			-	30	10-15
BOD			-	20	45
Flow Rate	GPM		0	180	38

THIS ANALYSIS OF WATER QUALITY IS SUBJECT TO THE RESTRICTIONS AND LIMITATIONS OF THE STANDARD METHODS.

WATER SOURCE	
WATER & IONIC BALANCE - BFD 835504-00-R-043 REV. A	
S T R E A M	41 SLUDGE FROM RAW WATER TREATMENT
	42 FLY ASH
	43 SLUDGE FROM SANITARY AND OILY-WATER TREATMENT
	44 BLOWDOWN FROM BOILER ASH HANDLING UNIT
	45 RDT TREATMENT EFFLUENT BEFORE FILTER

Date 3-8-22
 Cont. No. 835504
 By 9/17

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		41	42	43	44	45
Total Dissolved Solids		—	—	—	2654	2277
Total Alkalinity	CaCO ₃	—	—	—	54	167
Total Hardness	CaCO ₃	—	—	—	1530	1902
pH		—	—	—	6.6	7.5
Total Suspended Solids		—	—	—	0	20
Calcium (Ca ⁺⁺)	CaCO ₃	—	—	—	880	1279
Magnesium (Mg ⁺⁺)	CaCO ₃	—	—	—	650	34
Sodium (Na ⁺)	CaCO ₃	—	—	—	338	144
Hydrogen (H ⁺)	CaCO ₃	—	—	—	—	—
Potassium (K ⁺)	CaCO ₃	—	—	—	110	2.3
Ammonium (NH ₄ ⁺)	CaCO ₃	—	—	—	—	—
TOTAL CATIONS	CaCO ₃	—	—	—	1978	2047
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	—	—	—	54	160
Carbonate (CO ₃ ⁻)	CaCO ₃	—	—	—	—	—
Hydroxide (OH ⁻)	CaCO ₃	—	—	—	—	—
Chloride (Cl ⁻)	CaCO ₃	—	—	—	21	483
Sulfate (SO ₄ ⁻)	CaCO ₃	—	—	—	1900	178
Nitrate (NO ₃ ⁻)	CaCO ₃	—	—	—	1.0	1039
Fluoride (F ⁻)	CaCO ₃	—	—	—	1.9	86
Phosphate (PO ₄ ⁻)	CaCO ₃	—	—	—	0.14	30
Sulfite (SO ₃ ⁻)	CaCO ₃	—	—	—	—	—
Thiocyanide (CNS ⁻)	CaCO ₃	—	—	—	—	65
Organic Acids	CaCO ₃	—	—	—	—	41
Cyanide (CN ⁻)	CaCO ₃	—	—	—	—	—
TOTAL ANIONS	CaCO ₃	—	—	—	1978	2047
Iron Total	Fe	—	—	—	0	—
Carbon Dioxide, Free	CO ₂	—	—	—	25	10
Silica	SiO ₂	—	—	—	70	8.7
Residual Chlorine	Cl ₂	—	—	—	—	—
Organic Chemicals		—	—	—	—	2.1
Manganese	Mn	—	—	—	<0.15	—
Copper	Cu	—	—	—	<0.01	—
Hydrogen Sulfide	H ₂ S	—	—	—	—	—
Other Trace Metals		—	—	—	5.5	—
Phenol	C ₆ H ₆	—	—	—	—	—
Sulfur	S	—	—	—	—	—
OIL & GREASE		—	—	—	—	25
TOC		—	—	—	—	410
SLUDGE	LBS./HR.	352	—	3980	—	—
ASH	LBS./HR.	—	54,240	—	—	—
COD		—	—	—	—	30-45
BOD		—	—	—	—	10-15
Flow Rate	GPM	0.5	—	7.0	17	4606

USE OR DISCLOSURE OF RESULTS DATA IS SUBJECT TO THE NOTICE PAGE AT THE FRONT OF THIS REPORT.

WATER SOURCE	
WATER & IONIC BALANCE - BFD 835504-00-R-043 REV. A	
S T R E A M	46 BLOWDOWN FROM GASIFIER ASH HANDLING UNIT
	47 BLOWDOWN FROM FLUE GAS DESULFURIZATION
	48 TREATED POK REACTION WATER
	49 SING CONDENSATE
	50 STEAM BLOWDOWN

Date 3-8-82
 Cont. No. 835504
 By 10/15

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		46	47	48	49	50
Total Dissolved Solids		2654	1765	-	-	4
Total Alkalinity	CaCO ₃	54	216	-	-	0
Total Hardness	CaCO ₃	1530	1148	-	-	0
pH		6.6	8.5	-	-	-
Total Suspended Solids		0	0	-	-	0
Calcium (Ca ⁺⁺)	CaCO ₃	850	774	-	-	0
Magnesium (Mg ⁺⁺)	CaCO ₃	150	374	-	-	0
Sodium (Na ⁺)	CaCO ₃	338	180	-	-	5.1
Hydrogen (H ⁺)	CaCO ₃	-	-	-	-	-
Potassium (K ⁺)	CaCO ₃	110	-	-	-	-
Ammonium (NH ₄ ⁺)	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	1978	1322	-	-	5.1
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	216	-	-	0
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	0
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	5.1
Chloride (Cl ⁻)	CaCO ₃	21	180	-	-	0
Sulfate (SO ₄ ⁻)	CaCO ₃	1900	920	-	-	0
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0	4.0	-	-	0
Fluoride (F ⁻)	CaCO ₃	1.9	7.6	-	-	0
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.56	-	-	0
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	1972	1322	-	-	5.1
Iron Total	Fe	0	0	-	-	0
Carbon Dioxide, Free	CO ₂	25	-	-	-	0
Silica	SiO ₂	70	10	-	-	0.25
Residual Chlorine	Cl ₂	-	-	-	-	0
Organic Chemicals		-	-	-	-	-
Manganese	Mn	< 0.5	< 0.15	-	-	0
Copper	Cu	< 0.01	< 0.01	-	-	0
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		5.5	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	200	20	14	47	243

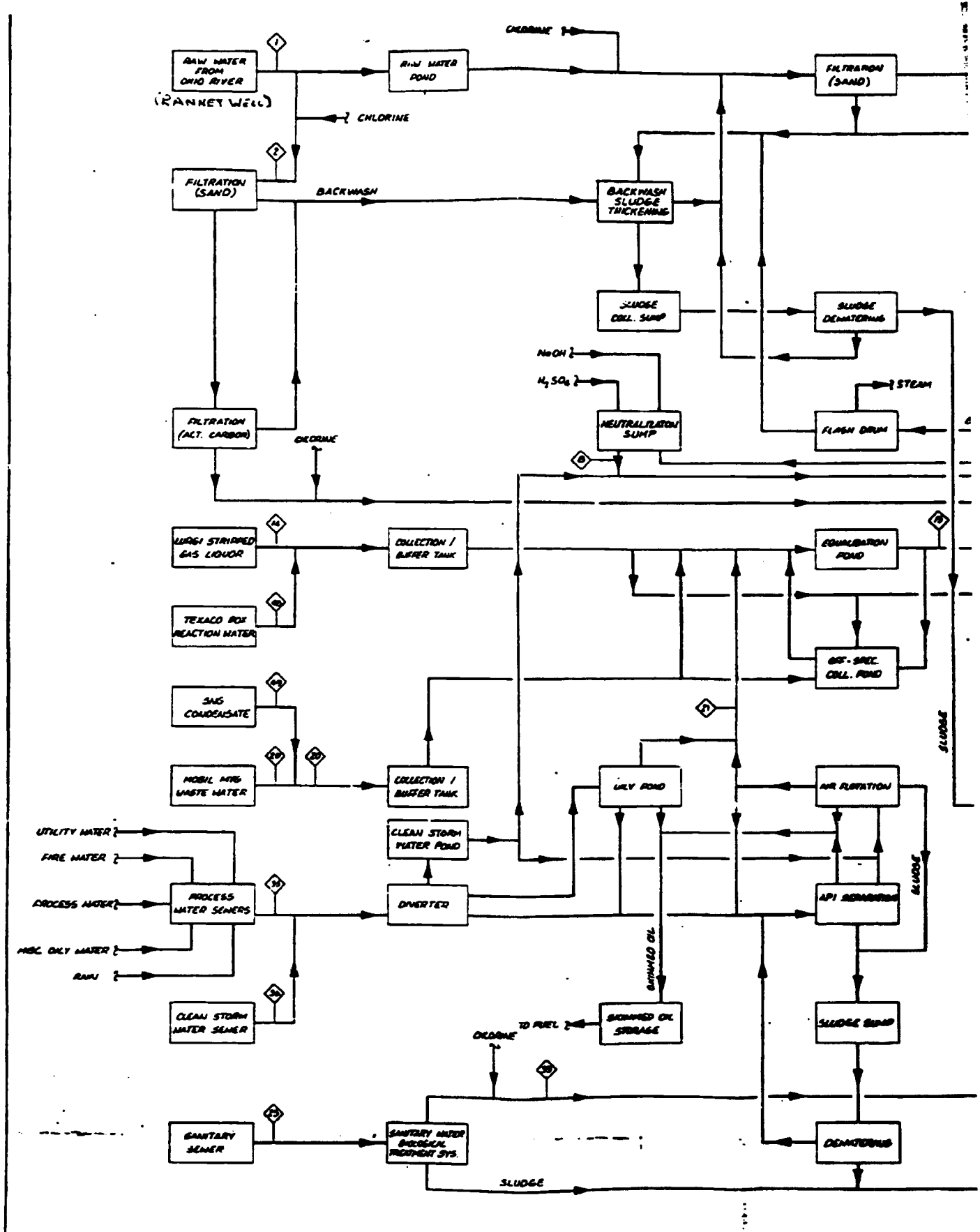
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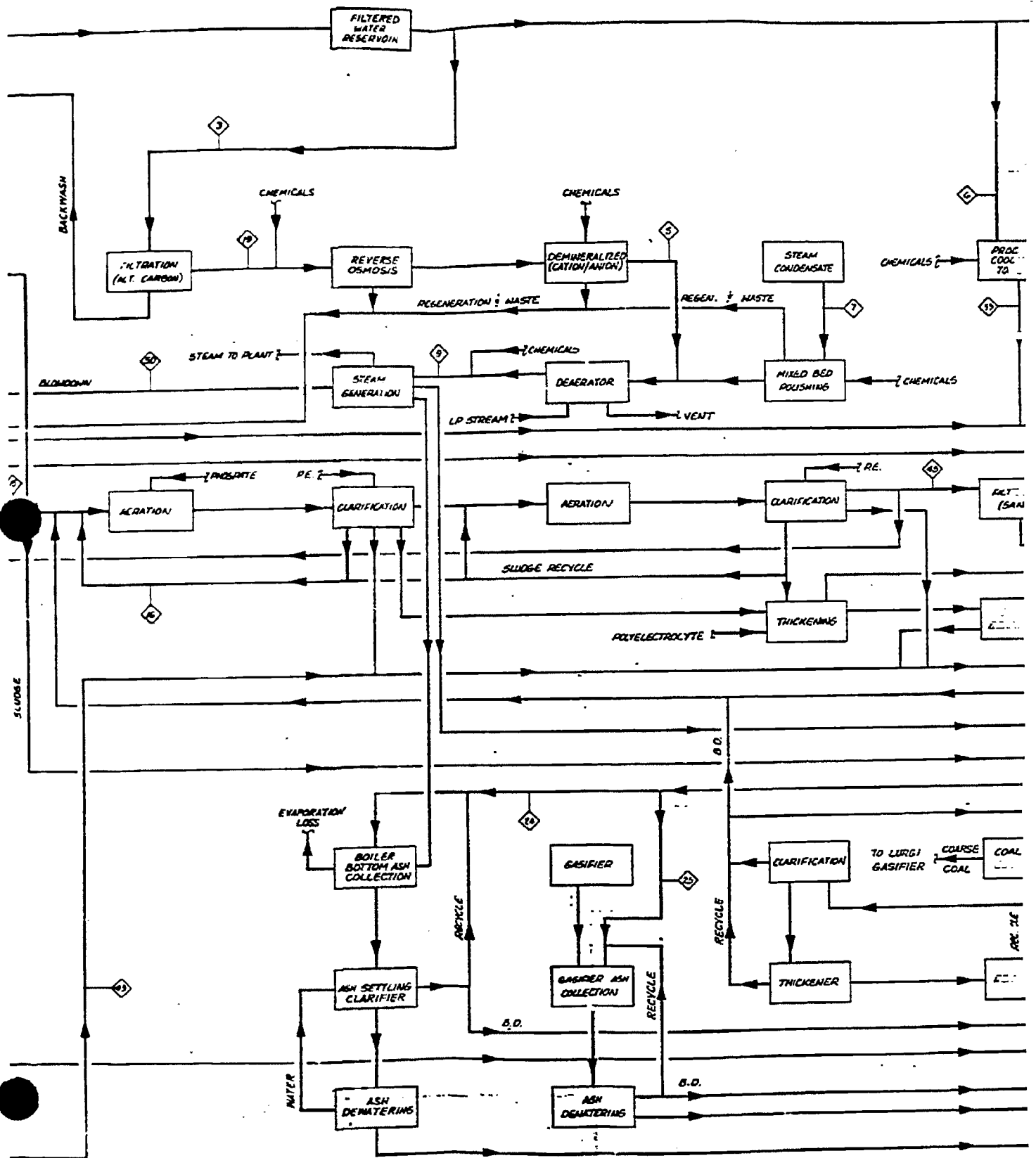
TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

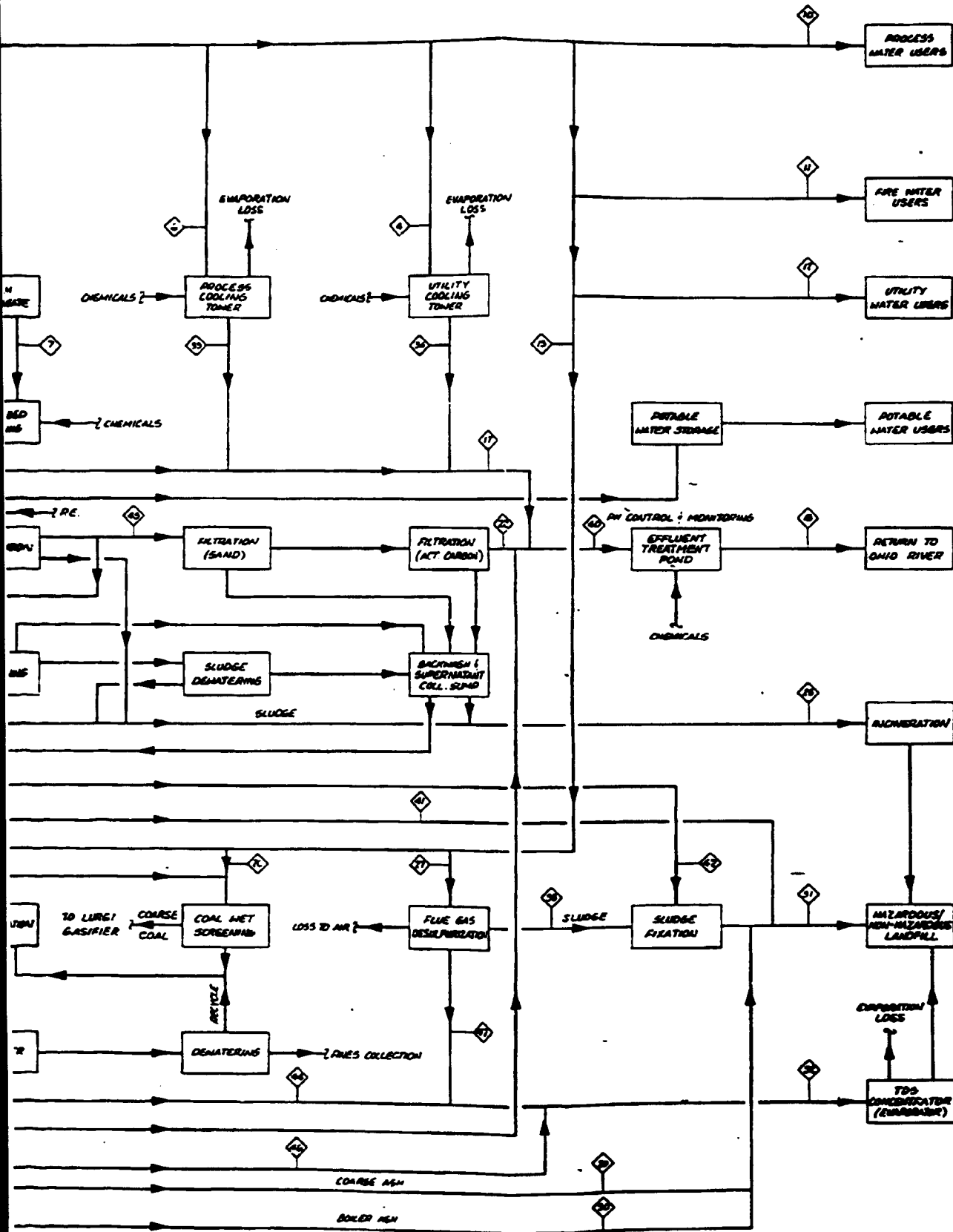
FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

APPENDIX 1

A1.3 BLOCK FLOW DIAGRAM - WATER AND SOLID WASTE MANAGEMENT
Drawing Number 835504-00-R-043 Rev A 3-3-82
(Case 15)

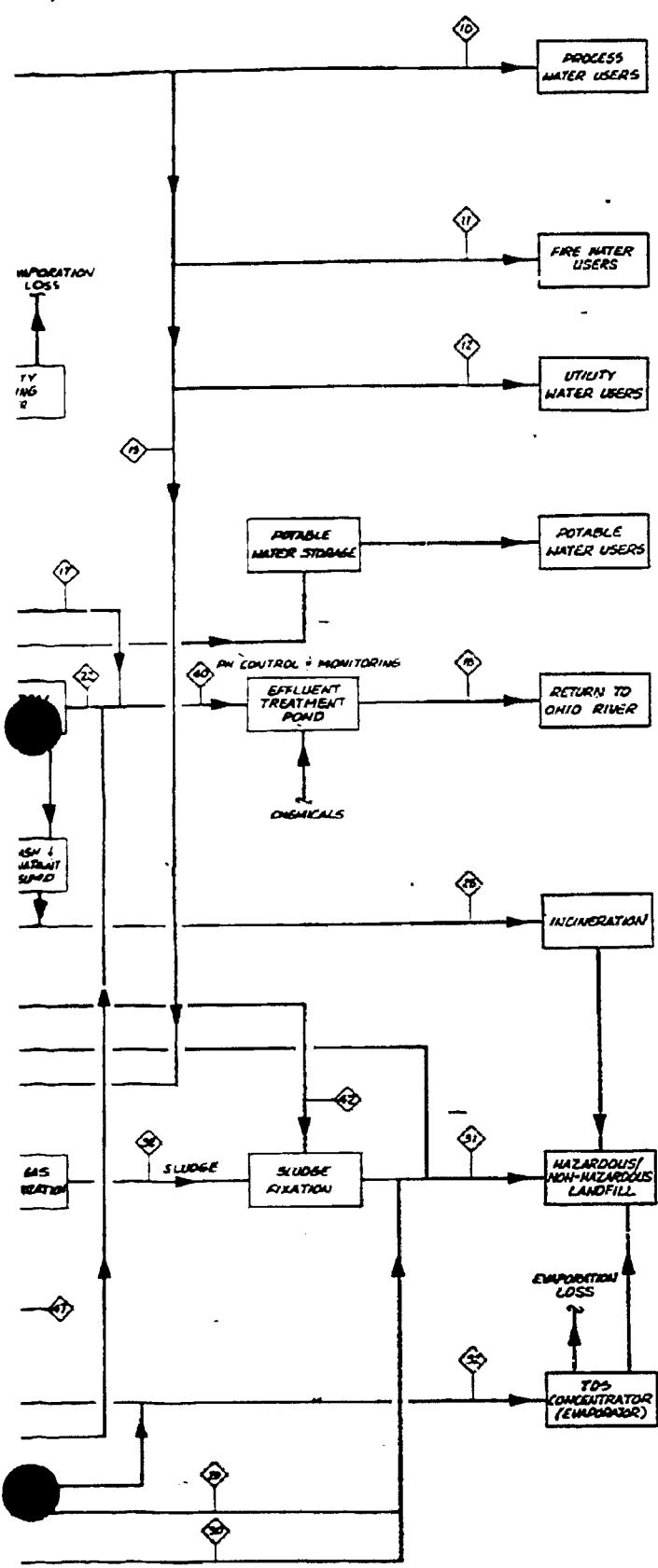






NOTES

1. OSHA
2. SPREA
3. AMER
4. ALL P
5. ALL F



NOTES:

1. DESIGN BASES IS BASED ON CASE 15.
2. STREAM FLOWRATES ARE BASED ON DRY WEATHER CONDITION
3. WATER MANAGEMENT SCHEME IS BASED ON DISCHARGING TREATED EFFLUENT TO THE OHIO RIVER.
4. ALL FLOWRATES IN THE MATERIAL BALANCE ARE GPM UNLESS OTHERWISE INDICATED.
5. ALL FLOWRATES ARE FOR NORMAL OPERATING CONDITIONS.

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CONFIDENTIAL
PRELIMINARY

TRI-STATE SYNFUELS PROJECT	
TITLE	BLOCK FLOW DIAGRAM
DATE	WATER AND SOLID WASTE
BY	MANAGEMENT
NO.	
REV.	
B35504-00-R-043	

APPENDIX 1

A1.4 PROCESS DESCRIPTION

A1.4.1 Coal Wet Screening And Wash Water Handling
(Unit 02)

Run-of-mine coal reclaimed from the ground stockpiles via wheel bucket reclaimer is transferred to the wet screening plant. Several wet screens are employed to wash down any fines (minus 1/4") from the coarse coal (2" x 1/4") which is fed directly to Lurgi gasifiers.

The minus 1/4" size fine is dewatered in centrifuge. The coal fines after having dried are stored in the fines silo. The fines can either be used for power and steam generation or sold to customers.

Overflow from the centrifuge is collected in clarified water head tank for recirculation.

Makeup water is added to compensate for water retained with the coal particulates and blowdown.

WATER SOURCE		UNIT 02 - COAL WASH HANDLING UNIT
S T R E A M	4 - RECYCLE WATER STREAM	PRELIMINARY
	5 - ...	
	6 - ...	
	2 - COAL FINES	
	3 - COAL COKE COI	

Date MAR. 2, 1982
 Cont. No. 835504
 By P. W. S.

CONSTITUENT	PPM	STREAM NO.				
		4	5	6	2	3
Total Dissolved Solids		607	443	607		
Total Alkalinity	CaCO ₃	54	54	54		
Total Hardness	CaCO ₃	332	332	332		
pH		6.6	6.6	6.6		
Total Suspended Solids		—	0	—		
Calcium (Ca ⁺⁺)	CaCO ₃	216	216	216		
Magnesium (Mg ⁺⁺)	CaCO ₃	—	116	116		
Sodium (Na ⁺)	CaCO ₃	143	—	143		
Hydrogen (H ⁺)	CaCO ₃	—	—	—		
Potassium (K ⁺)	CaCO ₃	—	—	—		
Ammonium (NH ₄ ⁺)	CaCO ₃	—	—	—		
TOTAL CATIONS	CaCO ₃	475	332	475		
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	54		
Carbonate (CO ₃ ⁻)	CaCO ₃	—	—	—		
Hydroxide (OH ⁻)	CaCO ₃	—	—	—		
Chloride (Cl ⁻)	CaCO ₃	161	21	161		
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254		
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0	1.0	1.0		
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9		
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14		
Sulfite (SO ₃ ⁻)	CaCO ₃	<1.0	—	<1.0		
Thiocyanide (CNS ⁻)	CaCO ₃	—	—	—		
Organic Acids	CaCO ₃	1.8	—	1.8		
Cyanide (CN ⁻)	CaCO ₃	—	—	—		
TOTAL ANIONS	CaCO ₃	475	332	475		
Iron Total	Fe	0	0	0		
Carbon Dioxide, Free	CO ₂	25	25	25		
Silica	SiO ₂	2.1	2.1	2.1		
Residual Chlorine	Cl ₂	—	1.5	—		
Organic Chemicals		0.2	—	0.2		
Manganese	Mn	<0.15	<0.15	<0.15		
Copper	Cu	<0.01	<0.01	<0.01		
SULFUR	S	—	—	—		
Other Trace Metals		4.28	—	4.28		
Phenol	C ₆ H ₆	600	—	600		
TKN	N	120	—	120		
Volatile Acid		—	—	—		
TOC		—	—	—		
COAL	LBS./HR.	—	—	—	171,400	857,050
Temperature	°F	75	75	75		
BOD		30	—	30		
Flow Rate	CPM	2104	200	50	40	110

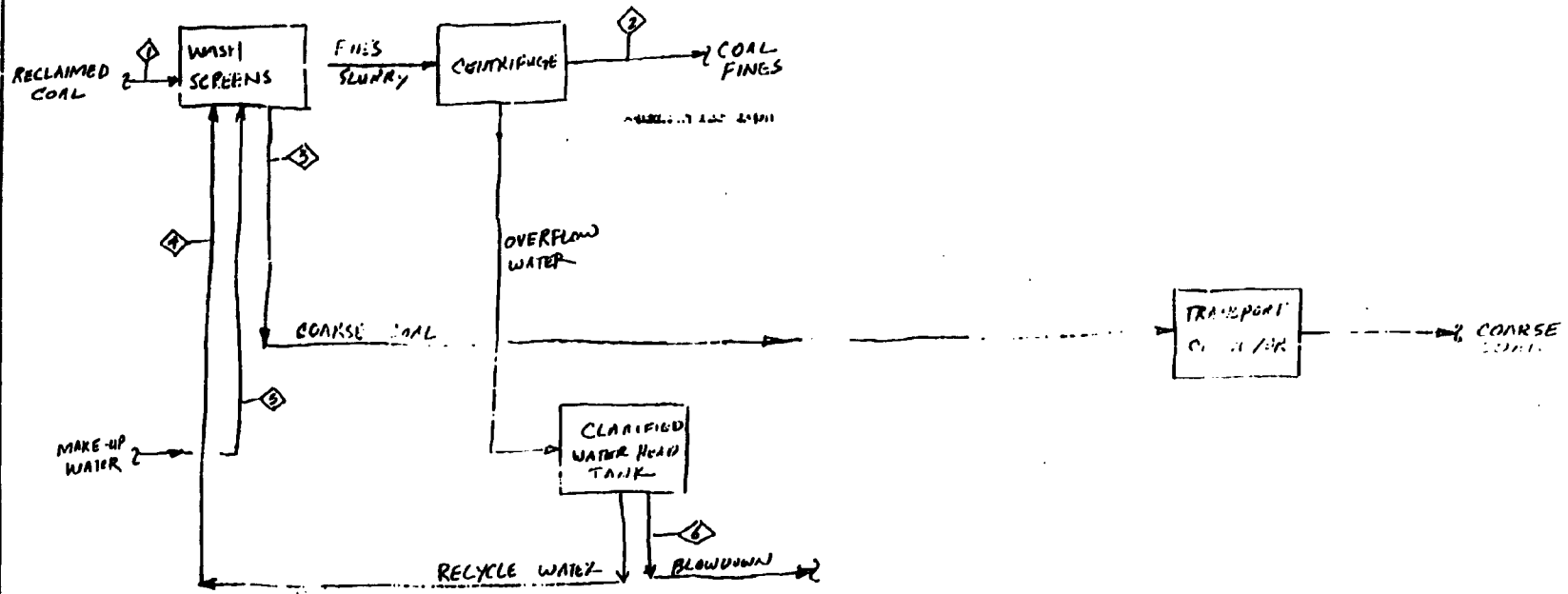
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4 FLOOR

4/29/82
CONT. NO. R35709
BY P.Hung
SHEET NO. 1 of 1

WATER MANAGEMENT BLOCK FLOW DIAGRAM UNIT 02 - COAL WASH AND WET SCREENING UNIT

PRELIMINARY



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TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.2 Gasifiers Ash Handling (Unit 03)

The coarse ash from the Lurgi gasifiers ash locks is directly discharged into a low velocity sluiceway. Water is used to sluice and at the same time quenching the hot ash. The low pressure steam generated from quenching hot ash is exhausted into the atmosphere by fan.

The sluiced ash is discharged to a crusher in which uncharred coal and clinker from the gasifiers bottom can be reduced to a smaller particle size. The ash slurry is collected in a holding sump prior to being dewatered. The coarse ash is discharged to a dump truck. The underflow is pumped to dewatering cyclones for further dewatering and conveyed to a plate thickener for further clarification. The underflow sludge is filtered and discharged to the final ash conveyor to be transferred to a dump truck.

The overflow water from the plate thickener and filter press is recirculated to the plant. Effluent water from the first stage clarifier of the raw water pretreatment plant is added as makeup for water losses due to evaporation by quenching, water retained in ash (sludge) and blowdown.

WATER SOURCE		UNIT 03 - ASH HANDLING UNIT (GASIFIER ASH)
S T R E A M	1 - GASIFIER ASH DISCHARGE	

Date 3/2/82
 Cont. No. 83104
 By L. D. ...

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.					
		1	2	3	4	5	6
Total Dissolved Solids							
Total Alkalinity	CaCO ₃						
Total Hardness	CaCO ₃						
pH							
Total Suspended Solids							
Calcium (Ca++)	CaCO ₃						
Magnesium (Mg++)	CaCO ₃						
Sodium (Na+)	CaCO ₃						
Hydrogen (H+)	CaCO ₃						
Potassium (K+)	CaCO ₃						
Ammonium (NH ₄ +))	CaCO ₃						
TOTAL CATIONS	CaCO ₃						
Bicarbonate (HCO ₃ ⁻)	CaCO ₃						
Carbonate (CO ₃ ⁻)	CaCO ₃						
Hydroxide (OH ⁻)	CaCO ₃						
Chloride (Cl ⁻)	CaCO ₃						
Sulfate (SO ₄ ⁻)	CaCO ₃						
Nitrate (NO ₃ ⁻)	CaCO ₃						
Fluoride (F ⁻)	CaCO ₃						
Phosphate (PO ₄ ⁻)	CaCO ₃						
Sulfite (SO ₃ ⁻)	CaCO ₃						
Thiocyanide (CNS ⁻)	CaCO ₃						
Organic Acids	CaCO ₃						
Cyanide (CN ⁻)	CaCO ₃						
TOTAL ANIONS	CaCO ₃						
Iron Total	Fe						
Carbon Dioxide, Free	CO ₂						
Silica	SiO ₂						
Residual Chlorine	Cl ₂						
Organic Chemicals							
Manganese	Mn						
Copper	Cu						
Hydrogen Sulfide	H ₂ S						
Other Trace Metals							
Phenol	C ₆ H ₆						
Sulfur	S						
Volatile Acid							
TOC							
ASH	LBS./HR.	146,300					
Temperature	°F						
COD							
BOD							
Flow Rate	GPM						

USE OF DISCHARGE OF WATER DATA
 IS SUBJECT TO THE RESTRICTIONS ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE		UNIT 03 - ASH HANDLING UNIT (GASIFIER ASH)
S T R E A M	1	RECYCLE WATER
	2	EVAPORATOR CONDENSATE
	3	MAKE-UP WATER
	5	CONDENSATE
	6	COFFEE ASH SLUDGE

Date MAR. 2, 1982
 Cont. No. 23550
 By P. L. L.

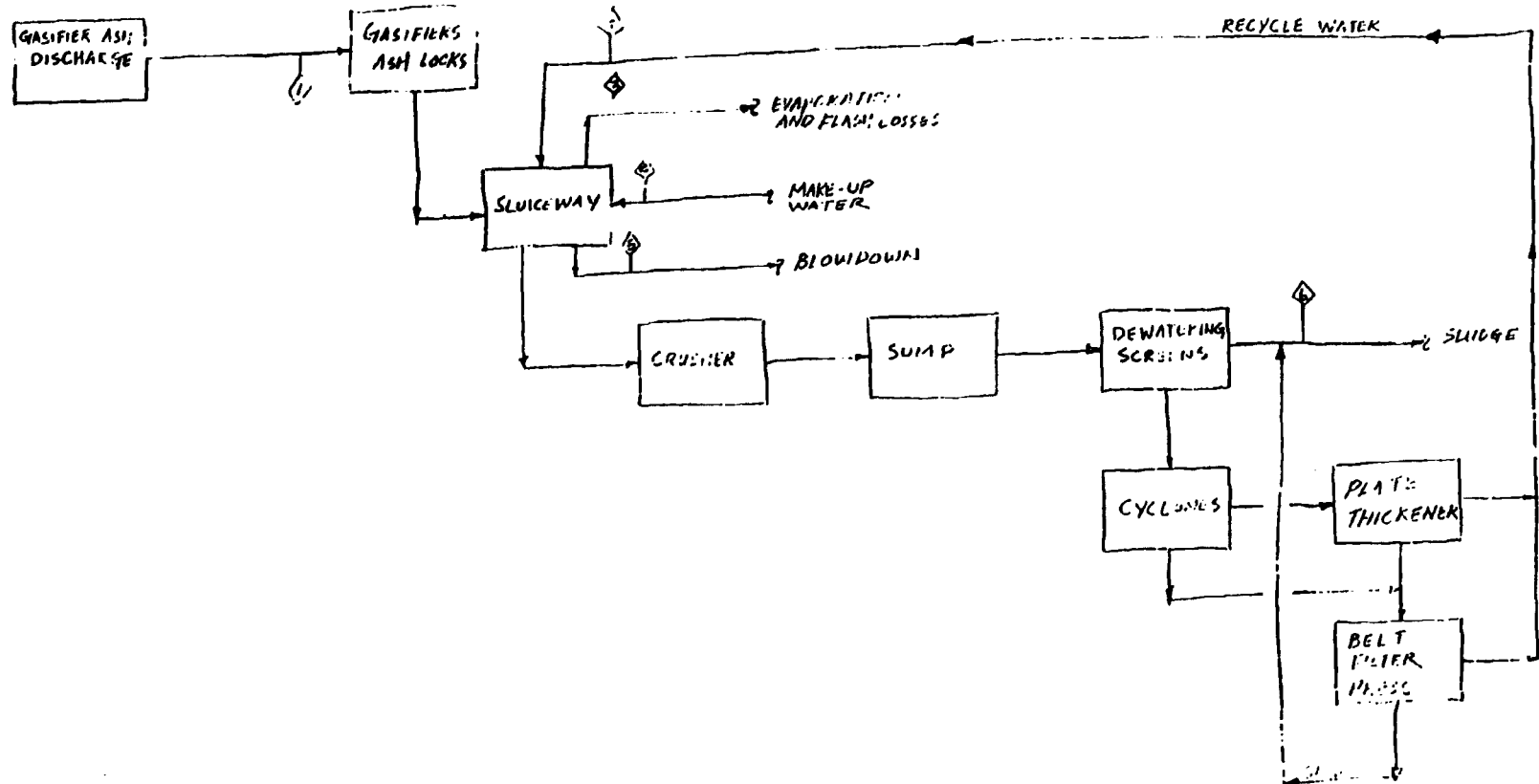
PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		2	3	4	5	6
Total Dissolved Solids		2654		443	2654	
Total Alkalinity	CaCO ₃	54		54	54	
Total Hardness	CaCO ₃	1100		332	1600	
pH		6.6		6.6	6.6	
Total Suspended Solids		0		0	0	
Calcium (Ca++)	CaCO ₃	390		216	580	
Magnesium (Mg++)	CaCO ₃	400		170	650	
Sodium (Na+)	CaCO ₃	538			337	
Hydrogen (H+)	CaCO ₃					
Potassium (K+)	CaCO ₃	110			110	
Ammonium (NH ₄ +))	CaCO ₃					
TOTAL CATIONS	CaCO ₃	1978		332	1978	
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54		54	54	
Carbonate (CO ₃ ⁻)	CaCO ₃					
Hydroxide (OH ⁻)	CaCO ₃					
Chloride (Cl ⁻)	CaCO ₃	21		21	21	
Sulfate (SO ₄ ⁻)	CaCO ₃	1900		254	1900	
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0		1.0	1.0	
Fluoride (F ⁻)	CaCO ₃	1.9		1.9	1.9	
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14		0.14	0.14	
Sulfite (SO ₃ ⁻)	CaCO ₃					
Thiocyanide (CNS ⁻)	CaCO ₃					
Organic Acids	CaCO ₃					
Cyanide (CN ⁻)	CaCO ₃					
TOTAL ANIONS	CaCO ₃	1978		332	1978	
Iron Total	Fe	0		0	0	
Carbon Dioxide, Free	CO ₂	25		25	25	
Silica	SiO ₂	70		3.1	70	
Residual Chlorine	Cl ₂			1.5		
Organic Chemicals						
Manganese	Mn	<0.5		<0.15	<0.15	
Copper	Cu	<0.01		<0.01	<0.01	
Hydrogen Sulfide	H ₂ S					
Other Trace Metals		5.50			5.5	
Phenol	C ₆ H ₆					
Sulfur	S					
Volatile Acid						
TOC						
SLUDGE (ASH)	LBS./HR.					161300
Temperature	°F	80		75	80	
COD						
Flow Rate	GPM	4580	20	250	200	30

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 NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER MANAGEMENT BLOCK FLOW DIAGRAM
UNIT 03 - ASH HANDLING (GASIFIER)

PRELIMINARY



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NOTICE PAGE AT THE FRONT OF THIS REPORT

A1.4.3 Boilers Ash Handling (Unit 03)

The steam and power plant discharge bottom and fly ash from its boiler furnaces. The fly ash is collected at the stack by emissions control equipment. Once the air pollution device is loaded with fly ash, it will automatically be discharged to a collection surge bin. Fly ash from the boilers cannot be sluiced with the bottom ash since it retains only a small quantity of fine fly ash particles. The fly ash is discharged dry, mixed, and stabilized with filter cake from the flue gas desulfurization unit by means of pug mill and hauled away to landfill site. The bottom ash continually falls from the furnace throat, through the bottom ash chute and into the water filled submerged conveyor trough. The cooled ash is conveyed into ash crusher by conveyor flights attached to the continuous loop of the conveyor chain. The size of the clinkers in the bottom ash is reduced prior to dispose to the ash dump. The wet ash stream is introduced into a plate clarifier. The solids settle out at the plate surfaces and slide downward to a dewatering filter-belt press. The filter cake is transferred along with ash from the crusher and discarded.

The overflow water from the clarifier and underflow from dewatering press is pumped into a storage tank for recirculation in the unit. Makeup water is added to compensate for evaporation, water retained in the sludge, and blowdown losses.

WATER SOURCE		UNIT 03 - ASH HANDLING UNIT (BOILER ASH)
S T R E A M	4	DELETED
	5	SLUDGE FROM FGD UNIT
	6	TOTAL STABILIZED SLUDGE (WITH PLYWOOD)
	8	WATER LOSS FROM BOTTOM ASH & WASHINGS
	9	MAKE UP WATER TO BOILER ASH HANDLING

REV A 3/8/82

Date MAR. 2, 1982

Cont. No. 95102

By [Signature]

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.			
		5	6	8	9
Total Dissolved Solids					443
Total Alkalinity	CaCO ₃				54
Total Hardness	CaCO ₃				332
pH					6.6
Total Suspended Solids					0
Calcium (Ca ⁺⁺)	CaCO ₃				216
Magnesium (Mg ⁺⁺)	CaCO ₃				116
Sodium (Na ⁺)	CaCO ₃				—
Hydrogen (H ⁺)	CaCO ₃				—
Potassium (K ⁺)	CaCO ₃				—
Ammonium (NH ₄ ⁺)	CaCO ₃				—
TOTAL CATIONS	CaCO ₃				332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃				54
Carbonate (CO ₃ ⁻)	CaCO ₃				—
Hydroxide (OH ⁻)	CaCO ₃				—
Chloride (Cl ⁻)	CaCO ₃				21
Sulfate (SO ₄ ⁻)	CaCO ₃				254
Nitrate (NO ₃ ⁻)	CaCO ₃				1.0
Fluoride (F ⁻)	CaCO ₃				1.9
Phosphate (PO ₄ ⁻)	CaCO ₃				0.14
Sulfite (SO ₃ ⁻)	CaCO ₃				—
Thiocyanide (CNS ⁻)	CaCO ₃				—
Organic Acids	CaCO ₃				—
Cyanide (CN ⁻)	CaCO ₃				—
TOTAL ANIONS	CaCO ₃				332
Iron Total	Fe				0
Carbon Dioxide, Free	CO ₂				25
Silica	SiO ₂				2.1
Residual Chlorine	Cl ₂				1.5
Organic Chemicals					—
Manganese	Mn				<0.15
Copper	Cu				<0.01
Hydrogen Sulfide	H ₂ S				—
Other Trace Metals					—
Phenol	C ₆ H ₆				—
Sulfur	S				—
Volatile Acid					—
TOC					—
SLUDGE (ASH)	LBS/HR.	206,000	260,240		—
Temperature	°F	—	—		75
COD		—	—		—
BOD		—	—		—
Flow Rate	GPM	180	180	2.5	22

THIS ANALYSIS IS PRELIMINARY
 IS SUBJECT TO THE REVISIONS TO BE
 MADE BY THE LABORATORY

WATER SOURCE		UNIT 03 - ASH HANDLING UNIT (BOILER ASH)
S T R E A M	10 - RECYCLE WATER	
	12 - SLUDGE FROM BOILER BOTTOM ASH HANDLING	
	1 - FLY ASH DISCHARGED	
	7 - BOILER BOTTOM ASH DISCHARGED	

Date 3/2/82
 Cont. No. 835504
 By S. J. ...

NY

CONSTITUENT	PPM	STREAM NO.				
		10	11	12	1	7
Total Dissolved Solids		2654	2654			
Total Alkalinity	CaCO ₃	54	54			
Total Hardness	CaCO ₃	1530	1530			
pH		6.6	6.6			
Total Suspended Solids		0	0			
Calcium (Ca++)	CaCO ₃	880	880			
Magnesium (Mg++)	CaCO ₃	650	650			
Sodium (Na+)	CaCO ₃	333	333			
Hydrogen (H+)	CaCO ₃	—	—			
Potassium (K+)	CaCO ₃	110	110			
Ammonium (NH ₄ +))	CaCO ₃	—	—			
TOTAL CATIONS	CaCO ₃	1978	1978			
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54			
Carbonate (CO ₃ ⁻)	CaCO ₃	—	—			
Hydroxide (OH ⁻)	CaCO ₃	—	—			
Chloride (Cl ⁻)	CaCO ₃	21	21			
Sulfate (SO ₄ ⁻)	CaCO ₃	1900	1900			
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0	1.0			
Fluoride (F ⁻)	CaCO ₃	1.9	1.9			
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14			
Sulfite (SO ₃ ⁻)	CaCO ₃	—	—			
Thiocyanide (CNS ⁻)	CaCO ₃	—	—			
Organic Acids	CaCO ₃	—	—			
Cyanide (CN ⁻)	CaCO ₃	—	—			
TOTAL ANIONS	CaCO ₃	1978	1978			
Iron Total	Fe	0	0			
Carbon Dioxide, Free	CO ₂	25	25			
Silica	SiO ₂	70	70			
Residual Chlorine	Cl ₂	—	—			
Organic Chemicals		—	—			
Manganese	Mn	<0.15	<0.15			
Copper	Cu	<0.01	<0.01			
Hydrogen Sulfide	H ₂ S	—	—			
Other Trace Metals		5.5	5.5			
Phenol	C ₆ H ₆	—	—			
Sulfur	S	—	—			
Volatile Acid		—	—			
ASH	LBS./HR.	—	—	13,160	54,240	11,910
SLUDGE	LBS./HR.	—	—			
Temperature	°F	75	75			
BOD		—	—			
Flow Rate	GPM	386	17	2.5		

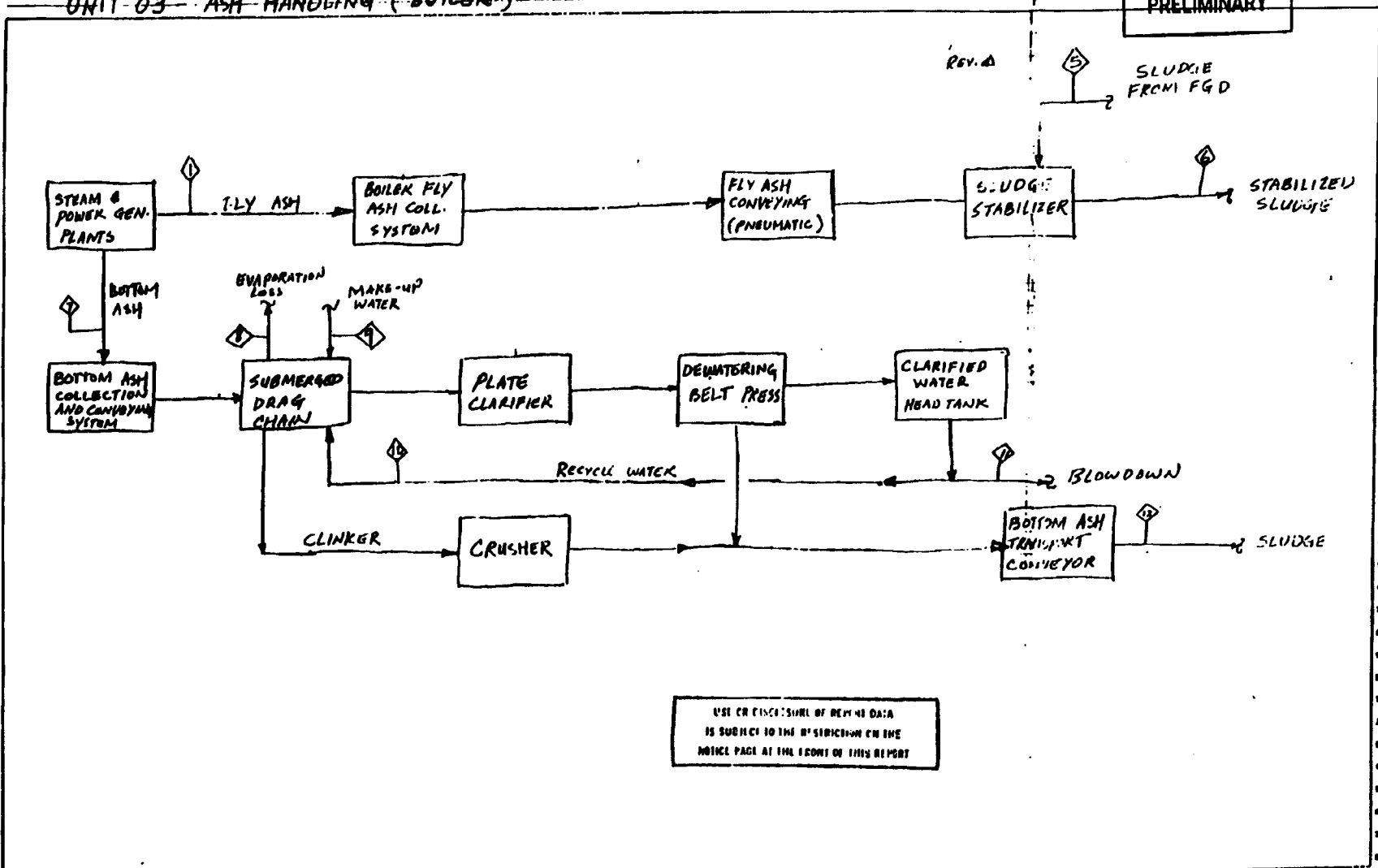
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WATER MANAGEMENT BLOCK FLOW DIAGRAM
 UNIT 03 - ASH HANDLING (BOILER)

REV. A 3/8/02

FLUOR

1/29/02
 CONT. NO. 231704
 BY P. [unclear]
 SHEET NO. 1 of 1



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TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.4 Unit 05 & 45 - Utility And Process Cooling Towers

Makeup water required for the process and utility cooling towers is supplied from the filtered water reservoir. This water has been chlorinated and filtered to remove organics and suspended solids. Blowdown from the process and utility cooling towers is discharged to the effluent pond. The circulating cooling water is treated for pH, corrosion, and biological growth control.

WATER SOURCE	
UNITS 05-45 UTILITY & PROCESS COOLING TOWERS	
S T R E A M	2 PROCESS C.T. MAKEUP - 43 ppm H ₂ SO ₄ ADDED
	3 PROCESS C.T. MAKEUP WATER (COPIES)
	4 PROCESS C.T. MAKEUP
	5 UTILITY C.T. MAKEUP - 43 ppm H ₂ SO ₄ ADDED
	6 UTILITY C.T. MAKEUP WATER

Date 3-3-82
 Cont. No. 8355A
 By Y.K.M. 1/2

PRELIMINARY

REV A 3-8-82

CONSTITUENT	PPM	STREAM NO.				
		2	3	4	5	6
Total Dissolved Solids		432	1297	1297	432	1297
Total Alkalinity	CaCO ₃	54	39	39	54	39
Total Hardness	CaCO ₃	332	996	996	332	996
pH		5.6	7.4	7.4	5.6	7.4
Total Suspended Solids		0	0	0	0	0
Calcium (Ca ⁺⁺)	CaCO ₃	216	648	648	216	648
Magnesium (Mg ⁺⁺)	CaCO ₃	116	348	348	116	348
Sodium (Na ⁺)	CaCO ₃	-	-	-	-	-
Hydrogen (H ⁺)	CaCO ₃	-	-	-	-	-
Potassium (K ⁺)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ ⁺)	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	996	996	332	996
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	13	39	39	13	39
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	0	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	63	63	21	63
Sulfate (SO ₄ ⁻)	CaCO ₃	295	885	885	295	885
Nitrate (NO ₃ ⁻)	CaCO ₃	1	3	3	1	3
Fluoride (F ⁻)	CaCO ₃	1.9	5.7	5.7	1.9	5.7
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.4	0.4	0.14	0.4
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	996	996	332	996
Iron Total	Fe	0	0	0	0	0
Carbon Dioxide, Free	CO ₂	6.1	3	3	6.1	3
Silica	SiO ₂	2.1	6.3	6.3	2.1	6.3
Residual Chlorine	Cl ₂	1.5	2	2	1.5	2
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0.45	0.45	0.15	0.45
Copper	Cu	2.01	2.23	2.23	2.01	2.23
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	5284	176142	1586	6948	278286

USE OR DISPOSITION OF THIS REPORT
 IS SUBJECT TO THE TERMS AND CONDITIONS
 LISTED ON THE REVERSE SIDE OF THIS REPORT

WATER SOURCE	
UNIT 05 & 5 UTILITY & PROCESS COOLING TOWER	
S T R E A M	7 UTILITY C.T. BLOWDOWN
	7 EYE - 1 - 2 - 3 - PROCESS C.T.
	7 SIAP & 1 - 2 - 3 - UTILITY C.T.

Date 3-3-82
 Cont. No. 1355A
 By W. H. 2.0

REV Δ 3-8-82

CONSTITUENT	PPM	STREAM NO.		
		7	8	9
Total Dissolved Solids		1297		
Total Alkalinity	CaCO ₃	39		
Total Hardness	CaCO ₃	996		
pH		7.4		
Total Suspended Solids		?		
Calcium (Ca ⁺⁺)	CaCO ₃	1048		
Magnesium (Mg ⁺⁺)	CaCO ₃	348		
Sodium (Na ⁺)	CaCO ₃	-		
Hydrogen (H ⁺)	CaCO ₃	-		
Potassium (K ⁺)	CaCO ₃	-		
Ammonium (NH ₄ ⁺)	CaCO ₃	-		
TOTAL CATIONS	CaCO ₃	396		
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	39		
Carbonate (CO ₃ ⁻)	CaCO ₃	-		
Hydroxide (OH ⁻)	CaCO ₃	-		
Chloride (Cl ⁻)	CaCO ₃	63		
Sulfate (SO ₄ ⁻)	CaCO ₃	885		
Nitrate (NO ₃ ⁻)	CaCO ₃	3		
Fluoride (F ⁻)	CaCO ₃	5.7		
Phosphate (PO ₄ ⁻)	CaCO ₃	0.4		
Sulfite (SO ₃ ⁻)	CaCO ₃	-		
Thiocyanide (CNS ⁻)	CaCO ₃	-		
Organic Acids	CaCO ₃	-		
Cyanide (CN ⁻)	CaCO ₃	-		
TOTAL ANIONS	CaCO ₃	996		
Iron Total	Fe	0		
Carbon Dioxide, Free	CO ₂	3		
Silica	SiO ₂	6.3		
Residual Chlorine	Cl ₂	2		
Organic Chemicals		-		
Manganese	Mn	0.95		
Copper	Cu	0.03		
Hydrogen Sulfide	H ₂ S	-		
Other Trace Metals		-		
Phenol	C ₆ H ₆	-		
Sulfur	S	-		
Volatile Acid		-		
TOC		-		
Oil & Grease		-		
Temperature	°F	-		
COD		-		
BOD		-		
Flow Rate	GPM	2055	36.98	4793

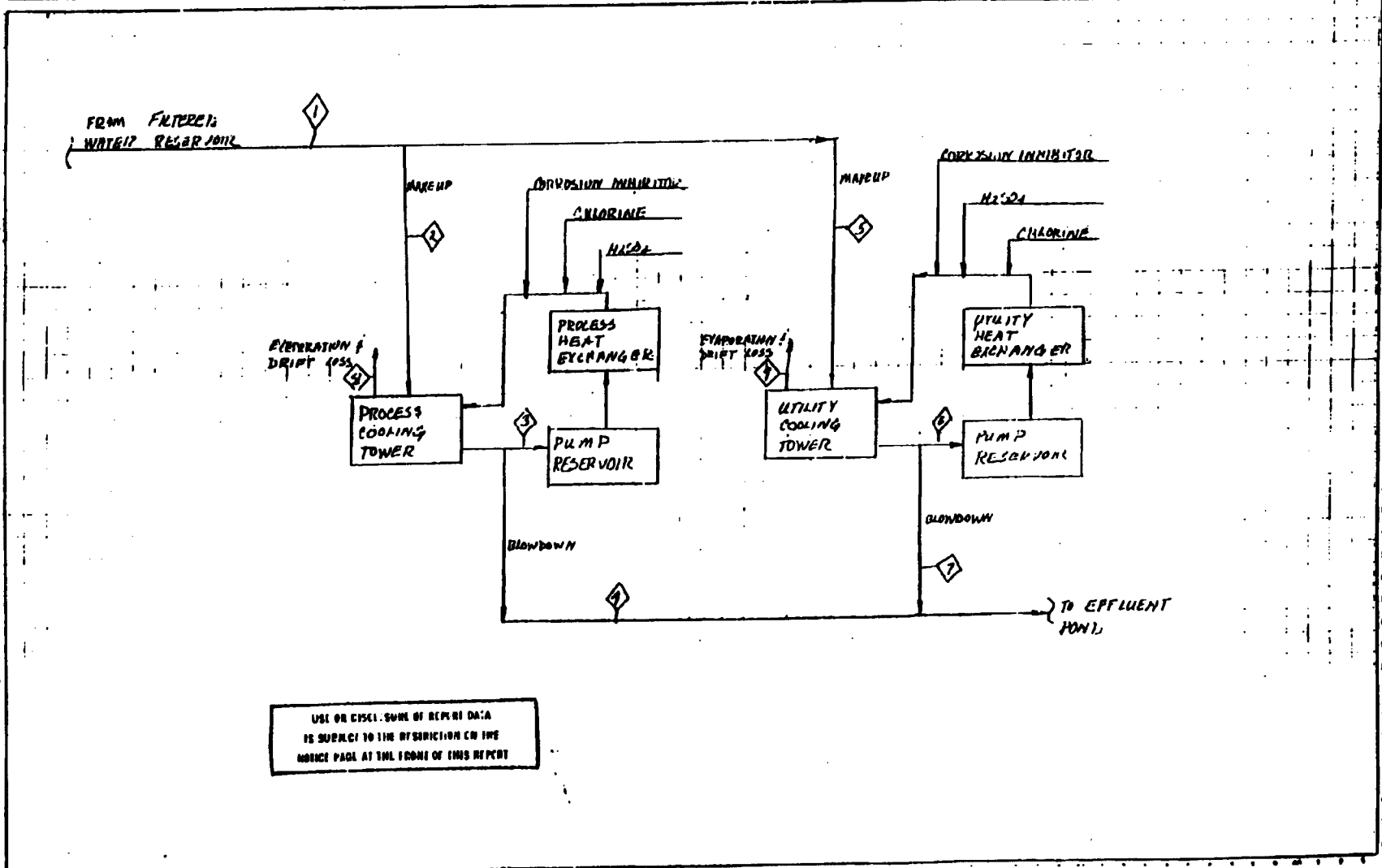
UPON RECEIVING OF REPORTS
 IS SUBJECT TO THE RESTRICTIONS ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

PRELIMINARY

4 FLOOR

2-5-82
CONT. NO. 15504
BY JHR/1 CWS
SHEET NO.

WATER MANAGEMENT BLOCK FLOW DIAGRAM
UNITS 05 & 15- UTILITY & PROCESS COOLING TOWERS



USE OR CISEL: SOME OF REPORT DATA
IS SUBJECT TO THE RESTRICTION ON THE
NOTICE PAGE AT THE FRONT OF THIS REPORT

Al.4.5 Unit 44 - Boiler Feed Water

The boiler feed water treatment system encompasses activated carbon filtration, reverse osmosis, and demineralization by ion exchange. The ion exchange demineralizers consist of strong acid cation exchangers containing a strong acid cation resin and strong basic anion exchangers containing a strong basic anion resin.

The water initially flows through activated carbon filters before flowing through the reverse osmosis unit for ion removal. The next unit is the cation exchanger where the remaining cations are exchanged with hydrogen ions. The water is then pumped through the anion unit for the removal of the remaining anions, CO₂, and silica in exchange for hydroxyl ions. This demineralized water is routed to storage tanks for use as boiler feed water makeup.

Unit 44 - Condensate mixed Bed Polishing

Condensate is treated in a mixed bed ion exchange polishing system. The mixed bed polishers contain a mixture of strong acid cation resin and strong basic anion resin of macroreticular type. The condensate polishers function as filter units by retaining suspended material, mainly corrosion products. They also function as demineralizers by exchanging dissolved ions against hydrogen and hydroxyl ions. The condensate is then sent to the treated condensate storage tank for reuse as boiler makeup.

The condensate polishing system is a high flow rate, externally regenerated mixed bed design sized to treat 100 percent of the boiler condensate flow on a continuous basis. These polishers may become exhausted due to the pressure drop caused by the suspended material removed from the condensate, or by a rise in effluent conductivity or silica levels due to depletion of hydrogen and/or hydroxyl ions from the ion-exchange resin. To restore the polishers to their intended function, the resin is sluiced from the service vessels into appropriate regeneration columns. The resin is then restored to its service function by back-washing only or by complete regeneration depending on the cause of the unit exhaustion. Regeneration is accomplished by application of sulfuric acid and sodium hydroxide to the appropriate resin.

WATER SOURCE	
UNIT 4A - BOILER FEED WATER	
S T R E A M	1 WATER FROM FILTERED WATER PEG
	2 FILTERED WATER FROM FILTERED EFFLUENT
	3 FILTERED WATER FROM FILTERED EFFLUENT
	4 CATION EXCHANGE EFFLUENT
	5 ANION EXCHANGE EFFLUENT

Date 5-3-72
 Cont. No. 85504
 By 11-11

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		1	2	3	4	5
Total Dissolved Solids		443	443	24	20	2
Total Alkalinity	CaCO ₃	54	54	4	4	0
Total Hardness	CaCO ₃	332	332	17.5	0	2
pH		6.67	6.64	5.3	3.6	
Total Suspended Solids		0	0	0	0	0
Calcium (Ca++)	CaCO ₃	216	216	11.9	0	2
Magnesium (Mg++)	CaCO ₃	116	116	5.1	0	2
Sodium (Na+)	CaCO ₃	-	-	-	-	6.5
Hydrogen (H+)	CaCO ₃	-	-	-	13.5	0
Potassium (K+)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ +))	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	332	17.5	13.5	6.5
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	4.0	0	0
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	6.5
Chloride (Cl ⁻)	CaCO ₃	21	21	1	1	0
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	12.3	12.3	0
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	0.1	0.1	0
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	0.1	0.1	0
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.01	0	0
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	17.5	13.5	6.5
Iron Total	Fe	2	2	0	0	0
Carbon Dioxide, Free	CO ₂	25	25	25	29	0
Silica	SiO ₂	2.1	2.1	0.3	0.3	0.01
Residual Chlorine	Cl ₂	1.5	0	0	0	0
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0	0	0	0
Copper	Cu	0.01	0	0	0	0
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	5814	5804	5047	4991	4935

USE OF RESULTS OF THIS DATA IS LIMITED TO THE REACTORS IN USE. NO OTHER USE AT THE PLANT AT THIS TIME BEING.

WATER SOURCE	
UNIT 4 - BOILER FEED WATER	
S T R E A M	6 STEAM CONDENSATE
	7 WASTE WASH WATER
	8 LEAKAGE FEED
	9 BOILER FEED WATER
	10 STEAM TO PLANT

Date 3-3-82
 Cont. No. 835524
 By W. A. S. M.

CONSTITUENT	PPM	STREAM NO.				
		6	7	8	9	10
Total Dissolved Solids		2	20.1	20.1	20.1	
Total Alkalinity	CaCO ₃	2	20.1	20.1	20.1	
Total Hardness	CaCO ₃	0	0	0	0	
pH						
Total Suspended Solids		0	0	0	0	
Calcium (Ca++)	CaCO ₃	0	0	0	0	
Magnesium (Mg++)	CaCO ₃	0	0	0	0	
Sodium (Na+)	CaCO ₃	2	20.1	20.1	20.1	
Hydrogen (H+)	CaCO ₃	0	0	0	0	
Potassium (K+)	CaCO ₃	0	0	0	0	
Ammonium (NH ₄ +))	CaCO ₃	0	0	0	0	
TOTAL CATIONS	CaCO ₃	2	20.1	20.1	20.1	
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	0	0	0	0	
Carbonate (CO ₃ ⁻)	CaCO ₃	0	0	0	0	
Hydroxide (OH ⁻)	CaCO ₃	2	20.1	20.1	20.1	
Chloride (Cl ⁻)	CaCO ₃	0	0	0	0	
Sulfate (SO ₄ ⁻)	CaCO ₃	0	0	0	0	
Nitrate (NO ₃ ⁻)	CaCO ₃	0	0	0	0	
Fluoride (F ⁻)	CaCO ₃	0	0	0	0	
Phosphate (PO ₄ ⁻)	CaCO ₃	0	0	0	0	
Sulfite (SO ₃ ⁻)	CaCO ₃	0	0	0	0	
Thiocyanide (CNS ⁻)	CaCO ₃	0	0	0	0	
Organic Acids	CaCO ₃	0	0	0	0	
Cyanide (CN ⁻)	CaCO ₃	0	0	0	0	
TOTAL ANIONS	CaCO ₃	2	20.1	20.1	20.1	
Iron Total	Fe	0	0	0	0	
Carbon Dioxide, Free	CO ₂	0	0	0	0	
Silica	SiO ₂	20.05	0.005	0.005	0.005	
Residual Chlorine	Cl ₂	0	0	0	0	
Organic Chemicals		0	0	0	0	
Manganese	Mn	0	0	0	0	
Copper	Cu	0	0	0	0	
Hydrogen Sulfide	H ₂ S	0	0	0	0	
Other Trace Metals		0	0	0	0	
Phenol	C ₆ H ₆	0	0	0	0	
Sulfur	S	0	0	0	0	
Volatile Acid		0	0	0	0	
TOC		0	0	0	0	
Oil & Grease		0	0	0	0	
Temperature	°F	0	0	0	0	
COD		0	0	0	0	
BOD		0	0	0	0	
Flow Rate	GPM	7234	7017	11952	12391	12147

USE OR DISCLOSURE OF REPORT DATA
 IS SUBJECT TO THE RESTRICTIONS IN THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE	
UNIT 14 - BOILER FEED WATER	
S T R E A M	11 REVERSE OSMOSIS UNIT WASTE
	12 SEWAGE EFFLUENT WASTE
	13 MILLION GAL WASTE
	14 BOILER FEED WATER
	15 WASTE

Date 3-3-82
 Cont. No. 835524
 By W.C.M. E.P.

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		11	12	13	14	15
Total Dissolved Solids		3120	4121		2	543
Total Alkalinity	CaCO ₃	19	0	2946	0	0
Total Hardness	CaCO ₃	2412	1577	0	0	0
pH		8.07	1.2			
Total Suspended Solids		0	0	0	0	0
Calcium (Ca++)	CaCO ₃	1569	1027	0	0	0
Magnesium (Mg++)	CaCO ₃	243	550	0	0	0
Sodium (Na+)	CaCO ₃	0	0	4037	5.1	420
Hydrogen (H+)	CaCO ₃	0	2107	0	0	0
Potassium (K+)	CaCO ₃	0	0	0	0	0
Ammonium (NH ₄ +))	CaCO ₃	0	0	0	0	0
TOTAL CATIONS	CaCO ₃	2412	3214	4037	5.1	420
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	19	0	1871	0	0
Carbonate (CO ₃ ⁻)	CaCO ₃	0	0	1075	0	0
Hydroxide (OH ⁻)	CaCO ₃	0	0	0	5.1	66
Chloride (Cl ⁻)	CaCO ₃	153	1	84	0	0
Sulfate (SO ₄ ⁻)	CaCO ₃	2218	3683	1696	0	442
Nitrate (NO ₃ ⁻)	CaCO ₃	7	0.1	9	0	0
Fluoride (F ⁻)	CaCO ₃	14	0.1	9	0	6
Phosphate (PO ₄ ⁻)	CaCO ₃	1	0.01	0	0	0
Sulfite (SO ₃ ⁻)	CaCO ₃	0	0	0	0	0
Thiocyanide (CNS ⁻)	CaCO ₃	0	0	0	0	0
Organic Acids	CaCO ₃	0	0	0	0	0
Cyanide (CN ⁻)	CaCO ₃	0	0	0	0	0
TOTAL ANIONS	CaCO ₃	2412	3624	4148	5.1	428
Iron Total	Fe	0	0	0	0	0
Carbon Dioxide, Free	CO ₂	222	29	0	0	0
Silica	SiO ₂	15	2.3	26	2.25	5
Residual Chlorine	Cl ₂	0	0	0	0	0
Organic Chemicals		0	0	0	0	0
Manganese	Mn	0	0	0	0	0
Copper	Cu	0	0	0	0	0
Hydrogen Sulfide	H ₂ S	0	0	0	0	0
Other Trace Metals		0	0	0	0	0
Phenol	C ₆ H ₆	0	0	0	0	0
Sulfur	S	0	0	0	0	0
Volatile Acid		0	0	0	0	0
TOC		0	0	0	0	0
Oil & Grease		0	0	0	0	0
Temperature	°F	0	0	0	0	0
COD		0	0	0	0	0
BOD		0	0	0	0	0
Flow Rate	GPM	757	56	56	243	217

FOR AN ANALYSIS OF THIS DATA
 IS TO BE USED TO THE EXTENT OF THE
 SOURCE PAGE AT THE FRONT OF THIS REPORT

WATER SOURCE	
UNIT 11 - BOILER FEED WATER	
S T R E A M	16 WASTE TO NEUTRALIZING JUMP
	17 WASTE TO EFFLUENT POND

Date 3-3-82
 Cont. No. 135504
 By M. J. [Signature]

CONSTITUENT	PPM	STREAM NO.	
		16	17
Total Dissolved Solids			
Total Alkalinity	CaCO ₃	125	
Total Hardness	CaCO ₃	1763	
pH		5.9	7
Total Suspended Solids			
Calcium (Ca ⁺⁺)	CaCO ₃	1197	
Magnesium (Mg ⁺⁺)	CaCO ₃	116	
Sodium (Na ⁺)	CaCO ₃	797	
Hydrogen (H ⁺)	CaCO ₃	0	
Potassium (K ⁺)	CaCO ₃	0	
Ammonium (NH ₄ ⁺)	CaCO ₃	0	
TOTAL CATIONS	CaCO ₃	2253	
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	125	
Carbonate (CO ₃ ⁻)	CaCO ₃	-	
Hydroxide (OH ⁻)	CaCO ₃	-	
Chloride (Cl ⁻)	CaCO ₃	196	
Sulfate (SO ₄ ⁻)	CaCO ₃	1793	
Nitrate (NO ₃ ⁻)	CaCO ₃	5	
Fluoride (F ⁻)	CaCO ₃	10	
Phosphate (PO ₄ ⁻)	CaCO ₃	1	
Sulfite (SO ₃ ⁻)	CaCO ₃	0	
Thiocyanide (CNS ⁻)	CaCO ₃	0	
Organic Acids	CaCO ₃	0	
Cyanide (CN ⁻)	CaCO ₃	5	
TOTAL ANIONS	CaCO ₃	2114	
Iron Total	Fe	-	
Carbon Dioxide, Free	CO ₂	261	
Silica	SiO ₂	12.1	
Residual Chlorine	Cl ₂		
Organic Chemicals			
Manganese	Mn		
Copper	Cu		
Hydrogen Sulfide	H ₂ S		
Other Trace Metals			
Phenol	C ₆ H ₆		
Sulfur	S		
Volatile Acid			
TOC			
Oil & Grease			
Temperature	°F		
COD			
BOD			
Flow Rate	GPM	1080	1080

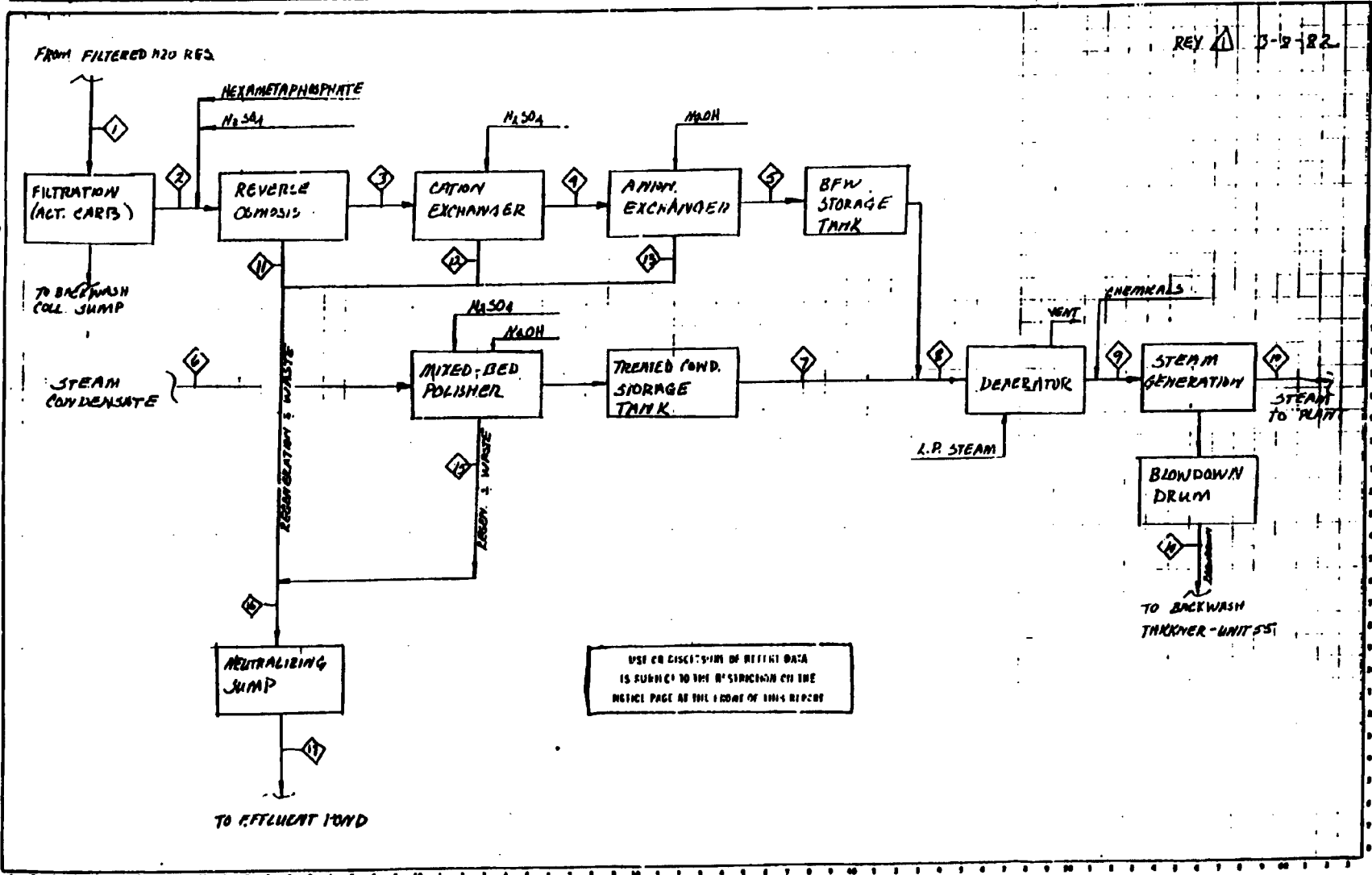
USE OR SACLOSURE OF TEST DATA
 IS SUBJECT TO THE RESTRICTIONS ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

PRELIMINARY

FLUOR

3-8-82
CONT. NO. 838504
BY *[Signature]*
SHEET NO.

WATER MANAGEMENT BLOCK FLOW DIAGRAM
UNIT 74 - ROLLER FEED WATER



REV 3-9-82

USE OF DISCRETION OF REFINER DATA IS SUBJECT TO THE DISCRETION OF THE NOTICE PAGE AT THE FRONT OF THIS REPORT

TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.6 Flue Gas Desulfurization

Al. 4.6

PRELIMINARY FLUOR

DATE 2/16/82
CONT. NO.
BY ... CR'D

WATER SOURCE	
UNIT 46 - FGD SCRUBBING	
S T R E A M	② EVAPORATION LOSS
	③ MAKE-UP WATER
	⑤ FGD SLUDGE RETAINED WATER
	④ BLOWDOWN

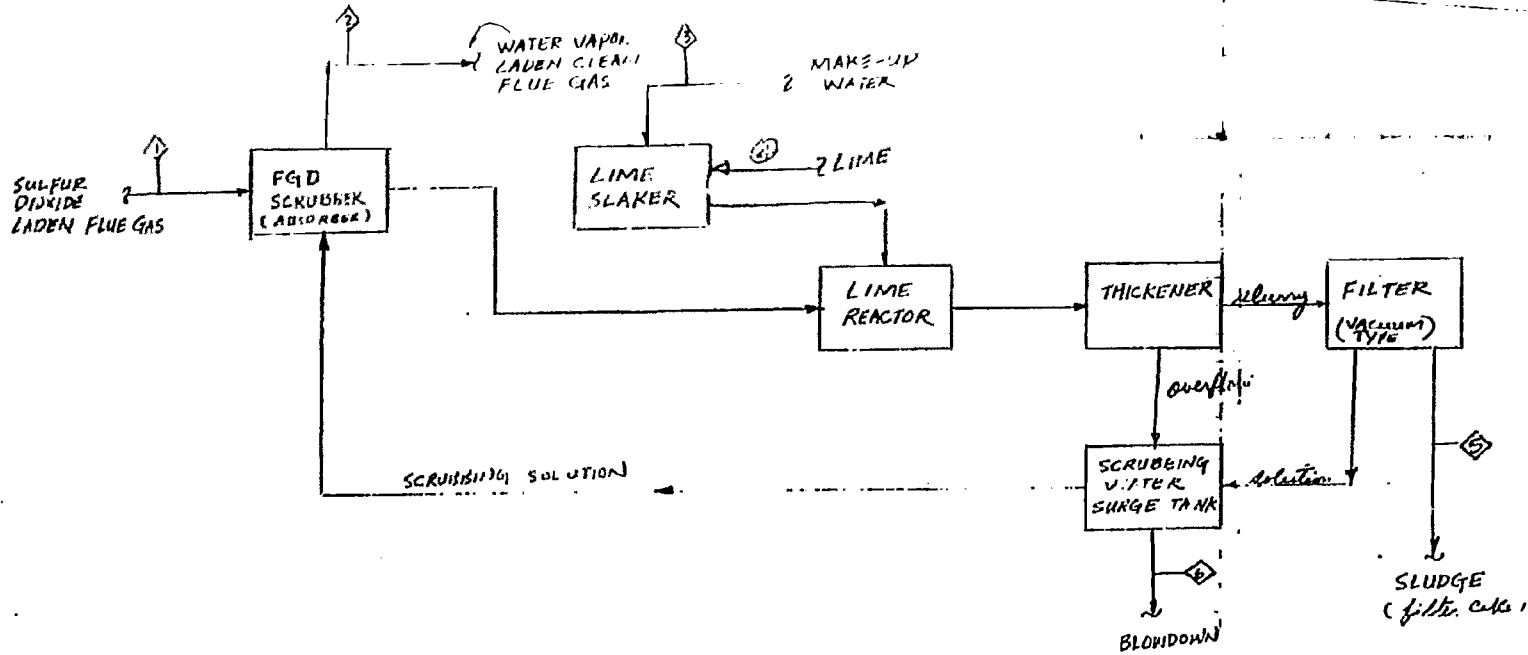
CONSTITUENT	PPM	STREAM NO.			
		②	③	⑤	④
Total Dissolved Solids			443		762
Total Alkalinity	CaCO ₃		51		316
Total Hardness	CaCO ₃		332		1158
PH			6.6		8.5
Total Suspended Solids			0		-
Calcium (Ca ⁺⁺)	CaCO ₃		216		774
Magnesium (Mg ⁺⁺)	CaCO ₃		116		374
Sodium (Na ⁺)	CaCO ₃				180
Potassium (K ⁺)	CaCO ₃				
Ammonium (NH ₄ ⁺)	CaCO ₃				
TOTAL CATIONS	CaCO ₃		332		1378
Carbonate (CO ₃ ⁼)	CaCO ₃		54		716
Hydroxide (OH ⁻)	CaCO ₃				
Chloride (Cl ⁻)	CaCO ₃		21		120
Sulfate (SO ₄ ⁼)	CaCO ₃		254		920
Nitrate (NO ₃ ⁻)	CaCO ₃		1.0		4
Fluoride (F ⁻)	CaCO ₃		1.9		1.6
Phosphate (PO ₄ ⁼)	CaCO ₃		0.14		0.55
Sulfite (SO ₃ ⁼)	CaCO ₃				
Thiocyanide (CNS ⁻)	CaCO ₃				
TOTAL ANIONS	CaCO ₃		332		332
Iron, Total	Fe		0		0
Carbon Dioxide, Free	CO ₂		25		
Silica	SiO ₂		2.1		10
Residual Chlorine	Cl ₂		1.5		
ORGANIC ACIDS					
Manganese	Mn		0.16		<0.10
Copper	Cu		0.01		<0.01
Free Ammonia	NH ₃				
Phenol	C ₆ H ₆				
SULFUR	S				
Turbidity					
Conductivity	micromhos/cm				
Temperature	OF	212	75		90
SLUDGE	lbs./hr.			206,000	
BOD					

USE OF THIS TABLE OF DATA IS LIMITED TO THE ESTIMATION OF THE QUALITY OF WATER AS RECEIVED AT THIS PLANT

WATER MANAGEMENT BLOCK FLOW DIAGRAM
 UNIT 46 FLUE GAS DESULFURIZATION

FLOOR

2/15/82
 CONT. NO. E35104
 BY P. King CSD
 SHEET NO. 1 of 1



PRELIMINARY

USE OF THE RESULTS OF REPLY DATA
 IS SUBJECT TO THE RESTRICTIONS ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

A1.4.7 Effluent Treatment (Unit 52)

Oily water is initially treated in API separators and Dissolved Air Flotation Units (DAF) to remove free oil and suspended material. The DAF effluent is then combined with the other process plant waste streams in the equalization pond. Other process plant waste streams include stripped gas liquor, Mobil MTG reaction water, and miscellaneous plant process effluents such as equipment leakage, wash water, etc. The pond serves to absorb any flow and chemical composition swings prior to the biological treatment. Off-spec waste is diverted to the off-spec collection pond and recycled back to the equalization pond. The collected water is initially pumped to a primary aeration basin, where Biological Oxygen Demand for the water is reduced. Phosphate is added at the aeration tank, then the aerated waste is pumped into a clarifier where suspended solids are collected. Next, the partially treated waste flows to a secondary aeration basin, where it will be further aerated. After extended aeration/contact time, the water is pumped to a secondary clarifier unit, where polyelectrolyte is added to obtain more efficient suspended solids removal.

Effluent from the second clarifier will be recycled to the off-spec collection pond if it is not acceptable. The clarifier overflow is routed through sand filters for the removal of residual suspended material. The waste water is then treated by activated carbon filters for further removal of residual organics and toxic substances. Then it is pumped to the treated effluent pond where it is blended with other plant wastes for pH adjustment, monitoring, and eventual discharge to the Ohio River. Part of the biosludge from the primary and secondary clarifier is routed to a sludge thickener for concentration. The balance of the sludge is recycled to the aeration tanks.

Storm and Oily Water Separation System (Unit 52)

The plot is divided into clean and contaminated drainage areas for the purpose of collecting and segregating clean and contaminated storm runoff.

The clean storm sewer (CSS) collects all runoff from clean areas and impounds it for discharge to the river if the water quality is environmentally acceptable. The two clean storm ponds provided are sized on the basis of impounding the runoff resulting from a 10-year frequency, one day duration storm event equivalent to 4.9 inches total rainfall collected over the surface of the clean storm sewer-watershed.

A1.4.7 Effluent Treatment (Unit 52) (Continued)

The oily water storm sewer (OWS) collects oily storm runoff and washdown from contaminated process areas and tankage. The oily water process sewer (POS) collects equipment drains and washdown. Oily water from both sewers flows to the oily water separation system where free oil is skimmed off and sludge is collected and removed. The overflow from the oily water separator is routed through an air flotation unit for final oil removal prior to being pumped to biological treatment. Two oily water ponds are provided to impound oily water during a storm event. The ponds are sized to impound the runoff resulting from a 25-year frequency, one day duration, storm event equivalent to 5.7 inches total rainfall collected over the surface of the oily water storm sewer watershed plus 40 minutes flush from the clean storm sewer for the same storm event.

Normally, under dry weather conditions, the OWS flow is to the oily water separator. During a storm event, the initial flush of the CSS is automatically diverted to the oily water ponds. After 30 minutes, the CSS is again routed to the clean storm ponds. During an extended storm event, the OWS may be manually diverted to the clean storm ponds. Oily water impounded in the oily water ponds during a storm event is pumped to biotreating through oily water separator and air flotation unit.

WATER SOURCE

STREAM NAME	1	LUGG STRIP GAS LIQUOR
	2	TEXACO POY REACTION WATER
	3	MOBIL MFG CONDENSATE
	4	SNK UNIT CONDENSATE
	5	OLY WATER PRE-TREATMENT BS FEED

Date 3/3/82
 Cont. No. P35504
 By Y.M.K.M.

CONSTITUENT	PPM	STREAM NO.				
		1	2	3	4	5
Total Dissolved Solids		1335	-	-	-	447
Total Alkalinity	CaCO ₃	-	-	-	-	54
Total Hardness	CaCO ₃	83	-	-	-	102
pH		6.1	-	3.2	-	6.7
Total Suspended Solids		-	-	-	-	57
Calcium (Ca++)	CaCO ₃	5	-	-	-	216
Magnesium (Mg++)	CaCO ₃	53	-	-	-	6
Sodium (Na+)	CaCO ₃	74	-	-	-	-
Hydrogen (H+)	CaCO ₃	-	-	-	-	-
Potassium (K+)	CaCO ₃	28	-	-	-	-
Ammonium (NH ₄ +))	CaCO ₃	225	-	-	-	-
TOTAL CATIONS	CaCO ₃	1247	-	-	-	532
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	-	-	-	-	54
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	694	-	-	-	21
Sulfate (SO ₄ ⁻)	CaCO ₃	73	-	-	-	254
Nitrate (NO ₃ ⁻)	CaCO ₃	26	-	-	-	1
Fluoride (F ⁻)	CaCO ₃	122	-	-	-	2
Phosphate (PO ₄ ⁻)	CaCO ₃	9	-	-	-	2.1
Sulfite (SO ₃ ⁻)	CaCO ₃	38	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	115	-	-	-	-
Organic Acids	CaCO ₃	207	-	527	-	-
Cyanide (CN ⁻)	CaCO ₃	19	-	-	-	-
TOTAL ANIONS	CaCO ₃	1336	-	-	-	352
Iron Total	Fe	6	-	-	-	-
Carbon Dioxide, Free	CO ₂	-	-	-	-	35
Silica	SiO ₂	12	-	-	-	2
Residual Chlorine	Cl ₂	-	-	-	-	1.5
Organic Chemicals		-	-	940	-	-
Manganese	Mn	-	-	-	-	2.1
Copper	Cu	-	-	-	-	1.1
Hydrogen Sulfide	H ₂ S	5	-	-	-	-
Other Trace Metals		57	-	-	-	-
Phenol	C ₆ H ₆	16	-	-	-	-
Sulfur	S	140	-	-	-	-
Volatile Acid		216	-	-	-	-
TOC		330	-	-	-	-
Oil & Grease		-	-	102	-	200
Temperature	°F					
COD		980		2300		300
BOD		653		1400		250
Flow Rate	GPM	3215	14	497	47	200

USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTIONS ON THE INSIDE PAGE AT THE FRONT OF THIS REPORT.

S T R E A M	6. DISSOLVED AIR FLOTATION UNIT EFFLUENT
	7. COAL SCREENING BLOW DOWN
	8. BIO-TREATMENT SYSTEM FEED
	9. BIO-TREATMENT EFFLUENT BEFORE FILTER
	10. BIO-TREATMENT EFFLUENT AFTER FILTER

Date 3/3/82
 Cont. No. 235114
 By VM KIM

CONSTITUENT	PPM	STREAM NO.				
		6	7	8	9	10
Total Dissolved Solids		528	507	1045	2880	2820
Total Alkalinity	CaCO ₃	68	54	12	160	160
Total Hardness	CaCO ₃	332	332	67	903	1903
pH		8.0	6.6	7.5	7.5	7.5
Total Suspended Solids		-	-	-	20	<5
Calcium (Ca ⁺⁺)	CaCO ₃	216	216	43	1879	1879
Magnesium (Mg ⁺⁺)	CaCO ₃	116	116	24	24	24
Sodium (Na ⁺)	CaCO ₃	60	140	144	131	141
Hydrogen (H ⁺)	CaCO ₃	-	-	-	-	-
Potassium (K ⁺)	CaCO ₃	-	-	0.3	0.3	0.3
Ammonium (NH ₄ ⁺)	CaCO ₃	-	-	85	-	-
TOTAL CATIONS	CaCO ₃	392	472	1069	1863	1863
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	68	54	12	160	160
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	161	483	483	483
Sulfate (SO ₄ ⁻)	CaCO ₃	297	254	105	178	178
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	60	1039	1039
Fluoride (F ⁻)	CaCO ₃	2	2	86	86	86
Phosphate (PO ₄ ⁻)	CaCO ₃	0.1	0.1	5.9	30	30
Sulfite (SO ₃ ⁻)	CaCO ₃	-	<1	26.1	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	20.6	<5	<5
Organic Acids	CaCO ₃	-	-	209	<1	-
Cyanide (CN ⁻)	CaCO ₃	-	-	1.3	-	-
TOTAL ANIONS	CaCO ₃	390	472	1069	2047	2047
Iron Total	Fe	-	-	4.	-	-
Carbon Dioxide, Free	CO ₂	1.3	25	0.4	10	10
Silica	SiO ₂	2.1	2.1	8.7	8.7	8.7
Residual Chlorine	Cl ₂	1.5	-	0.3	-	-
Organic Chemicals		-	-	117	<1	-
Manganese	Mn	-	0.2	-	-	-
Copper	Cu	-	-	0.1	-	-
Hydrogen Sulfide	H ₂ S	-	-	3.4	-	-
Other Trace Metals		-	-	26	-	-
Phenol	C ₆ H ₆	-	12	11.	-	-
Sulfur	S	-	-	98	-	-
Volatile Acid		-	-	151	-	-
TOC		-	9	231	<10	<10
Oil & Grease		10	-	13	<5	<1
Temperature	°F	-	-	-	-	-
COD		90	63	959	30-45	30-45
BOD		20	30	622	10-15	10
Flow Rate	GPM	795	50	4618	4606	4606

USE OR CONSULT STATE OF MICHIGAN
 DEPARTMENT OF ENVIRONMENTAL
 QUALITY CONTROL DIVISION FOR THE
 POLICE PRICE AND REGULATIONS ON THIS REPORT

WATER SOURCE

S T R E A M	11 OILY WATER SLUDGE
	12 BIO TREATMENT SYSTEM SLUDGE
	13 EFFLUENT TO OHIO RIVER

Date 3/3/22

Cont. No. F35504

By YAKIM

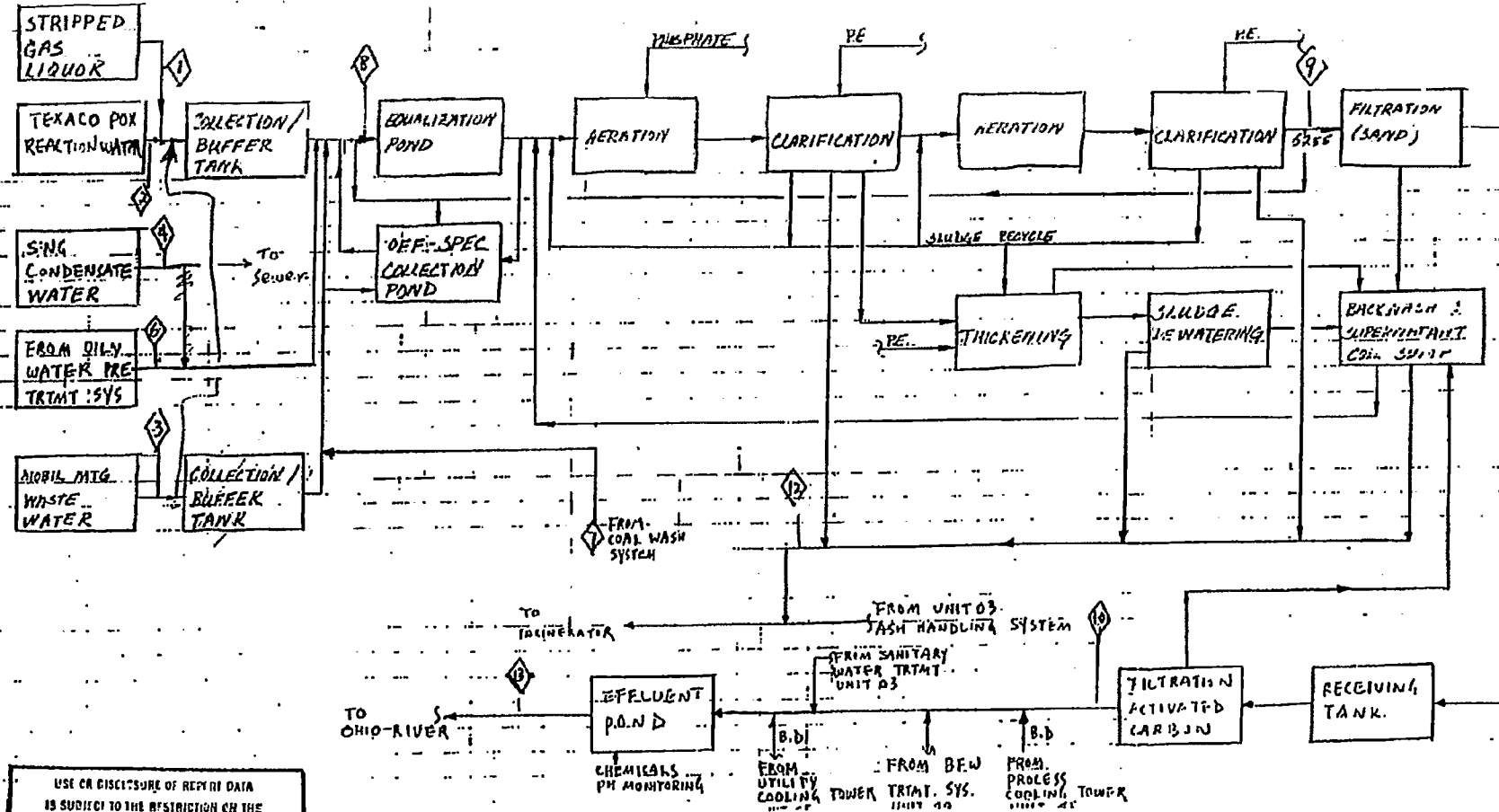
CONSTITUENT	PPM	STREAM NO.		
		11	12	13
Total Dissolved Solids				2302
Total Alkalinity	CaCO ₃			137
Total Hardness	CaCO ₃			1537
pH				7
Total Suspended Solids				-
Calcium (Ca++)	CaCO ₃			1314
Magnesium (Mg++)	CaCO ₃			227
Sodium (Na+)	CaCO ₃			125
Hydrogen (H+)	CaCO ₃			-
Potassium (K+)	CaCO ₃			2.1
Ammonium (NH ₄ +))	CaCO ₃			-
TOTAL CATIONS	CaCO ₃			1626
Bicarbonate (HCO ₃ ⁻)	CaCO ₃			127
Carbonate (CO ₃ ⁻²)	CaCO ₃			-
Hydroxide (OH ⁻)	CaCO ₃			-
Chloride (Cl ⁻)	CaCO ₃			284
Sulfate (SO ₄ ⁻²)	CaCO ₃			657
Nitrate (NO ₃ ⁻)	CaCO ₃			515
Fluoride (F ⁻)	CaCO ₃			46
Phosphate (PO ₄ ⁻³)	CaCO ₃			15
Sulfite (SO ₃ ⁻²)	CaCO ₃			-
Thiocyanide (CNS ⁻)	CaCO ₃			<3
Organic Acids	CaCO ₃			-
Cyanide (CN ⁻)	CaCO ₃			-
TOTAL ANIONS	CaCO ₃			1647
Iron Total	Fe			-
Carbon Dioxide, Free	CO ₂			24
Silica	SiO ₂			X
Residual Chlorine	Cl ₂			3
Organic Chemicals				-
Manganese	Mn			0.2
Copper	Cu			-
Hydrogen Sulfide	H ₂ S			-
Other Trace Metals				-
Phenol	C ₆ H ₆			-
Sulfur	S			-
Volatile Acid				-
TOC				-
Oil & Grease SLUDGE	#/HR	180	2000	-
Temperature	°F			
COD				15-20
BOD				<5
Flow Rate	GPM	5	12	9371

USE ONLY THE DATA
 INDICATED IN THE
 INSTRUCTIONS OF THE
 ANALYZER FOR THE
 ANALYSIS OF THE SAMPLE

WATER MANAGEMENT BLOCK FLOW DIAGRAM
 UNIT 52- BIOLOGICAL TREATMENT SYSTEM

DATE 2-5-83
 CONT. NO. 23300
 BY H. G. M. G. M. G. M.
 SHEET NO. 1
 Rev. 1. 3/9/82
 YMK

PRELIMINARY



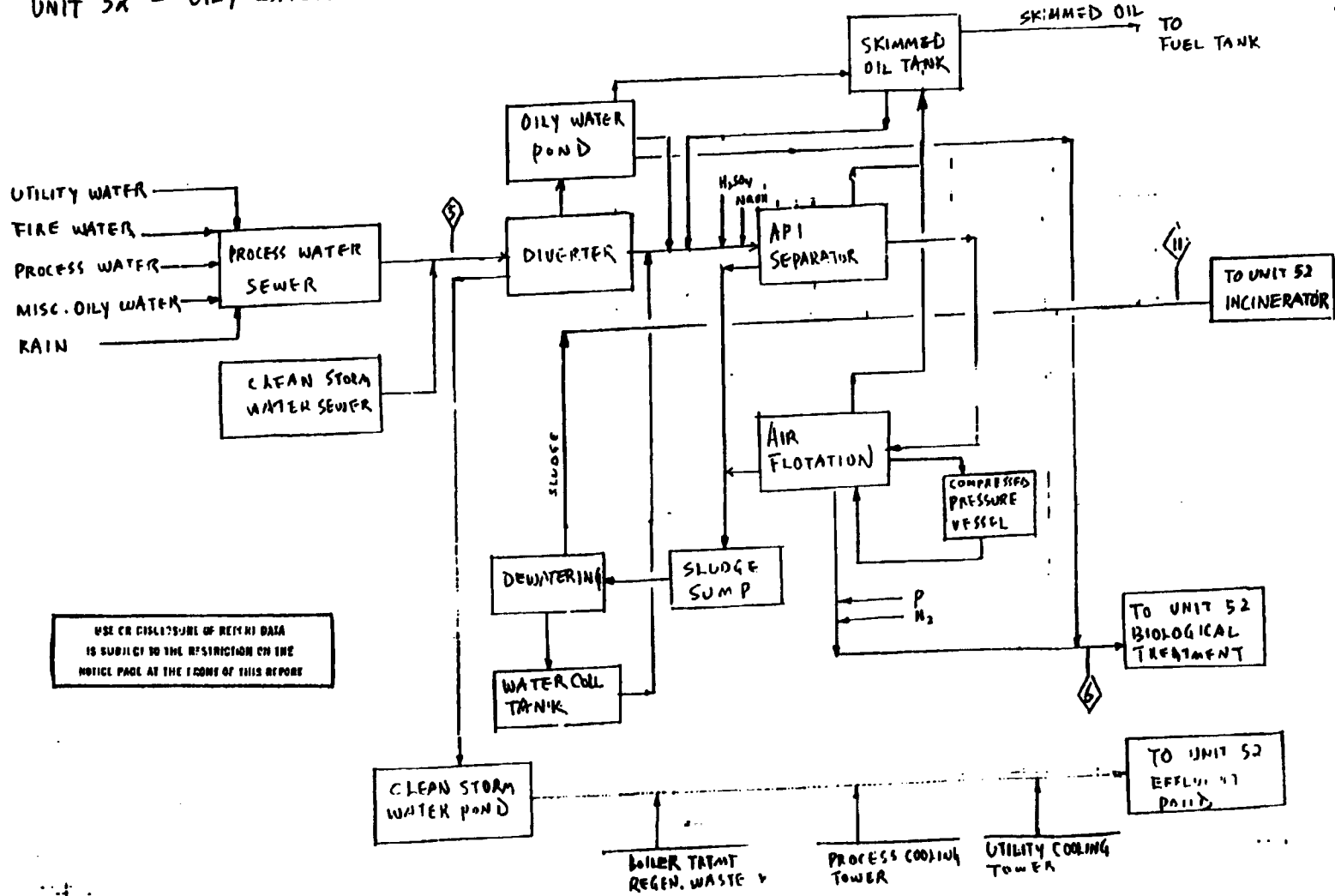
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 IS SUBJECT TO THE RESTRICTION ON THE
 NOTICE PAGE AT THE FRONT OF THIS REPORT

PRELIMINARY

BY: V. R. K. CH'D.
DATE: 1961

WATER MANAGEMENT BLOCK FLOW DIAGRAM

UNIT 52 - OILY WATER TREATMENT SYSTEM



USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTIONS ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

100-100000-100

TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.8 Sludge and Dissolved Solid Disposal System
(Unit 52)

The sludge and dissolved solids resulted from the treatment of liquid effluents at the synfuels plant are handled in three separate systems:

1. The blowdown of recirculating water from the hot gasifier ash, boiler ash, and FGD units are discharged to a TDS concentrator in which the total dissolved solids are concentrated by evaporating the water portion. The slurry will then be conveyed to a landfill along with ash sludge generated from gasifier and boiler.
2. The fly ash collected from the coal-fired boilers is first blended with the sludges generated from the flue gas desulfurization unit before discharging these stabilized solid wastes to the landfill.
3. The main bulk of the biological sludge from the plant consists of sanitary wastewater treatment, process waste water, raw water biological treatment facilities, and oily sludge from oil/water treatment facility. This sludge mixture is further dewatered. The dry sludge cake is incinerated in the multiple-hearth incinerator.

WATER SOURCE		UNIT 3 - DISSOLVED SOLIDS TO SLUDGE DISPOSAL SYSTEM	
S T R E A M	1	GASIFIER ASH	BLOWDOWN
	2	BOILER BOTTOM ASH	BLOWDOWN
	3	FGD SCRUBBER	BLOWDOWN
	4	TOTAL BLOWDOWN TO TDS CONCENTRATOR	

Date 3/2/82
Cont. No. 835704
By P. H. Way

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.			
		1	2	3	4
Total Dissolved Solids		2654	2654	1765	2579
Total Alkalinity	CaCO ₃	54	54	216	68
Total Hardness	CaCO ₃	1530	1530	1148	1498
pH		6.6	6.6	8.5	6.8
Total Suspended Solids		0	0	0	0
Calcium (Ca++)	CaCO ₃	880	880	774	871
Magnesium (Mg++)	CaCO ₃	650	650	374	627
Sodium (Na+)	CaCO ₃	338	338	180	325
Hydrogen (H+)	CaCO ₃	—	—	—	—
Potassium (K+)	CaCO ₃	110	110	—	100
Ammonium (NH ₄ +))	CaCO ₃	—	—	—	—
TOTAL CATIONS	CaCO ₃	1978	1978	1328	1923
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	216	68
Carbonate (CO ₃ ⁻)	CaCO ₃	—	—	—	—
Hydroxide (OH ⁻)	CaCO ₃	—	—	—	—
Chloride (Cl ⁻)	CaCO ₃	21	21	180	34
Sulfate (SO ₄ ⁻)	CaCO ₃	1900	1900	920	1817
Nitrate (NO ₃ ⁻)	CaCO ₃	1.0	1.0	4	1.5
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	7.6	2.5
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.56	0.18
Sulfite (SO ₃ ⁻)	CaCO ₃	—	—	—	—
Thiocyanide (CNS ⁻)	CaCO ₃	—	—	—	—
Organic Acids	CaCO ₃	—	—	—	—
Cyanide (CN ⁻)	CaCO ₃	—	—	—	—
TOTAL ANIONS	CaCO ₃	1978	1978	1328	1923
Iron Total	Fe	0	0	0	0
Carbon Dioxide, Free	CO ₂	25	25	—	23
Silica	SiO ₂	70	70	10	65
Residual Chlorine	Cl ₂	—	—	—	—
Organic Chemicals		—	—	—	—
Manganese	Mn	<0.15	<0.15	<0.15	<0.15
Copper	Cu	<0.01	<0.01	<0.01	<0.01
Hydrogen Sulfide	H ₂ S	—	—	—	—
Other Trace Metals		5.5	5.5	—	5.04
Phenol	C ₆ H ₆	—	—	—	—
Sulfur	S	—	—	—	—
Volatile Acid		—	—	—	—
TOC		—	—	—	—
SLUDGE	LBS./HR.	—	—	—	—
Temperature	°F	80	80	100	85
COD		—	—	—	—
BOD		—	—	—	—
Flow Rate	GPM	200	17	20	237

This analysis is preliminary and is subject to change. The results are for information only and should not be used for regulatory purposes.

WATER SOURCE UNIT 53 DISPOSAL SYSTEM

STREAM	5 - GASIFIER ASH SLUDGE (COARSE ASH SLUDGE)
	6 - BOILER BOTTOM ASH SLUDGE
	7 - TOTAL GASIFIER AND BOILER BOTTOM ASH SLUDGE TO LANDFILL
	PRELIMINARY

Date 3/2/82
 Cont. No. 83JJ04
 By P. HUNG

CONSTITUENT	PPM	STREAM NO.		
		5	6	7
Total Dissolved Solids				
Total Alkalinity	CaCO ₃			
Total Hardness	CaCO ₃			
pH				
Total Suspended Solids				
Calcium (Ca ⁺⁺)	CaCO ₃			
Magnesium (Mg ⁺⁺)	CaCO ₃			
Sodium (Na ⁺)	CaCO ₃			
Hydrogen (H ⁺)	CaCO ₃			
Potassium (K ⁺)	CaCO ₃			
Ammonium (NH ₄ ⁺)	CaCO ₃			
TOTAL CATIONS	CaCO ₃			
Bicarbonate (HCO ₃ ⁻)	CaCO ₃			
Carbonate (CO ₃ ⁻)	CaCO ₃			
Hydroxide (OH ⁻)	CaCO ₃			
Chloride (Cl ⁻)	CaCO ₃			
Sulfate (SO ₄ ⁻)	CaCO ₃			
Nitrate (NO ₃ ⁻)	CaCO ₃			
Fluoride (F ⁻)	CaCO ₃			
Phosphate (PO ₄ ⁻)	CaCO ₃			
Sulfite (SO ₃ ⁻)	CaCO ₃			
Thiocyanide (CNS ⁻)	CaCO ₃			
Organic Acids	CaCO ₃			
Cyanide (CN ⁻)	CaCO ₃			
TOTAL ANIONS	CaCO ₃			
Iron Total	Fe			
Carbon Dioxide, Free	CO ₂			
Silica	SiO ₂			
Residual Chlorine	Cl ₂			
Organic Chemicals				
Manganese	Mn			
Copper	Cu			
Hydrogen Sulfide	H ₂ S			
Other Trace Metals				
Phenol	C ₆ H ₆			
Sulfur	S			
Volatile Acid				
TOC				
SLUDGE (ASH)	LBS./HR.	161,300	13,160	174,460
Temperature	°F			
COD				
BOD				
Flow Rate	GPM	30	2.5	32.5

USE IN DISCUSSION OF RESULTS AND
 IS SUBJECT TO THE R. H. H. CO. USE
 REPORT MADE AT THE (200) (2) THIS REPORT

WATER SOURCE UNIT 52, DISSOLVED SOLIDS AND SLUDGE DISPOSAL SYSTEM

REV A 3/8/82

STREAM
8 FLY ASH Δ
9 - SLUDGE FROM FGD UNIT
10 - TOTAL FIXED SLUDGE WITH FLY ASH

Date 3/2/82
Cont. No. 83532
By P. L. King

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.		
		8	9	10
Total Dissolved Solids				
Total Alkalinity	CaCO ₃			
Total Hardness	CaCO ₃			
pH				
Total Suspended Solids				
Calcium (Ca ⁺⁺)	CaCO ₃			
Magnesium (Mg ⁺⁺)	CaCO ₃			
Sodium (Na ⁺)	CaCO ₃			
Hydrogen (H ⁺)	CaCO ₃			
Potassium (K ⁺)	CaCO ₃			
Ammonium (NH ₄ ⁺)	CaCO ₃			
TOTAL CATIONS	CaCO ₃			
Bicarbonate (HCO ₃ ⁻)	CaCO ₃			
Carbonate (CO ₃ ⁻)	CaCO ₃			
Hydroxide (OH ⁻)	CaCO ₃			
Chloride (Cl ⁻)	CaCO ₃			
Sulfate (SO ₄ ⁻)	CaCO ₃			
Nitrate (NO ₃ ⁻)	CaCO ₃			
Fluoride (F ⁻)	CaCO ₃			
Phosphate (PO ₄ ⁻)	CaCO ₃			
Sulfite (SO ₃ ⁻)	CaCO ₃			
Thiocyanide (CNS ⁻)	CaCO ₃			
Organic Acids	CaCO ₃			
Cyanide (CN ⁻)	CaCO ₃			
TOTAL ANIONS	CaCO ₃			
Iron Total	Fe			
Carbon Dioxide, Free	CO ₂			
Silica	SiO ₂			
Residual Chlorine	Cl ₂			
Organic Chemicals				
Manganese	Mn			
Copper	Cu			
Hydrogen Sulfide	H ₂ S			
Other Trace Metals				
Phenol	C ₆ H ₆			
Sulfur	S			
Volatile Acid				
TOC				
SLUDGE (ASH)	LBS/HR.	54240	266,000	260,240
Temperature	°F			
COD				
BOD				
Flow Rate	GPM		180	180

USE FOR PRELIMINARY ONLY. IF DATA IS REQUIRED FOR FINAL DESIGN, ANALYZE WITH ANALYSIS AND REPORT.

WATER SOURCE		UNIT 5. - DISSOLVED SOLIDS AN. SLUDGE DISPOSAL SYSTEM
S T R E A M	12	EXCESS BIO-SLUDGE FROM SANITARY WASTEWATER
	13	OILY SLUDGE FROM OILY WATER TREATMENT
	14	BIO-SLUDGE FROM PROCESS WASTEWATER BIO-TREATMENT PLANT
	15	TOTAL BIO & OILY SLUDGE TO INCINERATION

Date _____
 Cont. No. _____
 By _____

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.			
		12	13	14	15
Total Dissolved Solids					
Total Alkalinity	CaCO ₃				
Total Hardness	CaCO ₃				
pH					
Total Suspended Solids					1
Calcium (Ca ⁺⁺)	CaCO ₃				
Magnesium (Mg ⁺⁺)	CaCO ₃				
Sodium (Na ⁺)	CaCO ₃				
Hydrogen (H ⁺)	CaCO ₃				
Potassium (K ⁺)	CaCO ₃				
Ammonium (NH ₄ ⁺)	CaCO ₃				
TOTAL CATIONS	CaCO ₃				
Bicarbonate (HCO ₃ ⁻)	CaCO ₃				
Carbonate (CO ₃ ⁻)	CaCO ₃				
Hydroxide (OH ⁻)	CaCO ₃				
Chloride (Cl ⁻)	CaCO ₃				
Sulfate (SO ₄ ⁻)	CaCO ₃				
Nitrate (NO ₃ ⁻)	CaCO ₃				
Fluoride (F ⁻)	CaCO ₃				
Phosphate (PO ₄ ⁻)	CaCO ₃				
Sulfite (SO ₃ ⁻)	CaCO ₃				
Thiocyanide (CNS ⁻)	CaCO ₃				
Organic Acids	CaCO ₃				
Cyanide (CN ⁻)	CaCO ₃				
TOTAL ANIONS	CaCO ₃				
Iron Total	Fe				
Carbon Dioxide, Free	CO ₂				
Silica	SiO ₂				
Residual Chlorine	Cl ₂				
Organic Chemicals					
Manganese	Mn				
Copper	Cu				
Hydrogen Sulfide	H ₂ S				
Other Trace Metals					
Phenol	C ₆ H ₆				
Sulfur	S				
SLUDGE	LBS./HR	1300	2800	8000	12,100
TOC					
Oil & Grease					
Temperature	°F				
COD					
BOD					
Flow Rate	GPM	2.0	5.0	12.0	19.0

USE OR CITE THIS REPORT AS A GUIDE
 IS SUBJECT TO THE RESERVATIONS ON THE
 COVER PAGE IN THE FRONT MATTER

WATER MANAGEMENT BLOCK FLOW DIAGRAM
 UNIT 52 - DISSOLVED SOLIDS AND SLUDGE DISPOSAL SYSTEM

T FLOOR

CONF. NO. YSA 107
 BY P. J. JAMES
 SHEET NO.

REV Δ 3/6/82

PRELIMINARY

CLASSIFIED
 ASPHERIC

BOILER
 BOTTOM ASH
 HANDLING

FLUE GAS
 CONDENSATE
 UNIT

TDS
 CONCENTRATOR

BOILER
 FLY ASH
 COLLECTION
 SYSTEM

SLUDGE
 STORAGE
 FACILITY

LANDFILL

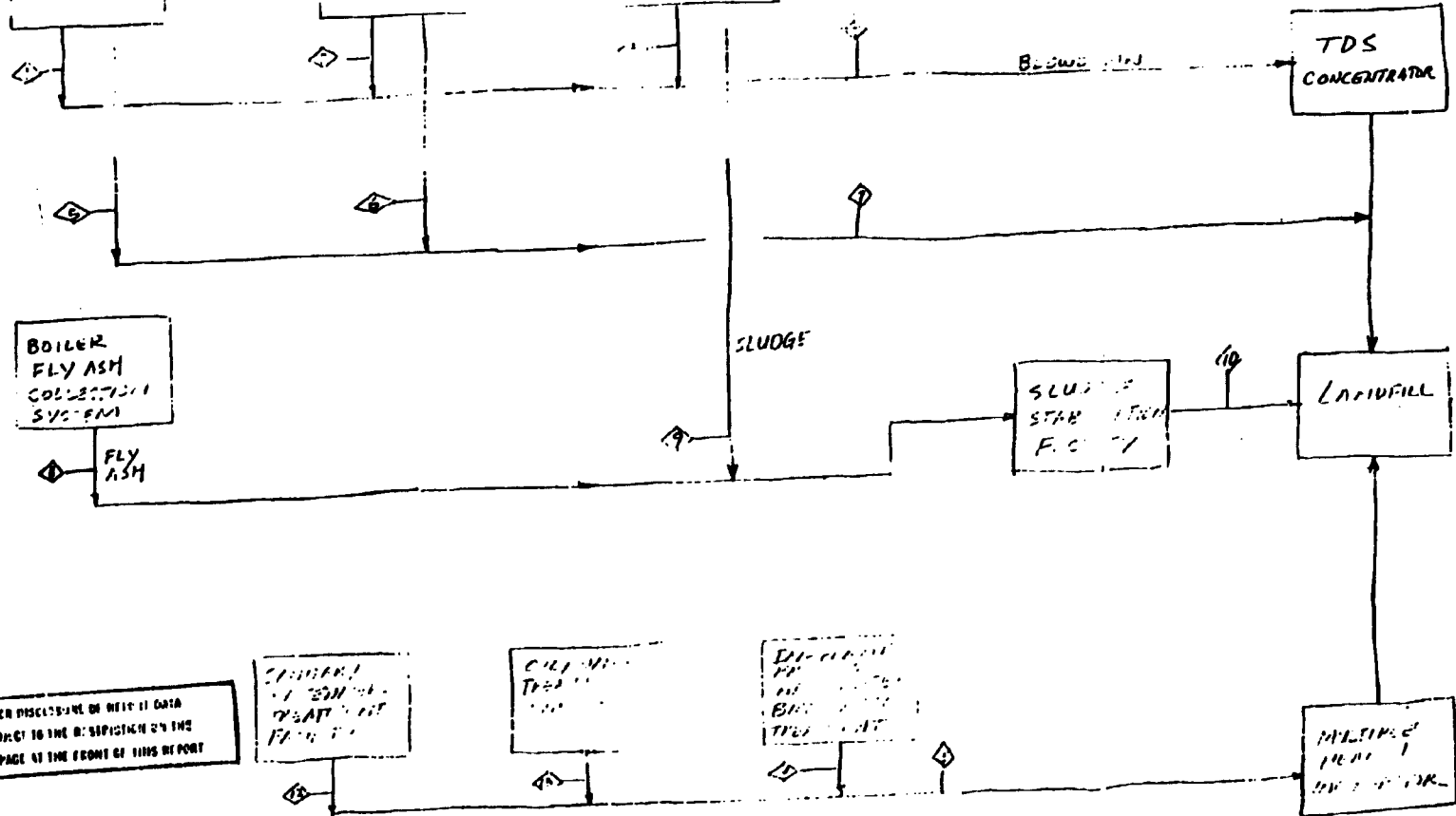
USE OR DISCUSSING OR REPLY DATA
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 NOTICE PAGE AT THE FRONT OF THIS REPORT

CONDENSATE
 TREATMENT
 FACILITY

CHEMICAL
 TREATMENT
 FACILITY

DISSOLVED
 SOLIDS
 TREATMENT
 FACILITY

MULTIPLE
 TREATMENT
 FACILITY



TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.9 Sanitary Sewage Treatment System (Unit 53)

The sewage influent to the sanitary sewer is comprised mostly of human liquids and solids waste. It is pumped through a bar grid designed to remove large pieces of wood or metallic refuse from the sewage that can cause damage to the sewage pump and comminutor. The coarse solid wastes are comminuted and sewage pumped into surge tank prior to treatment in the aeration tank. In the biological aeration, suspended solids are produced from the conversion of BOD. The sewage is decomposed by aerobic bacteria and other organisms in the presence of diffused air. These micro-organisms form a dark brown mass (activated sludge).

In the clarifier, the activated sludge settles to the bottom and the clear treated liquid flows over a weir into the outlet pipe which carries the plant effluent to the chlorine contractor. The settled sludge is recirculated back to the aeration tank to decompose more incoming sewage. Chlorine gas is used to kill the disease carrying bacteria which might be in the effluent. The treated effluent is fed to a sand bed filtration chamber. The filter can remove fine effluent particles that may carry over by the flowing water. Once the filter is loaded with particles, backwash followed by a rinsing cycle will unplug the sand bed. The final effluent usually requires pH adjustment before discharging into the Ohio River (downstream of the raw water suction inlet).

UNIT 53 - SANITARY SEWAGE TREATMENT

Date 3/24/82
 Cont. No. 835504
 By P. S. ...

S
T
R
E
A
M

1 - RAW SEWAGE INFLUENT
2 - ...
4 - ...

PRELIMINARY

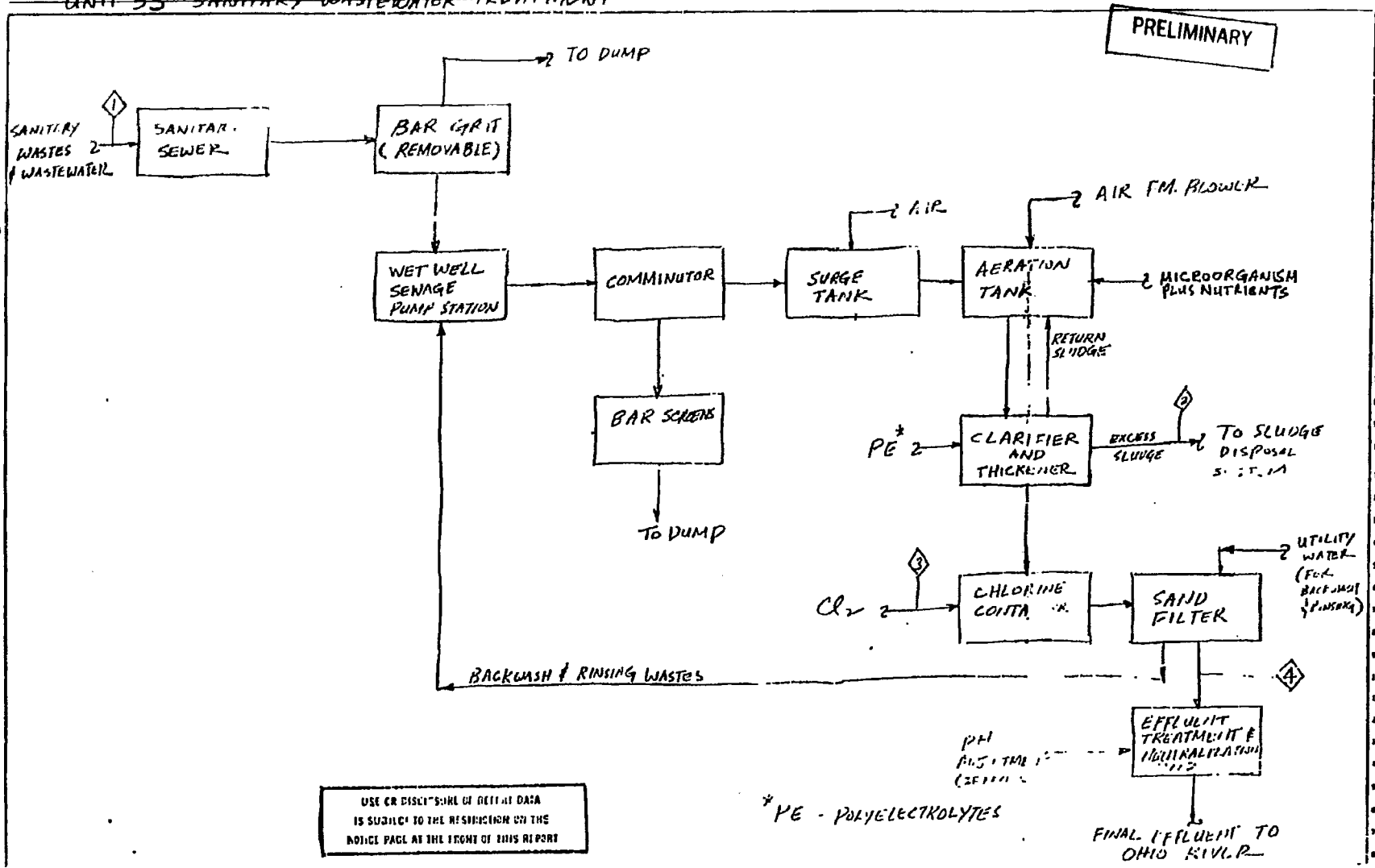
CONSTITUENT	PPM	STREAM NO.		
		1	2	4
Total Dissolved Solids		761	-	686
Total Alkalinity	CaCO ₃	164	-	69
Total Hardness	CaCO ₃	439	-	439
PH		7.4	-	6.7
Total Suspended Solids		255	-	5
Calcium (Ca++)	CaCO ₃	263	-	263
Magnesium (Mg++)	CaCO ₃	176	-	176
Sodium (Na+)	CaCO ₃	-	-	90
Hydrogen (H+)	CaCO ₃	-	-	-
Potassium (K+)	CaCO ₃	-	-	-
Ammonia (NH ₄ +))	CaCO ₃	50	-	0
TOTAL CATIONS	CaCO ₃	579	-	529
Bicarbonate (HCO ₃)	CaCO ₃	164	-	69
Carbonate (CO ₃ -)	CaCO ₃	-	-	-
Hydroxide (OH-)	CaCO ₃	-	-	-
Chloride (Cl-)	CaCO ₃	110	-	110
Sulfate (SO ₄ -)	CaCO ₃	254	-	254
Nitrate (NO ₃)	CaCO ₃	1	-	51
Fluoride (F-)	CaCO ₃	2	-	2
Phosphate (PO ₄ -)	CaCO ₃	42	-	43
Sulfite (SO ₃ -)	CaCO ₃	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-
TOTAL ANIONS	CaCO ₃	579	-	529
Iron Total	Fe	0.4	-	0.1
Carbon Dioxide, Free	CO ₂	12	-	-
Silica	SiO ₂	-	-	-
Residual Chlorine	Cl ₂	-	-	-
Organic Nitrogen	N	35	-	15
Manganese	Mn	-	-	-
Copper	Cu	-	-	-
Hydrogen Sulfide	H ₂ S	-	-	-
FREE AMMONIA	NH ₃	-	-	-
Phenol	C ₆ H ₆	-	-	-
Sulfur	S	-	-	-
SLUDGE	lbs./hr.	-	10	-
TOC		-	-	-
Oil & Grease		-	-	-
Temperature	°F	-	-	-
COD		200	-	200
BOD		300	-	30
Flow Rate	GPM	30	0.5	29.5

THIS REPORT IS PRELIMINARY AND IS SUBJECT TO THE QUALITY CONTROL PROGRAM OF THE SANITARY SEWAGE TREATMENT PLANT.

WATER MANAGEMENT BLOCK FLOW DIAGRAM
 UNIT 53 SANITARY WASTEWATER TREATMENT

FLOOR

FEB 2, 1962
 CONT NO. 25, 1054
 BY P. H. HENNING'S
 SHEET NO. 1 of 1



USE OR DISCLOSURE OF REPORT DATA IS SUBJECT TO THE RESTRICTIONS ON THE NOTICE PAGE AT THE FRONT OF THIS REPORT

* PE - POLYELECTROLYTES

FINAL EFFLUENT TO OHIO RIVER

TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.10 Unit 55 - Raw Water

Raw water from a Ranney Well structure is pumped to a raw water storage pond. Water from this pond is pumped through a sand filter to remove suspended solids. The water is chlorinated prior to filtration by in-line chlorination to remove organic matter. The filtered water is collected at the filtered water reservoir for use as boiler feed water makeup, cooling tower makeup, utility water, process water, fire water, and solids handling system makeup. The backwash from the sand filter unit is collected in the backwash sludge thickener where it is concentrated to about 10 to 12 percent solids. The waste stream is then further concentrated to about 40 percent solids in the sludge dewatering unit before being discharged to sludge disposal.

WATER SOURCE	
100 FT RAN WATER (FROM RAINWATER WELL)	
S T R E A M	1 RAN WATER FROM RAINWATER WELL
	2 ... AFTER 1.5 ...
	3 ...
	4 ...
	5 ...

Date 3-3-82
 Cont. No. 23650
 By MKR

PRELIMINARY

REV A 3-8-82

CONSTITUENT	PPM	STREAM NO.				
		1	2	3	4	5
Total Dissolved Solids		451	444	443	443	541
Total Alkalinity	CaCO ₃	22	54	54	54	61
Total Hardness	CaCO ₃	332	332	332	332	332
pH		7.55	7.67	7.64	7.7	7.7
Total Suspended Solids		10	10	0	0	1220
Calcium (Ca ⁺⁺)	CaCO ₃	216	216	216	216	216
Magnesium (Mg ⁺⁺)	CaCO ₃	116	116	116	116	116
Sodium (Na ⁺)	CaCO ₃	-	-	-	-	-
Hydrogen (H ⁺)	CaCO ₃	-	-	-	-	-
Potassium (K ⁺)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ ⁺)	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	332	332	332	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	22	54	54	54	61
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	7	21	21	21	19
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254	254	254
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	1	1	1
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9	1.9	1.9
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14	0.14	0.14
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	332	332	332
Iron Total	Fe	0.12	0.78	0	0	0.4
Carbon Dioxide, Free	CO ₂	12	25	25	25	19
Silica	SiO ₂	2.1	2.1	2.1	2.1	2.1
Residual Chlorine	Cl ₂	-	1.5	1.5	1.5	-
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0.15	0.15	0.15	0.15
Copper	Cu	20.01	20.01	20.01	20.01	20.01
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	CPM	10552	10770	10957	10914	1

USE OR DISCLOSE OF REPORT DATA IS SUBJECT TO THE RESTRICTIONS ON THE REVERSE PAGE OF THE FRONT OF THIS REPORT.

WATER SOURCE	
UNIT 55 - RAW WATER	
S T R E A M	6 BACKWASH - ACTIVATED CARBON FILTER
	7 FINE SCREEN - 20 MICRONS
	8 RECYCLE - BACKWASH TO RECYCLER
	9 TRICKLE - 12 INCHES DIA
	10 RECYCLE - SLUDGE DEWATERING

Date 3-2-82
 Cont. No. 8000
 By K.L.G. 2/3

CONSTITUENT	PPM	STREAM NO.				
		6	7	8	9	10
Total Dissolved Solids		443	559	443	1598.3	443
Total Alkalinity	CaCO ₃	54	54	54	54	54
Total Hardness	CaCO ₃	332	332	332	332	332
pH		6.64	6.64	6.64	6.64	6.64
Total Suspended Solids		0	1471	0	1020.99	0
Calcium (Ca++)	CaCO ₃	216	216	216	216	216
Magnesium (Mg++)	CaCO ₃	116	116	116	116	116
Sodium (Na+)	CaCO ₃	-	-	-	-	-
Hydrogen (H+)	CaCO ₃	-	-	-	-	-
Potassium (K+)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ +))	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	332	332	332	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54	54	54	54	54
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	-	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	21	21	21	21	21
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254	254	254
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	1	1	1
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9	1.9	1.9
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14	0.14	0.14
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	332	332	332
Iron Total	Fe	0	116	0	155.40	0
Carbon Dioxide, Free	CO ₂	25	25	25	25	25
Silica	SiO ₂	2.1	2.1	2.1	2.1	2.1
Residual Chlorine	Cl ₂	1.5	1.5	1.5	1.5	1.5
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0.15	0.15	0.15	0.15
Copper	Cu	20.01	20.01	20.01	20.01	20.01
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	-	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	10	137	148	2	1.5

USE OR REPRODUCTION OF THIS REPORT IS SUBJECT TO THE RESTRICTIONS THE NOTICE PAGE OF THIS REPORT

WATER SOURCE	
UNIT 55 - RAW WATER	
S T R E A M	11 SLIDE TO DISPOSAL

Date 3-3-82
 Cont. No. 235504
 By PAK 3/3

CONSTITUENT	PPM	STREAM NO.			
		11			
Total Dissolved Solids		62603			
Total Alkalinity	CaCO ₃	54			
Total Hardness	CaCO ₃	332			
pH		4.62			
Total Suspended Solids		40219			
Calcium (Ca++)	CaCO ₃	216			
Magnesium (Mg++)	CaCO ₃	116			
Sodium (Na+)	CaCO ₃	-			
Hydrogen (H+)	CaCO ₃	-			
Potassium (K+)	CaCO ₃	-			
Ammonium (NH ₄ +))	CaCO ₃	-			
TOTAL CATIONS	CaCO ₃	332			
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	54			
Carbonate (CO ₃ ⁻)	CaCO ₃	-			
Hydroxide (OH ⁻)	CaCO ₃	-			
Chloride (Cl ⁻)	CaCO ₃	21			
Sulfate (SO ₄ ⁻)	CaCO ₃	254			
Nitrate (NO ₃ ⁻)	CaCO ₃	1			
Fluoride (F ⁻)	CaCO ₃	1.9			
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14			
Sulfite (SO ₃ ⁻)	CaCO ₃	-			
Thiocyanide (CNS ⁻)	CaCO ₃	-			
Organic Acids	CaCO ₃	-			
Cyanide (CN ⁻)	CaCO ₃	-			
TOTAL ANIONS	CaCO ₃	332			
Iron Total	Fe	62160			
Carbon Dioxide, Free	CO ₂	25			
Silica	SiO ₂	2.1			
Residual Chlorine	Cl ₂	1.5			
Organic Chemicals		-			
Manganese	Mn	2.15			
Copper	Cu	2.21			
Hydrogen Sulfide	H ₂ S	-			
Other Trace Metals		-			
Phenol	C6H6	-			
Sulfur	S	-			
Volatile Acid		-			
TOC		-			
Oil & Grease		-			
Temperature	°F	-			
COD		-			
BOD		-			
Flow Rate	CPM	2.5			

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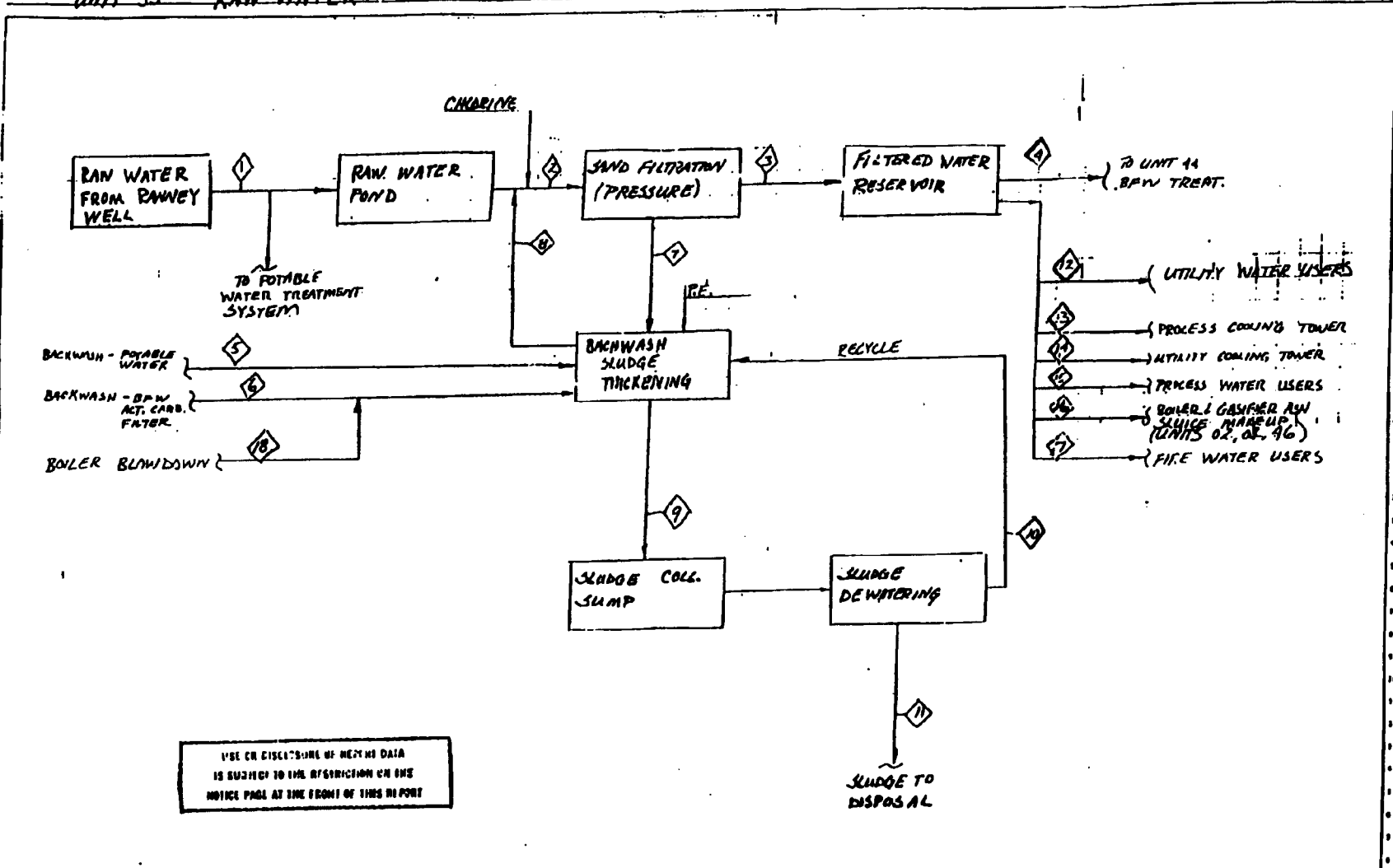
PRELIMINARY

4 FLOOR

1-22-64
CONT. NO. 835304
BY MRM CHA'S
SHEET NO.

WATER MANAGEMENT BLOCK FLOW DIAGRAM
UNIT 55 - RAW WATER

REV 3-8-82



TRI-STATE SYNFUELS COMPANY
Indirect Coal Liquefaction Plant
Western Kentucky

FLUOR ENGINEERS AND CONSTRUCTORS, INC.
Contract 835504

A1.4.11 Unit 55 - Potable Water Supply

The potable water supply is drawn upstream from the raw water storage pond. This water is treated separately by in-line chlorination and sand filtration to remove organics and suspended solids. A receiving tank is provided after the sand filter. The water is pumped from the tank through an activated carbon filter where organics and free chlorine will be removed. Following the activated carbon filter, the water is chlorinated and pumped to potable water storage tanks for distribution.

WATER SOURCE	
UNIT 55 - POTABLE WATER SYSTEM	
S T R E A M	1 RAW WATER FROM RAINNEY WELL
	2 RAW WATER - TWIN LAKE
	3 SAND FILTER EFFLUENT
	4 ACT. CARB. FILTER EFFLUENT
	5 POTABLE WATER

Date 3-3-82
 Cont. No. 83554
 By TLM

PRELIMINARY

CONSTITUENT	PPM	STREAM NO.				
		1	2	3	4	5
Total Dissolved Solids		451	447	446	446	446
Total Alkalinity	CaCO ₃	62	61	61	61	62
Total Hardness	CaCO ₃	332	332	332	332	332
pH		7.05	6.81	6.81	6.81	6.73
Total Suspended Solids		15	10	0	0	0
Calcium (Ca ⁺⁺)	CaCO ₃	216	216	216	216	216
Magnesium (Mg ⁺⁺)	CaCO ₃	116	116	116	116	116
Sodium (Na ⁺)	CaCO ₃	-	-	-	-	-
Hydrogen (H ⁺)	CaCO ₃	-	-	-	-	-
Potassium (K ⁺)	CaCO ₃	-	-	-	-	-
Ammonium (NH ₄ ⁺)	CaCO ₃	-	-	-	-	-
TOTAL CATIONS	CaCO ₃	332	332	332	332	332
Bicarbonate (HCO ₃ ⁻)	CaCO ₃	68	61	61	61	60
Carbonate (CO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Hydroxide (OH ⁻)	CaCO ₃	0	-	-	-	-
Chloride (Cl ⁻)	CaCO ₃	7	14	14	14	15
Sulfate (SO ₄ ⁻)	CaCO ₃	254	254	254	254	254
Nitrate (NO ₃ ⁻)	CaCO ₃	1	1	1	1	1
Fluoride (F ⁻)	CaCO ₃	1.9	1.9	1.9	1.9	1.9
Phosphate (PO ₄ ⁻)	CaCO ₃	0.14	0.14	0.14	0.14	0.14
Sulfite (SO ₃ ⁻)	CaCO ₃	-	-	-	-	-
Thiocyanide (CNS ⁻)	CaCO ₃	-	-	-	-	-
Organic Acids	CaCO ₃	-	-	-	-	-
Cyanide (CN ⁻)	CaCO ₃	-	-	-	-	-
TOTAL ANIONS	CaCO ₃	332	332	332	332	332
Iron Total	Fe	0.78	0.76	0	0	0
Carbon Dioxide, Free	CO ₂	12	14	14	14	20
Silica	SiO ₂	2.1	2.1	2.1	2.1	2.1
Residual Chlorine	Cl ₂	-	1.5	1.5	0	0.5
Organic Chemicals		-	-	-	-	-
Manganese	Mn	0.15	0.15	0.15	0	0
Copper	Cu	10.01	10.01	10.01	0	0
Hydrogen Sulfide	H ₂ S	-	-	-	-	-
Other Trace Metals		-	-	-	-	-
Phenol	C ₆ H ₆	-	-	-	-	-
Sulfur	S	0	-	-	-	-
Volatile Acid		-	-	-	-	-
TOC		-	-	-	-	-
Oil & Grease		-	-	-	-	-
Temperature	°F	-	-	-	-	-
COD		-	-	-	-	-
BOD		-	-	-	-	-
Flow Rate	GPM	121	121	120	120	120

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 WITHOUT THE WRITTEN PERMISSION OF THE ENGINEER
 IS PROHIBITED BY THE TERMS OF THIS REPORT

PRELIMINARY

1 FLUOR

2-3 42
CONT. NO. 842504
BY MRM CMB
SHEET NO.

WATER MANAGEMENT BLOCK FLOW DIAGRAM
UNIT 55 - POTABLE WATER SYSTEM (RANNEY WELL)

CHLORINE

RAW WATER
RANNEY WELL

FILTRATION
(SAND)

RECEIVING
TANK

FILTRATION
(ACT. CARBON)

POTABLE
WATER
STORAGE

TO POTABLE
WATER USES

BACKWASH TO
COLL. SUMP

CHLORINE

USE OR DISCLOSURE OF REPORT DATA
IS SUBJECT TO THE RESTRICTION ON THE
NOTICE PAGE AT THE FRONT OF THIS REPORT

