DOE/METC-84-26-Vol.3-Pt.1
(DE84012008)

# FAILURE MODE ANALYSIS FOR LIME/LIMESTONE FGD SYSTEMS

VOLUME III - PLANT PROFILES
Part 1 of 3

By
**S. M. Kenney**
**H. S. Rosenberg**
**L-I. O. Nilsson**
**J. H. Oxley**

August 1984

For
U. S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia

By
Battelle
Columbus Laboratories
Columbus, Ohio

**FOSSIL ENERGY**

## DISCLAIMER

## DISCLAIMER



Available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161.

Price: Printed Copy A25
Microfiche A01

Codes are used for pricing all publications. The code is determined by the number of pages in the publication. Information pertaining to the pricing codes can be found in the current issues of the following publications, which are generally available in most libraries: *Energy Research Abstracts (ERA); Government Reports Announcements* and Index (*GRA* and I); *Scientific and Technical Abstract Reports (STAR);* and publication NTIS-PR-360 available from NTIS at the above address.

DOE/METC--84-26-Vol.3-Pt.1

DE84 012008

# FAILURE MODE ANALYSIS FOR LIME/LIMESTONE FGD SYSTEMS

VOLUME III - PLANT PROFILES
Part 1 of 3

By
**S. M. Kenney**
**H. S. Rosenberg**
**L-I. O. Nilsson**
**J. H. Oxley**

August 1984

Under Contract No.: W-7405-Eng-92-122

For
U. S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

By
Battelle
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

DOE/METC-84-26-Vol.3-Pt.1
(DE84012008)
Distribution Category UC-90h

# FAILURE MODE ANALYSIS FOR LIME/LIMESTONE FGD SYSTEMS

VOLUME III - PLANT PROFILES
Part 1 of 3

By
**S. M. Kenney**
**H. S. Rosenberg**
**L-I. O. Nilsson**
**J. H. Oxley**

August 1984

Under Contract No.: W-7405-Eng-92-122

For
U. S. Department of Energy
Office of Fossil Energy
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

By
Battelle
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

Table of Contents

ALABAMA ELECTRIC COOP

TOMBIGBEE 2, 3

# SECTION 1

## BACKGROUND

The Tombigbee Power Station of Alabama Electric Cooperative, which is located near Leroy, Alabama, was expanded in the late 1970's with the addition of two identical 255 MW (gross) units, Tombigbee 2 and 3. Each unit fires a bituminous coal with an average sulfur content of 1.61%. At the time of construction of Tombigbee 2, this unit was subject to the 1971 Federal NSPS. To comply with these standards, the utility found it necessary to install an FGD system. In August 1975, a contract was awarded to Peabody Process Systems for the design and installation of a wet limestone scrubbing process for both units 2 and 3. Research-Cottrell was contracted to supply a 99.5% efficient ESP for primary particulate matter control. $SO_2$ is removed with an efficiency of 85.0% from 70% of the boiler flue gas generated by each unit. The remaining 30% of the particulate cleaned flue gas is used for flue gas reheat. The total unit design $SO_2$ removal efficiency is 59.5%. Unit 2 commenced commercial operations in September 1978, and unit 3 was placed in service in June 1979.

## SECTION 2

## PROCESS DESCRIPTION

The emission control systems installed on both Tombigbee 2 and 3 are identical and consist of a limestone FGD system for $SO_2$ control and a hot-side ESP for primary particulate matter control. The FGD systems were supplied by Peabody Process Systems and consist of two spray tower absorbers each. Each tower was designed to handle 35% of the boiler flue gas flow of 953,000 acfm at 291°F.

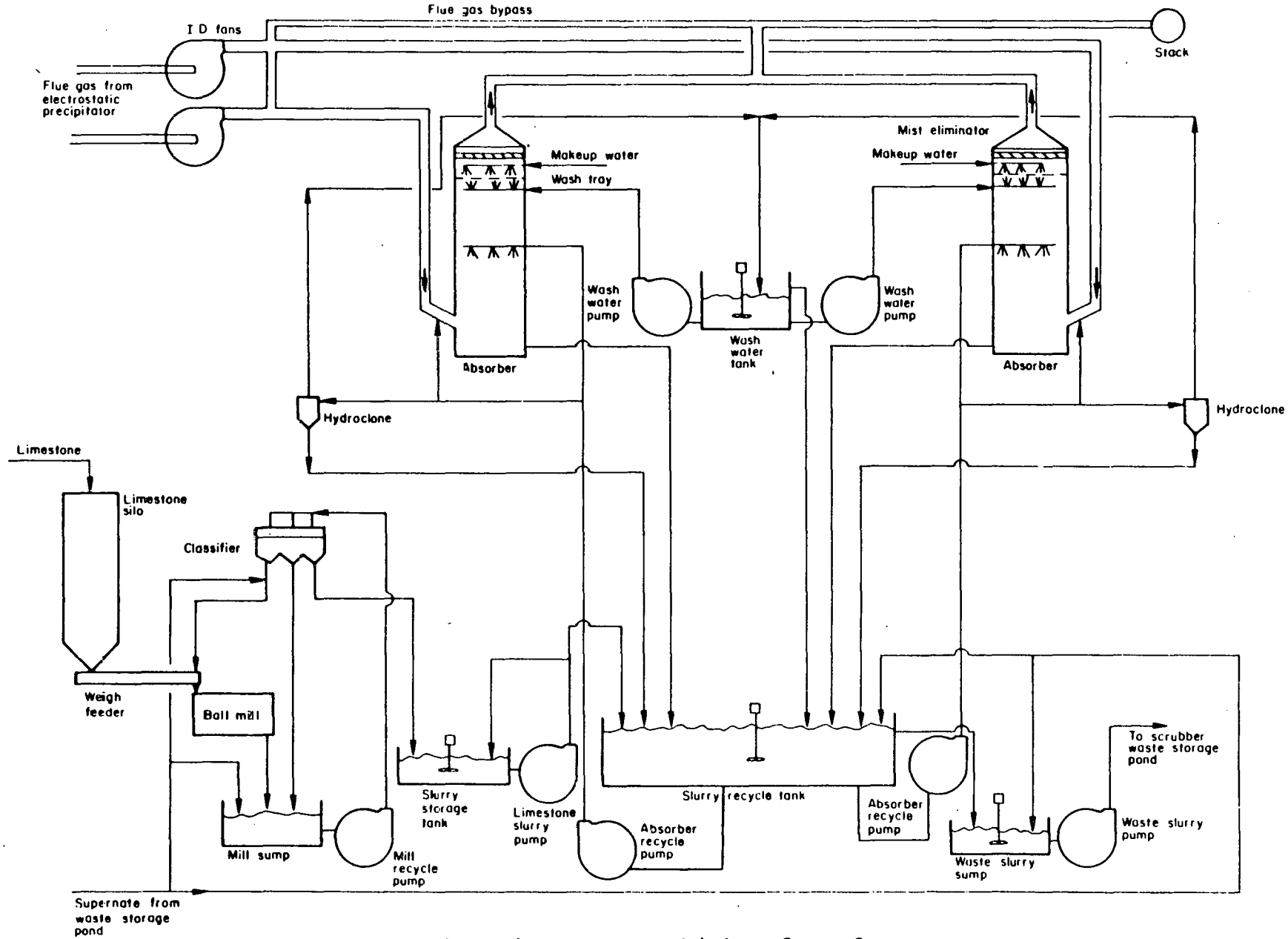
Flue gas exits the boiler economizer at 745°F and enters a four-field hot side ESP with an efficiency of 99.5%. The cleaned gas enters the boiler air preheater at 725°F through two parallel ducts from the ESP. Each gas stream is drawn through an ID fan that forces the gas into a common header feeding the $SO_2$ absorber towers and the bypass duct at 291°F. Of the 953,000 acfm of gas entering the header, 30% bypasses the absorbers and 35% passes through each tower.

Approximately 334,000 acfm of gas is fed into the base of each spray tower. The flue gas turns 90 degrees and passes through countercurrent spray zones. The saturated gas then passes through a horizontal, single-stage chevron mist eliminator into a common duct to the stack at 540,000 acfm and 130°F.

The scrubbed gas joins the bypasses gas and the combined stream enters the 400-ft stack at approximately 820,000 acfm and 170°F. The system operates in an open water loop mode.

Spent slurry is bled from the base of the absorbers to a common slurry recycle tank. Overflow from the recycle tank goes to a sump where it is mixed with supernatant from the sludge pond. The waste slurry from the sump is pumped out to the on-site lined sludge pond and sludge pond overflow goes to the process waste pond. Wastewater from the process waste pond is monitored for flow and pH and discharged to the river.

A flow diagram for the Tombigbee 2, 3 FGD systems is shown on the next page.




Flow Diagram: Tombigbee 2 or 3



Alabama Electric Coop
Tombigbee 2,3

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

GENERAL PLANT INFORMATION
- COMPANY NAME: ALABAMA ELECTRIC COOPERATIVE
- ASSOCIATED UTILITIES:
- PLANT NAME: TOMBIGBEE
- UNIT NUMBER: 2
- PLANT ADDRESS: TOMBIGBEE POWER PLANT
- CITY: LEROY
- COUNTY: WASHINGTON
- STATE: ALABAMA
- ZIP CODE: 36548
- EPA REGION: 4
- RIVER BASIN/LAKE REGION: TOMBIGBEE
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 525
- GROSS UNIT GENERATING CAPACITY - MW: 255
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 235
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 243
- EQUIVALENT SCRUBBED CAPACITY - MW: 179

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: RILEY STOKER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: TURBO FIRED
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 5/78
- DESIGN BOILER FLUE GAS FLOW - ACFM: 953,000
- FLUE GAS TEMPERATURE - F: 291
- FLUE GAS OXYGEN - %: 6
- HEAT RATE - BTU/KWH: 9400
- DESIGN FIRING RATE - TPH: 107
- EXCESS AIR - %: 25
- CAPACITY FACTOR - %:
- STACK HEIGHT - FT: 400

A SHELL MATERIAL: CONCRETE

B FLUE MATERIAL GENERIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL SPECIFIC TYPE:
- FLUE MATERIAL TRADE/COMMON NAME:
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 16.5
- STACK GAS INLET TEMPERATURE - F: 170
- STACK GAS OUTLET VELOCITY - FT/SEC: 58

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER:
- MINE NAME/AREA: PICKENS, KINLOCK, AND JONES SPUR
- MINE LOCATION - COUNTY:
- MINE LOCATION - STATE: ALABAMA, TENNESSEE, AND KENTUCKY
- AVERAGE HEAT CONTENT - BTU/LB: 11,424
- RANGE HEAT CONTENT - BTU/LB: 10,000-11,000
- AVERAGE ASH CONTENT - %: 14.73
- RANGE ASH CONTENT - %: 15-18
- AVERAGE MOISTURE CONTENT - %: 6.64
- RANGE MOISTURE CONTENT - %: 3-20
- AVERAGE SULFUR CONTENT - %: 1.61
- RANGE SULFUR CONTENT - %: 1.5-1.75
- AVERAGE CHLORIDE CONTENT - %: 0.04
- RANGE CHLORIDE CONTENT - %:
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: 1980 WEIGHTED AVERAGE AS BURNED

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT:

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: NONE
- TYPE (HOT SIDE/COLD SIDE): HOT SIDE
- SUPPLIER: RESEARCH-COTTRELL
- INLET FLUE GAS CAPACITY - ACFM: 953,000
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O: 0.5
- PARTICLE OUTLET LOAD - GR/SCF: 0.046

C PARTICLE REMOVAL EFFICIENCY - %: 99.5
- FLUE GAS CONDITIONING TYPE:

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: PEABODY PROCESS SYSTEMS
A-E FIRM: BURNS & MCDONNEL
CONSTRUCTION FIRM: PEABODY PROCESS SYSTEMS
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - %: 59.5 (OVERALL)
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

COMMERCIAL START-UP: 9/78
INITIAL START-UP: 9/78
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 12/75
CONTRACT AWARDED: 8/75
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
- DESIGN COAL SULFUR CONTENT - %: 1.48
- DESIGN COAL HEAT CONTENT - BTU/LB: 12,500
- DESIGN COAL ASH CONTENT - %: 10.0
- DESIGN COAL MOISTURE CONTENT - %: 8.0
- DESIGN COAL CHLORIDE CONTENT - %: 0.04
- FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 100,000 (BOTH UNITS)
- FGD SYSTEM TURNDOWN RATIO: _____
- FGD SYSTEM TURNDOWN METHOD: _____
- FGD SYSTEM PRESSURE DROP - IN. H2O: 4.5
- FGD SYSTEM OXIDATION - %: 20 (75 DESIGN)
- FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
- FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 15
- FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 2
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 3
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
- FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): N/A
- TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
  - SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NONE
  - TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): _____
- FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
- RESTRICTIONS TO USING BYPASS: AIR QUALITY STANDARDS
- TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
- TIME SCHEDULE FOR BOILER SHUTDOWNS: 2/YEAR
- PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
- PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
- TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE OTHER DATA SHEETS

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: 2
- NUMBER OF SPARES: NONE
- TYPE: SPRAY

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

LOCATION: INLET DUCT OF ABSORBER
SUPPLIER:
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: INCOLOY 825 (INLET WASH ZONE ONLY)
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
INLET GAS FLOW - ACFM: 270,000
INLET GAS TEMPERATURE - F: 291
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
LIQUID RECIRCULATION RATE - GPM: 550 (MINIMUM)
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL: REFRAX
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: NONE
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME:
SUPPLIER: PEABODY PROCESS SYSTEMS
DIMENSIONS - FT: 24 DIA X 90 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: NATURAL RUBBER IN SPRAY ZONE AND GLASS FLAKE/POLYESTER ABOVE AND BELOW
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1150
BOILER LOAD PER ABSORBER - %: 35
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS: 6
NOZZLE MATERIAL: SILICON CARBIDE
NOZZLE PRESSURE DROP - PSI: 12
LIQUID RECIRCULATION RATE - GPM: 19,980
L/G RATIO - GAL/1000 ACF: 74
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC: 10
ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD: TAKE PUMPS OFF LINE, ABSORBER OUT OF SERVICE, AND VARY GAS FLOW
INLET GAS FLOW RATE - ACFM: 333,550
INLET GAS TEMPERATURE - F: 130
INLET SO2 LEVEL - PPM: 1000-1200

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

INLET SO2 LEVEL - LB/MM BTU: VARIES
INLET PARTICLE LEVEL - GR/SCF: 0.046
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 130
OUTLET SO2 LEVEL - PPM: 100-150
OUTLET SO2 LEVEL - LB/MM BTU: <1.2 (OVERALL)
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 85
PARTICLE REMOVAL EFFICIENCY - %: 99.5 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: NONE
NUMBER PER MODULE: 2 PASS
GENERIC TYPE: (A) BULK SEPARATION (B) IMPINGEMENT
SPECIFIC TYPE: (A) PERFORATED PLATE (B) BAFFLE
COMMON DESIGN: (A) SIEVE TRAY (B) CHEVRON VANE
MANUFACTURER: SHAH-HEIL
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): _____
NUMBER OF STAGES: (A) 1 (B) 1
NUMBER OF PASSES/STAGE: (A) _____ (B) 4
FREEBOARD DISTANCE - FT: _____
DISTANCE BETWEEN STAGES - IN.: (A) _____ (B) _____
DISTANCE BETWEEN VANES - IN.: _____
VANE ANGLES - DEGREES: _____
PRESSURE DROP - IN. H2O: (A) 0.5 (B) 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: (A) 10 (B) 10
CONSTRUCTION MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) PLASTIC/FIBERGLASS
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (A) N/A (B) NORYL®
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (A) SLURRY THAT HAS PASSED HYDROCLONES (B) MAKEUP
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (A) BELOW (B) BELOW
WASH FREQUENCY: (A) CONTINUOUSLY (B) INTERMITTENTLY
WASH DURATION: (A) N/A (B) VARIES WITH BOILER LOAD
WASH RATE - GAL/MIN: (A) 250
WASH COVERAGE - GAL/MIN/SQ FT: _____

REHEATER
NUMBER OF REHEATERS: 1
NUMBER OF SPARES: _____
NUMBER PER MODULE: _____

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): BYPASS
SPECIFIC TYPE (STEAM, HOT WATER, ETC.): COLD SIDE
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): N/A
COMBUSTION FUEL SULFUR CONTENT - %: N/A
LOCATION: ABSORBER OUTLET DUCT
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 30
TEMPERATURE INCREASE - F: 48
INLET FLUE GAS FLOW RATE - ACFM: 285,900
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F: 178
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS: N/A
NUMBER OF BUNDLES PER BANK: N/A
NUMBER OF TUBES PER BUNDLE: N/A
STEAM OR WATER PRESSURE - PSIG: N/A
STEAM OR WATER TEMPERATURE - F: N/A
SELF CLEANING DEVICE TYPE: N/A
MATERIAL GENERIC TYPE: HIGH ALLOY MIXING VANE
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: INCONEL 625

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: NONE
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: PEABODY PROCESS SYSTEMS
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND QUENCHER
FLUE GAS FLOW RATE - ACFM: 477,000
FLUE GAS TEMPERATURE - F: 291
PRESSURE DROP - IN. H2O:
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) GUILLOTINE (B) GUILLOTINE (C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.):
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER):
MANUFACTURER: (A) MOSSER (B) MOSSER (C) MOSSER
MODULATION (OPEN/CLOSED, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) HIGH ALLOY WITH STAINLESS STEEL SEALS
(B) HIGH ALLOY (C) NONE
LINER MATERIAL SPECIFIC TYPE: (A) TYPE 316 SEALS
LINER MATERIAL TRADE/COMMON NAME: (A) INCOLOY 825
(B) INCOLOY 825 WITH INCONEL 625 SEALS

DUCTWORK
LOCATION: (A) INLET (B) OUTLET AND BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): (A) 7 FT X 12 FT
(B) 5.5 FT X 12 FT AND 13 FT X 16 FT
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) FLUOROPOLYMER
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) CXL 2000

EXPANSION JOINTS
LOCATION:
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: RUBBERIZED ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER LINED STEEL
D NUMBER OF DEVICES: 1
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH: 10
PRODUCT QUALITY - % SOLIDS: 35
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS:

TANKS
*SEE ATTACHMENT A

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY (B) SPRAY HEADERS (C) LIMESTONE SLURRY, MAKEUP WATER, WASH WATER, WASTE WATER DISCHARGE, ME WASH HEADERS, HYDROCLONE LINES, POND AND RETURN LINES
DIMENSIONS - IN.:
MANUFACTURER:
MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) RUBBER-LINED AND CLAD CARBON STEEL (C) FRP

MAJOR VALVES
LOCATION: (B) CLEAR WATER SERVICE
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PARTIAL PLUG (B) BUTTERFLY
CONTROL MODE (AUTOMATIC/MANUAL):
DIMENSIONS - IN.:
MANUFACTURER: (A) DEZURIK (B) MEDIA
MATERIAL: (A) RUBBER (B) CARBON STEEL

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 6.2
MOISTURE CONTENT - % TOTAL FREE WATER: _____
PERCENT CASO3 - DRY: 17 (DESIGN)
PERCENT CASO4 - DRY: 70 (DESIGN)
PERCENT CAOH2 - DRY: 0
PERCENT CACO3 - DRY: 5
PERCENT ASH - DRY: 1
PERCENT OTHER COMPOUNDS - DRY: 7

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): _____
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
E SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): CLAY
SITE DIMENSIONS - AREA/DEPTH: 34.8 ACRES X 25 FT
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: 20

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: _____
- CHEMICAL PARAMETERS (PH, ETC.): PH
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS
- CONTROL LEVELS: PH 5.8-6.0

F
- MONITOR TYPE (MANUFACTURER, ETC.): TBI
- MONITOR LOCATION: RECYCLE TANK
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC (PROGRAM CONTROL)
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): _____

G
- TYPE (OPEN/CLOSED): OPEN
- EVAPORATION WATER LOSS - GPM: 166
- SLUDGE HYDRATION WATER LOSS - GPM: 4
- SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0
- EFFLUENT WATER LOSS - GPM: _____
- RECEIVING WATER STREAM NAME: TOMBIGBEE RIVER
- MAKEUP WATER ADDITION - GPM: 157
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING TOWER BLOWDOWN
- MAKEUP WATER ADDITION POINTS & AMOUNTS: SEAL WATER - 18 GPM, MIST ELIMINATOR - 139 GPM
- MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
- PRINCIPAL CONSTITUENTS: 95% $CaCO_3$
- SOURCE/SUPPLIER: ALLIED PRODUCTS CO.
- SUPPLIER LOCATION: ALABASTER, AL
- CONSUMPTION (SPECIFY UNITS): 3.5 TPH
- UTILIZATION - %: 90
- POINT OF ADDITION: BALL MILL

H ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
- CAPITAL COST - $: 17,900,000
- CAPITAL COST - $/KW: 35.1
- OPERATING COST - MILLS/KWH: 1.75
  - MAINTENANCE COST: $644,000/YR
  - LABOR COST: $424,000/YR
  - UTILITIES COST: $2,760,000/YR
  - CHEMICALS COST: $235,000/YR
  - WASTE DISPOSAL COST: $15,600/YR

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: _____
- MIST ELIMINATOR - %: _____
- REHEATER - %: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/28/81

ALABAMA ELECTRIC COOP
TOMBIGBEE 2

FAN - %:
BALL MILL - %:
SLAKER - %: N/A
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL:
SLAKER: N/A
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER:
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 2

ATTACHMENT A

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): OPEN
- LOCATION: OUTSIDE
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 60 DIA X 20 HIGH
- CAPACITY - GAL: 423,000
- RETENTION TIME - MIN: 10
- NUMBER OF AGITATORS: 4
- AGITATOR CONFIGURATION: 90 DEGREES APART
- AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): COVERED
- LOCATION: OUTDOORS
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 23 DIA X 20 HIGH
- CAPACITY - GAL: 64,000
- RETENTION TIME - MIN:
- NUMBER OF AGITATORS: 1
- AGITATOR CONFIGURATION:
- AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASH WATER
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): OPEN
- LOCATION: OUTDOORS
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 10 DIA X 11 HIGH

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

CAPACITY - GAL: 7802
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: CENTERED
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): HYDROCLONE UNDERFLOW
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION: RUBBER CLAD CARBON STEEL
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDOORS
CONFIGURATION: TOP CYLINDRICAL, BOTTOM CONE
DIMENSIONS - FT: 4 X 3
CAPACITY - GAL: 470
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: RUBBER CLAD CARBON STEEL
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP

NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: OUTSIDE
CONFIGURATION: RECTANGULAR BOX
DIMENSIONS - FT: 14 X 15.6 X 14.3
CAPACITY - GAL: 17,180
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 6
NUMBER OF SPARES: NONE
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: D-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 7360
MOTOR BRAKE HP: 300
SPEED - RPM: 1184/720
HEAD - FT: 86
SERVICE (PH, SOLIDS): 15% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BALL MILL RECIRCULATION
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 155
MOTOR BRAKE HP: 10
SPEED - RPM: 1045
HEAD - FT: 50
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIMESTONE SLURRY FEED

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 240
MOTOR BRAKE HP: 15
SPEED - RPM: 120
HEAD - FT: 78
SERVICE (PH, SOLIDS): PH 7.8, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 300
MOTOR BRAKE HP: 25
SPEED - RPM: _____
HEAD - FT: 81
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASTE SLURRY
NUMBER OF PUMPS: 2
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 2

COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 360
MOTOR BRAKE HP: 40
SPEED - RPM:
HEAD - FT: 114
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SUPERNATE RETURN
NUMBER OF PUMPS: 1
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM:
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/28/81

ALABAMA ELECTRIC COOP
TOMBIGBEE 2

COMMENTS/FOOTNOTES

A ONE STACK SHELL IS PROVIDED FOR BOTH UNITS, TOMBIGBEE 2 AND 3, ENCLOSING SEPARATE FLUES.
B PEABODY CONTINENTAL-HEINE CO.
C 3.5 GRAINS/ACF INLET DUST LOADING.
D THE REAGENT PREPARATION SYSTEM IS COMMON TO BOTH UNITS 2 AND 3.
E A LOCAL SOURCE OF CLAY WAS PURCHASED AS A MINERAL RIGHT. THE CLAY WAS APPLIED TO THE POND AREAS BY SEPARATELY COMPACTING EACH LAYER.
F TWO LEAR-SIEGLER OPACITY MONITORS AND ONE EACH OF DUPONT $NO_x$ AND OXYGEN MONITORS; TWO DUPONT $SO_2$ MONITORS.
G THE FGD SYSTEM IS CONSIDERED CLOSED LOOP BY THE UTILITY, BUT OVERFLOW FROM THE SLUDGE POND GOES TO THE PROCESS WASTE POND FOR DISCHARGE TO THE RIVER.
H UNITS 2 AND 3 COMBINED. TOTALS FOR FIRST SIX MONTHS OF 1981 - O&S - $192,691; MAINTENANCE - $90,829; LIMESTONE - $101,417.

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

GENERAL PLANT INFORMATION
- COMPANY NAME: ALABAMA ELECTRIC COOPERATIVE
- ASSOCIATED UTILITIES:
- PLANT NAME: TOMBIGBEE
- UNIT NUMBER: 3
- PLANT ADDRESS: TOMBIGBEE POWER PLANT
- CITY: LEROY
- COUNTY: WASHINGTON
- STATE: ALABAMA
- ZIP CODE: 36548
- EPA REGION: 4
- RIVER BASIN/LAKE REGION: TOMBIGBEE
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 525
- GROSS UNIT GENERATING CAPACITY - MW: 255
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 235
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 243
- EQUIVALENT SCRUBBED CAPACITY - MW: 179

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: RILEY STOKER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: TURBO FIRED
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 6/79
- DESIGN BOILER FLUE GAS FLOW - ACFM: 953,000
- FLUE GAS TEMPERATURE - F: 291
- FLUE GAS OXYGEN - %: 6
- HEAT RATE - BTU/KWH: 9400
- DESIGN FIRING RATE - TPH: 107
- EXCESS AIR - %: 25
- CAPACITY FACTOR - %:
- STACK HEIGHT - FT: 400

A SHELL MATERIAL: CONCRETE

B FLUE MATERIAL GENERIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL SPECIFIC TYPE:
- FLUE MATERIAL TRADE/COMMON NAME:
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 16.5
- STACK GAS INLET TEMPERATURE - F: 170
- STACK GAS OUTLET VELOCITY - FT/SEC: 58

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER:
- MINE NAME/AREA: PICKENS, KINLOCK, AND JONES SPUR
- MINE LOCATION - COUNTY:
- MINE LOCATION - STATE: ALABAMA, TENNESSEE, AND KENTUCKY
- AVERAGE HEAT CONTENT - BTU/LB: 11,424
- RANGE HEAT CONTENT - BTU/LB: 10,000-11,000
- AVERAGE ASH CONTENT - %: 14.73
- RANGE ASH CONTENT - %: 15-18
- AVERAGE MOISTURE CONTENT - %: 6.64
- RANGE MOISTURE CONTENT - %: 3-20
- AVERAGE SULFUR CONTENT - %: 1.61
- RANGE SULFUR CONTENT - %: 1.5-1.75
- AVERAGE CHLORIDE CONTENT - %: 0.04
- RANGE CHLORIDE CONTENT - %:
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: 1980 WEIGHTED AVERAGE AS BURNED

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT:

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: NONE
- TYPE (HOT SIDE/COLD SIDE): HOT SIDE
- SUPPLIER: RESEARCH-COTTRELL
- INLET FLUE GAS CAPACITY - ACFM: 953,000
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O: 0.5
- PARTICLE OUTLET LOAD - GR/SCF: 0.046

C PARTICLE REMOVAL EFFICIENCY - %: 99.5
- FLUE GAS CONDITIONING TYPE:

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 3

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: PEABODY PROCESS SYSTEMS
A-E FIRM: BURNS & MCDONNEL
CONSTRUCTION FIRM: PEABODY PROCESS SYSTEMS
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - %: 59.5 (OVERALL)
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/28/81

ALABAMA ELECTRIC COOP
TOMBIGBEE 3

COMMERCIAL START-UP: 6/79
INITIAL START-UP: 6/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 12/75
CONTRACT AWARDED: 8/75
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 1.48
DESIGN COAL HEAT CONTENT - BTU/LB: 12,500
DESIGN COAL ASH CONTENT - %: 10.0
DESIGN COAL MOISTURE CONTENT - %: 8.0
DESIGN COAL CHLORIDE CONTENT - %: 0.04
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 100,000 (BOTH UNITS)
FGD SYSTEM TURNDOWN RATIO: _____
FGD SYSTEM TURNDOWN METHOD: _____
FGD SYSTEM PRESSURE DROP - IN. H2O: 4.5
FGD SYSTEM OXIDATION - %: 20 (75 DESIGN)
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 2
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 3
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): N/A
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NONE
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): _____
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: AIR QUALITY STANDARDS
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: 2/YEAR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE OTHER DATA SHEETS

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: 2
NUMBER OF SPARES: NONE
TYPE: SPRAY

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

LOCATION: INLET DUCT OF ABSORBER
SUPPLIER:
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: INCOLOY 825 (INLET WASH ZONE ONLY)
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
INLET GAS FLOW - ACFM: 270,000
INLET GAS TEMPERATURE - F: 291
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
LIQUID RECIRCULATION RATE - GPM: 550 (MINIMUM)
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL: REFRAX
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: NONE
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME:
SUPPLIER: PEABODY PROCESS SYSTEMS
DIMENSIONS - FT: 24 DIA X 90 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: NATURAL RUBBER IN SPRAY ZONE AND GLASS FLAKE/POLYESTER ABOVE AND BELOW
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1150
BOILER LOAD PER ABSORBER - %: 35
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS: 6
NOZZLE MATERIAL: SILICON CARBIDE
NOZZLE PRESSURE DROP - PSI: 12
LIQUID RECIRCULATION RATE - GPM: 19,980
L/G RATIO - GAL/1000 ACF: 74
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC: 10
ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD: TAKE PUMPS OFF LINE, ABSORBER OUT OF SERVICE, AND VARY GAS FLOW
INLET GAS FLOW RATE - ACFM: 333,550
INLET GAS TEMPERATURE - F: 130
INLET SO2 LEVEL - PPM: 1000-1200

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/28/81

ALABAMA ELECTRIC COOP
TOMBIGBEE 3

INLET SO2 LEVEL - LB/MM BTU: VARIES
INLET PARTICLE LEVEL - GR/SCF: 0.046
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 130
OUTLET SO2 LEVEL - PPM: 100-150
OUTLET SO2 LEVEL - LB/MM BTU: <1.2 (OVERALL)
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 85
PARTICLE REMOVAL EFFICIENCY - %: 99.5 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: NONE
NUMBER PER MODULE: 2 PASS
GENERIC TYPE: (A) BULK SEPARATION (B) IMPINGEMENT
SPECIFIC TYPE: (A) PERFORATED PLATE (B) BAFFLE
COMMON DESIGN: (A) SIEVE TRAY (B) CHEVRON VANE
MANUFACTURER: SHAH-HEIL
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): _____
NUMBER OF STAGES: (A) 1 (B) 1
NUMBER OF PASSES/STAGE: (A) _____ (B) 4
FREEBOARD DISTANCE - FT: _____
DISTANCE BETWEEN STAGES - IN.: (A) _____ (B) _____
DISTANCE BETWEEN VANES - IN.: _____
VANE ANGLES - DEGREES: _____
PRESSURE DROP - IN. H2O: (A) 0.5 (B) 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: (A) 10 (B) 10
CONSTRUCTION MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) PLASTIC/FIBERGLASS
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (A) N/A (B) NORYL®
WASH WATER SOURCE (FRESH, BLENDED,
SUPERNATANT): (A) SLURRY THAT HAS PASSED HYDROCLONES (B) MAKEUP
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (A) BELOW
(B) BELOW
WASH FREQUENCY: (A) CONTINUOUSLY (B) INTERMITTENTLY
WASH DURATION: (A) N/A (B) VARIES WITH BOILER LOAD
WASH RATE - GAL/MIN: (A) 250
WASH COVERAGE - GAL/MIN/SQ FT: _____

REHEATER
NUMBER OF REHEATERS: 1
NUMBER OF SPARES: _____
NUMBER PER MODULE: _____

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): BYPASS
SPECIFIC TYPE (STEAM, HOT WATER, ETC.): COLD SIDE
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): N/A
COMBUSTION FUEL SULFUR CONTENT - %: N/A
LOCATION: ABSORBER OUTLET DUCT
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 30
TEMPERATURE INCREASE - F: 48
INLET FLUE GAS FLOW RATE - ACFM: 285,900
INLET FLUE GAS TEMPERATURE - F: ____
OUTLET FLUE GAS FLOW RATE - ACFM: ____
OUTLET FLUE GAS TEMPERATURE - F: 178
ENERGY REQUIREMENT - MM BTU/HR: ____
NUMBER OF HEAT EXCHANGER BANKS: N/A
NUMBER OF BUNDLES PER BANK: N/A
NUMBER OF TUBES PER BUNDLE: N/A
STEAM OR WATER PRESSURE - PSIG: N/A
STEAM OR WATER TEMPERATURE - F: N/A
SELF CLEANING DEVICE TYPE: N/A
MATERIAL GENERIC TYPE: HIGH ALLOY MIXING VANE
MATERIAL SPECIFIC TYPE: ____
MATERIAL TRADE/COMMON NAME: INCONEL 625

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: NONE
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: PEABODY PROCESS SYSTEMS
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND QUENCHER
FLUE GAS FLOW RATE - ACFM: 477,000
FLUE GAS TEMPERATURE - F: 291
PRESSURE DROP - IN. H2O: ____
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) GUILLOTINE (B) GUILLOTINE (C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): ____
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): ____
MANUFACTURER: (A) MOSSER (B) MOSSER (C) MOSSER
MODULATION (OPEN/CLOSED, ETC.): ____

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) HIGH ALLOY WITH STAINLESS STEEL SEALS
(B) HIGH ALLOY (C) NONE
LINER MATERIAL SPECIFIC TYPE: (A) TYPE 316 SEALS
LINER MATERIAL TRADE/COMMON NAME: (A) INCOLOY 825
(B) INCOLOY 825 WITH INCONEL 625 SEALS

DUCTWORK
LOCATION: (A) INLET (B) OUTLET AND BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): (A) 7 FT X 12 FT
(B) 5.5 FT X 12 FT AND 13 FT X 16 FT
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) FLUOROPOLYMER
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) CXL 2000

EXPANSION JOINTS
LOCATION:
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: RUBBERIZED ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER LINED STEEL
D NUMBER OF DEVICES: 1
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH: 10
PRODUCT QUALITY - % SOLIDS: 35
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS:

TANKS
*SEE ATTACHMENT A

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 3

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY (B) SPRAY HEADERS (C) LIMESTONE SLURRY, MAKEUP WATER, WASH WATER, WASTE WATER DISCHARGE, ME WASH HEADERS, HYDROCLONE LINES, POND AND RETURN LINES
DIMENSIONS - IN.:
MANUFACTURER:
MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) RUBBER-LINED AND CLAD CARBON STEEL (C) FRP

MAJOR VALVES
LOCATION: (B) CLEAR WATER SERVICE
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PARTIAL PLUG (B) BUTTERFLY
CONTROL MODE (AUTOMATIC/MANUAL):
DIMENSIONS - IN.:
MANUFACTURER: (A) DEZURIK (B) MEDIA
MATERIAL: (A) RUBBER (B) CARBON STEEL

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 6.2
MOISTURE CONTENT - % TOTAL FREE WATER: _____
PERCENT CASO3 - DRY: 17 (DESIGN)
PERCENT CASO4 - DRY: 70 (DESIGN)
PERCENT CAOH2 - DRY: 0
PERCENT CACO3 - DRY: 5
PERCENT ASH - DRY: 1
PERCENT OTHER COMPOUNDS - DRY: 7

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): _____
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
E SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): CLAY
SITE DIMENSIONS - AREA/DEPTH: 34.8 ACRES X 25 FT
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: 20

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM:
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS
CONTROL LEVELS: PH 5.8-6.0
F MONITOR TYPE (MANUFACTURER, ETC.): TBI
MONITOR LOCATION: RECYCLE TANK
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC (PROGRAM CONTROL)
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL):
G TYPE (OPEN/CLOSED): OPEN
EVAPORATION WATER LOSS - GPM: 166
SLUDGE HYDRATION WATER LOSS - GPM: 4
SLUDGE INTERSTITIAL WATER LOSS - GPM:
POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0
EFFLUENT WATER LOSS - GPM:
RECEIVING WATER STREAM NAME: TOMBIGBEE RIVER
MAKEUP WATER ADDITION - GPM: 157
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING TOWER BLOWDOWN
MAKEUP WATER ADDITION POINTS & AMOUNTS: SEAL WATER - 18 GPM, MIST ELIMINATOR - 139 GPM
MAKEUP WATER PRE-TREATMENT TYPE:

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: 95% $CaCO_3$
SOURCE/SUPPLIER: ALLIED PRODUCTS CO.
SUPPLIER LOCATION: ALABASTER, AL
CONSUMPTION (SPECIFY UNITS): 3.5 TPH
UTILIZATION - %: 90
POINT OF ADDITION: BALL MILL

H ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 17,900,000
CAPITAL COST - $/KW: 35.1
OPERATING COST - MILLS/KWH: 1.75
MAINTENANCE COST: $644,000/YR
LABOR COST: $424,000/YR
UTILITIES COST: $2,760,000/YR
CHEMICALS COST: $235,000/YR
WASTE DISPOSAL COST: $15,600/YR

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %:
MIST ELIMINATOR - %:
REHEATER - %:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/28/81

ALABAMA ELECTRIC COOP
TOMBIGBEE 3

FAN - %:
BALL MILL - %:
SLAKER - %: N/A
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL:
SLAKER: N/A
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER:
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

ATTACHMENT A

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): OPEN
- LOCATION: OUTSIDE
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 60 DIA X 20 HIGH
- CAPACITY - GAL: 423,000
- RETENTION TIME - MIN: 10
- NUMBER OF AGITATORS: 4
- AGITATOR CONFIGURATION: 90 DEGREES APART
- AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: _____
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): COVERED
- LOCATION: OUTDOORS
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 23 DIA X 20 HIGH
- CAPACITY - GAL: 64,000
- RETENTION TIME - MIN: _____
- NUMBER OF AGITATORS: 1
- AGITATOR CONFIGURATION: _____
- AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: _____
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASH WATER
- NUMBER OF TANKS: 1
- NUMBER OF SPARES: 0
- TYPE (OPEN/COVERED): OPEN
- LOCATION: OUTDOORS
- CONFIGURATION: CIRCULAR
- DIMENSIONS - FT: 10 DIA X 11 HIGH

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

CAPACITY - GAL: 7802
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: CENTERED
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): HYDROCLONE UNDERFLOW
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION: RUBBER CLAD CARBON STEEL
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDOORS
CONFIGURATION: TOP CYLINDRICAL, BOTTOM CONE
DIMENSIONS - FT: 4 X 3
CAPACITY - GAL: 470
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: RUBBER CLAD CARBON STEEL
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: RESISTA-FLAKE 1151

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP

NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: OUTSIDE
CONFIGURATION: RECTANGULAR BOX
DIMENSIONS - FT: 14 X 15.6 X 14.3
CAPACITY - GAL: 17,180
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 3

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 6
NUMBER OF SPARES: NONE
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: D-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 7360
MOTOR BRAKE HP: 300
SPEED - RPM: 1184/720
HEAD - FT: 86
SERVICE (PH, SOLIDS): 15% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BALL MILL RECIRCULATION
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 155
MOTOR BRAKE HP: 10
SPEED - RPM: 1045
HEAD - FT: 50
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIMESTONE SLURRY FEED

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 3

NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 240
MOTOR BRAKE HP: 15
SPEED - RPM: 120
HEAD - FT: 78
SERVICE (PH, SOLIDS): PH 7.8, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 300
MOTOR BRAKE HP: 25
SPEED - RPM:
HEAD - FT: 81
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASTE SLURRY
NUMBER OF PUMPS: 2
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE

UTILITY EMISSION CONTROL SYSTEM DATA ALABAMA ELECTRIC COOP
DATE: 7/28/81 TOMBIGBEE 3

COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 360
MOTOR BRAKE HP: 40
SPEED - RPM:
HEAD - FT: 114
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SUPERNATE RETURN
NUMBER OF PUMPS: 1
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM:
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA — ALABAMA ELECTRIC COOP
DATE: 7/28/81 — TOMBIGBEE 3

COMMENTS/FOOTNOTES

A ONE STACK SHELL IS PROVIDED FOR BOTH UNITS, TOMBIGBEE 2 AND 3, ENCLOSING SEPARATE FLUES.
B PEABODY CONTINENTAL-HEINE CO.
C 3.5 GRAINS/ACF INLET DUST LOADING.
D THE REAGENT PREPARATION SYSTEM IS COMMON TO BOTH UNITS 2 AND 3.
E A LOCAL SOURCE OF CLAY WAS PURCHASED AS A MINERAL RIGHT. THE CLAY WAS APPLIED TO THE POND AREAS BY SEPARATELY COMPACTING EACH LAYER.
F TWO LEAR-SIEGLER OPACITY MONITORS AND ONE EACH OF DUPONT $NO_x$ AND OXYGEN MONITORS; TWO DUPONT $SO_2$ MONITORS.
G THE FGD SYSTEM IS CONSIDERED CLOSED LOOP BY THE UTILITY, BUT OVERFLOW FROM THE SLUDGE POND GOES TO THE PROCESS WASTE POND FOR DISCHARGE TO THE RIVER.
H UNITS 2 AND 3 COMBINED. TOTALS FOR FIRST SIX MONTHS OF 1981 - O&S - $192,691; MAINTENANCE - $90,829; LIMESTONE - $101,417.

# SECTION 4

# PERFORMANCE DATA

Alabama Electric Coop
Tombigbee 2, 3

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Alabama Electric Tombigbee 2 Commercial start-up | 9/78 | 720 | 183 | A<br>B<br>System | 133 | 81 | Damper | Modules were forced out of service for 34 hours because the isolation damper could not be re-opened after being closed |
| | 10/78 | 744 | 596 | A<br>B<br>System | 342 | 66 | | |
| | 11/78 | 720 | 684 | A<br>B<br>System | 450 | 89 | Piping | Waste slurry fiberglass elbow failed |
| | 12/78 | 744 | 700 | A<br>B<br>System | 668 | 98 | | |
| | 1/79 | 744 | 742 | A<br>B<br>System | 524 | 89 | Mist eliminator | Plugging due to ESP outage (75-hour outage) |
| | 2/79 | 672 | 297 | A<br>B<br>System | 284 | 98 | | |
| | 3/79 | 744 | 737 | A<br>B<br>System | 691 | 95 | | |
| | 4/79 | 720 | 292 | A<br>B<br>System | 292 | 100 | | |
| | 5/79 | 744 | 725 | A<br>B<br>System | 391 | 93 | | |

Alabama Electric Coop
Tombigbee 2, 3

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Tombigbee 2 (continued) | 6/79 | 720 | 391 | A<br>B<br>System | 190 | 98 | Mist eliminator | Deformed during a temperature excursion. New mist eliminators were installed |
| | 7/79 | 744 | 587 | A<br>B<br>System | 270 | 93 | | |
| | 8/79 | 744 | 566 | A<br>B<br>System | 322 | 99 | Modicon controller | 6-hour outage due to necessary adjustment to controller |
| | | | | | | | ESP | Modules down 37 hours due to ESP outage |
| | 9/79 | 720 | 591 | A<br>B<br>System | 311 | 100 | | |
| | 10/79 | 744 | 0 | A<br>B<br>System | 0 | 100 | Generator | System down entire month due to generator outage |
| | 11/79 | 720 | 0 | A<br>B<br>System | 0 | 100 | Generator | System down entire month due to generator outage |
| | 12/79 | 744 | 133 | A<br>B<br>System | 19 | 97 | Piping | 24-hour outage due to ruptured waste slurry line repairs |
| | 1/80 | 744 | 439 | A<br>B<br>System | 203 | 91 | Expansion joint | Abrasion problems |
| | | | | | | | Piping | 69-hour outage due to ruptured waste slurry line repairs |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Tombigbee 2 (continued) | 2/80 | 696 | 696 | A | | | | |
| | | | | B | | | | |
| | | | | System | 554 | 99 | | |
| | 3/80 | 744 | 684 | A | | | | |
| | | | | B | | | | |
| | | | | System | 551 | 100 | | |
| | 4/80 | 720 | 719 | A | | | | |
| | | | | B | | | | |
| | | | | System | 532 | 100 | | |
| | 5/80 | 744 | 739 | A | | | | |
| | | | | B | | | | |
| | | | | System | 472 | 100 | | |
| | 6/80 | 720 | 90 | A | | 100 | | |
| | | | | B | | 0 | Damper | Module down 6/80 through 11/80 due to burned out damper drive motor |
| | | | | System | 40 | 50 | | |
| | 7/80 | 744 | 415 | A | | 100 | | |
| | | | | B | | 0 | | |
| | | | | System | 203 | 50 | | |
| | 8/80 | 744 | 162 | A | | 100 | | |
| | | | | B | | 0 | | |
| | | | | System | 68 | 50 | | |
| | 9/80 | 720 | 417 | A | | 100 | | |
| | | | | B | | 0 | | |
| | | | | System | 164 | 50 | | |
| | 10/80 | 744 | 0 | A | | 100 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 50 | Turbine/generator | Unit down entire month for a turbine/generator inspection |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Tombigbee 2 (continued) | 11/80 | 720 | 150 | A | | 100 | | |
| | | | | B | | 0 | | |
| | | | | System | 56 | 50 | | |
| | 12/80 | 744 | 710 | A | | 100 | | |
| | | | | B | | 62 | | Module B damper repairs completed |
| | | | | System | 545 | 81 | | |

Alabama Electric Coop.
Tombigbee 2, 3

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Alabama Electric | 6/79 | 720 | | System | | | | Initial start-up/commercial operations commenced |
| Tombigbee 3 | 7/79 | 744 | 295 | A | | | | |
| | | | | B | | | | |
| | | | | System | 76 | 73 | | |
| | 8/79 | 744 | 490 | A | | | | |
| | | | | B | | | | |
| | | | | System | 255 | 98 | Modicon controller | 6-hour outage due to necessary adjustments to controller |
| | | | | | | | ESP | Modules down 37 hours due to ESP outage |
| | 9/79 | 720 | 137 | A | | | | |
| | | | | B | | | | |
| | | | | System | 58 | 100 | Generator | Low boiler and FGD hours due to generator outage |
| | 10/79 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 646 | 100 | Ball mill | 4-hour outage due to reagent slurry shortage causec by problems with limestone ball mill lubricatcn system |
| | 11/79 | 720 | 720 | A | | | | |
| | | | | B | | | | |
| | | | | System | 605 | 97 | ESP flyash han-dling systems | ESP shutdown for 23 hours due to jammed flyash handling system |
| | | | | | | | Piping | Waste slurry line ruptured, forcing the unit out of service for 24 hours |
| | 12/79 | 744 | 652 | A | | | | |
| | | | | B | | | | |
| | | | | System | 541 | 100 | | |
| | 1/80 | 744 | 328 | A | | | | |
| | | | | B | | | | |
| | | | | System | 188 | 100 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Tombigbee 3 (continued) | 2/80 | 696 | 24 | A | | | | |
| | | | | B | | | | |
| | | | | System | 16 | 100 | | |
| | 3/80 | 744 | 0 | A | | | | |
| | | | | B | | | | |
| | | | | System | 0 | 100 | | Unit 3 was kept out of service |
| | 4/80 | 720 | 0 | A | | | | |
| | | | | B | | | | |
| | | | | System | 0 | 100 | | Boiler did not operate |
| | 5/80 | 744 | 60 | A | | | | |
| | | | | B | | | Damper | Module out for 31 hours when inlet damper switch failed causing the drive motor to burn out |
| | | | | System | 5 | 96 | Boiler | Low boiler and FGD hours due to boiler related problems |
| | 6/80 | 720 | 643 | A | | | | |
| | | | | B | | | | |
| | | | | System | 379 | 100 | | |
| | 7/80 | 744 | 650 | A | | | | |
| | | | | B | | | | |
| | | | | System | 440 | 100 | | Modules were utilized on an as needed basis |
| | 8/80 | 744 | 590 | A | | | | |
| | | | | B | | | | |
| | | | | System | 552 | 100 | | |
| | 9/80 | 720 | 369 | A | | | | |
| | | | | B | | | | |
| | | | | System | 304 | 91 | Process control | Problems were encountered from 9/80 through 11/80 with the programmable process controller |
| | 10/80 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 472 | 97 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Tombigbee 3 (continued) | 11/80 | 720 | 720 | A | | | | |
| | | | | B | | | | |
| | | | | System | 617 | 99 | | |
| | 12/80 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 576 | 100 | | |

ARIZONA ELECTRIC POWER COOP

APACHE 2, 3

# SECTION 1

## BACKGROUND

The Apache Power Station of Arizona Electric Power Cooperation is located in Cochise, Arizona, and consists of three units. Apache 1 is a gas and oil-fired 75 MW (gross) unit, and Apache 2 and 3 are identical coal-fired 195 MW (gross) units. At the time of construction of Apache 2 and 3, an SIP limitation of 0.8 pounds of $SO_2$ per million Btu was in effect. Arizona Electric's coal source, which is several hundred miles away and contains a low sulfur content (0.6% maximum), was not sufficient to ensure continual compliance with the SIP standard. As a result, the utility was faced with two alternatives for $SO_2$ control -- install FGD or utilize coal cleaning. Since coal cleaning technology was considered both technically underdeveloped and expensive at that time, the utility chose to install FGD.

In July 1974, a contract was awarded to Research-Cottrell to supply a wet limestone scrubbing process for both Apache 2 and 3. A contract was also awarded to Air Correction/UOP for one ESP per unit upstream of the FGD system for particulate matter control.

Arizona Electric Power
Apache 2, 3

The utility is presently planning the installation of a coal cleaning facility at their company owned coal mine (Carbon Coal Company, McKinley Mine). The cleaning facility is being built primarily to remove gravel, grit, and pyrite from coal.

## SECTION 2

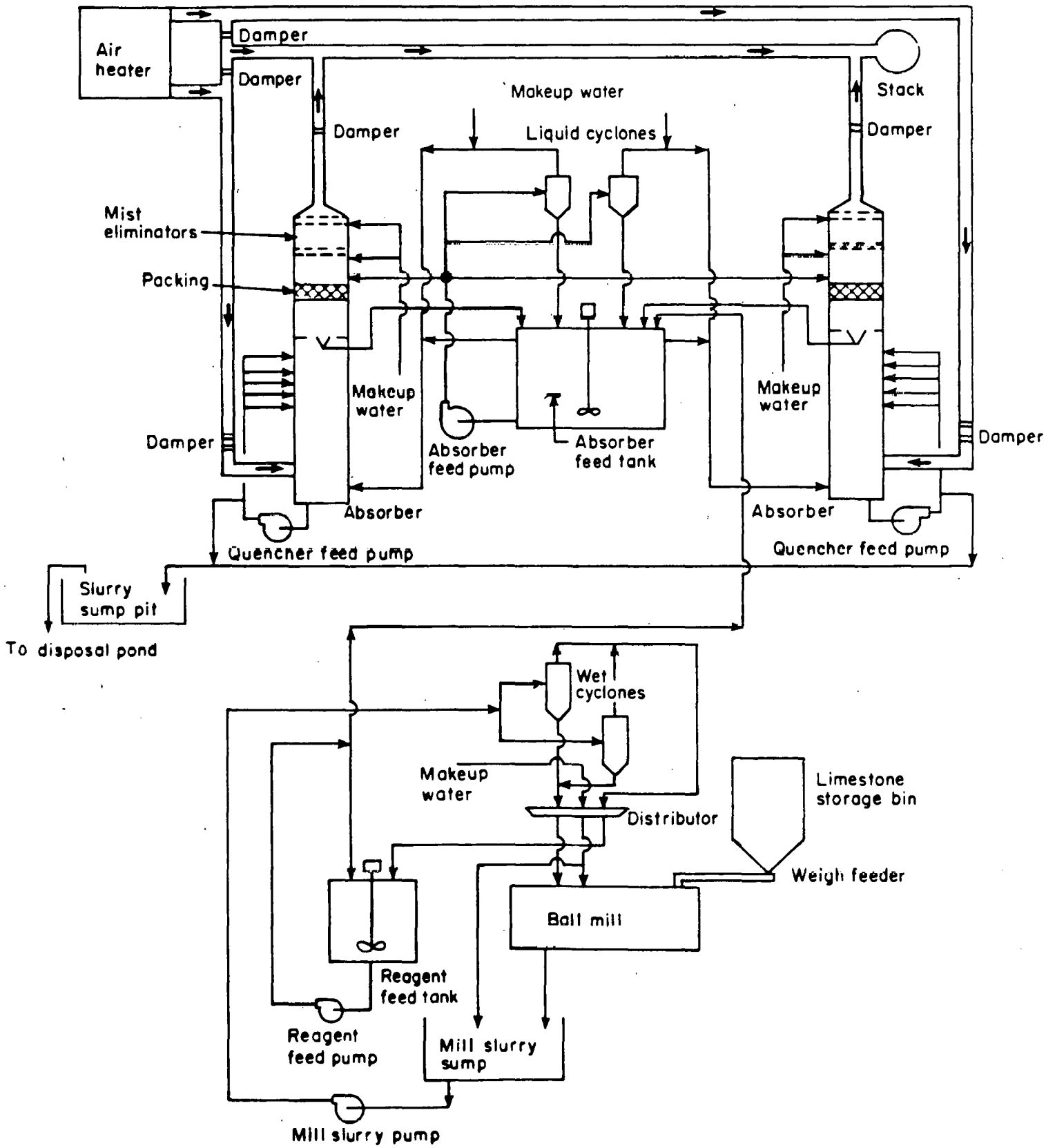
## PROCESS DESCRIPTION

The emission control systems installed on Apache 2 and 3 each consist of a hot-side ESP for primary particulate matter control followed by a wet limestone FGD system for $SO_2$ control. The FGD systems were supplied by Research-Cottrell and include two modules, each of which is designed to handle 50% of the total boiler flue gas flow of 1,104,000 acfm at 710°F. However, since the units are presently burning coal with an average sulfur content of 0.5%, and each system was designed to accomodate coal with a sulfur content of 1.0%, it is currently necessary to scrub only 50% of the boiler flue gas to meet standards. As a result, the utility alternates between modules, using one module as a spare.

After the flue gas exits each boiler, it passes through a hot-side ESP. Here 99.6% of the particulate matter is removed. From the preheater, the hot flue gas is ducted through two ID fans that exhaust into the base of one of two spray/packed absorber towers. The flue gas first passes through a quencher located in the base of the tower where the gas is cooled. The gas then continues up through the absorber vessel and passes through a four-foot layer of grid packing that is continually contacted with limestone slurry. Mist elimination is provided

by two stages of horizontal mist eliminators situated above the packing layer in each tower. The saturated flue gas from both systems is ducted to a common 400-foot lined stack where it exits through separate flues. The system operates in an open water loop mode and spent absorbent of 30% solids is disposed of in an offsite sludge pond.

A flow diagram for the Apache 2, 3 FGD systems is shown on the next page.




Flow Diagram: Apache 2 or 3

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

GENERAL PLANT INFORMATION
- COMPANY NAME: ARIZONA ELECTRIC POWER COOPERATIVE
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: APACHE
- UNIT NUMBER: 2
- PLANT ADDRESS: ROUTE 1, P.O. BOX 104
- CITY: COCHISE
- COUNTY: COCHISE
- STATE: ARIZONA
- ZIP CODE: 85606
- EPA REGION: 9
- RIVER BASIN/LAKE REGION: NONE
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.8
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7

A NET PLANT GENERATING CAPACITY - MW: 530
- GROSS UNIT GENERATING CAPACITY - MW: 195
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 175
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 183
- EQUIVALENT SCRUBBED CAPACITY - MW: 97.5

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: RILEY STOKER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: OPPOSED
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED,BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 1/79
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,104,000
- FLUE GAS TEMPERATURE - F: 710
- FLUE GAS OXYGEN - %: 3.5
- HEAT RATE - BTU/KWH: 8936
- DESIGN FIRING RATE - TPH: 90
- EXCESS AIR - %: 20
- CAPACITY FACTOR - %: 75
- STACK HEIGHT - FT: 400
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: CARBON STEEL
- FLUE MATERIAL SPECIFIC TYPE:
- FLUE MATERIAL TRADE/COMMON NAME: N/A
- FLUE LINER MATERIAL GENERIC TYPE: ORGANIC
- FLUE LINER MATERIAL SPECIFIC TYPE: FLUOROELASTOMER
- FLUE LINER MATERIAL TRADE/COMMON NAME: CXL-2000
- FLUE INNER DIAMETER - FT: 16.2
- STACK GAS INLET TEMPERATURE - F: 193
- STACK GAS OUTLET VELOCITY - FT/SEC: 55-56

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

FUEL DATA (ACTUAL)
FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
NAME OF SUPPLIER: CARBON COAL COMPANY; PITTSBURGH MIDWAY COAL COMPANY
B MINE NAME/AREA: MENTMORE MINE; MCKINLEY MINE
MINE LOCATION - COUNTY: NAVAJO
MINE LOCATION - STATE: NEW MEXICO
AVERAGE HEAT CONTENT - BTU/LB: 9900
RANGE HEAT CONTENT - BTU/LB: 9500-10,800
AVERAGE ASH CONTENT - % 16
RANGE ASH CONTENT - %: 15-20
AVERAGE MOISTURE CONTENT - % 13
RANGE MOISTURE CONTENT - %: 9-15
AVERAGE SULFUR CONTENT - %: 0.5
RANGE SULFUR CONTENT - %: 0.4-0.6
AVERAGE CHLORIDE CONTENT - %: 0.005
RANGE CHLORIDE CONTENT - % 0-0.03
C FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
NUMBER OF MECHANICAL COLLECTORS: NONE
NUMBER OF SPARES:
TYPE:
SUPPLIER:
INLET FLUE GAS CAPACITY - ACFM:
INLET FLUE GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
PARTICLE OUTLET LOAD - GR/SCF:
PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
NUMBER OF SPARES: 0
TYPE (HOT SIDE/COLD SIDE): HOT SIDE
SUPPLIER: AIR CORRECTION DIVISION, UOP
INLET FLUE GAS CAPACITY - ACFM: 1,104,000
INLET FLUE GAS TEMPERATURE - F: 710
PRESSURE DROP - IN. H2O: 0.5
PARTICLE OUTLET LOAD - GR/SCF: 0.04
PARTICLE REMOVAL EFFICIENCY - % 99.6
FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
NUMBER OF PARTICLE SCRUBBERS: NONE
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - %

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: RESEARCH-COTTRELL
A-E FIRM: BURNS & MCDONNELL
CONSTRUCTION FIRM: RESEARCH-COTTRELL
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.6
D SO2 DESIGN REMOVAL EFFICIENCY - % 49
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

COMMERCIAL START-UP: 1/79
INITIAL START-UP: 8/78
CONSTRUCTION COMPLETION: 8/78
CONSTRUCTION INITIATION: 7/76
CONTRACT AWARDED: 7/74
LETTER OF INTENT SIGNED: 7/74
INITIATED BID REQUEST 7/74
INITIATED PRELIMINARY DESIGN 7/74

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 1.0
DESIGN COAL HEAT CONTENT - BTU/LB: 10,000
DESIGN COAL ASH CONTENT - %: 17
DESIGN COAL MOISTURE CONTENT - %: 18
DESIGN COAL CHLORIDE CONTENT - %: 0
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 43,560 (1 ACRE)
E FGD SYSTEM TURNDOWN RATIO: 3.25:1
F FGD SYSTEM TURNDOWN METHOD: REDUCE BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 5
FGD SYSTEM OXIDATION - %: 80
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
G FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
H FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): NONE
I TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: N/A
J TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
K FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
L RESTRICTIONS TO USING BYPASS: NONE
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEK SCHEDULED OUTAGE 1/YEAR
M PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): N/A
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): GENERAL CLEANING AND INSPECTION
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): GENERAL CLEANING AND INSPECTION

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: 2
N NUMBER OF SPARES: 1
TYPE: CYCLONIC SPRAY QUENCHER

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

LOCATION: BOTTOM OF ABSORBER
SUPPLIER: RESEARCH-COTTRELL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR
INLET GAS FLOW - ACFM: 400,000
INLET GAS TEMPERATURE - F: 270
PRESSURE DROP - IN. H2O: <1
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
LIQUID RECIRCULATION RATE - GPM: 8000-10,000
L/G RATIO - GAL/1000 ACF: 20
NUMBER OF SPRAY HEADERS: _____
NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI: ____

ABSORBER
NUMBER OF ABSORBERS: 2
N NUMBER OF SPARES: 1
O GENERIC TYPE: COMBINATION
SPECIFIC TYPE: SPRAY/PACKED
TRADE/COMMON NAME: N/A
SUPPLIER: RESEARCH-COTTRELL
DIMENSIONS - FT: 30 DIA X 80 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 50
GAS/LIQUID CONTACT DEVICE TYPE: SPRAY ZONE AND VERTICAL CROSS CHANNEL FIXED GRID PACKING
NUMBER OF GAS CONTACTING ZONES: 2
P DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 2
NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI: ____
LIQUID RECIRCULATION RATE - GPM: 8000-10,000
L/G RATIO - GAL/1000 ACF: 40
GAS-SIDE PRESSURE DROP - IN. H2O: 2-3
SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
ABSORBER TURNDOWN RATIO: 1.625:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW
INLET GAS FLOW RATE - ACFM: 200,000
INLET GAS TEMPERATURE - F: 150-160

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 2

INLET SO2 LEVEL - PPM: 430
INLET SO2 LEVEL - LB/MM BTU: 1.0
INLET PARTICLE LEVEL - GR/SCF: 0.04
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 115
OUTLET SO2 LEVEL - PPM: 250-300 (OVERALL)
OUTLET SO2 LEVEL - LB/MM BTU: 0.6 (OVERALL)
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 97
PARTICLE REMOVAL EFFICIENCY - %: 99.6 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 2
N NUMBER OF SPARES: 1
NUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER: MUNTERS
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): A-FRAME LOWER STAGE; "EGG CRATE" UPPER STAGE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 3
FREEBOARD DISTANCE - FT: 2
DISTANCE BETWEEN STAGES - IN.: 12
DISTANCE BETWEEN VANES - IN.: 4 (LOWER STAGE)
VANE ANGLES - DEGREES: 45 (LOWER STAGE)
PRESSURE DROP - IN. H2O: <1
SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: POLYVINYL CHLORIDE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: PVC
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH
POINT OF WATER COLLECTION: TO REACTION TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): UNDERSPRAY
WASH FREQUENCY: INTERMITTENT (LOWER STAGE); ONCE EVERY HOUR (UPPER STAGE)
WASH DURATION: 20 SECONDS (UPPER STAGE)
WASH RATE - GAL/MIN: 200 (UPPER STAGE)
WASH COVERAGE - GAL/MIN SQ FT.: ____

REHEATER
Q NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 2

SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2 (1 FAN PER MODULE)
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: ALLIS CHALMERS
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN AIR PREHEATERS AND ABSORBERS
FLUE GAS FLOW RATE - ACFM: 400,000
FLUE GAS TEMPERATURE - F: 270
PRESSURE DROP - IN. H2O: _____
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): SHUT-OFF (ALL)
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
(C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE,
PARALLEL BLADE, ETC.): (A&C) PARALLEL BLADE MULTILOUVER
(B) TOP-ENTRY GUILLOTINE

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

TRADE/COMMON DESIGN (SINGLE LOUVER/
DOUBLE LOUVER): (A&C) DOUBLE LOUVER/SEAL AIR
(B) DOUBLE GUILLOTINE/SEAL AIR
MANUFACTURER:
MODULATION (OPEN/CLOSED, ETC.): OPEN/CLOSED (ALL)
SEAL AIR - ACFM: 500 (ALL)
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: N/A
R LINER MATERIAL GENERIC TYPE: (A) NONE (B) HIGH ALLOY (C) HIGH ALLOY
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) (C)
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) INCOLOY 825 CLADDING AND INCONEL 625 SEALS (C) INCOLOY 825

DUCTWORK
LOCATION: (A) INLET AND BYPASS (B) OUTLET
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR (ALL)
DIMENSIONS (DIAMETER, LENGTH, ETC.): 12 FT X 14 FT
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) FLUOROELASTOMER
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) CXL-2000

EXPANSION JOINTS
LOCATION: FRONT AND REAR OF ALL DAMPERS
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC (ALL)
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT (ALL)
PRESSURE (NEGATIVE/POSITIVE): POSITIVE (ALL)
OPERATING TEMPERATURE - F: 270 INLET; 115 OUTLET; 270 BYPASS
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: VITON®/ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): TUBE MILL
MANUFACTURER: KENNEDY VAN SAUN
S MATERIALS: RUBBER-LINED CARBON STEEL
NUMBER OF DEVICES: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
FULL LOAD DRY FEED CAPACITY - TPH: 5
PRODUCT QUALITY - % SOLIDS: 45
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 20-30
PREPARED REAGENT POINT OF ADDITION: ABSORBER FEED TANK
T ON-SITE STORAGE CAPABILITY - DAYS: 14

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) INSIDE ABSORBER (B) RECYCLE SLURRY AND SLUDGE (C) LINE FROM BOWL IN ABSORBER
DIMENSIONS - IN.: (C) 16
MANUFACTURER:
MATERIAL: (A) TYPE 316L STAINLESS STEEL (B) RUBBER-LINED CARBON STEEL (C) FRP

MAJOR VALVES
LOCATION: (A) PUMP SUCTION SIDE (B) PUMP DISCHARGE (C) DRAIN
FUNCTION (ISOLATION, CONTROL, ETC.): ISOLATION (ALL)
TYPE (BALL, GLOBE, PLUG, ETC.): (A) BUTTERFLY (B) PLUG (C) BUTTERFLY
U CONTROL MODE (AUTOMATIC/MANUAL): AUTOMATIC (ALL)
DIMENSIONS - IN.:
MANUFACTURER: (A) KEYSTONE (B) DEZURIK (C) KEYSTONE
MATERIAL: (A) BAKELITE PLASTIC DISCS AND RUBBER-LINED SEATS (B) RUBBER-LINED (C) TYPE 316 STAINLESS STEEL WITH TEFLON® SEATS

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 2

NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER: 70
PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY: 80
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
V GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): BELOW GRADE
LOCATION (ON-SITE/OFF-SITE): OFF-SITE
W TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: 25 TO 30 ACRES BY 18 FT DEEP

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

SITE CAPACITY - VOLUME/ACRE-FT/TONS: 450-540 ACRE-FT
SITE SERVICE LIFE - YEARS: 30

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: QUENCHER RECYCLE LINE
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS
CONTROL LEVELS: 5.0 (PH)
MONITOR TYPE (MANUFACTURER, ETC.): _____
MONITOR LOCATION: _____
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): MANUAL
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): OPEN
EVAPORATION WATER LOSS - GPM: _____
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: 1840
Y SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): WELL WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: ME WASH AND SLURRY PREPARATION
MAKEUP WATER PRE-TREATMENT TYPE: NONE

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: >93% $CaCO_3$
SOURCE/SUPPLIER: PAUL LIME
SUPPLIER LOCATION: DOUGLAS, ARIZONA
CONSUMPTION (SPECIFY UNITS): _____
UTILIZATION - %: 99
POINT OF ADDITION: BALL MILL

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 11,400,000
CAPITAL COST - $/KW: 58.4
OPERATING COST - MILLS/KWH: 1.46
MAINTENANCE COST: $50,700/YR
LABOR COST: $21,700/YR
UTILITIES COST: $2,750,000/YR
CHEMICALS COST: $52,200/YR
WASTE DISPOSAL COST: $200/YR

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 2

N ABSORBER - %: 100
MIST ELIMINATOR - %: 0
REHEATER - %: N/A
FAN - %: 0
BALL MILL - %: 0
SLAKER - %: N/A
EFFLUENT HOLD TANK - %: 0
RECIRCULATION PUMP - %: 50 (ABSORBER RECIRCULATION);
100 (QUENCHER RECIRCULATION)
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
N ABSORBER: 1.0
MIST ELIMINATOR: 0
REHEATER: N/A
FAN: 0
BALL MILL: 0
SLAKER: N/A
EFFLUENT HOLD TANK: 0
RECIRCULATION PUMP: 1 (ABSORBER RECIRCULATION); 2 (QUENCHER RECIRCULATION)
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER FEED
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: NEXT TO ABSORBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 25 X 40
CAPACITY - GAL: 38,000
RETENTION TIME - MIN: 13 (WITH ONE ABSORBER IN OPERATION)
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REAGENT FEED
NUMBER OF TANKS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: NEXT TO BALL MILL
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SLURRY SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: UNDERNEATH BALL MILL
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 2

DIMENSIONS - FT: 2 X 3
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP PIT
NUMBER OF TANKS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: SQUARE
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: N/A
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECYCLE
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: SRL1, SRL-C, 18-16
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 10,000
MOTOR BRAKE HP: 400
SPEED - RPM: 3000
HEAD - FT: 85
SERVICE (PH, SOLIDS): PH 4.0-5.4, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): QUENCHER RECYCLE
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: SRL1, SRL-C, 16-14
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 10,000
MOTOR BRAKE HP: 250
SPEED - RPM: 3000
HEAD - FT: 10
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL SLURRY RECYCLE
NUMBER OF PUMPS: 2 (SHARED BETWEEN UNITS 2 & 3)

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 2

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: 40
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: AUSTENITIC
IMPELLER MATERIAL TRADE/COMMON NAME: TYPE 316 OR TYPE 317

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE FEED
NUMBER OF PUMPS: 2 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: INGERSOLL-RAND
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 500
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 50
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED,
ABSORBER RECIRCULATION, ETC.): WASTE SLURRY TRANSFER
NUMBER OF PUMPS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): MOYNO
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 2

MANUFACTURER: ROBBINS & MYERS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 2

COMMENTS/FOOTNOTES

A INCLUDES 3 SMALL GAS FIRED TURBINES IN ADDITION TO THE APACHE UNITS 1, 2, & 3.

B AEPCO OWNS THE CARBON COAL COMPANY WHICH SUPPLIES 90% OF THEIR COAL. THE REMAINING 10% IS OBTAINED FROM PITTSBURGH MIDWAY LOCATED IN THE SAME AREA. COAL CHARACTERISTICS ARE VIRTUALLY THE SAME.

C CARBON COAL COMPANY SPOT ANALYSIS (7/27/81)
- AVERAGE HEAT CONTENT - BTU/LB: 9693
- AVERAGE ASH CONTENT - %: 16.04
- AVERAGE MOISTURE CONTENT - %: 13.46
- AVERAGE SULFUR CONTENT - %: 0.42
- AVERAGE CHLORIDE CONTENT - %: 0.01

D DESIGNED FOR 97% $SO_2$ REMOVAL WHEN ALL THE FLUE GAS IS SCRUBBED, BUT ONLY HALF THE GAS IS SCRUBBED FOR AN OVERALL REMOVAL EFFICIENCY OF 49%.

E BASED ON TOTAL DESIGN SYSTEM CAPACITY OF 197 MW.

F FLUE GAS IS PASSED THROUGH AN ABSORBER DOWN TO A MINIMUM LOADING OF 60 MW. BELOW 60 MW, THE FLUE GAS IS BYPASSED TO THE STACK.

G 3 SHIFTS/DAY SEVEN DAYS A WEEK (SHARED BETWEEN UNITS 2 & 3).

H 1 SHIFT/DAY SEVEN DAYS A WEEK (COMPRISED OF 1 INSTRUMENTATION, 1 ELECTRICIAN, AND 3 MISCELLANEOUS MAINTENANCE PERSONNEL DEDICATED TO BOTH FGD SYSTEMS).

I ON SECOND SHIFT 5 DAYS/WEEK THERE ARE 4-6 NON-DEDICATED MAINTENANCE PERSONNEL AVAILABLE TO PERFORM FGD SYSTEM MAINTENANCE ON AN AS-NEEDED BASIS.

J 1 FOR DAY SHIFT ONLY.

K FGD SYSTEM TOTALLY BYPASSED AT UNIT LOAD OF 60 MW.

L WITHIN NSPS GUIDELINES.

M WORK PERFORMED ON SPARE ABSORBER AS NEEDED.

N ONLY ONE TRAIN IS NEEDED TO MEET THE $SO_2$ EMISSION STANDARD.

O DOUBLE LOOP COMBINATION TOWER WITH SPRAY TOWER (QUENCHER) LOWER STAGE AND "WETTED FILM CONTACTOR" GRID TYPE UPPER STAGE (RESEARCH-COTTRELL DESIGN).

P SINGLE STAGE MUNTERS PACKING IS 48 IN. IN THICKNESS AND APPROXIMATELY 30 FT ABOVE ABSORBER BOWL.

Q SINCE ONLY ONE MODULE IS NEEDED TO MEET COMPLIANCE, THE SYSTEM EFFECTIVELY HAS BYPASS REHEAT. HOWEVER, THE DUCTWORK AND STACK ARE DESIGNED FOR BOTH ABSORBERS TO OPERATE SIMULTANEOUSLY WITHOUT ANY REHEAT.

R THE OUTLET AND BYPASS DAMPERS ARE CLAD ON WET SIDE ONLY. THE WET SIDE IS THE UPSTREAM SIDE FOR THE INLET DAMPERS AND THE DOWNSTREAM SIDE FOR THE BYPASS DAMPERS.

S LINED WITH BLACK NATURAL RUBBER.

T LIMESTONE STORAGE PILE (14 DAYS); LIMESTONE SLURRY STORAGE (14-16 HOURS).

U AUTOMATIC IN FAILURE MODE; OTHERWISE CONTROLLED BY SWITCHES ON CONTROL PANEL.

V ASH POND AND SLUDGE POND ARE SHARED BETWEEN UNITS 2 & 3.

W ASH POND (8 IN. DIA PIPELINE); SLUDGE POND (4 IN. DIA PIPELINE).

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 2

COMMENTS/FOOTNOTES (CONTINUED)

X AUTOMATIC PH AND PERCENT SOLIDS MONITORS LOCATED IN THE QUENCHER (BOTTOM OF ABSORBER VESSEL) ARE NO LONGER USED. GRAB SAMPLES ARE TAKEN MANUALLY FROM THE QUENCHER PUMP RECYCLE LINE ON AN HOURLY BASIS TO MEASURE PH AND PERCENT SOLIDS.

Y FIVE 900-1000 FT DEEP WELLS (NO POND WATER RETURN IS USED).

Z UNITS 2 AND 3 COMBINED.

AA THE RUBBER-LINED SUMP PUMP IMPELLERS WERE REPLACED WITH TYPE 316 STAINLESS STEEL IN ONE CASE, AND WITH TYPE 317 STAINLESS STEEL IN ANOTHER.

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

GENERAL PLANT INFORMATION
COMPANY NAME: ARIZONA ELECTRIC POWER COOPERATIVE
ASSOCIATED UTILITIES: NONE
PLANT NAME: APACHE
UNIT NUMBER: 3
PLANT ADDRESS: ROUTE 1, P.O. BOX 104
CITY: COCHISE
COUNTY: COCHISE
STATE: ARIZONA
ZIP CODE: 85606
EPA REGION: 9
RIVER BASIN/LAKE REGION: NONE
REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
SO2 EMISSION LIMITATION - LB/MM BTU: 0.8
NOX EMISSION LIMITATION - LB/MM BTU: 0.7
A NET PLANT GENERATING CAPACITY - MW: 530
GROSS UNIT GENERATING CAPACITY - MW: 195
NET UNIT GENERATING CAPACITY WITH FGD - MW: 175
NET UNIT GENERATING CAPACITY W/O FGD - MW: 183
EQUIVALENT SCRUBBED CAPACITY - MW: 97.5

UNIT DATA (BOILER AND STACK)
BOILER SUPPLIER: RILEY STOKER
FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
FURNACE FIRING METHOD: OPPOSED
WET BOTTOM/DRY BOTTOM: DRY BOTTOM
FURNACE DRAFT TYPE (FORCED, INDUCED,BALANCED): BALANCED
SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
COMMERCIAL SERVICE DATE: 9/79
DESIGN BOILER FLUE GAS FLOW - ACFM: 1,104,000
FLUE GAS TEMPERATURE - F: 710
FLUE GAS OXYGEN - %: 3.5
HEAT RATE - BTU/KWH: 8936
DESIGN FIRING RATE - TPH: 90
EXCESS AIR - %: 20
CAPACITY FACTOR - %: 75
STACK HEIGHT - FT: 400
SHELL MATERIAL: CONCRETE
FLUE MATERIAL GENERIC TYPE: CARBON STEEL
FLUE MATERIAL SPECIFIC TYPE:
FLUE MATERIAL TRADE/COMMON NAME: N/A
FLUE LINER MATERIAL GENERIC TYPE: ORGANIC
FLUE LINER MATERIAL SPECIFIC TYPE: VINYL ESTER
FLUE LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 282-X
FLUE INNER DIAMETER - FT: 16.2
STACK GAS INLET TEMPERATURE - F: 193
STACK GAS OUTLET VELOCITY - FT/SEC: 55-56

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

FUEL DATA (ACTUAL)
FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
NAME OF SUPPLIER: CARBON COAL COMPANY; PITTSBURGH MIDWAY COAL COMPANY
B MINE NAME/AREA: MENTMORE MINE; MCKINLEY MINE
MINE LOCATION - COUNTY: NAVAJO
MINE LOCATION - STATE: NEW MEXICO
AVERAGE HEAT CONTENT - BTU/LB: 9900
RANGE HEAT CONTENT - BTU/LB: 9500-10,800
AVERAGE ASH CONTENT - % 16
RANGE ASH CONTENT - %: 15-20
AVERAGE MOISTURE CONTENT - % 13
RANGE MOISTURE CONTENT - %: 9-15
AVERAGE SULFUR CONTENT - %: 0.5
RANGE SULFUR CONTENT - %: 0.4-0.6
AVERAGE CHLORIDE CONTENT - %: 0.005
RANGE CHLORIDE CONTENT - % 0-0.03
C FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
NUMBER OF MECHANICAL COLLECTORS: NONE
NUMBER OF SPARES:
TYPE:
SUPPLIER:
INLET FLUE GAS CAPACITY - ACFM:
INLET FLUE GAS TEMPERATURE - F:
PRESSURE DROP IN. H2O:
PARTICLE OUTLET LOAD - GR/SCF:
PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
NUMBER OF SPARES: 0
TYPE (HOT SIDE/COLD SIDE): HOT SIDE
SUPPLIER: AIR CORRECTION DIVISION, UOP
INLET FLUE GAS CAPACITY - ACFM: 1,104,000
INLET FLUE GAS TEMPERATURE - F: 710
PRESSURE DROP - IN. H2O: 0.5
PARTICLE OUTLET LOAD - GR/SCF: 0.04
PARTICLE REMOVAL EFFICIENCY - % 99.6
FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
NUMBER OF PARTICLE SCRUBBERS: NONE
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - %

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: RESEARCH-COTTRELL
A-E FIRM: BURNS & MCDONNELL
CONSTRUCTION FIRM: RESEARCH-COTTRELL
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.6
D SO2 DESIGN REMOVAL EFFICIENCY - % 49
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

COMMERCIAL START-UP: 6/79
INITIAL START-UP: 4/79
CONSTRUCTION COMPLETION: 4/79
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 8/74
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST _____
INITIATED PRELIMINARY DESIGN _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 1.0
DESIGN COAL HEAT CONTENT - BTU/LB: 10,000
DESIGN COAL ASH CONTENT - %: 17
DESIGN COAL MOISTURE CONTENT - %: 18
DESIGN COAL CHLORIDE CONTENT - %: 0
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 43,560 (1 ACRE)
E FGD SYSTEM TURNDOWN RATIO: 3.25/1
F FGD SYSTEM TURNDOWN METHOD: REDUCE BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 5
FGD SYSTEM OXIDATION - %: 80
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
G FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
H FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): NONE
I TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: N/A
J TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
K FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
L RESTRICTIONS TO USING BYPASS: NONE
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEK SCHEDULED OUTAGE 1/YEAR
M PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): N/A
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): GENERAL CLEANING AND INSPECTION
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): GENERAL CLEANING AND INSPECTION

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: 2
N NUMBER OF SPARES: 1
TYPE: CYCLONIC SPRAY QUENCHER

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

LOCATION: BOTTOM OF ABSORBER
SUPPLIER: RESEARCH-COTTRELL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR
INLET GAS FLOW - ACFM: 400,000
INLET GAS TEMPERATURE - F: 270
PRESSURE DROP - IN. H2O: <1
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
LIQUID RECIRCULATION RATE - GPM: 8000-10,000
L/G RATIO - GAL/1000 ACF: 20
NUMBER OF SPRAY HEADERS: ____
NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI: ____

ABSORBER
NUMBER OF ABSORBERS: 2
N NUMBER OF SPARES: 1
O GENERIC TYPE: COMBINATION
SPECIFIC TYPE: SPRAY/PACKED
TRADE/COMMON NAME: N/A
SUPPLIER: RESEARCH-COTTRELL
DIMENSIONS - FT: 30 DIA X 80 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 50
GAS/LIQUID CONTACT DEVICE TYPE: SPRAY ZONE AND VERTICAL CROSS CHANNEL FIXED GRID PACKING
NUMBER OF GAS CONTACTING ZONES: 2
P DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 2
NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI: ____
LIQUID RECIRCULATION RATE - GPM: 8000-10,000
L/G RATIO - GAL/1000 ACF: 40
GAS-SIDE PRESSURE DROP - IN. H2O: 2-3
SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
ABSORBER TURNDOWN RATIO: 1.625:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW
INLET GAS FLOW RATE - ACFM: 200,000
INLET GAS TEMPERATURE - F: 150-160

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

INLET SO2 LEVEL - PPM: 430
INLET SO2 LEVEL - LB/MM BTU: 1.0
INLET PARTICLE LEVEL - GR/SCF: 0.04
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 115
OUTLET SO2 LEVEL - PPM: 250-300 (OVERALL)
OUTLET SO2 LEVEL - LB/MM BTU: 0.6 (OVERALL)
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 97
PARTICLE REMOVAL EFFICIENCY - %: 99.6 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 2
N NUMBER OF SPARES: 1
NUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER: MUNTERS
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): A-FRAME LOWER STAGE; "EGG CRATE" UPPER STAGE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 3
FREEBOARD DISTANCE - FT: 2
DISTANCE BETWEEN STAGES - IN.: 12
DISTANCE BETWEEN VANES - IN.: 4 (LOWER STAGE)
VANE ANGLES - DEGREES: 45 (LOWER STAGE)
PRESSURE DROP - IN. H2O: <1
SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: POLYVINYL CHLORIDE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: PVC
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH
POINT OF WATER COLLECTION: TO REACTION TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): UNDERSPRAY
WASH FREQUENCY: INTERMITTENT (LOWER STAGE); ONCE EVERY HOUR (UPPER STAGE)
WASH DURATION: 20 SECONDS (UPPER STAGE)
WASH RATE - GAL/MIN: 200 (UPPER STAGE)
WASH COVERAGE - GAL/MIN SQ FT.: ____

REHEATER
Q NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 50
TEMPERATURE INCREASE - F: 78
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F: 115
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F: 193
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2 (1 FAN PER MODULE)
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: ALLIS CHALMERS
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN AIR PREHEATERS AND ABSORBERS
FLUE GAS FLOW RATE - ACFM: 400,000
FLUE GAS TEMPERATURE - F: 270
PRESSURE DROP - IN. H2O:
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): SHUT-OFF (ALL)
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
(C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE,
PARALLEL BLADE, ETC.): (A&C) PARALLEL BLADE MULTILOUVER
(B) TOP-ENTRY GUILLOTINE

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

TRADE/COMMON DESIGN (SINGLE LOUVER/
DOUBLE LOUVER): (A&C) DOUBLE LOUVER/SEAL AIR
(B) DOUBLE GUILLOTINE/SEAL AIR
MANUFACTURER: _____
MODULATION (OPEN/CLOSED, ETC.): OPEN/CLOSED (ALL)
SEAL AIR - ACFM: 500 (ALL)
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
MATERIAL SPECIFIC TYPE: _____
MATERIAL TRADE/COMMON NAME: N/A
R LINER MATERIAL GENERIC TYPE: (A) NONE (B) HIGH ALLOY (C) HIGH ALLOY
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) _____ (C) _____
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) INCOLOY 825 CLADDING AND INCONEL 625 SEALS (C) INCOLOY 825

DUCTWORK
LOCATION: (A) INLET AND BYPASS (B) OUTLET
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR (ALL)
DIMENSIONS (DIAMETER, LENGTH, ETC.): 12 FT X 14 FT
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
S LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) VINYL ESTER
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) FLAKELINE 282-X

EXPANSION JOINTS
LOCATION: FRONT AND REAR OF ALL DAMPERS
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC (ALL)
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT (ALL)
PRESSURE (NEGATIVE/POSITIVE): POSITIVE (ALL)
OPERATING TEMPERATURE - F: 270 INLET; 115 OUTLET; 270 BYPASS
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: VITON®/ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): TUBE MILL
MANUFACTURER: KENNEDY VAN SAUN
T MATERIALS: RUBBER-LINED CARBON STEEL
NUMBER OF DEVICES: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
FULL LOAD DRY FEED CAPACITY - TPH: 5
PRODUCT QUALITY - % SOLIDS: 45
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 20-30
PREPARED REAGENT POINT OF ADDITION: ABSORBER FEED TANK
U ON-SITE STORAGE CAPABILITY - DAYS: 14

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) INSIDE ABSORBER (B) RECYCLE SLURRY AND SLUDGE (C) LINE FROM BOWL IN ABSORBER
DIMENSIONS - IN.: (C) 16
MANUFACTURER:
MATERIAL: (A) TYPE 316L STAINLESS STEEL (B) RUBBER-LINED CARBON STEEL (C) FRP

MAJOR VALVES
LOCATION: (A) PUMP SUCTION SIDE (B) PUMP DISCHARGE (C) DRAIN
FUNCTION (ISOLATION, CONTROL, ETC.): ISOLATION (ALL)
TYPE (BALL, GLOBE, PLUG, ETC.): (A) BUTTERFLY (B) PLUG (C) BUTTERFLY
V CONTROL MODE (AUTOMATIC/MANUAL): AUTOMATIC (ALL)
DIMENSIONS - IN.:
MANUFACTURER: (A) KEYSTONE (B) DEZURIK (C) KEYSTONE
MATERIAL: (A) BAKELITE PLASTIC DISCS AND RUBBER-LINED SEATS (B) RUBBER-LINED (C) TYPE 316 STAINLESS STEEL WITH TEFLON® SEATS

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER: 70
PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY: 80
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
W GENERIC TYPE (LANDFILL, POND, ETC.): POND (SHARED BETWEEN UNITS 2 & 3)
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): BELOW GRADE
LOCATION (ON-SITE/OFF-SITE): OFF-SITE
X TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: 25 TO 30 ACRES BY 18 FT DEEP

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: 30

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: QUENCHER RECYCLE LINE
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS
CONTROL LEVELS: 5.0 (PH)
MONITOR TYPE (MANUFACTURER, ETC.): _____
MONITOR LOCATION: _____
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): MANUAL
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): _____

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): OPEN
EVAPORATION WATER LOSS - GPM: _____
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: 1840
Z SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): WELL WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: ME WASH AND SLURRY PREPARATION
MAKEUP WATER PRE-TREATMENT TYPE: NONE

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: >93% $CaCO_3$
SOURCE/SUPPLIER: PAUL LIME
SUPPLIER LOCATION: DOUGLAS, ARIZONA
CONSUMPTION (SPECIFY UNITS): _____
UTILIZATION - %: 99
POINT OF ADDITION: BALL MILL

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 11,400,000
CAPITAL COST - $/KW: 58.4
OPERATING COST - MILLS/KWH: 1.46
MAINTENANCE COST: $50,700/YR
LABOR COST: $21,700/YR
UTILITIES COST: $2,750,000/YR
CHEMICALS COST: $52,200/YR
WASTE DISPOSAL COST: $200/YR

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

N ABSORBER - %: 100
MIST ELIMINATOR - %: 0
REHEATER - %: N/A
FAN - %: 0
BALL MILL - %: 0
SLAKER - %: N/A
EFFLUENT HOLD TANK - %: 0
RECIRCULATION PUMP - %: 50 (ABSORBER RECIRCULATION);
100 (QUENCHER RECIRCULATION)
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
N ABSORBER: 1.0
MIST ELIMINATOR: 0
REHEATER: N/A
FAN: 0
BALL MILL: 0
SLAKER: N/A
EFFLUENT HOLD TANK: 0
RECIRCULATION PUMP: 1 (ABSORBER RECIRCULATION); 2 (QUENCHER RECIRCULATION)
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER FEED
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: NEXT TO ABSORBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 25 X 40
CAPACITY - GAL: 38,000
RETENTION TIME - MIN: 13 (WITH ONE ABSORBER IN OPERATION)
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REAGENT FEED
NUMBER OF TANKS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: NEXT TO BALL MILL
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SLURRY SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: UNDERNEATH BALL MILL
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

DIMENSIONS - FT: 2 X 3
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP PIT
NUMBER OF TANKS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: SQUARE
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: N/A
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECYCLE
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: SRL1, SRL-C, 18-16
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 10,000
MOTOR BRAKE HP: 400
SPEED - RPM: 3000
HEAD - FT: 85
SERVICE (PH, SOLIDS): PH 4.0-5.4, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): QUENCHER RECYCLE
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: SRL1, SRL-C, 16-14
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 10,000
MOTOR BRAKE HP: 250
SPEED - RPM: 3000
HEAD - FT: 10
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL SLURRY RECYCLE
NUMBER OF PUMPS: 2 (SHARED BETWEEN UNITS 2 & 3)

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 APACHE 3

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: 40
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: AUSTENITIC
IMPELLER MATERIAL TRADE/COMMON NAME: TYPE 316 OR TYPE 317

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE FEED
NUMBER OF PUMPS: 2 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: INGERSOLL-RAND
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 500
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 50
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED,
ABSORBER RECIRCULATION, ETC.): WASTE SLURRY TRANSFER
NUMBER OF PUMPS: 1 (SHARED BETWEEN UNITS 2 & 3)
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): MOYNO
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA ELECTRIC POWER
DATE: 8/12/81-8/13/81 — APACHE 3

MANUFACTURER: ROBBINS & MYERS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

COMMENTS/FOOTNOTES

A INCLUDES 3 SMALL GAS FIRED TURBINES IN ADDITION TO THE APACHE UNITS 1, 2, & 3.

B AEPCO OWNS THE CARBON COAL COMPANY WHICH SUPPLIES 90% OF THEIR COAL. THE REMAINING 10% IS OBTAINED FROM PITTSBURGH MIDWAY LOCATED IN THE SAME AREA. COAL CHARACTERISTICS ARE VIRTUALLY THE SAME.

C CARBON COAL COMPANY SPOT ANALYSIS (7/27/81)
AVERAGE HEAT CONTENT - BTU/LB: 9693
AVERAGE ASH CONTENT - %: 16.04
AVERAGE MOISTURE CONTENT - %: 13.46
AVERAGE SULFUR CONTENT - %: 0.42
AVERAGE CHLORIDE CONTENT - %: 0.01

D DESIGNED FOR 97% $SO_2$ REMOVAL WHEN ALL THE FLUE GAS IS SCRUBBED, BUT ONLY HALF THE GAS IS SCRUBBED FOR AN OVERALL REMOVAL EFFICIENCY OF 49%.

E BASED ON TOTAL DESIGN SYSTEM CAPACITY OF 197 MW.

F FLUE GAS IS PASSED THROUGH AN ABSORBER DOWN TO A MINIMUM LOADING OF 60 MW. BELOW 60 MW, THE FLUE GAS IS BYPASSED TO THE STACK.

G 3 SHIFTS/DAY SEVEN DAYS A WEEK (SHARED BETWEEN UNITS 2 & 3).

H 1 SHIFT/DAY SEVEN DAYS A WEEK (COMPRISED OF 1 INSTRUMENTAL, 1 ELECTRICIAN, AND 3 MISCELLANEOUS MAINTENANCE PERSONNEL DEDICATED TO BOTH FGD SYSTEMS).

I ON SECOND SHIFT 5 DAYS/WEEK THERE ARE 4-6 NON-DEDICATED MAINTENANCE PERSONNEL AVAILABLE TO PERFORM FGD SYSTEM MAINTENANCE ON AN AS-NEEDED BASIS.

J 1 FOR DAY SHIFT ONLY.

K FGD SYSTEM TOTALLY BYPASSED AT UNIT LOAD OF 60 MW.

L WITHIN NSPS GUIDELINES.

M WORK PERFORMED ON SPARE ABSORBER AS NEEDED.

N ONLY ONE TRAIN IS NEEDED TO MEET THE $SO_2$ EMISSION STANDARD.

O DOUBLE LOOP COMBINATION TOWER WITH SPRAY TOWER (QUENCHER) LOWER STAGE AND "WETTED FILM CONTACTOR" GRID TYPE UPPER STAGE (RESEARCH-COTTRELL DESIGN).

P SINGLE STAGE MUNTERS PACKING IS 48 IN. IN THICKNESS AND APPROXIMATELY 30 FT ABOVE ABSORBER BOWL.

Q SINCE ONLY ONE MODULE IS NEEDED TO MEET COMPLIANCE, THE SYSTEM EFFECTIVELY HAS BYPASS REHEAT. HOWEVER, THE DUCTWORK AND STACK ARE DESIGNED FOR BOTH ABSORBERS TO OPERATE SIMULTANEOUSLY WITHOUT ANY REHEAT.

R THE OUTLET AND BYPASS DAMPERS ARE CLAD ON WET SIDE ONLY. THE WET SIDE IS THE UPSTREAM SIDE FOR THE INLET DAMPERS AND THE DOWNSTREAM SIDE FOR THE BYPASS DAMPERS.

S AN EMERGENCY SPRAY SYSTEM IS AVAILABLE TO PREVENT HEAT DAMAGE TO THE LINING IN THE OUTLET DUCT AND THE FLUE. THE SAME TYPE OF SPRAY SYSTEM WILL ALSO BE INSTALLED ON UNIT 2.

T LINED WITH BLACK NATURAL RUBBER.

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81-8/13/81

ARIZONA ELECTRIC POWER
APACHE 3

COMMENTS/FOOTNOTES (CONTINUED)

U LIMESTONE STORAGE PILE (14 DAYS); LIMESTONE SLURRY STORAGE (14-16 HOURS).
V AUTOMATIC IN FAILURE MODE; OTHERWISE CONTROLLED BY SWITCHES ON CONTROL PANEL.
W ASH POND AND SLUDGE POND ARE SHARED BETWEEN UNITS 2 & 3.
X ASH POND (8 IN. DIA. PIPELINE); SLUDGE POND (4 IN. DIA. PIPELINE).
Y AUTOMATIC PH AND PERCENT SOLIDS MONITORS LOCATED IN THE QUENCHER (BOTTOM OF ABSORBER VESSEL) ARE NO LONGER USED. GRAB SAMPLES ARE TAKEN MANUALLY FROM THE QUENCHER PUMP RECYCLE LINE ON AN HOURLY BASIS TO MEASURE PH AND PERCENT SOLIDS.
Z FIVE 900-1000 FT DEEP WELLS (NO POND WATER RETURN IS USED).
AA UNITS 2 AND 3 COMBINED.
BB THE RUBBER-LINED SUMP PUMP IMPELLERS WERE REPLACED WITH TYPE 316 STAINLESS STEEL IN ONE CASE, AND WITH TYPE 317 STAINLESS STEEL IN ANOTHER.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Electric Power Apache 2 | 8/78 | 744 | | System | | | | Initial operation of the FGD system was conducted for testing purposes |
| | 9/78 | 720 | | System | | | | Testing continued |
| | 10/78 | 744 | 303 | System | | | Ductwork | Utility decided that in approximately a year the scrubber inlet ductwork would be changed from carbon steel to stainless steel |
| | 11/78 | 720 | 488 | System | 334 | | Monitors | $SO_2$ stack monitors not operating |
| | | | | | | | Limestone ball mill | Unable to operate at design capacity |
| | 12/78 | 744 | 512 | System | 0 | | Reagent feed line | 30-hour outage due to ruptured line |
| Commercial start-up | 1/79 | 744 | 662 | System | 0 | | System | FGD system was down from 12/78 through 2/79 for various shakedown/debugging problems (such as maintaining recycle pump operation) |
| | 2/79 | 672 | 504 | System | 0 | | System | Shakedown/debugging problems continued |
| | 3/79 | 744 | 372 | System | 0 | | Boiler | Boiler explosion caused unit to be down entire month |
| | 4/79 | 720 | 720 | System | | | | Compliance tests were completed and unit declared commercial |
| | 5/79 | 744 | | System | | | | |
| | 6/79 | 720 | | System | | | Reagent feed piping | FRP rupturing problem (particularly at piping connections) |
| | 7/79 | 744 | | System | | | Ball mill | Underdesigned |
| | 8/79 | 744 | | System | | | Reagent handling system | Feed line failures and pipe plugging problems |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Apache 2 (continued) | 9/79 | 720 | | System | | | Piping | The FRP section from the ball mill to the modules failed (utility is in the process of replacing all FRP piping with carbon steel piping) |
| | 10/79 | 744 | | System | 0 | 0 | Reagent handling system | Modules down entire month for piping repairs |
| | 11/79 | 720 | 41 | System | 41 | 100 | | Unit was down most of the month for a scheduled inspection |
| | 12/79 | 744 | 130 | System | 0 | 100 | | Reagent handling system problems were resolved and unit was available 100% of the time |
| | 1/80 | 744 | 731 | System | 426 | 91 | Pumps | Malfunctioned |
| | | | | | | | Ball mill | Broken feed belt |
| | 2/80 | 696 | 668 | System | 646 | 93 | ESP | Failed |
| | | | | | | | Pumps | Malfunctioned |
| | 3/80 | 744 | 744 | System | 738 | 99 | Pumps | Malfunctioned |
| | | | | | | | Valves | Sticking problem |
| | | | | | | | Ball mill | Feed belt problems |
| | 4/80 | 720 | 678 | System | 442 | 67 | Piping | Slurry recirculation pipeline ruptured |
| | | | | | | | Pumps | Failure problem |
| | 5/80 | 744 | 744 | System | 673 | 91 | Ball mill | Malfunctioned |
| | | | | | | | Pumps and valves | Failure problem |
| | 6/80 | 720 | | System | | | | Utility lost data |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Apache 2 (continued) | 7/30 | 744 | 738 | 202 | | 100 | | Module 202 was available entire month but was not operated |
| | | | | 203 | | 85 | | |
| | | | | System | 633 | 100 | Damper | Bypass damper |
| | | | | | | | Packing pump | Failed |
| | | | | | | | Circuit breaker | Malfunctioned |
| | 8/30 | 744 | 714 | 202 | | 0 | Liner | Module down entire month because of relining |
| | | | | 203 | | 97 | Sample line | 24-hour outage due to sample line failure |
| | | | | System | 471 | 97 | | |
| | 9/30 | 720 | | 202 | | | | No information was reported |
| | | | | 203 | | | | |
| | | | | System | | | | |
| | 10/30 | 744 | 699 | 202 | | 0 | | Module down entire month for a scheduled inspection |
| | | | | 203 | | 93 | | |
| | | | | System | 613 | 93 | System control | pH instability problems |
| | 11/80 | 720 | 214 | 202 | | 20 | | |
| | | | | 203 | | 0 | | |
| | | | | System | 48 | 20 | Ball mill | 72-hour outage due to ball mill failure |
| | 12/80 | 744 | 743 | 202 | | 100 | | |
| | | | | 203 | | 0 | | |
| | | | | System | 743 | 100 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Electric Power Apache 3 | 6/79 | 720 | | System | | | | Minor shakedown problems were encountered during initial start-up |
| | 7/79 | 744 | | System | | | | |
| | 8/79 | 744 | | System | | | Reagent handling system | Feedline failures and pipe plugging problems (reagent handling system accommodates both Apache 2 and 3) |
| Commercial start-up | 9/79 | 720 | | System | | | Piping | The FRP section of feed pipe from the ball mill to the modules failed |
| | 10/79 | 744 | | System | 0 | 0 | Reagent handling system | Modules down entire month for piping repairs |
| | 11/79 | 720 | 713 | 302 | | 89 | | |
| | | | | 303 | | 89 | | |
| | | | | System | 644 | 100 | | |
| | 12/79 | 744 | 744 | 302 | | | | |
| | | | | 303 | | | | |
| | | | | System | 741 | 100 | Damper | Outage time was due to faulty boiler flue damper |
| | 1/80 | 744 | 744 | 302 | | | | |
| | | | | 303 | | | | |
| | | | | System | 682 | 92 | Pumps | Malfunctioned |
| | | | | | | | Ball mill | Broken feed belt |
| | 2/80 | 696 | 671 | 302 | | | | |
| | | | | 303 | | | | |
| | | | | System | 497 | 96 | ESP | Failed |
| | | | | | | | Pumps | Malfunctioned |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Apache 3 (continued) | 3/80 | 744 | 744 | 302<br>303<br>System | 677 | 91 | Pumps | Malfunctioned |
| | | | | | | | Valves | Sticking problem |
| | | | | | | | Ball mill | Feed belt problems |
| | 4/80 | 720 | 227 | 302<br>303<br>System | 227 | 99 | Piping | Slurry recirculation pipeline ruptured |
| | | | | | | | Pumps | Failure problem |
| | 5/80 | 744 | 39 | 302<br>303<br>System | 0 | 0 | System | System down entire month for a scheduled inspection (the liners in the quencher were repaired during this scheduled outage period) |
| | 6/80 | 720 | | 302<br>303<br>System | | | | Utility lost data |
| | 7/80 | 744 | 721 | 302 | | 29 | Absorber | 528-hour outage to repair liner |
| | | | | 303 | | 0 | Absorber | 744-hour outage to repair liner |
| | | | | System | 216 | 29 | Pump | Packing pump failed |
| | 8/80 | 744 | 599 | 302 | | 99 | Pump | Quencher pump failed |
| | | | | 303 | | 99 | Sampling line | Failed |
| | | | | System | 402 | 99 | | |
| | 9/80 | 720 | | 302<br>303<br>System | | | | No information was reported |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Apache 3 (continued) | 10/80 | 744 | 567 | 302 | | 76 | | |
| | | | | 303 | | 0 | Pump | Quencher pump |
| | | | | System | 507 | 76 | System control | pH instability problems |
| | 11/80 | 744 | 717 | 302 | | 78 | | |
| | | | | 303 | | 100 | | |
| | | | | System | 688 | 100 | Sample line | Failed |
| | | | | | | | Pump | Quencher pump |
| | 12/80 | 744 | 729 | 302 | | 0 | | |
| | | | | 303 | | 100 | | |
| | | | | System | 719 | 100 | | |

# ARIZONA PUBLIC SERVICE

## CHOLLA 1, 2

# SECTION 1

# BACKGROUND

The Cholla Power Station of Arizona Public Service is located near Joseph City, Arizona. Cholla is a planned five-unit generating station with four of the units presently operating. Each unit burns low-sulfur, bituminous coal that has a typical heating value of 10,150 Btu/lb and an average sulfur content of 0.5%.

In May 1962 when Cholla 1, a 119-MW (gross) unit, began operations, no environmental controls were in effect. During the 1970's, the Arizona State Department of Health promulgated a regulation requiring that particulate matter emissions not exceed 0.196 pounds per million Btu and $SO_2$ emissions not exceed 1.0 pound per million Btu. In order for Cholla 1 to comply with these regulations, the utility found it necessary to install an FGD system. A contract was awarded to Research-Cottrell to design and install a wet limestone scrubbing system. The emission control system design was a result of a pilot plant program conducted at the station by Research-Cottrell and Arizona Public Service. The scrubbers were installed primarily to control particulate matter; therefore, only one of the two scrubbing trains was equipped with an $SO_2$ absorber. The FGD system commenced operation in October 1973.

Arizona Public Service
Cholla 1, 2

The generating capacity of the Cholla Power Station was expanded in mid-1978 when unit 2, which is rated at 285 MW (gross), was brought on line. Because emission regulations required that three of the five units planned for the Cholla station be equipped with FGD systems, Research-Cottrell was contracted to install a limestone FGD system for $SO_2$ control. The system began initial operations in April 1978.

Cholla 3 is equipped with an ESP for particulate matter control only. Cholla 4 includes a Research-Cottrell limestone FGD system which commenced initial operations in March 1981.

## SECTION 2

## PROCESS DESCRIPTION

The Cholla 1 FGD system consists of two parallel modules (A and B), each designed to accomodate 50% of the total boiler flue gas flow of 480,000 acfm at 276°F. Module A includes a variable-throat, flooded-disc scrubber for particulate control, followed by a combination tower (spray/packed) that uses a limestone slurry for $SO_2$ removal.

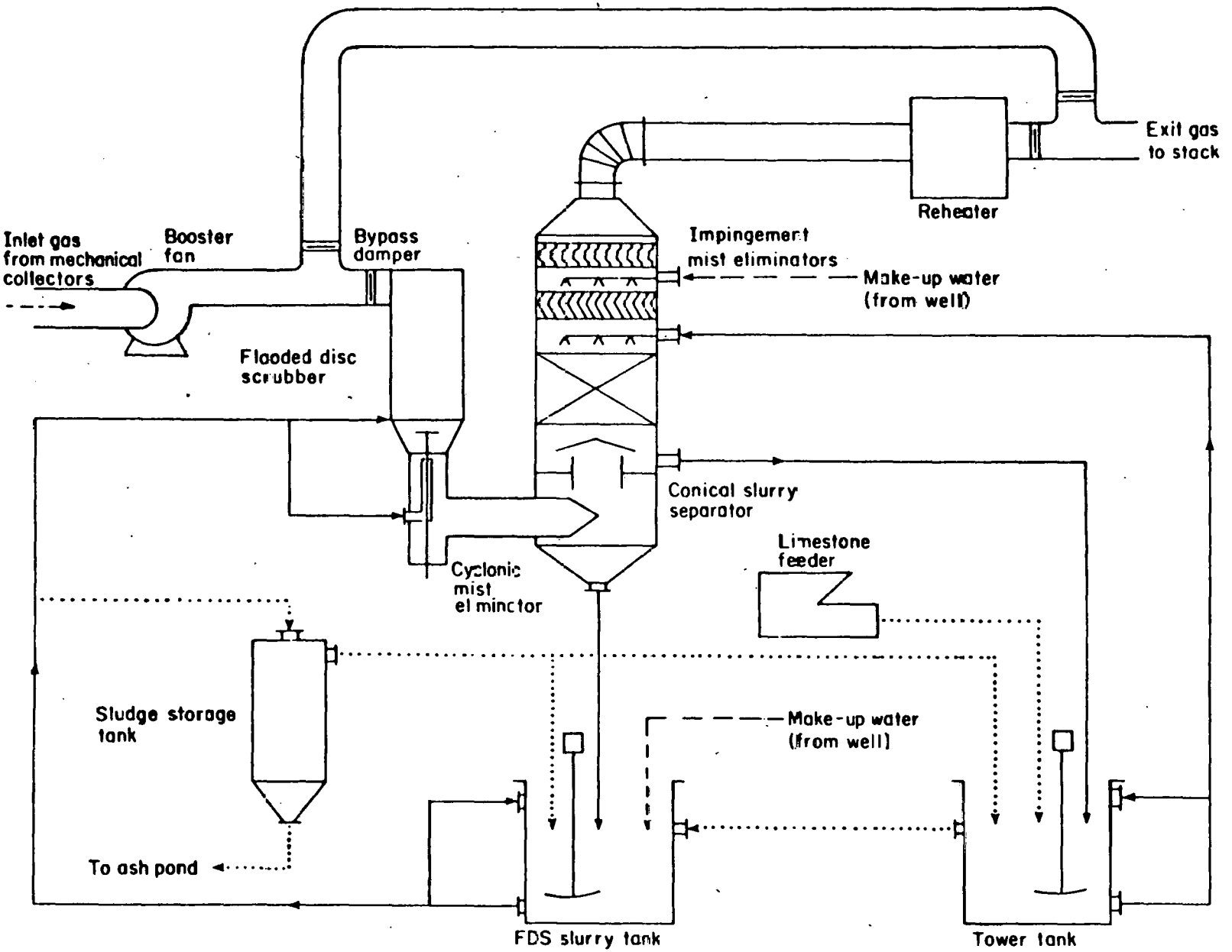
Module B differs from Module A only in that the absorber tower is not packed and limestone slurry is not circulated through it. Module A is designed for 90% $SO_2$ removal efficiency and Module B for 25%. This yields a combined $SO_2$ removal efficiency of 58.4%. This efficiency is based on an inlet $SO_2$ concentration of approximately 400 to 500 ppm. Either or both modules can be bypassed.

Before exiting the modules, the flue gas passes through a chevron vane mist eliminator (one per module) before being reheated by an in-line steam reheater. The flue gas from each module is then ducted to a common 250-foot concrete stack.

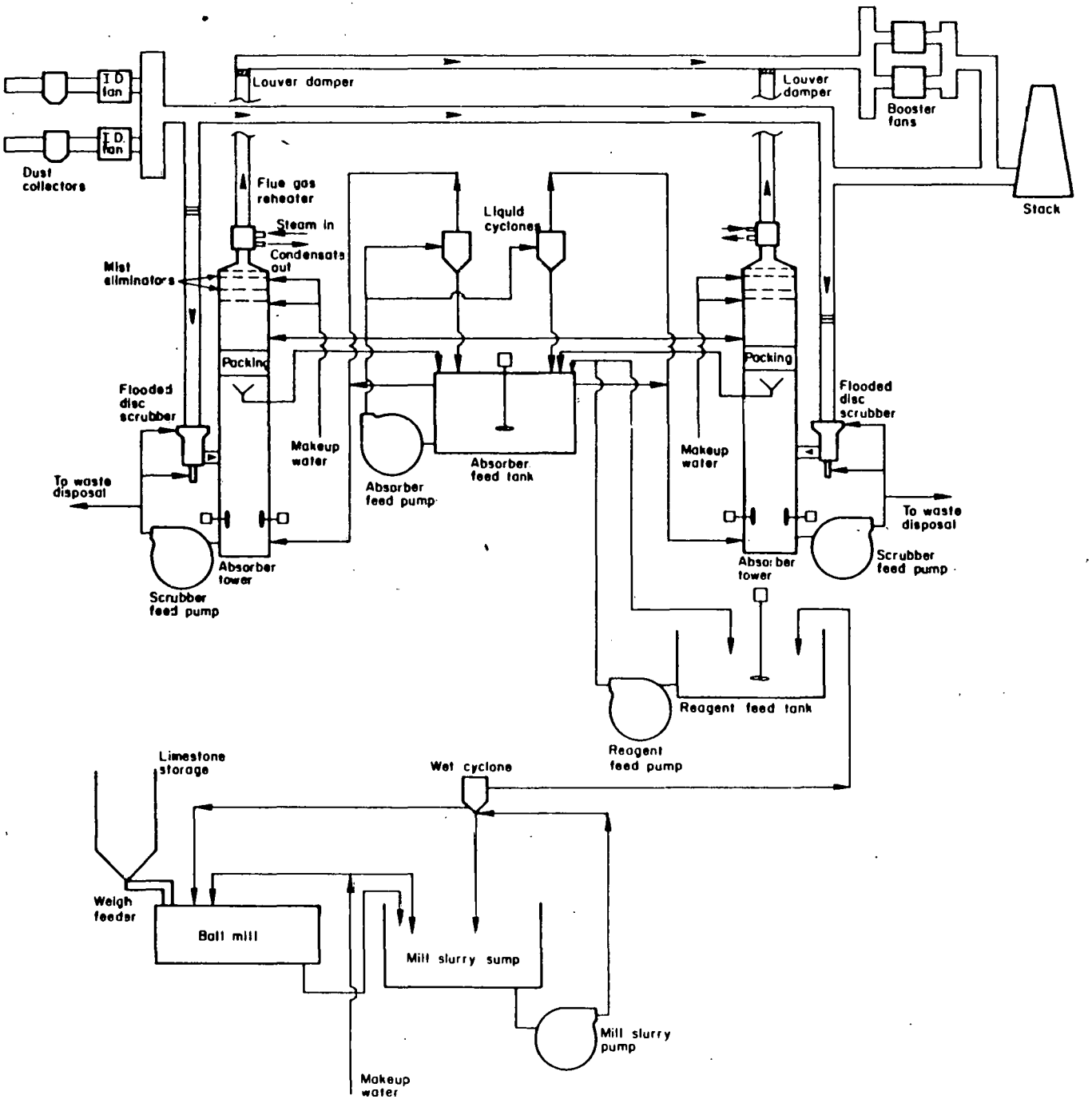
The Cholla 2 FGD system consists of four combination towers (spray/packed) where limestone slurry is recirculated for primary $SO_2$ removal. Each absorber module is preceeded by a flooded disk venturi scrubber for particulate matter removal.

From each module, the flue gas passes through chevron vane mist eliminators prior to being ducted through a common in-line steam reheater and exiting through a 550-foot stack.

Both FGD systems operate in an open water loop mode and the untreated waste is disposed of in an on-site unlined pond. Flow diagrams for the Cholla 1, 2 FGD systems are shown on the next two pages.




Flow Diagram: Cholla 1




Flow Diagram: Cholla 2

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

GENERAL PLANT INFORMATION
- COMPANY NAME: ARIZONA PUBLIC SERVICE COMPANY
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: CHOLLA
- UNIT NUMBER: 1
- PLANT ADDRESS: P.O. BOX 188
- CITY: JOSEPH CITY
- COUNTY: NAVAJO
- STATE: ARIZONA
- ZIP CODE: 85036
- EPA REGION: 9
- RIVER BASIN/LAKE REGION: COLORADO
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.196
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.0
- NOX EMISSION LIMITATION - LB/MM BTU: 0.8
- NET PLANT GENERATING CAPACITY - MW: 645
- GROSS UNIT GENERATING CAPACITY - MW: 119
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 115
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 119
- EQUIVALENT SCRUBBED CAPACITY - MW: 119

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: COMBUSTION ENGINEERING
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: TANGENTIAL
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 1962
- DESIGN BOILER FLUE GAS FLOW - ACFM: 480,000
- FLUE GAS TEMPERATURE - F: 276
- FLUE GAS OXYGEN - %: 3
- HEAT RATE - BTU/KWH: 10,320
- DESIGN FIRING RATE - TPH: 54
- EXCESS AIR - %: 15
- CAPACITY FACTOR - %: 93
- STACK HEIGHT - FT: 250
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL SPECIFIC TYPE: _____
- FLUE MATERIAL TRADE/COMMON NAME: _____
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 12
- STACK GAS INLET TEMPERATURE - F: 161
- STACK GAS OUTLET VELOCITY - FT/SEC: 65

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: PITTSBURG & MIDWAY COAL CO.
- MINE NAME/AREA: MCKINLEY MINE
- MINE LOCATION - COUNTY: MCKINLEY
- MINE LOCATION - STATE: NEW MEXICO
- AVERAGE HEAT CONTENT - BTU/LB: 10,150
- RANGE HEAT CONTENT - BTU/LB: 9650-10,600
- AVERAGE ASH CONTENT - % 13.5
- RANGE ASH CONTENT - %: 9.7-22.5
- AVERAGE MOISTURE CONTENT - % 16
- RANGE MOISTURE CONTENT - %: _____
- AVERAGE SULFUR CONTENT - %: 0.50
- RANGE SULFUR CONTENT - %: 0.4-1.0
- AVERAGE CHLORIDE CONTENT - %: 0.02
- RANGE CHLORIDE CONTENT - % 0.01-0.04
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): _____
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: 1
- NUMBER OF SPARES: 0
- TYPE: CYCLONE (MULTI-TUBE)
- SUPPLIER: RESEARCH-COTTRELL
- INLET FLUE GAS CAPACITY - ACFM: 480,000
- INLET FLUE GAS TEMPERATURE - F: 276
- PRESSURE DROP - IN. H2O: _____
- PARTICLE OUTLET LOAD - GR/SCF: 1.2-2.0
- PARTICLE REMOVAL EFFICIENCY - %: 75

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: NONE
- NUMBER OF SPARES:
- TYPE (HOT SIDE/COLD SIDE):
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %
- FLUE GAS CONDITIONING TYPE:

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: 2
- NUMBER OF SPARES: _____

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.): VENTURI
A SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.): VARIABLE-THROAT (NO LONGER VARIABLE)
TRADE/COMMON NAME: FLOODED DISC SCRUBBER
SUPPLIER: RESEARCH-COTTRELL
DIMENSIONS - FT: 6 DIA X 45 HIGH
SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL
SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
B LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR
BOILER LOAD PER SCRUBBER (DESIGN) - %: 50
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.): NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL: TYPE 316L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 5340
L/G RATIO - GAL/1000 ACF: 22
PH CONTROL ADDITIVE: ABSORBER SLURRY (TRAIN A ONLY)
GAS-SIDE PRESSURE DROP - IN. H2O: 15
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM: 240,000
INLET GAS TEMPERATURE - F: 278
INLET SO2 LEVEL - PPM: 400
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF: 1.2-2.0
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F: 121
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - % 99.2

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: RESEARCH-COTTRELL
A-E FIRM: EBASCO
CONSTRUCTION FIRM: RESEARCH-COTTRELL
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %:
SO2 DESIGN REMOVAL EFFICIENCY - % 50-60 (OVERALL)
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

COMMERCIAL START-UP: 12/73
INITIAL START-UP: 10/73
CONSTRUCTION COMPLETION: 12/73
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 7/71
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST 4/71
INITIATED PRELIMINARY DESIGN 1/71

FGD DESIGN AND OPERATING PARAMETERS

DESIGN COAL SULFUR CONTENT - %: ____
DESIGN COAL HEAT CONTENT - BTU/LB: _____
DESIGN COAL ASH CONTENT - %: _____
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: _____
FGD SYSTEM TURNDOWN METHOD: _____
FGD SYSTEM PRESSURE DROP - IN. H2O: _____
FGD SYSTEM OXIDATION - %: HIGH
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: <15
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: <15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
C FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 24 OPERATION PLUS 16 MAINTENANCE
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 2 (DAY SHIFT ONLY)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): _____
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): PLANT MAINTENANCE
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: ROTATE AS NEEDED
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): _____
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: GET PERMISSION FROM STATE
TIME SCHEDULE FOR REDUCED BOILER LOAD: SYSTEM DEMAND; 90% CAPACITY PER MONTH
TIME SCHEDULE FOR BOILER SHUTDOWNS: 2 WEEKS PER YEAR MINOR; 5 TO 6 WEEKS EVERY 5 YEARS MAJOR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): FAN BALANCE
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): CAN DO MAINTENANCE ON MODULE THAT IS DOWN; USUALLY DO NOT TAKE UNIT DOWN; USE BYPASS

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/14/81 CHOLLA 1

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
D NUMBER OF ABSORBERS: 2
NUMBER OF SPARES:
GENERIC TYPE: PACKED TOWER
SPECIFIC TYPE: FIXED BED PACKING
TRADE/COMMON NAME:
SUPPLIER: RESEARCH-COTTRELL
DIMENSIONS - FT: 22 DIA X 70 HIGH
SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL
SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BOILER LOAD PER ABSORBER - %: 50
E GAS/LIQUID CONTACT DEVICE TYPE: VERTICAL CROSS CHANNEL FIXED GRID PACKING
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL: TYPE 316L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 9300
L/G RATIO - GAL/1000 ACF: 45
GAS-SIDE PRESSURE DROP - IN. H2O: 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
ABSORBER TURNDOWN RATIO: 2:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; CONSTANT LIQUID FLOW

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

INLET GAS FLOW RATE - ACFM: 205,000
INLET GAS TEMPERATURE - F: 122
INLET SO2 LEVEL - PPM: _____
INLET SO2 LEVEL - LB/MM BTU: _____
INLET PARTICLE LEVEL - GR/SCF: _____
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: _____
OUTLET SO2 LEVEL - PPM: 180 (OVERALL)
OUTLET SO2 LEVEL - LB/MM BTU: _____
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 90
PARTICLE REMOVAL EFFICIENCY - %: 99.7 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: _____
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A) IMPINGEMENT (B) IMPINGEMENT
SPECIFIC TYPE: (A) _____ (B) BAFFLE
COMMON DESIGN: (A) CHEVRON VANE (B) OPEN VANE (SLAT)
MANUFACTURER: _____
CONFIGURATION (HORIZONTAL/VERTICAL): (A) VERTICAL (B) VERTICAL
SHAPE (Z-SHAPE/A-FRAME): (A) N/A (B) FLAT
NUMBER OF STAGES: (A) 1 (B) 1
NUMBER OF PASSES/STAGE: (A) N/A (B) 2 FIRST STAGE AND 4 SECOND STAGE
FREEBOARD DISTANCE - FT: (A) _____ (B) 13.5
DISTANCE BETWEEN STAGES - IN.: _____
DISTANCE BETWEEN VANES - IN.: (B) 1.5 FIRST STAGE AND 7.1 SECOND STAGE
VANE ANGLES - DEGREES: (B) 45 (BOTH STAGES)
PRESSURE DROP - IN. H2O: (B) 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: (B) 9-11
CONSTRUCTION MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) POLYPROPYLENE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (A) N/A
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (A) NONE (B) MAKEUP WATER
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (B) UNDERSPRAY
WASH FREQUENCY: (B) ONCE/30 MINUTES
WASH DURATION: (B) 45 SECONDS
WASH RATE - GAL/MIN: _____
WASH COVERAGE - GAL/MIN SQ FT.: _____

REHEATER
NUMBER OF REHEATERS: 2

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

NUMBER OF SPARES:
NUMBER PER MODULE: 1
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): IN-LINE
SPECIFIC TYPE (STEAM, HOT WATER, ETC.): STEAM
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): BARE TUBES
COMBUSTION FUEL SULFUR CONTENT - %: N/A
LOCATION: SEPARATE VESSEL AFTER ABSORBER
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: N/A
TEMPERATURE INCREASE - F: 40
INLET FLUE GAS FLOW RATE - ACFM: 245,000
INLET FLUE GAS TEMPERATURE - F: 120
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F: 160
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS: 3
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
F SELF CLEANING DEVICE TYPE: STEAM SOOT BLOWERS
MATERIAL GENERIC TYPE: STAINLESS STEEL
MATERIAL SPECIFIC TYPE: TYPE 316L
MATERIAL TRADE/COMMON NAME: N/A

FANS
NUMBER OF FANS: 4
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: WESTINGHOUSE
FUNCTION (UNIT/BOOSTER): 2 FD FANS AND 2 BOOSTER FANS
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN MECHANICAL COLLECTORS AND SCRUBBERS
FLUE GAS FLOW RATE - ACFM: 240,000
FLUE GAS TEMPERATURE - F: 276
PRESSURE DROP - IN. H2O:
MATERIAL GENERIC TYPE: LOW ALLOY STEEL
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: COR-TEN

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS (D) FD FAN INLET (E) BOOSTER FAN INLET
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2 (D) 2 (E) 2
FUNCTION (CONTROL/SHUT-OFF): (A, B, C) SHUT-OFF; (D, E) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A, B, C) GUILLOTINE; (D, E) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER):
MANUFACTURER:
MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
MATERIAL GENERIC TYPE: STAINLESS STEEL (ALL)
MATERIAL SPECIFIC TYPE: TYPE 316L
MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE (ALL)
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET TO REHEATER (C) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.):
DIMENSIONS (DIAMETER, LENGTH, ETC.):
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
G LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC (C) NONE
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) MICA FLAKE/POLYESTER (C) N/A
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) FLAKELINE 252 (C) N/A

EXPANSION JOINTS
LOCATION:
H TYPE (METALLIC/ELASTOMERIC): (A) ELASTOMERIC (B) METALLIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: (A) VITON® REINFORCED WITH CANVAS (B) STAINLESS STEEL

REAGENT PREPARATION EQUIPMENT
I FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): NONE
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.):
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER:
MATERIALS:
NUMBER OF DEVICES:
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH:
PRODUCT QUALITY - % SOLIDS:
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION:
ON-SITE STORAGE CAPABILITY - DAYS:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) SLURRY PIPING (B) SPRAY HEADERS
DIMENSIONS - IN.: _____
MANUFACTURER: _____
MATERIAL: (A) TYPE 316L STAINLESS STEEL, RUBBER-LINED CARBON STEEL, AND FRP (B) TYPE 316L STAINLESS STEEL

MAJOR VALVES
LOCATION: SLURRY LINES
FUNCTION (ISOLATION, CONTROL, ETC.): ISOLATION
TYPE (BALL, GLOBE, PLUG, ETC.): BUTTERFLY
CONTROL MODE (AUTOMATIC/MANUAL): _____
DIMENSIONS - IN.: _____
MANUFACTURER: _____
MATERIAL: RUBBER-LINED STEEL

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 1

CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: _____
MOISTURE CONTENT - % TOTAL FREE WATER: 86-88
PERCENT CASO3 - DRY: _____
PERCENT CASO4 - DRY: _____
PERCENT CA(OH)2 - DRY: _____
PERCENT CACO3 - DRY: _____
PERCENT ASH - DRY: _____
PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: 70-100 ACRES X 6 FT DEPTH
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: SCRUBBER AND ABSORBER HOLD TANK
- CHEMICAL PARAMETERS (PH, ETC.): PH
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): _____
- CONTROL LEVELS: PH 5.2 IN SCRUBBER HOLD TANK, 6.5 IN ABSORBER HOLD TANK
- MONITOR TYPE (MANUFACTURER, ETC.): _____
- MONITOR LOCATION: _____
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): MANUAL
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): _____

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): _____
- TYPE (OPEN/CLOSED): OPEN
- EVAPORATION WATER LOSS - GPM: _____
- SLUDGE HYDRATION WATER LOSS - GPM: _____
- SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
- EFFLUENT WATER LOSS - GPM: _____
- RECEIVING WATER STREAM NAME: _____
- MAKEUP WATER ADDITION - GPM: 120
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
- MAKEUP WATER ADDITION POINTS & AMOUNTS: _____
- MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
- PRINCIPAL CONSTITUENTS: _____
- SOURCE/SUPPLIER: SUPERIOR CO.
- SUPPLIER LOCATION: ST. JOHNS, ARIZONA
- CONSUMPTION (SPECIFY UNITS): _____
- UTILIZATION - %: _____
- POINT OF ADDITION: ABSORBER RECYCLE TANK

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
- CAPITAL COST - $: 9,400,000
- CAPITAL COST - $/KW: 74.6
- OPERATING COST - MILLS/KWH: 2.33
  - MAINTENANCE COST: $322,000/YR
  - LABOR COST: $275,000/YR
  - UTILITIES COST: $694,000/YR
  - CHEMICALS COST: $31,600/YR
  - WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: _____
- ABSORBER - %: _____
- MIST ELIMINATOR - %: _____
- REHEATER - %: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

FAN - %:
BALL MILL - %: N/A
SLAKER - %: N/A
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER:
ABSORBER:
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL: N/A
SLAKER: N/A
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER:
PARTICIPANTS: ARIZONA PUBLIC SERVICE, RESEARCH-COTTRELL
PROCESS: LIMESTONE
PLANT DESIGN: FLOODED DISC SCRUBBER
SUPPLIER: RESEARCH-COTTRELL
SERVICE DATE: 1971
PERIOD OF OPERATION - MONTHS: 6
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW: 1.6
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SCRUBBER RECYCLE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 12.5 DIA X 14 HIGH
CAPACITY - GAL: _____
RETENTION TIME - MIN: 7
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLUDGE HOLDUP
NUMBER OF TANKS: 2
NUMBER OF SPARES: _____
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: _____
DIMENSIONS - FT: 18.5 DIA X 27 HIGH
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: _____
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER TOWER HOLDUP
NUMBER OF TANKS: 1
NUMBER OF SPARES: _____
TYPE (OPEN/COVERED): _____
LOCATION: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

CONFIGURATION:
DIMENSIONS - FT: 27.3 DIA X 28 HIGH
CAPACITY - GAL:
RETENTION TIME - MIN: 5
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY MAKEUP
NUMBER OF TANKS: 1
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: TYPE 316L STAINLESS STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.):
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SCRUBBER RECIRCULATION
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 2670
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 90
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 317
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 317
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 9300
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 100
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 317
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 317
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 317
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 317
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLUDGE DISPOSAL
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULD
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): _____
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 1

COMMENTS/FOOTNOTES

A FLOODED DISC SCRUBBER ACTS AS AN ANNULAR-THROAT VENTURI; BOTTOM ENTRY LIQUID DISTRIBUTION.
B ONLY THE LOWER PORTION IS LINED. THE WET SUMP AND FLOOR WERE OVERLAYED WITH ACID-RESISTANT BRICK AND COROBOND MORTAR.
C COMMON WORK FORCE FOR UNITS 1 AND 2.
D THE TRAIN B ABSORBER HAS NO LIMESTONE FEED AND NO PACKING. WATER IS SPRAYED INTO THE FLOODED DISC SCRUBBER FOR FLY ASH REMOVAL.
E MUNTERS T 2-81 POLYPROPYLENE PACKING.
F THE SOOT BLOWERS ARE OPERATED FOR ABOUT 2 MINUTES EVERY HOUR.
G THE FLAKELINE 252 LINING IN TRAIN B FAILED AND WAS REPLACED WITH OTHER LININGS, INCLUDING FLAKELINE 103, WHICH WERE PATCHED SEVERAL TIMES. FINALLY, PLASITE 4030 WAS APPLIED.
H THE ORIGINAL EXPANSION JOINTS WERE TYPE 316L STAINLESS STEEL, BUT CONDENSATE PUDDLES CAUSED FAILURES.
I LIMESTONE IS PURCHASED IN POWDERED FORM.

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

GENERAL PLANT INFORMATION
- COMPANY NAME: ARIZONA PUBLIC SERVICE COMPANY
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: CHOLLA
- UNIT NUMBER: 2
- PLANT ADDRESS: P.O. BOX 188
- CITY: JOSEPH CITY
- COUNTY: NAVAJO
- STATE: ARIZONA
- ZIP CODE: 85036
- EPA REGION: 9
- RIVER BASIN/LAKE REGION: COLORADO
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.167
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.0
- NOX EMISSION LIMITATION - LB/MM BTU: 0.8
- NET PLANT GENERATING CAPACITY - MW: 645
- GROSS UNIT GENERATING CAPACITY - MW: 285
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 235
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 250
- EQUIVALENT SCRUBBED CAPACITY - MW: 285

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: COMBUSTION ENGINEERING
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: TANGENTIAL
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 6/78
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,100,000
- FLUE GAS TEMPERATURE - F: 288
- FLUE GAS OXYGEN - %: 3.5
- HEAT RATE - BTU/KWH: 11,200
- DESIGN FIRING RATE - TPH: 147
- EXCESS AIR - %: 20
- CAPACITY FACTOR - %: 89
- STACK HEIGHT - FT: 550
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: CARBON STEEL
- FLUE MATERIAL SPECIFIC TYPE:
- FLUE MATERIAL TRADE/COMMON NAME: N/A
- FLUE LINER MATERIAL GENERIC TYPE: ORGANIC
- FLUE LINER MATERIAL SPECIFIC TYPE: INERT FLAKE/VINYL ESTER
- FLUE LINER MATERIAL TRADE/COMMON NAME: PLASITE 4030
- FLUE INNER DIAMETER - FT: 14.7
- STACK GAS INLET TEMPERATURE - F: 161
- STACK GAS OUTLET VELOCITY - FT/SEC: 100

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: PITTSBURG & MIDWAY COAL CO.
- MINE NAME/AREA: MCKINLEY MINE
- MINE LOCATION - COUNTY: MCKINLEY
- MINE LOCATION - STATE: NEW MEXICO
- AVERAGE HEAT CONTENT - BTU/LB: 10,150
- RANGE HEAT CONTENT - BTU/LB: 9650-10,600
- AVERAGE ASH CONTENT - % 13.5
- RANGE ASH CONTENT - %: 9.7-22.5
- AVERAGE MOISTURE CONTENT - % 15.0
- RANGE MOISTURE CONTENT - %: _____
- AVERAGE SULFUR CONTENT - %: 0.5
- RANGE SULFUR CONTENT - %: 0.4-1.0
- AVERAGE CHLORIDE CONTENT - %: 0.02
- RANGE CHLORIDE CONTENT - % 0.01-0.04
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): _____
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: 2
- NUMBER OF SPARES: 0
- TYPE: CYCLONES
- SUPPLIER: UOP
- INLET FLUE GAS CAPACITY - ACFM: 550,000
- INLET FLUE GAS TEMPERATURE - F: 280
- PRESSURE DROP - IN. H2O: _____
- PARTICLE OUTLET LOAD - GR/SCF: 1-5 (NORMALLY 1.8)
- PARTICLE REMOVAL EFFICIENCY - %: 65-70

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: NONE
- NUMBER OF SPARES:
- TYPE (HOT SIDE/COLD SIDE):
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %
- FLUE GAS CONDITIONING TYPE:

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: 4
- NUMBER OF SPARES: 1

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.): VENTURI
A SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.): VARIABLE-THROAT (NO LONGER VARIABLE
TRADE/COMMON NAME: FLOODED DISC SCRUBBER
SUPPLIER: RESEARCH-COTTRELL
DIMENSIONS - FT: 6 DIA X 45 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
B LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR
BOILER LOAD PER SCRUBBER (DESIGN) - %: 33.3
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.): NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL: TYPE 317L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 9800
L/G RATIO - GAL/1000 ACF: 25
PH CONTROL ADDITIVE: ABSORBER SLURRY
GAS-SIDE PRESSURE DROP - IN. H2O: 23
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM: 392,000
INLET GAS TEMPERATURE - F: 280
INLET SO2 LEVEL - PPM: 350 (RANGE 250-950)
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF: 1.8 (RANGE 1-5)
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F: 121
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - % >99 (OVERALL)

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: RESEARCH-COTTRELL
A-E FIRM: EBASCO
CONSTRUCTION FIRM: BECHTEL
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.7
SO2 DESIGN REMOVAL EFFICIENCY - % 75
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

COMMERCIAL START-UP: 6/78
INITIAL START-UP: 4/78
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 7/75
CONTRACT AWARDED: 12/74
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST _____
INITIATED PRELIMINARY DESIGN _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: _____
DESIGN COAL HEAT CONTENT - BTU/LB: _____
DESIGN COAL ASH CONTENT - %: _____
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: 7.3:1
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE; REDUCE GAS FLOW
FGD SYSTEM PRESSURE DROP - IN. H2O: 26-27
FGD SYSTEM OXIDATION - %: >90
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: 15
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
C FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 24 OPERATION PLUS 16 MAINTENANCE
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 2 (DAY SHIFT ONLY)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): _____
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): PLANT MAINTENANCE
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: ROTATE AS NEEDED
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): _____
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: GET PERMISSION FROM STATE
TIME SCHEDULE FOR REDUCED BOILER LOAD: SYSTEM DEMAND; 90% CAPACITY PER MONTH
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEKS PER YEAR MINOR; 5-6 WEEKS EVERY 5 YEARS MAJOR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): FAN BALANCE
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): CAN DO MAINTENANCE ON MODULE THAT IS DOWN; USUALLY DO NOT TAKE UNIT DOWN; USE BYPASS

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: NONE
- NUMBER OF SPARES:
- TYPE:
- LOCATION:
- SUPPLIER:
- SHELL MATERIAL GENERIC TYPE:
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME:
- LINER MATERIAL GENERIC TYPE:
- LINER MATERIAL SPECIFIC TYPE:
- LINER MATERIAL TRADE/COMMON NAME:
- INLET GAS FLOW - ACFM:
- INLET GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
- LIQUID RECIRCULATION RATE - GPM:
- L/G RATIO - GAL/1000 ACF:
- NUMBER OF SPRAY HEADERS:
- NOZZLE MATERIAL:
- NOZZLE PRESSURE DROP - PSI:

ABSORBER
- NUMBER OF ABSORBERS: 4
- NUMBER OF SPARES: 1
- GENERIC TYPE: PACKED TOWER
- SPECIFIC TYPE: FIXED BED PACKING
- TRADE/COMMON NAME:
- SUPPLIER: RESEARCH-COTTRELL
- DIMENSIONS - FT: 22 DIA X 70 HIGH
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY AND GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR AND FLAKELINE 103
- BOILER LOAD PER ABSORBER - %: 33.3

D GAS/LIQUID CONTACT DEVICE TYPE: VERTICAL CROSS CHANNEL FIXED GRID PACKING
- NUMBER OF GAS CONTACTING ZONES: 2
- DISTANCE BETWEEN GAS CONTACTING ZONES - IN.:
- NUMBER OF SPRAY HEADERS:
- NOZZLE MATERIAL: TYPE 317L STAINLESS STEEL
- NOZZLE PRESSURE DROP - PSI
- LIQUID RECIRCULATION RATE - GPM: 19,200
- L/G RATIO - GAL/1000 ACF: 40
- GAS-SIDE PRESSURE DROP - IN. H2O:
- SUPERFICIAL GAS VELOCITY - FT/SEC: 9-11
- ABSORBER TURNDOWN RATIO: 2.4:1

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW
INLET GAS FLOW RATE - ACFM: 392,000
INLET GAS TEMPERATURE - F: 122
INLET SO2 LEVEL - PPM: _____
INLET SO2 LEVEL - LB/MM BTU: _____
INLET PARTICLE LEVEL - GR/SCF: _____
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 121
OUTLET SO2 LEVEL - PPM: <10
OUTLET SO2 LEVEL - LB/MM BTU: _____
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: >98 (OVERALL)
PARTICLE REMOVAL EFFICIENCY - %: >99 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) MIST ELIMINATOR
(B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 4 (B) 4
NUMBER OF SPARES: (A) 1 (B) 1
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A) IMPINGEMENT (B) IMPINGEMENT
SPECIFIC TYPE: (A) _____ (B) BAFFLE
COMMON DESIGN: (A) _____ (B) CHEVRON VANE
MANUFACTURER: _____
CONFIGURATION (HORIZONTAL/VERTICAL): (A) VERTICAL (B) VERTICAL
SHAPE (Z-SHAPE/A-FRAME): (A) A-FRAME
(B) FLAT
NUMBER OF STAGES: (A) 1 (B) 2
NUMBER OF PASSES/STAGE: (A) N/A (B) 2 FIRST STAGE AND 4 SECOND STAGE
FREEBOARD DISTANCE - FT: _____
DISTANCE BETWEEN STAGES - IN.: _____
DISTANCE BETWEEN VANES - IN.: _____
VANE ANGLES - DEGREES: _____
PRESSURE DROP - IN. H2O: _____
SUPERFICIAL GAS VELOCITY - FT/SEC: (B) 9-11
CONSTRUCTION MATERIAL GENERIC TYPE: (A) _____ (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) _____ (B) POLYPROPYLENE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (A) _____ (B) _____
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (A) NONE (B) FRESH
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (B) UNDERSPRAY
WASH FREQUENCY: (B) 1-3 TIMES PER HR FOR LOWER STAGE AND ONCE/8 HRS FOR UPPER STAGE
WASH DURATION: (B) 2 MINUTES
WASH RATE - GAL/MIN: (B) 250
WASH COVERAGE - GAL/MIN SQ FT.: (B) _____

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

REHEATER
- NUMBER OF REHEATERS: 4
- NUMBER OF SPARES: 1
- NUMBER PER MODULE: 1
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): IN-LINE
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.): STEAM
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): BARE TUBES
- COMBUSTION FUEL SULFUR CONTENT - %: N/A
- LOCATION: TOP OF THE ABSORBER
- AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: N/A
- TEMPERATURE INCREASE - F: 40
- INLET FLUE GAS FLOW RATE - ACFM: _____
- INLET FLUE GAS TEMPERATURE - F: 121
- OUTLET FLUE GAS FLOW RATE - ACFM: _____
- OUTLET FLUE GAS TEMPERATURE - F: 160
- ENERGY REQUIREMENT - MM BTU/HR: _____
- NUMBER OF HEAT EXCHANGER BANKS: 3
- NUMBER OF BUNDLES PER BANK: _____
- NUMBER OF TUBES PER BUNDLE: _____
- STEAM OR WATER PRESSURE - PSIG: _____
- STEAM OR WATER TEMPERATURE - F: _____
- SELF CLEANING DEVICE TYPE: AIR SOOT BLOWERS
- MATERIAL GENERIC TYPE: HIGH ALLOY
- MATERIAL SPECIFIC TYPE: _____
- MATERIAL TRADE/COMMON NAME: INCONEL 625 TUBES AND SHELLS; UDDEHOLM 904L BAFFLES

FANS
- NUMBER OF FANS: (A) 2 (B) 2
- NUMBER OF SPARES: _____
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL (BOTH)
- SUPPLIER: _____
- FUNCTION (UNIT/BOOSTER): (A) UNIT (B) BOOSTER
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: (A) FORCED DRAFT (B) INDUCED DRAFT
- SERVICE (WET/DRY): DRY (BOTH)
- TYPE OF WASH: _____
- LOCATION WRT MAJOR COMPONENTS: (A) BETWEEN MECHANICAL COLLECTORS AND SCRUBBERS (B) AFTER REHEATERS
- FLUE GAS FLOW RATE - ACFM: _____
- FLUE GAS TEMPERATURE - F: (A) 280 (B) 160
- PRESSURE DROP - IN. H2O: _____
- MATERIAL GENERIC TYPE: (B) RUBBER-LINED CARBON STEEL HOUSINGS AND INCONEL BLADES
- MATERIAL SPECIFIC TYPE: _____
- MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS (D) FAN INLET (E) FAN OUTLET
NUMBER OF DAMPERS: (A) 4 (B) 4 (C) 2 (D) 4 (E) 4
E FUNCTION (CONTROL/SHUT-OFF): (A, E) SHUT-OFF (B, C, D) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) GUILLOTINE (B, C, D, E) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) _____ (B) _____
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) DOUBLE BLADED
MANUFACTURER: MOSSER (ALL)
MODULATION (OPEN/CLOSED, ETC.): _____
SEAL AIR - ACFM: _____
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
F MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) STAINLESS STEEL
MATERIAL SPECIFIC TYPE: (A) _____ (B) TYPE 317L
MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A
LINER MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) NONE
LINER MATERIAL SPECIFIC TYPE: (A) TYPE 317L (B) N/A
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A

DUCTWORK
G LOCATION: (A) INLET (B) OUTLET (C) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): _____
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC (C) NONE
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) GLASS FLAKE/POLYESTER AND INERT FLAKE/VINYL ESTER (C) N/A
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) FLAKELINE 103 AND PLASITE 4030 (C) N/A

EXPANSION JOINTS
LOCATION: _____
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): _____
OPERATING TEMPERATURE - F: _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: VITON®/ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): _____
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER-LINED CARBON STEEL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

NUMBER OF DEVICES: 2
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH: 7
PRODUCT QUALITY - % SOLIDS: 25
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 22.5
PREPARED REAGENT POINT OF ADDITION: ABSORBER FEED TANK
ON-SITE STORAGE CAPABILITY - DAYS:

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) SLURRY PIPING (B) SLURRY PIPING (C) SPRAY HEADERS
DIMENSIONS - IN.: (A) ≥4 (B) <4 (C)
MANUFACTURER:
MATERIAL: (A) RUBBER-LINED CARBON STEEL B) FRP (C) TYPE 317L STAINLESS STEEL

MAJOR VALVES
LOCATION: (A) SUCTION SIDE OF PUMPS (B) PUMP DISCHARGE (C)
FUNCTION (ISOLATION, CONTROL, ETC.):
TYPE (BALL, GLOBE, PLUG, ETC.): (A) BUTTERFLY (B) PLUG (C) PINCH
CONTROL MODE (AUTOMATIC/MANUAL):
DIMENSIONS - IN.:
MANUFACTURER: (A) KEYSTONE (B) DEZURIK (C)
MATERIAL: RUBBER-LINED (ALL)

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/14/81 — CHOLLA 2

OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER: 35
PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY:
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: MIXED WITH FLY ASH TO OBTAIN 65% SOLIDS
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): BLEED STREAM
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): NONE
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS: 15

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: _____
H SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: _____

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: SCRUBBER AND ABSORBER HOLD TANK
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): _____
CONTROL LEVELS: PH 4.8-5.2 IN SCRUBBER HOLD TANK; 5.9-6.2 IN ABSORBER HOLD TANK
MONITOR TYPE (MANUFACTURER, ETC.): _____
MONITOR LOCATION: _____
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): _____
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): _____

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): _____
TYPE (OPEN/CLOSED): OPEN
EVAPORATION WATER LOSS - GPM: _____
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: 120
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
MAKEUP WATER ADDITION POINTS & AMOUNTS: _____
MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: _____
SOURCE/SUPPLIER: _____
SUPPLIER LOCATION: PEACH SPRINGS, ARIZONA
CONSUMPTION (SPECIFY UNITS): _____
UTILIZATION - %: _____
POINT OF ADDITION: BALL MILL

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 39,200,000
CAPITAL COST - $/KW: 149
OPERATING COST - MILLS/KWH: 2.47
MAINTENANCE COST: $894,000/YR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

LABOR COST: $93,600/YR
UTILITIES COST: $1,390,000/YR
CHEMICALS COST: $408,000/YR
WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
SCRUBBER - %: 33.3
ABSORBER - %: 33.3
MIST ELIMINATOR - %: _____
REHEATER - %: _____
FAN - %: _____
BALL MILL - %: _____
SLAKER - %: N/A
EFFLUENT HOLD TANK - %: _____
RECIRCULATION PUMP - %: _____
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: 1.0
ABSORBER: 1.0
MIST ELIMINATOR: _____
REHEATER: _____
FAN: _____
BALL MILL: _____
SLAKER: N/A
EFFLUENT HOLD TANK: _____
RECIRCULATION PUMP: _____
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: _____
PARTICIPANTS: ARIZONA PUBLIC SERVICE, RESEARCH-COTTRELL
PROCESS: LIMESTONE
PLANT DESIGN: FLOODED DISC SCRUBBER
SUPPLIER: RESEARCH-COTTRELL
SERVICE DATE: 1971
PERIOD OF OPERATION - MONTHS: 6
GAS FEED: _____
EQUIVALENT SCRUBBED CAPACITY - MW: 1.6
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER FEED
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION: CIRCULAR
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN: 7
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: VERTICAL
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REAGENT FEED
NUMBER OF TANKS: 2
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): OPEN
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: VERTICAL
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SLURRY SUMP
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: AT MILL
CONFIGURATION:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: TYPE 316L STAINLESS STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SCRUBBER FEED
NUMBER OF TANKS: 4
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): N/A
LOCATION: TANK IS BOTTOM OF ABSORBER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN: 7
NUMBER OF AGITATORS: 2
AGITATOR CONFIGURATION: HORIZONTAL
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLUDGE STORAGE
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SCRUBBER RECYCLE
NUMBER OF PUMPS: 3 (PER MODULE)
NUMBER OF SPARES: 1 (PER MODULE)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.):
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: DENVER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 4900
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
I IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECYCLE
NUMBER OF PUMPS: 2 (PER MODULE)
NUMBER OF SPARES: 1 (PER MODULE)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.):
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: DENVER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM:
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
I IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL SLURRY SUMP
NUMBER OF PUMPS:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.):
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM:
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
J IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): REAGENT FEED
NUMBER OF PUMPS:
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.):
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GOULDS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM:
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS:
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.):
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/14/81

ARIZONA PUBLIC SERVICE
CHOLLA 2

MANUFACTURER: GOULDS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): _____
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/14/81 CHOLLA 2

COMMENTS/FOOTNOTES

A FLOODED DISC SCRUBBER ACTS AS AN ANNULAR-THROAT VENTURI; BOTTOM ENTRY LIQUID DISTRIBUTION.
B IN THE TAPERED SECTION OF THE VENTURI, THERE IS A CEILCOTE 8300 MEMBRANE COVERED WITH SiC BRICK AND SAUEREISEN NO. 33 MORTAR. THE SAME SYSTEM IS USED ON THE WALLS BELOW THE THROAT, BUT WITH COROBOND MORTAR.
C COMMON WORK FORCE FOR UNITS 1 AND 2.
D MUNTERS T 2-81 POLYPROPYLENE PACKING.
E ONE SHUT-OFF GUILLOTINE DAMPER IN THE BYPASS DUCT HAS BEEN ABANDONED.
F ALL THE DAMPERS HAVE INCONEL 625 SEALS.
G THE BYPASS DUCT HAS AN EMERGENCY QUENCHER SPRAY TO PROTECT THE STACK LINING.
H REPORTED DISPOSAL SPACE REQUIREMENT IS 52 ACRE-FT/YEAR.
I CLOSE-FACED IMPELLER.
J OPEN-FACED IMPELLER.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGC hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Public Service Cholla 1 | 10/73 | 744 | | System | | | | Initial testing of FGD system was conducted |
| | 11/73 | 720 | | System | | | | |
| Commercial start-up | 12/73 | 744 | | System | | | Ductwork | Because of a difference in the size of the main duct and reheater transition duct, the gas flow was producing harmonic vibrations in the reheater. The vibrations were partially dampered by installation of baffles |
| | | | | | | | Reheater | Corrosion of tube bundles |
| | | | | | | | Piping | Slurry lines plugged due to low flow rates |
| | | | | | | | Fans | Vibration problems encountered because of the accumulation of scale buildup when unit was idle |
| | | | | | | | Pumps | Solid deposition in spare pumps |
| | 1/74 | 744 | | System | | | | No major problems reported for period of 1/74 to 3/74. Availability averaged 92.6% during the period |
| | 2/74 | 672 | | System | | | | |
| | 3/74 | 744 | | System | | | | |
| | 4/74 | 720 | | A | | | Expansion joints | 240 hour outage to replace corroded Cor-ten steel expansion joints |
| | | | | B | | | Expansion joints | 312 hour outage to replace corroded Cor-ten steel expansion joints |
| | | | | System | | | | |
| | 5/74 | 744 | 744 | System | | | | |
| | 6/74 | 720 | | System | | | | |
| | 7/74 | 744 | 744 | System | 729 | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 8/74 | 744 | 744 | A<br>B<br>System | 724 | 100 | | |
| | 9/74 | 720 | | System | | | | |
| | 10/74 | 744 | | System | | | System | System down for annual overhaul |
| | | | | | | | Venturi scrubbers | During the outage several instances of pitting corrosion were discovered in the 316L SS flooded disc scrubber walls |
| | | | | | | | Reheater | Tube leaks discovered on B-side reheater |
| | 11/74 | 720 | | System | | | | |
| | 12/74 | 744 | | System | | | | |
| | 0/75 | | | System | | | | Operation of the system throughout 1975 and 1976 was accompanied by a number of minor problem areas including: significant corrosion attack in the vessel walls of the venturi flooded-disc particulate scrubber module; acid corrosion in the B-side reheater housing; scale buildup in the pipe outlet at the sludge/flyash evaporation pond; plugging in the scrubber tower packing and mist eliminator; erosion in the pumps; corrosion in the boiler exhaust elbow of the ductwork leading from the scrubbers to the stack |
| | 1/75 | 744 | 744 | System | 730 | | Bypass | Bypass system experienced control problems |
| | | | | | | | B-side absorber | Leak problem |
| | | | | | | | A-side venturi | Leaks discovered over the mouth of the venturi throat (leaks were attributed to normal wear) |
| | | | | | | | Reheater | Tube leak problem on B-side reheater |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla (continued) | 2/75 | 672 | 672 | System | 626 | | Modules | Leak problem continued |
| | | | | | | | Pump | Recycle pump required repairs |
| | | | | | | | System | Erosion/corrosion problems |
| | 3/75 | 744 | | System | | | System | Plugging problems encountered at dead spaces, in pipe lines, and valves of idle pumps as well as process lines during reduced flow rate periods |
| | | | | | | | Pipe liners | Failures due to defects in fabrication, unsatisfactory liner materials, and too high velocities through pipes and fittings |
| | | | | | | | Scrubber | Plugging of flooded disc scrubber packing |
| | 4/75 | 720 | 670 | System | 515 | | Bypass | Bypass system experienced control problems |
| | | | | | | | Valves and piping | Plugging |
| | | | | | | | Absorber | Plugging of absorber tower packing |
| | 5/75 | 744 | 744 | System | 325 | | | Module down most of month for scheduled repairs |
| | 6/75 | 720 | 720 | A | | 100 | Absorber | Plugging of Munters packing of A-side absorber |
| | | | | B | | 100 | | |
| | | | | System | 720 | 100 | Mist eliminators | Plugging |
| | 7/75 | 744 | 744 | System | 729 | | Piping | Flooded-disc scrubber recirculation lines plugged |
| | 8/75 | 744 | 744 | A | | | Module | Shutdown for inspection |
| | | | | B | | 100 | | |
| | | | | System | 724 | | | |
| | 9/75 | 720 | 720 | System | 567 | | Piping | Plugging problem of recirculation lines continued |
| | 10/75 | 744 | 538 | System | 276 | | System | Shutdown for scheduled equipment overhaul (module linings were repaired) |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 11/75 | 720 | 720 | System | 617 | | | |
| | 12/75 | 744 | 744 | System | 744 | | Pump | Recycle pump malfunctioned |
| | | | | | | | Reheater | B-side reheater malfunctioned |
| | 1/76 | 744 | 744 | System | 684 | | Valves and recir-culation lines | Plugging |
| | 2/76 | 696 | | | | | | No information reported |
| | 3/76 | 744 | | | | | | No information reported |
| | 4/76 | 720 | | System | | | Ductwork | Coating failures in the elbow of the B-side absorber exhaust duct leading to the stack |
| | | | | | | | Reheat | B-side reheat required repairs |
| | 5/76 | 744 | | System | | | Reheater | Corrosion and plugging problems occurred on the A-side reheater tubes |
| | | | | | | | Venturi scrubbers | Plugging of recirculation lines and the flooded-disc scrubber packing |
| | | | | | | | Mist eliminators | Plugging |
| | | | | | | | Pumps | High maintenance area for Cholla 1 |
| | 6/76 | 744 | 720 | System | | | Recycle tanks | Scaling and corrosion problems |
| | 7/76 | 744 | | System | | | | |
| | 8/76 | 744 | | System | | | Ductwork | Coating repairs to the elbow of the module exhaust duct were completed |
| | | | | | | | Valve | Malfunctioning solenoid valve in the B-side mist eliminator wash system prevented adequate washing |
| | 9/76 | 720 | 720 | A<br>B | | 100 | | |
| | | | | System | 698 | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 10/76 | 744 | 417 | A | | 100 | | |
| | | | | B | | 66 | | |
| | | | | System | 346 | 83 | | |
| | 11/76 | 720 | 720 | System | 619 | | Reheater | Steam leak |
| | | | | | | | Damper | Inlet damper adjustment problems |
| | 12/76 | 744 | 744 | System | 620 | | | |
| | 1/77 | 744 | 744 | System | 608 | | Module | Packing in Module A was replaced |
| | | | | | | | System | Minor corrosion and plugging problems were experienced |
| | 2/77 | 672 | 672 | System | 620 | | Dampers | Mechanical difficulties with bypass dampers |
| | 3/77 | 744 | 744 | System | 608 | | Absorber | A-side absorber tower packing replaced and internals on both absorbers were washed |
| | 4/77 | 720 | 638 | System | 632 | | | |
| | 5/77 | 744 | 645 | System | 645 | | | System shutdown for annual inspection |
| | 6/77 | 720 | 720 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 720 | 100 | | |
| | 7/77 | 744 | 744 | System | | | Limestone slurry tank | Minor leak problem |
| | | | | | | | Piping | Return slurry line leakage |
| | 8/77 | 744 | 744 | System | 729 | | Slurry disposal tank | Leaks repaired |
| | 9/77 | 720 | 720 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 718 | 100 | | |
| | 10/77 | 744 | 744 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 743 | 100 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 11/77 | 720 | 169 | A | | 100 | | |
| | | | | B | | 97 | Pump | Recycle pump expansion joint failure |
| | | | | | | | Venturi scrubber | Leak problem in B-side venturi |
| | | | | System | 155 | 98 | | |
| | 12/77 | 744 | | System | 0 | 0 | System | Down entire month for inspection |
| | | | | | | | Centrifugal separator shell below the absorber | Corrosion problem |
| | | | | | | | Lining | Epoxy material had eroded and disbonded from the scrubber discs and the centrifugal separator shell below the absorber |
| | | | | | | | Venturi scrubber | Spray distribution deflector above the flooded disc failed due to stress - corrosion cracking |
| | | | | | | | Ductwork | Extensive corrosion in ductwork leading from Module A absorber tower exhaust elbow to the reheater (liner of elbow has failed repeatedly) |
| | 1/78 | 744 | 135 | A | | | | |
| | | | | B | | | | |
| | | | | System | 127 | | | Scheduled overhaul continued |
| | 2/78 | 672 | 642 | A | | | | |
| | | | | B | | | | |
| | | | | System | 600 | | | |
| | 3/78 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 739 | | | |
| | 4/78 | 720 | 720 | A | | | | |
| | | | | B | | 100 | | |
| | | | | System | 694 | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 5/78 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 680 | | | |
| | 6/78 | 720 | 720 | A | | 100 | | |
| | | | | B | | | | |
| | | | | System | 717 | | | |
| | 7/78 | 744 | 744 | A | | | | |
| | | | | B | | 100 | | |
| | | | | System | 742 | | | |
| | 8/78 | 744 | 744 | A | | 100 | | |
| | | | | B | | | Reheater | Plugged B-side reheat coils were replaced |
| | | | | System | 726 | | | |
| | 9/78 | 720 | 720 | A | | 100 | | |
| | | | | B | | | | |
| | | | | System | 712 | | | |
| | 10/78 | 744 | 434 | A | | | | |
| | | | | B | | | | |
| | | | | System | 425 | | | |
| | 11/78 | 720 | 720 | A | | | | |
| | | | | B | | | | |
| | | | | System | 688 | | | |
| | 12/78 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 646 | | System control | Specific problem was not reported |
| | 1/79 | 744 | 744 | A | | | | |
| | | | | B | | 100 | | |
| | | | | System | 741 | | | |
| | 2/79 | 672 | 672 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 672 | 100 | | |

[continued]

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 3/79 | 744 | 744 | A | | | | |
| | | | | B | | 100 | | |
| | | | | System | 726 | | Reheater | Plugged reheat tubes. The old tubes, in un-sectionalized bundles, were replaced with new tubes of split coil construction and made of 316L SS |
| | 4/79 | 720 | 720 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 720 | 100 | | |
| | 5/79 | 744 | 744 | A | | | | |
| | | | | B | | | Ductwork | Ductwork from absorber tower to stack was replaced |
| | | | | System | 533 | | Venturi scrubber | Lining repaired |
| | 6/79 | 720 | 720 | A | | | Absorber | Module A absorber tower Munters packing was replaced |
| | | | | B | | 100 | | |
| | | | | System | 642 | | | |
| | 7/79 | 744 | | | | | | No information was available |
| | 8/79 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 712 | | | |
| | 9/79 | 720 | | | | | | No information was available |
| | 10/79 | 744 | 342 | A | | | | |
| | | | | B | | | | |
| | | | | System | 328 | | | |
| | 11/79 | 720 | 720 | A | | | | |
| | | | | B | | | | |
| | | | | System | 632 | | | |
| | 12/79 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 672 | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler-hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 1 (continued) | 1/80 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 724 | | | |
| | 2/80 | 696 | 696 | A | | 100 | | |
| | | | | B | | | | |
| | | | | System | 694 | | | |
| | 3/80 | 744 | 744 | A | | | | |
| | | | | B | | | | |
| | | | | System | 715 | | | |
| | 4/80 | 720 | 720 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 720 | 100 | | |
| | 5/80 | 744 | 744 | A | | 100 | | |
| | | | | B | | 99 | Booster fan | Specific problem was not reported |
| | | | | System | 741 | 100 | | |
| | 6/80 | 720 | 613 | A | | 100 | | |
| | | | | B | | 99 | Valve | Block valve malfunctioned |
| | | | | System | 516 | 100 | | |
| | 7/80 | 744 | 744 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | System | 739 | 100 | | |
| | 8/80 | 744 | | System | | | | No information was reported |
| | 9/80 | 720 | | System | | | | No information was reported |
| | 10/80 | 744 | | System | | | | Information was not available at that time |
| | 11/80 | 720 | | System | | | | Information was not available at that time |
| | 12/80 | 744 | | System | | | Ductwork | During the fourth quarter the ductwork downstream of the B-side modules had to be replaced |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Public Service Cholla 2 | 4/78 | 720 | | System | | | | Initial shakedown/debugging operations commenced |
| | 5/78 | 744 | | System | | | | |
| Commercial start-up | 6/78 | 720 | | System | | | | |
| | 7/78 | 744 | | System | | | Piping | Experienced continued vibration problems in slurry recycle lines |
| | | | | | | | Absorber | Corrosion resistant coating in downcomer area of one of the absorber modules peeled |
| | 8/78 | 744 | | System | | | | |
| | 9/78 | 720 | | System | | | Piping | Vibration problems in slurry recycle lines continued |
| | 10/78 | 744 | | System | | | | |
| | 11/78 | 720 | | System | | | | Shakedown/debugging operations continued |
| | 12/78 | 744 | | System | | | | |
| | 1/79 | 744 | | System | | | | No information was available from utility starting 1/79 to 12/80 |
| | 2/79 | 672 | | System | | | | |
| | 3/79 | 744 | | System | | | | |
| | 4/79 | 720 | | System | | | | |
| | 5/79 | 744 | | System | | | | |
| | 6/79 | 720 | | System | | | | |
| | 7/79 | 744 | | System | | | | |
| | 8/79 | 744 | | System | | | | |
| | 9/79 | 720 | | System | | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cholla 2 (continued) | 10/79 | 744 | | System | | | | |
| | 11/79 | 720 | | System | | | | |
| | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 744 | | System | | | | |
| | 4/80 | 720 | | System | | | | |
| | 5/80 | 744 | | System | | | | |
| | 6/80 | 720 | | System | | | | |
| | 7/80 | 744 | | System | | | | |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | | | | |
| | 10/80 | 744 | | System | | | | |
| | 11/80 | 720 | | System | | | | |
| | 12/80 | 744 | | System | | | | |

ARIZONA PUBLIC SERVICE

FOUR CORNERS 1, 2, 3

# SECTION 1

## BACKGROUND

The Four Corners Power Station of Arizona Public Service (APS) is located in Fruitland, New Mexico. Four Corners is a mine mouth plant located next to the Navajo mine. Four Corners 1, 2, and 3 are pulverized coal-fired units which were originally placed in service in the early 1960's. These units are rated at 175 MW, 175 MW, and 225 MW, respectively.

State emission standards were developed for Units 1, 2, and 3, limiting particulate matter emissions to 0.05 pounds per million Btu, and an interim limitation of 0.5 pounds per million Btu for Units 4 and 5. In anticipation of these regulations, a "crash program" commenced in 1970 for the installation of venturi scrubbers on Units 1, 2, and 3 for particulate matter removal. The deadline of December 31, 1971, was met.

New Mexico air pollution control officials, and the six utility owners of Units 4 and 5 reached an agreement on emission limits with respect to $SO_2$ emissions in 1980 and a compliance schedule was set. The agreement called for a significant upgrading of the scrubber systems at Units 1, 2, and 3 and a new removal system for Units 4 and 5 (755 MW each). The settlement called for the average rate of $SO_2$ removal to be 72% at the power plant complex in 1985.

Based on the 72% removal figure, engineers felt that the existing battery of six scrubbers at Units 1, 2, and 3 could be

upgraded through adjustment in acid-alkalinity control by the addition of lime and Magnesium oxide. For Units 4 and 5, the plans are to install bag filters to meet particulate requirements and absorber towers for $SO_2$ removal. The baghouse will upgrade particulate removal from 97% to 99.9%.

Partial upgrading of the scrubbers on Units 1, 2, and 3 has taken place. They appear to be meeting existing particulate and $SO_2$ removal requirements. Further upgrading of the $SO_2$ removal system is in progress in order to bring the $SO_2$ removal efficiency to 72% by 1985. The $SO_2$ system on Units 4 and 5 are scheduled for initial startup by 1985 and the baghouse system is scheduled for operation at the end of 1982.

## SECTION 2

## PROCESS DESCRIPTION

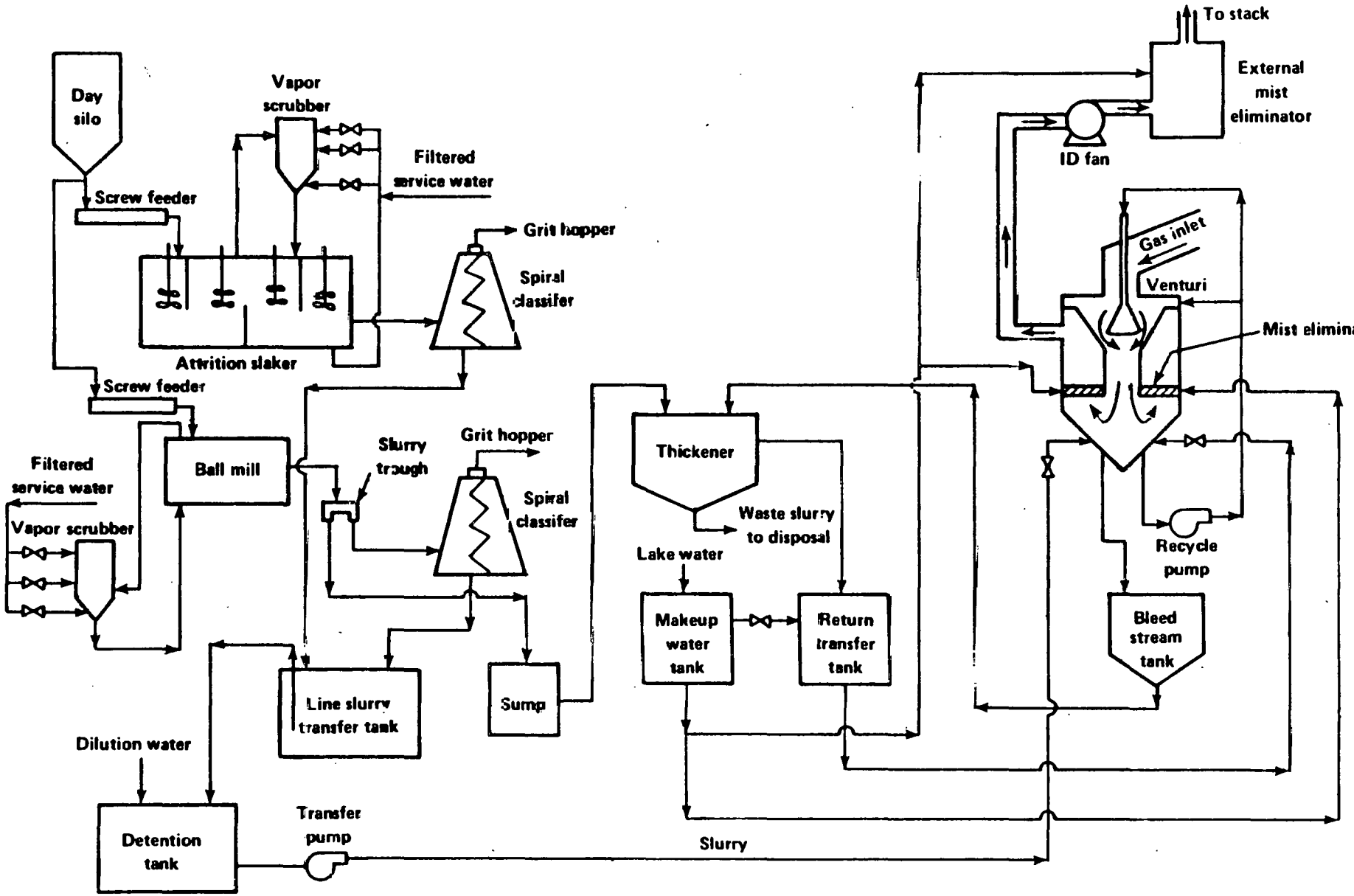
The lime/alkaline flyash emission control systems installed on Four Corners 1, 2, and 3 each consist of a Chemico venturi scrubber for both primary particulate matter and $SO_2$ removal. The Four Corners 1 and 2 systems were designed to accommodate a boiler flue gas flow of 814,000 acfm (340°F) each. The Four Corners 3 system was designed to accommodate 1,030,000 acfm (340°F).

Following the air preheater, the flue gas from each boiler enters the top of the venturi scrubbers where it first comes in contact with the scrubbing slurry. The venturi scrubbers are each equipped with a variable throat/top entry plumb bob to maintain a constant pressure drop at variable boiler loads. After traveling through the center of the venturi, the flue gas turns 180 degrees and travels upward through a spray zone where it is again contacted with the scrubbing slurry. The spent slurry from the venturi and the spray zone is collected in recirculation tanks within each venturi module. Spent slurry is bled from each venturi recirculation tank to a distribution tank and on to a thickener where lime is added to raise the pH level of the alkaline flyash slurry. Thickener overflow is drawn off

to a liquid transfer tank and then pumped back to the scrubber recirculation tank and back to the spray headers. Thickener underflow is bled to a holding tank and on to the flyash pond. Water is recovered from the scrubber discharge with a vapor-compression evaporator yielding fresh process water.

Prior to entering the stack, the flue gas passes through a water wash tray and mist eliminator near the top of the absorber chamber and a wet ID fan. Four Corners 1 and 2 share a common 250-foot stack, while Four Corners 3 has its own 250-foot stack.

A flow diagram for the Four Corners 1, 2, 3 FGD system is shown on the next page.




Flow Diagram: Four Corners 1, 2, or 3

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

GENERAL PLANT INFORMATION
COMPANY NAME: ARIZONA PUBLIC SERVICE COMPANY
ASSOCIATED UTILITIES:
PLANT NAME: FOUR CORNERS
UNIT NUMBER: 1
PLANT ADDRESS: P.O. BOX 355
CITY: FRUITLAND
COUNTY: SAN JUAN
STATE: NEW MEXICO
ZIP CODE: 87416
EPA REGION: 6
RIVER BASIN/LAKE REGION: UPPER COLORADO
REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.05 (0.04 FOR FINES <2μ)
A SO2 EMISSION LIMITATION - LB/MM BTU:
NOX EMISSION LIMITATION - LB/MM BTU: 0.7
NET PLANT GENERATING CAPACITY - MW: 2085
GROSS UNIT GENERATING CAPACITY - MW: 195
NET UNIT GENERATING CAPACITY WITH FGD - MW: 175
NET UNIT GENERATING CAPACITY W/O FGD - MW: 175
EQUIVALENT SCRUBBED CAPACITY - MW: 195

UNIT DATA (BOILER AND STACK)
BOILER SUPPLIER: RILEY STOKER
FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
FURNACE FIRING METHOD: FRONT
WET BOTTOM/DRY BOTTOM: DRY BOTTOM
FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
COMMERCIAL SERVICE DATE: 5/63
DESIGN BOILER FLUE GAS FLOW - ACFM: 814,000
FLUE GAS TEMPERATURE - F: 340 (INLET TO ABSORBER)
FLUE GAS OXYGEN - %: 2-4
HEAT RATE - BTU/KWH: 10,300 NET; 9400 GROSS
DESIGN FIRING RATE - TPH: 93
EXCESS AIR - %: 10-20
CAPACITY FACTOR - %: 70-85
B STACK HEIGHT - FT: 250 (COMMON WITH UNIT 2; ONE FLUE)
SHELL MATERIAL: CONCRETE; PRESSURIZED ANNULUS
FLUE MATERIAL GENERIC TYPE: ACID-RESISTANT BRICK AND MORTAR
FLUE MATERIAL SPECIFIC TYPE: TYPE HS BRICK AND CHEMICALLY BONDED MORTAR
FLUE MATERIAL TRADE/COMMON NAME: PENNWALT POTASSIUM SILICATE MORTAR
FLUE LINER MATERIAL GENERIC TYPE: N/A
FLUE LINER MATERIAL SPECIFIC TYPE: N/A
FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
FLUE INNER DIAMETER - FT: 17.5
STACK GAS INLET TEMPERATURE - F: 120
STACK GAS OUTLET VELOCITY - FT/SEC: 80

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
- NAME OF SUPPLIER: UTAH INTERNATIONAL
- MINE NAME/AREA: NAVAJO MINE
- MINE LOCATION - COUNTY: SAN JUAN
- MINE LOCATION - STATE: NEW MEXICO
- AVERAGE HEAT CONTENT - BTU/LB: 8800
- RANGE HEAT CONTENT - BTU/LB: 8500-9100
- AVERAGE ASH CONTENT - % 22.0
- RANGE ASH CONTENT - %: 19-25
- AVERAGE MOISTURE CONTENT - % 10.8
- RANGE MOISTURE CONTENT - %: 8.5-13.4
- AVERAGE SULFUR CONTENT - %: 0.75
- RANGE SULFUR CONTENT - %: 0.5-1.3
- AVERAGE CHLORIDE CONTENT - %: 0.03
- RANGE CHLORIDE CONTENT - % 0.01-0.06
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- *CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED
- SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBERS ONLY)

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: NONE
- NUMBER OF SPARES:
- TYPE (HOT SIDE/COLD SIDE):
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %
- FLUE GAS CONDITIONING TYPE:

C PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS:
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - %

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIME/ALKALINE FLY ASH
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: CHEMICO FOR SCRUBBERS; IN-HOUSE FOR LIME ADDITION
A-E FIRM: IN-HOUSE
CONSTRUCTION FIRM: JESCO ON MECHANICAL AND FOLEY ON ELECTRICAL
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - % 50 NOW; 60 AND 72 LATER (MAY ADD Mg)
CURRENT STATUS: OPERATIONAL (50% $SO_2$ REMOVAL)
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

COMMERCIAL START-UP: _____
INITIAL START-UP: 11/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: _____
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST _____
INITIATED PRELIMINARY DESIGN _____

FGD DESIGN AND OPERATING PARAMETERS
- DESIGN COAL SULFUR CONTENT - %: 1.3
- DESIGN COAL HEAT CONTENT - BTU/LB: 8500
- DESIGN COAL ASH CONTENT - %: 25
- DESIGN COAL MOISTURE CONTENT - %: 13.4
- DESIGN COAL CHLORIDE CONTENT - %: 0.06
- FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBERS ONLY)
- FGD SYSTEM TURNDOWN RATIO: INFINITE
- FGD SYSTEM TURNDOWN METHOD: USUALLY HAVE BOTH TOWERS ON-LINE
- FGD SYSTEM PRESSURE DROP - IN. H2O: 12-15
- FGD SYSTEM OXIDATION - %: 20
- FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
- FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10 (5-15)
- FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 200 (UNITS 1, 2, & 3)
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 5
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 17-25 ON WEEKDAYS
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
- FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): VARIABLE
- TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
  - SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: N/A
  - TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
- FGD SYSTEM BYPASS CAPABILITY (YES/NO): NO
- RESTRICTIONS TO USING BYPASS: N/A
- TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
- TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEKS/YR MINOR; 10 WEEKS/5 YRS MAJOR
- PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): N/A
- PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): WHATEVER IS REQUIRED; OPEN DOORS AND INSPECT
- TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): INSPECT AND DO WHAT IS REQUIRED

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: NONE

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
GENERIC TYPE: VENTURI
SPECIFIC TYPE: VARIABLE-THROAT TOP-ENTRY PLUMB BOB
TRADE/COMMON NAME: _____
SUPPLIER: CHEMICO
DIMENSIONS - FT: 25 DIA
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
D LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-FILLED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 50
GAS/LIQUID CONTACT DEVICE TYPE: VENTURI THROAT (TANGENTIAL NOZZLES AT TOP AND AT SIDE OF THROAT)
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 1
NOZZLE MATERIAL: CARBON STEEL INLET PIPE AT TOP; NO NOZZLES
NOZZLE PRESSURE DROP - PSI: N/A
LIQUID RECIRCULATION RATE - GPM: 10,000
L/G RATIO - GAL/1000 ACF: 24
GAS-SIDE PRESSURE DROP - IN. H2O: 10-15
SUPERFICIAL GAS VELOCITY - FT/SEC: _____
ABSORBER TURNDOWN RATIO: INFINITE
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; HOLD PRESSURE DROP CONSTANT
INLET GAS FLOW RATE - ACFM: 814,000 TOTAL

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

INLET GAS TEMPERATURE - F: 340
INLET SO2 LEVEL - PPM: 945 @ 3% $O_2$
INLET SO2 LEVEL - LB/MM BTU: 1.7
INLET PARTICLE LEVEL - GR/SCF: 8-12
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM: 550,000 SCFM
OUTLET GAS TEMPERATURE - F: 120-130
OUTLET SO2 LEVEL - PPM: 320 @ 3% $O_2$
OUTLET SO2 LEVEL - LB/MM BTU: 0.55
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU: <0.05
SO2 REMOVAL EFFICIENCY - %: 67.5
PARTICLE REMOVAL EFFICIENCY - %: >99.5

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR (AFTER FAN)
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: (A) 0 (B) 0
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER:
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL (BOTH)
SHAPE (Z-SHAPE/A-FRAME): FLAT (BOTH)
NUMBER OF STAGES: 1 (BOTH)
NUMBER OF PASSES/STAGE: 6 (BOTH)
FREEBOARD DISTANCE - FT:
DISTANCE BETWEEN STAGES - IN.:
DISTANCE BETWEEN VANES - IN.:
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: (B) 1
SUPERFICIAL GAS VELOCITY - FT/SEC:
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: FRP IN CARBON STEEL HOUSING LINED WITH FLAKELINE 103
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH (FROM LAKE)
POINT OF WATER COLLECTION: ME VESSEL
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): OVERSPRAY AND UNDERSPRAY

E WASH FREQUENCY: ONCE PER SHIFT
WASH DURATION:
WASH RATE - GAL/MIN:
WASH COVERAGE - GAL/MIN SQ FT.: 81

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

REHEATER
- NUMBER OF REHEATERS: NONE
- NUMBER OF SPARES:
- NUMBER PER MODULE:
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
- COMBUSTION FUEL SULFUR CONTENT - %:
- LOCATION:
- AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
- TEMPERATURE INCREASE - F:
- INLET FLUE GAS FLOW RATE - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- OUTLET FLUE GAS FLOW RATE - ACFM:
- OUTLET FLUE GAS TEMPERATURE - F:
- ENERGY REQUIREMENT - MM BTU/HR:
- NUMBER OF HEAT EXCHANGER BANKS:
- NUMBER OF BUNDLES PER BANK:
- NUMBER OF TUBES PER BUNDLE:
- STEAM OR WATER PRESSURE - PSIG:
- STEAM OR WATER TEMPERATURE - F:
- SELF CLEANING DEVICE TYPE:
- MATERIAL GENERIC TYPE:
- MATERIAL SPECIFIC TYPE:
- MATERIAL TRADE/COMMON NAME:

FANS
- NUMBER OF FANS: 2
- NUMBER OF SPARES: 0
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
- SUPPLIER: AMERICAN STANDARD
- FUNCTION (UNIT/BOOSTER): UNIT
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: INDUCED DRAFT
- SERVICE (WET/DRY): WET
- TYPE OF WASH: FRESH WATER SPRAY; CONTINUOUS @ 5 GPM ON EACH SIDE
- LOCATION WRT MAJOR COMPONENTS: BETWEEN ABSORBER AND EXTERNAL MIST ELIMINATOR
- FLUE GAS FLOW RATE - ACFM: 550,000
- FLUE GAS TEMPERATURE - F: 120-130
- PRESSURE DROP - IN. H2O: _____
- MATERIAL GENERIC TYPE: (A) HIGH ALLOY STEEL BLADES (B) RUBBER-LINED CARBON STEEL HOUSING
- MATERIAL SPECIFIC TYPE: _____
- MATERIAL TRADE/COMMON NAME: (A) INCONEL 625 (B) NATURAL RUBBER

DAMPERS
- LOCATION: (A) FAN INLET (B) AHEAD OF STACK
- NUMBER OF DAMPERS: (A) 2 (B) 1
- FUNCTION (CONTROL/SHUT-OFF): (A) CONTROL (B) SHUT-OFF

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) SINGLE
MANUFACTURER: (A) AMERICAN STANDARD
MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM: NONE
SERVICE CONDITIONS (MAX GAS TEMP/TIME): (A) 120-130 F
MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) CARBON STEEL
MATERIAL SPECIFIC TYPE: (A) TYPE 316L
MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET (ME TO STACK)
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) CIRCULAR (B) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): (A) 14 DIA X 90 (B) 12 X 12 X 50
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) A283 (B) A283
SHELL MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A
LINER MATERIAL GENERIC TYPE: (A) NONE
(B) ORGANIC OVER STAINLESS STEEL 316L
LINER MATERIAL SPECIFIC TYPE: (B) GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (B) FLAKELINE 103 AND 251

EXPANSION JOINTS
LOCATION: HOT SIDE AND WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): NEGATIVE PRIOR TO THE FAN, POSITIVE AFTER
OPERATING TEMPERATURE - F: 340 AT HOT, 120 AT WET
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: VITON

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): (A) LIME SLAKING
(B) CRUSHING GRITS
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): (A) SLAKER (B) BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): (A) SLURRY SLAKER
MANUFACTURER: (A) JOY (B) KENNEDY VAN SAUN
MATERIALS: (A) CARBON STEEL
NUMBER OF DEVICES: (A&B) 1 (UNITS 1, 2, & 3)
NUMBER OF SPARES: 0
FULL LOAD DRY FEED CAPACITY - TPH: (A) 15
PRODUCT QUALITY - % SOLIDS: (A) 30 (DILUTE TO 12 TO 14)
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

PREPARED REAGENT POINT OF ADDITION: BOTTOM OF VENTURI TOWER; BENEATH LIQUID LEVEL
ON-SITE STORAGE CAPABILITY - DAYS: (A) 30 (560 TONS PER SILO; 4 CARBON STEEL SILOS)

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY (B) SLUDGE TRANSFER
DIMENSIONS - IN.: (A) 12-24
MANUFACTURER: (B) DRISCOLL
MATERIAL: (A) RUBBER-LINED CARBON STEEL (BUTYL 40) (B) FRP

MAJOR VALVES
LOCATION: _____
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PINCH (B) DIAPHRAGM
CONTROL MODE (AUTOMATIC/MANUAL): (A) MANUAL (B) AUTOMATIC
DIMENSIONS - IN.: (A) UP TO 24
MANUFACTURER: (A) SAUNDERS (B) SAUNDERS
MATERIAL: (A) RUBBER-LINED (B) RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 2 (UNITS 1, 2, & 3)
NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 100 DIA
CAPACITY - GAL: 1,000,000
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL WALLS (B) CONCRETE BOTTOM
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: (A&B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) GLASS FLAKE-REINFORCED POLYESTER
(B) FIBERGLASS MAT AND GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (A) FLAKELINE 103 AND 251
(B) KOPPERS 6693 AND FLAKELINE 103 AND 251
RAKE MATERIAL: TYPE 316L STAINLESS STEEL
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30 TO 50%
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

OUTLET STREAM DISPOSITION: TO ASH POND
OVERFLOW STREAM DISPOSITION: FOR RE-USE

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 140,000 LB/HR WET (60% WATER); 3 UNITS
MOISTURE CONTENT - % TOTAL FREE WATER: 60
PERCENT CASO3 - DRY: 18
PERCENT CASO4 - DRY: 5
PERCENT CAOH2 - DRY: 1
PERCENT CACO3 - DRY: 1
PERCENT ASH - DRY: 75
PERCENT OTHER COMPOUNDS - DRY: <1

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 1

SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): MAN-MADE
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: 70 ACRES/55 FT (CAPACITY)
SITE CAPACITY - VOLUME/ACRE-FT/TONS: 5,900,000 TONS
SITE SERVICE LIFE - YEARS: 9.6

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: SLURRY STREAM AT TANGENTIAL NOZZLE
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS, FLOW, TEMPERATURE
CONTROL LEVELS: PH 6.2 TO 7.2; 12% SOLIDS
MONITOR TYPE (MANUFACTURER, ETC.): FLOW THRU PH; NUCLEAR DENSITY METER (TEXAS NUCLEAR)
MONITOR LOCATION: RECYCLE LOOP ON TANGENTIAL NOZZLE HEADER
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
TYPE (OPEN/CLOSED): OPEN (POND OVERFLOW IS SENT TO EVAPORATOR-VAPOR COMPRESSION UNIT)
EVAPORATION WATER LOSS - GPM: <100
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: _____
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING LAKE WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: RETURN WATER TANKS; ME WASH; LIME SLURRY DILUTION
MAKEUP WATER PRE-TREATMENT TYPE: COARSE SCREENING

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME
PRINCIPAL CONSTITUENTS: CaO
SOURCE/SUPPLIER: CAN AM, PAUL LIME CO.
SUPPLIER LOCATION: DOUGLAS, ARIZONA
CONSUMPTION (SPECIFY UNITS): 20 TPD (TOTAL)
UTILIZATION - %: 83
POINT OF ADDITION: SLAKER, ABSORBER BOTTOM

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

CAPITAL COST - $/KW:
OPERATING COST - MILLS/KWH:
MAINTENANCE COST:
LABOR COST:
UTILITIES COST:
CHEMICALS COST:
WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %:
MIST ELIMINATOR - %:
REHEATER - %: N/A
FAN - %:
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %:
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER: N/A
FAN:
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER:
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: 1
PARTICIPANTS: ARIZONA PUBLIC SERVICE, CHEMICO
PROCESS: LIME
PLANT DESIGN: VENTURI
SUPPLIER: CHEMICO
SERVICE DATE: 1970
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): BLEED STREAM (TAKEN OUT OF SERVICE)

NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: AT SCRUBBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): N/A
LOCATION: TANK IS BOTTOM OF ABSORBER
CONFIGURATION: CONICAL
DIMENSIONS - FT: N/A
CAPACITY - GAL: _____
RETENTION TIME - MIN: <4
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MAKEUP WATER
NUMBER OF TANKS: 1 (3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 1

LOCATION: INDEPENDENT, NEAR THICKENERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RETURN TRANSFER
NUMBER OF TANKS: 1 (3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDEPENDENT, NEAR THICKENERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME SLURRY TRANSFER
NUMBER OF TANKS: 4 (3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: AT LIME PREPARATION PLANT
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1 PER TANK
AGITATOR CONFIGURATION: TOP MOUNTED
AGITATOR MATERIALS: CARBON STEEL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLIS CHALMERS
PUMP MODEL NUMBER: SRL-C
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 12,000
MOTOR BRAKE HP: 300
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 6.2-7.2, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON, RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: BUTYL WITH DUROMETER 40
IMPELLER MATERIAL GENERIC TYPE: CAST STEEL, RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE (STANDBY)
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARREN
PUMP MODEL NUMBER: 12PL22
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT DRIVE
CAPACITY - GPM: 15,000
MOTOR BRAKE HP: 300
SPEED - RPM: 1180
HEAD - FT: 110
SERVICE (PH, SOLIDS): PH 6.2-7.2; 10% SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BLEED STREAM TANK
NUMBER OF PUMPS: 2

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 1

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 4 (FOR 2 THICKENERS)
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY TRANSFER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 1

MANUFACTURER: HAZELTON
PUMP MODEL NUMBER: CTE
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 300
MOTOR BRAKE HP: 75
SPEED - RPM: 1350
HEAD - FT: 250
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RETURN WATER PUMP
NUMBER OF PUMPS: 2 (3 UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARREN
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 4800
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 140
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SERVICE WATER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 0 (BUT 1 EMERGENCY)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT
COMMON DESIGN (V-BELT, ETC.): DIRECT
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ME WATER
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 1

COMMENTS/FOOTNOTES

A THE LIMITATION IS A PERCENTAGE REMOVAL; 50% REMOVAL IS REQUIRED NOW BUT THIS WILL BE INCREASED TO 60% LATER AND FINALLY TO 72% IN 1985. WITH THE CURRENT $SO_2$ INPUT OF 1.7 LB $SO_2/10^6$ BTU, THIS CORRESPONDS TO 0.85, 0.68, AND 0.48 LB $SO_2/10^6$ BTU EMISSION LIMITATION, RESPECTIVELY.

B UNITS 1 AND 2 SHARE A COMMON STACK.

C PRIMARY PARTICULATE REMOVAL IS ACCOMPLISHED IN THE SAME VENTURI TOWERS THAT ARE USED FOR $SO_2$ REMOVAL.

D PRE-KRETE G-8 ON PLUMB BOB; $Al_2O_3$ BRICK ON SIDE OF THROAT; REST OF ABSORBER IS LINED WITH FLAKELINE 103 OVERSPRAYED WITH CEILCOTE 251.

E PRE-MIST ELIMINATOR
UNDER: 81 GPM AT 40 PSI FOR 3 MIN. EVERY 100 MINUTES
OVER: 100 GPM AT 40 PSI FOR 3 MIN. EVERY 100 MINUTES
EXTERNAL MIST ELIMINATOR
UNDER: 150 GPM AT 40 PSI FOR 1.5 MIN. EVERY 150 MINUTES
OVER: 200 GPM AT 70-100 PSI FOR 1.5 MIN. MANUALLY ACTIVATED AT HIGH MIST ELIMINATOR PRESSURE DROP.

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 2

GENERAL PLANT INFORMATION
- COMPANY NAME: ARIZONA PUBLIC SERVICE COMPANY
- ASSOCIATED UTILITIES:
- PLANT NAME: FOUR CORNERS
- UNIT NUMBER: 2
- PLANT ADDRESS: P.O. BOX 355
- CITY: FRUITLAND
- COUNTY: SAN JUAN
- STATE: NEW MEXICO
- ZIP CODE: 87416
- EPA REGION: 6
- RIVER BASIN/LAKE REGION: UPPER COLORADO
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.05 (0.04 FOR FINES <2μ)

A
- SO2 EMISSION LIMITATION - LB/MM BTU:
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 2085
- GROSS UNIT GENERATING CAPACITY - MW: 195
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 175
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 175
- EQUIVALENT SCRUBBED CAPACITY - MW: 195

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: RILEY STOKER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: FRONT
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 1963
- DESIGN BOILER FLUE GAS FLOW - ACFM: 814,000
- FLUE GAS TEMPERATURE - F: 340 (INLET TO ABSORBER)
- FLUE GAS OXYGEN - %: 2-4
- HEAT RATE - BTU/KWH: 10,300 NET; 9400 GROSS
- DESIGN FIRING RATE - TPH: 93
- EXCESS AIR - %: 10-20
- CAPACITY FACTOR - %: 70-85

B
- STACK HEIGHT - FT: 250 (COMMON WITH UNIT 1; ONE FLUE)
- SHELL MATERIAL: CONCRETE; PRESSURIZED ANNULUS
- FLUE MATERIAL GENERIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL SPECIFIC TYPE: TYPE HS BRICK AND CHEMICAL BONDED MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: PENNWALT POTASSIUM SILICATE MORTAR
- FLUE LINER MATERIAL GENERIC TYPE: N/A
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 17.5
- STACK GAS INLET TEMPERATURE - F: 120
- STACK GAS OUTLET VELOCITY - FT/SEC: 80

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
- NAME OF SUPPLIER: UTAH INTERNATIONAL
- MINE NAME/AREA: NAVAJO MINE
- MINE LOCATION - COUNTY: SAN JUAN
- MINE LOCATION - STATE: NEW MEXICO
- AVERAGE HEAT CONTENT - BTU/LB: 8800
- RANGE HEAT CONTENT - BTU/LB: 8500-9100
- AVERAGE ASH CONTENT - % 22.0
- RANGE ASH CONTENT - %: 19-25
- AVERAGE MOISTURE CONTENT - % 10.8
- RANGE MOISTURE CONTENT - %: 8.5-13.4
- AVERAGE SULFUR CONTENT - %: 0.75
- RANGE SULFUR CONTENT - %: 0.5-1.3
- AVERAGE CHLORIDE CONTENT - %: 0.03
- RANGE CHLORIDE CONTENT - % 0.01-0.06
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED
- SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBER ONLY)

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: NONE
- NUMBER OF SPARES:
- TYPE (HOT SIDE/COLD SIDE):
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %
- FLUE GAS CONDITIONING TYPE:

C PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS:
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - %

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIME/ALKALINE FLY ASH
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: CHEMICO FOR SCRUBBERS; IN-HOUSE FOR LIME ADDITION
A-E FIRM: IN-HOUSE
CONSTRUCTION FIRM: JESCO ON MECHANICAL AND FOLEY ON ELECTRICAL
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - % 50 (WILL BE INCREASED TO 72 IN 1985)
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

COMMERCIAL START-UP: _____
INITIAL START-UP: 11/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: _____
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST _____
INITIATED PRELIMINARY DESIGN _____

FGD DESIGN AND OPERATING PARAMETERS
- DESIGN COAL SULFUR CONTENT - %: 1.3
- DESIGN COAL HEAT CONTENT - BTU/LB: 8500
- DESIGN COAL ASH CONTENT - %: 25
- DESIGN COAL MOISTURE CONTENT - %: 13.4
- DESIGN COAL CHLORIDE CONTENT - %: 0.06
- FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBER ONLY)
- FGD SYSTEM TURNDOWN RATIO: INFINITE
- FGD SYSTEM TURNDOWN METHOD: USUALLY HAVE BOTH TOWERS ON-LINE
- FGD SYSTEM PRESSURE DROP - IN. H20: 12-15
- FGD SYSTEM OXIDATION - %: ~20
- FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
- FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10 (5-15)
- FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 200 (UNITS 1, 2, & 3)
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 5
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 17-25 ON WEEKDAYS
- FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
- FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): VARIABLE
- TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
  - SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: N/A
  - TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
- FGD SYSTEM BYPASS CAPABILITY (YES/NO): NO
- RESTRICTIONS TO USING BYPASS: N/A
- TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
- TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEKS/YR MINOR; 10 WEEKS/5 YRS MAJOR
- PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): N/A
- PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): WHATEVER IS REQUIRED; OPEN DOORS AND INSPECT
- TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): INSPECT AND DO WHAT IS REQUIRED

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: NONE
- NUMBER OF SPARES:
- TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 2

LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
GENERIC TYPE: VENTURI
SPECIFIC TYPE: VARIABLE-THROAT TOP-ENTRY PLUMB BOB
TRADE/COMMON NAME:
SUPPLIER: CHEMICO
DIMENSIONS - FT: 25 DIA
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
D LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-FILLED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 50
GAS/LIQUID CONTACT DEVICE TYPE: VENTURI THROAT (TANGENTIAL NOZZLES AT TOP AND AT SIDE OF THROAT)
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 1
NOZZLE MATERIAL: NO NOZZLES; INLET PIPE OF CARBON STEEL
NOZZLE PRESSURE DROP - PSI: N/A
LIQUID RECIRCULATION RATE - GPM: 10,000
L/G RATIO - GAL/1000 ACF: 24
GAS-SIDE PRESSURE DROP - IN. H2O: 10-15
SUPERFICIAL GAS VELOCITY - FT/SEC:
ABSORBER TURNDOWN RATIO: INFINITE
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; HOLD PRESSURE DROP CONSTANT
INLET GAS FLOW RATE - ACFM: 814,000 TOTAL
INLET GAS TEMPERATURE - F: 340
INLET SO2 LEVEL - PPM: 945 AT 3% $O_2$

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

INLET SO2 LEVEL - LB/MM BTU: 1.7
INLET PARTICLE LEVEL - GR/SCF: 8-12
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM: 550,000 SCFM
OUTLET GAS TEMPERATURE - F: 120-130
OUTLET SO2 LEVEL - PPM: 320 AT 3% $O_2$
OUTLET SO2 LEVEL - LB/MM BTU: 0.55
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU: <0.05
SO2 REMOVAL EFFICIENCY - %: 67.5
PARTICLE REMOVAL EFFICIENCY - %: >99.5

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR (AFTER FAN)

TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: 0
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A&B) IMPINGEMENT
SPECIFIC TYPE: (A&B) BAFFLE
COMMON DESIGN: (A&B) CHEVRON VANE
MANUFACTURER: SEVERAL DIFFERENT
CONFIGURATION (HORIZONTAL/VERTICAL): (A&B) HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): (A&B) FLAT
NUMBER OF STAGES: (A&B) 1
NUMBER OF PASSES/STAGE: (A&B) 6
FREEBOARD DISTANCE - FT:
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.:
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: (A) (B) 1
SUPERFICIAL GAS VELOCITY - FT/SEC:
CONSTRUCTION MATERIAL GENERIC TYPE: (A&B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A&B) FRP IN CARBON STEEL HOUSING LINED WITH FLAKELINE 103
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH (FROM LAKE)
POINT OF WATER COLLECTION: ME VESSEL
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (A&B) OVERSPRAY AND UNDERSPRAY
E WASH FREQUENCY:
WASH DURATION:
WASH RATE - GAL/MIN:
WASH COVERAGE - GAL/MIN SQ FT.:

REHEATER
NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 2

NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: AMERICAN STANDARD
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: INDUCED DRAFT
SERVICE (WET/DRY): WET
TYPE OF WASH: FRESH WATER SPRAY, 5 GPM ON BOTH SIDES
LOCATION WRT MAJOR COMPONENTS: BETWEEN ABSORBER AND EXTERNAL ME
FLUE GAS FLOW RATE - ACFM: 550,000
FLUE GAS TEMPERATURE - F: 120-130
PRESSURE DROP - IN. H2O:
MATERIAL GENERIC TYPE: (A) HIGH ALLOY STEEL BLADES
(B) RUBBER-LINED CARBON STEEL HOUSING
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: (A) INCONEL 625 (B) NATURAL RUBBER

DAMPERS
LOCATION: (A) FAN INLET (B) BEFORE STACK
NUMBER OF DAMPERS: (A) 2 (B) 1
FUNCTION (CONTROL/SHUT-OFF): (A) CONTROL (B) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL BLADE
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) SINGLE LOUVER
MANUFACTURER: (A) AMERICAN STANDARD

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM: NONE
SERVICE CONDITIONS (MAX GAS TEMP/TIME): (A) 120-130 F
MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) CARBON STEEL
MATERIAL SPECIFIC TYPE: (A) TYPE 316L
MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET (ME TO STACK)
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) CIRCULAR (B) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): (A) 14 DIA X 90 FT
(B) 12 X 12 X 50 FT
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) A283 (B) A283
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC OVER TYPE 316L SS
LINER MATERIAL SPECIFIC TYPE: (B) GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (B) FLAKELINE 103 AND 251

EXPANSION JOINTS
LOCATION: HOT AND WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): NEGATIVE PRIOR TO THE FAN, POSITIVE AFTER
OPERATING TEMPERATURE - F: 340 AT HOT SIDE, 120 AT WET
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: VITON

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): (A) LIME SLAKING
(B) CRUSHING GRITS
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): (A) SLAKER (B) BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): (A) SLURRY SLAKER
MANUFACTURER: (A) JOY (B) KENNEDY VAN SAUN
MATERIALS: (A) CARBON STEEL
NUMBER OF DEVICES: (A&B) 1 FOR UNITS 1, 2, & 3
NUMBER OF SPARES: 0
FULL LOAD DRY FEED CAPACITY - TPH: (A) 15
PRODUCT QUALITY - % SOLIDS: (A) 30 DILUTED TO 12-14%
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REGENT POINT OF ADDITION: BENEATH LIQUID LEVEL IN BOTTOM OF VENTURI TOWER
ON-SITE STORAGE CAPABILITY - DAYS: (A) 30 (560 TONS PER SILO, 4 CARBON STEEL SILOS)

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 2

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) SLURRY RECYCLE (B) SLUDGE TRANSFER
DIMENSIONS - IN.: (A) 12-14
MANUFACTURER: (B) DRISCOLL
MATERIAL: (A) RUBBER-LINED (BUTYL 40) CARBON STEEL (B) FRP

MAJOR VALVES
LOCATION: _____
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PINCH (B) DIAPHRAGM
CONTROL MODE (AUTOMATIC/MANUAL): (A) MANUAL (B) AUTOMATIC
DIMENSIONS - IN.: (A) UP TO 24
MANUFACTURER: (A&B) SAUNDERS
MATERIAL: (A&B) RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 2 (UNITS 1, 2, & 3)
NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 100
CAPACITY - GAL: 1,000,000
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL WALLS (B) CONCRETE FLOOR
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: (A&B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) GLASS FLAKE-REINFORCED POLYESTER
(B) FIBERGLASS MAT AND GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (A) FLAKELINE 103 AND 251
(B) KOPPERS 6693 AND FLAKELINE 103 AND 251
RAKE MATERIAL: TYPE 316L STAINLESS STEEL
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30-50%
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM DISPOSITION: TO ASH POND
OVERFLOW STREAM DISPOSITION: FOR RE-USE

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 2

DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 140,000 LB/HR WET (60% WATER); ALL THREE UNITS
MOISTURE CONTENT - % TOTAL FREE WATER: 60
PERCENT CASO3 - DRY: 18
PERCENT CASO4 - DRY: 5
PERCENT CAOH2 - DRY: 1
PERCENT CACO3 - DRY: 1
PERCENT ASH - DRY: 75
PERCENT OTHER COMPOUNDS - DRY: <1

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): MAN-MADE
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

SITE DIMENSIONS - AREA/DEPTH: 70 ACRES/55 FT
SITE CAPACITY - VOLUME/ACRE-FT/TONS: 5,900,000 (70 LB/FT$^3$)
SITE SERVICE LIFE - YEARS: 9.6

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: SLURRY STREAM
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): % SOLIDS, FLOW, TEMPERATURE
CONTROL LEVELS: PH 6.2-7.2, 12% SOLIDS
MONITOR TYPE (MANUFACTURER, ETC.): PH: APS FLOW THROUGH; DENSITY: TEXAS NUCLEAR
MONITOR LOCATION: RECYCLE LOOP ON TANGENTIAL NOZZLE HEADER
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
TYPE (OPEN/CLOSED): OPEN (POND OVERFLOW IS SENT TO EVAPORATION-VAPOR COMPRESSION UNIT)
EVAPORATION WATER LOSS - GPM: <100
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: _____
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): CODING LAKE WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: RETURN WATER TANKS, ME WASH, LIME SLURRY DILUTION
MAKEUP WATER PRE-TREATMENT TYPE: COARSE SCREENING

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME
PRINCIPAL CONSTITUENTS: CaO
SOURCE/SUPPLIER: CAN AM, PAUL LIME CO.
SUPPLIER LOCATION: DOUGLAS, ARIZONA
CONSUMPTION (SPECIFY UNITS): 20 TPD (TOTAL)
UTILIZATION - %: 83
POINT OF ADDITION: SLAKER, ABSORBER BOTTOM

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: _____
CAPITAL COST - $/KW: _____
OPERATING COST - MILLS/KWH: _____
MAINTENANCE COST: _____
LABOR COST: _____
UTILITIES COST: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

CHEMICALS COST:
WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %:
- MIST ELIMINATOR - %:
- REHEATER - %: N/A
- FAN - %:
- BALL MILL - %: N/A
- SLAKER - %:
- EFFLUENT HOLD TANK - %:
- RECIRCULATION PUMP - %:
- THICKENER - %:
- VACUUM FILTER - %: N/A
- CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
- SCRUBBER: N/A
- ABSORBER:
- MIST ELIMINATOR:
- REHEATER: N/A
- FAN:
- BALL MILL: N/A
- SLAKER:
- EFFLUENT HOLD TANK:
- RECIRCULATION PUMP:
- THICKENER:
- VACUUM FILTER: N/A
- CENTRIFUGE: N/A

PILOT PLANT
- UNIT NUMBER: 1
- PARTICIPANTS: ARIZONA PUBLIC SERVICE, CHEMICO
- PROCESS: LIME
- PLANT DESIGN: VENTURI
- SUPPLIER: CHEMICO
- SERVICE DATE: 1970
- PERIOD OF OPERATION - MONTHS:
- GAS FEED:
- EQUIVALENT SCRUBBED CAPACITY - MW:
- STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): BLEED STREAM (TAKEN OUT OF SERVICE)

NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: AT SCRUBBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): N/A
LOCATION: BOTTOM OF ABSORBER
CONFIGURATION: CONICAL
DIMENSIONS - FT: N/A
CAPACITY - GAL: _____
RETENTION TIME - MIN: <4
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MAKEUP WATER
NUMBER OF TANKS: 1 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

LOCATION: INDEPENDENT, NEAR THICKENERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RETURN TRANSFER
NUMBER OF TANKS: 1 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDEPENDENT, NEAR THICKENER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME SLURRY TRANSFER
NUMBER OF TANKS: 4 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: AT LIME PREPARATION PLANT
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1 PER TANK
AGITATOR CONFIGURATION: TOP MOUNTED
AGITATOR MATERIALS: CARBON STEEL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLIS CHALMERS
PUMP MODEL NUMBER: SRL-C
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 12,000
MOTOR BRAKE HP: 300
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 6.2-7.2, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON, RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: BUTYL WITH DUROMETER 40
IMPELLER MATERIAL GENERIC TYPE: CAST STEEL, RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE (STANDBY)
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): DIRECT
MANUFACTURER: WARREN
PUMP MODEL NUMBER: 12PL22
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT DRIVE
CAPACITY - GPM: 15,000
MOTOR BRAKE HP: 300
SPEED - RPM: 1180
HEAD - FT: 110
SERVICE (PH, SOLIDS): PH 6.2-7.2; 10% SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BLEED STREAM TANK
NUMBER OF PUMPS: 2

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 4 (FOR 2 THICKENERS)
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY TRANSFER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

MANUFACTURER: HAZELTON
PUMP MODEL NUMBER: CTE
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 300
MOTOR BRAKE HP: 75
SPEED - RPM: 1350
HEAD - FT: 250
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RETURN WATER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARREN
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 4800
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 140
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SERVICE WATER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 0 (BUT 1 EMERGENCY)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT
COMMON DESIGN (V-BELT, ETC.): DIRECT
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 2

SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ME WATER
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 2

COMMENTS/FOOTNOTES

A THE LIMITATION IS A PERCENTAGE REMOVAL; 50% REMOVAL IS REQUIRED NOW BUT THIS WILL BE INCREASED TO 60% LATER AND FINALLY TO 72% IN 1985. WITH THE CURRENT $SO_2$ INPUT OF 1.7 LB $SO_2/10^6$ BTU, THIS CORRESPONDS TO 0.85, 0.68, AND 0.48 LB $SO_2/10^6$ BTU EMISSION LIMITATION, RESPECTIVELY.

B UNITS 1 AND 2 SHARE A COMMON STACK.

C PRIMARY PARTICULATE REMOVAL IS ACCOMPLISHED IN THE SAME VENTURI TOWERS THAT ARE USED FOR $SO_2$ REMOVAL.

D PRE-KRETE G-8 ON PLUMB BOB; $AL_2O_3$ BRICK ON SIDE OF THROAT; REST OF ABSORBER IS LINED WITH FLAKELINE 103 OVERSPRAYED WITH CEILCOTE 251.

E PRE-MIST ELIMINATOR
UNDER: 81 GPM AT 40 PSI FOR 3 MIN. EVERY 100 MINUTES
OVER: 100 GPM AT 40 PSI FOR 3 MIN. EVERY 100 MINUTES
EXTERNAL MIST ELIMINATOR
UNDER: 150 GPM AT 40 PSI FOR 1.5 MIN. EVERY 150 MINUTES
OVER: 200 GPM AT 70-100 PSI FOR 1.5 MIN. MANUALLY ACTIVATED AT HIGH MIST ELIMINATOR PRESSURE DROP.

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 3

GENERAL PLANT INFORMATION
- COMPANY NAME: ARIZONA PUBLIC SERVICE COMPANY
- ASSOCIATED UTILITIES:
- PLANT NAME: FOUR CORNERS
- UNIT NUMBER: 3
- PLANT ADDRESS: P.O. BOX 355
- CITY: FRUITLAND
- COUNTY: SAN JUAN
- STATE: NEW MEXICO
- ZIP CODE: 87416
- FPA REGION: 6
- RIVER BASIN/LAKE REGION: UPPER COLORADO
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.05 (0.04 FOR FINES <2μ)

A
- SO2 EMISSION LIMITATION - LB/MM BTU:
- NOX EMISSION LIMITATION - LB/MM BTU: NONE
- NET PLANT GENERATING CAPACITY - MW: 2085
- GROSS UNIT GENERATING CAPACITY - MW: 240
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 225
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 225
- EQUIVALENT SCRUBBED CAPACITY - MW: 240

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: FOSTER WHEELER CORP.
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: FRONT
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 1964
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,030,000
- FLUE GAS TEMPERATURE - F: 340 (INLET TO ABSORBER)
- FLUE GAS OXYGEN - %: 2-4
- HEAT RATE - BTU/KWH: 10,300 NET; 9400 GROSS
- DESIGN FIRING RATE - TPH: 123
- EXCESS AIR - %: 10-20
- CAPACITY FACTOR - %: 70-85

B
- STACK HEIGHT - FT: 250
- SHELL MATERIAL: CONCRETE; PRESSURIZED ANNULUS
- FLUE MATERIAL GENERIC TYPE: ACID RESISTANT BRICK AND MORTAR
- FLUE MATERIAL SPECIFIC TYPE: TYPE HS BRICK AND CHEMICAL BONDED MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: PENNWALT POTASSIUM SILICATE MORTAR
- FLUE LINER MATERIAL GENERIC TYPE: N/A
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT:
- STACK GAS INLET TEMPERATURE - F: 120
- STACK GAS OUTLET VELOCITY - FT/SEC:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 3

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
- NAME OF SUPPLIER: UTAH INTERNATIONAL
- MINE NAME/AREA: NAVAJO MINE
- MINE LOCATION - COUNTY: SAN JUAN
- MINE LOCATION - STATE: NEW MEXICO
- AVERAGE HEAT CONTENT - BTU/LB: 8800
- RANGE HEAT CONTENT - BTU/LB: 8500-9100
- AVERAGE ASH CONTENT - % 22.0
- RANGE ASH CONTENT - %: 19-25
- AVERAGE MOISTURE CONTENT - % 10.8
- RANGE MOISTURE CONTENT - %: 8.5-13.4
- AVERAGE SULFUR CONTENT - %: 0.75
- RANGE SULFUR CONTENT - %: 0.5-1.3
- AVERAGE CHLORIDE CONTENT - %: 0.03
- RANGE CHLORIDE CONTENT - % 0.01-0.06
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED
- SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBER ONLY)

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: NONE
- NUMBER OF SPARES:
- TYPE (HOT SIDE/COLD SIDE):
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %
- FLUE GAS CONDITIONING TYPE:

C PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS:
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %
PARTICLE REMOVAL EFFICIENCY - %

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC): LIME/ALKALINE FLY ASH
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: CHEMICO FOR SCRUBBERS; IN-HOUSE FOR LIME ADDITION
A-E FIRM: IN-HOUSE
CONSTRUCTION FIRM: JESCO ON MECHANICAL AND FOLEY ON ELECTRICAL
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - % 50 (WILL BE INCREASED TO 72 IN 1985)
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

COMMERCIAL START-UP: _____
INITIAL START-UP: 11/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: _____
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST _____
INITIATED PRELIMINARY DESIGN _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 1.3
DESIGN COAL HEAT CONTENT - BTU/LB: 8500
DESIGN COAL ASH CONTENT - %: 25
DESIGN COAL MOISTURE CONTENT - %: 13.4
DESIGN COAL CHLORIDE CONTENT - %: 0.06
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 5600 (SCRUBBER ONLY)
FGD SYSTEM TURNDOWN RATIO: INFINITE
FGD SYSTEM TURNDOWN METHOD: USUALLY HAVE BOTH TOWERS ON-LINE, VENTURI THROAT
FGD SYSTEM PRESSURE DROP - IN. H2O: 12-15
FGD SYSTEM OXIDATION - %: ~20
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10 (5-15)
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 200 (UNITS 1, 2, & 3)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 17-25 ON WEEKDAYS
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): VARIABLE
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: N/A
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): NO
RESTRICTIONS TO USING BYPASS: N/A
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 WEEKS/YR MINOR; 10 WEEKS/5 YRS MAJOR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): N/A
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): WHATEVER IS REQUIRED; OPEN DOORS AND INSPECT
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): INSPECT AND DO WHAT IS REQUIRED

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA — ARIZONA PUBLIC SERVICE
DATE: 10/15/81 — FOUR CORNERS 3

LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
GENERIC TYPE: VENTURI
SPECIFIC TYPE: VARIABLE-THROAT TOP-ENTRY PLUMB BOB
TRADE/COMMON NAME: _____
SUPPLIER: CHEMICO
DIMENSIONS - FT: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
D LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-FILLED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 50
GAS/LIQUID CONTACT DEVICE TYPE: VENTURI THROAT (TANGENTIAL NOZZLES AT TOP AND AT SIDE OF THROAT)
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 1
NOZZLE MATERIAL: NO NOZZLES; INLET PIPE OF CARBON STEEL
NOZZLE PRESSURE DROP - PSI: N/A
LIQUID RECIRCULATION RATE - GPM: ___
L/G RATIO - GAL/1000 ACF: 24
GAS-SIDE PRESSURE DROP - IN. H2O: 10-15
SUPERFICIAL GAS VELOCITY - FT/SEC: _____
ABSORBER TURNDOWN RATIO: INFINITE
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; HOLD PRESSURE DROP CONSTANT
INLET GAS FLOW RATE - ACFM: 1,030,000 TOTAL
INLET GAS TEMPERATURE - F: 340
INLET SO2 LEVEL - PPM: 945 AT 3% $O_2$

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

INLET SO2 LEVEL - LB/MM BTU: 1.7
INLET PARTICLE LEVEL - GR/SCF: 8-12
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F: 120-130
OUTLET SO2 LEVEL - PPM: 320 AT 3% $O_2$
OUTLET SO2 LEVEL - LB/MM BTU: 0.55
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU: <0.05
SO2 REMOVAL EFFICIENCY - %: 67.5
PARTICLE REMOVAL EFFICIENCY - %: >99.5

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR (AFTER FAN)
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: 0
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A&B) IMPINGEMENT
SPECIFIC TYPE: (A&B) BAFFLE
COMMON DESIGN: (A&B) CHEVRON VANE
MANUFACTURER: SEVERAL DIFFERENT
CONFIGURATION (HORIZONTAL/VERTICAL): (A&B) HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): (A&B) FLAT
NUMBER OF STAGES: (A&B) 1
NUMBER OF PASSES/STAGE: (A&B) 6
FREEBOARD DISTANCE - FT:
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.:
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: (A) (B) 2
SUPERFICIAL GAS VELOCITY - FT/SEC:
CONSTRUCTION MATERIAL GENERIC TYPE: (A&B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A&B) FRP IN CARBON STEEL HOUSING LINED WITH FLAKELINE 103
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH (FROM LAKE)
POINT OF WATER COLLECTION: ME VESSEL
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (A&B) OVERSPRAY AND UNDERSPRAY
WASH FREQUENCY:
WASH DURATION:
WASH RATE - GAL/MIN:
WASH COVERAGE - GAL/MIN SQ FT.:

REHEATER
NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: AMERICAN STANDARD
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: INDUCED DRAFT
SERVICE (WET/DRY): WET
TYPE OF WASH: FRESH WATER SPRAY, 5 GPM ON BOTH SIDES
LOCATION WRT MAJOR COMPONENTS: BETWEEN ABSORBER AND EXTERNAL ME
FLUE GAS FLOW RATE - ACFM: 515,000
FLUE GAS TEMPERATURE - F: 120-130
PRESSURE DROP - IN. H2O:
MATERIAL GENERIC TYPE: (A) HIGH ALLOY STEEL BLADES
(B) RUBBER-LINED CARBON STEEL HOUSING
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: (A) INCONEL 625 (B) BUTYL 90

DAMPERS
LOCATION: (A) FAN INLET (B) BEFORE STACK
NUMBER OF DAMPERS: (A) 2 (B) 1
FUNCTION (CONTROL/SHUT-OFF): (A) CONTROL (B) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL BLADE
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) SINGLE LOUVER
MANUFACTURER: (A) AMERICAN STANDARD

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

MODULATION (OPEN/CLOSED, ETC.): _____
SEAL AIR - ACFM: NONE
SERVICE CONDITIONS (MAX GAS TEMP/TIME): (A) 120-130 F
MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) CARBON STEEL
MATERIAL SPECIFIC TYPE: (A) TYPE 316L
MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET (ME TO STACK)
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) CIRCULAR (B) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) A283 (B) A283
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC OVER TYPE 316L SS
LINER MATERIAL SPECIFIC TYPE: (B) GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (B) FLAKELINE 103 AND 251

EXPANSION JOINTS
LOCATION: HOT AND WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): NEGATIVE BEFORE FAN, POSITIVE AFTER
OPERATING TEMPERATURE - F: 340 AT HOT SIDE, 120 AT WET SIDE
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: _____
MATERIAL: _____

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): (A) LIME SLAKING
(B) CRUSHING GRITS
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): (A) SLAKER (B) BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): (A) SLURRY SLAKER
MANUFACTURER: (A) JOY (B) KENNEDY VAN SAUN
MATERIALS: (A) CARBON STEEL
NUMBER OF DEVICES: (A&B) 1 FOR UNITS 1, 2, & 3
NUMBER OF SPARES: 0
FULL LOAD DRY FEED CAPACITY - TPH: (A) 15
PRODUCT QUALITY - % SOLIDS: (A) 30 DILUTED TO 12-14%
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
PREPARED REAGENT POINT OF ADDITION: BENEATH LIQUID LEVEL IN BOTTOM OF VENTURI TOWER
ON-SITE STORAGE CAPABILITY - DAYS: (A) 30 (560 TONS PER SILO, 4 CARBON STEEL SILOS)

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) SLURRY RECYCLE (B) SLUDGE TRANSFER
DIMENSIONS - IN.: (A) 12-14
MANUFACTURER: (B) DRISCOLL
MATERIAL: (A) RUBBER-LINED (BUTYL 40) CARBON STEEL (B) FRP

MAJOR VALVES
LOCATION: _____
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PINCH (B) DIAPHRAGM
CONTROL MODE (AUTOMATIC/MANUAL): (A) MANUAL (B) AUTOMATIC
DIMENSIONS - IN.: (A) UP TO 24
MANUFACTURER: (A&B) SAUNDERS
MATERIAL: (A&B) RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 2 (UNITS 1, 2, & 3)
NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 100
CAPACITY - GAL: 1,000,000
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL WALLS (B) CONCRETE FLOOR
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: (A&B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) GLASS FLAKE-REINFORCED POLYESTER
(B) FIBERGLASS MAT AND GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (A) FLAKELINE 103 AND 251
(B) KOPPERS 6693 AND FLAKELINE 103 AND 251
RAKE MATERIAL: TYPE 316L STAINLESS STEEL
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30-50%
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM DISPOSITION: TO ASH POND
OVERFLOW STREAM DISPOSITION: FOR RE-USE

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 140,000 LB/HR WET (60% WATER) ALL THREE UNITS
MOISTURE CONTENT - % TOTAL FREE WATER: 60
PERCENT CASO3 - DRY: 18
PERCENT CASO4 - DRY: 5
PERCENT CAOH2 - DRY: 1
PERCENT CACO3 - DRY: 1
PERCENT ASH - DRY: 75
PERCENT OTHER COMPOUNDS - DRY: <1

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): MAN-MADE
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: 70 ACRES/55 FT

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

SITE CAPACITY - VOLUME/ACRE-FT/TONS: 5,900,000 TONS
SITE SERVICE LIFE - YEARS: 9.6

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: SLURRY STREAM
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): % SOLIDS, FLOW, TEMPERATURE
CONTROL LEVELS: PH 6.2-7.2, 12% SOLIDS
MONITOR TYPE (MANUFACTURER, ETC.): FLOW THROUGH PH; DENSITY: TEXAS NUCLEAR
MONITOR LOCATION: RECYCLE LOOP ON TANGENTIAL NOZZLE HEADER
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
TYPE (OPEN/CLOSED): OPEN (POND OVERFLOW IS SENT TO EVAPORATION-VAPOR COMPRESSION UNIT)
EVAPORATION WATER LOSS - GPM: <100
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: _____
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING LAKE WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: RETURN WATER TANKS, ME WASH, LIME SLURRY DILUTION
MAKEUP WATER PRE-TREATMENT TYPE: COARSE SCREENING

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME
PRINCIPAL CONSTITUENTS: CaO
SOURCE/SUPPLIER: CAN AM, PAUL LIME CO.
SUPPLIER LOCATION: DOUGLAS, ARIZONA
CONSUMPTION (SPECIFY UNITS): 20 TPD (TOTAL)
UTILIZATION - %: 83
POINT OF ADDITION: SLAKER, ABSORBER BOTTOM

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: _____
CAPITAL COST - $/KW: _____
OPERATING COST - MILLS/KWH: _____
MAINTENANCE COST: _____
LABOR COST: _____
UTILITIES COST: _____
CHEMICALS COST: _____
WASTE DISPOSAL COST: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %:
- MIST ELIMINATOR - %:
- REHEATER - %: N/A
- FAN - %:
- BALL MILL - %: N/A
- SLAKER - %:
- EFFLUENT HOLD TANK - %:
- RECIRCULATION PUMP - %:
- THICKENER - %:
- VACUUM FILTER - %: N/A
- CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
- SCRUBBER: N/A
- ABSORBER:
- MIST ELIMINATOR:
- REHEATER: N/A
- FAN:
- BALL MILL: N/A
- SLAKER:
- EFFLUENT HOLD TANK:
- RECIRCULATION PUMP:
- THICKENER:
- VACUUM FILTER: N/A
- CENTRIFUGE: N/A

PILOT PLANT
- UNIT NUMBER: 1
- PARTICIPANTS: ARIZONA PUBLIC SERVICE, CHEMICO
- PROCESS: LIME
- PLANT DESIGN: VENTURI
- SUPPLIER: CHEMICO
- SERVICE DATE: 1970
- PERIOD OF OPERATION - MONTHS:
- GAS FEED:
- EQUIVALENT SCRUBBED CAPACITY - MW:
- STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 3

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): BLEED STREAM
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: AT SCRUBBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): N/A
LOCATION: BOTTOM OF ABSORBER
CONFIGURATION: CONICAL
DIMENSIONS - FT: N/A
CAPACITY - GAL: _____
RETENTION TIME - MIN: <4
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MAKEUP WATER
NUMBER OF TANKS: 1 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDEPENDENT, NEAR THICKENER
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RETURN TRANSFER
NUMBER OF TANKS: 1 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: INDEPENDENT, NEAR THICKENER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME SLURRY TRANSFER
NUMBER OF TANKS: 4 (FOR 3 UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: AT LIME PREPARATION PLANT
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1 PER TANK
AGITATOR CONFIGURATION: TOP MOUNTED
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 3

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLIS CHALMERS
PUMP MODEL NUMBER: SRL-C
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 6.2-7.2, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON, RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: BUTYL WITH DUROMETER 40
IMPELLER MATERIAL GENERIC TYPE: CAST STEEL, RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE (STANDBY)
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): DIRECT
MANUFACTURER: WARREN
PUMP MODEL NUMBER: 12PL22
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT DRIVE
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 6.2-7.2; 10% SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RI FED STREAM TANK
NUMBER OF PUMPS: 2

UTILITY EMISSION CONTROL SYSTEM DATA ARIZONA PUBLIC SERVICE
DATE: 10/15/81 FOUR CORNERS 3

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 4 (FOR 2 THICKENERS)
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY TRANSFER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

MANUFACTURER: HAZELTON
PUMP MODEL NUMBER: CTE
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 300
MOTOR BRAKE HP: 75
SPEED - RPM: 1350
HEAD - FT: 250
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RETURN WATER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARREN
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 4800
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: 140
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SERVICE WATER
NUMBER OF PUMPS: 2 (FOR 3 UNITS)
NUMBER OF SPARES: 0 (ONE EMERGENCY)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT
COMMON DESIGN (V-BELT, ETC.): DIRECT
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ME WATER
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 10/15/81

ARIZONA PUBLIC SERVICE
FOUR CORNERS 3

COMMENTS/FOOTNOTES

A THE LIMITATION IS A PERCENTAGE REMOVAL; 50% REMOVAL IS REQUIRED NOW BUT THIS WILL BE INCREASED TO 60% LATER AND FINALLY TO 72% IN 1985. WITH THE CURRENT $SO_2$ INPUT OF 1.7 LB $SO_2/10^6$ BTU, THIS CORRESPONDS TO 0.85, 0.68, AND 0.48 LB $SO_2/10^6$ BTU EMISSION LIMITATION, RESPECTIVELY.

B UNIT 3 HAS ITS OWN STACK.

C PRIMARY PARTICULATE REMOVAL IS ACCOMPLISHED IN THE SAME VENTURI TOWERS THAT ARE USED FOR $SO_2$ REMOVAL.

D PRE-KRETE G-8 ON PLUMB BOB; $Al_2O_3$ BRICK ON SIDE OF THROAT; REST OF ABSORBER IS LINED WITH FLAKELINE 103 OVERSPRAYED WITH CEILCOTE 251.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Public Service Four Corners 1 | 11/79 | 720 | | System | | | | Initial shakedown/debugging operations commenced |
| | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 744 | | System | | | | Shakedown/debugging operations continued |
| | 4/80 | 720 | | System | | | | |
| | 5/80 | 744 | | System | | | | |
| | 6/80 | 720 | | System | | | | The utility was unavailable to release performance data for publication (same response for remaining months) |
| | 7/80 | 744 | | System | | | | |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | | | | |
| | 10/80 | 744 | | System | | | | |
| | 11/80 | 720 | | System | | | | |
| | 12/80 | 744 | | System | | | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Public Service Four Corners 2 | 11/79 | 720 | | System | | | | Initial shakedown/debugging operations commenced |
| | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 744 | | System | | | | Shakedown/debugging operations continued |
| | 4/80 | 720 | | System | | | | |
| | 5/80 | 744 | | System | | | | |
| | 6/80 | 720 | | System | | | | The utility was unavailable to release performance data for publication (same response for remaining months) |
| | 7/80 | 744 | | System | | | | |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | | | | |
| | 10/80 | 744 | | System | | | | |
| | 11/80 | 720 | | System | | | | |
| | 12/80 | 744 | | System | | | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Arizona Public Service Four Corners 3 | 11/79 | 720 | | System | | | | Initial shakedown/debugging operations commenced |
| | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 744 | | System | | | | Shakedown/debugging operations continued |
| | 4/80 | 720 | | System | | | | |
| | 5/80 | 744 | | System | | | | |
| | 6/80 | 720 | | System | | | | The utility was unavailable to release performance data for publication (same response for remaining months) |
| | 7/80 | 744 | | System | | | | |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | | | | |
| | 10/80 | 744 | | System | | | | |
| | 11/80 | 720 | | System | | | | |
| | 12/80 | 744 | | System | | | | |

BASIN ELECTRIC POWER COOP

LARAMIE RIVER 1

# SECTION 1

## BACKGROUND

During the 1970's, Basin Electric Power initiated plans to construct a new generating station, Laramie River, located in Wheatland, Wyoming. Laramie River 1 is a pulverized coal-fired unit with a generating capacity of 570 MW (gross). At the time the unit was in the initial design phase, the State of Wyoming had not finalized their SIP. As such, the utility had two alternatives to meet the applicable Federal New Source Performance Standards -- install FGD or burn low-sulfur coal.

In February 1976, Wyoming completed their SIP which required coal-fired units not under construction by January 1, 1974, to meet an $SO_2$ emission limitation of 0.2 pounds per million Btu and a particulate matter emission limitation of 0.1 pounds per million Btu. In order to comply with this regulation, the utility decided to install an FGD system. In January 1977, Basin Electric Power awarded a contract to Research-Cottrell to supply a wet limestone scrubbing system. Babcock and Wilcox was contracted to supply a cold-side ESP for primary particulate matter control.

## SECTION 2

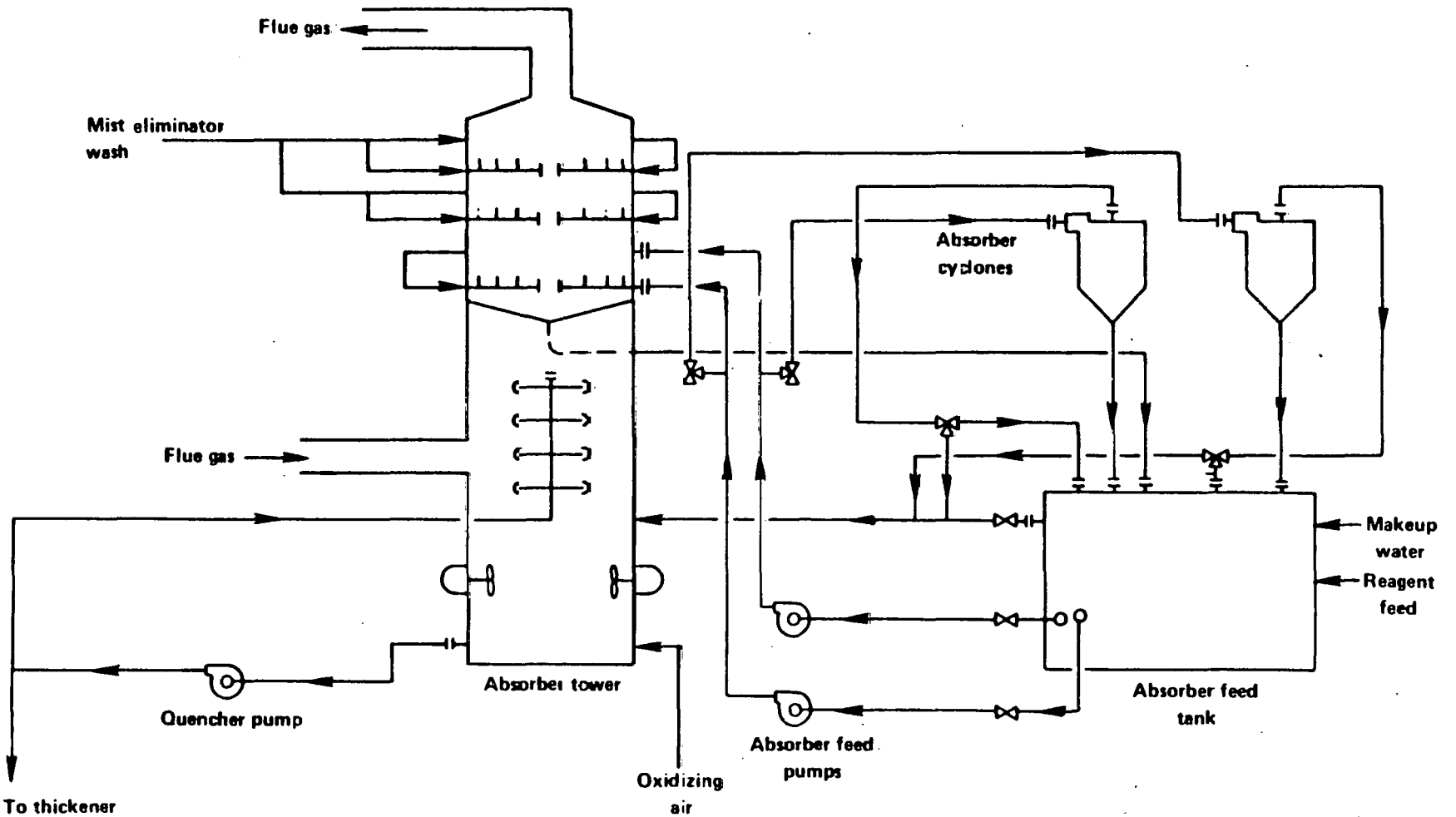
## PROCESS DESCRIPTION

The emission control system at the Laramie River 1 consists of a cold-side ESP for primary particulate matter control followed by a Research-Cottrell wet limestone FGD system for $SO_2$ control. The FGD system includes five spray/packed towers, each of which is designed to handle 25% of the total boiler flue gas flow of 2,300,000 acfm at 286°F. As a result, one of the five absorber towers can be spared at full load.

After the flue gas exits the boiler preheater, it passes into an ESP with a particulate matter removal efficiency of 99.6%. The flue gas (2,300,000 acfm at 286°F) is fed into the base of the absorbers where it rises through a spray zone in the tower and a 2.0-foot layer of polypropylene packing. Mist elimination is provided by one stage of vertical mist eliminators situated above the packing layer in each tower. From the mist eliminators, the saturated flue gas enters the 600-foot stack.

The spent slurry is dewatered by a thickener and a centrifuge to approximately 70% solids. The sludge from this closed water loop system is forcibly oxidized before being conveyed to an on-site landfill.

A flow diagram for the Laramie River 1 FGD system is shown on the next page.




Flow Diagram: Laramie River 1

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

GENERAL PLANT INFORMATION
- COMPANY NAME: BASIN ELECTRIC POWER COOPERATIVE
- ASSOCIATED UTILITIES: TRI-STATE G&T ASSOCIATION, MISSOURI BASIN MUNICIPAL POWER AGENCY, HEARTLAND CONSUMERS POWER DISTRICT, LINCOLN ELECTRIC SYSTEM, AND WYOMING MUNICIPAL POWER AGENCY
- PLANT NAME: LARAMIE RIVER
- UNIT NUMBER: 1
- PLANT ADDRESS: P.O. BOX 1346
- CITY: WHEATLAND
- COUNTY: PLATTE
- STATE: WYOMING
- ZIP CODE: 82201
- EPA REGION: 8
- RIVER BASIN/LAKE REGION: LARAMIE
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.2
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 1500
- GROSS UNIT GENERATING CAPACITY - MW: 570
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 545
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 550
- EQUIVALENT SCRUBBED CAPACITY - MW: 570

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: OPPOSED WALL
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 7/80
- DESIGN BOILER FLUE GAS FLOW - ACFM: 2,300,000
- FLUE GAS TEMPERATURE - F: 286
- FLUE GAS OXYGEN - %: 3.5
- HEAT RATE - BTU/KWH: 10,400
- DESIGN FIRING RATE - TPH: 338
- EXCESS AIR - %: 16.7
- CAPACITY FACTOR - %: 90
- STACK HEIGHT - FT: 600
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME:
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 28.5

UTILITY EMISSION CONTROL SYSTEM DATA BASIN ELECTRIC POWER COOP
DATE: 8/13/81 LARAMIE RIVER 1

STACK GAS INLET TEMPERATURE - F: 127
STACK GAS OUTLET VELOCITY - FT/SEC: 50

FUEL DATA (ACTUAL)
FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
NAME OF SUPPLIER: SUN OIL COMPANY
MINE NAME/AREA: CORDERO MINE
MINE LOCATION - COUNTY: CAMPBELL
MINE LOCATION - STATE: WYOMING
AVERAGE HEAT CONTENT - BTU/LB: 8250
RANGE HEAT CONTENT - BTU/LB: 8200-8400
AVERAGE ASH CONTENT - %: 6.0
RANGE ASH CONTENT - %: 5.5-6.5
AVERAGE MOISTURE CONTENT - %: 28.92
RANGE MOISTURE CONTENT - %: 27.0-30.0
AVERAGE SULFUR CONTENT - %: 0.35
RANGE SULFUR CONTENT - %: 0.30-0.38
AVERAGE CHLORIDE CONTENT - %: 0.015
RANGE CHLORIDE CONTENT - %: 0.01-0.02
FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
FUEL ANALYSIS DATE: CONTINUOUS

PARTICLE CONTROL GENERAL DATA
CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
SPACE REQUIREMENTS - SQ FT: 28,000

MECHANICAL COLLECTOR
NUMBER OF MECHANICAL COLLECTORS: NONE
NUMBER OF SPARES:
TYPE:
SUPPLIER:
INLET FLUE GAS CAPACITY - ACFM:
INLET FLUE GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
PARTICLE OUTLET LOAD - GR/SCF:
PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
NUMBER OF SPARES: 0
TYPE (HOT SIDE/COLD SIDE): COLD SIDE
SUPPLIER: BABCOCK & WILCOX
INLET FLUE GAS CAPACITY - ACFM: 2,300,000
INLET FLUE GAS TEMPERATURE - F: 286
PRESSURE DROP - IN. H2O: 3.30
PARTICLE OUTLET LOAD - GR/SCF: 0.006
PARTICLE REMOVAL EFFICIENCY - %: 99.6
FLUE GAS CONDITIONING TYPE: NONE

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:
- GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
- SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
- TRADE/COMMON NAME:
- SUPPLIER:
- DIMENSIONS - FT:
- SHELL MATERIAL GENERIC TYPE:
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME:
- LINER MATERIAL GENERIC TYPE:
- LINER MATERIAL SPECIFIC TYPE:
- LINER MATERIAL TRADE/COMMON NAME:
- BOILER LOAD PER SCRUBBER (DESIGN) - %:
- GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
- NUMBER OF GAS CONTACTING ZONES:
- DISTANCE BETWEEN CONTACTING ZONES - IN.:
- NUMBER OF SPRAY HEADERS:
- NOZZLE MATERIAL:
- NOZZLE PRESSURE DROP - PSI:
- LIQUID RECIRCULATION RATE - GPM:
- L/G RATIO - GAL/1000 ACF:
- PH CONTROL ADDITIVE:
- GAS-SIDE PRESSURE DROP - IN. H2O:
- SUPERFICIAL GAS VELOCITY - FT/SEC:
- INLET GAS FLOW RATE - ACFM:
- INLET GAS TEMPERATURE - F:
- INLET SO2 LEVEL - PPM:
- INLET SO2 LEVEL - LB/MM BTU:
- INLET PARTICLE LEVEL - GR/SCF:
- INLET PARTICLE LEVEL - LB/MM BTU:
- OUTLET GAS FLOW RATE - ACFM:
- OUTLET GAS TEMPERATURE - F:
- OUTLET SO2 LEVEL - PPM:
- OUTLET SO2 LEVEL - LB/MM BTU:
- OUTLET PARTICLE LEVEL - GR/SCF:
- OUTLET PARTICLE LEVEL - LB/MM BTU:
- SO2 REMOVAL EFFICIENCY - %:
- PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
- PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
- PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
- SYSTEM SUPPLIER: RESEARCH-COTTRELL
- A-E FIRM: BURNS & MCDONNELL
- CONSTRUCTION FIRM: RESEARCH-COTTRELL
- APPLICATION (NEW/RETROFIT): NEW
- PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.6

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

SO2 DESIGN REMOVAL EFFICIENCY - %: 90
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A
COMMERCIAL START-UP: 7/80
INITIAL START-UP: 7/80
CONSTRUCTION COMPLETION: 6/80
CONSTRUCTION INITIATION: 1/78
CONTRACT AWARDED: 1/77
LETTER OF INTENT SIGNED: 12/76
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 0.81
DESIGN COAL HEAT CONTENT - BTU/LB: 8139
DESIGN COAL ASH CONTENT - %: 7.89
DESIGN COAL MOISTURE CONTENT - %: 28.92
DESIGN COAL CHLORIDE CONTENT - %: 0.04
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 25,000
FGD SYSTEM TURNDOWN RATIO: 8:1
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE; REDUCE GAS FLOW
FGD SYSTEM PRESSURE DROP - IN. H2O: 8.6
FGD SYSTEM OXIDATION - %: 90
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 80
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 4 (PER DAY)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 2
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 4,000
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): 1 SHIFT IS DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: 1 MONTH OUT OF 5 MONTHS
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): NOT DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: USED DURING STARTUP AND SHUTDOWNS; EMISSION LIMITS
TIME SCHEDULE FOR REDUCED BOILER LOAD: 60% LOAD FROM 10:00 P.M. TO 5:00 A.M.
TIME SCHEDULE FOR BOILER SHUTDOWNS: 18 MONTH CYCLE; 5-8 WEEK OUTAGE
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): DON'T NEED TO DO MAINTENANCE DURING REDUCED LOAD BECAUSE OF SPARE TRAIN
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): LONG LIST OF MAINTENANCE ITEMS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): DRAIN TOWER FOR VISUAL INSPECTION

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: 5
- NUMBER OF SPARES: 1
- TYPE: SPRAY ZONE
- LOCATION: BOTTOM OF ABSORBER
- SUPPLIER: RESEARCH-COTTRELL
- SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: UDDEHOLM 904L WALLS AND HASTELLOY G FLOOR
- LINER MATERIAL GENERIC TYPE: NONE
- LINER MATERIAL SPECIFIC TYPE: N/A
- LINER MATERIAL TRADE/COMMON NAME: N/A
- INLET GAS FLOW - ACFM: 575,000
- INLET GAS TEMPERATURE - F: 286
- PRESSURE DROP - IN. H2O:
- LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
- LIQUID RECIRCULATION RATE - GPM: 4770
- L/G RATIO - GAL/1000 ACF: 17
- NUMBER OF SPRAY HEADERS: 5 (40 NOZZLES)
- NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
- NOZZLE PRESSURE DROP - PSI:

ABSORBER
- NUMBER OF ABSORBERS: 5
- NUMBER OF SPARES: 1

A
- GENERIC TYPE: COMBINATION
- SPECIFIC TYPE: SPRAY/PACKED (SPRAY ZONE IS QUENCHER)
- TRADE/COMMON NAME:
- SUPPLIER: RESEARCH-COTTRELL
- DIMENSIONS - FT: 30 X 30 X 80

B
- SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL AND HIGH ALLOY (IN QUENCH ZONE)
- SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
- SHELL MATERIAL TRADE/COMMON NAME: UDDEHOLM 904L (IN QUENCH ZONE)
- LINER MATERIAL GENERIC TYPE: NONE
- LINER MATERIAL SPECIFIC TYPE: N/A
- LINER MATERIAL TRADE/COMMON NAME: N/A
- BOILER LOAD PER ABSORBER - %: 25

C
- GAS/LIQUID CONTACT DEVICE TYPE: GRID PACKING
- NUMBER OF GAS CONTACTING ZONES: 1
- DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
- NUMBER OF SPRAY HEADERS: 2 MAIN AND 20 SUBHEADERS
- NOZZLE MATERIAL: TYPE 316 STAINLESS STEEL
- NOZZLE PRESSURE DROP - PSI:
- LIQUID RECIRCULATION RATE - GPM: 23,372
- L/G RATIO - GAL/1000 ACF: 40
- GAS-SIDE PRESSURE DROP - IN. H2O: 6.0
- SUPERFICIAL GAS VELOCITY - FT/SEC: 10

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

ABSORBER TURNDOWN RATIO: 2:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW
INLET GAS FLOW RATE - ACFM: 575,000
INLET GAS TEMPERATURE - F: 286 (127-133 AFTER QUENCHER)
INLET SO2 LEVEL - PPM: 280 (QUENCHER INLET)
INLET SO2 LEVEL - LB/MM BTU: 0.765 (QUENCHER INLET)
INLET PARTICLE LEVEL - GR/SCF: 0.015
INLET PARTICLE LEVEL - LB/MM BTU: 0.050
OUTLET GAS FLOW RATE - ACFM: 483,750
OUTLET GAS TEMPERATURE - F: 127
OUTLET SO2 LEVEL - PPM: 15
OUTLET SO2 LEVEL - LB/MM BTU: 0.02
OUTLET PARTICLE LEVEL - GR/SCF: 0.006
OUTLET PARTICLE LEVEL - LB/MM BTU: 0.01
SO2 REMOVAL EFFICIENCY - %: 95
PARTICLE REMOVAL EFFICIENCY - %: 60

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 5
NUMBER OF SPARES: 1
NUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER: _____
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): Z-SHAPE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 3
FREEBOARD DISTANCE - FT: _____
DISTANCE BETWEEN STAGES - IN.: _____
DISTANCE BETWEEN VANES - IN.: _____
VANE ANGLES - DEGREES: _____
PRESSURE DROP - IN. H2O: 2.6
SUPERFICIAL GAS VELOCITY - FT/SEC: 10
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: POLYPROPYLENE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: _____
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): COOLING TOWER BLOWDOWN
POINT OF WATER COLLECTION: ABSORBER FEED TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): OVERSPRAY AND UNDERSPRAY
WASH FREQUENCY: UNDER - ONCE/15 MIN; TOP - ONCE/8 HRS
WASH DURATION: 10 MINUTES (BOTH)
WASH RATE - GAL/MIN: 292 (BOTH)
WASH COVERAGE - GAL/MIN/SQ FT: 0.32 (BOTH)

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

REHEATER
- NUMBER OF REHEATERS: NONE (ORIGINALLY WERE NOT ALLOWED TO BYPASS)
- NUMBER OF SPARES:
- NUMBER PER MODULE:
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): BYPASS
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
- COMBUSTION FUEL SULFUR CONTENT - %:
- LOCATION:
- AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 10-15
- TEMPERATURE INCREASE - F: 23
- INLET FLUE GAS FLOW RATE - ACFM:
- INLET FLUE GAS TEMPERATURE - F: 127
- OUTLET FLUE GAS FLOW RATE - ACFM:
- OUTLET FLUE GAS TEMPERATURE - F: 150
- ENERGY REQUIREMENT - MM BTU/HR:
- NUMBER OF HEAT EXCHANGER BANKS:
- NUMBER OF BUNDLES PER BANK:
- NUMBER OF TUBES PER BUNDLE:
- STEAM OR WATER PRESSURE - PSIG:
- STEAM OR WATER TEMPERATURE - F:
- SELF CLEANING DEVICE TYPE:
- MATERIAL GENERIC TYPE: STAINLESS STEEL
- MATERIAL SPECIFIC TYPE: TYPE 316
- MATERIAL TRADE/COMMON NAME: N/A

FANS
- NUMBER OF FANS: 2
- NUMBER OF SPARES: 0
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): AXIAL
- SUPPLIER: BABCOCK & WILCOX
- FUNCTION (UNIT/BOOSTER): UNIT
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
- SERVICE (WET/DRY): DRY
- TYPE OF WASH: NONE
- LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND ABSORBER
- FLUE GAS FLOW RATE - ACFM: $2.3 \times 10^6/2$
- FLUE GAS TEMPERATURE - F: 286
- PRESSURE DROP - IN. H2O: 25 MAXIMUM
- MATERIAL GENERIC TYPE: CARBON STEEL
- MATERIAL SPECIFIC TYPE: AISI 1110
- MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
- LOCATION: (A) FAN INLET AND OUTLET (B) SYSTEM OUTLET (C) BYPASS (D) TOWER INLET (E) TOWER OUTLET
- NUMBER OF DAMPERS: (A) 4 (B) 1 (C) 2 (D) 10 (E) 5
- FUNCTION (CONTROL/SHUT-OFF): (A) CONTROL (B) CONTROL (C) CONTROL (D) 5 CONTROL AND 5 SHUT-OFF (E) SHUT-OFF

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A,B,C) LOUVER (D) 5 LOUVER AND 5 GUILLOTINE (ONE OF EACH IN EACH TRAIN) (E) GUILLOTINE
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): OPPOSED BLADE AND PARALLEL BLADE
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) DOUBLE (B,C,D,E) SINGLE
MANUFACTURER: LOUVER-FOURNEY, GUILLOTINE-ANDCO
MODULATION (OPEN/CLOSED, ETC.): _____
SEAL AIR - ACFM: 60,500 (TOTAL FOR A, D, AND E)
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: DRY SIDE - CARBON STEEL; WET SIDE - STAINLESS STEEL
MATERIAL SPECIFIC TYPE: WET SIDE - TYPE 316
MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) STAINLESS STEEL (C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (B) TYPE 317LM
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

EXPANSION JOINTS
LOCATION: (A) SYSTEM INLET (B) SYSTEM OUTLET (C) TOWER INLET (D) TOWER OUTLET
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): POSITIVE EXCEPT FOR INLET SIDE OF ID FAN
OPERATING TEMPERATURE - F: 286 INLET; 127 OUTLET
DESIGN CONFIGURATION (V-SHAPED, ETC.): V-SHAPED
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: _____

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): TUBE MILL
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER-LINED CARBON STEEL
NUMBER OF DEVICES: 2 (FOR UNITS 1 AND 2)
NUMBER OF SPARES: 0 (CAN USE MILL FROM OTHER UNIT)

UTILITY EMISSION CONTROL SYSTEM DATA — BASIN ELECTRIC POWER COOP
DATE: 8/13/81 — LARAMIE RIVER 1

FULL LOAD DRY FEED CAPACITY - TPH: 15
PRODUCT QUALITY - % SOLIDS: 35
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
PREPARED REAGENT POINT OF ADDITION: ABSORBER FEED TANK
ON-SITE STORAGE CAPABILITY - DAYS: 90 (3 IN SLURRY TANKS)

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY (B) RECLAIMED WATER (C) SLUDGE
DIMENSIONS - IN.: (A) 12 (B) 3 (C) 3
MANUFACTURER: (B,C) BONDSTRAND
MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) FRP (C) FRP

MAJOR VALVES
LOCATION: PUMP SUCTION AND DISCHARGE
FUNCTION (ISOLATION, CONTROL, ETC.): ISOLATION
TYPE (BALL, GLOBE, PLUG, ETC.): PLUG
CONTROL MODE (AUTOMATIC/MANUAL): AUTOMATIC
DIMENSIONS - IN.: _____
MANUFACTURER: DEZURIK
MATERIAL: RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 3 (UNITS 1 AND 2)
NUMBER OF SPARES: 1
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 110 DIA X 10 DEPTH
CAPACITY - GAL: 1,000,000
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: COAL TAR EPOXY
LINER MATERIAL TRADE/COMMON NAME: _____
RAKE MATERIAL: COAL-TAR EPOXY CLAD CARBON STEEL
FEED STREAM SOURCE: QUENCHER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 650 GPM, 10% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 100 GPM, 30% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 550 GPM, 0.5% SOLIDS
OUTLET STREAM DISPOSITION: TO CENTRIFUGE
OVERFLOW STREAM DISPOSITION: TO RECLAIMED WATER TANK AND THEN TO QUENCHER

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

SOLIDS DEWATERING
- DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): CENTRIFUGE
- DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): SOLID BOWL
- DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): CONTINUOUS
- NUMBER OF DEVICES: 4 (2 PER UNIT)
- NUMBER OF SPARES: 0
- CONFIGURATION: PARALLEL
- DIMENSIONS - FT: 6-8
- CAPACITY: 110 GPM
- SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL
- SHELL MATERIAL SPECIFIC TYPE: TYPE 316
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: NONE
- LINER MATERIAL SPECIFIC TYPE: N/A
- LINER MATERIAL TRADE/COMMON NAME: N/A
- BELT MATERIAL GENERIC TYPE: N/A
- BELT MATERIAL SPECIFIC TYPE: N/A
- BELT MATERIAL TRADE/COMMON NAME: N/A
- FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
- FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35% SOLIDS
- OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 70% SOLIDS
- OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
- OUTLET STREAM DISPOSITION: TO PUG MILL
- OVERFLOW STREAM DISPOSITION: TO CENTRATE TANK AND THEN THICKENER

SLUDGE
- FULL LOAD QUANTITY - TPH/DRY: 4
- MOISTURE CONTENT - % TOTAL FREE WATER: 30
- PERCENT CASO3 - DRY: 8
- PERCENT CASO4 - DRY: 90
- PERCENT CAOH2 - DRY: 0
- PERCENT CACO3 - DRY: 1-2
- PERCENT ASH - DRY: NEGLIGIBLE
- PERCENT OTHER COMPOUNDS - DRY: NEGLIGIBLE

SLUDGE TREATMENT
- METHOD: (A) FORCED OXIDATION (800-1000 ACFM OF AIR PER MODULE)
  (B) FLY ASH BLENDING (3 ASH:1 SLUDGE)
- COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): (A) RECYCLE STREAM (B) BLEED STREAM
- DEVICE (OXIDATION TANK, PUG MILL, ETC.): (A) SPARGER IN QUENCHER (B) PUG MILL
- PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): NONE
- INLET FLOW RATE - GPM: _____
- INLET QUALITY - % SOLIDS: (A) 10 (B) 70

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

SLUDGE DISPOSAL
- NATURE (INTERIM/FINAL): FINAL
- GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
- SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
- COMMON DESIGN (ABANDONED SURFACE MINE, ETC.):
- LOCATION (ON-SITE/OFF-SITE): ON-SITE
- TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): CONVEYOR BELT
- SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): PVC LINING
- SITE DIMENSIONS - AREA/DEPTH: 60-90 FT DEEP (160 ACRES TOTAL FOR DISPOSAL)
- SITE CAPACITY - VOLUME/ACRE-FT/TONS:
- SITE SERVICE LIFE - YEARS: 35 DESIGN (ACTUALLY MORE)

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: ABSORBER FEED AND QUENCHER FEED
- CHEMICAL PARAMETERS (PH, ETC.): PH, $SO_2$ INLET, $SO_2$ OUTLET
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS, GAS FLOW
- CONTROL LEVELS: PH 5.8-6.2 IN ABSORBER; PH 4.5-5.0 IN QUENCHER; 1.08 S.G. IN ABSORBER; 1.05 S.G. IN QUENCHER
- MONITOR TYPE (MANUFACTURER, ETC.): GREAT LAKES (PH); DYNASCIENCE FOR CONTROL ($SO_2$; NOT USED); LEAR-SIEGLER FOR EMISSIONS MONITORING; KAY-RAY (DENSITY)
- MONITOR LOCATION: ABSORBER FEED TANK AND QUENCHER; DENSITY ON PUMP DISCHARGE
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK (PH AND DENSITY)

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
- TYPE (OPEN/CLOSED): CLOSED
- EVAPORATION WATER LOSS - GPM: 370
- SLUDGE HYDRATION WATER LOSS - GPM:
- SLUDGE INTERSTITIAL WATER LOSS - GPM:
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0
- EFFLUENT WATER LOSS - GPM: 0
- RECEIVING WATER STREAM NAME: N/A
- MAKEUP WATER ADDITION - GPM: 400
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING TOWER BLOWDOWN
- MAKEUP WATER ADDITION POINTS & AMOUNTS: ME WASH, PUMP SEALS, AND TOWER MAKEUP
- MAKEUP WATER PRE-TREATMENT TYPE: NONE

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
- PRINCIPAL CONSTITUENTS: 95% $CaCO_3$
- SOURCE/SUPPLIER: HOLLY SUGAR COMPANY
- SUPPLIER LOCATION: WYOMING (WITHIN 40 MILES OF PLANT; DIFFERENT LOCATIONS)
- CONSUMPTION (SPECIFY UNITS): 2000 TONS/MONTH
- UTILIZATION - %: 90-92
- POINT OF ADDITION: BALL MILL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
- CAPITAL COST - $: 23,000,000 (WITHOUT DEWATERING)
- CAPITAL COST - $/KW:
- OPERATING COST - MILLS/KWH:
  - MAINTENANCE COST:
  - LABOR COST:
  - UTILITIES COST:
  - CHEMICALS COST:
  - WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: 25.0
- MIST ELIMINATOR - %: 25.0
- REHEATER - %: N/A
- FAN - %: 0
- BALL MILL - %: 0
- SLAKER - %: N/A
- EFFLUENT HOLD TANK - %: 25.0
- RECIRCULATION PUMP - %: 25.0
- THICKENER - %: 33.3
- VACUUM FILTER - %: N/A
- CENTRIFUGE - %: 0

FGD SPARE COMPONENT INDICES
- SCRUBBER: N/A
- ABSORBER: 1.0
- MIST ELIMINATOR:
- REHEATER: N/A
- FAN:
- BALL MILL:
- SLAKER: N/A
- EFFLUENT HOLD TANK:
- RECIRCULATION PUMP:
- THICKENER:
- VACUUM FILTER: N/A
- CENTRIFUGE:

PILOT PLANT
- UNIT NUMBER: NONE
- PARTICIPANTS:
- PROCESS:
- PLANT DESIGN:
- SUPPLIER:
- SERVICE DATE:
- PERIOD OF OPERATION - MONTHS:
- GAS FEED:
- EQUIVALENT SCRUBBED CAPACITY - MW:
- STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER FEED TANK
NUMBER OF TANKS: 5
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): COVERED
LOCATION: ABSORBER BUILDING
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 30 DIA
CAPACITY - GAL: 200,000
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): QUENCHER FEED TANK
NUMBER OF TANKS: 5
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): N/A
LOCATION: BOTTOM OF TOWER IS TANK
CONFIGURATION: RECTANGULAR WITH ROUNDED BAFFLES
DIMENSIONS - FT: 30 HIGH
CAPACITY - GAL: 100,000
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 2
AGITATOR CONFIGURATION: SIDE MOUNTED (GEOMETRY NOT ADEQUATE)
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: UDDEHOLM 904L WALLS AND HASTELLOY G BOTTOM
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY STORAGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

TYPE (OPEN/COVERED): COVERED
LOCATION: MILL BUILDING
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 25 HIGH
CAPACITY - GAL: 100,000
RETENTION TIME - MIN: N/A
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECLAIM WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: IN DEWATERING BUILDING
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: 300,000
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: WAS PVC; NOW COAL TAR EPOXY
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): CENTRATE
NUMBER OF TANKS: 1 (FOR BOTH UNITS)
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: _____
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: 10,000
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SEAL WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION:
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT:
CAPACITY - GAL: 1500
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA | BASIN ELECTRIC POWER COOP
DATE: 8/13/81 | LARAMIE RIVER 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER FEED
NUMBER OF PUMPS: 10
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: 18 X 36 DG
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 11,688
MOTOR BRAKE HP: 300
SPEED - RPM: 1200
HEAD - FT: 75.6
SERVICE (PH, SOLIDS): PH 5.9, 10% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): QUENCHER FEED
NUMBER OF PUMPS: 5
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: 18 X 36 DG
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 9770
MOTOR BRAKE HP: 300
SPEED - RPM: 1200
HEAD - FT: 66.6
SERVICE (PH, SOLIDS): PH 4.5, 15% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL PRODUCT
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A66
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 200
MOTOR BRAKE HP: 20
SPEED - RPM: 1450
HEAD - FT: 95
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL OR CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL OR CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIMESTONE SLURRY TRANSFER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B66
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 500
MOTOR BRAKE HP: 60
SPEED - RPM: 1250
HEAD - FT: 150
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL OR CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL OR CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MAKEUP WATER SUPPLY
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): VERTICAL TURBINE
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: JOHNSTON
PUMP MODEL NUMBER: 20CC

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 5225
MOTOR BRAKE HP: 500
SPEED - RPM: 1800
HEAD - FT: 290
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECLAIMED WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: C66
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 3000
MOTOR BRAKE HP: 200
SPEED - RPM: 1025
HEAD - FT: 140
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SEAL WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): HORIZONTAL, CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: AURORA
PUMP MODEL NUMBER: 364 A
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 250
MOTOR BRAKE HP: 25
SPEED - RPM: 3600
HEAD - FT: 205

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

SERVICE (PH, SOLIDS): NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER BLOWDOWN (TO THICKENER)
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): VERTICAL SPLIT CASE
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B66
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 510
MOTOR BRAKE HP: 50
SPEED - RPM: 1230
HEAD - FT: 100
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 3 PER UNIT
NUMBER OF SPARES: 1 PER UNIT
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): RUBBER DIAPHRAGM
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): N/A
COMMON DESIGN (V-BELT, ETC.): N/A
MANUFACTURER: DORR-OLIVER
PUMP MODEL NUMBER: 45 ODS
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 152
MOTOR BRAKE HP:
SPEED - RPM:
HEAD - FT: 100
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

IMPELLER MATERIAL GENERIC TYPE:
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): CENTRATE
NUMBER OF PUMPS: 2 (COMMON FOR BOTH UNITS)
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): VERTICAL CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B66
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 500
MOTOR BRAKE HP: 10
SPEED - RPM: 690
HEAD - FT: 25
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): DEWATERING BUILDING SUMP PUMPS
NUMBER OF PUMPS: 2/2 (TWO IN SERIES, 4 TOTAL)
NUMBER OF SPARES: 1/1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): VERTICAL CENTRIFUGAL/VERTICAL CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ALLEN-SHERMAN-HOFF/ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B6V/B6V
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 610/800
MOTOR BRAKE HP: 30/50
SPEED - RPM: 1100/1500
HEAD - FT: 55/80
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/13/81

BASIN ELECTRIC POWER COOP
LARAMIE RIVER 1

COMMENTS/FOOTNOTES

A DOUBLE LOOP COMBINATION TOWER WITH SPRAY TOWER LOWER STAGE AND "WETTED FILM CONTACTOR" GRID TYPE UPPER STAGE (RESEARCH-COTTRELL DESIGN).
B TYPE 316L STAINLESS STEEL TOP AND UDDEHOLM 904L BOTTOM.
C VERTICAL CROSS CHANNEL FIXED GRID PACKING BY MUNTERS.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Basin Electric Power | | | | | | | | |
| Laramie River 1 | 7/80 | 744 | | System | | | | Initial shake-down/commercial operations commenced |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | | | | |
| | 10/80 | 744 | 709 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | C | | 100 | | |
| | | | | D | | 22 | Quencher | Module down for 584 hours for maintenance on welds in the quencher section due to corrosion of the Uddeholm 904L |
| | | | | E | | 100 | | |
| | | | | System | 715 | 100 | | |
| | 11/80 | 720 | 578 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | C | | 100 | | |
| | | | | D | | 2 | Quencher | Down 720 hours for repairs |
| | | | | E | | 100 | | |
| | | | | System | 568 | 100 | | |
| | 12/80 | 744 | 693 | A | | 20 | Quencher | Maintenance on welds due to corrosion of the Uddeholm 904L |
| | | | | B | | 100 | | |
| | | | | C | | 100 | | |
| | | | | D | | 76 | Quencher | Maintenance on welds due to corrosion of the Uddeholm 904L |
| | | | | E | | 100 | | |
| | | | | System | 592 | 100 | | |

BIG RIVERS ELECTRIC

GREEN 1, 2

# SECTION 1

## BACKGROUND

The Green Generating Station of Big Rivers Rural Electric Coop is located in Sebree, Kentucky. Presently, the plant has a gross generating capacity of 484 MW (gross); each boiler, Green 1 and 2, is rated at 242 MW (gross). The units fire a western Kentucky coal with an average sulfur content of 3.75%. At the time the units were being planned, it was determined that full-scale FGD systems would be required for control of $SO_2$ emissions in order to comply with the 1971 Federal NSPS.

In October 1976, American Air Filter was awarded a contract to install a wet lime FGD system at Green 1. The contract between American Air Filter and Big Rivers Electric for an identical system to be installed on Green 2 was awarded also in October 1976. Dravo was contracted to supply magnesium-promoted (thiosorbic) lime for both systems and IU Conversion Systems (IUCS) was contracted to supply the equipment for chemical fixation of the sludge prior to disposal. Initial startup of the Green 1 and 2 FGD systems occurred in December 1979 and November 1980, respectively.

## SECTION 2

## PROCESS DESCRIPTION

The emission control systems at Green 1 and 2 consist of cold-side ESP's for primary particulate matter control followed by wet lime FGD systems for $SO_2$ removal. The FGD systems were supplied by American Air Filter and each system includes two parallel spray tower modules. Each tower is capable of handling 65% of the boiler flue gas flow of 1,000,000 acfm at 300°F.

Following the boiler, the flue gas from each unit is ducted through two parallel ESP's, each designed to remove 99.6% of the inlet particulate matter. From each ESP, the flue gas enters a spray tower absorber module where it is contacted with the lime slurry through six stages of countercurrent spray. The initial spray tower design included a quencher section at the base of each module for flue gas saturation; however, operational problems with the inlet dampers were attributed to slurry spray from the quenchers splashing back on the damper tracks. As a result, the utility valved these sections out of the liquid circuit. All slurry that was recirculated through the quenchers is now recirculated through the absorber sprays.

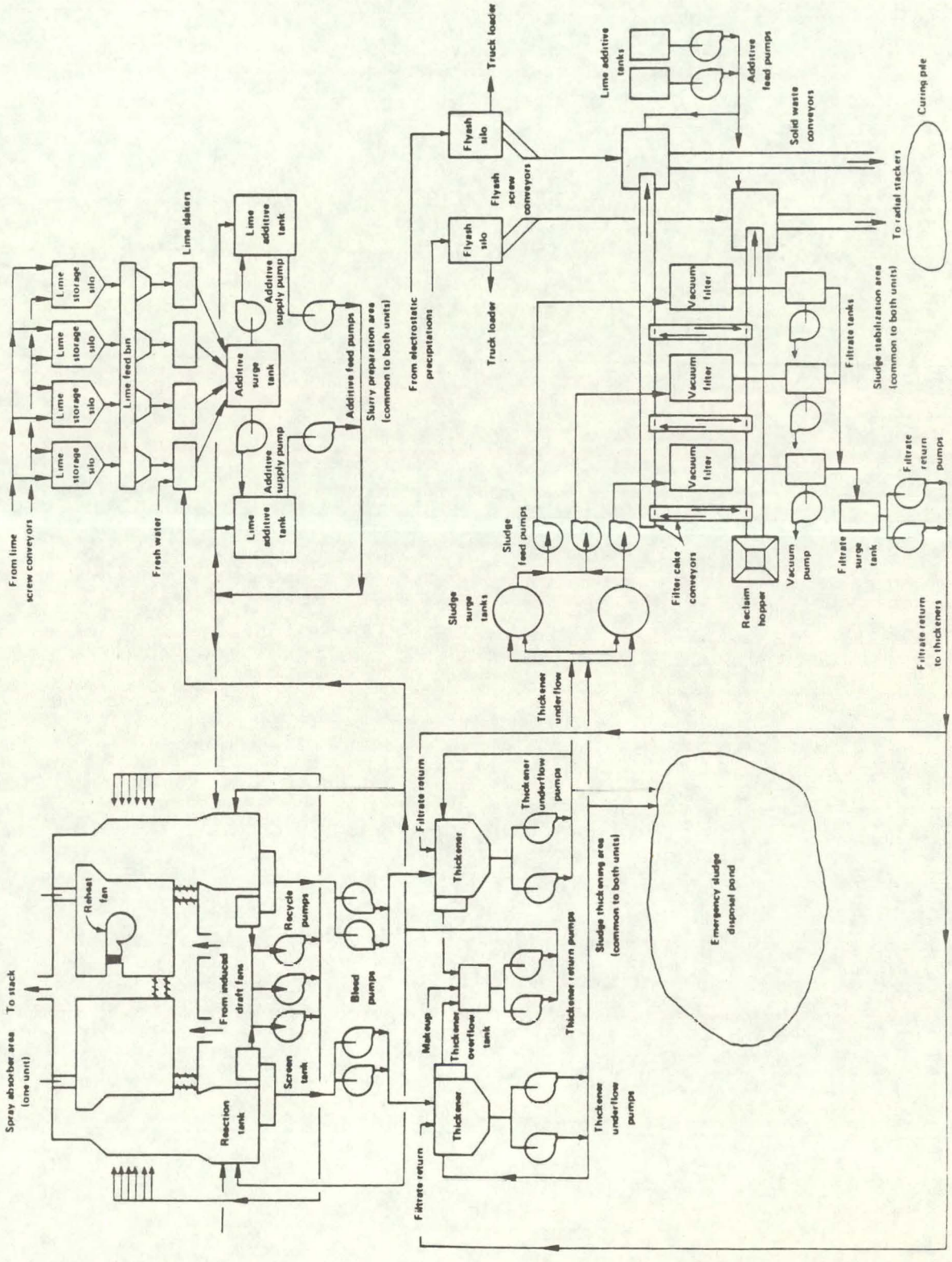
After exiting the spray towers, the saturated gas passes through chevron vane mist eliminators (one per absorber) prior

to entering a common duct into which air from the indirect hot air reheater is injected. The reheater boosts the temperature of the flue gas 25°F before it enters the 350-foot concrete stack.

The sludge from both closed water loop systems is dewatered through the use of two thickeners (per system). Thickener underflow is piped to a common IUCS facility where the sludge is further dewatered through the use of three vacuum filters. The dewatered product is mixed with flyash (collected both at the Green Station and the adjacent Reid Station) and dry lime in a pug mill and then conveyed to a nearby pile. After curing for two to three days, the 77% solids product is trucked to an on-site landfill.

A flow diagram for the Green 1, 2 FGD systems is shown on the next page.

Big Rivers Electric
Green 1,2




Flow Diagram: Green 1 or 2

Big Rivers Electric
Green 1, 2

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

GENERAL PLANT INFORMATION
- COMPANY NAME: BIG RIVERS ELECTRIC CORPORATION
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: GREEN
- UNIT NUMBER: 1
- PLANT ADDRESS: P.O. BOX 145
- CITY: SEBREE
- COUNTY: HENDERSON
- STATE: KENTUCKY
- ZIP CODE: 42455
- EPA REGION: 4
- RIVER BASIN/LAKE REGION: GREEN
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.20
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 444
- GROSS UNIT GENERATING CAPACITY - MW: 242
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 222
- NET UNIT GENERATING CAPACITY W/O FGD - MW: _____
- EQUIVALENT SCRUBBED CAPACITY - MW: 242

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: _____
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): _____
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: _____
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,000,000
- FLUE GAS TEMPERATURE - F: 300
- FLUE GAS OXYGEN - %: _____
- HEAT RATE - BTU/KWH: 10,145 (NET)
- DESIGN FIRING RATE - TPH: 101
- EXCESS AIR - %: _____
- CAPACITY FACTOR - %: _____
- STACK HEIGHT - FT: 350
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: CARBON STEEL
- FLUE MATERIAL SPECIFIC TYPE: _____
- FLUE MATERIAL TRADE/COMMON NAME: N/A
- FLUE LINER MATERIAL GENERIC TYPE: INORGANIC
- FLUE LINER MATERIAL SPECIFIC TYPE: CHEMICALLY-BONDED MORTAR
- FLUE LINER MATERIAL TRADE/COMMON NAME: SAUEREISEN NO. 72
- FLUE INNER DIAMETER - FT: 15.0
- STACK GAS INLET TEMPERATURE - F: _____
- STACK GAS OUTLET VELOCITY - FT/SEC: _____

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: WEBSTER COUNTY COAL CORP./PEABODY COAL
- MINE NAME/AREA: RETIKI MINE, DOTIKI MINE
- MINE LOCATION - COUNTY: WEBSTER, MUHLENBERG, & OHIO
- MINE LOCATION - STATE: KENTUCKY
- AVERAGE HEAT CONTENT - BTU/LB: 9750
- RANGE HEAT CONTENT - BTU/LB: 9000-10,500
- AVERAGE ASH CONTENT - %: 20
- RANGE ASH CONTENT - %: 15-25
- AVERAGE MOISTURE CONTENT - %: 11
- RANGE MOISTURE CONTENT - %: 8-14
- AVERAGE SULFUR CONTENT - %: 3.75
- RANGE SULFUR CONTENT - %: 3.4-4.0
- AVERAGE CHLORIDE CONTENT - %: 0.05
- RANGE CHLORIDE CONTENT - %: _____
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 2
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: AMERICAN AIR FILTER
- INLET FLUE GAS CAPACITY - ACFM: 500,000
- INLET FLUE GAS TEMPERATURE - F: 300
- PRESSURE DROP - IN. H2O: 0.5-2.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.03
- PARTICLE REMOVAL EFFICIENCY - %: 99.6
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME (THIOSORBIC®)
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: AMERICAN AIR FILTER
A-E FIRM: BURNS & ROE
CONSTRUCTION FIRM: AMERICAN AIR FILTER
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.0

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

SO2 DESIGN REMOVAL EFFICIENCY - %: 90.0
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A
A COMMERCIAL START-UP: 12/79
INITIAL START-UP: 12/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 10/76
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 4.0
DESIGN COAL HEAT CONTENT - BTU/LB: 10,000
DESIGN COAL ASH CONTENT - %: 20.0
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: _____
FGD SYSTEM TURNDOWN METHOD: REDUCE BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 3.23
FGD SYSTEM OXIDATION - %: 80
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 6
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
B FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 272
C FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 8
D FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 7
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
E FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 1440
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): SHARED WITH BOILER
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: EVERY 30 DAYS
F TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): SHARED WITH BOILER
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: 48 HOURS MAXIMUM
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: TWO UNIT OUTAGES PER YEAR
G PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): NONE
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): ALL NECESSARY MAINTENANCE
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): NONE

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

QUENCHER/PRESATURATOR
H NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME: N/A
SUPPLIER: AMERICAN AIR FILTER
DIMENSIONS - FT: 34 X 71.5
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: INORGANIC
LINER MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED MORTAR
LINER MATERIAL TRADE/COMMON NAME: PRE-KRETE G-8
BOILER LOAD PER ABSORBER - %: 65
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 6
NOZZLE MATERIAL: _____
NOZZLE PRESSURE DROP - PSI: _____
LIQUID RECIRCULATION RATE - GPM: 20,280
L/G RATIO - GAL/1000 ACF: 41
GAS-SIDE PRESSURE DROP - IN. H2O: 1.5
SUPERFICIAL GAS VELOCITY - FT/SEC: 9.2

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD:
INLET GAS FLOW RATE - ACFM: 500,000
INLET GAS TEMPERATURE - F: 300
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF: 0.03
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %: 90
PARTICLE REMOVAL EFFICIENCY - %:

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 2
NUMBER OF SPARES: 0
LUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER:
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): Z-SHAPE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 6
FREEBOARD DISTANCE - FT: 6
DISTANCE BETWEEN STAGES - IN.: 48
DISTANCE BETWEEN VANES - IN.: 4
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: 0.8-1.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 9.5
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE:
CONSTRUCTION MATERIAL TRADE/COMMON NAME: NORYL®
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): BLENDED
POINT OF WATER COLLECTION: REACTION TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): OVERSPRAY/UNDERSPRAY (FIRST STAGE)
UNDERSPRAY (SECOND STAGE)
WASH FREQUENCY: 20 MINUTE INTERVALS
WASH DURATION: 5 MINUTES
WASH RATE - GAL/MIN: 150
WASH COVERAGE - GAL/MIN/SQ FT:

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

REHEATER
- NUMBER OF REHEATERS: 1
- NUMBER OF SPARES: 0
- NUMBER PER MODULE: N/A
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): INDIRECT HOT AIR
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.): EXTERNAL HEAT EXCHANGER
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): STEAM TUBE BUNDLE
- COMBUSTION FUEL SULFUR CONTENT - %: N/A
- LOCATION: HEATED AIR INJECTED INTO BYPASS DUCT
- AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: NONE
- TEMPERATURE INCREASE - F: 25
- INLET FLUE GAS FLOW RATE - ACFM: _____
- INLET FLUE GAS TEMPERATURE - F: _____
- OUTLET FLUE GAS FLOW RATE - ACFM: _____
- OUTLET FLUE GAS TEMPERATURE - F: _____
- ENERGY REQUIREMENT - MM BTU/HR: _____
- NUMBER OF HEAT EXCHANGER BANKS: 3
- NUMBER OF BUNDLES PER BANK: _____
- NUMBER OF TUBES PER BUNDLE: _____
- STEAM OR WATER PRESSURE - PSIG: _____
- STEAM OR WATER TEMPERATURE - F: _____
- SELF CLEANING DEVICE TYPE: _____
- MATERIAL GENERIC TYPE: _____
- MATERIAL SPECIFIC TYPE: _____
- MATERIAL TRADE/COMMON NAME: _____

FANS
- NUMBER OF FANS: 2
- NUMBER OF SPARES: 0
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
- SUPPLIER: WESTINGHOUSE
- FUNCTION (UNIT/BOOSTER): UNIT
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
- SERVICE (WET/DRY): DRY
- TYPE OF WASH: NONE
- LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND BYPASS DUCT
- FLUE GAS FLOW RATE - ACFM: 582,330
- FLUE GAS TEMPERATURE - F: 300
- PRESSURE DROP - IN. H2O: _____
- MATERIAL GENERIC TYPE: CARBON STEEL
- MATERIAL SPECIFIC TYPE: AISI 1110
- MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
- LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) REHEAT DAMPER (D) BYPASS DAMPER
- NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 1 (D) 1

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) SHUT-OFF (D) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE (C) GUILLOTINE (D) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL BLADE MULTILOUVER (B) TOP ENTRY GUILLOTINE/SEAL AIR (C) TOP ENTRY GUILLOTINE/SEAL AIR (D) PARALLEL BLADE MULTILOUVER
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) DOUBLE LOUVER/SEAL AIR (B) N/A (C) N/A (D) DOUBLE LOUVER/SEAL AIR
MANUFACTURER: _____
MODULATION (OPEN/CLOSED, ETC.): _____
SEAL AIR - ACFM: _____
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: _____
MATERIAL SPECIFIC TYPE: _____
MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

DUCTWORK
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) RECTANGULAR (B) RECTANGULAR (C) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) _____ (B) _____ (C) HIGH STRENGTH LOW ALLOY
SHELL MATERIAL TRADE/COMMON NAME: (A) _____ (B) _____ (C) COR-TEN
LINER MATERIAL GENERIC TYPE: (A) NONE (B) INORGANIC (C) INORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) HYDRAULICALLY-BONDED MORTAR (C) HYDRAULICALLY-BONDED MORTAR
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) PRE-KRETE G-8 (C) PRE-KRETE G-8

EXPANSION JOINTS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) BYPASS
TYPE (METALLIC/ELASTOMERIC): (A) ELASTOMERIC (B) ELASTOMERIC (C) ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): (A) GAS CIRCUIT (B) GAS CIRCUIT (C) GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): (A) POSITIVE (B) POSITIVE (C) POSITIVE
OPERATING TEMPERATURE - F: (A) 300 (B) _____ (C) _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: _____
MATERIAL: ASBESTOS WITH TEFLON® LINER (ALL)

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

REAGENT PREPARATION EQUIPMENT
- FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
- PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
- DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): _____
- MANUFACTURER: WALLACE AND TIERNAN
- MATERIALS: _____
- NUMBER OF DEVICES: 4
- NUMBER OF SPARES: _____
- FULL LOAD DRY FEED CAPACITY - TPH: 4
- PRODUCT QUALITY - % SOLIDS: 22
- FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
- PREPARED REAGENT POINT OF ADDITION: REACTION TANKS
- ON-SITE STORAGE CAPABILITY - DAYS: 30

TANKS
- *SEE ATTACHMENT A

PUMPS
- *SEE ATTACHMENT B

MAJOR PIPING
- FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) ADDITIVE SLURRY TRANSFER (B) ABSORBER RECIRCULATION (C) ABSORBER BLOWDOWN (D) SLUDGE DISPOSAL (E) OTHER RECLAIMED WATER
- DIMENSIONS - IN.: _____
- MANUFACTURER: _____
- MATERIAL: (A) FRP (B) FRP (C) FRP (D) FRP (E) CARBON STEEL

MAJOR VALVES
- LOCATION: (A) ADDITIVE SLURRY TRANSFER (B) ABSORBER RECIRCULATION (C) ABSORBER BLOWDOWN (D) SLUDGE DISPOSAL (E) OTHER RECLAIMED WATER
- FUNCTION (ISOLATION, CONTROL, ETC.): (A) CONTROL/ISOLATION (B) ISOLATION (C) ISOLATION (D) ISOLATION/CONTROL (E) ISOLATION/CONTROL
- TYPE (BALL, GLOBE, PLUG, ETC.): (A) KNIFEGATE/PINCH (B) KNIFEGATE (C) KNIFEGATE (D) KNIFEGATE/PINCH (E) PINCH/_____
- CONTROL MODE (AUTOMATIC/MANUAL): _____
- DIMENSIONS - IN.: _____
- MANUFACTURER: (A) DEZURIK/R.K.L. (B) DEZURIK (C) DEZURIK (D) DEZURIK/_____ (E) _____/_____
- MATERIAL: (A) CARBON STEEL/CAST IRON (B) CARBON STEEL (C) CARBON STEEL (D) _____/CAST IRON (E) _____/CAST IRON

THICKENERS
- NUMBER OF THICKENERS: 2
- NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 125 (DIA) X 15.5 (DEPTH)
CAPACITY - GAL: _____
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____
RAKE MATERIAL: _____
FEED STREAM SOURCE: BLEED PUMP DISCHARGE
FEED STREAM CHARACTERISTICS
(VOLUME FLOW RATE, PERCENT SOLIDS): 547 GPM, 6% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OVERFLOW STREAM CHARACTERISTICS
(VOLUME FLOW RATE, PERCENT SOLIDS): 25% SOLIDS
OUTLET STREAM DISPOSITION: TO VACUUM FILTERS
OVERFLOW STREAM DISPOSITION: THICKENER RETURN WATER TANK

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): DRUM
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): ROTARY DRUM
NUMBER OF DEVICES: 3
NUMBER OF SPARES: 1
CONFIGURATION: _____
DIMENSIONS - FT: 12 (DIA) X 20 (LONG)
CAPACITY: 20 TPH (291 GPM @ 25-30% SOLIDS)
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____
BELT MATERIAL GENERIC TYPE: ORGANIC
BELT MATERIAL SPECIFIC TYPE: POLYPROPYLENE
BELT MATERIAL TRADE/COMMON NAME: _____
FEED STREAM SOURCE (ABSORBER BLEED,
THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 25% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 45% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM DISPOSITION: PUG MILL
OVERFLOW STREAM DISPOSITION: _____

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: _____
MOISTURE CONTENT - % TOTAL FREE WATER: _____

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

PERCENT CASO3 - DRY: _____
PERCENT CASO4 - DRY: _____
PERCENT CAOH2 - DRY: _____
PERCENT CACO3 - DRY: _____
PERCENT ASH - DRY: _____
PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
METHOD: SLUDGE STABILIZATION
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): BLEED STREAM
DEVICE (OXIDATION TANK, PUG MILL, ETC.): PUG MILL
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS (POZ-O-TEC)
INLET FLOW RATE - GPM: _____
INLET QUALITY - % SOLIDS: 25

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): _____
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): N/A
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): TRUCK
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): _____
SITE DIMENSIONS - AREA/DEPTH: 200 ACRES
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: _____

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: (A) ABSORBER RECYCLE (B) ABSORBER OUTLET GAS STREAM
CHEMICAL PARAMETERS (PH, ETC.): (A) PH (B) OUTLET $SO_2$
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): (A) % SOLIDS
(B) _____
CONTROL LEVELS: (A) PH 9, 6% SOLIDS (B) _____
MONITOR TYPE (MANUFACTURER, ETC.): (A) LEEDS & NORTHRUP/TEXAS NUCLEAR
(B) DUPONT/LEAR SIEGLER
MONITOR LOCATION: (A) SCREEN TANKS (B) _____
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): _____
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): (A) FEEDBACK (B) FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM: _____
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: _____
RECEIVING WATER STREAM NAME: _____
MAKEUP WATER ADDITION - GPM: _____

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

SOURCE OF MAKEUP WATER (RIVER WATER, ETC.):
MAKEUP WATER ADDITION POINTS & AMOUNTS:
MAKEUP WATER PRE-TREATMENT TYPE:

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME (THIOSORBIC)
PRINCIPAL CONSTITUENTS: 92% CaO, 2-6% INERTS, 2-6% MgO
SOURCE/SUPPLIER:
SUPPLIER LOCATION:
CONSUMPTION (SPECIFY UNITS):
UTILIZATION - %:
POINT OF ADDITION: SLAKER

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $:
CAPITAL COST - $/KW: 43.2
OPERATING COST - MILLS/KWH:
MAINTENANCE COST:
LABOR COST:
UTILITIES COST:
CHEMICALS COST:
WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %: 30
MIST ELIMINATOR - %: 0
REHEATER - %: 0
FAN - %: 0
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: 0
VACUUM FILTER - %: 33
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER: 0.4
MIST ELIMINATOR: 0
REHEATER: 0
FAN: 0
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: 0

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 1

VACUUM FILTER: 1
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REACTION
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: BOTTOM OF ABSORBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 44 DIA X 29
CAPACITY - GAL: 200,000
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP-ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SCREEN
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: TO SIDE OF REACTION TANKS
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD,
SCRUBBER RECYCLE, ETC.): THICKENER RETURN WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 1

DIMENSIONS - FT: 12 DIA X 12
CAPACITY - GAL: 10,000
RETENTION TIME - MIN: 3
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MIST ELIMINATOR WASH TANK
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ADDITIVE HOLD
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 30 DIA X 40
CAPACITY - GAL: 200,000
RETENTION TIME - MIN: 1440
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 1

SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ADDITIVE SURGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: GH-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 21,000
MOTOR BRAKE HP: 800
SPEED - RPM: 490
HEAD - FT: 80
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE SLURRY BLEED
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: 30
SPEED - RPM: 900
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 1

NUMBER OF PUMPS: 4
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-B-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 2721
MOTOR BRAKE HP: 15
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): 20-35% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE FEED
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 400
MOTOR BRAKE HP: 25
SPEED - RPM: _____
HEAD - FT: 90
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER RETURN
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 1

MANUFACTURER: INGERSOL-RAND
PUMP MODEL NUMBER: 8 X 11 SC
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 1800
MOTOR BRAKE HP: 50
SPEED - RPM: 1750
HEAD - FT: 80
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLUDGE FEED
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: FRANE 2 SRL
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 210
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: 140
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

0

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE SUPPLY
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 200
MOTOR BRAKE HP: 20

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 1

SPEED - RPM: _____
HEAD - FT: 90
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 1

COMMENTS/FOOTNOTES

A COMMERCIAL BY UTILITY DEFINITION; COMPLIANCE TEST HAS NOT BEEN PERFORMED.

B FOR BOTH UNITS 1 AND 2.

C EIGHT OPERATORS FOR BOTH UNITS 1 AND 2 BROKEN DOWN AS FOLLOWS:

1 - SUPERINTENDENT
1 - SUPERVISOR
2 - AUXILIARY
2 - UTILITIES
1 - SOLID WASTE
1 - UTILITY SOLID WASTE

THE OPERATORS ARE ON DUTY THREE SHIFTS A DAY AND SEVEN DAYS A WEEK. ON THE DAY SHIFT THERE IS AN EXTRA AUXILIARY AND UTILITY OPERATOR.

D ON THE AVERAGE, SEVEN MAINTENANCE PERSONNEL PERFORM FGD SYSTEM MAINTENANCE ON BOTH UNITS 1 AND 2 DURING THE DAY SHIFT, FIVE DAYS A WEEK. THESE MEN ROTATE TO BOILER MAINTENANCE EVERY 30 DAYS. THERE IS ONE MAINTENANCE SHIFT AT NIGHT CONSISTING OF TWO MEN THAT ARE AVAILABLE FOR FGD MAINTENANCE IF NEEDED; HOWEVER, MOST FGD MAINTENANCE IS PERFORMED DURING THE DAY SHIFT ONLY.

E GENERALLY 5-6 MEN PER UNIT OUTAGE (TWICE A YEAR AT 3 WEEKS EACH) FOR BOTH UNITS.

F THERE IS ONE MAINTENANCE SUPERVISOR THAT ROTATES TO BOILER DUTY WITH THE MAINTENANCE PERSONNEL.

G ALTHOUGH THE SYSTEMS WERE DESIGNED TO ALLOW MAINTENANCE DURING REDUCED BOILER LOAD (ON ONE MODULE), THE DAMPERS DO NOT SEAL WELL ENOUGH TO ALLOW THIS.

H THE INITIAL SYSTEM DESIGN INCLUDED A QUENCHER SECTION AT THE BASE OF EACH TOWER, BUT THESE HAVE BEEN VALVED OUT.

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

GENERAL PLANT INFORMATION
- COMPANY NAME: BIG RIVERS ELECTRIC CORPORATION
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: GREEN
- UNIT NUMBER: 2
- PLANT ADDRESS: P.O. BOX 145
- CITY: SEBREE
- COUNTY: HENDERSON
- STATE: KENTUCKY
- ZIP CODE: 42455
- EPA REGION: 4
- RIVER BASIN/LAKE REGION: GREEN
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.20
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 444
- GROSS UNIT GENERATING CAPACITY - MW: 242
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 222
- NET UNIT GENERATING CAPACITY W/O FGD - MW: _____
- EQUIVALENT SCRUBBED CAPACITY - MW: 242

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: _____
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): _____
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: _____
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,000,000
- FLUE GAS TEMPERATURE - F: 300
- FLUE GAS OXYGEN - %: _____
- HEAT RATE - BTU/KWH: 10,145 (NET)
- DESIGN FIRING RATE - TPH: 101
- EXCESS AIR - %: _____
- CAPACITY FACTOR - %: _____
- STACK HEIGHT - FT: 350
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: CARBON STEEL
- FLUE MATERIAL SPECIFIC TYPE: _____
- FLUE MATERIAL TRADE/COMMON NAME: N/A
- FLUE LINER MATERIAL GENERIC TYPE: INORGANIC
- FLUE LINER MATERIAL SPECIFIC TYPE: CHEMICALLY-BONDED MORTAR
- FLUE LINER MATERIAL TRADE/COMMON NAME: SAUEREISEN NO. 72
- FLUE INNER DIAMETER - FT: 15.0
- STACK GAS INLET TEMPERATURE - F: _____
- STACK GAS OUTLET VELOCITY - FT/SEC: _____

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: WEBSTER COUNTY COAL CORP./PEABODY COAL
- MINE NAME/AREA: RETIKI MINE, DOTIKI MINE
- MINE LOCATION - COUNTY: WEBSTER, MUHLENBERG, & OHIO
- MINE LOCATION - STATE: KENTUCKY
- AVERAGE HEAT CONTENT - BTU/LB: 9750
- RANGE HEAT CONTENT - BTU/LB: 9000-10,500
- AVERAGE ASH CONTENT - %: 20
- RANGE ASH CONTENT - %: 15-25
- AVERAGE MOISTURE CONTENT - %: 11
- RANGE MOISTURE CONTENT - %: 8-14
- AVERAGE SULFUR CONTENT - %: 3.75
- RANGE SULFUR CONTENT - %: 3.4-4.0
- AVERAGE CHLORIDE CONTENT - %: 0.05
- RANGE CHLORIDE CONTENT - %: _____
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): AVERAGE
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 2
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: AMERICAN AIR FILTER
- INLET FLUE GAS CAPACITY - ACFM: 500,000
- INLET FLUE GAS TEMPERATURE - F: 300
- PRESSURE DROP - IN. H2O: 0.5-2.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.03
- PARTICLE REMOVAL EFFICIENCY - %: 99.6
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME (THIOSORBIC®)
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: AMERICAN AIR FILTER
A-E FIRM: BURNS & ROE
CONSTRUCTION FIRM: AMERICAN AIR FILTER
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.0

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 2

SO2 DESIGN REMOVAL EFFICIENCY - %: 90.0
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A
A COMMERCIAL START-UP: 12/80
INITIAL START-UP: 11/80
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 10/76
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 4.0
DESIGN COAL HEAT CONTENT - BTU/LB: 10,000
DESIGN COAL ASH CONTENT - %: 20.0
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: _____
FGD SYSTEM TURNDOWN METHOD: REDUCE BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 3.23
FGD SYSTEM OXIDATION - %: 80
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 6
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
B FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 272
C FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 8
D FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 7
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
E FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 1440
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): SHARED WITH BOILER
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL
ROTATION TO FGD SYSTEM: EVERY 30 DAYS
F TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): SHARED WITH BOILER
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: 48 HOURS MAXIMUM
TIME SCHEDULE FOR REDUCED BOILER LOAD: NONE
TIME SCHEDULE FOR BOILER SHUTDOWNS: TWO UNIT OUTAGES PER YEAR
G PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): NONE
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): ALL NECESSARY MAINTENANCE
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): NONE

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

QUENCHER/PRESATURATOR
H NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME: N/A
SUPPLIER: AMERICAN AIR FILTER
DIMENSIONS - FT: 34 X 71.5
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: INORGANIC
LINER MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED MORTAR
LINER MATERIAL TRADE/COMMON NAME: PRE-KRETE G-8
BOILER LOAD PER ABSORBER - %: 65
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 6
NOZZLE MATERIAL: _____
NOZZLE PRESSURE DROP - PSI: _____
LIQUID RECIRCULATION RATE - GPM: 20,280
L/G RATIO - GAL/1000 ACF: 41
GAS-SIDE PRESSURE DROP - IN. H2O: 1.5
SUPERFICIAL GAS VELOCITY - FT/SEC: 9.2

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD:
INLET GAS FLOW RATE - ACFM: 500,000
INLET GAS TEMPERATURE - F: 300
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF: 0.03
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %: 90
PARTICLE REMOVAL EFFICIENCY - %:

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 2
NUMBER OF SPARES: 0
NUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER:
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): Z-SHAPE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 6
FREEBOARD DISTANCE - FT: 6
DISTANCE BETWEEN STAGES - IN.: 48
DISTANCE BETWEEN VANES - IN.: 4
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: 0.8-1.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 9.5
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE:
CONSTRUCTION MATERIAL TRADE/COMMON NAME: NORYL®
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): BLENDED
POINT OF WATER COLLECTION: REACTION TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY,
FRONTSPRAY/BACKSPRAY): OVERSPRAY/UNDERSPRAY (FIRST STAGE)
UNDERSPRAY (SECOND STAGE)
WASH FREQUENCY: 20 MINUTE INTERVALS
WASH DURATION: 5 MINUTES
WASH RATE - GAL/MIN: 150
WASH COVERAGE - GAL/MIN/SQ FT:

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

REHEATER
- NUMBER OF REHEATERS: 1
- NUMBER OF SPARES: 0
- NUMBER PER MODULE: N/A
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): INDIRECT HOT AIR
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.): EXTERNAL HEAT EXCHANGER
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): STEAM TUBE BUNDLE
- COMBUSTION FUEL SULFUR CONTENT - %: N/A
- LOCATION: HEATED AIR INJECTED INTO BYPASS DUCT
- AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: NONE
- TEMPERATURE INCREASE - F: 25
- INLET FLUE GAS FLOW RATE - ACFM: _____
- INLET FLUE GAS TEMPERATURE - F: _____
- OUTLET FLUE GAS FLOW RATE - ACFM: _____
- OUTLET FLUE GAS TEMPERATURE - F: _____
- ENERGY REQUIREMENT - MM BTU/HR: _____
- NUMBER OF HEAT EXCHANGER BANKS: 3
- NUMBER OF BUNDLES PER BANK: _____
- NUMBER OF TUBES PER BUNDLE: _____
- STEAM OR WATER PRESSURE - PSIG: _____
- STEAM OR WATER TEMPERATURE - F: _____
- SELF CLEANING DEVICE TYPE: _____
- MATERIAL GENERIC TYPE: _____
- MATERIAL SPECIFIC TYPE: _____
- MATERIAL TRADE/COMMON NAME: _____

FANS
- NUMBER OF FANS: 2
- NUMBER OF SPARES: 0
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
- SUPPLIER: WESTINGHOUSE
- FUNCTION (UNIT/BOOSTER): UNIT
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
- SERVICE (WET/DRY): DRY
- TYPE OF WASH: NONE
- LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND BYPASS DUCT
- FLUE GAS FLOW RATE - ACFM: 582,330
- FLUE GAS TEMPERATURE - F: 300
- PRESSURE DROP - IN. H2O: _____
- MATERIAL GENERIC TYPE: CARBON STEEL
- MATERIAL SPECIFIC TYPE: AISI 1110
- MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
- LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) REHEAT DAMPER (D) BYPASS DAMPER
- NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 1 (D) 1

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) SHUT-OFF (D) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE (C) GUILLOTINE (D) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL BLADE MULTILOUVER (B) TOP ENTRY GUILLOTINE/SEAL AIR (C) TOP ENTRY GUILLOTINE/SEAL AIR (D) PARALLEL BLADE MULTILOUVER
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) DOUBLE LOUVER/SEAL AIR (B) N/A (C) N/A (D) DOUBLE LOUVER/SEAL AIR
MANUFACTURER: _____
MODULATION (OPEN/CLOSED, ETC.): _____
SEAL AIR - ACFM: _____
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: _____
MATERIAL SPECIFIC TYPE: _____
MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

DUCTWORK
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) RECTANGULAR (B) RECTANGULAR (C) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL (C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) _____ (B) _____ (C) HIGH STRENGTH LOW ALLOY
SHELL MATERIAL TRADE/COMMON NAME: (A) _____ (B) _____ (C) COR-TEN
LINER MATERIAL GENERIC TYPE: (A) NONE (B) INORGANIC (C) INORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) HYDRAULICALLY-BONDED MORTAR (C) HYDRAULICALLY-BONDED MORTAR
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) PRE-KRETE G-8 (C) PRE-KRETE G-8

EXPANSION JOINTS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) BYPASS
TYPE (METALLIC/ELASTOMERIC): (A) ELASTOMERIC (B) ELASTOMERIC (C) ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): (A) GAS CIRCUIT (B) GAS CIRCUIT (C) GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): (A) POSITIVE (B) POSITIVE (C) POSITIVE
OPERATING TEMPERATURE - F: (A) 300 (B) _____ (C) _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: _____
MATERIAL: ASBESTOS WITH TEFLON® LINER (ALL)

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

REAGENT PREPARATION EQUIPMENT
- FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
- PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
- DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): _____
- MANUFACTURER: WALLACE AND TIERNAN
- MATERIALS: _____
- NUMBER OF DEVICES: 4
- NUMBER OF SPARES: _____
- FULL LOAD DRY FEED CAPACITY - TPH: 4
- PRODUCT QUALITY - % SOLIDS: 22
- FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
- PREPARED REAGENT POINT OF ADDITION: REACTION TANKS
- ON-SITE STORAGE CAPABILITY - DAYS: 30

TANKS
- *SEE ATTACHMENT A

PUMPS
- *SEE ATTACHMENT B

MAJOR PIPING
- FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) ADDITIVE SLURRY TRANSFER (B) ABSORBER RECIRCULATION (C) ABSORBER BLOWDOWN (D) SLUDGE DISPOSAL (E) OTHER RECLAIMED WATER
- DIMENSIONS - IN.: _____
- MANUFACTURER: _____
- MATERIAL: (A) FRP (B) FRP (C) FRP (D) FRP (E) CARBON STEEL

MAJOR VALVES
- LOCATION: (A) ADDITIVE SLURRY TRANSFER (B) ABSORBER RECIRCULATION (C) ABSORBER BLOWDOWN (D) SLUDGE DISPOSAL (E) OTHER RECLAIMED WATER
- FUNCTION (ISOLATION, CONTROL, ETC.): (A) CONTROL/ISOLATION (B) ISOLATION (C) ISOLATION (D) ISOLATION/CONTROL (E) ISOLATION/CONTROL
- TYPE (BALL, GLOBE, PLUG, ETC.): (A) KNIFEGATE/PINCH (B) KNIFEGATE (C) KNIFEGATE (D) KNIFEGATE/PINCH (E) PINCH/_____
- CONTROL MODE (AUTOMATIC/MANUAL): _____
- DIMENSIONS - IN.: _____
- MANUFACTURER: (A) DEZURIK/R.K.L. (B) DEZURIK (C) DEZURIK (D) DEZURIK/_____ (E) _____/_____
- MATERIAL: (A) CARBON STEEL/CAST IRON (B) CARBON STEEL (C) CARBON STEEL (D) _____/CAST IRON (E) _____/CAST IRON

THICKENERS
- NUMBER OF THICKENERS: 2
- NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 125 (DIA) X 15.5 (DEPTH)
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE: CONCRETE
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE: BLEED PUMP DISCHARGE
FEED STREAM CHARACTERISTICS
(VOLUME FLOW RATE, PERCENT SOLIDS): 547 GPM, 6% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS
(VOLUME FLOW RATE, PERCENT SOLIDS): 25% SOLIDS
OUTLET STREAM DISPOSITION: TO VACUUM FILTERS
OVERFLOW STREAM DISPOSITION: THICKENER RETURN WATER TANK

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): DRUM
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): ROTARY DRUM
NUMBER OF DEVICES: 3
NUMBER OF SPARES: 1
CONFIGURATION:
DIMENSIONS - FT: 12 (DIA) X 20 (LONG)
CAPACITY: 20 TPH (291 GPM @ 25-30% SOLIDS)
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE: ORGANIC
BELT MATERIAL SPECIFIC TYPE: POLYPROPYLENE
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED,
THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 25% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 45% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION: PUG MILL
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER:

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY:
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: SLUDGE STABILIZATION
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): BLEED STREAM
DEVICE (OXIDATION TANK, PUG MILL, ETC.): PUG MILL
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS (POZ-O-TEC)
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS: 25

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.):
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): N/A
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): TRUCK
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.):
SITE DIMENSIONS - AREA/DEPTH: 200 ACRES
SITE CAPACITY - VOLUME/ACRE-FT/TONS:
SITE SERVICE LIFE - YEARS:

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: (A) ABSORBER RECYCLE (B) ABSORBER OUTLET GAS STREAM
CHEMICAL PARAMETERS (PH, ETC.): (A) PH (B) OUTLET $SO_2$
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): (A) % SOLIDS (B)
CONTROL LEVELS: (A) PH 9, 6% SOLIDS (B)
MONITOR TYPE (MANUFACTURER, ETC.): (A) LEEDS & NORTHRUP/TEXAS NUCLEAR (B) DUPONT/LEAR SIEGLER
MONITOR LOCATION: (A) SCREEN TANKS (B)
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL):
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): (A) FEEDBACK (B) FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM:
SLUDGE HYDRATION WATER LOSS - GPM:
SLUDGE INTERSTITIAL WATER LOSS - GPM:
POND SEEPAGE/RUNOFF WATER LOSS - GPM:
EFFLUENT WATER LOSS - GPM:
RECEIVING WATER STREAM NAME:
MAKEUP WATER ADDITION - GPM:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 2

SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
MAKEUP WATER ADDITION POINTS & AMOUNTS: _____
MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME (THIOSORBIC)
PRINCIPAL CONSTITUENTS: 92% CaO, 2-6% INERTS, 2-6% MgO
SOURCE/SUPPLIER: _____
SUPPLIER LOCATION: _____
CONSUMPTION (SPECIFY UNITS): _____
UTILIZATION - %: _____
POINT OF ADDITION: SLAKER

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: _____
CAPITAL COST - $/KW: 43.2
OPERATING COST - MILLS/KWH: _____
MAINTENANCE COST: _____
LABOR COST: _____
UTILITIES COST: _____
CHEMICALS COST: _____
WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %: 30
MIST ELIMINATOR - %: 0
REHEATER - %: 0
FAN - %: 0
BALL MILL - %: N/A
SLAKER - %: _____
EFFLUENT HOLD TANK - %: _____
RECIRCULATION PUMP - %: _____
THICKENER - %: 0
VACUUM FILTER - %: 33
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER: 0.4
MIST ELIMINATOR: 0
REHEATER: 0
FAN: 0
BALL MILL: N/A
SLAKER: _____
EFFLUENT HOLD TANK: _____
RECIRCULATION PUMP: _____
THICKENER: 0

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 2

VACUUM FILTER: 1
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REACTION
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: BOTTOM OF ABSORBERS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 44 DIA X 29
CAPACITY - GAL: 200,000
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP-ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SCREEN
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: TO SIDE OF REACTION TANKS
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD,
SCRUBBER RECYCLE, ETC.): THICKENER RETURN WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

DIMENSIONS - FT: 12 DIA X 12
CAPACITY - GAL: 10,000
RETENTION TIME - MIN: 3
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MIST ELIMINATOR WASH TANK
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ADDITIVE HOLD
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: _____
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 30 DIA X 40
CAPACITY - GAL: 200,000
RETENTION TIME - MIN: 1440
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 2

SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ADDITIVE SURGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION:
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 — GREEN 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: GH-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 21,000
MOTOR BRAKE HP: 800
SPEED - RPM: 490
HEAD - FT: 80
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE SLURRY BLEED
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: _____
MOTOR BRAKE HP: 30
SPEED - RPM: 900
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

NUMBER OF PUMPS: 4
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-B-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 2721
MOTOR BRAKE HP: 15
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): 20-35% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE FEED
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 400
MOTOR BRAKE HP: 25
SPEED - RPM: _____
HEAD - FT: 90
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER RETURN
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

MANUFACTURER: INGERSOL-RAND
PUMP MODEL NUMBER: 8 X 11 SC
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 1800
MOTOR BRAKE HP: 50
SPEED - RPM: 1750
HEAD - FT: 80
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLUDGE FEED
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: JOY/DENVER
PUMP MODEL NUMBER: FRANE 2 SRL
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 210
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: 140
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: ORGANIC
IMPELLER MATERIAL SPECIFIC TYPE: PLASTIC
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ADDITIVE SUPPLY
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 200
MOTOR BRAKE HP: 20

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/1/81 AND 7/8/81

BIG RIVERS ELECTRIC
GREEN 2

SPEED - RPM: _____
HEAD - FT: 90
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: CAST IRON
CASING MATERIAL SPECIFIC TYPE: GREY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA BIG RIVERS ELECTRIC
DATE: 7/1/81 AND 7/8/81 GREEN 2

COMMENTS/FOOTNOTES

A COMMERCIAL BY UTILITY DEFINITION; COMPLIANCE TEST HAS NOT BEEN PERFORMED.

B FOR BOTH UNITS 1 AND 2.

C EIGHT OPERATORS FOR BOTH UNITS 1 AND 2 BROKEN DOWN AS FOLLOWS:

1 - SUPERINTENDENT
1 - SUPERVISOR
2 - AUXILIARY
2 - UTILITIES
1 - SOLID WASTE
1 - UTILITY SOLID WASTE

THE OPERATORS ARE ON DUTY THREE SHIFTS A DAY AND SEVEN DAYS A WEEK. ON THE DAY SHIFT THERE IS AN EXTRA AUXILIARY AND UTILITY OPERATOR.

D ON THE AVERAGE, SEVEN MAINTENANCE PERSONNEL PERFORM FGD SYSTEM MAINTENANCE ON BOTH UNITS 1 AND 2 DURING THE DAY SHIFT, FIVE DAYS A WEEK. THESE MEN ROTATE TO BOILER MAINTENANCE EVERY 30 DAYS. THERE IS ONE MAINTENANCE SHIFT AT NIGHT CONSISTING OF TWO MEN THAT ARE AVAILABLE FOR FGD MAINTENANCE IF NEEDED; HOWEVER, MOST FGD MAINTENANCE IS PERFORMED DURING THE DAY SHIFT ONLY.

E GENERALLY 5-6 MEN PER UNIT OUTAGE (TWICE A YEAR AT 3 WEEKS EACH) FOR BOTH UNITS.

F THERE IS ONE MAINTENANCE SUPERVISOR THAT ROTATES TO BOILER DUTY WITH THE MAINTENANCE PERSONNEL.

G ALTHOUGH THE SYSTEMS WERE DESIGNED TO ALLOW MAINTENANCE DURING REDUCED BOILER LOAD (ON ONE MODULE), THE DAMPERS DO NOT SEAL WELL ENOUGH TO ALLOW THIS.

H THE INITIAL SYSTEM DESIGN INCLUDED A QUENCHER SECTION AT THE BASE OF EACH TOWER, BUT THESE HAVE BEEN VALVED OUT.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Big Rivers Electric Green 1 Commercial start-up | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 744 | | System | | | | |
| | 4/80 | 720 | 576 | System | 324 | 65 | Instrumentation | Specific problem was not reported |
| | | | | | | | ESP | Tripped |
| | | | | | | | Reagent feed | Low on lime in holding tanks (cause was not reported) |
| | 5/80 | 744 | 720 | System | 548 | 74 | Instrumentation | Specific problem was not reported |
| | | | | | | | Reagent feed | Low level in additive tank (cause was not reported) |
| | | | | | | | Waste disposal | Specific problem was not reported |
| | | | | | | | Modules | Solids in carryover |
| | 6/80 | 720 | | System | | | | |
| | 7/80 | 744 | | System | | | | |
| | 8/80 | 744 | | System | | | | |
| | 9/80 | 720 | | System | 293 | | | |
| | 10/80 | 744 | | System | 304 | 80 | Instrumentation | Control system malfunction |
| | 11/80 | 720 | | System | 691 | 98 | Piping | Leaks in Module A bleed line |
| | 12/80 | 744 | | System | 695 | 98 | Piping | Leaks in mist eliminator wash lines |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Big Rivers Electric Green 2 | 11/80 | 720 | | System | 661 | 94 | | System is in the startup phase of operation |
| | | | | | | | Thickener | Rake problems |
| | | | | | | | Piping | Plugging of additive feed line |
| Commercial start-up | 12/80 | 744 | | System | 194 | 96 | Dampers | Malfunction of bypass dampers |

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

CENTRAL ILLINOIS LIGHT

DUCK CREEK 1

# SECTION 1

## BACKGROUND

The Duck Creek Generating Station is owned and operated by Central Illinois Light Company. The plant is situated in an unreclaimed strip mining area near Canton, Illinois. Duck Creek 1 is a pulverized-coal unit with a generating capacity of 416 MW (gross). The unit was constructed in the early 1970's and was required to meet the 1971 Federal NSPS. Low-sulfur western coal was considered as an alternative means of compliance, but initial cost estimates indicated that burning high sulfur coal (from nearby mines) in conjunction with FGD would be more economical. As a result, a contract was awarded to Riley Stoker/Environeering (Riley Stoker supplied the boiler) to supply a limestone slurry FGD system for $SO_2$ control. Primary particulate matter control is provided by two parallel cold-side ESP's supplied by Pollution Control-Walther (now Combustion Engineering/Walther).

Duck Creek 1 has been operating since June 1976. The utility originally planned to install only one 25% capacity absorber module to conduct a high sulfur coal test program. The data obtained was to have been used to design the remaining system. Approval of this plan, which was originally granted at the state level, was later revoked by the U.S. EPA, which required the entire plant to comply with the 1971 Federal NSPS.

A consent decree granted CILCo by the EPA gave the utility a variance to burn high sulfur coal from July 1, 1976, to April 1, 1977. During this period, one absorber module (completed by June 1976) remained in the gas path and removed $SO_2$ from 25% of the boiler flue gas. The timetable for the installation of the remaining modules was accelerated to August 1978. During the interim period between the end of the variance and the completion of the remaining modules, low sulfur Colorado coal was burned in the boiler in order to comply with standards.

The first absorber module was placed in service on July 1, 1976, and operated intermittently throughout the remainder of the year and for approximately one month in early 1977. A number of problems, including plugging, scaling, corrosion, and materials failure, were encountered during this period. As a result of this initial operating experience, CILCo and Riley Stoker/Environeering made some design changes to both the existing and planned absorber modules during the April 1977 to August 1978 period when low sulfur (0.7% S) coal was burned. On July 23, 1978, the three remaining absorber modules were completed and all four modules were placed in the gas path for treatment of high sulfur coal flue gas.

Since initial operation of all four absorber modules in an integrated mode, several design modifications have been made. The original stack design included four collection hoppers near the base for the collection of entrained moisture droplets. During the months of July and August, 1979, the four hoppers

were replaced with a single collection vessel that is equipped with a spray wash system that continually flushes the hopper walls with pond return water to prevent solids accumulation and plugging. All liquid collected in the hopper drains to a sump pit prior to being pumped to the disposal pond.

In March and April, 1981 the mist eliminator wash system was modified. The original configuration consisted of fresh water sprays on the second stages which was collected in a wash-down tank and reused on the first stage. As such, the system included separate mist eliminator wash pumps. These pumps are no longer in use. The modified system utilizes pond return water for mist eliminator wash and includes an overspray/underspray configuration on both stages. The mist eliminators are washed for 5 minutes every 20 minutes and the water is collected in the recycle tank and utilized as makeup to balance the closed water loop operation.

Currently, the utility has plans for the addition of a second disposal pond as a result of filling the initial pond more quickly than expected. When completed, the new pond will receive overflow from the old pond and supernatant will be returned to the FGD system from the new pond. The utility is also considering the installation of a forced oxidation sludge treatment facility.

## SECTION 2

## PROCESS DESCRIPTION

The emission control system installed at the Duck Creek station consists of cold-side ESP's for primary particulate matter control and a wet limestone FGD system for $SO_2$ control.

Flue gas exits the boiler and passes through half-size air preheaters. The flue gas (1,520,000 acfm maximum at 275°F) then enters two ESP's connected in parallel; each ESP treats 50% of the total gas flow and is designed to remove 99.8% of inlet particulates. The gas is discharged from the ESP's and enters a common manifold supplying four unit induced-draft fans. These ID fans overcome draft loss in the boiler as well as in the ESP's and FGD system. They are connected in parallel to a common duct that distributes the flue gas to the FGD system or to the bypass duct.

The FGD system is equipped with a complex network of ducts and dampers that allow part or all of the flue gas to bypass any or all of the absorber modules during outages or emergencies. A breeching section, which can accomodate any or all of the boiler flue gas, consists of a straight duct that extends from the ID fan discharge manifold to the base of the stack. Flue gas enters and exits the FGD system via a common inlet and discharge duct, which routes gas to and from the four absorber modules.

The common inlet and discharge duct exits the bypass breeching downstream of the common ID fan discharge duct and enters upstream of the stack entry point. During partial or full load bypass situations, the flue gas can pass directly from the ID fans to the stack.

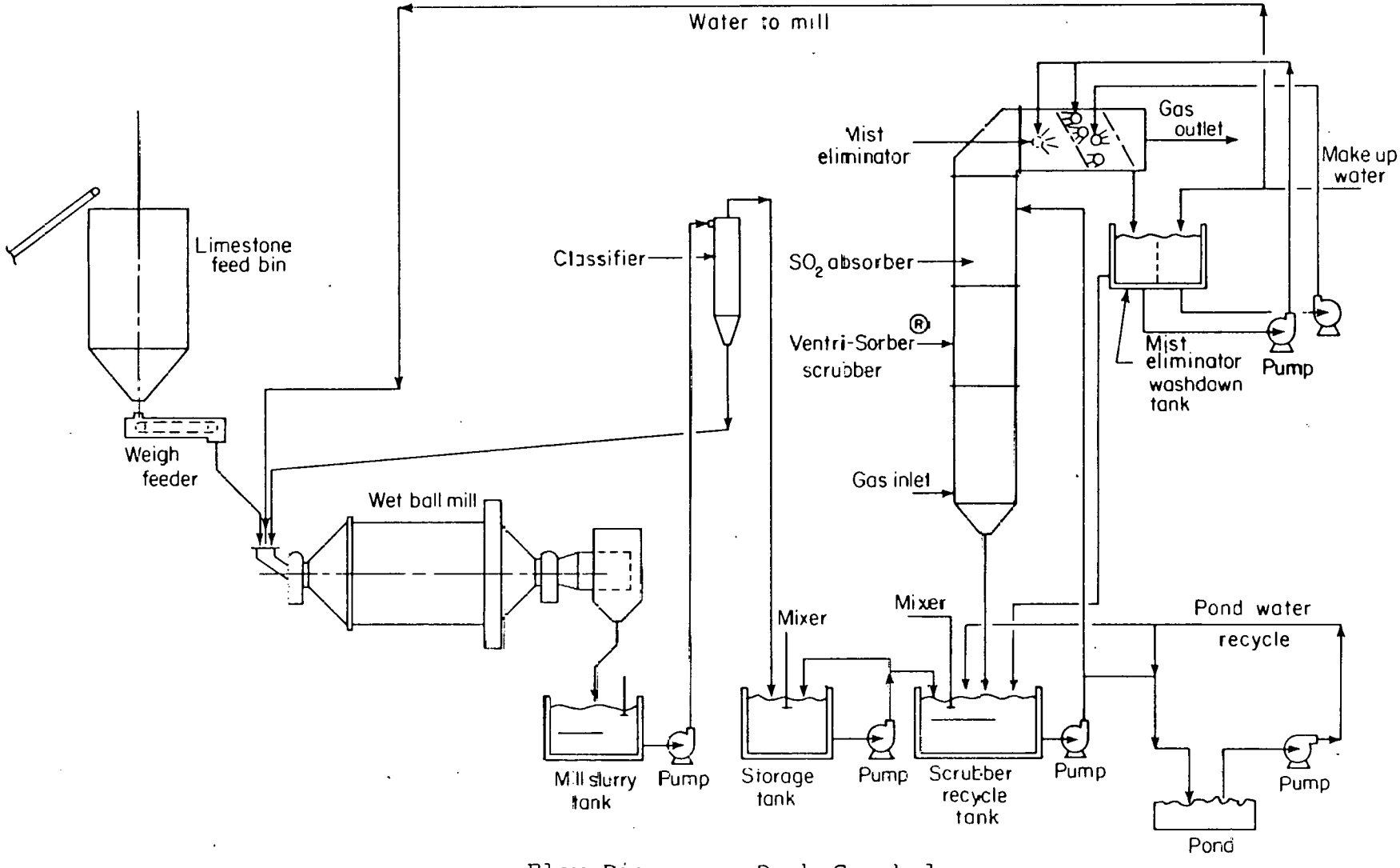
From the common inlet and discharge duct, flue gas enters the base of each scrubber module (354,000 acfm maximum at 275°F), where it is quenched to saturation conditions. The quenched gas flows upward through eight successive stages of rod decks, where contact is made with the scrubbing slurry in a countercurrent fashion. The scrubbing slurry sprayed (15,750 gpm) from the top of each module flows downward through the rod decks, which provide sites for contact between gas and slurry.

The scrubbed, saturated gas stream in each module exits the spray zone and turns 90 degrees to pass through a mist elimination section. Entrained droplets of moisture and slurry are removed from the gas stream by two stages of chevron-type, slanted vertical mist eliminators located in the horizontal discharge duct of each module. A mist eliminator wash system is included that utilizes pond return water for a 5 minute wash of both stages at 20 minute intervals. Scrubbed, saturated gas exits the FGD system and enters the 500-ft "wet stack" (i.e., no reheat is included) through the breeching section.

The spent scrubbing slurry from the recirculation lines of each module is combined with liquid waste streams from plant sumps and discharged to an onsite sludge disposal pond. The

sludge disposal pond accommodates bottom ash and flyash disposal as well as FGD waste and is clay lined to prevent contamination of nearby water streams. The waste solids settle out in the pond and supernatant is returned for use in the mist eliminator wash system and the preparation of the limestone slurry.

A flow diagram for the Duck Creek 1 FGD system is shown on the next page.




Flow Diagram: Duck Creek 1

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

GENERAL PLANT INFORMATION
- COMPANY NAME: CENTRAL ILLINOIS LIGHT COMPANY
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: DUCK CREEK
- UNIT NUMBER: 1
- PLANT ADDRESS: RURAL ROUTE 5
- CITY: CANTON
- COUNTY: FULTON
- STATE: ILLINOIS
- ZIP CODE: 61602
- EPA REGION: 5
- RIVER BASIN/LAKE REGION: ILLINOIS
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 378
- GROSS UNIT GENERATING CAPACITY - MW: 416
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 378
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 390
- EQUIVALENT SCRUBBED CAPACITY - MW: 416

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: RILEY STOKER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: FRONT
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 6/76
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,520,000
- FLUE GAS TEMPERATURE - F: 275
- FLUE GAS OXYGEN - %: <7

A
- HEAT RATE - BTU/KWH: 9840
- DESIGN FIRING RATE - TPH: 174
- EXCESS AIR - %: 20
- CAPACITY FACTOR - %: 55-60
- STACK HEIGHT - FT: 500
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: CARBON STEEL
- FLUE MATERIAL SPECIFIC TYPE: HIGH STRENGTH LOW ALLOY
- FLUE MATERIAL TRADE/COMMON NAME: COR-TEN
- FLUE LINER MATERIAL GENERIC TYPE: ORGANIC
- FLUE LINER MATERIAL SPECIFIC TYPE: MICA FLAKE/POLYESTER

B
- FLUE LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 151
- FLUE INNER DIAMETER - FT: 19.0
- STACK GAS INLET TEMPERATURE - F: 125
- STACK GAS OUTLET VELOCITY - FT/SEC: 71.0

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: FREEMAN UNITED
- MINE NAME/AREA: CROWN MINE
- MINE LOCATION - COUNTY:
- MINE LOCATION - STATE: ILLINOIS
- AVERAGE HEAT CONTENT - BTU/LB: 10,396

C RANGE HEAT CONTENT - BTU/LB: 9800-11,000
C AVERAGE ASH CONTENT - %: 9.12
C RANGE ASH CONTENT - %: 6-18

- AVERAGE MOISTURE CONTENT - %: 15.43

C RANGE MOISTURE CONTENT - %: 13-23

- AVERAGE SULFUR CONTENT - %: 3.3-3.4
- RANGE SULFUR CONTENT - %: 2.4-4.0
- AVERAGE CHLORIDE CONTENT - %: 0.06
- RANGE CHLORIDE CONTENT - %:
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): SPOT
- FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT:

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 2
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: POLLUTION CONTROL-WALTHER
- INLET FLUE GAS CAPACITY - ACFM: 760,000 EACH
- INLET FLUE GAS TEMPERATURE - F: 275
- PRESSURE DROP - IN. H2O: 0.5
- PARTICLE OUTLET LOAD - GR/SCF: 0.009
- PARTICLE REMOVAL EFFICIENCY - %: 99.8
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: ENVIRONEERING, RILEY STOKER
A-E FIRM: GILBERT/COMMONWEALTH ASSOCIATES
CONSTRUCTION FIRM: RILEY STOKER
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: N/A
SO2 DESIGN REMOVAL EFFICIENCY - %: 85.3
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/5/81

CENTRAL ILLINOIS LIGHT
DUCK CREEK 1

COMMERCIAL START-UP: 8/78
D INITIAL START-UP: 7/76
E CONSTRUCTION COMPLETION: 8/78
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 8/73
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 4
DESIGN COAL HEAT CONTENT - BTU/LB: 9800
DESIGN COAL ASH CONTENT - %: 18
DESIGN COAL MOISTURE CONTENT - %: 23
DESIGN COAL CHLORIDE CONTENT - %: 0.02-0.08
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: 4:1
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE
FGD SYSTEM PRESSURE DROP - IN. H2O: 13
FGD SYSTEM OXIDATION - %: 10
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): LOWER THAN BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 144
F FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 2
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 4 (DAY SHIFT); 5 (EVENING SHIFT); 0 (NIGHT SHIFT)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 2
G FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): VARIABLE
H TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): DEDICATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NONE
I TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: NONE
TIME SCHEDULE FOR REDUCED BOILER LOAD: 12:00 A.M. TO 6:00 A.M. DAILY (REDUCED TO 170-230 MW)
J TIME SCHEDULE FOR BOILER SHUTDOWNS: NONE
K PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): REMOVE ONE MODULE FROM SERVICE FOR INSPECTION, CLEANING, & REPAIR
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): ALL NECESSARY MAINTENANCE
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): GENERAL CLEANUP

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE

UTILITY EMISSION CONTROL SYSTEM DATA  CENTRAL ILLINOIS LIGHT
DATE: 8/5/81  DUCK CREEK 1

NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 4
NUMBER OF SPARES: 0
GENERIC TYPE: PACKED TOWER
SPECIFIC TYPE: ROD DECK
TRADE/COMMON NAME: VENTRI-SORBER®
SUPPLIER: ENVIRONEERING, RILEY STOKER
DIMENSIONS - FT: 40 X 5 X 40
L SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL WITH HIGH ALLOY AT TOP
SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: HASTELLOY G AT TOP
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BOILER LOAD PER ABSORBER - %: 25
GAS/LIQUID CONTACT DEVICE TYPE: ROD DECKS
NUMBER OF GAS CONTACTING ZONES: 8
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
M NOZZLE MATERIAL: TYPE 316L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI: N/A
LIQUID RECIRCULATION RATE - GPM: 15,750
L/G RATIO - GAL/1000 ACF: 50
GAS-SIDE PRESSURE DROP - IN. H2O: 8
SUPERFICIAL GAS VELOCITY - FT/SEC: 12
ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW
INLET GAS FLOW RATE - ACFM: 354,000
INLET GAS TEMPERATURE - F: 275

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

INLET SO2 LEVEL - PPM: 2800
INLET SO2 LEVEL - LB/MM BTU: 6.4
INLET PARTICLE LEVEL - GR/SCF: 0.009
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM: 303,500
OUTLET GAS TEMPERATURE - F: 125
N OUTLET SO2 LEVEL - PPM: 420
OUTLET SO2 LEVEL - LB/MM BTU: 1.05
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %: 85.3
PARTICLE REMOVAL EFFICIENCY - %:

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 4
NUMBER OF SPARES: 0
NUMBER PER MODULE: 1
GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER:
O CONFIGURATION (HORIZONTAL/VERTICAL): VERTICAL
SHAPE (Z-SHAPE/A-FRAME): Z-SHAPE
NUMBER OF STAGES: 2
NUMBER OF PASSES/STAGE: 3
FREEBOARD DISTANCE - FT: 12
DISTANCE BETWEEN STAGES - IN.: 48
DISTANCE BETWEEN VANES - IN.: 2.5
VANE ANGLES - DEGREES: 90
PRESSURE DROP - IN. H2O: 1.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 13
CONSTRUCTION MATERIAL GENERIC TYPE: HIGH ALLOY
CONSTRUCTION MATERIAL SPECIFIC TYPE: NICKEL/CHROMIUM
CONSTRUCTION MATERIAL TRADE/COMMON NAME: HASTELLOY G
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): SUPERNATANT
POINT OF WATER COLLECTION: ABSORBER SUMP
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): OVERSPRAY/UNDERSPRAY (BOTH STAGES)
WASH FREQUENCY: EVERY 20 MINUTES
WASH DURATION: 5 MINUTES
WASH RATE - GAL/MIN:
WASH COVERAGE - GAL/MIN/SQ FT:

REHEATER
NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:
NUMBER PER MODULE:

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: NONE
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 4
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: BUFFALO FORGE
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND ABSORBER
FLUE GAS FLOW RATE - ACFM: 354,000
FLUE GAS TEMPERATURE - F: 275
PRESSURE DROP - IN. H2O: 38
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET (C) BYPASS ISOLATION
(D) BYPASS CONTROL (E) ID FAN INLET (F) ID FAN OUTLET
NUMBER OF DAMPERS: (A) 4 (B) 8 (C) 1 (D) 1 (E) 8 (F) 4
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) SHUT-OFF
(D) CONTROL (E) CONTROL (F) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) LOUVER (B) GUILLOTINE
(C) LOUVER (D) LOUVER (E) _____
(F) LOUVER

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) PARALLEL BLADE MULTILOUVER (B) N/A (C) PARALLEL BLADE MULTILOUVER (D) PARALLEL BLADE MULTILOUVER (E) _____ (F) PARALLEL BLADE MULTILOUVER

TRADE/COMMON DESIGN (SINGLE LOUVER /DOUBLE LOUVER): (A) DOUBLE LOUVER (B) N/A (C) SINGLE LOUVER (D) SINGLE LOUVER (E) _____ (F) DOUBLE LOUVER

MANUFACTURER: (A) AMERICAN STANDARD (B) ENVIRONMENTAL ELEMENTS (C) AMERICAN STANDARD (D) AMERICAN STANDARD (E) BUFFALO FORGE (F) AMERICAN STANDARD

MODULATION (OPEN/CLOSED, ETC.): _____

SEAL AIR - ACFM: (A) 4150 (B) 1200 (C) N/A (D) N/A (E) _____ (F) 4150

SERVICE CONDITIONS (MAX GAS TEMP/TIME): (A) 450 F (B) 450 F (C) 450 F (D) _____ (E) _____ (F) 700 F

MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) HIGH ALLOY (C) HIGH ALLOY (D) HIGH ALLOY

MATERIAL SPECIFIC TYPE: (A) _____ (B) NICKEL CHROMIUM (C) NICKEL CHROMIUM (D) NICKEL CHROMIUM

MATERIAL TRADE/COMMON NAME: (A) N/A (B) HASTELLOY G (C) HASTELLOY G (D) HASTELLOY G

LINER MATERIAL GENERIC TYPE: NONE

LINER MATERIAL SPECIFIC TYPE: N/A

LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK

LOCATION: (A) INLET (B) OUTLET AND BYPASS (C) TRANSITION DUCT AT BASE OF STACK

CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) RECTANGULAR (B) CIRCULAR (C) CIRCULAR TO SQUARE

DIMENSIONS (DIAMETER, LENGTH, ETC.): _____

SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) HIGH ALLOY (C) HIGH ALLOY

SHELL MATERIAL SPECIFIC TYPE: (A) _____ (B) NICKEL CHROMIUM (C) NICKEL CHROMIUM

SHELL MATERIAL TRADE/COMMON NAME: (A) N/A (B) HASTELLOY G (C) HASTELLOY G

LINER MATERIAL GENERIC TYPE: NONE

LINER MATERIAL SPECIFIC TYPE: N/A

LINER MATERIAL TRADE/COMMON NAME: N/A

EXPANSION JOINTS

LOCATION: ABSORBER INLET DUCTS

TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC

FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT

PRESSURE (NEGATIVE/POSITIVE): POSITIVE

OPERATING TEMPERATURE - F: 275

DESIGN CONFIGURATION (V-SHAPED, ETC.): _____

MANUFACTURER: _____

MATERIAL: VITON® (HASTELLOY G FRAMES)

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

REAGENT PREPARATION EQUIPMENT
- FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
- PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL
- DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): TUBE MILL
- MANUFACTURER: KENNEDY VAN SAUN
- MATERIALS: RUBBER-LINED CARBON STEEL
- NUMBER OF DEVICES: 1
- NUMBER OF SPARES: 0
- FULL LOAD DRY FEED CAPACITY - TPH: 40
- PRODUCT QUALITY - % SOLIDS: 35
- FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
- PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
- ON-SITE STORAGE CAPABILITY - DAYS: _____

TANKS
- *SEE ATTACHMENT A

PUMPS
- *SEE ATTACHMENT B

MAJOR PIPING
- FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) POND RETURN (B) OTHERS
- DIMENSIONS - IN.: _____
- MANUFACTURER: (A) _____ (B) ATLANTIC BRIDGE COMPANY
- MATERIAL: (A) CONCRETE (B) FRP

MAJOR VALVES
- LOCATION: _____
- FUNCTION (ISOLATION, CONTROL, ETC.): ISOLATION
- TYPE (BALL, GLOBE, PLUG, ETC.): PINCH
- CONTROL MODE (AUTOMATIC/MANUAL): MANUAL
- DIMENSIONS - IN.: _____
- MANUFACTURER: _____
- MATERIAL: RUBBER

THICKENERS
- NUMBER OF THICKENERS: NONE
- NUMBER OF SPARES:
- CONFIGURATION:
- DIMENSIONS - FT:
- CAPACITY - GAL:
- SHELL MATERIAL GENERIC TYPE:
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME:
- LINER MATERIAL GENERIC TYPE:
- LINER MATERIAL SPECIFIC TYPE:
- LINER MATERIAL TRADE/COMMON NAME:
- RAKE MATERIAL:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/5/81

CENTRAL ILLINOIS LIGHT
DUCK CREEK 1

FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: _____
MOISTURE CONTENT - % TOTAL FREE WATER: _____
PERCENT CASO3 - DRY: _____
PERCENT CASO4 - DRY: _____
PERCENT CAOH2 - DRY: _____
PERCENT CACO3 - DRY: _____
PERCENT ASH - DRY: _____
PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

SLUDGE DISPOSAL
- NATURE (INTERIM/FINAL): FINAL
- GENERIC TYPE (LANDFILL, POND, ETC.): LINED POND
- SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
- COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): ABOVE GRADE
- LOCATION (ON-SITE/OFF-SITE): ON-SITE
- TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
- SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): CLAY LINING
- SITE DIMENSIONS - AREA/DEPTH: 57 ACRES
- SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
- SITE SERVICE LIFE - YEARS: 5

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: ABSORBER RECYCLE
- CHEMICAL PARAMETERS (PH, ETC.): PH
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): PERCENT SOLIDS, LIQUID LEVEL
- CONTROL LEVELS: PH 6.0 AT INLET, 5.5 AT OUTLET
- MONITOR TYPE (MANUFACTURER, ETC.): _____
- MONITOR LOCATION: RECYCLE TANK
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
- TYPE (OPEN/CLOSED): CLOSED
- EVAPORATION WATER LOSS - GPM: _____
- SLUDGE HYDRATION WATER LOSS - GPM: _____
- SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
- EFFLUENT WATER LOSS - GPM: _____
- RECEIVING WATER STREAM NAME: NONE
- MAKEUP WATER ADDITION - GPM: 600
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
- MAKEUP WATER ADDITION POINTS & AMOUNTS: MIST ELIMINATOR, BALL MILL, PUMP SEALS
- MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
- PRINCIPAL CONSTITUENTS: 95% $CaCO_3$
- SOURCE/SUPPLIER: _____
- SUPPLIER LOCATION: _____

P CONSUMPTION (SPECIFY UNITS): 40 TPH
- UTILIZATION - %: 67
- POINT OF ADDITION: RECYCLE TANK

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
- CAPITAL COST - $: 50,500,000
- CAPITAL COST - $/KW: 121
- OPERATING COST - MILLS/KWH: 2.68
  - MAINTENANCE COST: $697,000/YR
  - LABOR COST: $295,000/YR
  - UTILITIES COST: $2,340,000/YR
  - CHEMICALS COST: $1,880,000/YR
  - WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: 0
- MIST ELIMINATOR - %: 0
- REHEATER - %: N/A
- FAN - %: 0
- BALL MILL - %: 0
- SLAKER - %: N/A
- EFFLUENT HOLD TANK - %: 0
- RECIRCULATION PUMP - %: 33
- THICKENER - %: N/A
- VACUUM FILTER - %: N/A
- CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
- SCRUBBER: N/A
- ABSORBER: 0
- MIST ELIMINATOR: 0
- REHEATER: N/A
- FAN: 0
- BALL MILL: 0
- SLAKER: N/A
- EFFLUENT HOLD TANK: 0
- RECIRCULATION PUMP: 4
- THICKENER: N/A
- VACUUM FILTER: N/A
- CENTRIFUGE: N/A

PILOT PLANT
- UNIT NUMBER: N/A
- PARTICIPANTS: CENTRAL ILLINOIS LIGHT
- PROCESS: LIMESTONE
- PLANT DESIGN:
- SUPPLIER: RILEY STOKER/ENVIRONEERING
- SERVICE DATE: 1973
- PERIOD OF OPERATION - MONTHS: 9
- GAS FEED:
- EQUIVALENT SCRUBBED CAPACITY - MW: 2.3
- STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 4
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: UNDER ABSORBER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 37 DIA X 22 HIGH
CAPACITY - GAL: 160,000
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP-ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY STORAGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: GRINDER BUILDING
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 26 DIA X 20
CAPACITY - GAL: 80,000
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP-ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MIST ELIMINATOR WASH
NUMBER OF TANKS: 4
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: UNDER MIST ELIMINATORS

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/5/81

CENTRAL ILLINOIS LIGHT
DUCK CREEK 1

CONFIGURATION: 2 COMPARTMENTS
DIMENSIONS - FT: 5 DIA X 10
CAPACITY - GAL: 3000
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MILL SLURRY TANK
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: NEXT TO BALL MILL
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: RUBBER
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 — DUCK CREEK 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RETURN WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: WORTHINGTON
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 800
MOTOR BRAKE HP:
SPEED - RPM: 1800
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 12
NUMBER OF SPARES: 4
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
Q MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 7875
MOTOR BRAKE HP: 300
SPEED - RPM: 1776
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY TRANSFER
NUMBER OF PUMPS: 2

UTILITY EMISSION CONTROL SYSTEM DATA CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 DUCK CREEK 1

NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: WORTHINGTON
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 705
MOTOR BRAKE HP:
SPEED - RPM: 1800
HEAD - FT: 79.5
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL SLURRY
R NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 800
MOTOR BRAKE HP: 60
SPEED - RPM: 1775
HEAD - FT:
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA CENTRAL ILLINOIS LIGHT
DATE: 8/5/81 DUCK CREEK 1

COMMENTS/FOOTNOTES

A DESIGN.
B CEILCOTE.
C DESIGN VALUES.
D ONE TRAIN (MODULE D) WAS CONSTRUCTED EARLIER AND BEGAN OPERATION IN JULY 1976.
E FOR FULL SCALE OPERATION.
F ONE OPERATOR ON THE BOARD, ONE ROVING FOR EQUIPMENT INSPECTION.
G OUTSIDE CONTRACTORS ARE UTILIZED ONLY DURING EXTENDED MAINTENANCE PERIODS (E.G., STACK HOPPER REPAIRS).
H MECHANICAL MAINTENANCE PERSONNEL ARE DEDICATED--INSTRUMENTATION AND ELECTRICAL MAINTENANCE PERSONNEL ARE BORROWED AS NEEDED FROM THE BOILER MAINTENANCE STAFF.
I ONE DEDICATED MAINTENANCE SUPERVISOR PER MAINTENANCE SHIFT.
J MAINTENANCE THAT REQUIRES A BOILER OUTAGE IS PERFORMED WHEN THE UNIT IS BROUGHT OFF-LINE TO CORRECT BOILER PROBLEMS (E.G., TUBE LEAKS). BOILER FORCED OUTAGES OCCUR ONE TO TWO TIMES A YEAR AND GENERALLY LAST ONE TO TWO DAYS EACH UNLESS THE OUTAGE OCCURS PRIOR TO A WEEKEND, AT WHICH TIME THE WEEKEND WILL ALSO BE UTILIZED FOR REPAIRS. IF SUFFICIENT FORCED BOILER OUTAGES DO NOT OCCUR, AN OUTAGE WILL BE SCHEDULED AS NEEDED.
K ONE MODULE IS REMOVED FROM SERVICE EACH NIGHT ON A ROTATIONAL SCHEDULE FOR MAINTENANCE. REDUCED BOILER LOAD AT NIGHT PERMITS THIS.
L RODS ARE TYPE 316L STAINLESS STEEL.
M OPEN PIPE REDUCERS (12 IN. TO 4 IN.) ARE USED INSTEAD OF NOZZLES.
N BASED ON A REMOVAL EFFICIENCY OF 83.5%.
O TILTED 35 DEGREES FROM VERTICAL PLANE.
P LIMESTONE CONSUMPTION WHEN BALL MILL IS OPERATING.
Q TRAIN D HAS WORTHINGTON RECYCLE PUMPS.
R THE MILL SLURRY PUMPS ARE ALTERNATED EVERY 15 DAYS.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Central Illinois Light Duck Creek 1 | 7/76 | 744 | | System | 8 | | Misc. equipment | The first module of the 4-module scrubbing system had problems with bad welds, faulty pipe hangers, and absorber leaks |
| | 8/76 | 744 | | System | 18 | | Misc. equipment | Module continued to experience construction problems |
| | 9/76 | 744 | | System | 360 | | Pipe lines | Leaks and breaks |
| | | | | | | | Pumps | Liner failures |
| | | | | | | | Mist eliminator | Plugging and scaling |
| | 10/76 | 744 | | System | 385 | | Mist eliminator | Plugging and scaling of mist eliminator resulted in the plugging of the piping and nozzles to the component's spray spray system |
| | 11/76 | 720 | | System | 24 | | Absorber | Rod deck changed and pressure drop increased |
| | | | | | | | Pumps/piping | Piping and pump liner were modified/replaced |
| | | | | | | | Mist eliminator | Fresh water system was installed due to continued scaling and plugging problems |
| | 12/76 | 744 | | System | 0 | | System | Module down entire month (unit burned low sulfur coal during outage) |
| | 1/77 | 744 | | System | 0 | | Boiler | Turbine/boiler overhaul |
| | 2/77 | 672 | 0 | System | 0 | | Boiler | Turbine/boiler overhaul |
| | 3/77 | 744 | 0 | System | 350 | | Mist eliminator spray wash system piping | Changed from PVC to FRP materials. An additional spray header was added |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | | | | | | | Slurry circulation system | Repaired/modified |
| | | | | | | | Recycle pumps | Linings changed from rubber to neoprene. Flush and drain system also added to minimize solids buildup |
| | | | | | | | Valves | Moved closer to tanks |
| | | | | | | | Slurry storage tanks | Flush and drain system added |
| | | | | | | | Mixers | Additional mixers added for greater agitation |
| | 4/77 | 720 | | System | 0 | | | Scrubber down until 7/78 when remaining scrubber modules were constructed (unit fired low sulfur coal) |
| | 5/77 | 744 | | System | 0 | | | |
| | 6/77 | 720 | | System | 0 | | | |
| | 7/77 | 744 | | System | 0 | | | |
| | 8/77 | 744 | | System | 0 | | | |
| | 9/77 | 720 | | System | 0 | | | |
| | 10/77 | 744 | | System | 0 | | | |
| | 11/77 | 720 | | System | 0 | | | |
| | 12/77 | 744 | | System | 0 | | | |
| | 1/78 | 744 | | System | 0 | | | |
| | 2/78 | 672 | | System | 0 | | | |
| | 3/78 | 744 | | System | 0 | | | |
| | 4/78 | 720 | | System | 0 | | | |
| | 5/78 | 744 | | System | 0 | | | |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 6/78 | 720 | | System | 0 | | | FGD construction completed |
| | 7/78 | 720 | | A | | | | |
| | | | | B | | | | |
| | | | | C | | | | |
| | | | | D | | | | |
| | | | | System | | | Slurry transfer tank | Under designed slurry transfer tank modified |
| | | | | | | | Handling system | Plugging problems caused by coal fines in the slurry (fines resulted from a common coal and limestone handling system) |
| Commercial start-up | 8/78 | 744 | 691 | A | | | | |
| | | | | B | | | | |
| | | | | C | | | | |
| | | | | D | | | | |
| | | | | System | 315 | 45 | | |
| | 9/78 | 720 | 691 | A | | | | |
| | | | | B | | | | |
| | | | | C | | | | |
| | | | | D | | | | |
| | | | | System | 317 | 46 | Handling system | Screen baskets were installed to keep coal particles from the limestone |
| | | | | | | | Slurry transfer | System prevented proper slurry flow due to under design. Old system was replaced with new piping system |
| | | | | | | | Recycle pump | Shut off valves plugged. Valves were replaced with pinch valves |
| | | | | | | | Scrubber waste water sump pumps | Plugging problem (caused by solids being sucked in due to lack of agitation) |
| | 10/78 | 744 | 449 | A | | 19 | | |
| | | | | B | | 23 | | |
| | | | | C | | 1 | | |
| | | | | D | | 21 | | |
| | | | | System | 117 | 16 | Flow control valve | Removed because it caused abrasion and failure of the recycle header (none of modules now utilize flow control valves) |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | | | | | | | Valve | Leaking valve resulted in contamination of the recycle pump gland seal-water system with pond return water causing scaling and plugging forcing shutdown of the recycle pumps (new valve system installed and operating pressures changed to prevent recurrence of the contamination) |
| | | | | | | | Handling system | A liquid/solid separator was installed in the slurry system to prevent plugging problems caused by coal fines in the slurry |
| | | | | | | | Modules | Excessive limestone carryover to mist eliminators (top rod decks were removed to improve gas flow and eliminate carryover) |
| | | | | | | | Blank off plates | Added to increase pressure drop |
| | 11/78 | 720 | 661 | A | | 8 | | |
| | | | | B | | 8 | Slurry tank pump | Liner failed (backup spare pump was also out of service to replace original 50-HP motor with a 75-HP motor) |
| | | | | C | | | | |
| | | | | D | | 8 | | |
| | | | | System | 59 | 8 | Ball mill | Pinion bearing on the ball mill drive failed |
| | | | | | | | Instrumentation | Level and density instruments on recycle tanks were modified (Leeds & Northrup level and density transmitters were replaced with Rosemount transmitters) |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 12/78 | 744 | 706 | A | | 23 | | |
| | | | | B | | 26 | | |
| | | | | C | | 21 | | |
| | | | | D | | 10 | | |
| | | | | System | 151 | 20 | Isolation damper | Failure problem |
| | | | | | | | Slurry discharge valve | Failure problem |
| | | | | | | | Limestone feeder | Plugging problems |
| | | | | | | | Ball mill | Specific problem was not reported |
| | | | | | | | Instrument control lines | Froze due to cold weather conditions |
| | 1/79 | 744 | 738 | A | | | | |
| | | | | B | | | | |
| | | | | C | | | | |
| | | | | D | | | | |
| | | | | System | 0 | 0 | Misc. equipment | Cold weather related problems (frozen instrument control lines, recycle tank suction lines, main module drain lines and mist eliminator drain lines) |
| | | | | | | | Slurry recycle valve | Plugging problems |
| | | | | | | | Slurry transfer pump | Failure problem |
| | 2/79 | 672 | 533 | A | | | | |
| | | | | B | | | | |
| | | | | C | | | | |
| | | | | D | | | | |
| | | | | System | 0 | 0 | Misc. equipment | Cold weather related problems continued |
| | | | | | | | Slurry recycle valve | Plugging problem continued |
| | | | | | | | Slurry transfer pump | Failure problem continued |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 3/79 | 744 | 744 | A | | 34 | | |
| | | | | B | | 7 | | |
| | | | | C | | 0 | Module | Cold weather related problems |
| | | | | D | | 0 | Module | Cold weather related problems |
| | | | | System | 70 | 10 | Mist eliminator | Broken spray lines and plugged nozzles |
| | | | | | | | Recycle water pump | Failure problem |
| | | | | | | | Waste-water pump | Failure problem |
| | | | | | | | Slurry nozzles | Plugging problem |
| | | | | | | | Instrumentation | General problem encountered |
| | 4/79 | 720 | 674 | A | | 100 | | |
| | | | | B | | 84 | | |
| | | | | C | | 87 | | |
| | | | | D | | 21 | | |
| | | | | System | | 73 | Inlet damper | Malfunctioned |
| | | | | | | | Mist eliminator | Plugged nozzles |
| | | | | | | | Slurry control valve | Malfunctioned |
| | | | | | | | Recycle tank mixer | Failure problem |
| | | | | | | | Recycle pump | Belt and bearing failures |
| | | | | | | | Slurry supply line | Failure problem |
| | 5/79 | 744 | 197 | A | | 96 | | |
| | | | | B | | 96 | | |
| | | | | C | | 95 | | |
| | | | | D | | 1 | Mist eliminator | Wash line failure |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | | | | System | 63 | 72 | Mist eliminator pump | Malfunctioned |
| | | | | | | | Mill shaker basket | Drive motor failed |
| | | | | | | | Slurry supply lines | Failure problem |
| | | | | | | | Stack liner | Blistered |
| | 6/79 | 720 | 661 | A | | 82 | | |
| | | | | B | | 89 | | |
| | | | | C | | 87 | | |
| | | | | D | | 92 | | |
| | | | | System | 577 | 88 | Mist eliminator | Plugging in mist eliminator and mist eliminator lines (a return line was also broken) |
| | | | | | | | Storage pump | Failure problem |
| | | | | | | | Recycle pump | Failure problem |
| | | | | | | | Slurry supply line | Plugging problem |
| | | | | | | | Damper | Failure problem |
| | | | | | | | Mill shaker basket | Failure problem |
| | 7/79 | 744 | 520 | A | | 93 | | |
| | | | | B | | 95 | | |
| | | | | C | | 96 | | |
| | | | | D | | 96 | | |
| | | | | System | 453 | 95 | Mist eliminator | Plugging problem |
| | | | | | | | Recycle pump | Failure problem |
| | 8/79 | 744 | 555 | A | | 3 | | |
| | | | | B | | 26 | | |
| | | | | C | | 14 | | |
| | | | | D | | 10 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | | | | System | 92 | 13 | Mist eliminator | Mist eliminator and mist eliminator drain lines plugged |
| | | | | | | | Limestone slurry forwarding pump | Failure problems |
| | | | | | | | Recycle pump | Failure problems |
| | | | | | | | Damper | Malfunctioned |
| | 9/79 | 720 | 665 | A | | 64 | | |
| | | | | B | | 61 | | |
| | | | | C | | 49 | | |
| | | | | D | | 89 | | |
| | | | | System | 378 | 66 | Mist eliminator | Plugging in mist eliminator, headers, and nozzles |
| | | | | | | | Damper | Failure problem |
| | | | | | | | Mist eliminator pump | Cavitation problem |
| | | | | | | | Slurry nozzles | Plugging due to outages |
| | | | | | | | Limestone conveyor | Plugging due to outages |
| | 10/79 | 744 | 744 | A | | 85 | | |
| | | | | B | | 94 | | |
| | | | | C | | 92 | | |
| | | | | D | | 94 | | |
| | | | | System | 625 | 91 | Mist eliminator | Pump malfunctioned, lines plugged and header gasket failed |
| | | | | | | | Isolation damper | Failed due to motor drive malfunction |
| | | | | | | | Slurry supply lines | Repaired |
| | 11/79 | 720 | 583 | A | | 43 | | |
| | | | | B | | 12 | | |
| | | | | C | | 22 | | |
| | | | | D | | 51 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | | | | System | 221 | 32 | Isolation damper | Malfunction problem continued |
| | | | | | | | Mist eliminator | Mist eliminator and drain plugging problems |
| | | | | | | | Recycle pump suction valves | Replaced |
| | | | | | | | Slurry supply lines | Failure problem |
| | 12/79 | 744 | 543 | A | | 55 | | |
| | | | | B | | 35 | Recycle tank | Liners repaired and covers installed |
| | | | | C | | 43 | | |
| | | | | D | | 26 | Recycle tank | Liners repaired and covers installed |
| | | | | System | 292 | 40 | Isolation damper | Malfunction problem continued |
| | 1/80 | 744 | 664 | A | | 25 | | |
| | | | | B | | 59 | | |
| | | | | C | | 17 | | |
| | | | | D | | 29 | | |
| | | | | System | 241 | 33 | Mist eliminator | Plugging problems continued (drain line modified) |
| | | | | | | | Limestone feeder | Plugging problems |
| | | | | | | | Inlet damper | Malfunctioned |
| | | | | | | | Slurry supply header | Leaks encountered |
| | | | | | | | Storage pump discharge valve | Repaired |
| | 2/80 | 696 | 696 | A | | 12 | Recycle discharge | Had to be replaced |
| | | | | B | | 73 | | |
| | | | | C | | 71 | | |
| | | | | D | | 41 | Mist eliminator | Had to be cleaned |
| | | | | | | | Recycle discharge valve | Had to be cleaned |
| | | | | System | 342 | 49 | Inlet damper | Drive replaced |
| | | | | | | | Slurry recycle line | Fiberglass repairs |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 3/80 | 744 | 629 | A | | 53 | | |
| | | | | B | | 73 | | |
| | | | | C | | 51 | | |
| | | | | D | | 34 | | |
| | | | | System | 393 | 53 | Recycle pump discharge valve | New valves installed to eliminate restricted flow problems on old valves |
| | | | | | | | Inlet damper | Carrier bearings replaced |
| | | | | | | | Mist eliminator | Wash system converted to return water in order to achieve higher quality wash water |
| | | | | | | | Recycle pump | Fiberglass discharge lines repaired |
| | 4/80 | 720 | 466 | A | | 53 | | |
| | | | | B | | 54 | | |
| | | | | C | | 57 | | |
| | | | | D | | 26 | | |
| | | | | System | 342 | 48 | Recycle tank mixer | Repaired |
| | | | | | | | Limestone handling system | Malfunctioned |
| | 5/80 | 744 | 484 | A | | 45 | | |
| | | | | B | | 46 | | |
| | | | | C | | 35 | | |
| | | | | D | | 44 | | |
| | | | | System | 314 | 43 | Recycle tank | Liner repaired |
| | | | | | | | Expansion joints | Leak problem |
| | | | | | | | Limestone storage tank mixer | Replaced |
| | | | | | | | Modules | Rod decks modified (to reduce system differentiation pressure) |
| | | | | | | | Limestone feeder system | Repaired |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 6/80 | 720 | 718 | A | | 88 | | |
| | | | | B | | 87 | | |
| | | | | C | | 85 | | |
| | | | | D | | 80 | | |
| | | | | System | 573 | 85 | Slurry supply header | Leak problem |
| | | | | | | | Nodules | Rod deck modifications |
| | 7/80 | 744 | 644 | A | | 91 | | |
| | | | | B | | 84 | Storage tank pump discharge valve | Repaired |
| | | | | | | | Storage tank mixer motor | Repaired |
| | | | | C | | 91 | | |
| | | | | D | | 88 | | |
| | | | | System | 490 | 89 | Slurry supply line | Repaired |
| | | | | | | | Mill system | Clutch malfunctioned |
| | 8/80 | 744 | 713 | A | | 89 | | |
| | | | | B | | 91 | | |
| | | | | C | | 91 | | |
| | | | | D | | 91 | | |
| | | | | System | 609 | 91 | Slurry isolation valve | Repaired |
| | | | | | | | Pond water return line | Repaired |
| | 9/80 | 720 | 720 | A | | 43 | | |
| | | | | B | | 48 | | |
| | | | | C | | 47 | | |
| | | | | D | | 46 | | |
| | | | | System | 316 | 46 | Limestone ball mill | Repaired |
| | | | | | | | Ballmill motor | Burned out (slurry contamination of the mill bearing oil) |
| | | | | | | | Recycle pump suction screen | Repaired |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duck Creek 1 (Continued) | 10/80 | 744 | 744 | A | | 73 | | |
| | | | | B | | 73 | | |
| | | | | C | | 74 | | |
| | | | | D | | 73 | | |
| | | | | System | 532 | 73 | Limestone ball mill motor | 168 hours of outage due to ball mill motor problems |
| | | | | | | | Recycle tank pump | Repaired |
| | | | | | | | Storage tank pump discharge valve | Repaired |
| | 11/80 | 720 | 548 | A | | 99 | | |
| | | | | B | | 96 | | |
| | | | | C | | 99 | | |
| | | | | D | | 95 | | |
| | | | | System | 486 | 97 | Mist eliminator | Fresh water flush value failed |
| | | | | | | | Recycle tank suction screen | Repaired |
| | 12/80 | 744 | 741 | A | | 94 | | |
| | | | | B | | 95 | Outlet damper | Repaired |
| | | | | C | | 87 | Inlet damper | Repaired |
| | | | | D | | 94 | | |
| | | | | System | 677 | 93 | Recycle tank suction screen | Plugging problems continued |

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

# COLORADO-UTE ELECTRIC ASSOCIATION

## CRAIG 1, 2

# SECTION 1

## BACKGROUND

The Craig Power Station of Colorado-Ute is situated in northwest Colorado approximately four miles southwest of Craig, Colorado. Both units fire a low-sulfur subbituminous coal (0.45% sulfur) and have generating capacities of 455 MW (gross) each.

In late 1976, after construction had commenced on the units at Craig, the Colorado State Air Pollution Control Commission voted to require the Colorado Ute Electric Association to install $SO_2$ controls. The utility challenged the commission's contention that it had the power to regulate large polluters' emission on the basis of the State's ambient air quality regulations; however, the utility lost the suit and in May 1977 awarded a contract to Peabody Process Systems to supply limestone FGD systems on both Craig 1 and 2. Belco was awarded the contract for ESP's to precede each FGD system to control particulate matter emissions.

Initial operations at Craig 2 commenced in December 1979. The Craig 1 initial startup was in October 1980.

## SECTION 2

## PROCESS DESCRIPTION

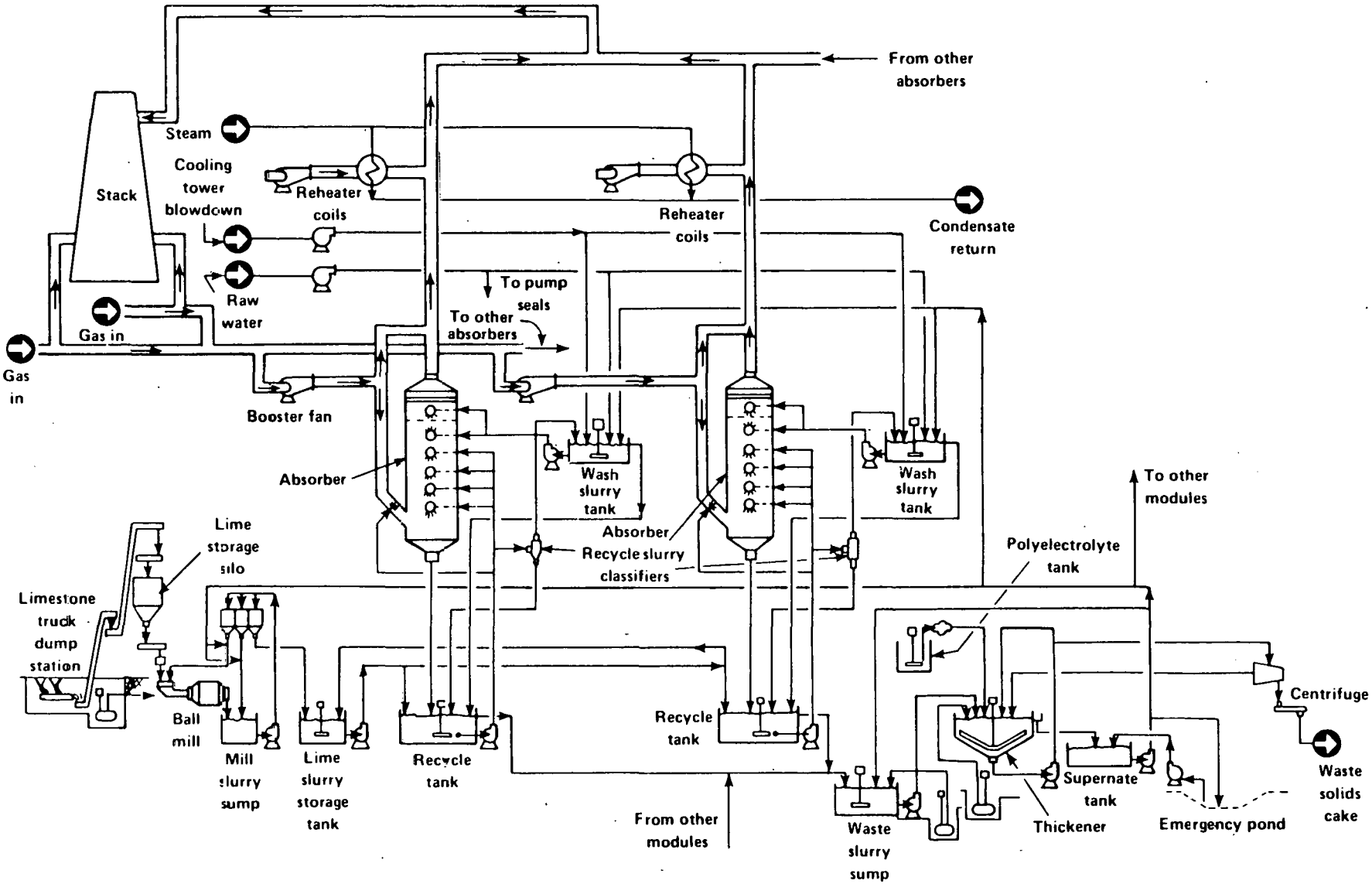
Each of the emission control systems installed on the Craig units consist of a hot-side ESP followed by a wet limestone FGD system. Each FGD system includes four spray tower modules, with one module functioning as a spare. Each module was designed to handle 30% of the boiler flue gas flow of 1,530,600 acfm at 250°F.

From the boiler, the flue gas enters the ESP with a design removal efficiency of 99.9%. After passing through the boiler air preheater, the gas stream is drawn through a booster fan, after which 90% of the flue gas is fed into the $SO_2$ absorber towers and 10% of the flue gas is fed into the bypass duct at 250°F.

Approximately 460,000 acfm (250°F) of flue gas is fed into the base of each spray tower. The flue gas turns 90 degrees and rises through four spray zones where limestone slurry is sprayed down, countercurrent to the gas flow. The cleaned, saturated gas passes through a horizontal, single-stage chevron mist eliminator and into the duct leading to the stack. The scrubbed gas joins the bypassed gas and the combined stream enters the 600-foot stack. The system includes an indirect hot air injection steam reheater that is used when high-sulfur coal ($\geq$0.96%)

is being burned to heat ambient air to 383°F prior to injection into the stack. When coal with an average sulfur content (approximately 0.45%) is burned, both the bypass and indirect hot air injection reheat strategies are utilized. At 0.24% sulfur or less, bypass gas alone is the reheat strategy.

The system operates in a closed water loop mode and the spent absorbent is disposed of in an off-site minefill. A flow diagram for the Craig 1, 2 FGD systems is included on the next page.




Flow Diagram: Craig 1 or 2

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

GENERAL PLANT INFORMATION
- COMPANY NAME: COLORADO-UTE ELECTRIC ASSOCIATION
- ASSOCIATED UTILITIES: SALT RIVER PROJECT, PLATTE RIVER POWER AUTHORITY, AND TRI-STATE GENERATION & TRANSMISSION ASSOCIATION
- PLANT NAME: CRAIG
- UNIT NUMBER: 1
- PLANT ADDRESS: P.O. BOX 1307
- CITY: CRAIG
- COUNTY: MOFFAT
- STATE: COLORADO
- ZIP CODE: 81625
- EPA REGION: 8
- RIVER BASIN/LAKE REGION: YAMPA
- REGULATORY CLASSIFICATION: STATE STD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1 (20% OPACITY)
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.4
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 900
- GROSS UNIT GENERATING CAPACITY - MW: 455
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 400
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 406
- EQUIVALENT SCRUBBED CAPACITY - MW: 455

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: FRONT AND REAR
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 7/80
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,530,600
- FLUE GAS TEMPERATURE - F: 250
- FLUE GAS OXYGEN - %: 5
- HEAT RATE - BTU/KWH: 10,600
- DESIGN FIRING RATE - TPH: 250
- EXCESS AIR - %: 20
- CAPACITY FACTOR - %: ~50
- STACK HEIGHT - FT: 600
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: _____
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 35.8
- STACK GAS INLET TEMPERATURE - F: 260
- STACK GAS OUTLET VELOCITY - FT/SEC: 60

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
- NAME OF SUPPLIER: UTAH INTERNATIONAL
- MINE NAME/AREA: ONE MILE SOUTH OF PLANT SITE
- MINE LOCATION - COUNTY: MOFFAT
- MINE LOCATION - STATE: COLORADO
- AVERAGE HEAT CONTENT - BTU/LB: 10,000
- RANGE HEAT CONTENT - BTU/LB: 9100-10,300
- AVERAGE ASH CONTENT - %: 8.0
- RANGE ASH CONTENT - %: 5.5-11.5
- AVERAGE MOISTURE CONTENT - %: 16.0
- RANGE MOISTURE CONTENT - %: 13.0-19.0
- AVERAGE SULFUR CONTENT - %: 0.45
- RANGE SULFUR CONTENT - %: 0.4-0.5
- AVERAGE CHLORIDE CONTENT - %: .03
- RANGE CHLORIDE CONTENT - %: 0.00-0.10
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): TYPICAL
- FUEL ANALYSIS DATE: 1979

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): HOT SIDE
- SUPPLIER: BELCO
- INLET FLUE GAS CAPACITY - ACFM: 2,950,000
- INLET FLUE GAS TEMPERATURE - F: 750
- PRESSURE DROP - IN. H2O: 3.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.01
- PARTICLE REMOVAL EFFICIENCY - %: 99.9
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: PEABODY PROCESS SYSTEMS
A-E FIRM: STEARNS-ROGER
CONSTRUCTION FIRM: PEABODY PROCESS SYSTEMS
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.8 (ESP)
SO2 DESIGN REMOVAL EFFICIENCY - %: 85
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

COMMERCIAL START-UP: 7/81
INITIAL START-UP: 10/80
CONSTRUCTION COMPLETION: 10/80
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 5/77
LETTER OF INTENT SIGNED: 5/77
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 0.96
DESIGN COAL HEAT CONTENT - BTU/LB: 9600
DESIGN COAL ASH CONTENT - %: 11.6
DESIGN COAL MOISTURE CONTENT - %: 15.3
DESIGN COAL CHLORIDE CONTENT - %: 0.1
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 130,680
FGD SYSTEM TURNDOWN RATIO: >3:1
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE
FGD SYSTEM PRESSURE DROP - IN. H2O: 3 (9 TRIPS IT OFF)
FGD SYSTEM OXIDATION - %: 99
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 264
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 6 FOR BOTH UNITS
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 10
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 3
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 0
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): ROTATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: PICK AT RANDOM
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: NO
TIME SCHEDULE FOR REDUCED BOILER LOAD: REDUCED LOAD AT NIGHT
TIME SCHEDULE FOR BOILER SHUTDOWNS: ANNUAL
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): DON'T PLAN TO REDUCE LOAD; WASH ONE TRAIN AT NIGHT
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): REPAIR WHAT NEEDS TO BE DONE
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): PUT AS MUCH PERSONNEL AS POSSIBLE TO DO WHAT NEEDS TO BE DONE

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: 4
- NUMBER OF SPARES: 1
- TYPE: QUENCH DUCT
- LOCATION: INLET TO ABSORBER
- SUPPLIER: PEABODY PROCESS SYSTEMS
- SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
- SHELL MATERIAL SPECIFIC TYPE: INCOLLOY 825
- SHELL MATERIAL TRADE/COMMON NAME: INCOLLOY 825
- LINER MATERIAL GENERIC TYPE: ORGANIC (IN TRANSITION REGION)
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
- INLET GAS FLOW - ACFM: 460,000
- INLET GAS TEMPERATURE - F: 250
- PRESSURE DROP - IN. H2O: <1
- LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
- LIQUID RECIRCULATION RATE - GPM: 400-650
- L/G RATIO - GAL/1000 ACF: 1.6 (DESIGN)
- NUMBER OF SPRAY HEADERS: 1 (16 NOZZLES)
- NOZZLE MATERIAL: SILICON CARBIDE
- NOZZLE PRESSURE DROP - PSI: _____

ABSORBER
- NUMBER OF ABSORBERS: 4
- NUMBER OF SPARES: 1
- GENERIC TYPE: SPRAY TOWER
- SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
- TRADE/COMMON NAME: SPRAY TOWER
- SUPPLIER: PEABODY PROCESS SYSTEMS
- DIMENSIONS - FT: 32 DIA. X 52.5 HIGH
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: AISI 1110
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: RUBBER IN SPRAY ZONE AND GLASS FLAKE/POLYESTER ABOVE AND BELOW SPRAY ZONE
- LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
- BOILER LOAD PER ABSORBER - %: 30
- GAS/LIQUID CONTACT DEVICE TYPE: NONE
- NUMBER OF GAS CONTACTING ZONES: 4
- DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: 120-180
- NUMBER OF SPRAY HEADERS: 4
- NOZZLE MATERIAL: SILICON CARBIDE
- NOZZLE PRESSURE DROP - PSI: 12
- LIQUID RECIRCULATION RATE - GPM: 24,000
- L/G RATIO - GAL/1000 ACF: 53
- GAS-SIDE PRESSURE DROP - IN. H2O: 1.5
- SUPERFICIAL GAS VELOCITY - FT/SEC: 10

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

ABSORBER TURNDOWN RATIO: CAN RUN 0-100% FOR LIMITED TIME (DEMISTER EFFICIENCY VARIES W/LOAD)
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; CHANGE FAN BLADE PITCH
INLET GAS FLOW RATE - ACFM: 460,000
INLET GAS TEMPERATURE - F: 250
INLET SO2 LEVEL - PPM: 350
INLET SO2 LEVEL - LB/MM BTU: 0.8
INLET PARTICLE LEVEL - GR/SCF: 0.010
INLET PARTICLE LEVEL - LB/MM BTU: 0.032
OUTLET GAS FLOW RATE - ACFM: 627,000 (WITH INDIRECT REHEAT)
OUTLET GAS TEMPERATURE - F: 164
OUTLET SO2 LEVEL - PPM: <150 (IN STACK)
OUTLET SO2 LEVEL - LB/MM BTU: 0.4
OUTLET PARTICLE LEVEL - GR/SCF: 0.005
OUTLET PARTICLE LEVEL - LB/MM BTU: 0.016
SO2 REMOVAL EFFICIENCY - %: 85
PARTICLE REMOVAL EFFICIENCY - %: 50

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 4
NUMBER OF SPARES: 1
NUMBER PER MODULE: 1
GENERIC TYPE: (B) IMPINGEMENT
SPECIFIC TYPE: (B) BAFFLE
COMMON DESIGN: (A) PERFORATED WASH TRAY (B) CHEVRON VANE
MANUFACTURER: (B) CEILCOTE
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): (B) S-SHAPE
NUMBER OF STAGES: 1
NUMBER OF PASSES/STAGE: (B) 4
FREEBOARD DISTANCE - FT: (B) 5.0
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.: (B) 1.2
VANE ANGLES - DEGREES: (B) 45
PRESSURE DROP - IN. H2O: (B) 1.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 10
CONSTRUCTION MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) TYPE 316 (B) POLYPHENYLENE OXIDE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (B) NORYL®
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (B) MAKEUP
POINT OF WATER COLLECTION: (B) WASH TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (B) OVERSPRAY
WASH FREQUENCY: (B) CONTINUOUS
WASH DURATION: (B) N/A
WASH RATE - GAL/MIN: (B) 100
WASH COVERAGE - GAL/MIN/SQ FT: (A) 0.5 (B) 0.12

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

REHEATER
- NUMBER OF REHEATERS: (A) 4 (B) 4
- NUMBER OF SPARES: (A) 1 (B) 1
- NUMBER PER MODULE: (A) 1 (B) 1
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): (A) BYPASS (B) INDIRECT HOT AIR
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.): (A) COLD SIDE (B) EXTERNAL HEAT BUNDLES
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): (A) N/A (B) STEAM TUBE BUNDLES
- COMBUSTION FUEL SULFUR CONTENT - %: (A) N/A (B) N/A
- LOCATION: (A,B) OUTLET DUCT BETWEEN ME AND OUTLET DAMPER

A AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 0-37
- TEMPERATURE INCREASE - F: (A) 50 (B) 50
- INLET FLUE GAS FLOW RATE - ACFM: 413,000
- INLET FLUE GAS TEMPERATURE - F: 110
- OUTLET FLUE GAS FLOW RATE - ACFM: 640,000
- OUTLET FLUE GAS TEMPERATURE - F: (A) 165 (B) 160
- ENERGY REQUIREMENT - MM BTU/HR: (A) N/A (B) 16 X $10^6$ BTU/HR (NOT USED YET)
- NUMBER OF HEAT EXCHANGER BANKS: (A) N/A (B) 1
- NUMBER OF BUNDLES PER BANK: (A) N/A (B) 1
- NUMBER OF TUBES PER BUNDLE: (A) N/A (B) 422
- STEAM OR WATER PRESSURE - PSIG: (A) N/A (B) 300
- STEAM OR WATER TEMPERATURE - F: (A) N/A (B) 424
- SELF CLEANING DEVICE TYPE: (A) NONE (B) NONE
- MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) CARBON STEEL
- MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) _____
- MATERIAL TRADE/COMMON NAME: (A) N/A (B) _____

FANS
- NUMBER OF FANS: (A) 4 (B) 4
- NUMBER OF SPARES: (A) 0 (B) 1
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): (A) AXIAL (B) AXIAL (VARIABLE PITCH)
- SUPPLIER: (A) BUFFALO FORGE (B) BUFFALO FORGE
- FUNCTION (UNIT/BOOSTER): (A) INDIRECT REHEAT (B) BOOSTER
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: (A) N/A (B) FORCED DRAFT
- SERVICE (WET/DRY): (A) DRY (B) DRY
- TYPE OF WASH: (A) NONE (B) NONE
- LOCATION WRT MAJOR COMPONENTS: (A) UPSTREAM OF STEAM COIL (B) INLET TO ABSORBER TOWER
- FLUE GAS FLOW RATE - ACFM: (A) 97,545 (B) 790,000
- FLUE GAS TEMPERATURE - F: (B) 250
- PRESSURE DROP - IN. H2O: (B) 11 (MAXIMUM)
- MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
- MATERIAL SPECIFIC TYPE: (A) _____ (B) AISI 1110
- MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

DAMPERS
LOCATION: (A) TOWER INLET (B) TOWER OUTLET (C) TOWER BYPASS (D) INDIRECT REHEAT (E) SYSTEM INLET (F) SYSTEM OUTLET (G) SYSTEM BYPASS
NUMBER OF DAMPERS: (A) 4 (B) 4 (C) 4 (D) 4 (E) 2 (F) 1 (G) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL (D) SHUT-OFF (E) SHUT-OFF (F) SHUT-OFF (G) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): ALL LOUVER EXCEPT GUILLOTINE FOR INDIRECT REHEAT
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): PARALLEL BLADE
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): 5 SINGLE AND 12 DOUBLE LOUVERS
MANUFACTURER: FORNEY ENGINEERING
MODULATION (OPEN/CLOSED, ETC.): MODULATION USED ONLY ON TOWER BYPASS
SEAL AIR - ACFM: 6500
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: LOUVER - CARBON STEEL AND STAINLESS STEEL; GUILLOTINE - CARBON STEEL AND HIGH ALLOY
MATERIAL SPECIFIC TYPE: LOUVER - A285 GRADE C FRAMES, A36 BLADES, AND TYPE 410 SHAFTS AND SEALS; GUILLOTINE - HIGH ALLOY SEALS
MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET TO QUENCH (B) OUTLET TO DAMPER (C) DAMPER TO STACK (D) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): VARIES
SHELL MATERIAL GENERIC TYPE: CARBON STEEL (ALL)
SHELL MATERIAL SPECIFIC TYPE: CARBON STEEL
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A,C,D) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (B) GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (B) FLAKELINE 103

EXPANSION JOINTS
LOCATION: HOT SIDE AND WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): POSITIVE
OPERATING TEMPERATURE - F: _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: GARLOCK
MATERIAL: _____

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): WET HORIZONTAL TUBE MILL
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER-LINED CARBON STEEL
NUMBER OF DEVICES: 1
NUMBER OF SPARES: 0 (CAN INTERCHANGE WITH BALL MILL ON UNIT 2)
FULL LOAD DRY FEED CAPACITY - TPH: 10
PRODUCT QUALITY - % SOLIDS: 35
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 24
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS: 200

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) HEAVY SLURRY LINES
(B) LIGHT SLURRY LINES AND CLEAR WATER LINES
DIMENSIONS - IN.: VARIES
MANUFACTURER: (A) (B) FIBERCAST
MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) FRP

MAJOR VALVES
LOCATION: (A) RECYCLE SLURRY (B) SUPERNATE (C) LIMESTONE SLURRY
FUNCTION (ISOLATION, CONTROL, ETC.): (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PLUG (B) BUTTERFLY (C) PINCH
CONTROL MODE (AUTOMATIC/MANUAL): (B) AUTOMATIC
DIMENSIONS - IN.: VARIES
MANUFACTURER: (A) DEZURIK (B) FISHER AND DEMCO (C) R.K.L.
MATERIAL: (A) RUBBER-LINED (B) STAINLESS STEEL (C) RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 1
B NUMBER OF SPARES:
CONFIGURATION: CENTER DRAW
DIMENSIONS - FT: 75 DIA X 15 DEPTH
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL WITH CONCRETE BOTTOM
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER ON WALLS AND MAT REINFORCED POLYESTER ON BOTTOM
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103 ON WALLS AND CEILCRETE 2500AR ON BOTTOM
RAKE MATERIAL: RUBBER-CLAD CARBON STEEL

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 5% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 100 GPM, <1% SUSPENDED SOLIDS
OUTLET STREAM DISPOSITION: TO CENTRIFUGES
OVERFLOW STREAM DISPOSITION: RECYCLED TO PROCESS

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): CENTRIFUGE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): HORIZONTAL BASKET, CENTER FEED
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): CONTINUOUS
NUMBER OF DEVICES: 1
B NUMBER OF SPARES: 1
CONFIGURATION: HORIZONTAL
DIMENSIONS - FT: 3 DIA X 6 LENGTH
CAPACITY: 126 GPM
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE: HASTELLOY C-276
SHELL MATERIAL TRADE/COMMON NAME: HASTELLOY C-276
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BELT MATERIAL GENERIC TYPE: N/A
BELT MATERIAL SPECIFIC TYPE: N/A
BELT MATERIAL TRADE/COMMON NAME: N/A
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 60% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 60 GPM
OUTLET STREAM DISPOSITION: LANDFILL
OVERFLOW STREAM DISPOSITION: TO WASTE SUMP AND THEN TO THICKENER

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 11.6
MOISTURE CONTENT - % TOTAL FREE WATER: 40
PERCENT CASO3 - DRY: 22.6
PERCENT CASO4 - DRY: 70.2
PERCENT CAOH2 - DRY: 0.0
PERCENT CACO3 - DRY: 2.9
PERCENT ASH - DRY: 0.3
PERCENT OTHER COMPOUNDS - DRY: 3.9 (INERTS)

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
C GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): _____
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): TRUCK
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): _____
SITE DIMENSIONS - AREA/DEPTH: _____
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: _____

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: _____
CHEMICAL PARAMETERS (PH, ETC.): PH, $SO_2$ CONCENTRATION
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): DENSITY, GAS FLOW, LIQUID FLOW
CONTROL LEVELS: PH 5.4, SOLIDS 12-15%
MONITOR TYPE (MANUFACTURER, ETC.): UNILOK - PH, OHMART - DENSITY, BROOKS - FLOW, DYNASCIENCES - MODULE $SO_2$, LEAR-SIEGLER - STACK $SO_2$
MONITOR LOCATION: RECYCLE TANK
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM: 282
SLUDGE HYDRATION WATER LOSS - GPM: 9
SLUDGE INTERSTITIAL WATER LOSS - GPM: 33
POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0
D EFFLUENT WATER LOSS - GPM: 0
RECEIVING WATER STREAM NAME: N/A
MAKEUP WATER ADDITION - GPM: 321
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING TOWER BLOWDOWN
MAKEUP WATER ADDITION POINTS & AMOUNTS: WASH TANKS - 204 GPM; SEAL WATER - 117 GPM
MAKEUP WATER PRE-TREATMENT TYPE: STRAINER

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: $CaCO_3$
SOURCE/SUPPLIER: _____
SUPPLIER LOCATION: CANYON CITY, COLORADO
CONSUMPTION (SPECIFY UNITS): 7,000 LB/HR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

UTILIZATION - %: <50 TO >99
POINT OF ADDITION: BALL MILL

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 66,000,000
CAPITAL COST - $/KW:
OPERATING COST - MILLS/KWH:
MAINTENANCE COST:
LABOR COST:
UTILITIES COST:
CHEMICALS COST:
WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %: 33.3
MIST ELIMINATOR - %: 33.3
REHEATER - %: 33.3 EACH METHOD
FAN - %:
BALL MILL - %: 0
SLAKER - %: N/A
EFFLUENT HOLD TANK - %: 33.3
RECIRCULATION PUMP - %:
THICKENER - %: 0
VACUUM FILTER - %: N/A
CENTRIFUGE - %: 50

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER: 1.0
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL:
SLAKER: N/A
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER:
VACUUM FILTER: N/A
CENTRIFUGE: 0.5

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECIRCULATION
NUMBER OF TANKS: 4
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): OPEN
LOCATION: AT BOTTOM OF ABSORBER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 45 DIA X 20 HIGH
CAPACITY - GAL: 208,000
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 4 PER TANK
AGITATOR CONFIGURATION: TOP ENTRY, CIRCUMFERENCE
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY STORAGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: PRODUCT DISCHARGE OF BALL MILL LOOP
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 20 DIA X 18 HIGH
CAPACITY - GAL: 38,188
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SUPERNATANT
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: OVERFLOW OF THICKENER
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

DIMENSIONS - FT: 20 DIA X 18 HIGH
CAPACITY - GAL: 36,875
RETENTION TIME - MIN: 18
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASH SLURRY
NUMBER OF TANKS: 4
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): OPEN
LOCATION: OVERFLOW OF RECYCLE SLURRY CLASSIFIER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 12.5 DIA X 8 HIGH
CAPACITY - GAL: 5349
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 4
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): POLYELECTROLYTE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: POLYELECTROLYTE ADDITION SKID
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 3 DIA X 3 HIGH
CAPACITY - GAL: _____
RETENTION TIME - MIN: N/A
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: LIP MOUNTED
AGITATOR MATERIALS: TYPE 316 SS
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: OVERFLOW FROM RECYCLE TANK
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: 17 X 17 X 10 DEPTH
CAPACITY - GAL: 21,670
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: CEILCRETE 2500AR

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RAW WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): DIRECT DRIVE
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3196 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 156
MOTOR BRAKE HP: 20
SPEED - RPM: 3500
HEAD - FT: 140
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECLAIM SUMP
NUMBER OF PUMPS: 7
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: AA-6-V
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 36
MOTOR BRAKE HP: 3
SPEED - RPM: 1600
HEAD - FT: 48
SERVICE (PH, SOLIDS): PH 3.5-9.0, 0-50% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): POND
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIESEL DRIVEN
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3796 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 250
MOTOR BRAKE HP: 9
SPEED - RPM: 1750
HEAD - FT: 63
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): COOLING TOWER BLOWDOWN BOOSTER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3196 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 560
MOTOR BRAKE HP: 5
SPEED - RPM: 1150
HEAD - FT: 25
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 8
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: DG-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 14,000
MOTOR BRAKE HP: 500
SPEED - RPM: 525
HEAD - FT: 103
SERVICE (PH, SOLIDS): PH 5.6-6.1, 15% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASH SLURRY
NUMBER OF PUMPS: 8
NUMBER OF SPARES: 4
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 550
MOTOR BRAKE HP: 30
SPEED - RPM: 950
HEAD - FT: 99
SERVICE (PH, SOLIDS): PH 5.6-6.1, 6% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SUPERNATANT
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 1100
MOTOR BRAKE HP: 40

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

SPEED - RPM: 900
HEAD - FT: 83
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): HYDRAULIC DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 2-1.5 BM
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE
CAPACITY - GPM: 156
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 5.6-7.5, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): POLYELECTROLYTE
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): PISTON
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT
COMMON DESIGN (V-BELT, ETC.): VARIABLE CAPACITY
MANUFACTURER: WALLACE AND TIERNAN
PUMP MODEL NUMBER: FA 56
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE SPEED
CAPACITY - GPM: 10
MOTOR BRAKE HP: _____
SPEED - RPM: 1725
HEAD - FT: 50
SERVICE (PH, SOLIDS): VARIABLE PH, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL PISTON
CASING MATERIAL SPECIFIC TYPE: _____

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 1

CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: N/A
IMPELLER MATERIAL SPECIFIC TYPE: N/A
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASTE SLURRY
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 1104
MOTOR BRAKE HP: 50
SPEED - RPM: 800
HEAD - FT: 104
SERVICE (PH, SOLIDS): PH 5.6-7.5, 4.3% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL RECIRCULATION
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 155
MOTOR BRAKE HP: 15
SPEED - RPM: 1150
HEAD - FT: 80
SERVICE (PH, SOLIDS): PH 7, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

PUMPS

FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIMESTONE SLURRY FEED
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 220
MOTOR BRAKE HP: 25
SPEED - RPM: 1400
HEAD - FT: 115
SERVICE (PH, SOLIDS): PH 7, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 1

COMMENTS/FOOTNOTES

A THERE ARE TWO MODES OF REHEAT, DEPENDING ON INLET $SO_2$ CONCENTRATION. WITH LOW SULFUR COAL ($\geq$ 0.24% S) 250 F INLET FLUE GAS MAY BE BYPASSED TO RAISE ABSORBER EXIT GAS TEMPERATURE 50 F. WITH HIGH SULFUR COAL ($\geq$ 0.96% S), AMBIENT AIR IS HEATED TO 383 F BY A STEAM COIL AND IS INJECTED INTO THE ABSORBER EXIT. MIXED MODE OPERATION IS ALSO POSSIBLE.

DESIGN CONDITIONS-MAX. SULFUR, 0% BYPASS
NORMAL CONDITIONS-AVG. SULFUR, 23% BYPASS
NORMAL CONDITIONS-MIN. SULFUR, 37% BYPASS

B ONE PER UNIT WITH COMMON SPARE.
C THE SLUDGE IS TEMPORARILY DEPOSITED ON SITE, BUT A SURFACE MINE WILL EVENTUALLY BE UTILIZED IN THE FUTURE.
D DURING UPSETS, THE SUPERNATE TANK OVERFLOWS TO THE EVAPORATION PONDS.

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

GENERAL PLANT INFORMATION
- COMPANY NAME: COLORADO-UTE ELECTRIC ASSOCIATION
- ASSOCIATED UTILITIES: SALT RIVER PROJECT, PLATTE RIVER POWER AUTHORITY, AND TRI-STATE GENERATION & TRANSMISSION ASSOCIATION
- PLANT NAME: CRAIG
- UNIT NUMBER: 2
- PLANT ADDRESS: P.O. BOX 1307
- CITY: CRAIG
- COUNTY: MOFFAT
- STATE: COLORADO
- ZIP CODE: 81625
- EPA REGION: 8
- RIVER BASIN/LAKE REGION: YAMPA
- REGULATORY CLASSIFICATION: STATE STD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1 (20% OPACITY)
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.4
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 900
- GROSS UNIT GENERATING CAPACITY - MW: 455
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 400
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 406
- EQUIVALENT SCRUBBED CAPACITY - MW: 455

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: FRONT AND REAR
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: 11/79
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,530,600
- FLUE GAS TEMPERATURE - F: 250
- FLUE GAS OXYGEN - %: 5
- HEAT RATE - BTU/KWH: 10,600
- DESIGN FIRING RATE - TPH: 250
- EXCESS AIR - %: 20
- CAPACITY FACTOR - %: ~50
- STACK HEIGHT - FT: 600
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: _____
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 35.8
- STACK GAS INLET TEMPERATURE - F: 260
- STACK GAS OUTLET VELOCITY - FT/SEC: 60

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): SUBBITUMINOUS
- NAME OF SUPPLIER: UTAH INTERNATIONAL
- MINE NAME/AREA: ONE MILE SOUTH OF PLANT SITE
- MINE LOCATION - COUNTY: MOFFAT
- MINE LOCATION - STATE: COLORADO
- AVERAGE HEAT CONTENT - BTU/LB: 10,000
- RANGE HEAT CONTENT - BTU/LB: 9100-10,300
- AVERAGE ASH CONTENT - %: 8.0
- RANGE ASH CONTENT - %: 5.5-11.5
- AVERAGE MOISTURE CONTENT - %: 16.0
- RANGE MOISTURE CONTENT - %: 13.0-19.0
- AVERAGE SULFUR CONTENT - %: 0.45
- RANGE SULFUR CONTENT - %: 0.4-0.5
- AVERAGE CHLORIDE CONTENT - %: .03
- RANGE CHLORIDE CONTENT - %: 0.00-0.10
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): TYPICAL
- FUEL ANALYSIS DATE: 1979

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): HOT SIDE
- SUPPLIER: BELCO
- INLET FLUE GAS CAPACITY - ACFM: 2,950,000
- INLET FLUE GAS TEMPERATURE - F: 750
- PRESSURE DROP - IN. H2O: 3.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.01
- PARTICLE REMOVAL EFFICIENCY - %: 99.9
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

TILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIMESTONE
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: PEABODY PROCESS SYSTEMS
A-E FIRM: STEARNS-ROGER
CONSTRUCTION FIRM: PEABODY PROCESS SYSTEMS
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.8 (ESP)
SO2 DESIGN REMOVAL EFFICIENCY - %: 85
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

COMMERCIAL START-UP: 7/81
INITIAL START-UP: 12/79
CONSTRUCTION COMPLETION: 10/80
CONSTRUCTION INITIATION: _____
CONTRACT AWARDED: 5/77
LETTER OF INTENT SIGNED: 5/77
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS

DESIGN COAL SULFUR CONTENT - %: 0.96
DESIGN COAL HEAT CONTENT - BTU/LB: 9600
DESIGN COAL ASH CONTENT - %: 11.6
DESIGN COAL MOISTURE CONTENT - %: 15.3
DESIGN COAL CHLORIDE CONTENT - %: 0.1
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 130,680
FGD SYSTEM TURNDOWN RATIO: >3:1
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE
FGD SYSTEM PRESSURE DROP - IN. H2O: 3 (9 TRIPS IT OFF)
FGD SYSTEM OXIDATION - %: 99
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 264
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 6 FOR BOTH UNITS
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 10
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 3
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 0
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): ROTATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: PICK AT RANDOM
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: NO
TIME SCHEDULE FOR REDUCED BOILER LOAD: REDUCED LOAD AT NIGHT
TIME SCHEDULE FOR BOILER SHUTDOWNS: ANNUAL
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): DON'T PLAN TO REDUCE LOAD; WASH ONE TRAIN AT NIGHT
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): REPAIR WHAT NEEDS TO BE DONE
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): PUT AS MUCH PERSONNEL AS POSSIBLE TO DO WHAT NEEDS TO BE DONE

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

QUENCHER/PRESATURATOR
- NUMBER OF QUENCHERS/PRESATURATORS: 4
- NUMBER OF SPARES: 1
- TYPE: QUENCH DUCT
- LOCATION: INLET TO ABSORBER
- SUPPLIER: PEABODY PROCESS SYSTEMS
- SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
- SHELL MATERIAL SPECIFIC TYPE: INCOLLOY 825
- SHELL MATERIAL TRADE/COMMON NAME: INCOLLOY 825
- LINER MATERIAL GENERIC TYPE: ORGANIC (IN TRANSITION REGION)
- LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
- LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
- INLET GAS FLOW - ACFM: 460,000
- INLET GAS TEMPERATURE - F: 250
- PRESSURE DROP - IN. H2O: <1
- LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): ABSORBER SLURRY
- LIQUID RECIRCULATION RATE - GPM: 400-650
- L/G RATIO - GAL/1000 ACF: 1.6 (DESIGN)
- NUMBER OF SPRAY HEADERS: 1 (16 NOZZLES)
- NOZZLE MATERIAL: SILICON CARBIDE
- NOZZLE PRESSURE DROP - PSI: _____

ABSORBER
- NUMBER OF ABSORBERS: 4
- NUMBER OF SPARES: 1
- GENERIC TYPE: SPRAY TOWER
- SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
- TRADE/COMMON NAME: SPRAY TOWER
- SUPPLIER: PEABODY PROCESS SYSTEMS
- DIMENSIONS - FT: 32 DIA. X 52.5 HIGH
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: AISI 1110
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: RUBBER IN SPRAY ZONE AND GLASS FLAKE/POLYESTER ABOVE AND BELOW SPRAY ZONE
- LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103
- BOILER LOAD PER ABSORBER - %: 30
- GAS/LIQUID CONTACT DEVICE TYPE: NONE
- NUMBER OF GAS CONTACTING ZONES: 4
- DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: 120-180
- NUMBER OF SPRAY HEADERS: 4
- NOZZLE MATERIAL: SILICON CARBIDE
- NOZZLE PRESSURE DROP - PSI: 12
- LIQUID RECIRCULATION RATE - GPM: 24,000
- L/G RATIO - GAL/1000 ACF: 53
- GAS-SIDE PRESSURE DROP - IN. H2O: 1.5
- SUPERFICIAL GAS VELOCITY - FT/SEC: 10

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

ABSORBER TURNDOWN RATIO: CAN RUN 0-100% FOR LIMITED TIME (DEMISTER EFFICIENCY VARIES W/LOAD)
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW; CHANGE FAN BLADE PITCH
INLET GAS FLOW RATE - ACFM: 460,000
INLET GAS TEMPERATURE - F: 250
INLET SO2 LEVEL - PPM: 350
INLET SO2 LEVEL - LB/MM BTU: 0.8
INLET PARTICLE LEVEL - GR/SCF: 0.010
INLET PARTICLE LEVEL - LB/MM BTU: 0.032
OUTLET GAS FLOW RATE - ACFM: 627,000 (WITH INDIRECT REHEAT)
OUTLET GAS TEMPERATURE - F: 164
OUTLET SO2 LEVEL - PPM: <150 (IN STACK)
OUTLET SO2 LEVEL - LB/MM BTU: 0.4
OUTLET PARTICLE LEVEL - GR/SCF: 0.005
OUTLET PARTICLE LEVEL - LB/MM BTU: 0.016
SO2 REMOVAL EFFICIENCY - %: 85
PARTICLE REMOVAL EFFICIENCY - %: 50

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: 4
NUMBER OF SPARES: 1
NUMBER PER MODULE: 1
GENERIC TYPE: (B) IMPINGEMENT
SPECIFIC TYPE: (B) BAFFLE
COMMON DESIGN: (A) PERFORATED WASH TRAY (B) CHEVRON VANE
MANUFACTURER: (B) CEILCOTE
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): (B) S-SHAPE
NUMBER OF STAGES: 1
NUMBER OF PASSES/STAGE: (B) 4
FREEBOARD DISTANCE - FT: (B) 5.0
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.: (B) 1.2
VANE ANGLES - DEGREES: (B) 45
PRESSURE DROP - IN. H2O: (B) 1.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 10
CONSTRUCTION MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) TYPE 316 (B) POLYPHENYLENE OXIDE
CONSTRUCTION MATERIAL TRADE/COMMON NAME: (B) NORYL®
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (B) MAKEUP
POINT OF WATER COLLECTION: (B) WASH TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (B) OVERSPRAY
WASH FREQUENCY: (B) CONTINUOUS
WASH DURATION: (B) N/A
WASH RATE - GAL/MIN: (B) 100
WASH COVERAGE - GAL/MIN/SQ FT: (A) 0.5 (B) 0.12

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

REHEATER
- NUMBER OF REHEATERS: (A) 4 (B) 4
- NUMBER OF SPARES: (A) 1 (B) 1
- NUMBER PER MODULE: (A) 1 (B) 1
- GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): (A) BYPASS (B) INDIRECT HOT AIR
- SPECIFIC TYPE (STEAM, HOT WATER, ETC.): (A) COLD SIDE (B) EXTERNAL HEAT BUNDLES
- COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): (A) N/A (B) STEAM TUBE BUNDLES
- COMBUSTION FUEL SULFUR CONTENT - %: (A) N/A (B) N/A
- LOCATION: (A,B) OUTLET DUCT BETWEEN ME AND OUTLET DAMPER

A AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 0-37
- TEMPERATURE INCREASE - F: (A) 50 (B) 50
- INLET FLUE GAS FLOW RATE - ACFM: 413,000
- INLET FLUE GAS TEMPERATURE - F: 110
- OUTLET FLUE GAS FLOW RATE - ACFM: 640,000
- OUTLET FLUE GAS TEMPERATURE - F: (A) 165 (B) 160
- ENERGY REQUIREMENT - MM BTU/HR: (A) N/A (B) 16 X $10^6$ BTU/HR (NOT USED YET)
- NUMBER OF HEAT EXCHANGER BANKS: (A) N/A (B) 1
- NUMBER OF BUNDLES PER BANK: (A) N/A (B) 1
- NUMBER OF TUBES PER BUNDLE: (A) N/A (B) 422
- STEAM OR WATER PRESSURE - PSIG: (A) N/A (B) 300
- STEAM OR WATER TEMPERATURE - F: (A) N/A (B) 424
- SELF CLEANING DEVICE TYPE: (A) NONE (B) NONE
- MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) CARBON STEEL
- MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) _____
- MATERIAL TRADE/COMMON NAME: (A) N/A (B) _____

FANS
- NUMBER OF FANS: (A) 4 (B) 4
- NUMBER OF SPARES: (A) 0 (B) 1
- DESIGN (CENTRIFUGAL, AXIAL, ETC.): (A) AXIAL (B) AXIAL (VARIABLE PITCH)
- SUPPLIER: (A) BUFFALO FORGE (B) BUFFALO FORGE
- FUNCTION (UNIT/BOOSTER): (A) INDIRECT REHEAT (B) BOOSTER
- APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: (A) N/A (B) FORCED DRAFT
- SERVICE (WET/DRY): (A) DRY (B) DRY
- TYPE OF WASH: (A) NONE (B) NONE
- LOCATION WRT MAJOR COMPONENTS: (A) UPSTREAM OF STEAM COIL (B) INLET TO ABSORBER TOWER
- FLUE GAS FLOW RATE - ACFM: (A) 97,545 (B) 790,000
- FLUE GAS TEMPERATURE - F: (B) 250
- PRESSURE DROP - IN. H2O: (B) 11 (MAXIMUM)
- MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
- MATERIAL SPECIFIC TYPE: (A) _____ (B) AISI 1110
- MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

DAMPERS
LOCATION: (A) TOWER INLET (B) TOWER OUTLET (C) TOWER BYPASS
(D) INDIRECT REHEAT (E) SYSTEM INLET (F) SYSTEM OUTLET
(G) SYSTEM BYPASS
NUMBER OF DAMPERS: (A) 4 (B) 4 (C) 4 (D) 4 (E) 2 (F) 1 (G) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL
(D) SHUT-OFF (E) SHUT-OFF (F) SHUT-OFF (G) SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): ALL LOUVER EXCEPT GUILLOTINE FOR INDIRECT REHEAT
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): PARALLEL BLADE
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): 5 SINGLE AND 12 DOUBLE LOUVERS
MANUFACTURER: FORNEY ENGINEERING
MODULATION (OPEN/CLOSED, ETC.): MODULATION USED ONLY ON TOWER BYPASS
SEAL AIR - ACFM: 6500
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: LOUVER - CARBON STEEL AND STAINLESS STEEL; GUILLOTINE - CARBON STEEL AND HIGH ALLOY
MATERIAL SPECIFIC TYPE: LOUVER - A285 GRADE C FRAMES, A36 BLADES, AND TYPE 410 SHAFTS AND SEALS; GUILLOTINE - HIGH ALLOY SEALS
MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET TO QUENCH (B) OUTLET TO DAMPER (C) DAMPER TO STACK
(D) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): VARIES
SHELL MATERIAL GENERIC TYPE: CARBON STEEL (ALL)
SHELL MATERIAL SPECIFIC TYPE: CARBON STEEL:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A,C,D) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (B) GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (B) FLAKELINE 103

EXPANSION JOINTS
LOCATION: HOT SIDE AND WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT
PRESSURE (NEGATIVE/POSITIVE): POSITIVE
OPERATING TEMPERATURE - F: _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: GARLOCK
MATERIAL: _____

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIMESTONE GRINDING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): BALL MILL

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): WET HORIZONTAL TUBE MILL
MANUFACTURER: KENNEDY VAN SAUN
MATERIALS: RUBBER-LINED CARBON STEEL
NUMBER OF DEVICES: 1
NUMBER OF SPARES: 0 (CAN INTERCHANGE WITH BALL MILL ON UNIT 2)
FULL LOAD DRY FEED CAPACITY - TPH: 10
PRODUCT QUALITY - % SOLIDS: 35
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 24
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS: 200

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) HEAVY SLURRY LINES
(B) LIGHT SLURRY LINES AND CLEAR WATER LINES
DIMENSIONS - IN.: VARIES
MANUFACTURER: (A) (B) FIBERCAST
MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) FRP

MAJOR VALVES
LOCATION: (A) RECYCLE SLURRY (B) SUPERNATE (C) LIMESTONE SLURRY
FUNCTION (ISOLATION, CONTROL, ETC.): (B) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PLUG (B) BUTTERFLY (C) PINCH
CONTROL MODE (AUTOMATIC/MANUAL): (B) AUTOMATIC
DIMENSIONS - IN.: VARIES
MANUFACTURER: (A) DEZURIK (B) FISHER AND DEMCO (C) R.K.L.
MATERIAL: (A) RUBBER-LINED (B) STAINLESS STEEL (C) RUBBER-LINED

THICKENERS
NUMBER OF THICKENERS: 1
B NUMBER OF SPARES:
CONFIGURATION: CENTER DRAW
DIMENSIONS - FT: 75 DIA X 15 DEPTH
CAPACITY - GAL: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL WITH CONCRETE BOTTOM
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER ON WALLS AND MAT REINFORCED POLYESTER ON BOTTOM
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103 ON WALLS AND CEILCRETE 2500AR ON BOTTOM
RAKE MATERIAL: RUBBER-CLAD CARBON STEEL

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 5% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 100 GPM, <1% SUSPENDED SOLIDS
OUTLET STREAM DISPOSITION: TO CENTRIFUGES
OVERFLOW STREAM DISPOSITION: RECYCLED TO PROCESS

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): CENTRIFUGE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): HORIZONTAL BASKET, CENTER FEED
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): CONTINUOUS
NUMBER OF DEVICES: 1
B NUMBER OF SPARES: 1
CONFIGURATION: HORIZONTAL
DIMENSIONS - FT: 3 DIA X 6 LENGTH
CAPACITY: 126 GPM
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE: HASTELLOY C-276
SHELL MATERIAL TRADE/COMMON NAME: HASTELLOY C-276
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BELT MATERIAL GENERIC TYPE: N/A
BELT MATERIAL SPECIFIC TYPE: N/A
BELT MATERIAL TRADE/COMMON NAME: N/A
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 60% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 60 GPM
OUTLET STREAM DISPOSITION: LANDFILL
OVERFLOW STREAM DISPOSITION: TO WASTE SUMP AND THEN TO THICKENER

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 11.6
MOISTURE CONTENT - % TOTAL FREE WATER: 40
PERCENT CASO3 - DRY: 22.6
PERCENT CASO4 - DRY: 70.2
PERCENT CAOH2 - DRY: 0.0
PERCENT CACO3 - DRY: 2.9
PERCENT ASH - DRY: 0.3
PERCENT OTHER COMPOUNDS - DRY: 3.9 (INERTS)

SLUDGE TREATMENT
METHOD: NONE
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
C GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): _____
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): TRUCK
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): _____
SITE DIMENSIONS - AREA/DEPTH: _____
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: _____

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: _____
CHEMICAL PARAMETERS (PH, ETC.): PH, $SO_2$ CONCENTRATION
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): DENSITY, GAS FLOW, LIQUID FLOW
CONTROL LEVELS: PH 5.4, SOLIDS 12-15%
MONITOR TYPE (MANUFACTURER, ETC.): UNILOK - PH, OHMART - DENSITY, BROOKS - FLOW, DYNASCIENCES - MODULE $SO_2$, LEAR-SIEGLER - STACK $SO_2$
MONITOR LOCATION: RECYCLE TANK
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): DESIGN
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM: 282
SLUDGE HYDRATION WATER LOSS - GPM: 9
SLUDGE INTERSTITIAL WATER LOSS - GPM: 33
POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0
D EFFLUENT WATER LOSS - GPM: 0
RECEIVING WATER STREAM NAME: N/A
MAKEUP WATER ADDITION - GPM: 321
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): COOLING TOWER BLOWDOWN
MAKEUP WATER ADDITION POINTS & AMOUNTS: WASH TANKS - 204 GPM; SEAL WATER - 117 GPM
MAKEUP WATER PRE-TREATMENT TYPE: STRAINER

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): LIMESTONE
PRINCIPAL CONSTITUENTS: $CaCO_3$
SOURCE/SUPPLIER: _____
SUPPLIER LOCATION: CANYON CITY, COLORADO
CONSUMPTION (SPECIFY UNITS): 7,000 LB/HR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

UTILIZATION - %: <50 TO >99
POINT OF ADDITION: BALL MILL

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 66,000,000
CAPITAL COST - $/KW:
OPERATING COST - MILLS/KWH:
MAINTENANCE COST:
LABOR COST:
UTILITIES COST:
CHEMICALS COST:
WASTE DISPOSAL COST:

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %: 33.3
MIST ELIMINATOR - %: 33.3
REHEATER - %: 33.3 EACH METHOD
FAN - %:
BALL MILL - %: 0
SLAKER - %: N/A
EFFLUENT HOLD TANK - %: 33.3
RECIRCULATION PUMP - %:
THICKENER - %: 0
VACUUM FILTER - %: N/A
CENTRIFUGE - %: 50

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER: 1.0
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL:
SLAKER: N/A
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER:
VACUUM FILTER: N/A
CENTRIFUGE: 0.5

PILOT PLANT
UNIT NUMBER: NONE
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECIRCULATION
NUMBER OF TANKS: 4
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): OPEN
LOCATION: AT BOTTOM OF ABSORBER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 45 DIA X 20 HIGH
CAPACITY - GAL: 208,000
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 4 PER TANK
AGITATOR CONFIGURATION: TOP ENTRY, CIRCUMFERENCE
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIMESTONE SLURRY STORAGE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: PRODUCT DISCHARGE OF BALL MILL LOOP
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 20 DIA X 18 HIGH
CAPACITY - GAL: 38,188
RETENTION TIME - MIN: 8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SUPERNATANT
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: OVERFLOW OF THICKENER
CONFIGURATION: CIRCULAR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

DIMENSIONS - FT: 20 DIA X 18 HIGH
CAPACITY - GAL: 36,875
RETENTION TIME - MIN: 18
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASH SLURRY
NUMBER OF TANKS: 4
NUMBER OF SPARES: 1
TYPE (OPEN/COVERED): OPEN
LOCATION: OVERFLOW OF RECYCLE SLURRY CLASSIFIER
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 12.5 DIA X 8 HIGH
CAPACITY - GAL: 5349
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 4
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS FLAKE/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): POLYELECTROLYTE
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): OPEN
LOCATION: POLYELECTROLYTE ADDITION SKID
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 3 DIA X 3 HIGH
CAPACITY - GAL: _____
RETENTION TIME - MIN: N/A
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: LIP MOUNTED
AGITATOR MATERIALS: TYPE 316 SS
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WASTE SLURRY SUMP
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): COVERED
LOCATION: OVERFLOW FROM RECYCLE TANK
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: 17 X 17 X 10 DEPTH
CAPACITY - GAL: 21,670
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY, CENTER
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: CEILCRETE 2500AR

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RAW WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): DIRECT DRIVE
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3196 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 150
MOTOR BRAKE HP: 20
SPEED - RPM: 3500
HEAD - FT: 140
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECLAIM SUMP
NUMBER OF PUMPS: /
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: AA-6-V
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 36
MOTOR BRAKE HP: 3
SPEED - RPM: 1600
HEAD - FT: 48
SERVICE (PH, SOLIDS): PH 3.5-9.0, 0-50% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): POND
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIESEL DRIVEN
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3796 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 250
MOTOR BRAKE HP: 9
SPEED - RPM: 1750
HEAD - FT: 63
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): COOLING TOWER BLOWDOWN BOOSTER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: 3196 MT
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 560
MOTOR BRAKE HP: 5
SPEED - RPM: 1150
HEAD - FT: 25
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: BRASS
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 8
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT

UTILITY EMISSION CONTROL SYSTEM DATA — COLORADO-UTE ELECTRIC
DATE: 8/12/81 — CRAIG 2

MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: DG-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 14,000
MOTOR BRAKE HP: 500
SPEED - RPM: 525
HEAD - FT: 103
SERVICE (PH, SOLIDS): PH 5.6-6.1, 15% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASH SLURRY
NUMBER OF PUMPS: 8
NUMBER OF SPARES: 4
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 550
MOTOR BRAKE HP: 30
SPEED - RPM: 950
HEAD - FT: 99
SERVICE (PH, SOLIDS): PH 5.6-6.1, 6% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SUPERNATANT
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 1100
MOTOR BRAKE HP: 40

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

SPEED - RPM: 900
HEAD - FT: 83
SERVICE (PH, SOLIDS): PH 7, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): HYDRAULIC DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 2-1.5 BM
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE
CAPACITY - GPM: 156
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): PH 5.6-7.5, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): POLYELECTROLYTE
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): PISTON
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): DIRECT
COMMON DESIGN (V-BELT, ETC.): VARIABLE CAPACITY
MANUFACTURER: WALLACE AND TIERNAN
PUMP MODEL NUMBER: FA 56
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE SPEED
CAPACITY - GPM: 10
MOTOR BRAKE HP: _____
SPEED - RPM: 1725
HEAD - FT: 50
SERVICE (PH, SOLIDS): VARIABLE PH, NEGLIGIBLE SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL PISTON
CASING MATERIAL SPECIFIC TYPE: _____

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: N/A
IMPELLER MATERIAL SPECIFIC TYPE: N/A
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): WASTE SLURRY
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: B-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 1104
MOTOR BRAKE HP: 50
SPEED - RPM: 800
HEAD - FT: 104
SERVICE (PH, SOLIDS): PH 5.6-7.5, 4.3% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MILL RECIRCULATION
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 155
MOTOR BRAKE HP: 15
SPEED - RPM: 1150
HEAD - FT: 80
SERVICE (PH, SOLIDS): PH 7, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 8/12/81

COLORADO-UTE ELECTRIC
CRAIG 2

PUMPS

FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIMESTONE SLURRY FEED

NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): V-BELT
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-6-6
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 220
MOTOR BRAKE HP: 25
SPEED - RPM: 1400
HEAD - FT: 115
SERVICE (PH, SOLIDS): PH 7, 35% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA COLORADO-UTE ELECTRIC
DATE: 8/12/81 CRAIG 2

COMMENTS/FOOTNOTES

A THERE ARE TWO MODES OF REHEAT, DEPENDING ON INLET $SO_2$ CONCENTRATION. WITH LOW SULFUR COAL ($\geq$ 0.24% S) 250 F INLET FLUE GAS MAY BE BYPASSED TO RAISE ABSORBER EXIT GAS TEMPERATURE 50 F. WITH HIGH SULFUR COAL ($\geq$ 0.96% S), AMBIENT AIR IS HEATED TO 383 F BY A STEAM COIL AND IS INJECTED INTO THE ABSORBER EXIT. MIXED MODE OPERATION IS ALSO POSSIBLE.

DESIGN CONDITIONS-MAX. SULFUR, 0% BYPASS
NORMAL CONDITIONS-AVG. SULFUR, 23% BYPASS
NORMAL CONDITIONS-MIN. SULFUR, 37% BYPASS

B ONE PER UNIT WITH COMMON SPARE.
C THE SLUDGE IS TEMPORARILY DEPOSITED ON SITE, BUT A SURFACE MINE WILL EVENTUALLY BE UTILIZED IN THE FUTURE.
D DURING UPSETS, THE SUPERNATE TANK OVERFLOWS TO THE EVAPORATION PONDS.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Colorado-Ute Electric Association | | | | | | | | |
| Craig 1 | 13/80 | 744 | | D | | | | Module D was first operational scrubber |
| | 11/80 | 720 | 619 | D | | 48 | | |
| | 12/80 | 744 | 716 | A | | 0 | | |
| | | | | B | | 53 | | |
| | | | | C | | 73 | | |
| | | | | D | | 60 | | |
| | | | | System | 807 | 62 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Colorado-Ute Electric Association | | | | | | | | |
| Craig 2 | 7/79 | 744 | | System | | | | |
| | 8/79 | 744 | | System | | | | |
| | 9/79 | 720 | | System | | | | |
| | 10/79 | 744 | | System | | | | |
| | 11/79 | 720 | | System | | | | |
| | 12/79 | 744 | | System | | | | |
| | 1/80 | 744 | | System | | | | |
| | 2/80 | 696 | | System | | | | |
| | 3/80 | 720 | | System | | | System control | Specific problem was not reported |
| | | | | | | | Bypass damper | Problems with opening/closing |
| | 4/80 | 720 | | System | | | | |
| Commercial start-up | 5/80 | 640 | 661 | A | | 38 | | |
| | | | | B | | 43 | | |
| | | | | C | | 47 | | |
| | | | | D | | 30 | | |
| | | | | System | 253 | 53 | | This system has effectively one spare module so that only three are currently needed at full load for compliance (until low sulfur coal source is exhausted several years ahead) |
| | | | | | | | | System availability based on three modules needed for compliance |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | F&D hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Craig 2 (Continued) | 6/80 | 720 | 663 | A | | 43 | | |
| | | | | B | | 54 | | |
| | | | | C | | 61 | | |
| | | | | D | | 35 | | |
| | | | | System | 380 | 66 | Spray nozzles | Plugging problem |
| | | | | | | | System chemistry | High pH levels in thickener underflow |
| | 7/80 | 744 | 640 | A | | 59 | | |
| | | | | B | | 62 | | |
| | | | | C | | 38 | | |
| | | | | D | | 44 | | |
| | | | | System | 350 | 68 | Spray nozzles | Plugging problem |
| | 8/80 | 744 | 672 | A | | 50 | | |
| | | | | B | | 50 | | |
| | | | | C | | 50 | | |
| | | | | D | | 50 | | |
| | | | | System | 327 | 67 | Spray nozzles | Plugging problem |
| | 9/80 | 720 | 713 | A | | 49 | | |
| | | | | B | | 58 | | |
| | | | | C | | 61 | | |
| | | | | D | | 67 | | |
| | | | | System | 552 | 78 | Spray nozzles | Plugging problem continued |
| | 10/80 | 744 | 99 | A | | 100 | | |
| | | | | B | | 100 | | |
| | | | | C | | 100 | | |
| | | | | D | | 100 | | |
| | | | | System | 90 | 100 | Boiler | Low boiler hours due to scheduled outage |
| | 11/80 | 720 | 321 | A | | 69 | | |
| | | | | B | | 0 | Booster fan | Blade pitch problems |
| | | | | C | | 71 | | |
| | | | | D | | 72 | | |
| | | | | System | | 71 | | |
| | 12/80 | 744 | 55 | A | | 43 | | |
| | | | | B | | 0 | Booster fan | Blade pitch problems |
| | | | | C | | 54 | | |
| | | | | D | | 61 | | |
| | | | | System | 377 | 53 | | |

COLUMBUS & SOUTHERN OHIO ELECTRIC

CONESVILLE 5, 6

Columbus & Southern Ohio Electric
Conesville 5, 6

## SECTION 1

## BACKGROUND

During the 1970's, the Conesville Power Station of Columbus and Southern Ohio Electric, which is a mine mouth plant located near a capitive source of high sulfur (4.5%) Ohio coal, was expanded with the addition of two identical units, Conesville 5 and 6. Each unit is coal-fired and has a generating capacity of 405 MW (gross). At the time that Conesville 5 and 6 were constructed, Ohio's new source emission limitation for sulfur dioxide was 1.0 pound of $SO_2$ per million Btu. In order to comply with this regulation, the utility was faced with two practical alternatives: install FGD equipment or burn low sulfur western coal. Since the utility had access to a nearby captive supply of high sulfur coal and since the availability of western coal was questionable and involved higher purchase and transportation costs, the utility decided that FGD was the most economical alternative. A contract was awarded to the Air Correction Division of UOP for the design and installation of a wet lime FGD system for both Conesville 5 and 6. Dravo was contracted to supply magnesium-promoted (thiosorbic) lime for the systems. IU Conversion Systems (IUCS) was contracted to chemically fixate the sludge prior to disposal.

Columbus & Southern Ohio Electric
Conesville 5, 6

Initial startup of Convesville 5 was delayed due to a fire in module A. Actual start-up occurred in January 1977 and the unit began commercial operation in February 1977. At that time, only one module (Module B) was operational. Module A began commercial operation in December 1977 upon completion of repair of the fire damage.

Conesville 6 commenced initial operations in June 1978. The unit was declared commercial one month later.

## SECTION 2

## PROCESS DESCRIPTION

The emission control systems at Conesville 5 and 6 are identical and consist of cold-side ESP's for primary particulate matter control followed by wet lime FGD systems for $SO_2$ control. The FGD systems were supplied by the Air Correction Division of UOP and consist of two parallel absorber modules per system. Each Turbulent Contact Absorber (TCA) was originally designed to handle 60% of the total boiler flue gas flow; however, because the FGD systems were underdesigned with respect to flue gas capacity, each module is currently only able to handle approximately 40% of the total boiler flue gas flow of 1,265,000 acfm at 296°F. The remaining portion of flue gas is bypassed around the system at full load.

Following the unit induced draft (ID) fan, which is located immediately downstream of the ESP, the flue gas enters a presaturator section that quenches the flue gas, lowering the temperature and providing some initial $SO_2$ removal. The gas then enters the absorber module and passes through a grid cage which provides a contacting surface between the lime slurry and the flue gas. The original modules also contained mobile spheres which were later removed. Spent slurry and reaction

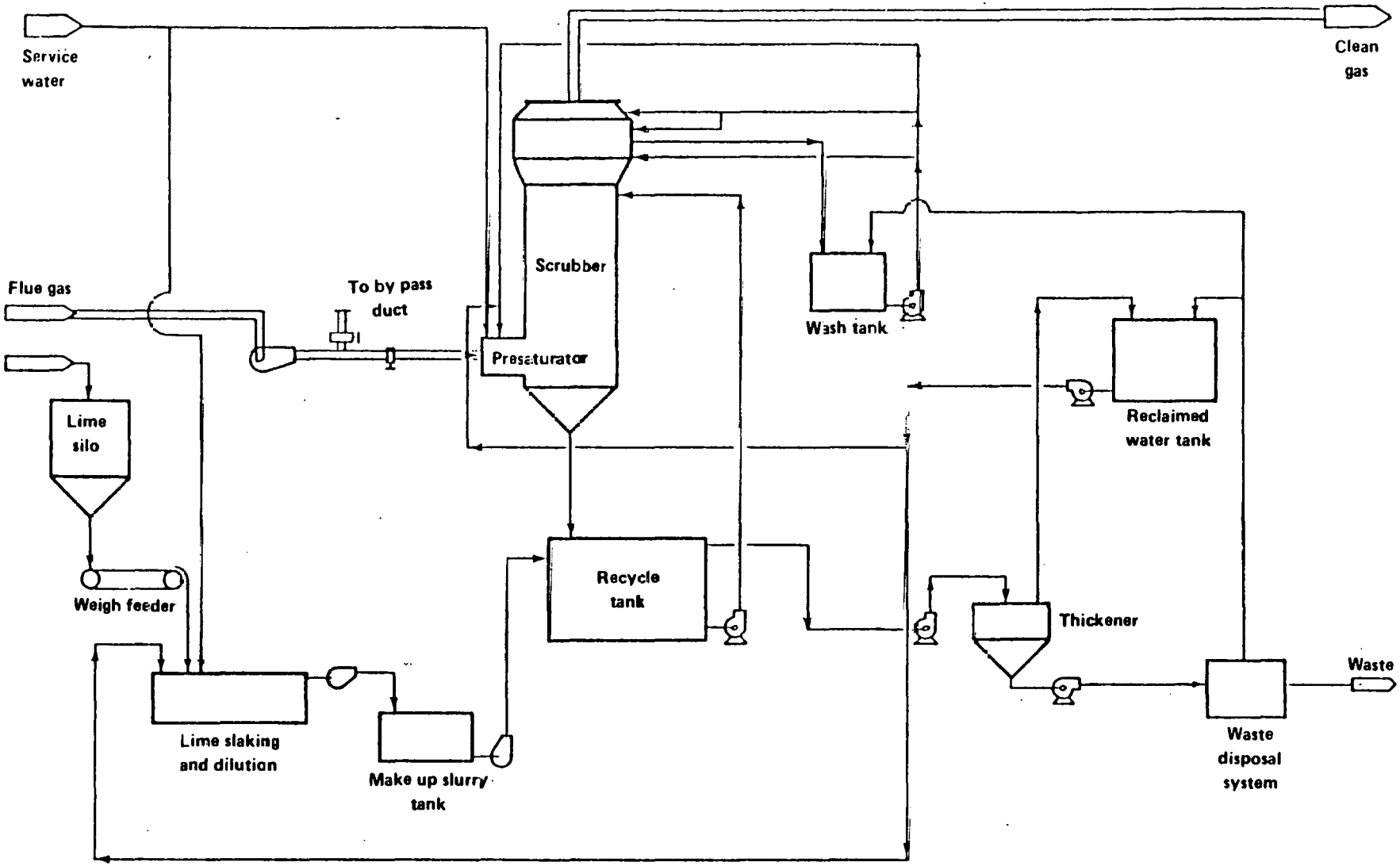
byproducts are collected below in the recycle tank. Fresh slurry is supplied to the module recycle tank from the slaked lime slurry storage tank. Following each module, the flue gas passes through a fiberglass trap-out tray and two horizontal banks of mist eliminators. The bottoms of the trap-out trays are washed intermittently, and the lower mist eliminators are wash continually with recycled pond water. The scrubbed flue gas from the modules of both systems is discharged to a common acid brick lined stack.

Following each boiler ID fan is bypass breeching so that each absorber module can be bypassed independently. Because the systems can only handle 80% of the boiler flue gas at full load, the remaining 20% of the gas is providing bypass reheat. Originally, no stack gas reheat was planned.

A bleed stream of spent reaction products is continuously withdrawn from the recycle tanks and pumped to a thickener. The underflow is cycled to fixation facilities supplied by IUCS. At these facilities the underflow is vacuum-filtered and mixed with a blend of dry fly ash and lime to form a solid substance (IUCS POZ-O-TEC). The product is stockpiled in an on-site landfill.

The wastewater pond receives ash sluice water, cooling water blowdown, and water from the sludge treatment plant. These systems operate in a closed water loop mode.

A flow diagram for the Conesville 5, 6 FGD systems is included on the next page.




Flow Diagram: Conesville 5 or 6

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

GENERAL PLANT INFORMATION
COMPANY NAME: COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY
ASSOCIATED UTILITIES: OWNED BY AMERICAN ELECTRIC POWER COMPANY
PLANT NAME: CONESVILLE
UNIT NUMBER: 5
PLANT ADDRESS: 47201 COUNTY ROAD 273
CITY: CONESVILLE
COUNTY: COSHOCTON
STATE: OHIO
ZIP CODE: 43811
EPA REGION: 5
RIVER BASIN/LAKE REGION: MUSKINGUM RIVER
REGULATORY CLASSIFICATION: STATE STD EQUAL/LESS STRINGENT THAN NSPS (12/71)
PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
NOX EMISSION LIMITATION - LB/MM BTU: 0.7
NET PLANT GENERATING CAPACITY - MW: 1890
GROSS UNIT GENERATING CAPACITY - MW: 405
NET UNIT GENERATING CAPACITY WITH FGD - MW: 373
NET UNIT GENERATING CAPACITY W/O FGD - MW: 380
EQUIVALENT SCRUBBED CAPACITY - MW: 350 (MAXIMUM)

UNIT DATA (BOILER AND STACK)
BOILER SUPPLIER: COMBUSTION ENGINEERING
FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
FURNACE FIRING METHOD: TANGENTIAL
WET BOTTOM/DRY BOTTOM: DRY BOTTOM
FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): CYCLING
COMMERCIAL SERVICE DATE: 6/76
DESIGN BOILER FLUE GAS FLOW - ACFM: 1,265,000 (1,393,839 MAX)
FLUE GAS TEMPERATURE - F: 296
FLUE GAS OXYGEN - %: 4.0 (AT FULL LOAD)
HEAT RATE - BTU/KWH: 9730 DESIGN; 10,450 ACTUAL (NET)
DESIGN FIRING RATE - TPH: 165
EXCESS AIR - %: 25
CAPACITY FACTOR - %: 60
STACK HEIGHT - FT: 800 (COMMON TO UNITS 5 AND 6)
SHELL MATERIAL: CONCRETE
A FLUE MATERIAL GENERIC TYPE: INORGANIC
FLUE MATERIAL SPECIFIC TYPE: ACID RESISTANT BRICK AND CHEMICALLY BONDED MORTAR
FLUE MATERIAL TRADE/COMMON NAME: ASTM C279 AND SAUEREISEN NO. 65
FLUE LINER MATERIAL GENERIC TYPE: NONE
FLUE LINER MATERIAL SPECIFIC TYPE: N/A
FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
FLUE INNER DIAMETER - FT: 26 TOP/44 BOTTOM
B STACK GAS INLET TEMPERATURE - F: 125-350
STACK GAS OUTLET VELOCITY - FT/SEC: 79

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: VARIOUS
- MINE NAME/AREA: _____
- MINE LOCATION - COUNTY: _____
- MINE LOCATION - STATE: OHIO
- AVERAGE HEAT CONTENT - BTU/LB: 10,800
- RANGE HEAT CONTENT - BTU/LB: 10,000-12,000
- AVERAGE ASH CONTENT - %: 14.9
- RANGE ASH CONTENT - %: 10-24
- AVERAGE MOISTURE CONTENT - %: 7.5
- RANGE MOISTURE CONTENT - %: 5-18
- AVERAGE SULFUR CONTENT - %: 4.5
- RANGE SULFUR CONTENT - %: 4.2-5.1
- AVERAGE CHLORIDE CONTENT - %: 0.01
- RANGE CHLORIDE CONTENT - %: 0.01-0.11
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): TYPICAL
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: RESEARCH-COTTRELL
- INLET FLUE GAS CAPACITY - ACFM: 1,394,000
- INLET FLUE GAS TEMPERATURE - F: 296
- PRESSURE DROP - IN. H2O: 2.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.025
- PARTICLE REMOVAL EFFICIENCY - %: 99.65
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME (THIOSORBIC®)
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: AIR CORRECTION DIVISION, UOP
A-E FIRM: BLACK & VEATCH
CONSTRUCTION FIRM: AIR CORRECTION DIVISION, UOP
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.65
SO2 DESIGN REMOVAL EFFICIENCY - %: 89.5
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

COMMERCIAL START-UP: 2/77
INITIAL START-UP: 1/77
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 5/75
CONTRACT AWARDED: 10/74
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: _____
DESIGN COAL HEAT CONTENT - BTU/LB: _____
DESIGN COAL ASH CONTENT - %: _____
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: 4:1
FGD SYSTEM TURNDOWN METHOD: TAKE ONE TRAIN OFF LINE BELOW 60 PERCENT BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 6-8
FGD SYSTEM OXIDATION - %: 15-20
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 7-8
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): _____
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 280
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 4.5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 6.5-8.5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 3
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 48,000
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): CONTRACTED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NONE
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): CONTRACTED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: 10-20% HAS TO BE BYPASSED; DESIGN TOO SMALL
TIME SCHEDULE FOR REDUCED BOILER LOAD: NIGHTLY, 5 NIGHTS/WEEK, 8 HRS/NIGHT
TIME SCHEDULE FOR BOILER SHUTDOWNS: ONCE PER YEAR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE DATA SHEETS
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE DATA SHEETS

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: 2
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

TYPE: SPRAY CHAMBER
LOCATION: INLET TO ABSORBER
SUPPLIER: AIR CORRECTION DIVISION, UOP
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: CARPENTER 20
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F: 286
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): RECLAIMED WATER
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF: 0.55
NUMBER OF SPRAY HEADERS: 4
NOZZLE MATERIAL: CARPENTER 20
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
C GENERIC TYPE: PACKED TOWER
C SPECIFIC TYPE:
C TRADE/COMMON NAME:
SUPPLIER: AIR CORRECTION DIVISION, UOP
DIMENSIONS - FT: 45 X 17.5 X 79.5 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: SYNTHETIC RUBBER
LINER MATERIAL TRADE/COMMON NAME: NEOPRENE
BOILER LOAD PER ABSORBER - %: 50 MAXIMUM
C GAS/LIQUID CONTACT DEVICE TYPE: GRID CAGES
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 9
NOZZLE MATERIAL: SILICON CARBIDE
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 31,560
L/G RATIO - GAL/1000 ACF: 45-90
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC: 6.5-13.1
ABSORBER TURNDOWN RATIO: 2.4:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW RATE TO A MINIMUM OF 25% OF FULL LOAD
INLET GAS FLOW RATE - ACFM: 639,568 (RATED VALUE)

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 5

INLET GAS TEMPERATURE - F: 125
INLET SO2 LEVEL - PPM: 3000
INLET SO2 LEVEL - LB/MM BTU: 10.16
INLET PARTICLE LEVEL - GR/SCF: 0.025
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 125
OUTLET SO2 LEVEL - PPM: 240
OUTLET SO2 LEVEL - LB/MM BTU: 1.05
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 92
PARTICLE REMOVAL EFFICIENCY - %: 99.65 (ESP)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: (A) 0 (B) 0
NUMBER PER MODULE: (A) 1 (B) 1
D GENERIC TYPE: (A) KNOCK-OUT (B) IMPINGEMENT
SPECIFIC TYPE: (A) TRAP-OUT TRAY (B) BAFFLE
COMMON DESIGN: (A) IRRIGATION TRAY (B) CHEVRON VANE
MANUFACTURER: _____
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
E SHAPE (Z-SHAPE/A-FRAME): _____
NUMBER OF STAGES: (A) 1 (B) 2
F NUMBER OF PASSES/STAGE: (A) _____ (B) 3 AND 4
FREEBOARD DISTANCE - FT: (A) 0.2 (B) 10
DISTANCE BETWEEN STAGES - IN.: (B) 4.5
DISTANCE BETWEEN VANES - IN.: (B) 2.0
VANE ANGLES - DEGREES: (B) 90
G PRESSURE DROP - IN. H2O: (B) 1.9
SUPERFICIAL GAS VELOCITY - FT/SEC: (A) 4.9-9.8 (B) 4.9-9.8
CONSTRUCTION MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) FRP (B) FRP
CONSTRUCTION MATERIAL TRADE/COMMON NAME: _____
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (A) RECLAIMED
(B) RECLAIMED
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY,
FRONTSPRAY/BACKSPRAY): (A) UNDERSIDE (B) TOP AND BOTTOM OF FIRST STAGE
WASH FREQUENCY: (A) INTERMITTENT (B) CONTINUOUS
WASH DURATION: (A) _____ (B) N/A
WASH RATE - GAL/MIN: (A) 90 (B) 1000
WASH COVERAGE - GAL/MIN/SQ FT: _____

REHEATER
H NUMBER OF REHEATERS: NONE

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 5

NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: N/A
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FAN
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND QUENCHER
FLUE GAS FLOW RATE - ACFM: 850,000
FLUE GAS TEMPERATURE - F: 296
PRESSURE DROP - IN. H2O: 2.0
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: A514-517
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) GUILLOTINE (B) GUILLOTINE (C) GUILLOTINE AND LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): _____
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): _____
MANUFACTURER: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
I MATERIAL GENERIC TYPE: (A) CARBON STEEL WITH HIGH ALLOY SEALS (B) HIGH ALLOY (C) HIGH ALLOY
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: (A) INCONEL 625 SEALS (B) INCONEL 625 (C) INCONEL 625
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET TO DAMPER (C) OUTLET BEYOND DAMPER (D) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.):
DIMENSIONS (DIAMETER, LENGTH, ETC.):
SHELL MATERIAL GENERIC TYPE: CARBON STEEL (ALL)
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: COR-TEN (ALL)
J LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC (C) INORGANIC (D) NONE
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) FLAKE-FILLED POLYESTER (C) CHEMICALLY BONDED CONCRETE (D) N/A
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) RESISTA-FLAKE 1170 or 1171 (C) SAUEREISEN NO. 72 (D) N/A

EXPANSION JOINTS
LOCATION:
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: TEFLON/ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER: WALLACE & TIERNAN
MATERIALS: CARBON STEEL
NUMBER OF DEVICES:
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH:
PRODUCT QUALITY - % SOLIDS:
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS:

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 5

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE LINES
(B) LIME SLURRY, SCRUBBER SLURRY BLEED, ME WASH, ABSORBER SPRAY HEADERS
(C) RECLAIMED WATER
DIMENSIONS - IN.: _____
MANUFACTURER: _____
K MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) FRP
(C) RUBBER-LINED CARBON STEEL

MAJOR VALVES
LOCATION: (A) RECYCLE (B) OTHERS
FUNCTION (ISOLATION, CONTROL, ETC.): _____
TYPE (BALL, GLOBE, PLUG, ETC.): (A) ECCENTRIC PLUG
(B) DIAPHRAGM AND BUTTERFLY
CONTROL MODE (AUTOMATIC/MANUAL): _____
DIMENSIONS - IN.: _____
MANUFACTURER: (A) DEZURIK (B) GRENELL SANDERS AND MOSITE
MATERIAL: (A) RUBBER-LINED (B) RUBBER-LINED

THICKENERS
L NUMBER OF THICKENERS: 2
NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 145 DIA X 16 DEEP
CAPACITY - GAL: _____
SHELL MATERIAL GENERIC TYPE: CARBON STEEL WALLS AND CONCRETE BOTTOM
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: ORGANIC ON BOTTOM
LINER MATERIAL SPECIFIC TYPE: EPOXY
LINER MATERIAL TRADE/COMMON NAME: _____
RAKE MATERIAL: _____
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 7-12% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM DISPOSITION: TO IUCS THICKENER AND THEN VACUUM FILTER
OVERFLOW STREAM DISPOSITION: TO RECLAIMED WATER TANK

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

SOLIDS DEWATERING
- DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
- DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): _____
- DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): _____
- NUMBER OF DEVICES: 3
- NUMBER OF SPARES: _____
- CONFIGURATION: _____
- DIMENSIONS - FT: _____
- CAPACITY: _____
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: _____
- SHELL MATERIAL TRADE/COMMON NAME: _____
- LINER MATERIAL GENERIC TYPE: _____
- LINER MATERIAL SPECIFIC TYPE: _____
- LINER MATERIAL TRADE/COMMON NAME: _____
- BELT MATERIAL GENERIC TYPE: ORGANIC
- BELT MATERIAL SPECIFIC TYPE: POLYPROPYLENE
- BELT MATERIAL TRADE/COMMON NAME: _____
- FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
- FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30% SOLIDS
- OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 50% SOLIDS
- OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
- OUTLET STREAM DISPOSITION: TO IUCS PROCESS
- OVERFLOW STREAM DISPOSITION: TO RECLAIMED WATER TANK

SLUDGE
- FULL LOAD QUANTITY - TPH/DRY: _____
- MOISTURE CONTENT - % TOTAL FREE WATER: _____
- PERCENT CASO3 - DRY: _____
- PERCENT CASO4 - DRY: _____
- PERCENT CAOH2 - DRY: _____
- PERCENT CACO3 - DRY: _____
- PERCENT ASH - DRY: _____
- PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
- METHOD: POZ-O-TEC
- COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): VACUUM FILTER PRODUCT
- DEVICE (OXIDATION TANK, PUG MILL, ETC.): MIXED WITH LIME AND FLY ASH TO 62% SOLIDS
- PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS
- INLET FLOW RATE - GPM: _____
- INLET QUALITY - % SOLIDS: 50

SLUDGE DISPOSAL
- NATURE (INTERIM/FINAL): FINAL
- GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 5

SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.):
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): CONVEYOR BELT
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.):
SITE DIMENSIONS - AREA/DEPTH: 80 ACRES/50 FT
SITE CAPACITY - VOLUME/ACRE-FT/TONS:
SITE SERVICE LIFE - YEARS:

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM:
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): RECYCLE TANK LEVEL
CONTROL LEVELS: OUTLET PH 5.5-6.3; RECYCLE PH 7.0-7.5
MONITOR TYPE (MANUFACTURER, ETC.):
MONITOR LOCATION: SLURRY DISCHARGE FROM ABSORBER
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL):
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM:
SLUDGE HYDRATION WATER LOSS - GPM:
SLUDGE INTERSTITIAL WATER LOSS - GPM:
POND SEEPAGE/RUNOFF WATER LOSS - GPM:
EFFLUENT WATER LOSS - GPM:
RECEIVING WATER STREAM NAME:
MAKEUP WATER ADDITION - GPM: 500
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.):
MAKEUP WATER ADDITION POINTS & AMOUNTS:
MAKEUP WATER PRE-TREATMENT TYPE:

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): THIOSORBIC® LIME
PRINCIPAL CONSTITUENTS: 90-95% CaO, 3-8% MgO
SOURCE/SUPPLIER: DRAVO
SUPPLIER LOCATION: MAYSVILLE, KY
CONSUMPTION (SPECIFY UNITS): 16 TPH
UTILIZATION - %: 90
POINT OF ADDITION: SLAKER

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 74,900,000
CAPITAL COST - $/KW: 91.2
OPERATING COST - MILLS/KWH: 3.28
MAINTENANCE COST: $980,000/YR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

LABOR COST: $1,000,000/YR
UTILITIES COST: $765,000/YR
CHEMICALS COST: $5,750,000/YR
WASTE DISPOSAL COST: $4,450,000/YR

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %:
MIST ELIMINATOR - %:
REHEATER - %: N/A
FAN - %:
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %:
VACUUM FILTER - %:
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER: N/A
FAN:
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER:
VACUUM FILTER:
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: CONESVILLE 4
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: BELOW ABSORBER MODULE
CONFIGURATION:
DIMENSIONS - FT: 45 DIA X 28 HIGH
CAPACITY - GAL: 332,930
RETENTION TIME - MIN: 7-8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER
LINER MATERIAL TRADE/COMMON NAME:

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECLAIMED WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: AT THICKENER OVERFLOW
CONFIGURATION:
DIMENSIONS - FT: 27 DIA X 7.5 HIGH
CAPACITY - GAL: 26,447
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLURRY TRANSFER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: UNDER SLAKER FLOOR
CONFIGURATION:
DIMENSIONS - FT: 16.5 DIA X 10 HIGH

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

CAPACITY - GAL: 15,825
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MIST ELIMINATOR WASH
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: LIME PREPARATION BUILDING
CONFIGURATION:
DIMENSIONS - FT: 8 DIA X 9.7 HIGH
CAPACITY - GAL: 3660
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLURRY STORAGE
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 10
NUMBER OF SPARES: 4
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: DG-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 9544
MOTOR BRAKE HP: 400
SPEED - RPM: 450
HEAD - FT: 90
SERVICE (PH, SOLIDS): PH 7-8, 7-12% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY TRANSFER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 660
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: 55
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY MAKEUP

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 232
MOTOR BRAKE HP: 20
SPEED - RPM:
HEAD - FT: 72
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE TANK DRAW-OFF
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 660
MOTOR BRAKE HP: 40
SPEED - RPM:
HEAD - FT: 120
SERVICE (PH, SOLIDS): PH 7-8, 7-12% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GOULDS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 1300
MOTOR BRAKE HP: 125
SPEED - RPM:
HEAD - FT: 195
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 316
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 316
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECLAIMED WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GOULDS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 1060
MOTOR BRAKE HP: 125
SPEED - RPM:
HEAD - FT: 235
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 316
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 316
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS:
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): MOYNO
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): HELICAL SCREW
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ROBBINS & MYERS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 5

COMMENTS/FOOTNOTES

A REPLACED COR-TEN STEEL FLUE BECAUSE FLAKELINE 151 LINING FAILED FROM BY-PASSING FLUE GAS AT A MAXIMUM TEMPERATURE OF 330 F. SIX OR SEVEN OTHER LININGS WERE TRIED AND NONE WORKED.

B STACK GAS INLET TEMPERATURE IS 125 F WHEN THE FLUE GAS IS SCRUBBED AND 296 F WHEN THE FLUE GAS IS BYPASSED.

C TOWERS WERE ORIGINALLY TURBULENT CONTACT ABSORBERS. THE BALLS HAVE BEEN REMOVED, BUT THE GRID CAGES HAVE BEEN LEFT IN.

D PRE-MIST ELIMINATOR ACTS AS A BULK ENTRAINMENT SEPARATOR AS WELL AS A TRAP OUT TRAY ONTO WHICH THE MIST ELIMINATOR WASH DRAINS, THUS KEEPING THE MIST ELIMINATOR WASH LOOP SEPARATE.

E TROUGH AND ROOF-TOP DESIGN FOR THE PRE-MIST ELIMINATOR.

F THREE PASSES FOR THE LOWER STAGE AND 4 PASSES FOR THE UPPER STAGE MIST ELIMINATOR.

G 1.6 IN. $H_2O$ FOR THE FIRST STAGE AND 0.3 IN. $H_2O$ FOR THE SECOND STAGE MIST ELIMINATOR.

H THE SYSTEM WAS DESIGNED TO HAVE A WET STACK WITH NO REHEAT; HOWEVER, BECAUSE THE FGD SYSTEM WAS UNDER-DESIGNED BY ROUGHLY 20%, A MINIMUM OF 10% OF THE FLUE GAS BYPASSES THE FGD SYSTEM AND GOES DIRECTLY FROM THE ESP TO THE STACK.

I TYPE 316 STAINLESS STEEL SEALS ON INLET DAMPERS CORRODED RAPIDLY AND WERE REPLACED WITH INCONEL 625 SEALS.

J FLAKELINE 151 LINING IN OUTLET DUCT DOWNSTREAM FROM THE OUTLET DAMPER FAILED DURING BYPASS AND WAS REPLACED WITH SAUEREISEN NO. 54 GUNNED ONTO A STEEL GRID. THE SAUEREISEN NO. 54 HAS BEEN REPLACED WITH SAUEREISEN NO. 72.

K THE RECLAIMED WATER LINES WERE FRP, BUT HIGH PRESSURE PULLED THE JOINTS APART.

L ONE THICKENER IS IN THE IUCS SYSTEM.

M UNITS 5 AND 6 COMBINED.

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 6

GENERAL PLANT INFORMATION
- COMPANY NAME: COLUMBUS & SOUTHERN OHIO ELECTRIC COMPANY
- ASSOCIATED UTILITIES: OWNED BY AMERICAN ELECTRIC POWER COMPANY
- PLANT NAME: CONESVILLE
- UNIT NUMBER: 6
- PLANT ADDRESS: 47201 COUNTY ROAD 273
- CITY: CONESVILLE
- COUNTY: COSHOCTON
- STATE: OHIO
- ZIP CODE: 43811
- EPA REGION: 5
- RIVER BASIN/LAKE REGION: MUSKINGUM RIVER
- REGULATORY CLASSIFICATION: STATE STD EQUAL/LESS STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: 0.7
- NET PLANT GENERATING CAPACITY - MW: 1890
- GROSS UNIT GENERATING CAPACITY - MW: 405
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 373
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 380
- EQUIVALENT SCRUBBED CAPACITY - MW: 350 (MAXIMUM)

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: COMBUSTION ENGINEERING
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD: TANGENTIAL
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): CYCLING
- COMMERCIAL SERVICE DATE: 1977
- DESIGN BOILER FLUE GAS FLOW - ACFM: 1,265,000 (1,393,839 MAX)
- FLUE GAS TEMPERATURE - F: 296
- FLUE GAS OXYGEN - %: 4.0 (AT FULL LOAD)
- HEAT RATE - BTU/KWH: 9730 DESIGN; 10,450 ACTUAL (NET)
- DESIGN FIRING RATE - TPH: 165
- EXCESS AIR - %: 25
- CAPACITY FACTOR - %: 60
- STACK HEIGHT - FT: 800 (COMMON TO UNITS 5 AND 6)
- SHELL MATERIAL: CONCRETE

A
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID RESISTANT BRICK AND CHEMICALLY BONDED MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: ASTM C279 AND SAUEREISEN NO. 65
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 26 TOP/44 BOTTOM

B
- STACK GAS INLET TEMPERATURE - F: 125-350
- STACK GAS OUTLET VELOCITY - FT/SEC: 79

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 6

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
- NAME OF SUPPLIER: VARIOUS
- MINE NAME/AREA: _____
- MINE LOCATION - COUNTY: _____
- MINE LOCATION - STATE: OHIO
- AVERAGE HEAT CONTENT - BTU/LB: 10,800
- RANGE HEAT CONTENT - BTU/LB: 10,000-12,000
- AVERAGE ASH CONTENT - %: 14.9
- RANGE ASH CONTENT - %: 10-24
- AVERAGE MOISTURE CONTENT - %: 7.5
- RANGE MOISTURE CONTENT - %: 5-18
- AVERAGE SULFUR CONTENT - %: 4.5
- RANGE SULFUR CONTENT - %: 4.2-5.1
- AVERAGE CHLORIDE CONTENT - %: 0.01
- RANGE CHLORIDE CONTENT - %: 0.01-0.11
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): TYPICAL
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: RESEARCH-COTTRELL
- INLET FLUE GAS CAPACITY - ACFM: 1,394,000
- INLET FLUE GAS TEMPERATURE - F: 296
- PRESSURE DROP - IN. H2O: 2.0
- PARTICLE OUTLET LOAD - GR/SCF: 0.025
- PARTICLE REMOVAL EFFICIENCY - %: 99.65
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME (THIOSORBIC®)
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: AIR CORRECTION DIVISION, UOP
A-E FIRM: BLACK & VEATCH
CONSTRUCTION FIRM: AIR CORRECTION DIVISION, UOP
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.65
SO2 DESIGN REMOVAL EFFICIENCY - %: 89.5
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

COMMERCIAL START-UP: 7/78
INITIAL START-UP: 6/78
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 5/75
CONTRACT AWARDED: 10/74
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: _____
DESIGN COAL HEAT CONTENT - BTU/LB: _____
DESIGN COAL ASH CONTENT - %: _____
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: 4:1
FGD SYSTEM TURNDOWN METHOD: TAKE ONE TRAIN OFF LINE BELOW 60 PERCENT BOILER LOAD
FGD SYSTEM PRESSURE DROP - IN. H2O: 6-8
FGD SYSTEM OXIDATION - %: 15-20
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 7-8
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): _____
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 280
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 4.5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 6.5-8.5
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 3
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 48,000
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): CONTRACTED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NONE
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): CONTRACTED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: 10-20% HAS TO BE BYPASSED; DESIGN TOO SMALL
TIME SCHEDULE FOR REDUCED BOILER LOAD: NIGHTLY, 5 NIGHTS/WEEK, 8 HRS/NIGHT
TIME SCHEDULE FOR BOILER SHUTDOWNS: ONCE PER YEAR
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE DATA SHEETS
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE DATA SHEETS

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: 2
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 6

TYPE: SPRAY CHAMBER
LOCATION: INLET TO ABSORBER
SUPPLIER: AIR CORRECTION DIVISION, UOP
SHELL MATERIAL GENERIC TYPE: HIGH ALLOY
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: CARPENTER 20
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F: 286
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.): RECLAIMED WATER
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF: 0.55
NUMBER OF SPRAY HEADERS: 4
NOZZLE MATERIAL: CARPENTER 20
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 2
NUMBER OF SPARES: 0
C GENERIC TYPE: PACKED TOWER
C SPECIFIC TYPE:
C TRADE/COMMON NAME:
SUPPLIER: AIR CORRECTION DIVISION, UOP
DIMENSIONS - FT: 45 X 17.5 X 79.5 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: SYNTHETIC RUBBER
LINER MATERIAL TRADE/COMMON NAME: NEOPRENE
BOILER LOAD PER ABSORBER - %: 50 MAXIMUM
C GAS/LIQUID CONTACT DEVICE TYPE: GRID CAGES
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 9
NOZZLE MATERIAL: SILICON CARBIDE
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 31,560
L/G RATIO - GAL/1000 ACF: 45-90
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC: 6.5-13.1
ABSORBER TURNDOWN RATIO: 2.4:1
ABSORBER TURNDOWN METHOD: REDUCE GAS FLOW RATE TO A MINIMUM OF 25% OF FULL LOAD
INLET GAS FLOW RATE - ACFM: 639,568 (RATED VALUE)

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

INLET GAS TEMPERATURE - F: 125
INLET SO2 LEVEL - PPM: 3000
INLET SO2 LEVEL - LB/MM BTU: 10.16
INLET PARTICLE LEVEL - GR/SCF: 0.025
INLET PARTICLE LEVEL - LB/MM BTU: _____
OUTLET GAS FLOW RATE - ACFM: _____
OUTLET GAS TEMPERATURE - F: 125
OUTLET SO2 LEVEL - PPM: 240
OUTLET SO2 LEVEL - LB/MM BTU: 1.05
OUTLET PARTICLE LEVEL - GR/SCF: _____
OUTLET PARTICLE LEVEL - LB/MM BTU: _____
SO2 REMOVAL EFFICIENCY - %: 92
PARTICLE REMOVAL EFFICIENCY - %: 99.65 (ESP)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR
(B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 2 (B) 2
NUMBER OF SPARES: (A) 0 (B) 0
NUMBER PER MODULE: (A) 1 (B) 1
D GENERIC TYPE: (A) KNOCK-OUT (B) IMPINGEMENT
SPECIFIC TYPE: (A) TRAP-OUT TRAY (B) BAFFLE
COMMON DESIGN: (A) IRRIGATION TRAY (B) CHEVRON VANE
MANUFACTURER: _____
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
E SHAPE (Z-SHAPE/A-FRAME): _____
NUMBER OF STAGES: (A) 1 (B) 2
F NUMBER OF PASSES/STAGE: (A) _____ (B) 3 AND 4
FREEBOARD DISTANCE - FT: (A) 0.2 (B) 10
DISTANCE BETWEEN STAGES - IN.: (B) 4.5
DISTANCE BETWEEN VANES - IN.: (B) 2.0
VANE ANGLES - DEGREES: (B) 90
G PRESSURE DROP - IN. H20: (B) 1.9
SUPERFICIAL GAS VELOCITY - FT/SEC: (A) 4.9-9.8 (B) 4.9-9.8
CONSTRUCTION MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) FRP (B) FRP
CONSTRUCTION MATERIAL TRADE/COMMON NAME: _____
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): (A) RECLAIMED
(B) RECLAIMED
POINT OF WATER COLLECTION: _____
WASH DIRECTION (OVERSPRAY/UNDERSPRAY,
FRONTSPRAY/BACKSPRAY): (A) UNDERSIDE (B) TOP AND BOTTOM OF FIRST STAGE
WASH FREQUENCY: (A) INTERMITTENT (B) CONTINUOUS
WASH DURATION: (A) _____ (B) N/A
WASH RATE - GAL/MIN: (A) 90 (B) 1000
WASH COVERAGE - GAL/MIN/SQ FT: _____

REHEATER
H NUMBER OF REHEATERS: NONE

UTILITY EMISSION CONTROL SYSTEM DATA — COLUMBUS & SOUTHERN OHIO ELECTRIC
DATE: 11/5/81 — CONESVILLE 6

NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: N/A
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 2
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FAN
FUNCTION (UNIT/BOOSTER): UNIT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND QUENCHER
FLUE GAS FLOW RATE - ACFM: 850,000
FLUE GAS TEMPERATURE - F: 296
PRESSURE DROP - IN. H2O: 2.0
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: A514-517
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS
NUMBER OF DAMPERS: (A) 2 (B) 2 (C) 2
FUNCTION (CONTROL/SHUT-OFF): (A) SHUT-OFF (B) SHUT-OFF (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) GUILLOTINE (B) GUILLOTINE (C) GUILLOTINE AND LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): _____
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): _____
MANUFACTURER: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):
I MATERIAL GENERIC TYPE: (A) CARBON STEEL WITH HIGH ALLOY SEALS
(B) HIGH ALLOY (C) HIGH ALLOY
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: (A) INCONEL 625 SEALS (B) INCONEL 625
(C) INCONEL 625
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET TO DAMPER (C) OUTLET BEYOND DAMPER
(D) BYPASS
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.):
DIMENSIONS (DIAMETER, LENGTH, ETC.):
SHELL MATERIAL GENERIC TYPE: CARBON STEEL (ALL)
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: COR-TEN (ALL)
J LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC (C) INORGANIC (D) NONE
LINER MATERIAL SPECIFIC TYPE: (A) N/A (B) FLAKE-FILLED POLYESTER
(C) CHEMICALLY BONDED CONCRETE (D) N/A
LINER MATERIAL TRADE/COMMON NAME: (A) N/A (B) RESISTA-FLAKE 1170 or 1171
(C) SAUEREISEN NO. 72 (D) N/A

EXPANSION JOINTS
LOCATION:
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER: RAYBESTOS-MANHATTAN
MATERIAL: TEFLON/ASBESTOS

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER: WALLACE & TIERNAN
MATERIALS: CARBON STEEL
NUMBER OF DEVICES:
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH:
PRODUCT QUALITY - % SOLIDS:
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION: RECYCLE TANK
ON-SITE STORAGE CAPABILITY - DAYS:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE LINES
(B) LIME SLURRY, SCRUBBER SLURRY BLEED, ME WASH, ABSORBER SPRAY HEADERS
(C) RECLAIMED WATER
DIMENSIONS - IN.:
MANUFACTURER:
K MATERIAL: (A) RUBBER-LINED CARBON STEEL (B) FRP
(C) RUBBER-LINED CARBON STEEL

MAJOR VALVES
LOCATION: (A) RECYCLE (B) OTHERS
FUNCTION (ISOLATION, CONTROL, ETC.):
TYPE (BALL, GLOBE, PLUG, ETC.): (A) ECCENTRIC PLUG
(B) DIAPHRAGM AND BUTTERFLY
CONTROL MODE (AUTOMATIC/MANUAL):
DIMENSIONS - IN.:
MANUFACTURER: (A) DEZURIK (B) GRENELL SANDERS AND MOSITE
MATERIAL: (A) RUBBER-LINED (B) RUBBER-LINED

THICKENERS
L NUMBER OF THICKENERS: 2
NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 145 DIA X 16 DEEP
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL WALLS AND CONCRETE BOTTOM
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: ORGANIC ON BOTTOM
LINER MATERIAL SPECIFIC TYPE: EPOXY
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 7-12% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION: TO IUCS THICKENER AND THEN VACUUM FILTER
OVERFLOW STREAM DISPOSITION: TO RECLAIMED WATER TANK

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

SOLIDS DEWATERING
- DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
- DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): _____
- DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): _____
- NUMBER OF DEVICES: 3
- NUMBER OF SPARES: _____
- CONFIGURATION: _____
- DIMENSIONS - FT: _____
- CAPACITY: _____
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE: _____
- SHELL MATERIAL TRADE/COMMON NAME: _____
- LINER MATERIAL GENERIC TYPE: _____
- LINER MATERIAL SPECIFIC TYPE: _____
- LINER MATERIAL TRADE/COMMON NAME: _____
- BELT MATERIAL GENERIC TYPE: ORGANIC
- BELT MATERIAL SPECIFIC TYPE: POLYPROPYLENE
- BELT MATERIAL TRADE/COMMON NAME: _____
- FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
- FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30% SOLIDS
- OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 50% SOLIDS
- OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
- OUTLET STREAM DISPOSITION: TO IUCS PROCESS
- OVERFLOW STREAM DISPOSITION: TO RECLAIMED WATER TANK

SLUDGE
- FULL LOAD QUANTITY - TPH/DRY: _____
- MOISTURE CONTENT - % TOTAL FREE WATER: _____
- PERCENT CASO3 - DRY: _____
- PERCENT CASO4 - DRY: _____
- PERCENT CAOH2 - DRY: _____
- PERCENT CACO3 - DRY: _____
- PERCENT ASH - DRY: _____
- PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
- METHOD: POZ-O-TEC
- COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): VACUUM FILTER PRODUCT
- DEVICE (OXIDATION TANK, PUG MILL, ETC.): MIXED WITH LIME AND FLY ASH TO 62% SOLIDS
- PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS
- INLET FLOW RATE - GPM: _____
- INLET QUALITY - % SOLIDS: 50

SLUDGE DISPOSAL
- NATURE (INTERIM/FINAL): FINAL
- GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): DIKED
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.):
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): CONVEYOR BELT
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.):
SITE DIMENSIONS - AREA/DEPTH: 80 ACRES/50 FT
SITE CAPACITY - VOLUME/ACRE-FT/TONS:
SITE SERVICE LIFE - YEARS:

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM:
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): RECYCLE TANK LEVEL
CONTROL LEVELS: OUTLET PH 5.5-6.3; RECYCLE PH 7.0-7.5
MONITOR TYPE (MANUFACTURER, ETC.):
MONITOR LOCATION: SLURRY DISCHARGE FROM ABSORBER
PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL):
TYPE (OPEN/CLOSED): CLOSED
EVAPORATION WATER LOSS - GPM:
SLUDGE HYDRATION WATER LOSS - GPM:
SLUDGE INTERSTITIAL WATER LOSS - GPM:
POND SEEPAGE/RUNOFF WATER LOSS - GPM:
EFFLUENT WATER LOSS - GPM:
RECEIVING WATER STREAM NAME:
MAKEUP WATER ADDITION - GPM: 500
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.):
MAKEUP WATER ADDITION POINTS & AMOUNTS:
MAKEUP WATER PRE-TREATMENT TYPE:

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
NAME (LIMESTONE, ADIPIC ACID, ETC.): THIOSORBIC® LIME
PRINCIPAL CONSTITUENTS: 90-95% CaO, 3-8% MgO
SOURCE/SUPPLIER: DRAVO
SUPPLIER LOCATION: MAYSVILLE, KY
CONSUMPTION (SPECIFY UNITS): 16 TPH
UTILIZATION - %: 90
POINT OF ADDITION: SLAKER

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 74,900,000
CAPITAL COST - $/KW: 91.2
OPERATING COST - MILLS/KWH: 3.28
MAINTENANCE COST: $980,000/YR

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

LABOR COST: $1,000,000/YR
UTILITIES COST: $765,000/YR
CHEMICALS COST: $5,750,000/YR
WASTE DISPOSAL COST: $4,450,000/YR

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %:
MIST ELIMINATOR - %:
REHEATER - %: N/A
FAN - %:
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %:
VACUUM FILTER - %:
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER: N/A
FAN:
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER:
VACUUM FILTER:
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: CONESVILLE 4
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECYCLE
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: BELOW ABSORBER MODULE
CONFIGURATION:
DIMENSIONS - FT: 45 DIA X 28 HIGH
CAPACITY - GAL: 332,930
RETENTION TIME - MIN: 7 8
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER
LINER MATERIAL TRADE/COMMON NAME:

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): RECLAIMED WATER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: AT THICKENER OVERFLOW
CONFIGURATION:
DIMENSIONS - FT: 27 DIA X 7.5 HIGH
CAPACITY - GAL: 25,447
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLURRY TRANSFER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: UNDER SLAKER FLOOR
CONFIGURATION:
DIMENSIONS - FT: 16.5 DIA X 10 HIGH

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

CAPACITY - GAL: 15,825
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): MIST ELIMINATOR WASH
NUMBER OF TANKS: 2
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED):
LOCATION: LIME PREPARATION BUILDING
CONFIGURATION:
DIMENSIONS - FT: 8 DIA X 9.7 HIGH
CAPACITY - GAL: 3660
RETENTION TIME - MIN:
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: ORGANIC
SHELL MATERIAL SPECIFIC TYPE: FRP
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLURRY STORAGE
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED):
LOCATION:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 10
NUMBER OF SPARES: 4
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: DG-9-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 9544
MOTOR BRAKE HP: 400
SPEED - RPM: 450
HEAD - FT: 90
SERVICE (PH, SOLIDS): PH 7-8, 7-12% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY TRANSFER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 660
MOTOR BRAKE HP: 20
SPEED - RPM: _____
HEAD - FT: 55
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY MAKEUP

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 232
MOTOR BRAKE HP: 20
SPEED - RPM:
HEAD - FT: 72
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECYCLE TANK DRAW-OFF
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GALIGHER
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 660
MOTOR BRAKE HP: 40
SPEED - RPM:
HEAD - FT: 120
SERVICE (PH, SOLIDS): PH 7-8, 7-12% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE:
CASING MATERIAL TRADE/COMMON NAME:
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME:

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MIST ELIMINATOR WASH
NUMBER OF PUMPS: 4
NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GOULDS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 1300
MOTOR BRAKE HP: 125
SPEED - RPM:
HEAD - FT: 195
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 316
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 316
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): RECLAIMED WATER
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.):
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: GOULDS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):
CAPACITY - GPM: 1060
MOTOR BRAKE HP: 125
SPEED - RPM:
HEAD - FT: 235
SERVICE (PH, SOLIDS):
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: TYPE 316
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: TYPE 316
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS:
NUMBER OF SPARES:
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): MOYNO
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): HELICAL SCREW
COMMON DESIGN (V-BELT, ETC.):
MANUFACTURER: ROBBINS & MYERS
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.):

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 11/5/81

COLUMBUS & SOUTHERN OHIO ELECTRIC
CONESVILLE 6

COMMENTS/FOOTNOTES

A REPLACED COR-TEN STEEL FLUE BECAUSE FLAKELINE 151 LINING FAILED FROM BY-PASSING FLUE GAS AT A MAXIMUM TEMPERATURE OF 330 F. SIX OR SEVEN OTHER LININGS WERE TRIED AND NONE WORKED.

B STACK GAS INLET TEMPERATURE IS 125 F WHEN THE FLUE GAS IS SCRUBBED AND 296 F WHEN THE FLUE GAS IS BYPASSED.

C TOWERS WERE ORIGINALLY TURBULENT CONTACT ABSORBERS. THE BALLS HAVE BEEN REMOVED, BUT THE GRID CAGES HAVE BEEN LEFT IN.

D PRE-MIST ELIMINATOR ACTS AS A BULK ENTRAINMENT SEPARATOR AS WELL AS A TRAP OUT TRAY ONTO WHICH THE MIST ELIMINATOR WASH DRAINS, THUS KEEPING THE MIST ELIMINATOR WASH LOOP SEPARATE.

E TROUGH AND ROOF-TOP DESIGN FOR THE PRE-MIST ELIMINATOR.

F THREE PASSES FOR THE LOWER STAGE AND 4 PASSES FOR THE UPPER STAGE MIST ELIMINATOR.

G 1.6 IN. $H_2O$ FOR THE FIRST STAGE AND 0.3 IN. $H_2O$ FOR THE SECOND STAGE MIST ELIMINATOR.

H THE SYSTEM WAS DESIGNED TO HAVE A WET STACK WITH NO REHEAT; HOWEVER, BECAUSE THE FGD SYSTEM WAS UNDER-DESIGNED BY ROUGHLY 20%, A MINIMUM OF 10% OF THE FLUE GAS BYPASSES THE FGD SYSTEM AND GOES DIRECTLY FROM THE ESP TO THE STACK.

I TYPE 316 STAINLESS STEEL SEALS ON INLET DAMPERS CORRODED RAPIDLY AND WERE REPLACED WITH INCONEL 625 SEALS.

J FLAKELINE 151 LINING IN OUTLET DUCT DOWNSTREAM FROM THE OUTLET DAMPER FAILED DURING BYPASS AND WAS REPLACED WITH SAUEREISEN NO. 54 GUNNED ONTO A STEEL GRID. THE SAUEREISEN NO. 54 HAS BEEN REPLACED WITH SAUEREISEN NO. 72.

K THE RECLAIMED WATER LINES WERE FRP, BUT HIGH PRESSURE PULLED THE JOINTS APART.

L ONE THICKENER IS IN THE IUCS SYSTEM.

M UNITS 5 AND 6 COMBINED.

Columbus & Southern Ohio Electric
Conesville 5, 6

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Columbus & Southern Ohio Electric Conesville 5 | 12/76 | 744 | | A<br>B<br>System | | | Module down | Fire delayed Module A startup until 11/77 |
| | 1/77 | 744 | | B<br>System | | | Misc. equipment | Cold weather related problems - frozen lines, gears, pipes, cracked flanges, frozen lime belt conveyor |
| Commercial start-up | 2/77 | 672 | 688 | B | | | TCA beds | Poor velocity distribution problems |
| | | | | | | | Presaturator | Pressure surges |
| | | | | | | | Mist eliminator | Scrubber liquor carryover |
| | | | | System | | | $SO_2$ analyzers | Specific problem not reported |
| | 3/77 | 744 | 520 | B<br>System | | | | |
| | 4/77 | 720 | 685 | B | | 42 | Presaturator | Corrosion to 316 SS area |
| | | | | | | | Recycle tank | Rubber liner peeled due to improper application |
| | | | | System | | | Tube thickeners | Plugging |
| | | | | | | | Reagent | Rocks up to 5 in. in dia. found in lime slurry (Dravo installed mech. separators and metal detectors) |
| | 5/77 | 744 | 712 | B<br>System | | 58 | | |
| | 6/77 | 720 | 713 | B<br>System | | 66 | System down | Unscheduled outage for repairs and modifications |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | 7/77 | 744 | 744 | B | | 0 | Scrubber liner | Repairs (specific problem not reported) |
| | | | | System | | | Unit process control/instrumentation | Modifications (specific problem not reported) |
| | | | | | | | Piping between thickener and IUCS system | Repairs (specific problem not reported) |
| | 8/77 | 744 | | B | | 0 | Module down | Unscheduled outage for repairs and modifications (some due to cold weather) |
| | | | | System | | | | |
| | 9/77 | 720 | 469 | B | | 53 | | |
| | | | | System | | | | |
| | 10/77 | 744 | 559 | B | | 32 | Module down | Module relined in areas with neoprene rubber (reason for relining was not reported) |
| | | | | System | | | | |
| | 11/77 | 720 | 715 | A | | 10 | Module down | Low flow rates caused plugging problems |
| | | | | B | | 33 | | |
| | | | | System | 133 | 22 | | |
| | 12/77 | 744 | 252 | A | | 93 | | |
| | | | | B | | 97 | | |
| | | | | System | 130 | 95 | System down | Scheduled 3-month outage |
| | | | | | | | Carbon steel flue liner | Corrosion (lined with acid brick during scheduled outage) |
| | 1/78 | 744 | 0 | A | | | | |
| | | | | B | | | | |
| | | | | System | 0 | 0 | | |
| | 2/78 | 672 | 0 | A | | | | |
| | | | | B | | | | |
| | | | | System | 0 | 0 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | 3/78 | 744 | 379 | A | | 20 | | |
| | | | | B | | 20 | | |
| | | | | System | 66 | 20 | pH controls | Operational problems experienced (specific problem not reported) |
| | | | | | | | $SO_2$ analyzers | Operational problems experienced (specific problem not reported) |
| | | | | | | | Reagent | Impurities in the lime caused plugging problems |
| | 4/78 | 720 | 716 | A | | 67 | | |
| | | | | B | | 65 | | |
| | | | | System | 421 | 66 | Flocculant feed system | Excess flocculant in thickener yielded a high solids level in the overflow and resulted in plugging problems in the scrubber modules |
| | 5/78 | 744 | 720 | A | | 52 | | |
| | | | | B | | 54 | | |
| | | | | System | 420 | 53 | Flocculant feed system | Continued flocculant problems required that thickeners be emptied to restore the proper flocculant balance |
| | 6/78 | 720 | 720 | A | | 48 | | |
| | | | | B | | 30 | | |
| | | | | System | 243 | 39 | Mist eliminator wash system | FRP pipe failed |
| | 7/78 | 744 | 727 | A | | 66 | | |
| | | | | B | | 43 | | |
| | | | | System | 359 | 55 | Mist eliminator and modules | Unscheduled outage due to the plugging of the mist eliminators and the scrubber ball regions of modules |
| | 8/78 | 744 | 667 | A | | 18 | | |
| | | | | B | | 18 | | |
| | | | | System | 135 | 18 | Mist eliminator | Forced outage to remove scale |
| | | | | | | | Ping pong balls | Scrubber balls had to be replaced |
| | | | | | | | Bypass damper | Operational problems experienced (specific problems not reported) |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | | | | | | | Sludge lines | Broken |
| | | | | | | | Lime slurry feed lines | Plugged |
| | 9/78 | 720 | 707 | A | | 61 | | |
| | | | | B | | 54 | | |
| | | | | System | 316 | 58 | | |
| | 10/78 | 744 | 713 | A | | 72 | | |
| | | | | B | | 82 | | |
| | | | | System | 301 | 77 | Damper | Damper drive problems |
| | | | | | | | Scrubber liner | Minimal rubber liner failure observed at the top of one of the scrubber modules just after the presaturator |
| | 11/78 | 720 | 642 | A | | 43 | | |
| | | | | B | | 84 | | |
| | | | | System | 331 | 64 | | |
| | 12/78 | 744 | 609 | A | | 7 | | |
| | | | | B | | 33 | | |
| | | | | System | 112 | 20 | Misc. equipmert | Cold weather related problems |
| | 1/79 | 744 | 602 | A | | 0 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 0 | | |
| | 2/79 | 672 | 629 | A | | 0 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 0 | System down | Unscheduled outage due to severe winter weather |
| | 3/79 | 744 | 652 | A | | 50 | | |
| | | | | B | | 0 | | |
| | | | | System | 160 | 25 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | 4/79 | 720 | 149 | A | | 17 | | |
| | | | | B | | 0 | Presaturator | Module did not operate because of severe corrosion at the presaturator inlet duct |
| | | | | System | 43 | 9 | | |
| | 5/79 | 744 | 744 | A | | 0 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 0 | Thickener | Repairs were made to the seal between the thickener base and sidewall during scheduled outage |
| | | | | | | | System down | 1-month scheduled outage |
| | 6/79 | 720 | 670 | A | | 69 | | |
| | | | | B | | 50 | | |
| | | | | System | 191 | 60 | pH lines | Plugged |
| | | | | | | | Outlet damper | Specific problem not reported |
| | | | | | | | Flyash conveyor | Flyash conveying problems resulted in about 48 hours outage |
| | 7/79 | 744 | 672 | A | | 75 | | |
| | | | | B | | 93 | | |
| | | | | System | 557 | 84 | | |
| | 8/79 | 744 | 305 | A | | 87 | | |
| | | | | B | | 86 | | |
| | | | | System | 72 | 86 | | |
| | 9/79 | 720 | 383 | A | | 89 | | |
| | | | | B | | 96 | | |
| | | | | System | 199 | 93 | | |
| | 10/79 | 744 | 443 | A | | 53 | | |
| | | | | B | | 48 | | |
| | | | | System | 341 | 51 | | |
| | 11/79 | 720 | 414 | A | | 74 | | |
| | | | | B | | 70 | | |
| | | | | System | 369 | 72 | | |

| Utility/unit | Date | Period hours | Boiler hours | Mocule | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | 12/79 | 744 | | A | | 0 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 0 | Lime blower compressor motor | Experienced problems during last half of 1979 |
| | | | | | | | Sludge pump | Cavitation problems sited |
| | | | | | | | Flyash conveyor | Experienced problems during last half of 1979 |
| | | | | | | | Reagent recirculation | Plugging encountered |
| | | | | | | | Inlet damper | Problems with the guild bars and seals in the inlet damper during the last half of 1979 |
| | 1/80 | 744 | 257 | A | | 89 | | |
| | | | | B | | 93 | | |
| | | | | System | 113 | 91 | System down | Unscheduled boiler outage occurred, during which maintenance was performed on the FGD system |
| | 2/80 | 696 | 343 | A | | 90 | | |
| | | | | B | | 93 | | |
| | | | | System | 226 | 92 | Mist eliminator | Mist eliminator nozzle plugging occurred causing some FGD system outage |
| | 3/80 | 744 | 744 | A | | 88 | | |
| | | | | B | | 88 | | |
| | | | | System | 606 | 88 | IUCS sludge stabilization process | Specific problem was not reported |
| | | | | | | | Scrubber liners and grid rods | Specific problem was not reported |
| | | | | | | | Mist eliminator | Mist eliminator nozzle plugging |
| | 4/80 | 720 | 673 | A | | 95 | | |
| | | | | B | | 75 | | |
| | | | | System | 506 | 85 | Dampers | Specific problem was not reported |
| | | | | | | | Presaturate hoses | Specific problem was not reported |
| | | | | | | | Nozzles | Specific problem was not reported |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 5 (continued) | 5/80 | 744 | 744 | A | | 92 | | |
| | | | | B | | 90 | | |
| | | | | System | 634 | 91 | Process controls/ instrumentation | Specific problem was not reported |
| | 6/80 | 720 | 717 | A | | 90 | | |
| | | | | B | | 94 | | |
| | | | | System | 523 | 86 | IUCS Disposal system | Specific problem was not reported |
| | | | | | | | Service water | Specific problem was not reported |
| | 7/80 | 744 | 461 | A | | 91 | | |
| | | | | B | | 89 | | |
| | | | | System | 352 | 90 | Presaturator | Presaturator hoses and nozzles plugged |
| | 8/80 | 744 | 432 | A | | 98 | | |
| | | | | B | | 95 | | |
| | | | | System | 373 | 97 | Reclaim water | Specific problem was not reported |
| | 9/80 | 720 | 717 | A | | 88 | | |
| | | | | B | | 89 | | |
| | | | | System | 568 | 89 | Inlet damper | Inlet damper inlet seal leakage |
| | | | | | | | Presaturator | Continued presaturation problems |
| | 10/80 | 744 | 723 | A | | 93 | | |
| | | | | B | | 89 | | |
| | | | | System | 571 | 91 | Dampers | Specific problem was not reported |
| | | | | | | | Agitator motor | Specific problem was not reported |
| | 11/80 | 720 | 630 | A | | 79 | | |
| | | | | B | | 86 | | |
| | | | | System | 316 | 83 | Lime slurry tank and agitator motor | 28-hour outage due to lime slurry tank and agitator problems |
| | | | | | | | Misc. equipment | Additional minor problems were encountered with the presaturator hoses, temperature probes, thickeners, and service water during 11/80 |
| | 12/80 | 744 | 689 | A | | 93 | | |
| | | | | B | | 91 | | |
| | | | | System | 604 | 92 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Columbus & Southern Ohio Electric Conesville 6 | 6/78 | 720 | 524 | A | | 56 | | |
| | | | | B | | 44 | | |
| | | | | System | 174 | 50 | Bypass damper | Boiler shut down because bypass damper could not be controlled |
| Commercial start-up | 7/78 | 744 | 502 | A | | 83 | | |
| | | | | B | | 70 | | |
| | | | | System | 141 | 77 | Bypass damper | Control problem continued |
| | | | | | | | Piping | The FRP transfer line from the thickener to the IUC's system ruptured as a result of water hammer in the line |
| | 8/78 | 744 | 642 | A | | 47 | | |
| | | | | B | | 62 | | |
| | | | | System | 354 | 55 | Sludge line | Breaks in lines |
| | | | | | | | Bypass damper | Control problem |
| | 9/78 | 720 | 706 | A | | 55 | | |
| | | | | B | | 69 | | |
| | | | | System | 372 | 62 | Lime slurry feed lines | Plugging problem |
| | | | | | | | Sludge lines | Breaks in lines |
| | | | | | | | Bypass damper | Control problem |
| | 10/78 | 744 | 603 | A | | 98 | | |
| | | | | B | | 37 | | |
| | | | | System | 199 | 68 | Damper seals and guide bars | Specific problem was not reported |
| | 11/78 | 720 | 600 | A | | 26 | | |
| | | | | B | | 26 | | |
| | | | | System | 36 | 26 | Lime transfer | Baghouse plugged when shakers became inoperable |
| | | | | | | | Thickener | The thickener rake motor burned out |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 6 (Continued) | 12/78 | 744 | 672 | A | | 35 | | |
| | | | | B | | 27 | | |
| | | | | System | 155 | 31 | Thickener | Thickener rake motor burned out |
| | 1/79 | 744 | 730 | A | | 5 | | |
| | | | | B | | 0 | | |
| | | | | System | 8 | 3 | System | System outage due to cold weather related problems |
| | 2/79 | 672 | 629 | A | | 0 | | |
| | | | | B | | 0 | | |
| | | | | System | 0 | 0 | System | System down all month due to cold weather related problems |
| | 3/79 | 744 | 604 | A | | 43 | | |
| | | | | B | | 32 | | |
| | | | | System | 216 | 38 | | |
| | 4/79 | 720 | 711 | A | | 82 | | |
| | | | | B | | 72 | | |
| | | | | System | 489 | 77 | | |
| | 5/79 | 744 | 0 | A | | | | |
| | | | | B | | | | |
| | | | | System | 0 | 100 | Boiler | Boiler did not operate due to a scheduled annual outage |
| | | | | | | | Thickener | Repairs were made to the seal between the thickener base and sidewall |
| | 6/79 | 720 | 433 | A | | 43 | | |
| | | | | B | | 49 | | |
| | | | | System | 209 | 46 | Fly ash conveyor | Fly ash conveying problems caused 48-hour outage |
| | | | | | | | pH lines | Plugging problem |
| | 7/79 | 744 | 544 | A | | 84 | | |
| | | | | B | | 89 | | |
| | | | | System | 196 | 86 | | |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Mocule | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 6 (Continued) | 8/79 | 744 | 744 | A | | 76 | | |
| | | | | B | | 78 | | |
| | | | | System | 310 | 77 | | |
| | 9/79 | 720 | 681 | A | | 88 | | |
| | | | | B | | 87 | | |
| | | | | System | 388 | 88 | | |
| | 10/79 | 744 | 713 | A | | 76 | | |
| | | | | B | | 43 | | |
| | | | | System | 320 | 60 | | |
| | 11/79 | 720 | 599 | A | | 67 | | |
| | | | | B | | 52 | | |
| | | | | System | 320 | 60 | | |
| | 12/79 | 744 | 744 | A | | 84 | | |
| | | | | B | | 91 | | |
| | | | | System | 606 | 88 | Lime blower compressor motor | Experienced problems during last half of 1979 |
| | | | | | | | Sludge pump | Cavitation problems |
| | | | | | | | Fly ash conveyor | Fly ash conveyor system caused problems during the latter half of 1979 |
| | | | | | | | Reagent circulation | Plugging problems |
| | | | | | | | Inlet damper | Guide bars and seals in the inlet damper caused problems during the last half of 1979 |
| | 1/80 | 744 | 744 | A | | 88 | | |
| | | | | B | | 89 | | |
| | | | | System | 566 | 89 | | |
| | 2/80 | 696 | 648 | A | | 87 | | |
| | | | | B | | 92 | | |
| | | | | System | 503 | 90 | Mist eliminator | Plugging of mist eliminator nozzles |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 6 (Continued) | 3/80 | 744 | 160 | A | | 93 | | |
| | | | | B | | 94 | | |
| | | | | System | 117 | 94 | Boiler | Low boiler hours due to boiler/turbine inspection outage |
| | 4/80 | 720 | 312 | A | | 99 | | |
| | | | | B | | 99 | | |
| | | | | System | 125 | 99 | Dampers | Specific problem was not reported |
| | | | | | | | Presaturator hoses | Specific problem was not reported |
| | | | | | | | Nozzles | Specific problem was not reported |
| | 5/80 | 744 | 701 | A | | 97 | | |
| | | | | B | | 96 | | |
| | | | | System | 323 | 97 | Instrumentation | Specific problem was not reported |
| | 6/80 | 720 | 715 | A | | 97 | | |
| | | | | B | | 97 | | |
| | | | | System | 444 | 97 | Service water | Specific problem was not reported |
| | | | | | | | IUCS disposal system | Specific problem was not reported |
| | 7/80 | 744 | 722 | A | | 96 | | |
| | | | | B | | 99 | | |
| | | | | System | 630 | 98 | Inlet damper | Seal leak problem |
| | | | | | | | Process control | Malfunctioned |
| | 8/80 | 744 | 343 | A | | 90 | | |
| | | | | B | | 97 | | |
| | | | | System | 259 | 94 | Reclaim water system | Problems encountered |
| | | | | | | | Recycle slurry system | Problems encountered |
| | 9/80 | 720 | 716 | A | | 94 | | |
| | | | | B | | 94 | | |
| | | | | System | 641 | 94 | Inlet damper | Seal leak problem |
| | | | | | | | IUCS system | Problems encountered |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Conesville 6 (Continued) | 10/80 | 744 | 670 | A | | 89 | | |
| | | | | B | | 94 | | |
| | | | | System | 535 | 92 | IUCS system | Problems with system continued |
| | 11/80 | 720 | 429 | A | | 100 | | |
| | | | | B | | 98 | | |
| | | | | System | 374 | 99 | | |
| | 12/80 | 744 | 744 | A | 86 | | | |
| | | | | B | 88 | | | |
| | | | | System | 87 | 744 | Reclaim water tank | Repaired |

COOPERATIVE POWER ASSOCIATION

COAL CREEK 1, 2

Cooperative Power Association
Coal Creek 1, 2

## SECTION 1

## BACKGROUND

During the 1970's, a joint venture between Cooperative Power Association and United Power Association resulted in the construction of the Coal Creek Power Station. The plant presently consists of two units rated at 550 MW (gross) each, and is located at the mouth of a lignite mine in central North Dakota. Coal Creek 1 and 2 fire lignite with an average sulfur content of 0.63%. At the time the units were built, the U.S. Environmental Protection Agency and the State of North Dakota had adopted air quality standards (pursuant to the Clean Air Act of 1970) limiting $SO_2$ emissions to 1.2 pounds per million Btu and particulate matter emissions to 0.10 pound per million Btu. Evaluation of feasible alternatives revealed that without gas cleaning equipment, $SO_2$ emissions could range from 0.9 to 2.7 pounds per million Btu input and particulate matter emissions could range from 4.2 to 13.5 pounds per million Btu input. As a result, Combustion Engineering was contracted to install lime/alkaline fly ash FGD systems to control $SO_2$ emissions from both Units 1 and 2.

A partial scrubbing system was selected over systems that require the scrubbing of all the flue gas. This system uses high efficiency scrubbers to process a maximum of 60% of the

gas. The remainder of the gas is bypassed; therefore, the need for reheat equipment is eliminated. This system improves the station heat rate and lowers the makeup water requirements.

The decision to use a lime/alkaline fly ash system was based on a lignite ash analysis which indicated that a significant amount of calcium is present; therefore, a system which allows maximum usage of the fly ash and minimize the use of lime would prove to be more economical.

Wheelabrator-Frye was awarded a contract to supply cold-side ESP's for control of particulate matter emissions. Initial operation of the Coal Creek 1 FGD system began in July 1979, and the Coal Creek 2 FGD system began operating approximately one year later.

Cooperative Power Association
Coal Creek 1, 2

## SECTION 2

## PROCESS DESCRIPTION

Each Coal Creek emission control system consists of a lime/alkaline fly ash FGD system designed to treat a maximum of 60% of the boiler flue gas flow of 2,200,000 acfm at 320°F, and an ESP to control particulate matter emissions.

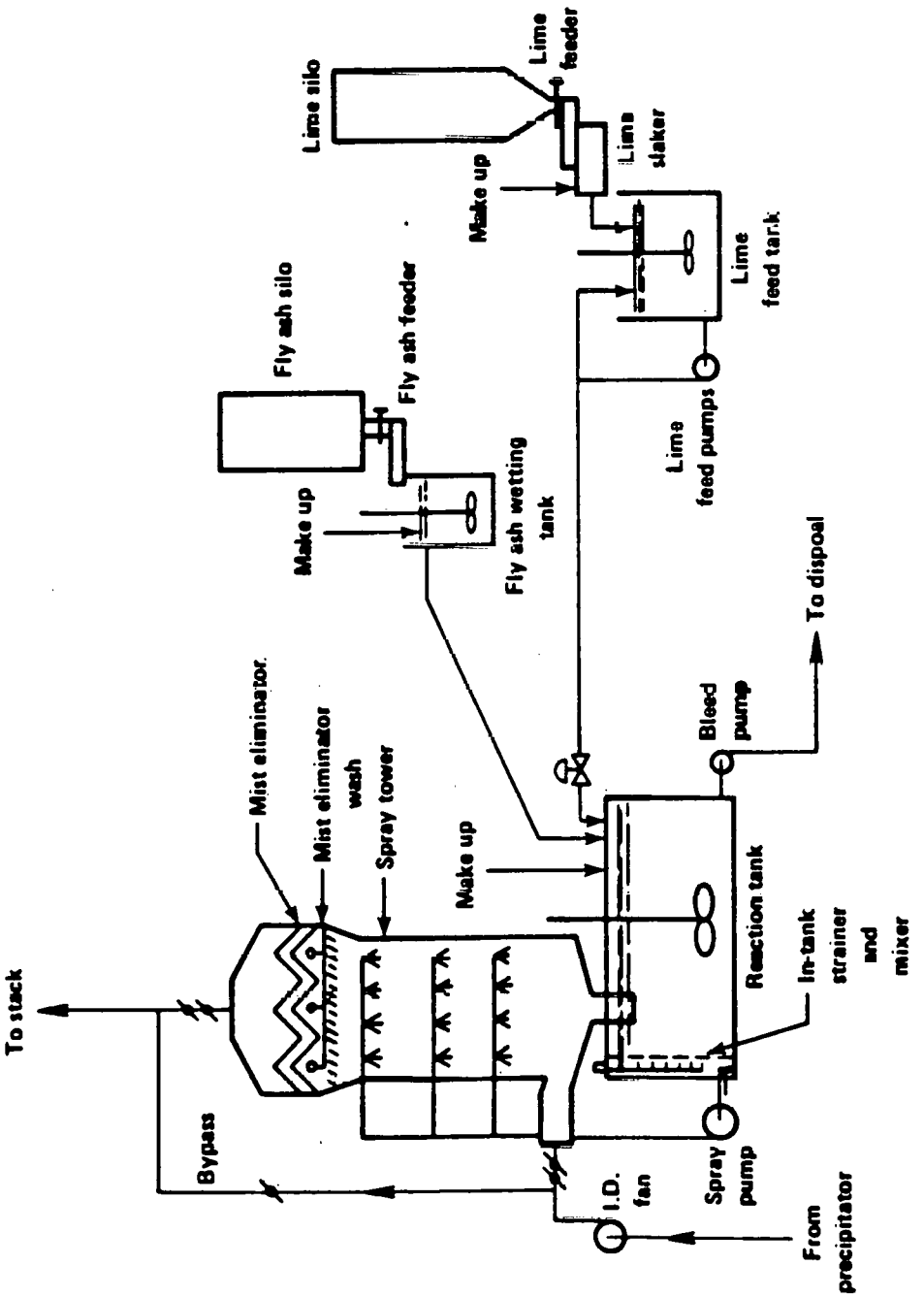
Following the boiler, the flue gas from each unit enters the ESP which is designed to remove 99.5% of the inlet particulate matter. After exiting the boiler air preheater, at full load conditions, approximately 60% of the flue gas is ducted into the absorber modules. Each system includes four countercurrent spray tower modules that contain three levels of spray nozzles. The flue gas flowing upward through each tower is contacted with the alkaline slurry recirculated from the reaction tanks. Mist elimination is provided by both a bulk entrainment separator and two layers of mist eliminators. Gas leaving the top of the scrubber modules is essentially free of entrained moisture, but is saturated at about 135°F. The gases are combined with the 40% bypass gases prior to entry into the 658-foot stack at approximately 1,700,000 acfm at 210°F. The gas stream exiting the stack contains approximately 450 ppm of $SO_2$ and 0.013 grains/dscf of particulate matter.

Cooperative Power Association
Coal Creek 1, 2

The alkaline additive to the reaction tanks is fly ash collected in the ESP's supplemented as required with slake pebble lime. These systems operate in an open water loop mode with the stabilized sludge being disposed of in a lined pond.

A flow diagram for the Coal Creek 1, 2 FGD systems is included on the next page.

Cooperative Power Association
Coal Creek 1,2




Flow Diagram: Coal Creek 1 or 2

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

GENERAL PLANT INFORMATION
- COMPANY NAME: COOPERATIVE POWER ASSOCIATION (56%)
- ASSOCIATED UTILITIES: UNITED POWER ASSOCIATION (44%)
- PLANT NAME: COAL CREEK
- UNIT NUMBER: 1
- PLANT ADDRESS: P.O. BOX 780
- CITY: UNDERWOOD
- COUNTY: MCLEAN
- STATE: NORTH DAKOTA
- ZIP CODE: 585/6
- EPA REGION: 8
- RIVER BASIN/LAKE REGION: MISSOURI
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: NONE
- NET PLANT GENERATING CAPACITY -MW: 1100
- GROSS UNIT GENERATING CAPACITY - MW: 550
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 500
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 500.5
- EQUIVALENT SCRUBBED CAPACITY - MW: 327

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: COMBUSTION ENGINEERING
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED LIGNITE

A FURNACE FIRING METHOD: TANGENTIAL
- WET BOTTOM/DRY BOTTOM:
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED):
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE:
- DESIGN BOILER FLUE GAS FLOW - ACFM: 2,200,000
- FLUE GAS TEMPERATURE - F: 320
- FLUE GAS OXYGEN - %: 3.5
- HEAT RATE - BTU/KWH:
- DESIGN FIRING RATE - TPH: 422
- EXCESS AIR - %: 10
- CAPACITY FACTOR - %: 60
- STACK HEIGHT - FT: 658
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME:
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 22.0
- STACK GAS INLET TEMPERATURE - F:
- STACK GAS OUTLET VELOCITY - FT/SEC: 90

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): LIGNITE
- NAME OF SUPPLIER: FALKIRK MINING CO.
- MINE NAME/AREA: UNDERWOOD FIELD
- MINE LOCATION - COUNTY: _____
- MINE LOCATION - STATE: NORTH DAKOTA
- AVERAGE HEAT CONTENT - BTU/LB: 6258
- RANGE HEAT CONTENT - BTU/LB: 3068-7660
- AVERAGE ASH CONTENT - %: 7.14
- RANGE ASH CONTENT - %: 3.9-16.0
- AVERAGE MOISTURE CONTENT - %: 39.8
- RANGE MOISTURE CONTENT - %: 27.8-52.6
- AVERAGE SULFUR CONTENT - %: 0.63
- RANGE SULFUR CONTENT - %: 0.18-1.41
- AVERAGE CHLORIDE CONTENT - %: 0.02
- RANGE CHLORIDE CONTENT - %: 0.0-0.08
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): _____
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: WHEELABRATOR-FRYE
- INLET FLUE GAS CAPACITY - ACFM: 2,310,000
- INLET FLUE GAS TEMPERATURE - F: 321
- PRESSURE DROP - IN. H2O: 2.5 (4.0 INCLUDING DUCTWORK)

B
- PARTICLE OUTLET LOAD - GR/SCF: 0.01
- PARTICLE REMOVAL EFFICIENCY - %: 99.5
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME/ALKALINE FLY ASH
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: COMBUSTION ENGINEERING
A-E FIRM: BLACK & VEATCH
CONSTRUCTION FIRM:
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - %: 54
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

COMMERCIAL START-UP: 8/79
INITIAL START-UP: 7/79
CONSTRUCTION COMPLETION: _____
CONSTRUCTION INITIATION: 8/77
CONTRACT AWARDED: 6/77
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: _____
DESIGN COAL HEAT CONTENT - BTU/LB: _____
DESIGN COAL ASH CONTENT - %: _____
DESIGN COAL MOISTURE CONTENT - %: _____
DESIGN COAL CHLORIDE CONTENT - %: _____
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 174,200 (BOTH UNITS)
FGD SYSTEM TURNDOWN RATIO: _____
FGD SYSTEM TURNDOWN METHOD: _____
FGD SYSTEM PRESSURE DROP - IN. H2O: 4.5
FGD SYSTEM OXIDATION - %: _____
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10-15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 3
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): MINIMAL (REDESIGNING)
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): ROTATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NO SCHEDULE
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: NONE
TIME SCHEDULE FOR REDUCED BOILER LOAD: NIGHTLY
TIME SCHEDULE FOR BOILER SHUTDOWNS: EVERY 18 MONTHS FOR 4 WEEKS
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE OTHER DATA SHEETS

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 4
NUMBER OF SPARES: 1
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME:
SUPPLIER: COMBUSTION ENGINEERING
DIMENSIONS - FT: 21.5 WIDE X 20 DEEP X 55 HIGH
SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL
SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BOILER LOAD PER ABSORBER - %: 15
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 3
NOZZLE MATERIAL: CERAMIC
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 20,790 (65,730 AT 60% SCRUBBING)
L/G RATIO - GAL/1000 ACF: 60
GAS-SIDE PRESSURE DROP - IN. H2O: 3.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 10.6
ABSORBER TURNDOWN RATIO:
ABSORBER TURNDOWN METHOD:
INLET GAS FLOW RATE - ACFM: 1,390,000
INLET GAS TEMPERATURE - F: 321
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

INLET PARTICLE LEVEL - GR/SCF: 0.01
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %: 90
PARTICLE REMOVAL EFFICIENCY - %:

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 4 (B) 4
NUMBER OF SPARES: (A) 0 (B) 0
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A) BULK SEPARATION (B) IMPINGEMENT
SPECIFIC TYPE: (A) BAFFLE SLATS (B) BAFFLE
COMMON DESIGN: (A) BULK ENTRAINMENT SEPARATOR (B) CHEVRON VANE
MANUFACTURER:
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
C SHAPE (Z-SHAPE/A-FRAME):
NUMBER OF STAGES: (A) 1 (B) 2
NUMBER OF PASSES/STAGE: (A) 1 (B) 2
FREEBOARD DISTANCE - FT: 8
DISTANCE BETWEEN STAGES - IN.: 30
DISTANCE BETWEEN VANES - IN.: 3
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H2O: 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: 8.9
CONSTRUCTION MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) FRP (B) FRP
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): COOLING TOWER BLOWDOWN
POINT OF WATER COLLECTION:
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): UNDERSPRAY
WASH FREQUENCY: INTERMITTENT
WASH DURATION:
WASH RATE - GAL/MIN: 600
WASH COVERAGE - GAL/MIN/SQ FT:

REHEATER
NUMBER OF REHEATERS: 1
NUMBER OF SPARES: 0
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): BYPASS
SPECIFIC TYPE (STEAM, HOT WATER, ETC.): COLD SIDE
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): N/A

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

COMBUSTION FUEL SULFUR CONTENT - %: N/A
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 40
TEMPERATURE INCREASE - F: 85
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F: 135
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F: 210
ENERGY REQUIREMENT - MM BTU/HR: N/A
NUMBER OF HEAT EXCHANGER BANKS: N/A
NUMBER OF BUNDLES PER BANK: N/A
NUMBER OF TUBES PER BUNDLE: N/A
STEAM OR WATER PRESSURE - PSIG: N/A
STEAM OR WATER TEMPERATURE - F: N/A
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 4
NUMBER OF SPARES:
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FAN COMPANY
FUNCTION (UNIT/BOOSTER): BALANCED DRAFT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN FSP AND ABSORBER
FLUE GAS FLOW RATE - ACFM:
FLUE GAS TEMPERATURE - F:
PRESSURE DROP - IN. H20: 42 (880 RPM), 26 (705 RPM) PRESSURE RISE
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS (D) ID FAN ISOLATION
NUMBER OF DAMPERS: (A) 8 (B) 8 (C) 4 (D) 4 INLET, 4 OUTLET
FUNCTION (CONTROL/SHUT-OFF): (A&B) ISOLATION (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.):
TRADE/COMMON DESIGN
(SINGLE LOUVER/DOUBLE LOUVER): (A&B) ALL DOUBLE LOUVERS EXCEPT BYPASS
(C) SINGLE LOUVER
MANUFACTURER:
MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

MATERIAL GENERIC TYPE: (A,C) LOW ALLOY STEEL BLADES AND STAINLESS STEEL SEALS
(B) STAINLESS STEEL
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: (A,C) COR-TEN AND TYPE 316L (B) TYPE 316L
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:

DUCTWORK
LOCATION: (A) OUTLET (B) INLET AND BYPASS (C) PLENUM TO STACK
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.):
DIMENSIONS (DIAMETER, LENGTH, ETC.):
SHELL MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B&C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) NONE (C) INORGANIC
LINER MATERIAL SPECIFIC TYPE: (C) GUNITE
LINER MATERIAL TRADE/COMMON NAME:

EXPANSION JOINTS
LOCATION: (A) INLET AND OUTLET (B) DUCTWORK
TYPE (METALLIC/ELASTOMERIC): (A) ELASTOMERIC (B) METALLIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT):
PRESSURE (NEGATIVE/POSITIVE):
OPERATING TEMPERATURE - F:
DESIGN CONFIGURATION (V-SHAPED, ETC.):
MANUFACTURER:
MATERIAL: (A) VITON®/ASBESTOS AT INLET AND BUTYL RUBBER AT OUTLET
(B) COR-TEN STEEL ON HOT SIDE AND TYPE 316L STAINLESS STEEL ON WET SIDE

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.):
MANUFACTURER: WALLACE AND TIERNAN
MATERIALS:
NUMBER OF DEVICES: 2
NUMBER OF SPARES:
FULL LOAD DRY FEED CAPACITY - TPH:
PRODUCT QUALITY - % SOLIDS: 10
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM:
PREPARED REAGENT POINT OF ADDITION: REACTION TANK
ON-SITE STORAGE CAPABILITY - DAYS: 10 (60% SCRUBBING)

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

MAJOR PIPING
  FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) ADDITIVE SLURRY TRANSFER AND DISTRIBUTION PIPING (B) ABSORBER RECYCLE (C) ABSORBER BLOWDOWN
  DIMENSIONS - IN.:
  MANUFACTURER:
  MATERIAL: FRP WITH ABRASION LINING (ALL)

MAJOR VALVES
  LOCATION: (A) ABSORBER RECYCLE (B) ABSORBER BLOWDOWN (C&D) ADDITIVE SLURRY TRANSFER AND DISTRIBUTION
  FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL (C) ISOLATION (D) CONTROL
  TYPE (BALL, GLOBE, PLUG, ETC.): (A) KNIFEGATE (B) PINCH (C) BUTTERFLY (D) NEEDLE
  CONTROL MODE (AUTOMATIC/MANUAL):
  DIMENSIONS - IN.:
  MANUFACTURER: (A) HILTON (B) R.K.L. (C) KEYSTONE (D) CE-INVALCO
  MATERIAL: (A) CAST IRON (B) CAST IRON/RUBBER (C) CAST IRON (D) CAST IRON

THICKENERS
  NUMBER OF THICKENERS: NONE
  NUMBER OF SPARES:
  CONFIGURATION:
  DIMENSIONS - FT:
  CAPACITY - GAL:
  SHELL MATERIAL GENERIC TYPE:
  SHELL MATERIAL SPECIFIC TYPE:
  SHELL MATERIAL TRADE/COMMON NAME:
  LINER MATERIAL GENERIC TYPE:
  LINER MATERIAL SPECIFIC TYPE:
  LINER MATERIAL TRADE/COMMON NAME:
  RAKE MATERIAL:
  FEED STREAM SOURCE:
  FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
  OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
  OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
  OUTLET STREAM DISPOSITION:
  OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
  DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
  DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
  DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
  NUMBER OF DEVICES:
  NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER:
PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY:
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: NONE (FLY ASH IS THE ABSORBENT)
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.):
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.):
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): CLAY LINING
SITE DIMENSIONS - AREA/DEPTH: 400 ACRES (BOTH UNITS)
SITE CAPACITY - VOLUME/ACRE-FT/TONS:
SITE SERVICE LIFE - YEARS: 35 (BOTH UNITS)

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: _____
- CHEMICAL PARAMETERS (PH, ETC.): (A) PH, $SO_2$
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): SOLIDS, LIQUID LEVEL
- CONTROL LEVELS: _____
- MONITOR TYPE (MANUFACTURER, ETC.): UNILOC FOR PH, LEAR & SIEGLER FOR $SO_2$, MOORE FOR SOLIDS, DREXELBROOK FOR LEVEL
- MONITOR LOCATION: REACTION TANK FOR PH
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): _____
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): _____

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): _____
- TYPE (OPEN/CLOSED): OPEN
- EVAPORATION WATER LOSS - GPM: _____
- SLUDGE HYDRATION WATER LOSS - GPM: _____
- SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
- EFFLUENT WATER LOSS - GPM: _____
- RECEIVING WATER STREAM NAME: _____
- MAKEUP WATER ADDITION - GPM: _____
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
- MAKEUP WATER ADDITION POINTS & AMOUNTS: _____
- MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME
- PRINCIPAL CONSTITUENTS: CaO
- SOURCE/SUPPLIER: PETE LIEN & SONS, INC.
- SUPPLIER LOCATION: RAPID CITY, SOUTH DAKOTA
- CONSUMPTION (SPECIFY UNITS): _____
- UTILIZATION - %: _____
- POINT OF ADDITION: SLAKER

ECONOMICS
- CAPITAL COST - $: 15,600,000 (BOTH UNITS)
- CAPITAL COST - $/KW: 28.4
- OPERATING COST - MILLS/KWH: _____
  - MAINTENANCE COST: _____
  - LABOR COST: _____
  - UTILITIES COST: _____
  - CHEMICALS COST: _____
  - WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

MIST ELIMINATOR - %:
REHEATER - %:
FAN - %:
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER:
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 1

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REACTION/RECYCLE/THICKENER
NUMBER OF TANKS: 2
NUMBER OF SPARES:
TYPE (OPEN/COVERED): COVERED
LOCATION: DIRECTLY UNDER ABSORBERS (INDOORS)
CONFIGURATION:
DIMENSIONS - FT: 19 X 51.5
CAPACITY - GAL: 296,000
RETENTION TIME - MIN: 10
NUMBER OF AGITATORS: 2
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: PHENOLIC PAINT
LINER MATERIAL TRADE/COMMON NAME:

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): FLY ASH WETTING
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED): COVERED
LOCATION: INDOORS
CONFIGURATION:
DIMENSIONS - FT: 6 X 6
CAPACITY - GAL: 860
RETENTION TIME - MIN: 7.5
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION:
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME FEED
NUMBER OF TANKS:
NUMBER OF SPARES:
TYPE (OPEN/COVERED): COVERED
LOCATION: INDOORS
CONFIGURATION:
DIMENSIONS - FT: 12 X 12

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

CAPACITY - GAL: 9350
RETENTION TIME - MIN: 45
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): _____
NUMBER OF TANKS: _____
NUMBER OF SPARES: _____
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: _____
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 COAL CREEK 1

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BLEED STREAM
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 3/2
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE
CAPACITY - GPM: 300
MOTOR BRAKE HP: 50
SPEED - RPM: 2655
HEAD - FT: 190
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY FEED
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 4/3
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 100
MOTOR BRAKE HP: 7.5
SPEED - RPM: 1580
HEAD - FT: 60
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 6

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 450STL
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): GEAR
CAPACITY - GPM: 17,300
MOTOR BRAKE HP: 700
SPEED - RPM: 510
HEAD - FT: 94
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): _____
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 1

COMMENTS/FOOTNOTES

A OVERFIRE AIR MINIMIZES $NO_x$ EMISSIONS.
B 1.1 TO 3.58 GRAINS/SCF AT INLET.
C CHEVRONS ARE BUCKLED SO THAT THEY APPEAR AS A SERIES OF SHALLOW TENT SHAPES ACROSS THE HORIZONTAL PLANE.

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

GENERAL PLANT INFORMATION
- COMPANY NAME: COOPERATIVE POWER ASSOCIATION (56%)
- ASSOCIATED UTILITIES: UNITED POWER ASSOCIATION (44%)
- PLANT NAME: COAL CREEK
- UNIT NUMBER: 2
- PLANT ADDRESS: P.O. BOX 780
- CITY: UNDERWOOD
- COUNTY: MCLEAN
- STATE: NORTH DAKOTA
- ZIP CODE: 58576
- EPA REGION: 8
- RIVER BASIN/LAKE REGION: MISSOURI
- REGULATORY CLASSIFICATION: NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.1
- SO2 EMISSION LIMITATION - LB/MM BTU: 1.2
- NOX EMISSION LIMITATION - LB/MM BTU: NONE
- NET PLANT GENERATING CAPACITY - MW: 1100
- GROSS UNIT GENERATING CAPACITY - MW: 550
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 500
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 500.5
- EQUIVALENT SCRUBBED CAPACITY - MW: 327

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: COMBUSTION ENGINEERING
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED LIGNITE

A FURNACE FIRING METHOD: TANGENTIAL
- WET BOTTOM/DRY BOTTOM:
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED):
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE:
- DESIGN BOILER FLUE GAS FLOW - ACFM: 2,200,000
- FLUE GAS TEMPERATURE - F: 320
- FLUE GAS OXYGEN - %: 3.5
- HEAT RATE - BTU/KWH:
- DESIGN FIRING RATE - TPH: 422
- EXCESS AIR - %: 10
- CAPACITY FACTOR - %: 60
- STACK HEIGHT - FT: 658
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME:
- FLUE LINER MATERIAL GENERIC TYPE: NONE
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 22.0
- STACK GAS INLET TEMPERATURE - F:
- STACK GAS OUTLET VELOCITY - FT/SEC: 90

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

FUEL DATA (ACTUAL)
- FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): LIGNITE
- NAME OF SUPPLIER: FALKIRK MINING CO.
- MINE NAME/AREA: UNDERWOOD FIELD
- MINE LOCATION - COUNTY: _____
- MINE LOCATION - STATE: NORTH DAKOTA
- AVERAGE HEAT CONTENT - BTU/LB: 6258
- RANGE HEAT CONTENT - BTU/LB: 3068-7660
- AVERAGE ASH CONTENT - %: 7.14
- RANGE ASH CONTENT - %: 3.9-16.0
- AVERAGE MOISTURE CONTENT - %: 39.8
- RANGE MOISTURE CONTENT - %: 27.8-52.6
- AVERAGE SULFUR CONTENT - %: 0.63
- RANGE SULFUR CONTENT - %: 0.18-1.41
- AVERAGE CHLORIDE CONTENT - %: 0.02
- RANGE CHLORIDE CONTENT - %: 0.0-0.08
- FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): _____
- FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
- CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED
- SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
- NUMBER OF MECHANICAL COLLECTORS: NONE
- NUMBER OF SPARES:
- TYPE:
- SUPPLIER:
- INLET FLUE GAS CAPACITY - ACFM:
- INLET FLUE GAS TEMPERATURE - F:
- PRESSURE DROP - IN. H2O:
- PARTICLE OUTLET LOAD - GR/SCF:
- PARTICLE REMOVAL EFFICIENCY - %:

ELECTROSTATIC PRECIPITATOR
- NUMBER OF ELECTROSTATIC PRECIPITATORS: 1
- NUMBER OF SPARES: 0
- TYPE (HOT SIDE/COLD SIDE): COLD SIDE
- SUPPLIER: WHEELABRATOR-FRYE
- INLET FLUE GAS CAPACITY - ACFM: 2,310,000
- INLET FLUE GAS TEMPERATURE - F: 321
- PRESSURE DROP - IN. H2O: 2.5 (4.0 INCLUDING DUCTWORK)

B
- PARTICLE OUTLET LOAD - GR/SCF: 0.01
- PARTICLE REMOVAL EFFICIENCY - %: 99.5
- FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
- NUMBER OF PARTICLE SCRUBBERS: NONE
- NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 2

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME/ALKALINE FLY ASH
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): NONE
SYSTEM SUPPLIER: COMBUSTION ENGINEERING
A-E FIRM: BLACK & VEATCH
CONSTRUCTION FIRM: _____
APPLICATION (NEW/RETROFIT): NEW
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.5
SO2 DESIGN REMOVAL EFFICIENCY - %: 54
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

COMMERCIAL START-UP: 9/80
INITIAL START-UP: 7/80
CONSTRUCTION COMPLETION:
CONSTRUCTION INITIATION: 8/77
CONTRACT AWARDED: 6/77
LETTER OF INTENT SIGNED:
INITIATED BID REQUEST:
INITIATED PRELIMINARY DESIGN:

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %:
DESIGN COAL HEAT CONTENT - BTU/LB:
DESIGN COAL ASH CONTENT - %:
DESIGN COAL MOISTURE CONTENT - %:
DESIGN COAL CHLORIDE CONTENT - %:
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 174,200 (BOTH UNITS)
FGD SYSTEM TURNDOWN RATIO:
FGD SYSTEM TURNDOWN METHOD:
FGD SYSTEM PRESSURE DROP - IN. H20: 4.5
FGD SYSTEM OXIDATION - %:
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS:
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 10-15
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 72
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 1
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 3
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): MINIMAL (REDESIGNING)
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): ROTATED
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: NO SCHEDULE
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): DEDICATED
FGD SYSTEM BYPASS CAPABILITY (YES/NO): YES
RESTRICTIONS TO USING BYPASS: NONE
TIME SCHEDULE FOR REDUCED BOILER LOAD: NIGHTLY
TIME SCHEDULE FOR BOILER SHUTDOWNS: EVERY 18 MONTHS FOR 4 WEEKS
PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): SEE OTHER DATA SHEETS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): SEE OTHER DATA SHEETS

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 4
NUMBER OF SPARES: 1
GENERIC TYPE: SPRAY TOWER
SPECIFIC TYPE: OPEN COUNTERCURRENT SPRAY
TRADE/COMMON NAME: _____
SUPPLIER: COMBUSTION ENGINEERING
DIMENSIONS - FT: 21.5 WIDE X 20 DEEP X 55 HIGH
SHELL MATERIAL GENERIC TYPE: STAINLESS STEEL
SHELL MATERIAL SPECIFIC TYPE: TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A
BOILER LOAD PER ABSORBER - %: 15
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 3
NOZZLE MATERIAL: CERAMIC
NOZZLE PRESSURE DROP - PSI: _____
LIQUID RECIRCULATION RATE - GPM: 20,790 (65,730 AT 60% SCRUBBING)
L/G RATIO - GAL/1000 ACF: 60
GAS-SIDE PRESSURE DROP - IN. H2O: 3.0
SUPERFICIAL GAS VELOCITY - FT/SEC: 10.6
ABSORBER TURNDOWN RATIO: _____
ABSORBER TURNDOWN METHOD: _____
INLET GAS FLOW RATE - ACFM: 1,390,000
INLET GAS TEMPERATURE - F: 321
INLET SO2 LEVEL - PPM: _____
INLET SO2 LEVEL - LB/MM BTU: _____

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 2

INLET PARTICLE LEVEL - GR/SCF: 0.01
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %: 90
PARTICLE REMOVAL EFFICIENCY - %:

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): (A) PRE-MIST ELIMINATOR (B) MIST ELIMINATOR
TOTAL NUMBER OF MIST ELIMINATORS: (A) 4 (B) 4
NUMBER OF SPARES: (A) 0 (B) 0
NUMBER PER MODULE: (A) 1 (B) 1
GENERIC TYPE: (A) BULK SEPARATION (B) IMPINGEMENT
SPECIFIC TYPE: (A) BAFFLE SLATS (B) BAFFLE
COMMON DESIGN: (A) BULK ENTRAINMENT SEPARATOR (B) CHEVRON VANE
MANUFACTURER:
CONFIGURATION (HORIZONTAL/VERTICAL): (A) HORIZONTAL (B) HORIZONTAL
C SHAPE (Z-SHAPE/A-FRAME):
NUMBER OF STAGES: (A) 1 (B) 2
NUMBER OF PASSES/STAGE: (A) 1 (B) 2
FREEBOARD DISTANCE - FT: 8
DISTANCE BETWEEN STAGES - IN.: 30
DISTANCE BETWEEN VANES - IN.: 3
VANE ANGLES - DEGREES:
PRESSURE DROP - IN. H20: 0.5
SUPERFICIAL GAS VELOCITY - FT/SEC: 8.9
CONSTRUCTION MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: (A) FRP (B) FRP
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): COOLING TOWER BLOWDOWN
POINT OF WATER COLLECTION:
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): UNDERSPRAY
WASH FREQUENCY: INTERMITTENT
WASH DURATION:
WASH RATE - GAL/MIN: 600
WASH COVERAGE - GAL/MIN/SQ FT:

REHEATER
NUMBER OF REHEATERS: 1
NUMBER OF SPARES: 0
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.): BYPASS
SPECIFIC TYPE (STEAM, HOT WATER, ETC.): COLD SIDE
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.): N/A

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

COMBUSTION FUEL SULFUR CONTENT - %: N/A
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT: 40
TEMPERATURE INCREASE - F: 85
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F: 135
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F: 210
ENERGY REQUIREMENT - MM BTU/HR: N/A
NUMBER OF HEAT EXCHANGER BANKS: N/A
NUMBER OF BUNDLES PER BANK: N/A
NUMBER OF TUBES PER BUNDLE: N/A
STEAM OR WATER PRESSURE - PSIG: N/A
STEAM OR WATER TEMPERATURE - F: N/A
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 4
NUMBER OF SPARES:
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FAN COMPANY
FUNCTION (UNIT/BOOSTER): BALANCED DRAFT
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: FORCED DRAFT
SERVICE (WET/DRY): DRY
TYPE OF WASH: NONE
LOCATION WRT MAJOR COMPONENTS: BETWEEN ESP AND ABSORBER
FLUE GAS FLOW RATE - ACFM:
FLUE GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O: 42 (880 RPM), 26 (705 RPM) PRESSURE RISE
MATERIAL GENERIC TYPE: CARBON STEEL
MATERIAL SPECIFIC TYPE: AISI 1110
MATERIAL TRADE/COMMON NAME: N/A

DAMPERS
LOCATION: (A) INLET (B) OUTLET (C) BYPASS (D) ID FAN ISOLATION
NUMBER OF DAMPERS: (A) 8 (B) 8 (C) 4 (D) 4 INLET, 4 OUTLET
FUNCTION (CONTROL/SHUT-OFF): (A&B) ISOLATION (C) CONTROL
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.):
TRADE/COMMON DESIGN
(SINGLE LOUVER/DOUBLE LOUVER): (A&B) ALL DOUBLE LOUVERS EXCEPT BYPASS
(C) SINGLE LOUVER
MANUFACTURER:
MODULATION (OPEN/CLOSED, ETC.):
SEAL AIR - ACFM:
SERVICE CONDITIONS (MAX GAS TEMP/TIME):

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 2

MATERIAL GENERIC TYPE: (A,C) LOW ALLOY STEEL BLADES AND STAINLESS STEEL SEALS (B) STAINLESS STEEL
MATERIAL SPECIFIC TYPE: _____
MATERIAL TRADE/COMMON NAME: (A,C) COR-TEN AND TYPE 316L (B) TYPE 316L
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

DUCTWORK
LOCATION: (A) OUTLET (B) INLET AND BYPASS (C) PLENUM TO STACK
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): _____
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B&C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) TYPE 316L
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) NONE (C) INORGANIC
LINER MATERIAL SPECIFIC TYPE: (C) GUNITE
LINER MATERIAL TRADE/COMMON NAME: _____

EXPANSION JOINTS
LOCATION: (A) INLET AND OUTLET (B) DUCTWORK
TYPE (METALLIC/ELASTOMERIC): (A) ELASTOMERIC (B) METALLIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): _____
PRESSURE (NEGATIVE/POSITIVE): _____
OPERATING TEMPERATURE - F: _____
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: _____
MATERIAL: (A) VITON®/ASBESTOS AT INLET AND BUTYL RUBBER AT OUTLET
(B) COR-TEN STEEL ON HOT SIDE AND TYPE 316L STAINLESS STEEL ON WET SIDE

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): _____
MANUFACTURER: WALLACE AND TIERNAN
MATERIALS: _____
NUMBER OF DEVICES: 2
NUMBER OF SPARES: _____
FULL LOAD DRY FEED CAPACITY - TPH: _____
PRODUCT QUALITY - % SOLIDS: 10
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: _____
PREPARED REAGENT POINT OF ADDITION: REACTION TANK
ON-SITE STORAGE CAPABILITY - DAYS: 10 (60% SCRUBBING)

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) ADDITIVE SLURRY TRANSFER AND DISTRIBUTION PIPING
(B) ABSORBER RECYCLE (C) ABSORBER BLOWDOWN
DIMENSIONS - IN.:
MANUFACTURER:
MATERIAL: (A) FRP WITH ABRASION LINING (ALL)

MAJOR VALVES
LOCATION: (A) ABSORBER RECYCLE (B) ABSORBER BLOWDOWN
(C&D) ADDITIVE SLURRY TRANSFER AND DISTRIBUTION
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) CONTROL
(C) ISOLATION (D) CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) KNIFEGATE (B) PINCH (C) BUTTERFLY
(D) NEEDLE
CONTROL MODE (AUTOMATIC/MANUAL):
DIMENSIONS - IN.:
MANUFACTURER: (A) HILTON (B) R.K.L. (C) KEYSTONE (D) CE-INVALCO
MATERIAL: (A) CAST IRON (B) CAST IRON/RUBBER (C) CAST IRON
(D) CAST IRON

THICKENERS
NUMBER OF THICKENERS: NONE
NUMBER OF SPARES:
CONFIGURATION:
DIMENSIONS - FT:
CAPACITY - GAL:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
RAKE MATERIAL:
FEED STREAM SOURCE:
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): NONE
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.):
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.):
NUMBER OF DEVICES:
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

CONFIGURATION:
DIMENSIONS - FT:
CAPACITY:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BELT MATERIAL GENERIC TYPE:
BELT MATERIAL SPECIFIC TYPE:
BELT MATERIAL TRADE/COMMON NAME:
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.):
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS):
OUTLET STREAM DISPOSITION:
OVERFLOW STREAM DISPOSITION:

SLUDGE
FULL LOAD QUANTITY - TPH/DRY:
MOISTURE CONTENT - % TOTAL FREE WATER:
PERCENT CASO3 - DRY:
PERCENT CASO4 - DRY:
PERCENT CAOH2 - DRY:
PERCENT CACO3 - DRY:
PERCENT ASH - DRY:
PERCENT OTHER COMPOUNDS - DRY:

SLUDGE TREATMENT
METHOD: NONE (FLY ASH IS THE ABSORBENT)
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.):
DEVICE (OXIDATION TANK, PUG MILL, ETC.):
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.):
INLET FLOW RATE - GPM:
INLET QUALITY - % SOLIDS:

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): POND
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.):
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.):
LOCATION (ON-SITE/OFF-SITE): ON-SITE
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): PIPELINE
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): CLAY LINING
SITE DIMENSIONS - AREA/DEPTH: 400 ACRES (BOTH UNITS)
SITE CAPACITY - VOLUME/ACRE-FT/TONS:
SITE SERVICE LIFE - YEARS: 35 (BOTH UNITS)

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: _____
- CHEMICAL PARAMETERS (PH, ETC.): (A) PH, $SO_2$
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): SOLIDS, LIQUID LEVEL
- CONTROL LEVELS: _____
- MONITOR TYPE (MANUFACTURER, ETC.): UNILOC FOR PH, LEAR & SIEGLER FOR $SO_2$, MOORE FOR SOLIDS, DREXELBROOK FOR LEVEL
- MONITOR LOCATION: REACTION TANK FOR PH
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): _____
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): _____

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): _____
- TYPE (OPEN/CLOSED): OPEN
- EVAPORATION WATER LOSS - GPM: _____
- SLUDGE HYDRATION WATER LOSS - GPM: _____
- SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
- EFFLUENT WATER LOSS - GPM: _____
- RECEIVING WATER STREAM NAME: _____
- MAKEUP WATER ADDITION - GPM: _____
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): _____
- MAKEUP WATER ADDITION POINTS & AMOUNTS: _____
- MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): ABSORBENT
- NAME (LIMESTONE, ADIPIC ACID, ETC.): LIME
- PRINCIPAL CONSTITUENTS: CaO
- SOURCE/SUPPLIER: PETE LIEN & SONS, INC.
- SUPPLIER LOCATION: RAPID CITY, SOUTH DAKOTA
- CONSUMPTION (SPECIFY UNITS): _____
- UTILIZATION - %: _____
- POINT OF ADDITION: SLAKER

ECONOMICS
- CAPITAL COST - $: 15,600,000 (BOTH UNITS)
- CAPITAL COST - $/KW: 28.4
- OPERATING COST - MILLS/KWH: _____
  - MAINTENANCE COST: _____
  - LABOR COST: _____
  - UTILITIES COST: _____
  - CHEMICALS COST: _____
  - WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

MIST ELIMINATOR - %:
REHEATER - %:
FAN - %:
BALL MILL - %: N/A
SLAKER - %:
EFFLUENT HOLD TANK - %:
RECIRCULATION PUMP - %:
THICKENER - %: N/A
VACUUM FILTER - %: N/A
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER:
MIST ELIMINATOR:
REHEATER:
FAN:
BALL MILL: N/A
SLAKER:
EFFLUENT HOLD TANK:
RECIRCULATION PUMP:
THICKENER: N/A
VACUUM FILTER: N/A
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER:
PARTICIPANTS:
PROCESS:
PLANT DESIGN:
SUPPLIER:
SERVICE DATE:
PERIOD OF OPERATION - MONTHS:
GAS FEED:
EQUIVALENT SCRUBBED CAPACITY - MW:
STATUS (ACTIVE/TERMINATED):

UTILITY EMISSION CONTROL SYSTEM DATA — COOPERATIVE POWER ASSOCIATION
DATE: 9/10/81 — COAL CREEK 2

ATTACHMENT A

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): REACTION/RECYCLE/THICKENER
- NUMBER OF TANKS: 2
- NUMBER OF SPARES:
- TYPE (OPEN/COVERED): COVERED
- LOCATION: DIRECTLY UNDER ABSORBERS (INDOORS)
- CONFIGURATION:
- DIMENSIONS - FT: 19 X 51.5
- CAPACITY - GAL: 296,000
- RETENTION TIME - MIN: 10
- NUMBER OF AGITATORS: 2
- AGITATOR CONFIGURATION:
- AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: ORGANIC
- LINER MATERIAL SPECIFIC TYPE: PHENOLIC PAINT
- LINER MATERIAL TRADE/COMMON NAME:

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): FLY ASH WETTING
- NUMBER OF TANKS:
- NUMBER OF SPARES:
- TYPE (OPEN/COVERED): COVERED
- LOCATION: INDOORS
- CONFIGURATION:
- DIMENSIONS - FT: 6 X 6
- CAPACITY - GAL: 860
- RETENTION TIME - MIN: 7.5
- NUMBER OF AGITATORS: 1
- AGITATOR CONFIGURATION:
- AGITATOR MATERIALS: CARBON STEEL
- SHELL MATERIAL GENERIC TYPE: CARBON STEEL
- SHELL MATERIAL SPECIFIC TYPE:
- SHELL MATERIAL TRADE/COMMON NAME: N/A
- LINER MATERIAL GENERIC TYPE: NONE
- LINER MATERIAL SPECIFIC TYPE: N/A
- LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
- FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME FEED
- NUMBER OF TANKS:
- NUMBER OF SPARES:
- TYPE (OPEN/COVERED): COVERED
- LOCATION: INDOORS
- CONFIGURATION:
- DIMENSIONS - FT: 12 X 12

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

CAPACITY - GAL: 9350
RETENTION TIME - MIN: 45
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: N/A
LINER MATERIAL TRADE/COMMON NAME: N/A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): _____
NUMBER OF TANKS: _____
NUMBER OF SPARES: _____
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: _____
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): BLEED STREAM
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 3/2
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): VARIABLE
CAPACITY - GPM: 300
MOTOR BRAKE HP: 50
SPEED - RPM: 2655
HEAD - FT: 190
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY FEED
NUMBER OF PUMPS: 2
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): BELT DRIVE
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 4/3
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 100
MOTOR BRAKE HP: 7.5
SPEED - RPM: 1580
HEAD - FT: 60
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 6

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

NUMBER OF SPARES: 2
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): CENTRIFUGAL
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: WARMAN
PUMP MODEL NUMBER: 450STL
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): GEAR
CAPACITY - GPM: 17,300
MOTOR BRAKE HP: 700
SPEED - RPM: 510
HEAD - FT: 94
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CAST IRON
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): _____
NUMBER OF PUMPS: _____
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): _____
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): _____
COMMON DESIGN (V-BELT, ETC.): _____
MANUFACTURER: _____
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 9/10/81

COOPERATIVE POWER ASSOCIATION
COAL CREEK 2

COMMENTS/FOOTNOTES

A OVERFIRE AIR MINIMIZES $NO_x$ EMISSIONS.
B 1.1 TO 3.58 GRAINS/SCF AT INLET.
C CHEVRONS ARE BUCKLED SO THAT THEY APPEAR AS A SERIES OF SHALLOW TENT SHAPES ACROSS THE HORIZONTAL PLANE.

# SECTION 1

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cooperative Power Association | | | | | | | | |
| Coal Creek 1 | 7/79 | 744 | | System | | | | |
| Commercial start-up | 8/79 | 744 | | System | | | | |
| | 9/79 | 720 | | System | | | | |
| | 10/79 | 744 | 711 | System | | | | |
| | 11/79 | 720 | 703 | System | | | | |
| | 12/79 | 744 | 719 | System | | | | |
| | 1/80 | 744 | 715 | System | 715 | | Modules | Cracked nozzles and plugging were found during an inspection |
| | 2/80 | 696 | 695 | System | | | Boiler ID fan | Electrical grounding problem |
| | 3/80 | 744 | 715 | System | 715 | | | |
| | 4/80 | 720 | 264 | 11 | | 97 | | |
| | | | | 12 | | 100 | | |
| | | | | 13 | | 100 | | |
| | | | | 14 | | 100 | | |
| | | | | System | 220 | 99 | | |
| | 5/80 | 744 | 372 | 11 | | 88 | | |
| | | | | 12 | | 79 | | |
| | | | | 13 | | 92 | | |
| | | | | 14 | | 91 | | |
| | | | | System | 188 | 88 | | |
| | 6/80 | 720 | 718 | 11 | | 93 | | |
| | | | | 12 | | 96 | | |
| | | | | 13 | | 75 | | |
| | | | | 14 | | 94 | | |
| | | | | System | 381 | 90 | | |

(Continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Coal Creek 1 (Continued) | 7/80 | 744 | 648 | 11 | | 100 | | |
| | | | | 12 | | 100 | | |
| | | | | 13 | | 100 | | |
| | | | | 14 | | 100 | | |
| | | | | System | 648 | 100 | | |
| | 8/80 | 744 | 525 | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | | | |
| | | | | 14 | | | | |
| | | | | System | 249 | | | |
| | 9/80 | 720 | 0 | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | | | |
| | | | | 14 | | | | |
| | | | | System | 0 | | Boiler | FGD system did not operate due to turbine bearing failure |
| | 10/80 | 744 | 149 | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | | | |
| | | | | 14 | | | | |
| | | | | System | 69 | | | |
| | 11/80 | 720 | 707 | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | | | |
| | | | | 14 | | | | |
| | | | | System | 307 | | | |
| | 12/80 | 744 | 739 | 11 | | | | |
| | | | | 12 | | | | |
| | | | | 13 | | | | |
| | | | | 14 | | | | |
| | | | | System | 344 | | | |

Cooperative Power Association
Coal Creek 1, 2

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Cooperative Power Association | | | | | | | | |
| Coal Creek 2 | 7/80 | 744 | 631 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | 250 | | | |
| | 8/80 | 744 | 566 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | 331 | | Lime handling conveyor belt | Problems encountered (vibrator conveyor to be installed 1/81) |
| Commercial start-up | 9/80 | 720 | 718 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | 472 | | | |
| | 10/80 | 744 | 742 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | | | | |
| | 11/80 | 720 | 504 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | | | | |
| | 12/80 | 744 | 730 | 21 | | | | |
| | | | | 22 | | | | |
| | | | | 23 | | | | |
| | | | | 24 | | | | |
| | | | | System | 404 | | | |

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

DUQUESNE LIGHT

ELRAMA 1-4

Duquesne Light
Elrama 1-4

## SECTION 1

## BACKGROUND

The Elrama Power Station of the Duquesne Light Company is an existing plant located on the Monongahela River approximately three miles upstream of the dam at Elizabeth, Pennsylvania. The station consists of four pulverized coal-fired boilers, each of which is coupled to its own turbine generator. Elrama 1 was first placed in service in 1952. Elrama 2, 3, and 4 were subsequently placed in service in 1953, 1954, and 1960. The station's combined gross and net generating capacities are 510-MW and 487-MW, respectively.

In December 1969, Gibbs and Hill was retained by Duquesne Light to conduct a comprehensive study of the most feasible means of complying with anticipated emission regulations being promulgated by Allegheny County for both the Phillips and Elrama Power Stations. As a result of this study, FGD was selected as the most practical means of achieving compliance at both stations. As such, Duquesne Light proceeded with a design evaluation study at Phillips which involved a 1500-cfm pilot plant program and subsequent scale-up to a plant-sized lime slurry FGD system comprising three single-stage venturi scrubbers and one two-stage venturi scrubber. At about this time, Duquesne Light proceeded with the installation of a lime slurry FGD system comprising five, parallel, single-stage venturi scrubbers at

Elrama. This system represented the first phase of emission control development at the station pending the outcome of the single-stage and double-stage testing at Phillips. As such, Duquesne Light signed a consent decree with Pennsylvania's Department of Environmental Resources to tie only two boilers into the FGD system during the interim evaluation period at Phillips. Elrama 1 was connected to the FGD system in October 1975 and Elrama 2 was added in February 1976.

The Phillips scrubber evaluation program demonstrated that single-stage scrubbers could achieve compliance with particulate and $SO_2$ emission regulations for 2% sulfur coal when using magnesium-promoted as the reagent. As a result, the second phase of FGD development at Elrama was completed to treat the station's entire flue gas output. This phase of development involved modifying the system to use magnesium-modified lime, replacement of the original thickeners with larger thickeners that could handle the greater waste production rate, and upgrading the IUCS sludge processing plant to dewater and treat the sludge in order to produce a suitable landfill material.

The remaining boilers at Elrama were connected to the FGD system in January (No. 4) and July (No. 3) of 1978. Compliance with air emission regulations with the entire plant connected to the FGD system was demonstrated at that time. In January 1981, a sodium thiosulfate addition test was initiated as a result of the successful addition program at Phillips. Continuous addition of sodium thiosulfate to the lime slurry was subsequently started in April 1981.

Duquesne Light
Elrama 1-4

## SECTION 2

## PROCESS DESCRIPTION

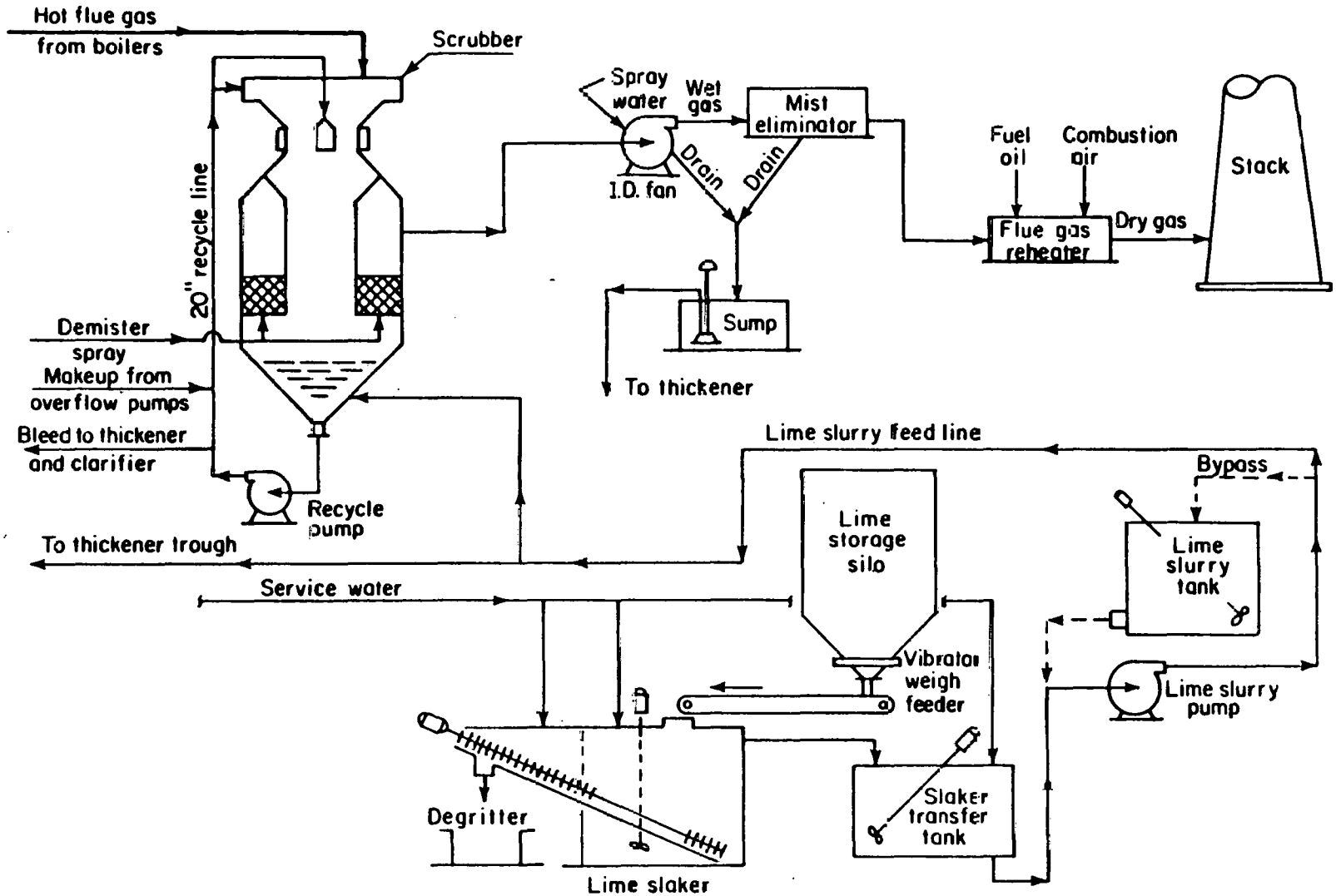
The Elrama Station emission control system consists of four mechanical collectors and ten cold-side electrostatic precipitators for primary particulate control, and five single-stage venturi scrubbers for secondary particulate and primary $SO_2$ control. Each of the five parallel scrubber modules is designed to handle a flue gas flow rate of 515,000 ACFM at 300°F. The system is equipped with a spare module.

The flue gas stream from each boiler passes through a mechanical collector and electrostatic precipitator at a rate of approximately 515,000 acfm at 300°F. Following the electrostatic precipitators, the flue gas from each unit is collected in a common header which directs the gas to the scrubber facility. The flue gas then enters one of five parallel, single-stage, variable-throat venturi scrubbers. Entering the top of each module, the gas passes downward through the venturi throat, contacting lime slurry which is recirculated into the module at a rate of 17,000 gpm (liquid-to-gas ratio of 33 gal/1000 acf). The scrubbed gas stream then passes through an internal mist eliminator (located within the module), a wet booster fan (induced draft with respect to the scrubber), and an external mist eliminator (a separate chamber downstream of the module

which houses mist eliminator blades). The scrubbed gas streams are then collected in a common duct leading to a 398-ft stack. The FGD system has no provision for reheat.

The spent scrubbing slurry is discharged from the slurry recirculation line of each module to two thickeners. This 5% solids bleed stream is concentrated to approximately 35 to 40% solids in the thickeners and transferred to the sludge processing plant. The sludge processing plant is an IUCS fixation facility operated by IUCS. In this facility, the thickener underflow is further concentrated to approximately 50% solids by two rotary drum vacuum filters (one spare) and mixed with dry fly ash (collected in the mechanical collectors and ESP's) and lime. The treated material is piled on the plant site by a rotary stacker for transfer via front-end loaders and trucks to an off-site landfill (approximately 12 miles from the plant site).

A flow diagram for the Elrama 1-4 FGD system is shown on the next page.




Flow Diagram: Elrama 1-4

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

GENERAL PLANT INFORMATION
- COMPANY NAME: DUQUESNE LIGHT
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: ELRAMA
- UNIT NUMBER: 1-4
- PLANT ADDRESS: P.O. BOX 237
- CITY: ELRAMA
- COUNTY: WASHINGTON
- STATE: PENNSYLVANIA
- ZIP CODE: 15038
- EPA REGION: 3
- RIVER BASIN/LAKE REGION: MONONGAHELA
- REGULATORY CLASSIFICATION: STATE STANDARD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.08
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.6
- NOX EMISSION LIMITATION - LB/MM BTU: NONE
- NET PLANT GENERATING CAPACITY - MW: 487
- GROSS UNIT GENERATING CAPACITY - MW: 510 (PLANT)
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 487 (PLANT)
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 494 (PLANT)
- EQUIVALENT SCRUBBED CAPACITY - MW: 510

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: BABCOCK & WILCOX
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD:
- WET BOTTOM/DRY BOTTOM: DRY
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): BASE
- COMMERCIAL SERVICE DATE: UNIT 1 - 1952, UNIT 2 - 1953, UNIT 3 - 1954, UNIT 4 - 1960
- DESIGN BOILER FLUE GAS FLOW - ACFM: 2,060,000
- FLUE GAS TEMPERATURE - F: 300
- FLUE GAS OXYGEN - %: 7.0

A
- HEAT RATE - BTU/KWH: 11,200-11,700 (NET)
- DESIGN FIRING RATE - TPH: 214
- EXCESS AIR - %: 25

B
- CAPACITY FACTOR - %: 70
- STACK HEIGHT - FT: 398
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: ASTM C279 TYPE L; SAUEREISEN NO. 65
- FLUE LINER MATERIAL GENERIC TYPE: N/A
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 26
- STACK GAS INLET TEMPERATURE - F: SUMMER 130
- STACK GAS OUTLET VELOCITY - FT/SEC: 52

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

FUEL DATA (ACTUAL)
  FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
C NAME OF SUPPLIER: DUQUESNE LIGHT (COMPANY-OWNED MINE)
  MINE NAME/AREA: WARWICK MINE, SEWICKLEY SEAM
  MINE LOCATION - COUNTY: WASHINGTON
  MINE LOCATION - STATE: GREENSBORO, PA
  AVERAGE HEAT CONTENT - BTU/LB: 11,568
  RANGE HEAT CONTENT - BTU/LB: 11,500-12,500
  AVERAGE ASH CONTENT - %: 16.8
  RANGE ASH CONTENT - %: 14.0-18.3
  AVERAGE MOISTURE CONTENT - %: 5.93
  RANGE MOISTURE CONTENT - %: 4.3-7.06
  AVERAGE SULFUR CONTENT - %: 2.05
  RANGE SULFUR CONTENT - %: 1.49-2.91
  AVERAGE CHLORIDE CONTENT - %: 0.04
  RANGE CHLORIDE CONTENT - %: 0.03-0.05
  FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): SPOT
D FUEL ANALYSIS DATE: _____

PARTICLE CONTROL GENERAL DATA
E CONFIGURATION (INTEGRATED/SEGREGATED): INTEGRATED AND SEGREGATED
  SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
  NUMBER OF MECHANICAL COLLECTORS: 4 (1/MODULE)
  NUMBER OF SPARES: 0
  TYPE: MULTICLONE
  SUPPLIER: RESEARCH-COTTRELL (1, 2, & 3); JOY WESTERN (4)
  INLET FLUE GAS CAPACITY - ACFM: 2,060,000 (TOTAL)
  INLET FLUE GAS TEMPERATURE - F: 300
  PRESSURE DROP - IN. H2O: 3.0
  PARTICLE OUTLET LOAD - GR/SCF: 0.23 (0.16 GR/ACF)
  PARTICLE REMOVAL EFFICIENCY - %: 95.0 (DESIGN); 89.5 (ACTUAL)

ELECTROSTATIC PRECIPITATOR
  NUMBER OF ELECTROSTATIC PRECIPITATORS: 2 PER UNIT (1, 2, & 3);
                                         4 PER UNIT (4)
  NUMBER OF SPARES: 0
  TYPE (HOT SIDE/COLD SIDE): COLD SIDE (WEIGHTED WIRE TYPE)
  SUPPLIER: RESEARCH-COTTRELL (1, 2, & 3); JOY WESTERN (4)
  INLET FLUE GAS CAPACITY - ACFM: 2,060,000 (TOTAL)
  INLET FLUE GAS TEMPERATURE - F: 300
  PRESSURE DROP - IN. H2O: 1.0
F PARTICLE OUTLET LOAD - GR/SCF: 0.011 (0.008 GR/ACF)
  PARTICLE REMOVAL EFFICIENCY - %: 95.0 (DESIGN); 70-80 (ACTUAL)
  FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
  NUMBER OF PARTICLE SCRUBBERS: NONE

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

NUMBER OF SPARES:
GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES -IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): MAGNESIUM OXIDE AND SODIUM THIOSULFATE
SYSTEM SUPPLIER: CHEMICO
A-E FIRM: GIBBS & HILL
CONSTRUCTION FIRM: CHEMICO
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99.3 (TOTAL INCLUDING MECHANICAL COLLECTORS, ESP'S, AND ABSORBERS)

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

SO2 DESIGN REMOVAL EFFICIENCY - %: 83
CURRENT STATUS: OPERATIONAL
TERMINATION DATE: N/A
COMMERCIAL START-UP: 7/78
INITIAL START-UP: 10/75 (UNIT 1), 2/76 (UNIT 2), 1/78 (UNIT 4), 7/78 (UNIT 3)
CONSTRUCTION COMPLETION: 7/78
CONSTRUCTION INITIATION: 12/71
CONTRACT AWARDED: 12/70
LETTER OF INTENT SIGNED: _____
INITIATED BID REQUEST: _____
INITIATED PRELIMINARY DESIGN: _____

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 2.2
DESIGN COAL HEAT CONTENT - BTU/LB: 11,500
DESIGN COAL ASH CONTENT - %: 17
DESIGN COAL MOISTURE CONTENT - %: 6
DESIGN COAL CHLORIDE CONTENT - %: 0.03
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: _____
FGD SYSTEM TURNDOWN RATIO: 8:1 (2:1 PER MODULE)
FGD SYSTEM TURNDOWN METHOD: TAKE TRAINS OFF LINE; VARIABLE THROAT VENTURI
FGD SYSTEM PRESSURE DROP - IN. H2O: 11
FGD SYSTEM OXIDATION - %: 20
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 5
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): 296
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 9-2/3
G FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 8 (DAY SHIFT ONLY)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
H FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): NONE
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): SHARED WITH BOILER
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: ON AN AS-NEEDED BASIS
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): INTEGRATED WITH PLANT
FGD SYSTEM BYPASS CAPABILITY (YES/NO): NO
RESTRICTIONS TO USING BYPASS: NO ALLOWANCE FOR BYPASS
TIME SCHEDULE FOR REDUCED BOILER LOAD: 60% AT NIGHT; DROPS DOWN TO 20-30% ON WEEKENDS
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 DAYS/YR FOR INSPECTION; 2 WEEKS/YR FOR MAINTENANCE AND REPAIR
I PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): MINOR MAINTENANCE PROBLEMS
I PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): MAJOR MAINTENANCE PROBLEMS

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): DEPENDING ON NATURE OF COMPONENT, INVESTIGATE CAUSE TO MODIFY DESIGN FOR PERMANENT SOLUTION.

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
NUMBER OF ABSORBERS: 5
NUMBER OF SPARES: 1
GENERIC TYPE: VENTURI
J SPECIFIC TYPE: VARIABLE THROAT/SIDE-MOVABLE BLADES
TRADE/COMMON NAME: N/A
SUPPLIER: CHEMICO
DIMENSIONS - FT: 31.3 X 66.4
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL
(B) STAINLESS STEEL SCRUBBER INTERNALS
SHELL MATERIAL SPECIFIC TYPE: (A) AISI 1110 (B) AUSTENITIC
SHELL MATERIAL TRADE/COMMON NAME: (A) N/A (B) TYPE 316L
K LINER MATERIAL GENERIC TYPE: (A) ORGANIC (B) INORGANIC (C) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) MAT-REINFORCED POLYESTER
(B) PREFIRED BRICK-SHAPES
(C) GLASS FLAKE-FILLED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (A) CEILCRETE 2500AR
(B) ACID-RESISTANT BRICK
(C) FLAKELINE 103
BOILER LOAD PER ABSORBER - %: 25
GAS/LIQUID CONTACT DEVICE TYPE: NONE
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

NUMBER OF SPRAY HEADERS: 12 TANGENTIAL AND 1 BULL NOZZLE
NOZZLE MATERIAL: TYPE 316L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 17,000
L L/G RATIO - GAL/1000 ACF: 33
GAS-SIDE PRESSURE DROP - IN. H2O: 8
SUPERFICIAL GAS VELOCITY - FT/SEC: 150 (ACROSS VENTURI)
ABSORBER TURNDOWN RATIO: 2:1
ABSORBER TURNDOWN METHOD: VARIABLE THROAT
INLET GAS FLOW RATE - ACFM: 515,000
INLET GAS TEMPERATURE - F: 300
INLET SO2 LEVEL - PPM: 1500
INLET SO2 LEVEL - LB/MM BTU: 3.5 (ASSUMING 100% CONVERSION TO $SO_2$)
INLET PARTICLE LEVEL - GR/SCF: 0.66-0.80 (0.45-0.55 GR/ACF)
INLET PARTICLE LEVEL - LB/MM BTU: 1.51-1.86
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F: 130 IN SUMMER; 90 IN WINTER
OUTLET SO2 LEVEL - PPM: 200
OUTLET SO2 LEVEL - LB/MM BTU: 0.6
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU: <0.1
SO2 REMOVAL EFFICIENCY - %: 83
PARTICLE REMOVAL EFFICIENCY - %: 93-95 (BASED ON TYPICAL INLET LOADINGS AND TYPICAL REMOVAL ACROSS MC/ESP'S)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/ MIST ELIMINATOR): (A) INTERNAL MIST ELIMINATOR (B) MIST ELIMINATOR IN EXTERNAL VESSEL
TOTAL NUMBER OF MIST ELIMINATORS: (A) 5 (B) 5
NUMBER OF SPARES: (A) 1 (B) 1 (ONE MODULE)
NUMBER PER MODULE: (A) 1 (B) 1
M GENERIC TYPE: IMPINGEMENT (BOTH)
SPECIFIC TYPE: BAFFLE (BOTH)
COMMON DESIGN: OPEN VANE (CHEVRON) (BOTH)
MANUFACTURER: HEIL (SUPPLIED BY CHEMICO) (BOTH)
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL (BOTH)
SHAPE (Z-SHAPE/A-FRAME): (A) TOROIDAL (B) CIRCULAR
NUMBER OF STAGES: 1 (BOTH)
NUMBER OF PASSES/STAGE: 4 (BOTH)
N FREEBOARD DISTANCE - FT: (A) 4.5
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.: 3 (BOTH)
VANE ANGLES - DEGREES: 90 (BOTH)
PRESSURE DROP - IN. H2O: (A) 0.8 (B) 0.2-0.3
SUPERFICIAL GAS VELOCITY - FT/SEC: 11 (BOTH)
CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: FIBERGLASS REINFORCED PLASTIC
CONSTRUCTION MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): FRESH MAKEUP WATER OR THICKENER OVERFLOW
POINT OF WATER COLLECTION: THICKENER OVERFLOW RETURN TANK
O WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): (A) BOTTOM AND TOP
(B) TOP
WASH FREQUENCY: (A) BOTTOM--AUTOMATIC SEQUENTIAL; TOP--MANUAL ONCE PER DAY
(B) TOP--MANUAL ONCE/WEEK
WASH DURATION: (A) BOTTOM--2 MINUTES; TOP--5 MINUTES (B) TOP--1 HOUR
WASH RATE - GAL/MIN: 52 (FOR INTERNAL UNDERSPRAY)
WASH COVERAGE - GAL/MIN/SQ FT:

REHEATER
P NUMBER OF REHEATERS: NONE
NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 5
NUMBER OF SPARES: 1 (ONE MODULE)
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FUEL ECONOMIZER CO.
FUNCTION (UNIT/BOOSTER): BOOSTER
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: INDUCED DRAFT
SERVICE (WET/DRY): WET
TYPE OF WASH: SPRAYED WITH FRESH WATER
LOCATION WRT MAJOR COMPONENTS: BETWEEN ABSORBER AND EXTERNAL ME
FLUE GAS FLOW RATE - ACFM: 550,000

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

FLUE GAS TEMPERATURE - F: 130
PRESSURE DROP - IN. H2O: 23 (20 IN. $H_2O$ @ INLET/3 IN. $H_2O$ @ DISCHARGE)
Q MATERIAL GENERIC TYPE: CARBON STEEL HOUSING WITH RUBBER LINING AND HIGH ALLOY ROTORS, BLADES, & WHEELS
MATERIAL SPECIFIC TYPE: _____
MATERIAL TRADE/COMMON NAME: CARPENTER 20 ROTORS, BLADES, & WHEELS

DAMPERS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET
(C) EXTERNAL MIST ELIMINATOR OUTLET
NUMBER OF DAMPERS: 15 (3 PER ABSORBER/EXTERNAL MIST ELIMINATOR)
FUNCTION (CONTROL/SHUT-OFF): SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) BUTTERFLY (B) LOUVER
(C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE, PARALLEL BLADE, ETC.): (A) N/A (B) PARALLEL BLADE MULTILOUVER
(C) PARALLEL BLADE MULTILOUVER
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): (A) N/A
(B&C) SINGLE LOUVER
MANUFACTURER: (A) _____ (B&C) ALLIS CHALMERS
MODULATION (OPEN/CLOSED, ETC.): OPEN OR CLOSED
SEAL AIR - ACFM: NONE
SERVICE CONDITIONS (MAX GAS TEMP/TIME): (A) 300 (B&C) _____
R MATERIAL GENERIC TYPE: STAINLESS STEEL/CARBON STEEL
MATERIAL SPECIFIC TYPE: AUSTENITIC/AISI 1110
MATERIAL TRADE/COMMON NAME: TYPE 316L/N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B&C) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (B&C) FLAKE GLASS
LINER MATERIAL TRADE/COMMON NAME: _____

DUCTWORK
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET
(C) EXTERNAL MIST ELIMINATOR OUTLET
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) CIRCULAR (B) RECTANGULAR
(C) CIRCULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
(C) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110 (ALL)
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC (C) ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER (B&C)
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103 (B&C)

EXPANSION JOINTS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET
(C) EXTERNAL MIST ELIMINATOR OUTLET
TYPE (METALLIC/ELASTOMERIC): (A) METALLIC (B&C) ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS CIRCUIT

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

PRESSURE (NEGATIVE/POSITIVE): (A&B) NEGATIVE (C) POSITIVE
OPERATING TEMPERATURE - F: (A) 300 (B&C) 130
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: _____
MATERIAL: (A) CARBON STEEL WITH COR-TEN (B&C) VITON®

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): PASTE SLAKER
MANUFACTURER: WALLACE & TIERNAN
MATERIALS: CARBON STEEL
NUMBER OF DEVICES: 5
NUMBER OF SPARES: 2
FULL LOAD DRY FEED CAPACITY - TPH: 4 (DRY FEED RATE)
PRODUCT QUALITY - % SOLIDS: 20-25
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 170 (ASSUMING 25% SOLIDS SLURRY PRODUCT)
PREPARED REAGENT POINT OF ADDITION: ABOVE SLURRY LEVEL IN ABSORBER
ON-SITE STORAGE CAPABILITY - DAYS: 14

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY
(B) LIME SLURRY TRANSFER & DISTRIBUTION
(C) ABSORBER BLEED (D) SPRAY HEADERS
(E) SLUDGE DISPOSAL (F) THICKENER OVERFLOW
DIMENSIONS - IN.: _____
MANUFACTURER: _____
MATERIAL: (A) RUBBER-LINED CARBON STEEL AND FRP (B) CARBON STEEL
(C) RUBBER-LINED CARBON (D) TYPE 316L STAINLESS STEEL
(E) FRP (F) RUBBER-LINED CARBON STEEL

MAJOR VALVES
LOCATION: (A) RECYCLE SLURRY (B) LIME SLURRY TRANSFER AND DISTRIBUTION
(C) ABSORBER BLEED (D) SLUDGE DISPOSAL (E) THICKENER OVERFLOW
FUNCTION (ISOLATION, CONTROL, ETC.): (A) ISOLATION (B) ISOLATION/CONTROL
(C) ISOLATION/CONTROL
(D) ISOLATION/CONTROL
(E) ISOLATION/CONTROL
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PLUG (B) WATER/_____
(C) PINCH/PINCH (D) PINCH/PINCH
(E) GATE/PINCH

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

CONTROL MODE (AUTOMATIC/MANUAL): _____
DIMENSIONS - IN.: _____
MANUFACTURER: (A) DEZURIK (B) DEZURIK/FISHER (C) R.K.L./R.K.L.
(D) R.K.L./R.K.L. (E) CRANE/R.K.L.
MATERIAL: (A) CARBON STEEL (RUBBER-LINED) (B) CARBON STEEL/STAINLESS STEEL
(C) CARBON STEEL (RUBBER-LINED)/CARBON STEEL (RUBBER-LINED)
(D) CARBON STEEL/CARBON STEEL (E) CARBON STEEL/CARBON STEEL

THICKENERS
NUMBER OF THICKENERS: 2
S NUMBER OF SPARES: 0
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 120 DIA X 8.5 HIGH
CAPACITY - GAL: 229,500
SHELL MATERIAL GENERIC TYPE: (A) CONCRETE FLOOR (B) CARBON STEEL WALLS
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) BITUMINOUS BASE MODIFIED ASPHALT
(B) MICA FLAKE-FILLED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: (A) CEILCOTE HOT MASTIC 195
(B) FLAKELINE 151
RAKE MATERIAL: RUBBER-CLAD CARBON STEEL
FEED STREAM SOURCE: ABSORBER BLEED STREAM
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 5% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35-40% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): <0.1%
OUTLET STREAM DISPOSITION: TO VACUUM FILTER (IUCS PLANT)
OVERFLOW STREAM DISPOSITION: THICKENER OVERFLOW TANK (RETURNED TO PROCESS VIA SCRUBBER RESERVOIR AND/OR MIST ELIMINATOR WASH)

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): DRUM
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): ROTARY
NUMBER OF DEVICES: 2
NUMBER OF SPARES: 1
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: ONE @ 650 $FT^2$ AND ONE @ 750 $FT^2$
CAPACITY: 60 TONS/HOUR
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____
BELT MATERIAL GENERIC TYPE: ORGANIC

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

BELT MATERIAL SPECIFIC TYPE: NYLON
BELT MATERIAL TRADE/COMMON NAME: N/A
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 35-40 % SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 60-70% SOLIDS
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): <0.1
OUTLET STREAM DISPOSITION: TO SLUDGE TREATMENT
OVERFLOW STREAM DISPOSITION: COLLECTED IN A DISTRIBUTION BOX AND THEN TRANSFERRED TO THE THICKENER OVERFLOW TANK

SLUDGE
T FULL LOAD QUANTITY - TPH/DRY: 1500 TPD (POZ-O-TEC TREATED MATERIAL)
MOISTURE CONTENT - % TOTAL FREE WATER: _____
PERCENT CASO3 - DRY: _____
PERCENT CASO4 - DRY: _____
PERCENT CAOH2 - DRY: _____
PERCENT CACO3 - DRY: _____
PERCENT ASH - DRY: 50
PERCENT OTHER COMPOUNDS - DRY: 50 ($SO_2$ WASTES)

SLUDGE TREATMENT
METHOD: FIXATION
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): FLY ASH/LIME
DEVICE (OXIDATION TANK, PUG MILL, ETC.): PUG MILL
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS (POZ-O-TEC)
INLET FLOW RATE - GPM: _____
INLET QUALITY - % SOLIDS: 35-40%; IUCS FILTER GIVES 60-70% SOLIDS

SLUDGE DISPOSAL
NATURE (INTERIM/FINAL): FINAL
GENERIC TYPE (LANDFILL, POND, ETC.): LANDFILL
SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): VALLEY FILL
COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): _____
U LOCATION (ON-SITE/OFF-SITE): OFF-SITE (12 MILES EAST OF PLANT)
TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): TRUCK (25 TON, TRI-AXLE, REAR DUMP)
SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): NONE
SITE DIMENSIONS - AREA/DEPTH: _____
SITE CAPACITY - VOLUME/ACRE-FT/TONS: _____
SITE SERVICE LIFE - YEARS: 10

PROCESS CONTROL AND INSTRUMENTATION
PROCESS STREAM: RECIRCULATING SLURRY
CHEMICAL PARAMETERS (PH, ETC.): PH
PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): FLOW
CONTROL LEVELS: PH 7.7

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

MONITOR TYPE (MANUFACTURER, ETC.): UNIVERSAL UNILOC
MONITOR LOCATION: INLET TANGENTIAL NOZZLE TO ABSORBER
V PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
TYPE (OPEN/CLOSED): OPEN
EVAPORATION WATER LOSS - GPM: _____
SLUDGE HYDRATION WATER LOSS - GPM: _____
SLUDGE INTERSTITIAL WATER LOSS - GPM: _____
POND SEEPAGE/RUNOFF WATER LOSS - GPM: _____
EFFLUENT WATER LOSS - GPM: 0-300
RECEIVING WATER STREAM NAME: MONONGAHELA RIVER
MAKEUP WATER ADDITION - GPM: _____
SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): RIVER WATER
MAKEUP WATER ADDITION POINTS & AMOUNTS: ME, PUMP SEALS, FANS, SLAKER
MAKEUP WATER PRE-TREATMENT TYPE: _____

CHEMICALS AND CONSUMPTION
FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): (A) ABSORBENT (B) ADDITIVE (C) FIXATIVE
NAME (LIMESTONE, ADIPIC ACID, ETC.): (A) MAGNESIUM-MODIFIED LIME (B) SODIUM THIOSULFATE (C) CALCIUM OXIDE
PRINCIPAL CONSTITUENTS: (A) CaO, MgO (B) $Na_2S_2O_3$ (C) CaO
SOURCE/SUPPLIER: (A) DRAVO
SUPPLIER LOCATION: (A) MAYSVILLE, KY
CONSUMPTION (SPECIFY UNITS): (A) 175-200 TPD
W UTILIZATION - %: (A) 90%
POINT OF ADDITION: (A) SLAKER

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
CAPITAL COST - $: 87,900,000
CAPITAL COST - $/KW: 172
OPERATING COST - MILLS/KWH: _____
MAINTENANCE COST: _____ _____
LABOR COST: _____
UTILITIES COST: _____
CHEMICALS COST: _____
WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
SCRUBBER - %: N/A
ABSORBER - %: 25
MIST ELIMINATOR - %: 25
REHEATER - %: N/A
FAN - %: 25
BALL MILL - %: N/A

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

SLAKER - %: 67
EFFLUENT HOLD TANK - %: 25
RECIRCULATION PUMP - %: 25
THICKENER - %: 0
VACUUM FILTER - %: 100
CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
SCRUBBER: N/A
ABSORBER: 1
MIST ELIMINATOR: 1
REHEATER: N/A
FAN: 1
BALL MILL: N/A
SLAKER: 0.8
EFFLUENT HOLD TANK: 1
RECIRCULATION PUMP: 1
THICKENER: 0
VACUUM FILTER: 1
CENTRIFUGE: N/A

PILOT PLANT
UNIT NUMBER: _____
PARTICIPANTS: CHEMICO
PROCESS: LIME/LIMESTONE
PLANT DESIGN: VENTURI
SUPPLIER: CHEMICO
SERVICE DATE: FEBRUARY 1971
PERIOD OF OPERATION - MONTHS: 4
GAS FEED: 1500 CFM
EQUIVALENT SCRUBBED CAPACITY - MW: 0.5
STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): THICKENER OVERFLOW
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE: CLOSED
LOCATION: OUTDOORS
CONFIGURATION: RECTANGULAR
DIMENSIONS - FT: 21 X 30 X 12
CAPACITY - GAL: 55,000
RETENTION TIME - MIN: 15
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): LIME SLURRY DILUTION
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE: _____
LOCATION: INDOORS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 11 DIA X 11
CAPACITY - GAL: 13,000
RETENTION TIME - MIN: 35
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: TOP ENTRY
AGITATOR MATERIALS: RUBBER-CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: CONCRETE (BELOW GRADE)
SHELL MATERIAL SPECIFIC TYPE: N/A
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: NONE
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): ABSORBER EFFLUENT HOLD TANK
NUMBER OF TANKS: 5
NUMBER OF SPARES: 1
TYPE: CLOSED

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

X LOCATION: BOTTOM OF ABSORBER VESSEL
CONFIGURATION: CONICAL
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: 1.5
NUMBER OF AGITATORS: NONE
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: MAT-REINFORCED POLYESTER
LINER MATERIAL TRADE/COMMON NAME: CEILCRETE 2500AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): THICKENER POLYMER MIX TANK
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE: _____
LOCATION: INDOORS
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): THICKENER DISTRIBUTION BOX
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE: _____
LOCATION: INDOORS
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/8/81 — ELRAMA 1-4

AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:

TANKS

FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): WATER STORAGE TANKS

NUMBER OF TANKS: 2
NUMBER OF SPARES: 1
TYPE:
LOCATION: OUTDOORS
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 8 X 40 DIA
CAPACITY - GAL:
RETENTION TIME - MIN:
NUMBER OF AGITATORS:
AGITATOR CONFIGURATION:
AGITATOR MATERIALS:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

ATTACHMENT B

Y PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 8 (2 PER MODULE)
NUMBER OF SPARES: 2 (SYSTEM), 0 (MODULE)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: WARMAN
PUMP MODEL NUMBER:
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): BELT
CAPACITY - GPM: 9000
MOTOR BRAKE HP: 350
SPEED - RPM: 480
HEAD - FT: 100
SERVICE (PH, SOLIDS): 7.5 PH, 3-5% SOLIDS
CASING MATERIAL GENERIC TYPE: CARBON STEEL/RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE: AISI 1110
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: HIGH ALLOY
IMPELLER MATERIAL SPECIFIC TYPE:
IMPELLER MATERIAL TRADE/COMMON NAME: ALLOY M-7

Y PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): ABSORBER RECIRCULATION
NUMBER OF PUMPS: 8 (2 PER MODULE)
NUMBER OF SPARES: 0 (PER MODULE)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: INGERSOLL-RAND
PUMP MODEL NUMBER: 12 X 22 LP
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 9000 (RATED); 8000 (ACTUAL)
MOTOR BRAKE HP: 350
SPEED - RPM: 1185
HEAD - FT: 100
SERVICE (PH, SOLIDS): 7.5 PH, 3-5% SOLIDS
CASING MATERIAL GENERIC TYPE: HIGH ALLOY
CASING MATERIAL SPECIFIC TYPE: IRON BASE/NICKEL-CHROMIUM-COPPER-MOLYBDENUM
CASING MATERIAL TRADE/COMMON NAME: CARPENTER 20
IMPELLER MATERIAL GENERIC TYPE: HIGH ALLOY
IMPELLER MATERIAL SPECIFIC TYPE: IRON BASE/NICKEL-CHROMIUM-COPPER-MOLYBDENUM
IMPELLER MATERIAL TRADE/COMMON NAME: CARPENTER 20

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): LIME SLURRY FEED
NUMBER OF PUMPS: 5
NUMBER OF SPARES: 1 (SYSTEM), 0 (MODULE)
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: GOULDS-MORRIS
PUMP MODEL NUMBER: 1-1/2 JC 14
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 90
MOTOR BRAKE HP: 20
SPEED - RPM: 1775
HEAD - FT: 105
SERVICE (PH, SOLIDS): 9-10 PH, 20-25% SOLIDS
CASING MATERIAL GENERIC TYPE: CAST IRON (RUBBER-LINED)
CASING MATERIAL SPECIFIC TYPE: GRAY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER OVERFLOW
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: GOULDS-MORRIS
PUMP MODEL NUMBER: 3175
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 1650 GPM
MOTOR BRAKE HP: 125
SPEED - RPM: 1180
HEAD - FT: 180
SERVICE (PH, SOLIDS): <0.1% SOLIDS
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: AUSTENITIC
CASING MATERIAL TRADE/COMMON NAME: CD-4MCU
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: AUSTENITIC
IMPELLER MATERIAL TRADE/COMMON NAME: CD-4MCU

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 3
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: A-6-5
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): DIRECT
CAPACITY - GPM: 200 GPM
MOTOR BRAKE HP: 25
SPEED - RPM: 1557
HEAD - FT: 110
SERVICE (PH, SOLIDS): 7.5 PH, 35-40% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

COMMENTS/FOOTNOTES

A HEAT RATES REPRESENT STATION OPERATING RANGE FOR 1981.

B TYPICAL OPERATING PROFILE IS MAXIMUM CONTINUOUS CAPACITY FROM 6 A.M. TO 10 P.M. WITH AFTERNOON AND EVENING PEAKS AND 60% LOAD FROM 10 P.M. TO 6 A.M. DURING THE WEEK. ON WEEKENDS, PLANT DROPS DOWN TO 100-150 MW FOR ENTIRE WEEKEND.

C 1/3 COAL TO PLANT FROM CAPTIVE MINE AND 2/3'S PURCHASED FROM SPOT MARKET.

D TYPICAL VALUES FOR 1980-81. FUEL ANALYSES DONE ON A SPOT BASIS.

E MECHANICAL COLLECTORS AND ESP'S PROVIDE PRIMARY PARTICULATE REMOVAL UPSTREAM OF SCRUBBERS, TYPICALLY REMOVING 83-86% OF INLET PARTICULATE.

F ACTUAL MECHANICAL COLLECTOR/ESP COMBINED PARTICULATE REMOVAL EFFICIENCY MEASURED AT ELRAMA IS APPROXIMATELY 83-86%. THIS TRANSLATES INTO AN OUTLET LOADING OF 0.45-0.55 GR/ACF BASED UPON AN INLET LOADING OF 3.26 GR/ACF FROM BOILER.

G MAINTENANCE REQUIREMENTS ARE TYPICALLY 8 PEOPLE/DAY-5 DAYS/WK-1 SHIFT/DAY DEDICATED TO FGD SYSTEM. MAXIMUM MAINTENANCE PERSONNEL AVAILABLE TO FGD SYSTEM IS 15. MAINTENANCE PEOPLE ARE SHARED WITH BOILER WHEN NOT USED FOR FGD SYSTEM.

H ONLY CEILCOTE BROUGHT IN PERIODICALLY TO REPAIR ABSORBER LINER WHEN NEEDED.

I IF A MAJOR PROBLEM ARISES, MAINTENANCE IS PERFORMED THAT NIGHT. IF MINOR PROBLEM, MAINTENANCE IS PERFORMED ON THE WEEKEND.

J PARTICULATE MATTER IS COLLECTED WITH $SO_2$ IN THE ABSORBER MODULES.

K ABSORBER VESSEL LINED WITH FLAKELINE 103 IN TANGENTIAL SHELF AREA, CEILCRETE 2500AR IN THROAT AREA, AND ACID BRICK IN CONVERGING DOWNCOMER AREA. FLAKELINE 282-X BEING TESTED IN ONE ABSORBER.

L BASED ON DESIGN INLET GAS FLOW CONDITIONS.

M IN ANNULUS OF FIRST STAGE BEFORE FAN AND FINAL MIST ELIMINATOR SECTION.

N RANGES FROM 4 TO 5 FT.

O EACH OF THE 12 NOZZLE HEADERS FOR EACH INTERNAL MIST ELIMINATOR UNDERSPRAY IS SPRAYED CONTINUOUSLY FOR 2 MINUTES; EACH OF THE FOUR TOP SPRAY NOZZLES RUN MANUALLY FOR 5 MINUTES ONCE PER DAY. EXTERNAL MIST ELIMINATOR IS WASHED ONCE PER WEEK MANUALLY FOR ONE HOUR.

P OIL-FIRED BURNERS EXTERNAL TO THE DUCTWORK HAVE BEEN REMOVED.

Q FAN HOUSINGS ARE CARBON STEEL LINED WITH BLACK NATURAL RUBBER. WHEELS AND BLADES ARE CONSTRUCTED OF HIGH ALLOY CARPENTER 20. SHAFTS ARE CARPENTER 20 LINED WITH BLACK NATURAL RUBBER. POLYURETHANE COATINGS (2 DIFFERENT TYPES) USED AS TOP COATS ON RUBBER AND EXPOSED SHELL TO PROTECT MATERIALS.

R

| MATERIALS | (A) | (B) | (C) |
|---|---|---|---|
| FRAME | 316L | FLAKEGLASS LINED CS | FLAKEGLASS LINED CS |
| BLADE | CS | 316L | 316L |
| SEAL | 316L | | ANGLED LIP |

S ONE THICKENER CAN HANDLE FULL LOAD OPERATION FOR LIMITED PERIODS OF TIME WITHOUT SEVERELY IMPACTING SYSTEM PERFORMANCE.

T ON A 5-DAY/WEEK SCHEDULE.

U SECOND FILL AREA. ORIGINAL LANDFILL WAS 1-2 MILES FROM PLANT SITE AND CONTAINED ALL ASH COLLECTED AT PLANT SINCE 1953.

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/8/81 ELRAMA 1-4

COMMENTS/FOOTNOTES (CONTINUED)

V PH CONTROL EFFECTED BY ADDING DILUTION WATER TO LIME SLURRY FEEDLINE ON DISCHARGE SIDE OF SLURRY FEED PUMP FROM DILUTION TANK (HIGH PH SIGNAL/ DILUTION WATER ADDITION, AND VICE-VERSA).
W BASED ON A STOICHIOMETRIC RATIO OF 1.1.
X THE BOTTOM OF THE ABSORBER VESSEL IS THE TANK.
Y SCRUBBER RECYCLE PUMPS BEING CONVERTED FROM INGERSOLL-RAND TO WARMAN. TO DATE, 6 ARE IN PLACE AND 2 ARE IN PROCESS OF MODIFICATION. ONLY 2 REMAINING INGERSOLL-RAND PUMPS ARE IN SERVICE (MODULE 501).

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duquesne Light Elrama 1-4 | 10/75 | 744 | 744 | System | | | | Initial shakedown/commercial operations commenced (only one boiler coupled to FGD) |
| | 11/75 | 720 | 720 | System | | | | |
| | 12/75 | 744 | 744 | System | | | | |
| | 1/76 | 744 | 744 | System | | | | |
| | 2/76 | 696 | 696 | System | | | | Second boiler connected to FGD system |
| | 3/76 | 744 | 744 | System | | | | |
| | 4/76 | 720 | 720 | System | | | | All five vessels were operational. The fifth vessel is testing the performance of two rubber-lined recycle pumps |
| | 5/76 | 744 | 744 | System | | | | |
| | 6/76 | 720 | 720 | System | | | | The fifth vessel was taken out of service for repairs and modifications required for the rubber-lined recycle pumps |
| | 7/76 | 744 | 744 | System | | | | |
| | 8/76 | 744 | 744 | System | | | Storage silo | Construction of an additional lime storage silo will be required for full-scale operation |
| | | | | | | | Thickener | Construction of an additional thickener will be required for full-scale operation |
| | | | | | | | Sludge fixation | Utility signed letter of intent with IUCS for long-term sludge fixation system |
| | 9/76 | 720 | 720 | System | | | | |
| | 10/76 | 744 | 744 | System | | | | |
| | 11/76 | 720 | 720 | System | | | | |
| | 12/76 | 744 | 744 | System | | | Pumps | Observations of the rubber-lined recycle pumps indicate some severe abrasion and gouging have occurred after 1000 hours of service time |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 1/77 | 744 | 744 | System | | | | |
| | 2/77 | 672 | 672 | System | | | | |
| | 3/77 | 744 | 744 | System | | | | Testing with thiosorbic lime was conducted |
| | 4/77 | 720 | 720 | System | | | | |
| | 5/77 | 744 | 744 | System | | | Pumps | Rubber-lined recycle pumps were removed due to gouging problems. Another set of rubber-lined pumps may be tested |
| | 6/77 | 720 | 720 | System | | | | |
| | 7/77 | 744 | 744 | System | | | | |
| | 8/77 | 744 | 744 | System | | | | |
| | 9/77 | 720 | 720 | System | | | | |
| | 10/77 | 744 | 744 | 101 | | | Bleed valve | Leaked (forced module off line for 24 hours) |
| | | | | 201 | | | | |
| | | | | 301 | | | ID fan | Rubber lining failed |
| | | | | 401 | | | ID fan | Rubber lining failed |
| | | | | 501 | | | Pump | Outages due to recycle pumps. New rubber-lined Wormen recycle pumps were installed |
| | | | | System | | | | |
| | 11/77 | 720 | 720 | 101 | | | | |
| | | | | 201 | | | | |
| | | | | 301 | | | | |
| | | | | 401 | | | | |
| | | | | 501 | | | | |
| | | | | System | 336 | | | Low FGD hours due to reduced loads (only two boilers were tied into the FGD system) |
| | 12/77 | 744 | 744 | System | | | | |
| | 1/78 | 744 | 744 | 101 | | | | |
| | | | | 201 | | | | |
| | | | | 301 | | | | |
| | | | | 401 | | | | |
| | | | | 501 | | | Pump | One pump experienced shaft bearing problems and Module 501 had to be taken off line |
| | | | | System | 405 | | | Low load and coal strike hampered good system operation |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Availability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 2/78 | 672 | 288 | 101 | | | | |
| | | | | 201 | | | | |
| | | | | 301 | | | | |
| | | | | 401 | | | | |
| | | | | 501 | | | | |
| | | | | System | 177 | | | |
| | 3/78 | 744 | 216 | System | 141 | | | System shutdown due to coal strike (several repairs/modifications were completed during strike) |
| | | | | | | | Boiler exit dampers | Lined with 316L SS |
| | | | | | | | Expansion joints | Joints upstream of the FGD system were shielded by metal plates; those downstream were completely replaced |
| | | | | | | | Ductwork | Downstream ductwork was relined with ceilcote |
| | | | | | | | Boilers | Third additional boiler was connected to FGD system |
| | 4/78 | 720 | 720 | System | | | | |
| | 5/78 | 744 | 744 | System | | | | |
| | 6/78 | 720 | 720 | System | | | | Fourth boiler tied into FGD system |
| | 7/78 | 744 | 744 | 101 | | 60 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 67 | Module | Downtime was for cleaning |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 77 | | |
| | | | | System | 744 | 100 | Mist eliminators | Plugging |
| | | | | | | | System chemistry | Unable to control system pH due to grit buildup in the lime handling and slurry preparation system |
| | 8/78 | 744 | 744 | 101 | | 77 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 51 | Module | Removed for cleaning |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 71 | Module | Removed for cleaning |
| | | | | System | 741 | 100 | | |

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 9/78 | 720 | 720 | 101 | | 72 | | |
| | | | | 201 | | 60 | | |
| | | | | 301 | | 93 | | |
| | | | | 401 | | 78 | | |
| | | | | 501 | | 94 | | |
| | | | | System | 700 | 99 | ID fan | Three ID fan housings were relined |
| | | | | | | | Lime mixing basin | Shutdown to remove grit buildup |
| | 10/78 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 99 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 81 | | |
| | | | | 501 | | 79 | | |
| | | | | System | 744 | 100 | | |
| | 11/78 | 720 | 720 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 81 | | |
| | | | | System | 720 | 100 | Lime supply | Insufficient supply |
| | 12/78 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 76 | | |
| | | | | 301 | | 93 | | |
| | | | | 401 | | 68 | | |
| | | | | 501 | | 98 | | |
| | | | | System | 720 | 100 | | |
| | 1/79 | 744 | 744 | 101 | | 45 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 68 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 735 | 100 | | |
| | 2/79 | 672 | 672 | 101 | | 100 | | |
| | | | | 201 | | 90 | | |
| | | | | 301 | | 14 | | |
| | | | | 401 | | 98 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 672 | 100 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 3/79 | 744 | 744 | 101 | | 99 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 78 | | |
| | | | | 401 | | 55 | | |
| | | | | 501 | | 70 | | |
| | | | | System | 680 | 100 | | |
| | 4/79 | 720 | 720 | 101 | | 64 | | |
| | | | | 201 | | 57 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 93 | | |
| | | | | System | 688 | 100 | | |
| | 5/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 98 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 52 | | |
| | | | | System | 744 | 100 | | |
| | 6/79 | 720 | 720 | 101 | | 100 | | |
| | | | | 201 | | 99 | | |
| | | | | 301 | | 93 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 717 | 100 | | |
| | 7/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 86 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 41 | | |
| | | | | System | 744 | 100 | | |
| | 8/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 41 | | |
| | | | | 501 | | 73 | | |
| | | | | System | 744 | 100 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 9/79 | 720 | 720 | 101 | | 44 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 90 | | |
| | | | | 501 | | 77 | | |
| | | | | System | 675 | 100 | | |
| | 10/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 48 | | |
| | | | | 401 | | 94 | | |
| | | | | 501 | | 84 | | |
| | | | | System | 744 | 100 | $SO_2$ monitor | New monitor was installed. No major problems were encountered |
| | 11/79 | 720 | 720 | 101 | | 100 | | |
| | | | | 201 | | 15 | | |
| | | | | 301 | | 92 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 95 | | |
| | | | | System | 720 | 100 | | |
| | 12/79 | 744 | 700 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 88 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 734 | 100 | | |
| | 1/80 | 744 | 513 | 101 | | 96 | | |
| | | | | 201 | | 87 | | |
| | | | | 301 | | 85 | | |
| | | | | 401 | | 86 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 528 | 100 | | |
| | 2/80 | 696 | 493 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 78 | | |
| | | | | System | 427 | 100 | Pumps | The two rubber-lined Wormen recycle pumps had logged 14,000 hours each without any repairs |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 3/80 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 74 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 78 | | |
| | | | | System | 595 | 100 | | |
| | 4/80 | 720 | 720 | 101 | | 40 | Pump | Recycle pump impellers had to be replaced (8 hour outage) |
| | | | | 201 | | 72 | Pump | Recycle pump impellers had to be replaced (8 hour outage) |
| | | | | 301 | | 87 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 572 | 94 | | |
| | 5/80 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 40 | | |
| | | | | 301 | | 94 | | |
| | | | | 401 | | 90 | | |
| | | | | 501 | | 97 | | |
| | | | | System | 586 | 100 | | |
| | 6/80 | 720 | 720 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 0 | Module | Cleaned and Ceilcote liner replaced (liner had lasted 17,000 operating hours) |
| | | | | 501 | | 100 | | |
| | | | | System | 710 | 100 | | |
| | 7/80 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 99 | | |
| | | | | 401 | | 76 | | |
| | | | | 501 | | 36 | | |
| | | | | System | 615 | 100 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Elrama 1-4 (continued) | 8/80 | 744 | 744 | 101 | | 31 | Module | Ceilcote liner replaced |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 99 | | |
| | | | | 501 | | 84 | Module | Ceilcote liner replaced (120 hour outage which started in July and finished in August) |
| | | | | System | 727 | 100 | | |
| | 9/80 | 720 | 720 | 101 | | 60 | | |
| | | | | 201 | | 39 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 100 | | |
| | | | | 501 | | 100 | | |
| | | | | System | 680 | 100 | Modules | During 9/80 to 11/80 the liners in Modules 101, 201, and 301 were replaced |
| | 10/80 | 744 | 744 | 101 | | 98 | | |
| | | | | 201 | | 32 | | |
| | | | | 301 | | 99 | | |
| | | | | 401 | | 91 | | |
| | | | | 501 | | 99 | | |
| | | | | System | 720 | 100 | | |
| | 11/80 | 720 | 720 | 101 | | 69 | ID fan | Fan housing lined with urethane |
| | | | | 102 | | 97 | | |
| | | | | 301 | | 63 | | |
| | | | | 401 | | 94 | | |
| | | | | 501 | | 77 | | |
| | | | | System | 711 | 100 | Pumps | The two rubber-lined Wormen recycle pumps had logged 20,000 hours each without any repairs |
| | 12/80 | 744 | | | | | | No information was reported |

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

DUQUESNE LIGHT

PHILLIPS 1-6

Duquesne Light
Phillips 1-6

## SECTION 1

## BACKGROUND

The Frank R. Phillips Power Station of the Duquesne Light Company is an existing plant which is located on a 42-acre plot in South Heights, Pennsylvania, approximately 18 miles from Pittsburgh. The station consisting of six coal-fired boilers, five (Nos. 1-5) of which are joined to a common steam header feeding three turbine generators (Nos. 1-3). The sixth steam generator (No. 6) is coupled to its turbine generator (No. 4). The Phillips 1 and 2 boilers were first placed in service in 1942; Phillips 3, 4, and 5 boilers in 1950; and Phillips 6 in 1956. The station's combined gross and net generating capacities are 408-MW and 387-MW, respectively.

In December 1969, Gibbs and Hill was retained to conduct a comprehensive study of the most feasible means of complying with anticipated emission regulations being promulgated by Allegheny County for both the Phillips and Elrama Power Stations. In September 1970, Gibbs and Hill submitted the results of that study indicating that FGD was the most practical means of achieving compliance at both stations. The study also concluded that a dual-stage venturi scrubbing system should be pilot tested. Pilot scrubber specifications were prepared and issued to five vendors in September 1970. The successful vendor,

Duquesne Light
Phillips 1-6

Chemico, installed a 1500-cfm pilot plant in February 1971 and completed tests in May of that year. The pilot tests indicated that 83% removal of the $SO_2$ resulting from the combustion of 2% sulfur coal would require lime scrubbing instead of limestone to achieve regulations (0.6 lb/$10^6$ Btu). As such, in July 1971, Chemico was awarded a contract to supply a full-scale lime FGD system consisting of three single-stage venturi scrubbers and one 2-stage venturi scrubbing train for particulate and $SO_2$ control.

The FGD system was installed at the plant on a six-acre plot in two distinct phases. The first phase of work involved erecting the two-stage scrubbing train and single-stage scrubbers, lime handling and preparation facilities, solids concentrating and disposal facilities, and a new 340-ft stack. This system, using conventional high calcium lime, operated for approximately two years to determine the feasibility of this design configuration. Upon completion of this initial phase of operation, it was determined that the single-stage scrubber design was adequate using magnesium-promoted lime. As such, the second phase of work on the FGD system was undertaken which involved additional lime slaking and storage facilities; an additional thickener; upgraded and expanded sludge processing based on a successful IUCS pilot plant test program at the plant; removal of the second-stage venturi scrubber in the two-stage scrubbing train from service (although leaving the module in the gas path); and the use of magnesium-promoted lime. This second phase of work completed the expansion of the FGD system to full plant compliance operation in the spring of 1978.

Duquesne Light
Phillips 1-6

In 1979, Duquesne Light tested sodium thiosulfate as an additive to the scrubbing slurry to improve $SO_2$ removal efficiency and reduce lime consumption and scaling. The success of this test program resulted in the incorporation of sodium thiosulfate addition as a permanent feature of the process.

Duquesne Light
Phillips 1-6

## SECTION 2

## PROCESS DESCRIPTION

The Phillips emission control system consists of six mechanical collectors and electrostatic precipitators for primary fly ash control followed by a lime slurry FGD system consisting of four single-stage venturi scrubbers for $SO_2$ and secondary fly ash control. This emission control system is designed to achieve compliance with Allegheny County $SO_2$ and particulate emission regulations of 0.6 lb/$10^6$ Btu and 0.08 lb/$10^6$ Btu, respectively.

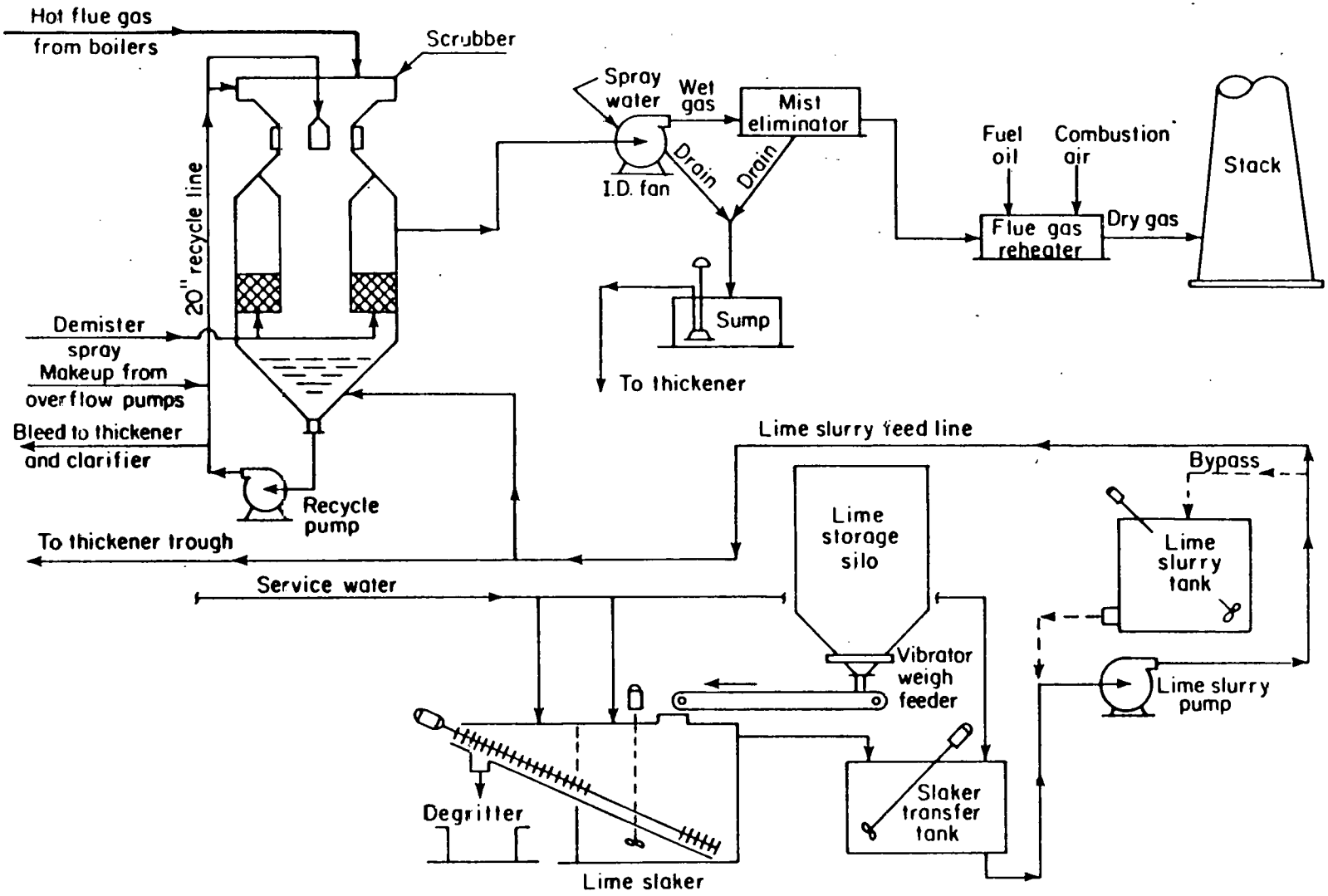
The Phillips station consists of six pulverized coal-fired boilers which produce a combined flue gas flow of 2,220,000 acfm at 362°F. All six boilers are retrofitted to a common duct leading to the four parallel, variable-throat venturi scrubber modules. Each scrubber module handles 550,000 acfm of flue gas and 16,000 gpm of recycled lime slurry to provide a liquid-to-gas ratio of 30 gal/1000 acf. Each scrubber module is also equipped with a single stage of internal mist eliminators, a 5000-hp wet induced draft fan, and an external mist elimination chamber. The scrubbed gas stream from each module are then joined in a common duct leading to a recently-added 340-ft stack. The FGD systems includes no spare modules and no reheat.

Duquesne Light
Phillips 1-6

The spent scrubbing slurry is discharged from the slurry recirculation line of each module to three thickeners (one spare). The 5% solids bleed stream is concentrated to approximately 30-35% solids in the thickeners and transferred to the sludge stabilization plant. The clarified overflow is returned to the process as mist eliminator wash water or lime dilution water.

The sludge stabilization plant is an IUCS facility operated by IUCS. The thickener underflow is concentrated to approximately 50% solids in two rotary drum vacuum filters (one spare) and mixed with dry fly ash (collected in the ESP's and mechanical collectors) and lime. The treated material is piled on the plant site by a rotary stacker for transfer via front-end loaders and trucks to a landfill approximately 10 miles from the plant site.

A flow diagram for the Phillips 1-6 FGD system is shown on the next page.




Flow Diagram: Phillips 1-6

# SECTION 3

# DESIGN DATA

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

GENERAL PLANT INFORMATION
- COMPANY NAME: DUQUESNE LIGHT
- ASSOCIATED UTILITIES: NONE
- PLANT NAME: PHILLIPS
- UNIT NUMBER: 1-6
- PLANT ADDRESS: P.O. BOX 331
- CITY: SOUTH HEIGHTS
- COUNTY: ALLEGHENY
- STATE: PENNSYLVANIA
- ZIP CODE: 15081
- EPA REGION: 3
- RIVER BASIN/LAKE REGION: OHIO
- REGULATORY CLASSIFICATION: STATE STD MORE STRINGENT THAN NSPS (12/71)
- PARTICLE EMISSION LIMITATION - LB/MM BTU: 0.08
- SO2 EMISSION LIMITATION - LB/MM BTU: 0.6
- NOX EMISSION LIMITATION - LB/MM BTU: NONE
- NET PLANT GENERATING CAPACITY - MW: 387
- GROSS UNIT GENERATING CAPACITY - MW: 408
- NET UNIT GENERATING CAPACITY WITH FGD - MW: 373
- NET UNIT GENERATING CAPACITY W/O FGD - MW: 387
- EQUIVALENT SCRUBBED CAPACITY - MW: 408

UNIT DATA (BOILER AND STACK)
- BOILER SUPPLIER: FOSTER WHEELER
- FURNACE TYPE (PULVERIZED COAL, CYCLONE, ETC.): PULVERIZED COAL
- FURNACE FIRING METHOD:
- WET BOTTOM/DRY BOTTOM: DRY BOTTOM
- FURNACE DRAFT TYPE (FORCED, INDUCED, BALANCED): BALANCED
- SERVICE LOAD (BASE, PEAK, STANDBY, ETC.): CYCLING
- COMMERCIAL SERVICE DATE: 1942-1956
- DESIGN BOILER FLUE GAS FLOW - ACFM: 2,220,000
- FLUE GAS TEMPERATURE - F: 362
- FLUE GAS OXYGEN - %: 12
- HEAT RATE - BTU/KWH: 13,000
- DESIGN FIRING RATE - TPH: 229
- EXCESS AIR - %: 100
- CAPACITY FACTOR - %: 65
- STACK HEIGHT - FT: 340
- SHELL MATERIAL: CONCRETE
- FLUE MATERIAL GENERIC TYPE: INORGANIC
- FLUE MATERIAL SPECIFIC TYPE: ACID-RESISTANT BRICK AND MORTAR
- FLUE MATERIAL TRADE/COMMON NAME: ASTM C279L AND SAUEREISEN NO. 65
- FLUE LINER MATERIAL GENERIC TYPE: N/A
- FLUE LINER MATERIAL SPECIFIC TYPE: N/A
- FLUE LINER MATERIAL TRADE/COMMON NAME: N/A
- FLUE INNER DIAMETER - FT: 26
- STACK GAS INLET TEMPERATURE - F: 125
- STACK GAS OUTLET VELOCITY - FT/SEC: 52

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/7/81 — PHILLIPS 1-6

FUEL DATA (ACTUAL)
FUEL GRADE (LIGNITE, SUBBITUMINOUS, ETC.): BITUMINOUS
A NAME OF SUPPLIER: DUQUESNE LIGHT (COMPANY-OWNED MINE)
MINE NAME/AREA: WARWICK MINE, SEWICKLEY SEAM
MINE LOCATION - COUNTY: WASHINGTON
MINE LOCATION - STATE: GREENSBORO, PA
AVERAGE HEAT CONTENT - BTU/LB: 11,568
RANGE HEAT CONTENT - BTU/LB: 11,500-12,500
AVERAGE ASH CONTENT - %: 16.8
RANGE ASH CONTENT - %: 14.0-18.3
AVERAGE MOISTURE CONTENT - %: 5.93
RANGE MOISTURE CONTENT - %: 4.3-7.06
AVERAGE SULFUR CONTENT - %: 2.05
RANGE SULFUR CONTENT - %: 1.49-2.91
AVERAGE CHLORIDE CONTENT - %: 0.04
RANGE CHLORIDE CONTENT - %: 0.03-0.05
FUEL ANALYSIS METHOD (AVERAGE, SPOT, TYPICAL): TYPICAL
FUEL ANALYSIS DATE: N/A

PARTICLE CONTROL GENERAL DATA
CONFIGURATION (INTEGRATED/SEGREGATED): SEGREGATED AND INTEGRATED
SPACE REQUIREMENTS - SQ FT: _____

MECHANICAL COLLECTOR
NUMBER OF MECHANICAL COLLECTORS: 6
NUMBER OF SPARES: 0
TYPE: MULTICLONES
SUPPLIER: RESEARCH-COTTRELL
INLET FLUE GAS CAPACITY - ACFM: 370,000
INLET FLUE GAS TEMPERATURE - F: 362
PRESSURE DROP IN. H2O: 0.5
PARTICLE OUTLET LOAD - GR/SCF: _____
PARTICLE REMOVAL EFFICIENCY - %: ___

ELECTROSTATIC PRECIPITATOR
NUMBER OF ELECTROSTATIC PRECIPITATORS: 6
NUMBER OF SPARES: 0
TYPE (HOT SIDE/COLD SIDE): COLD SIDE
SUPPLIER: RESEARCH-COTTRELL
INLET FLUE GAS CAPACITY - ACFM: 370,000
INLET FLUE GAS TEMPERATURE - F: 362
PRESSURE DROP - IN. H2O: 0.5
PARTICLE OUTLET LOAD - GR/SCF: 3-4
PARTICLE REMOVAL EFFICIENCY - %: 70 (MECHANICAL COLLECTOR AND ESP)
FLUE GAS CONDITIONING TYPE: NONE

PARTICLE SCRUBBER
NUMBER OF PARTICLE SCRUBBERS: NONE
NUMBER OF SPARES:

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

GENERIC TYPE (VENTURI, PACKED TOWER, ETC.):
SPECIFIC TYPE (FIXED THROAT, MOBILE BED, ETC.):
TRADE/COMMON NAME:
SUPPLIER:
DIMENSIONS - FT:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
BOILER LOAD PER SCRUBBER (DESIGN) - %:
C GAS CONTACTING DEVICE TYPE (MOBILE BALLS, RODS, ETC.):
NUMBER OF GAS CONTACTING ZONES:
DISTANCE BETWEEN CONTACTING ZONES - IN.:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
PH CONTROL ADDITIVE:
GAS-SIDE PRESSURE DROP - IN. H2O:
SUPERFICIAL GAS VELOCITY - FT/SEC:
INLET GAS FLOW RATE - ACFM:
INLET GAS TEMPERATURE - F:
INLET SO2 LEVEL - PPM:
INLET SO2 LEVEL - LB/MM BTU:
INLET PARTICLE LEVEL - GR/SCF:
INLET PARTICLE LEVEL - LB/MM BTU:
OUTLET GAS FLOW RATE - ACFM:
OUTLET GAS TEMPERATURE - F:
OUTLET SO2 LEVEL - PPM:
OUTLET SO2 LEVEL - LB/MM BTU:
OUTLET PARTICLE LEVEL - GR/SCF:
OUTLET PARTICLE LEVEL - LB/MM BTU:
SO2 REMOVAL EFFICIENCY - %:
PARTICLE REMOVAL EFFICIENCY - %:

FGD SYSTEM GENERAL DATA
PROCESS TYPE (LIME, LIMESTONE, ETC.): LIME
PROCESS ADDITIVES (MG/ADIPIC ACID/ETC.): MAGNESIUM OXIDE AND SODIUM THIOSULFATE
SYSTEM SUPPLIER: CHEMICO
A-E FIRM: GIBBS & HILL
CONSTRUCTION FIRM: GIBBS & HILL
APPLICATION (NEW/RETROFIT): RETROFIT
PARTICLE DESIGN REMOVAL EFFICIENCY - %: 99 (OVERALL)
SO2 DESIGN REMOVAL EFFICIENCY - %: 83
CURRENT STATUS: OPERATIONAL

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

TERMINATION DATE: N/A
COMMERCIAL START-UP: 6/74
INITIAL START-UP: 7/73
CONSTRUCTION COMPLETION: 7/73
CONSTRUCTION INITIATION: 12/71
CONTRACT AWARDED: 7/71
LETTER OF INTENT SIGNED: 4/71
INITIATED BID REQUEST: 10/70
INITIATED PRELIMINARY DESIGN: 12/69

FGD DESIGN AND OPERATING PARAMETERS
DESIGN COAL SULFUR CONTENT - %: 2.3
DESIGN COAL HEAT CONTENT - BTU/LB: 11,000
DESIGN COAL ASH CONTENT - %: 21
DESIGN COAL MOISTURE CONTENT - %: 7
DESIGN COAL CHLORIDE CONTENT - %: 0.1
FGD SYSTEM SPACE REQUIREMENTS - SQ FT: 261,000 (ENTIRE FGD PLANT)
FGD SYSTEM TURNDOWN RATIO: 4:1
FGD SYSTEM TURNDOWN METHOD: TAKE 2 TRAINS OFF-LINE; VARIABLE THROAT VENTURI
FGD SYSTEM PRESSURE DROP - IN. H2O: 16
FGD SYSTEM OXIDATION - %: 40-50
FGD SYSTEM SCRUBBER RECYCLE LIQUOR - % SOLIDS: N/A
FGD SYSTEM ABSORBER RECYCLE LIQUOR - % SOLIDS: 5
FGD SYSTEM MAINTENANCE RESPONSIBILITY LEVEL (SAME AS BOILER, LOWER, OR HIGHER): SAME AS BOILER
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MANHOURS/DAY): ~140
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (OPERATORS/SHIFT): 8-2/3
B FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE PERSONNEL/SHIFT): 8 (DAY SHIFT ONLY)
FGD SYSTEM OPERATION & MAINTENANCE REQUIREMENT (MAINTENANCE SHIFTS/DAY): 1
FGD SYSTEM MAINTENANCE BY OUTSIDE CONTRACTORS (MANHOURS/YEAR): 1800
TYPE OF FGD SYSTEM MAINTENANCE CREW (DEDICATED, ETC.): SAME CREW AS FOR BOILER
SCHEDULE FOR BOILER MAINTENANCE PERSONNEL ROTATION TO FGD SYSTEM: INTEGRATED WITH PLANT ON AN AS-NEEDED BASIS
TYPE OF MAINTENANCE SUPERVISORS (DEDICATED, ETC.): INTEGRATED WITH PLANT
FGD SYSTEM BYPASS CAPABILITY (YES/NO): NO
RESTRICTIONS TO USING BYPASS: NO ALLOWANCE FOR BYPASS
TIME SCHEDULE FOR REDUCED BOILER LOAD: WEEKENDS
TIME SCHEDULE FOR BOILER SHUTDOWNS: 3 DAYS/YR FOR INSPECTION; 2 WEEKS/YR FOR MAINTENANCE AND REPAIRS
C PLANNED MAINTENANCE DURING REDUCED BOILER LOAD (TYPE AND FREQUENCY): MINOR MAINTENANCE PROBLEMS
C PLANNED MAINTENANCE DURING BOILER SHUTDOWNS (TYPE AND FREQUENCY): MAJOR MAINTENANCE PROBLEMS
TYPE OF MAINTENANCE PERFORMED WHEN FAILURE OCCURS (OTHER THAN CORRECTING CAUSE OF FAILURE): DEPENDING ON NATURE OF COMPONENT, INVESTIGATE CAUSE TO MODIFY DESIGN FOR PERMANENT SOLUTION.

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

QUENCHER/PRESATURATOR
NUMBER OF QUENCHERS/PRESATURATORS: NONE
NUMBER OF SPARES:
TYPE:
LOCATION:
SUPPLIER:
SHELL MATERIAL GENERIC TYPE:
SHELL MATERIAL SPECIFIC TYPE:
SHELL MATERIAL TRADE/COMMON NAME:
LINER MATERIAL GENERIC TYPE:
LINER MATERIAL SPECIFIC TYPE:
LINER MATERIAL TRADE/COMMON NAME:
INLET GAS FLOW - ACFM:
INLET GAS TEMPERATURE - F:
PRESSURE DROP - IN. H2O:
LIQUID TYPE (MAKEUP WATER, RECLAIMED WATER, ABSORBER SLURRY, ETC.):
LIQUID RECIRCULATION RATE - GPM:
L/G RATIO - GAL/1000 ACF:
NUMBER OF SPRAY HEADERS:
NOZZLE MATERIAL:
NOZZLE PRESSURE DROP - PSI:

ABSORBER
D NUMBER OF ABSORBERS: 4
NUMBER OF SPARES: 0
GENERIC TYPE: VENTURI
SPECIFIC TYPE: VARIABLE-THROAT/SIDE-ENTRY BLADES
TRADE/COMMON NAME: N/A
SUPPLIER: CHEMICO
DIMENSIONS - FT: 40 DIA X 66 HIGH
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC AND INORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS CLOTH REINFORCED AMINE-CURED EPOXY; GLASS FLAKE-FILLED POLYESTER; ACID-RESISTANT BRICK AND MORTAR
E LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR; FLAKELINE 103;
BOILER LOAD PER ABSORBER - %: 25
GAS/LIQUID CONTACT DEVICE TYPE: VARIABLE THROAT VENTURI
NUMBER OF GAS CONTACTING ZONES: 1
DISTANCE BETWEEN GAS CONTACTING ZONES - IN.: N/A
NUMBER OF SPRAY HEADERS: 12 TANGENTIAL AND 1 BULL NOZZLE
NOZZLE MATERIAL: TYPE 316L STAINLESS STEEL
NOZZLE PRESSURE DROP - PSI:
LIQUID RECIRCULATION RATE - GPM: 16,000
L/G RATIO - GAL/1000 ACF: 30
GAS-SIDE PRESSURE DROP - IN. H2O: 8
SUPERFICIAL GAS VELOCITY - FT/SEC: 150 (THRU VENTURI THROAT)

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

ABSORBER TURNDOWN RATIO: 2:1
ABSORBER TURNDOWN METHOD: VARIABLE THROAT
INLET GAS FLOW RATE - ACFM: 550,000
INLET GAS TEMPERATURE - F: 362
INLET SO2 LEVEL - PPM: 1000
INLET SO2 LEVEL - LB/MM BTU: 4
INLET PARTICLE LEVEL - GR/SCF: 3-4
INLET PARTICLE LEVEL - LB/MM BTU: 6-8
OUTLET GAS FLOW RATE - ACFM: 375,000-400,000
OUTLET GAS TEMPERATURE - F: 125
OUTLET SO2 LEVEL - PPM: 150-170
OUTLET SO2 LEVEL - LB/MM BTU: ≤0.6
OUTLET PARTICLE LEVEL - GR/SCF: 0.04
OUTLET PARTICLE LEVEL - LB/MM BTU: ≤0.08
SO2 REMOVAL EFFICIENCY - %: 83-85
PARTICLE REMOVAL EFFICIENCY - %: 99 (OVERALL)

MIST ELIMINATOR
FUNCTION (PRE-MIST ELIMINATOR/MIST ELIMINATOR): MIST ELIMINATOR
F TOTAL NUMBER OF MIST ELIMINATORS: 7 (1 INTERNAL + 1 EXTERNAL IN SEPARATE VESSEL PER TRAIN)
NUMBER OF SPARES: 0
G NUMBER PER MODULE: 2
H GENERIC TYPE: IMPINGEMENT
SPECIFIC TYPE: BAFFLE
COMMON DESIGN: CHEVRON VANE
MANUFACTURER: HEIL
CONFIGURATION (HORIZONTAL/VERTICAL): HORIZONTAL
SHAPE (Z-SHAPE/A-FRAME): FLAT
NUMBER OF STAGES: 1
NUMBER OF PASSES/STAGE: 4
I FREEBOARD DISTANCE - FT: 4.5 (INTERNAL); 19 (EXTERNAL)
DISTANCE BETWEEN STAGES - IN.: N/A
DISTANCE BETWEEN VANES - IN.: 2-3
VANE ANGLES - DEGREES: 90
PRESSURE DROP - IN. H2O: 4.0
J SUPERFICIAL GAS VELOCITY - FT/SEC: 10
K CONSTRUCTION MATERIAL GENERIC TYPE: ORGANIC
CONSTRUCTION MATERIAL SPECIFIC TYPE: FIBERGLASS REINFORCED PLASTIC
CONSTRUCTION MATERIAL TRADE/COMMON NAME:
WASH WATER SOURCE (FRESH, BLENDED, SUPERNATANT): THICKENER OVERFLOW
POINT OF WATER COLLECTION: THICKENER OVERFLOW TANK
WASH DIRECTION (OVERSPRAY/UNDERSPRAY, FRONTSPRAY/BACKSPRAY): UNDERSPRAY
WASH FREQUENCY: CONTINOUS
WASH DURATION: N/A
WASH RATE - GAL/MIN: 50-60 GAL/MIN PER TRAIN, 200 GAL/MIN TOTAL
WASH COVERAGE - GAL/MIN/SQ FT: 0.5-1.0

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

REHEATER
NUMBER OF REHEATERS: NONE (REMOVED FROM SERVICE)
NUMBER OF SPARES:
NUMBER PER MODULE:
GENERIC TYPE (IN-LINE, INDIRECT HOT AIR, IN-LINE BURNER, ETC.):
SPECIFIC TYPE (STEAM, HOT WATER, ETC.):
COMMON DESIGN (BARE OR FIN TUBES, GAS OR OIL, ETC.):
COMBUSTION FUEL SULFUR CONTENT - %:
LOCATION:
AVERAGE PERCENT OF GAS BYPASSED FOR REHEAT:
TEMPERATURE INCREASE - F:
INLET FLUE GAS FLOW RATE - ACFM:
INLET FLUE GAS TEMPERATURE - F:
OUTLET FLUE GAS FLOW RATE - ACFM:
OUTLET FLUE GAS TEMPERATURE - F:
ENERGY REQUIREMENT - MM BTU/HR:
NUMBER OF HEAT EXCHANGER BANKS:
NUMBER OF BUNDLES PER BANK:
NUMBER OF TUBES PER BUNDLE:
STEAM OR WATER PRESSURE - PSIG:
STEAM OR WATER TEMPERATURE - F:
SELF CLEANING DEVICE TYPE:
MATERIAL GENERIC TYPE:
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME:

FANS
NUMBER OF FANS: 4
NUMBER OF SPARES: 0
DESIGN (CENTRIFUGAL, AXIAL, ETC.): CENTRIFUGAL
SUPPLIER: GREEN FUEL ECONOMIZER CO.
FUNCTION (UNIT/BOOSTER): BOOSTER
APPLICATION (INDUCED DRAFT/FORCED DRAFT) - WRT ABSORBER: INDUCED DRAFT
SERVICE (WET/DRY): WET
TYPE OF WASH: CONTINUOUS WITH FRESH WATER
LOCATION WRT MAJOR COMPONENTS: BETWEEN ABSORBER AND EXTERNAL ME
FLUE GAS FLOW RATE - ACFM: 400,000
FLUE GAS TEMPERATURE - F: 125
PRESSURE DROP - IN. H2O: 17
L MATERIAL GENERIC TYPE: HIGH ALLOY
MATERIAL SPECIFIC TYPE:
MATERIAL TRADE/COMMON NAME: INCOLOY 825 HOUSINGS AND RUBBER-LINED CARPENTER 20 ROTORS WITH INCOLOY WELDS AND CARPENTER 20 WHEELS AND BLADES

DAMPERS
LOCATION: (A) ABSORBER INLET (B) ABSORBER OUTLET
(C) EXTERNAL MIST ELIMINATOR OUTLET
NUMBER OF DAMPERS: 12 (3/MODULE)

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

FUNCTION (CONTROL/SHUT-OFF): SHUT-OFF
GENERIC TYPE (LOUVER, BUTTERFLY, ETC.): (A) BUTTERFLY (B) LOUVER
(C) LOUVER
SPECIFIC TYPE (OPPOSED BLADE,
PARALLEL BLADE, ETC.): (A) N/A (B) PARALLEL BLADE MULTILOUVER
(C) PARALLEL BLADE MULTILOUVER
TRADE/COMMON DESIGN (SINGLE LOUVER/DOUBLE LOUVER): _____
MANUFACTURER: _____
MODULATION (OPEN/CLOSED, ETC.): OPEN/CLOSED
SEAL AIR - ACFM: NONE
SERVICE CONDITIONS (MAX GAS TEMP/TIME): _____
MATERIAL GENERIC TYPE: (A) LINED CARBON STEEL (B) STAINLESS STEEL
(C) STAINLESS STEEL
MATERIAL SPECIFIC TYPE: (A) AISI 1110 (B) _____ (C) AUSTENITIC
MATERIAL TRADE/COMMON NAME: (A) N/A (B) _____ (C) TYPE 316L
M LINER MATERIAL GENERIC TYPE: (A) STAINLESS STEEL (B) STAINLESS STEEL
LINER MATERIAL SPECIFIC TYPE: (A) TYPE 316L (B) TYPE 316L
LINER MATERIAL TRADE/COMMON NAME: N/A

DUCTWORK
LOCATION: (A) INLET (B) OUTLET
CONFIGURATION (CIRCULAR, RECTANGULAR, ETC.): (A) RECTANGULAR
(B) RECTANGULAR
DIMENSIONS (DIAMETER, LENGTH, ETC.): _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL (B) CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: (A) AISI 1110 (B) AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: (A) NONE (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

EXPANSION JOINTS
LOCATION: WET SIDE
TYPE (METALLIC/ELASTOMERIC): ELASTOMERIC
FUNCTION (GAS CIRCUIT/LIQUID CIRCUIT): GAS
PRESSURE (NEGATIVE/POSITIVE): POSITIVE
OPERATING TEMPERATURE - F: 125
DESIGN CONFIGURATION (V-SHAPED, ETC.): _____
MANUFACTURER: GARLOCK
N MATERIALS: ASBESTOS-REINFORCED BUTYL RUBBER (GARLOCK 300)

REAGENT PREPARATION EQUIPMENT
FUNCTION (LIMESTONE GRINDING, LIME SLAKING, ETC.): LIME SLAKING
PREPARATION DEVICE (BALL MILL, CRUSHER, ETC.): SLAKER
DEVICE TYPE (TUBE MILL, CONICAL MILL, ETC.): PASTE SLAKER
MANUFACTURER: WALLACE & TIERNAN
MATERIALS: CARBON STEEL
NUMBER OF DEVICES: 4
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/7/81 — PHILLIPS 1-6

FULL LOAD DRY FEED CAPACITY - TPH: 4 (DRY FEED)
PRODUCT QUALITY - % SOLIDS: 20-25
FULL LOAD PRODUCT QUANTITY EMPLOYED - GPM: 100 (25/MODULE)
PREPARED REAGENT POINT OF ADDITION: BOTTOM CONE OF ABSORBER VESSEL
ON-SITE STORAGE CAPABILITY - DAYS: 14

TANKS
*SEE ATTACHMENT A

PUMPS
*SEE ATTACHMENT B

MAJOR PIPING
FUNCTION (RECYCLE SLURRY, RECLAIMED WATER, SLUDGE, ETC.): (A) RECYCLE SLURRY (B) LIME SLURRY (C) ABSORBER EFFLUENT (D) SPRAY HEADERS
DIMENSIONS - IN.: _____
MANUFACTURER: _____
MATERIAL: (A) RUBBER-LINED CARBON STEEL AND FRP (B) CARBON STEEL (C) STAINLESS STEEL (D) TYPE 316L STAINLESS STEEL

MAJOR VALVES
LOCATION: (A) GENERAL (B) PUMPS
FUNCTION (ISOLATION, CONTROL, ETC.): (A) _____ (B) ISOLATION
TYPE (BALL, GLOBE, PLUG, ETC.): (A) PINCH (B) PLUG
CONTROL MODE (AUTOMATIC/MANUAL): (A) AUTOMATIC (B) _____
DIMENSIONS - IN.: _____
MANUFACTURER: (A) _____ (B) DEZURIK
MATERIAL: (A) RUBBER LINED (B) _____

THICKENERS
NUMBER OF THICKENERS: 3
0 NUMBER OF SPARES: 1
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 75 DIAMETER
CAPACITY - GAL: _____
SHELL MATERIAL GENERIC TYPE: (A) CARBON STEEL WALLS (B) CONCRETE FLOOR
SHELL MATERIAL SPECIFIC TYPE: (A) AISI 1110 (B) N/A
SHELL MATERIAL TRADE/COMMON NAME: (A) N/A (B) N/A
LINER MATERIAL GENERIC TYPE: (A) ORGANIC (B) ORGANIC
LINER MATERIAL SPECIFIC TYPE: (A) FLAKE GLASS/POLYESTER (B) BITUMINOUS BASE MODIFIED ASPHALT
LINER MATERIAL TRADE/COMMON NAME: (A) FLAKELINE 103 (B) CEILCOTE HOT MASTIC 195
RAKE MATERIAL: RUBBER-CLAD STEEL
FEED STREAM SOURCE: ABSORBER BLEED
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 5% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30-35% SOLIDS

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): _____
OUTLET STREAM DISPOSITION: TO VACUUM FILTER
OVERFLOW STREAM DISPOSITION: TO MIST ELIMINATOR WASH

SOLIDS DEWATERING
DEVICE GENERIC TYPE (CENTRIFUGE, VACUUM FILTER, ETC.): VACUUM FILTER
DEVICE SPECIFIC TYPE (DRUM, HORIZONTAL BELT, ETC.): DRUM
DEVICE COMMON DESIGN (ROTARY, BELT FILTER, ETC.): ROTARY
NUMBER OF DEVICES: 2
NUMBER OF SPARES: 1 (SPARE CAPACITY)
CONFIGURATION: CIRCULAR
DIMENSIONS - FT: 12 DIA X 16
CAPACITY: 150 LB/HR/SQ FT OF CLOTH AREA (DESIGN)
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____
BELT MATERIAL GENERIC TYPE: _____
BELT MATERIAL SPECIFIC TYPE: _____
BELT MATERIAL TRADE/COMMON NAME: _____
FEED STREAM SOURCE (ABSORBER BLEED, THICKENER UNDERFLOW, ETC.): THICKENER UNDERFLOW
FEED STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 30-35% SOLIDS
OUTLET STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): 50
OVERFLOW STREAM CHARACTERISTICS (VOLUME FLOW RATE, PERCENT SOLIDS): <0.1% SOLIDS
OUTLET STREAM DISPOSITION: TO SLUDGE TREATMENT
OVERFLOW STREAM DISPOSITION: THICKENER OVERFLOW TANK

SLUDGE
FULL LOAD QUANTITY - TPH/DRY: 1170 TPD (IUCS PRODUCT FOR LANDFILLING)
MOISTURE CONTENT - % TOTAL FREE WATER: 25-30
PERCENT CASO3 - DRY: 4
PERCENT CASO4 - DRY: 10
PERCENT CAOH2 - DRY: _____
PERCENT CACO3 - DRY: _____
PERCENT ASH - DRY: 50
PERCENT OTHER COMPOUNDS - DRY: _____

SLUDGE TREATMENT
METHOD: FIXATION
COMMON DESIGN (RECYCLE STREAM, BLEED STREAM, ETC.): BLEED STREAM
DEVICE (OXIDATION TANK, PUG MILL, ETC.): PUG MILL
PROPRIETARY PROCESS (IUCS, DRAVO, ETC.): IUCS (POZ-O-TEC)
INLET FLOW RATE - GPM: 500-600
INLET QUALITY - % SOLIDS: 50

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/7/81 — PHILLIPS 1-6

SLUDGE DISPOSAL
- NATURE (INTERIM/FINAL): (A) INTERIM (B) FINAL
- GENERIC TYPE (LANDFILL, POND, ETC.): (A) CONCRETE PAD FOR ON-SITE CURING (B) LANDFILL
- SPECIFIC TYPE (DIKED, SIDE HILL, ETC.): (B) VALLEY FOR BACK FILLING
- COMMON DESIGN (ABANDONED SURFACE MINE, ETC.): (B) BACKFILL IN 4 FOOT TIERS
- LOCATION (ON-SITE/OFF-SITE): (A) ON-SITE (B) OFF-SITE
- TRANSPORTATION METHOD (PIPELINE, TRUCK, ETC.): (A) PIPELINE (B) TRUCK
- SITE TREATMENT (CLAY LINING, SYNTHETIC LINING, ETC.): (B) COMPACTED CLAY LIKE NATURAL SOIL
- SITE DIMENSIONS - AREA/DEPTH:
- SITE CAPACITY - VOLUME/ACRE-FT/TONS:
- SITE SERVICE LIFE - YEARS: (A) ONE WEEK (B) 10 YEARS

PROCESS CONTROL AND INSTRUMENTATION
- PROCESS STREAM: SLURRY RECIRCULATION STREAM
- CHEMICAL PARAMETERS (PH, ETC.): PH
- PHYSICAL PARAMETERS (PERCENT SOLIDS, DENSITY, FLOW, ETC.): FLOW
- CONTROL LEVELS: PH SET 7.7
- MONITOR TYPE (MANUFACTURER, ETC.): UNIVERSAL UNILOC
- MONITOR LOCATION: TANGENTIAL NOZZLE AT INLET TO ABSORBER
- PROCESS CONTROL MANNER (AUTOMATIC/MANUAL): AUTOMATIC
- PROCESS CONTROL MODE (FEEDBACK/FEED FORWARD): FEEDBACK

WATER BALANCE
- WATER BALANCE ENTRIES (DESIGN/ACTUAL): ACTUAL
- TYPE (OPEN/CLOSED): OPEN
- EVAPORATION WATER LOSS - GPM: 220
- SLUDGE HYDRATION WATER LOSS - GPM: 30
- SLUDGE INTERSTITIAL WATER LOSS - GPM: 50
- POND SEEPAGE/RUNOFF WATER LOSS - GPM: 0

P EFFLUENT WATER LOSS - GPM: 0-300
- RECEIVING WATER STREAM NAME: OHIO RIVER
- MAKEUP WATER ADDITION - GPM: 25-350 DEPENDING ON LOAD
- SOURCE OF MAKEUP WATER (RIVER WATER, ETC.): RIVER
- MAKEUP WATER ADDITION POINTS & AMOUNTS: SLAKER, PUMPS, SEALS, FANS, ME
- MAKEUP WATER PRE-TREATMENT TYPE: SCREENED/FILTERED

CHEMICALS AND CONSUMPTION
- FUNCTION (ABSORBENT, SOLIDS SETTLING, ETC.): (A) ABSORBENT (B) ADDITIVE
- NAME (LIMESTONE, ADIPIC ACID, ETC.): (A) MAGNESIUM-MODIFIED LIME (B) SODIUM THIOSULFATE
- PRINCIPAL CONSTITUENTS: (A) CaO, MgO (B) $Na_2S_2O_3$
- SOURCE/SUPPLIER: (A) DRAVO (B) ALLIED CHEMICAL
- SUPPLIER LOCATION: (A) MAYSVILLE, KY
- CONSUMPTION (SPECIFY UNITS): (A) 120 TPD (B) 12 LB/TON LIME
- UTILIZATION - %: 85
- POINT OF ADDITION: SLAKER

UTILITY EMISSION CONTROL SYSTEM DATA — DUQUESNE LIGHT
DATE: 7/7/81 — PHILLIPS 1-6

ECONOMICS (ADJUSTED FOR CONSISTENCY; MID-1980 TIME BASE; 65% CAPACITY FACTOR)
- CAPITAL COST - $: 79,000,000
- CAPITAL COST - $/KW: 193
- OPERATING COST - MILLS/KWH: _____
  - MAINTENANCE COST: _____
  - LABOR COST: _____
  - UTILITIES COST: _____
  - CHEMICALS COST: _____
  - WASTE DISPOSAL COST: _____

FGD SPARE CAPACITY INDICES
- SCRUBBER - %: N/A
- ABSORBER - %: 0
- MIST ELIMINATOR - %: 0
- REHEATER - %: N/A
- FAN - %: 0
- BALL MILL - %: N/A
- SLAKER - %: 0
- EFFLUENT HOLD TANK - %: 0
- RECIRCULATION PUMP - %: 0
- THICKENER - %: 50
- VACUUM FILTER - %: 100
- CENTRIFUGE - %: N/A

FGD SPARE COMPONENT INDICES
- SCRUBBER: N/A
- ABSORBER: 0
- MIST ELIMINATOR: 0
- REHEATER: N/A
- FAN: 0
- BALL MILL: N/A
- SLAKER: 0
- EFFLUENT HOLD TANK: 0
- RECIRCULATION PUMP: 0
- THICKENER: 0.5
- VACUUM FILTER: 1
- CENTRIFUGE: N/A

PILOT PLANT
- UNIT NUMBER: _____
- PARTICIPANTS: CHEMICO
- PROCESS: LIME/LIMESTONE
- PLANT DESIGN: VENTURI
- SUPPLIER: CHEMICO
- SERVICE DATE: FEBRUARY 1971
- PERIOD OF OPERATION - MONTHS: 4
- GAS FEED: 1500 CFM
- EQUIVALENT SCRUBBED CAPACITY - MW: 0.5
- STATUS (ACTIVE/TERMINATED): TERMINATED

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

ATTACHMENT A

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SCRUBBER/ ABSORBER RECYCLE
NUMBER OF TANKS: 4
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): CLOSED
LOCATION: LOWER PART OF ABSORBER
CONFIGURATION: CONICAL
DIMENSIONS - FT: 31.33 (TOP DIAMETER)
CAPACITY - GAL: 24,000
RETENTION TIME - MIN: 1.5
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: GLASS CLOTH REINFORCED AMINE-CURED EPOXY
LINER MATERIAL TRADE/COMMON NAME: COROLINE 505AR

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLAKER TRANSFER
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 1
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: RUBBER CLAD CARBON STEEL
SHELL MATERIAL GENERIC TYPE: INORGANIC
SHELL MATERIAL SPECIFIC TYPE: HYDRAULICALLY-BONDED CONCRETE
SHELL MATERIAL TRADE/COMMON NAME: PORTLAND CEMENT
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: CEILCOTE

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): THICKENER OVERFLOW
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: _____

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: 0
AGITATOR CONFIGURATION: N/A
AGITATOR MATERIALS: N/A
SHELL MATERIAL GENERIC TYPE: CARBON STEEL
SHELL MATERIAL SPECIFIC TYPE: AISI 1110
SHELL MATERIAL TRADE/COMMON NAME: N/A
LINER MATERIAL GENERIC TYPE: ORGANIC
LINER MATERIAL SPECIFIC TYPE: FLAKE GLASS/POLYESTER
LINER MATERIAL TRADE/COMMON NAME: FLAKELINE 103

TANKS
FUNCTION (ABSORBER EFFLUENT HOLD, SCRUBBER RECYCLE, ETC.): SLUDGE STABILIZATION MIXING
NUMBER OF TANKS: 1
NUMBER OF SPARES: 0
TYPE (OPEN/COVERED): _____
LOCATION: _____
CONFIGURATION: _____
DIMENSIONS - FT: _____
CAPACITY - GAL: _____
RETENTION TIME - MIN: _____
NUMBER OF AGITATORS: _____
AGITATOR CONFIGURATION: _____
AGITATOR MATERIALS: _____
SHELL MATERIAL GENERIC TYPE: _____
SHELL MATERIAL SPECIFIC TYPE: _____
SHELL MATERIAL TRADE/COMMON NAME: _____
LINER MATERIAL GENERIC TYPE: _____
LINER MATERIAL SPECIFIC TYPE: _____
LINER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

ATTACHMENT B

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SCRUBBER/ABSORBER RECIRCULATION
NUMBER OF PUMPS: 8
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: INGERSOLL-RAND
PUMP MODEL NUMBER: 12 X 22 LP
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 9000
MOTOR BRAKE HP: 350
SPEED - RPM: 1185
HEAD - FT: 125
SERVICE (PH, SOLIDS): PH 7.7, 5% SOLIDS
CASING MATERIAL GENERIC TYPE: HIGH ALLOY
CASING MATERIAL SPECIFIC TYPE: NICKEL ALLOY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: NI-HARD TYPE 4
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER OVERFLOW
NUMBER OF PUMPS: 6
NUMBER OF SPARES: _____
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: GOULDS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 2000
MOTOR BRAKE HP: 60
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: STAINLESS STEEL
CASING MATERIAL SPECIFIC TYPE: AUSTENITIC
CASING MATERIAL TRADE/COMMON NAME: TYPE 316L
IMPELLER MATERIAL GENERIC TYPE: STAINLESS STEEL
IMPELLER MATERIAL SPECIFIC TYPE: AUSTENITIC
IMPELLER MATERIAL TRADE/COMMON NAME: TYPE 316L

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): THICKENER UNDERFLOW
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: ALLEN-SHERMAN-HOFF
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 105
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): 45-48% SOLIDS
CASING MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
CASING MATERIAL SPECIFIC TYPE: AISI 1110
CASING MATERIAL TRADE/COMMON NAME: N/A
IMPELLER MATERIAL GENERIC TYPE: RUBBER-LINED CARBON STEEL
IMPELLER MATERIAL SPECIFIC TYPE: AISI 1110
IMPELLER MATERIAL TRADE/COMMON NAME: N/A

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): SLURRY FEED
NUMBER OF PUMPS: 5
NUMBER OF SPARES: 1
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: MORRIS
PUMP MODEL NUMBER: _____
PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: _____
MOTOR BRAKE HP: _____
SPEED RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: HIGH ALLOY
CASING MATERIAL SPECIFIC TYPE: NICKEL ALLOY CAST IRON
CASING MATERIAL TRADE/COMMON NAME: NI-HARD TYPE 4
IMPELLER MATERIAL GENERIC TYPE: HIGH ALLOY
IMPELLER MATERIAL SPECIFIC TYPE: NICKEL ALLOY CAST IRON
IMPELLER MATERIAL TRADE/COMMON NAME: NI-HARD TYPE 4

PUMPS
FUNCTION (ADDITIVE FEED, ABSORBER RECIRCULATION, ETC.): MAKEUP WATER
NUMBER OF PUMPS: 1
NUMBER OF SPARES: 0
GENERIC TYPE (CENTRIFUGAL, DIAPHRAGM, ETC.): NONDISPLACEMENT
SPECIFIC TYPE (BELT DRIVE, DIRECT DRIVE, ETC.): CENTRIFUGAL
COMMON DESIGN (V-BELT, ETC.): SINGLE-ADMISSION INTAKE
MANUFACTURER: _____
PUMP MODEL NUMBER: _____

UTILITY EMISSION CONTROL SYSTEM DATA
DATE: 7/7/81

DUQUESNE LIGHT
PHILLIPS 1-6

PUMP DRIVE (BELT, VARIABLE, DIRECT, ETC.): _____
CAPACITY - GPM: 900
MOTOR BRAKE HP: _____
SPEED - RPM: _____
HEAD - FT: _____
SERVICE (PH, SOLIDS): _____
CASING MATERIAL GENERIC TYPE: _____
CASING MATERIAL SPECIFIC TYPE: _____
CASING MATERIAL TRADE/COMMON NAME: _____
IMPELLER MATERIAL GENERIC TYPE: _____
IMPELLER MATERIAL SPECIFIC TYPE: _____
IMPELLER MATERIAL TRADE/COMMON NAME: _____

UTILITY EMISSION CONTROL SYSTEM DATA DUQUESNE LIGHT
DATE: 7/7/81 PHILLIPS 1-6

COMMENTS/FOOTNOTES

A ONE-THIRD OF COAL TO PLANT FROM CAPTIVE MINE AND TWO-THIRDS PURCHASED FROM SPOT MARKET.
B MAINTENANCE REQUIREMENTS ARE TYPICALLY 8 PEOPLE/DAY-5 DAYS/WK-1 SHIFT/DAY DEDICATED TO FGD SYSTEM. MAXIMUM MAINTENANCE PERSONNEL AVAILABLE TO FGD SYSTEM IS 20. MAINTENANCE PEOPLE ARE SHARED WITH BOILER WHEN NOT USED FOR FGD.
C IF A MAJOR PROBLEM ARISES, MAINTENANCE IS PERFORMED THAT NIGHT. IF MINOR PROBLEM, MAINTENANCE IS PERFORMED ON THE WEEKEND.
D ONE SCRUBBER TRAIN IS EQUIPPED IN SERIES WITH AN ADDITIONAL VENTURI FOR ADDED $SO_2$ REMOVAL. PRESENTLY, THE MODULE ACTS ONLY AS ADDITIONAL DUCTWORK SINCE SLURRY IS NOT FED TO IT.
E THE CARBON STEEL SHELL IS LINED WITH FLAKELINE 103 ON THE UPPER INCLINE PORTION, COROLINE 505AR ON THE CENTER CONE AND INTERNAL RESERVOIR, AND ACID-RESISTANT BRICK AND MORTAR ON THE UPPER INCLINE ABOVE THE INTERNAL MIST ELIMINATOR.
F ONE INTERNAL PER VESSEL PLUS ONE EXTERNAL CHAMBER FOR ALL THREE SINGLE-STAGE MODULES.
G FOUR SINGLE-STAGE VENTURI MODULES.
H IN ANNULUS OF FIRST STAGE BEFORE FAN AND FINAL MIST ELIMINATOR SECTION.
I RANGES FROM 4 TO 5 FT (INTERNAL); 18-20 FT (EXTERNAL ME).
J RANGES FROM 9-11 FT/SEC.
K CHEMICO DESIGN.
L ORIGINAL RUBBER-LINED CARBON STEEL HOUSINGS ARE IN PROCESS OF BEING REPLACED WITH INCOLOY 825 HOUSINGS (2 OF 4 SO FAR). ROTORS OF CARPENTER 20 WITH INCOLOY WELDS.
M CLADDING ON FAN INLET DAMPER CORRODED; FLAKE GLASS/POLYESTER (FLAKELINE 103) AND MAT-REINFORCED EPOXY (COROLINE 506) LININGS USED. STAINLESS STEEL CLADDING ADDED TO ABSORBER INLET DAMPER AFTER CORROSION OCCURRED.
N TYPE 316 STAINLESS STEEL EROSION PLATES ADDED TO PROTECT OUTLET JOINTS.
O PLANT CAN OPERATE WITH TWO THICKENERS; HOWEVER, A THIRD THICKENER (SPARE) IS USED TO GAIN EXTRA SETTLING TIME.
P DEPENDS ON PLANT LOAD BECAUSE OF FIXED MINIMUM WATER DEMAND VERSUS WATER THAT CAN BE EVAPORATED.

# SECTION 4

# PERFORMANCE DATA

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Duquesne Light Phillips 1-6 | 7/73 | 744 | | System | 232 | | | Initial shakedown/debugging operations commenced |
| | 8/73 | 744 | | System | | | | |
| | 9/73 | 720 | | System | | | | |
| | 10/73 | 744 | | System | | | | |
| | 11/73 | 720 | | System | | | | |
| | 12/73 | 744 | | System | | | | |
| | 1/74 | 744 | | System | | | | |
| | 2/74 | 672 | | System | | | | |
| | 3/74 | 744 | | System | | | ID fans | Erosion/corrosion of fan shaft shrouds, 316-clad fan campers, and the stiffener bars |
| | 4/74 | 720 | | System | | | | |
| | 5/74 | 744 | | System | | | | |
| Commercial start-up | 5/74 | 720 | | System | | | | |
| | 7/74 | 744 | | System | | | ID fans | Fan vibration |
| | | | | | | | Recycle pumps | Carpenter 20 alloy impellors and casing continued to fail due to erosion/corrosion (utility to conduct performance recycle pump testing) |
| | 8/74 | 744 | | System | | | Misc. equipment | Plugging |
| | 9/74 | 720 | | System | | | | |
| | 10/74 | 744 | | System | | | | |
| | 11/74 | 720 | | System | | | ID fans. | Fan blades required rebracing |
| | 12/74 | 744 | | System | | | Mist eliminators | Mist eliminator holes repaired with Ceilcote |
| | | | | | | | Dampers | Venturi dampers were seizing due to plugging |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 1/75 | 744 | | System | | | Stabilizing agent injection lines | Plugging |
| | | | | | | | $SO_2$ monitors | Wet side monitors failed |
| | 2/75 | 672 | | System | | | | |
| | 3/75 | 744 | | System | | | | Fourth FGD train became operational for the first time |
| | | | | | | | Stabilizing agent injection lines | Calcilox injection lines continued to plug |
| | 4/75 | 720 | | System | | | Instrumentation | Problems monitoring pressure drop across venturi dampers |
| | | | | | | | Dampers | Venturi dampers continue to seize due to solid buildup |
| | | | | | | | Mist eliminators | Continuous wash system was initiated due to continued plugging and erosion problems |
| | 5/75 | 744 | | System | | | | |
| | 6/75 | 720 | | System | | | Scrubber train | The two-stage scrubber train was out of service for general maintenance |
| | | | | | | | Pumps | Recycle pumps replaced |
| | | | | | | | Boiler | Unburned carbon fines caused plugging problems in FGD equipment |
| | | | | | | | Lime handling system | Specific problem was not reported |
| | | | | | | | Sludge stabilization | Specific problem was not reported |
| | 7/75 | 744 | 506 | System | 458 | | | |
| | 8/75 | 744 | 489 | System | 453 | | | |
| | 9/75 | 720 | 672 | System | 460 | | | |

(continued)

Duquesne Light
Phillips 1-6

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 10/75 | 744 | 687 | System | 451 | | | Thioscrbic lime scrubbing was initiated |
| | 11/75 | 720 | 720 | System | 355 | | | |
| | 12/75 | 744 | 709 | System | 397 | | Lime slaker | Additional slaker added |
| | 1/76 | 744 | 722 | System | 405 | | | |
| | 2/76 | 696 | 672 | System | 472 | | | |
| | 3/76 | 744 | | System | 542 | | | Availability for first quarter of 1976 was 72% |
| | 4/76 | 720 | | System | | | Venturi scrubbers | Utility continues to experience problems with solic deposition in the venturi throat of the scrubbing trains, causing movement inhibition and greater pressure drops |
| | 5/76 | 744 | | System | | | | |
| | 6/76 | 720 | | | | | Lime storage silos | 3 additional silos were ordered |
| | | | | | | | Thickener | 1 additional thickener was ordered |
| | | | | | | | Stack | Leaks in acid brick flue (particularly in the mortar joints) and corroded steel bands supporting brick |
| | 7/76 | 744 | | System | | | | |
| | 8/76 | 744 | | System | | | Mist eliminators | Turning vanes repaired |
| | | | | | | | Venturi scrubber | Ceilcote coating on Module 401 failed (original coat eroded away and corrosion had set in) |
| | | | | | | | ID fans | Overhaul |
| | | | | | | | Stack | Repairs made to acid brick flue lining and steel support bands |
| | 9/76 | 720 | | System | | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 10/76 | 744 | | System | | | | IUCS system construction started |
| | 11/76 | 720 | | System | | | | |
| | 12/76 | 744 | | System | | | | Contract awarded to Dravo for thiosorbic lime |
| | | | | | | | | IUCS sludge stabilization facility started operation |
| | | | | | | | Thickeners | Polyelectrolyte material was added to enhance settling (added on a temporary basis until third thickener came on-line) |
| | 1/77 | 744 | | System | | | | |
| | 2/77 | 672 | | System | | | | |
| | 3/77 | 744 | | System | | | | |
| | 4/77 | 720 | | System | | | Pumps | Recycle pump carborundum impellers and wear rings were performing well after 4000 hours of operation |
| | 5/77 | 720 | | System | | | Ductwork | 96 hour outage to repair leaks in wet duct header leading to stack |
| | | | | | | | Dampers | Erosion of boiler exit dampers |
| | | | | | | | External mist eliminator | Module 201 external mist eliminator had experienced erosion and plugging problems |
| | 6/77 | 720 | | System | | | | |
| | 7/77 | 744 | | System | | | | Recycle pump evaluation continued. Components being evaluated included Carborundum impellers, Carborundum wear rings, titanium impellers, 317 SS wear rings, and Stellite-tipped impellers |
| | 8/77 | 744 | | System | | | | |
| | 9/77 | 720 | | System | | | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 10/77 | 744 | 744 | System | 507 | | Module 101 | Down 113 hours for regular maintenance and repairs |
| | | | | | | | Module 201 | ID fan was balanced and repairs were made to fan housing rubber lining |
| | | | | | | | Module 301 | Down 57 hours for regular maintenance and repairs |
| | | | | | | | Module 401 | Down 36 hours to repair holes in ID fan lining and to tie in thickener bleed line |
| | 11/77 | 720 | 720 | System | 483 | | Boiler exit dampers | Replaced (old dampers failed due to flyash erosion) |
| | | | | | | | Stack | Steel band stack supports continue to corrode due to condensed moisture |
| | | | | | | | Module 301 | Down for overhaul from 11/17 to 2/6 |
| | 12/77 | 744 | | System | | | | |
| | 1/78 | 744 | 744 | System | 421 | | IUCS system | Experienced dewatering problems |
| | | | | | | | Stack | 72 hour outage to replace carbon steel support bands in stack with stainless steel bands (1/6 to 1/8) |
| | 2/78 | 672 | 480 | System | 167 | | | |
| | 3/78 | 744 | 0 | System | 0 | 0 | | System shut down on 2/11 due to coal strike |
| | | | | | | | Boiler exit dampers | Dampers lined with 316 SS on areas of high erosion caused by flyash impingement |
| | | | | | | | Expansion joints | Joints on the inlet ductwork were shielded by metal plates |
| | | | | | | | Ductwork | Numerous holes in wet ductwork were repaired and relined with ceilcote |
| | | | | | | | Stack | Bricks replaced near top of stack |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 4/78 | 720 | 528 | System | | | | |
| | 5/78 | 744 | 744 | System | | | | FGD system came back on line (coal strike over) |
| | 6/78 | 720 | 720 | System | | | | |
| | 7/78 | 744 | 744 | 101 | | 48 | | |
| | | | | 201 | | 44 | Mist eliminator | Internal mist eliminators were replaced |
| | | | | 301 | | 86 | Mist eliminator | Internal mist eliminators were cleaned |
| | | | | 401 | | 83 | | |
| | | | | System | 459 | 65 | Mist eliminator | Plugging due to low pH chemistry caused by lime handling and slurry preparation failures and related water balance problems |
| | | | | | | | Slurry handling system | Plugging due to grit from the lime handling facility |
| | 8/78 | 744 | 744 | 101 | | 100 | Module | Lining repaired and cleaned with high pressure water |
| | | | | 201 | | 73 | Mist eliminator | Internal mist eliminator replaced |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 92 | Module | Cleaned with high pressure water |
| | | | | System | 638 | 91 | | |
| | 9/78 | 720 | 720 | 101 | | 64 | Module | Lining repaired and cleaned with high pressure water |
| | | | | 201 | | 83 | | |
| | | | | 301 | | 84 | | |
| | | | | 401 | | 66 | Module | Cleaned with high pressure water |
| | | | | System | 470 | 74 | Lime mixing basin | Shut down to remove grit buildup |
| | | | | | | | Sludge fixation | Insufficient supplies of dry flyash to mix with the sludge (apparently not enough flyash is being collected with the present system) |
| | 10/78 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 98 | | |
| | | | | 301 | | 95 | | |
| | | | | 401 | | 5 | | |
| | | | | System | 509 | 75 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 11/78 | 720 | 720 | 101 | | 44 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 92 | | |
| | | | | 401 | | 71 | | |
| | | | | System | 538 | 77 | System | Scaling because of high excess air entering the system from the boilers causing the soft sulfite to be oxidized to hard sulfate on scrubber internals |
| | 12/78 | 744 | 744 | 101 | | 92 | | |
| | | | | 201 | | 98 | | |
| | | | | 301 | | 30 | | |
| | | | | 401 | | 90 | | |
| | | | | System | 547 | 78 | Sludge fixation | Insufficient supplies of flyash resulted in wet sludge product which had to be left on site to dry before transport to disposal |
| | 1/79 | 744 | 744 | 101 | | 89 | | |
| | | | | 201 | | 78 | | |
| | | | | 301 | | 50 | | |
| | | | | 401 | | 86 | | |
| | | | | System | 539 | 76 | | |
| | 2/79 | 672 | 672 | 101 | | 39 | Module exit duct | Duct support columns collapsed due to excessive scale buildup |
| | | | | 201 | | 72 | | |
| | | | | 301 | | 88 | | |
| | | | | 401 | | 100 | | |
| | | | | System | 503 | 75 | | |
| | 3/79 | 744 | 744 | 101 | | 0 | | |
| | | | | 201 | | 97 | | |
| | | | | 301 | | 98 | | |
| | | | | 401 | | 100 | | |
| | | | | System | 529 | 74 | | |
| | 4/79 | 720 | 720 | 101 | | 90 | | |
| | | | | 201 | | 6 | | |
| | | | | 301 | | 98 | | |
| | | | | 401 | | 89 | | |
| | | | | System | 473 | 71 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 5/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 0 | | |
| | | | | 301 | | 99 | | |
| | | | | 401 | | 99 | | |
| | | | | System | 550 | 75 | | |
| | 6/79 | 720 | 720 | 101 | | 71 | | |
| | | | | 201 | | 29 | | |
| | | | | 301 | | 86 | | |
| | | | | 401 | | 86 | | |
| | | | | System | 457 | 68 | | |
| | 7/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 99 | | |
| | | | | 301 | | 73 | | |
| | | | | 401 | | 30 | | |
| | | | | System | 542 | 75 | | |
| | 8/79 | 744 | 744 | 101 | | 100 | | |
| | | | | 201 | | 98 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 0 | | |
| | | | | System | 519 | 74 | | |
| | 9/79 | 720 | 720 | 101 | | 89 | | |
| | | | | 201 | | 95 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 0 | | |
| | | | | System | 446 | 71 | | |
| | 10/79 | 744 | 696 | 101 | | 100 | | |
| | | | | 201 | | 87 | | |
| | | | | 301 | | 94 | | |
| | | | | 401 | | 0 | | |
| | | | | System | 515 | 70 | | |
| | 11/79 | 720 | 720 | 101 | | 53 | | |
| | | | | 201 | | 99 | | |
| | | | | 301 | | 84 | | |
| | | | | 401 | | 12 | | |
| | | | | System | 441 | 62 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 12/79 | 744 | 744 | 101 | | 0 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 91 | | |
| | | | | 401 | | 78 | | |
| | | | | System | 486 | 67 | ID fans | Housing liners replaced |
| | | | | | | | Mechanical collectors | Upgraded to improve quality of sludge |
| | 1/80 | 744 | 744 | 101 | | 0 | | |
| | | | | 201 | | 98 | | |
| | | | | 301 | | 100 | | |
| | | | | 401 | | 98 | | |
| | | | | System | 536 | 74 | | |
| | 2/80 | 696 | 696 | 101 | | 14 | | |
| | | | | 201 | | 92 | | |
| | | | | 301 | | 86 | | |
| | | | | 401 | | 94 | | |
| | | | | System | 488 | 71 | ID fans | Rubber liners continue to fail (2 fans to be replaced with inconel) |
| | | | | | | | | Addition of sodium thiosulfate has solved scale formation problems |
| | 3/80 | 744 | 744 | 101 | | 95 | ID fan | Balance problems |
| | | | | 201 | | 59 | ID fan | 264 hour outage to repair hub bolts |
| | | | | 301 | | 48 | ID fan | Rubber lining repaired |
| | | | | 401 | | 95 | Valves | 2 hour outage to repair make-up valve |
| | | | | System | 407 | 60 | | |
| | 4/80 | 720 | 720 | 101 | | 93 | ID fan | Bearing and fan instrumentation problems |
| | | | | 201 | | 14 | ID fan | Bearing problem (corrected when balanced) |
| | | | | 301 | | 99 | ID fan | ID fan motor malfunctioned |
| | | | | 401 | | 96 | Pump | Recycle replaced |
| | | | | System | 527 | 97 | | |
| | 5/80 | 744 | 744 | 101 | | 68 | Control damper and instrumentation | Repaired |
| | | | | 201 | | 82 | ID fan | 24 hour outage to repair bearing |
| | | | | | | | Internal mist eliminator | 48 hour outage to wash plugged mist eliminators |
| | | | | 301 | | 92 | ID fan | Balanced |
| | | | | 401 | | 92 | ID fan | 58 hour outage to inspect ID fan control damper |
| | | | | System | 506 | 83 | | |

(continued)

| Utility/unit | Date | Period hours | Boiler hours | Module | FGD hours | Avail-ability | Problem equipment area | Problem description/comments |
|---|---|---|---|---|---|---|---|---|
| Phillips 1-6 (continued) | 6/80 | 720 | 672 | 101 | | 97 | | |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 76 | ID fan | 176 hour outage to rubber line fan housings |
| | | | | 401 | | 100 | | |
| | | | | System | 527 | 93 | | |
| | 7/80 | 744 | 744 | 101 | | 94 | Pump | Recycle impeller replaced |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 95 | Pump | Recycle impeller replaced |
| | | | | 401 | | 91 | Pump | Recycle impeller replaced |
| | | | | System | 648 | 95 | | |
| | 8/80 | 744 | 744 | 101 | | 91 | | |
| | | | | 201 | | 97 | | |
| | | | | 301 | | 88 | | |
| | | | | 401 | | 92 | Pump | Recycle pump packing failed |
| | | | | System | 614 | 92 | ID fan | 6/80 to 8/80 ID fan housings were relined with rubber |
| | 9/80 | 720 | 720 | 101 | | 56 | | |
| | | | | 201 | | 46 | | |
| | | | | 301 | | 55 | | |
| | | | | 401 | | 61 | | |
| | | | | System | 318 | 54 | | Unit shut down on 9/20 for inspection |
| | | | | | | | Stack | Mortar deterioration |
| | | | | | | | Duct expansion joint | Repaired |
| | 10/80 | 744 | 720 | 101 | | 94 | | |
| | | | | 201 | | 94 | | |
| | | | | 301 | | 4 | Module | Relined with Ceilcote |
| | | | | 401 | | 94 | Module | Relined with Ceilcote |
| | | | | System | 523 | 72 | | |
| | 11/80 | 720 | 720 | 101 | | 52 | Module | Relined with Ceilcote |
| | | | | 201 | | 100 | | |
| | | | | 301 | | 95 | | |
| | | | | 401 | | 92 | | |
| | | | | System | 604 | 85 | | |
| | 12/80 | 744 | | System | | | | Information was not available |

☆ U.S. GOVERNMENT PRINTING OFFICE: 1985-544-063/10425