Appendices

Appendix A – WKE Case

Appendix B – TXU Case

Appendix C – BB Power Report on Boiler Penetraions

Appendix A – WKE Case

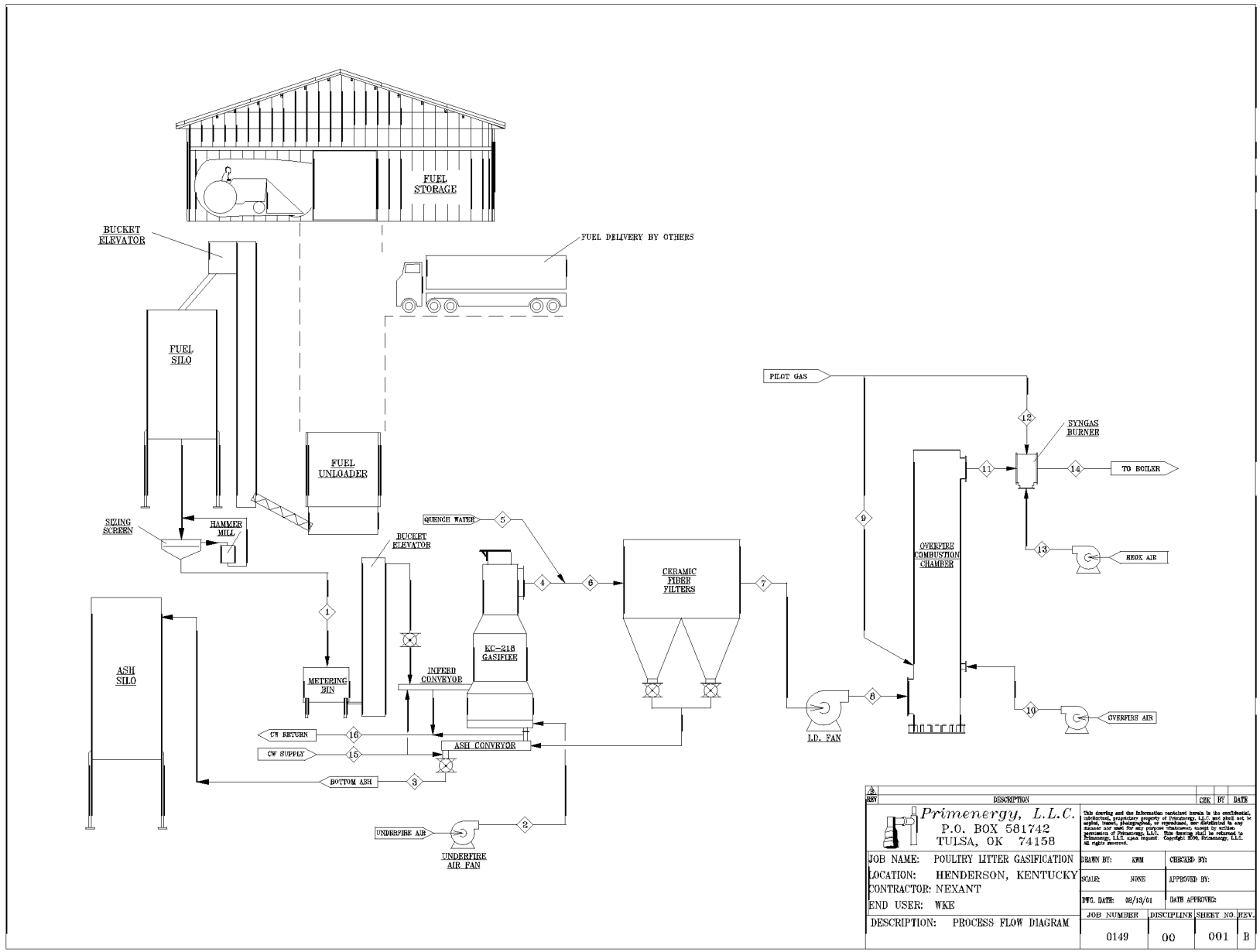

FUEL STORAGE
BUCKET ELEVATOR
FUEL DELIVERY BY OTHERS
FUEL SILO
FUEL UNLOADER
SIZING SCREEN
HAMMER MILL
BUCKET ELEVATOR
QUENCH WATER
5
4
6
CERAMIC FIBER FILTERS
7
PILOT GAS
12
SYNGAS BURNER
11
14
TO BOILER
9
OVERFIRE COMBUSTION CHAMBER
13
REDX AIR
ASH SILO
1
METERING BIN
INFEED CONVEYOR
KC-21S GASIFIER
I.D. FAN
8
10
OVERFIRE AIR
CW RETURN
16
CW SUPPLY
15
ASH CONVEYOR
BOTTOM ASH
3
UNDERFIRE AIR
2
UNDERFIRE AIR FAN
DESCRIPTION
CHK
BY
DATE
Primenergy, L.L.C.
P.O. BOX 581742
TULSA, OK 74158
JOB NAME: POULTRY LITTER GASIFICATION
LOCATION: HENDERSON, KENTUCKY
CONTRACTOR: NEXANT
END USER: WKE
DESCRIPTION: PROCESS FLOW DIAGRAM
DRAWN BY: KWM
CHECKED BY:
SCALE: NONE
APPROVED BY:
DWG. DATE: 02/13/01
DATE APPROVED:
JOB NUMBER
DISCIPLINE
SHEET NO.
REV.
0149
00
001
B

Table A-1 Reid Plant Single KC-18 Material and Energy Balance

Stream ID	1	2	3	4	5	6	7	8	9
Stream	GASIFIER	GASIFIER	GASIFIER	GASIFIER	QUENCH	HGF	HOT GAS	ID	PILOT
Name	FEED	COMB AIR	BOTTOM ASH	SYNGAS	WATER	INLET SYNGAS	FILTER EXHAUST	FAN EXHAUST	GAS
Pressure, psig ("w.c.-g)	----	(20.0)	----	(-0.25)	50	(-0.50)	(-10.0)	(8.0)	30
Temperature, °F	77	80	300	1550	77	1400	1382	1382	77
Molecular Weight (lb/lbmole)	---	28.68	67.17	24.95	18.02	24.69	24.66	24.66	16.04
Component	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
Carbon	4,617		467						
Hydrogen	527								
Nitrogen	463								
Oxygen	3,416								
Sulfur	83								
Chlorine	0								
Fuel Gas									23
Carbon Monoxide				3,819		3,819	3,819	3,819	
Carbon Dioxide				9,207		9,207	9,207	9,207	
Hydrogen				421		421	421	421	
Water (v)		267		5,412		6,576	6,576	6,576	
Nitrogen		20,853		21,316		21,316	21,316	21,316	
Oxygen		6,313							
Sulfur Dioxide				166		166	166	166	
Hydrogen Chloride				0					
Ash	3,494		3,961	70		70			
Lime									
Water (l)	4,200				1,164				
TOTAL	16,800	27,433	4,428	40,410	1,164	41,574	41,505	41,505	23

Table A-1 Reid Plant Single KC-18 Material and Energy Balance (contd.)

Stream ID	1	2	3	4	5	6	7	8	9
Stream	GASIFIER	GASIFIER	GASIFIER	GASIFIER	QUENCH	HGF	HOT GAS	ID	PILOT
Name	FEED	COMB	BOTTOM	SYNGAS	WATER	INLET	FILTER	FAN	GAS
		AIR	ASH			SYNGAS	EXHAUST	EXHAUST	
Pressure, psig ("w.c.-g)	----	(20.0)	----	(-0.25)	50	(-0.50)	(-10.0)	(8.0)	30
Temperature, °F	77	80	300	1550	77	1400	1382	1382	77
Molecular Weight (lb/lbmole)	---	28.68	67.17	24.95	18.02	24.69	24.66	24.66	16.04
Component	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
TOTAL	16,800	27,433	4,428	40,410	1,164	41,574	41,505	41,505	23
AVAILABLE ENERGY VALUE (LHV-Hv), Btu/lb	4,196		14,100.0	953.9		927.1	928.7	928.7	21,502
AVAILABLE ENERGY, MMBtu/h	70.50		6.6	38.5	0.0	38.5	38.5	38.5	0.5
FLOW RATE, scfm (gpm)		6,050		10,243	(2.33)	10,652	10,644	10,644	9
FLOW RATE, acfm		6,283		39,593		38,100	37,701	37,701	9

Table A-1 Reid Plant Single KC-18 Material and Energy Balance (contd.)

Stream ID	10	11	12	13	14	15	16
Stream	OVERFIRE	OVERFIRE	PILOT	REOX	COMB	GASIFIER	GASIFIER
Name	COMB	SYNGAS	GAS	COMB	PROD TO	COOLING	CW
	AIR			AIR	BOILER	WATER	RETURN
Pressure, psig ("w.c.-g)	(13.0)	(7.0)	30	(13.0)	(6.0)	60	10
Temperature, °F	80	2400	scfm	80	2330	110	165
Molecular Weight (lb/lbmole)	28.68	26.96	16.04	28.68	28.02	18.02	18.02
Component	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
Carbon							
Hydrogen							
Nitrogen							
Oxygen							
Sulfur							
Chlorine							
Fuel Gas			23				
Carbon Monoxide		633					
Carbon Dioxide		14,276			15,335		
Hydrogen		200					
Water (v)	157	8,756		245	10,844		
Nitrogen	12,257	33,574		19,099	52,673		
Oxygen	3,711			5,782	3,737		
Sulfur Dioxide							
Hydrogen Chloride							
Ash							
Lime							
Water (l)						26,738	26,738
TOTAL	16,125	57,440	23	25,125	82,588	26,738	26,738

Table A-1 Reid Plant Single KC-18 Material and Energy Balance (contd.)

Stream ID	10	11	12	13	14	15	16
Stream	OVERFIRE	OVERFIRE	PILOT	REOX	COMB	GASIFIER	GASIFIER
Name	COMB	SYNGAS	GAS	COMB	PROD TO	COOLING	CW
	AIR			AIR	BOILER	WATER	RETURN
Pressure, psig ("w.c.-g)	(13.0)	(7.0)	30	(13.0)	(6.0)	60	10
Temperature, °F	80	2400	scfm	80	2330	110	165
Molecular Weight (lb/lbmole)	28.68	26.96	16.04	28.68	28.02	18.02	18.02
Component	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h	lb/h
TOTAL	16,125	57,440	23	25,125	82,588	26,738	26,738
AVAILABLE ENERGY VALUE (LHV-Hv), Btu/lb		229.0	21,502			0.0	1.0
AVAILABLE ENERGY, MMBtu/h		13.2	0.5			0.0	1.5
FLOW RATE, scfm (gpm)	3,556	13,478	9	5,541	18,642	(53.5)	(53.5)
FLOW RATE, acfm	3,693	74,129	8	5,754	100,031		

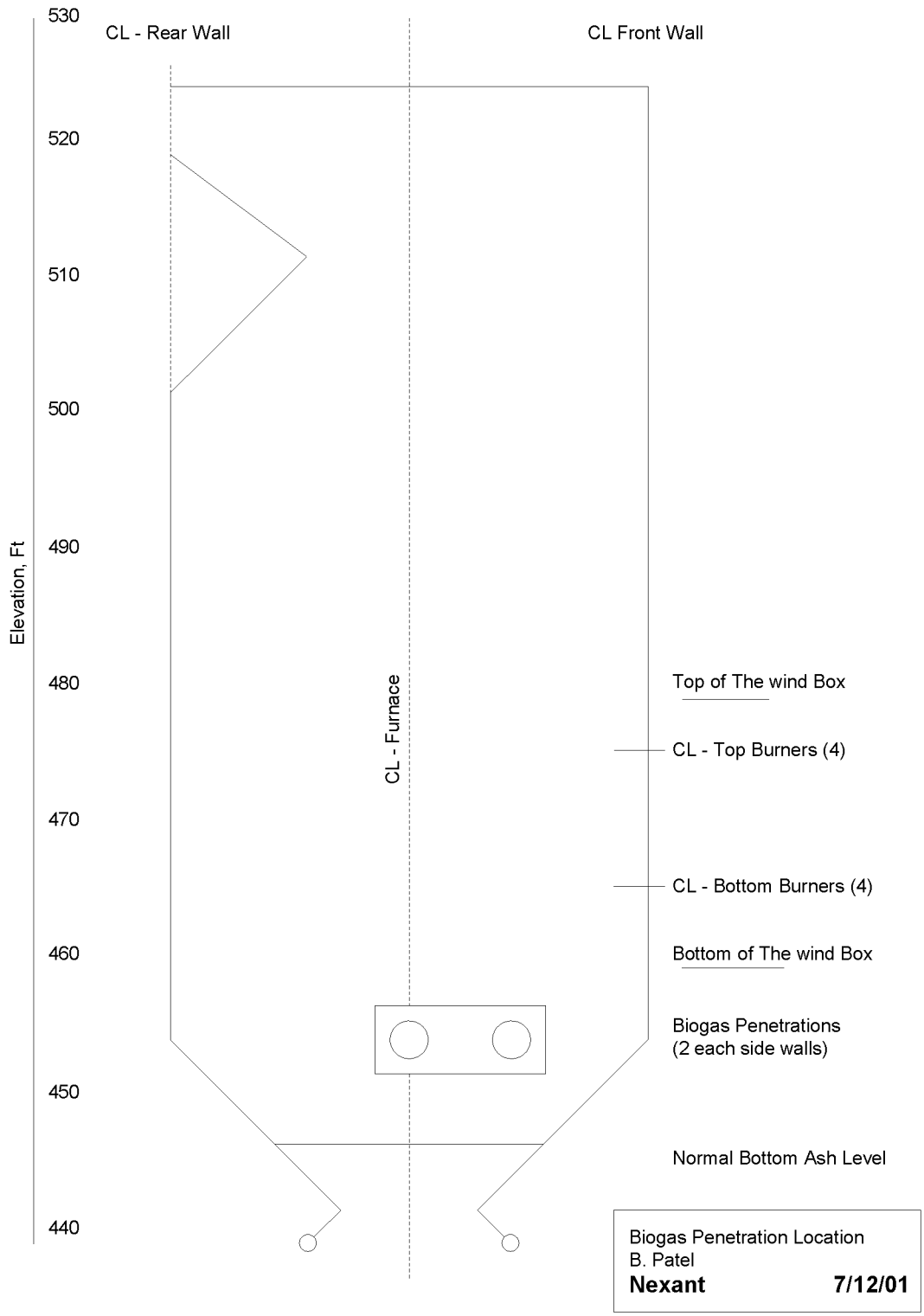
Table B-2 Reid Plant Cost Sensitive Analysis

Case		Base Case	2	3	4	5	6	7	8
Litter Cost	$/ton	$ 12	$ 8	$ 10	$ 12	$ 6	$ 8	$ 10	$ 12
Ash Credits	$/Ton	$ (6)	$ (6)	$ (8)	$ (10)	$ (12)	$ (12)	$ (14)	$ (16)
Capital Cost		$ 9,500,000	$ 9,500,000	$ 9,500,000	$ 9,500,000	$ 8,900,000	$ 8,900,000	$ 8,900,000	$ 8,900,000
WKE Cost		$ 4,750,000	$ 4,750,000	$ 4,750,000	$ 4,750,000	$ 4,450,000	$ 4,450,000	$ 4,450,000	$ 4,450,000
Interest	%	7.5%	7.5%	7.0%	7.0%	7.0%	7.5%	7.0%	7.0%
Period	Years	10.0	10.0	15.0	15.0	15.0	10.0	10.0	10.0
Power Cost									
Fuel	c/kwh	1.74	1.12	1.35	1.58	0.56	0.87	1.10	1.33
O&M	c/kwh	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03
Capital	c/kwh	2.39	2.39	1.80	1.80	1.69	2.24	2.19	2.19
Total	c/kwh	5.17	4.54	4.18	4.41	3.28	4.14	4.32	4.55

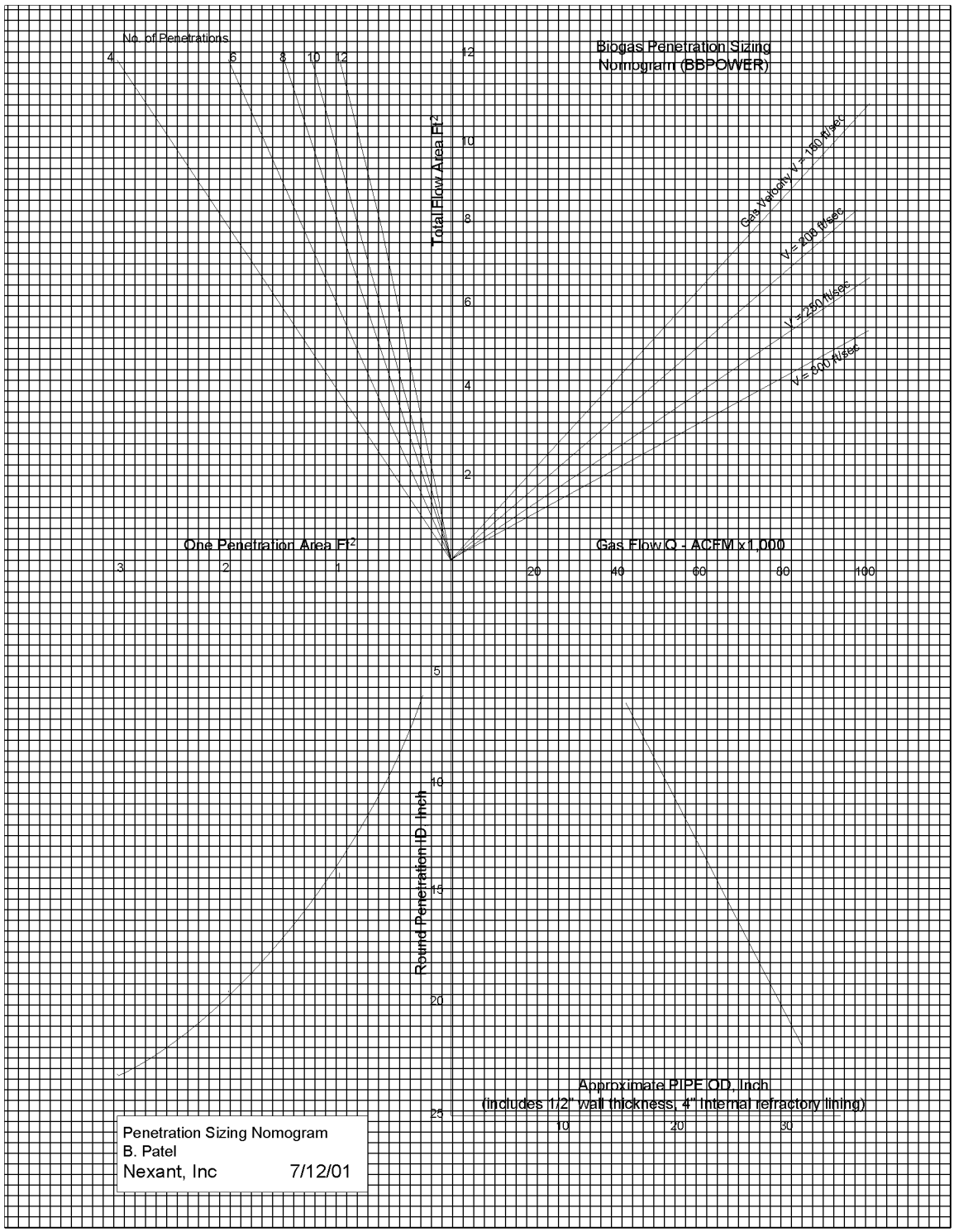
Table A-2 Electrical Power Consumption

SYSTEM MOTOR LIST & ELECTRICAL REQUIREMENT					
ITEM	MOTOR SIZE Hp	QTY SUPL.	QTY OPRTG	OPR FACTOR	ELEC. USAGE Kw
Fuel Receiving Hopper	15	1	1	0.40	4.5
Fuel Receiving Hopper Discharge Conveyor	15	1	1	0.40	4.5
Storage Silo Bucket Elevator	20	1	1	0.40	6.0
Separation Screen	5	1	1	0.40	1.5
Hammermill	50	1	1	0.40	14.9
Hammermill Air System	15	1	1	0.40	4.5
Silo Unloader	15	1	1	0.40	4.5
Silo Discharge Conveyor	10	1	1	0.40	3.0
Metering Bin Discharge Screw	5	1	1	0.50	1.9
Bucket Elevator	5	1	1	0.50	1.9
Fuel Feed Rotary Valve	5	1	1	0.50	1.9
Fuel Infeed Auger	5	1	1	0.50	1.9
Agitator	5	1	1	0.50	1.9
Ash Discharge Auger #1	3	1	1	0.50	1.1
Ash Discharge Auger #2	3	1	1	0.50	1.1
Ash Cooling Auger	5	1	1	0.50	1.9
Underfire Air Fan	40	1	1	0.85	25.5
Cooling Water Pump	10	2	1	0.38	2.8
Syngaas Compressor	100	1	1	0.65	48.6
Fly Ash Discharge Valve	1	2	2	0.50	0.7
Final Ash Conveyor	10	1	1	0.50	3.7
ID Fan	250	1	1	0.83	155.3
Overfire Air Fan	10	1	1	0.50	3.8
Reox/Recycle Fan	10	1	1	0.55	4.1
Air Compressor	100	1	1	0.50	37.4
Miscellaneous Electrical Usage	----	----	----	----	2.0
Total	**567.0**				**340.6**

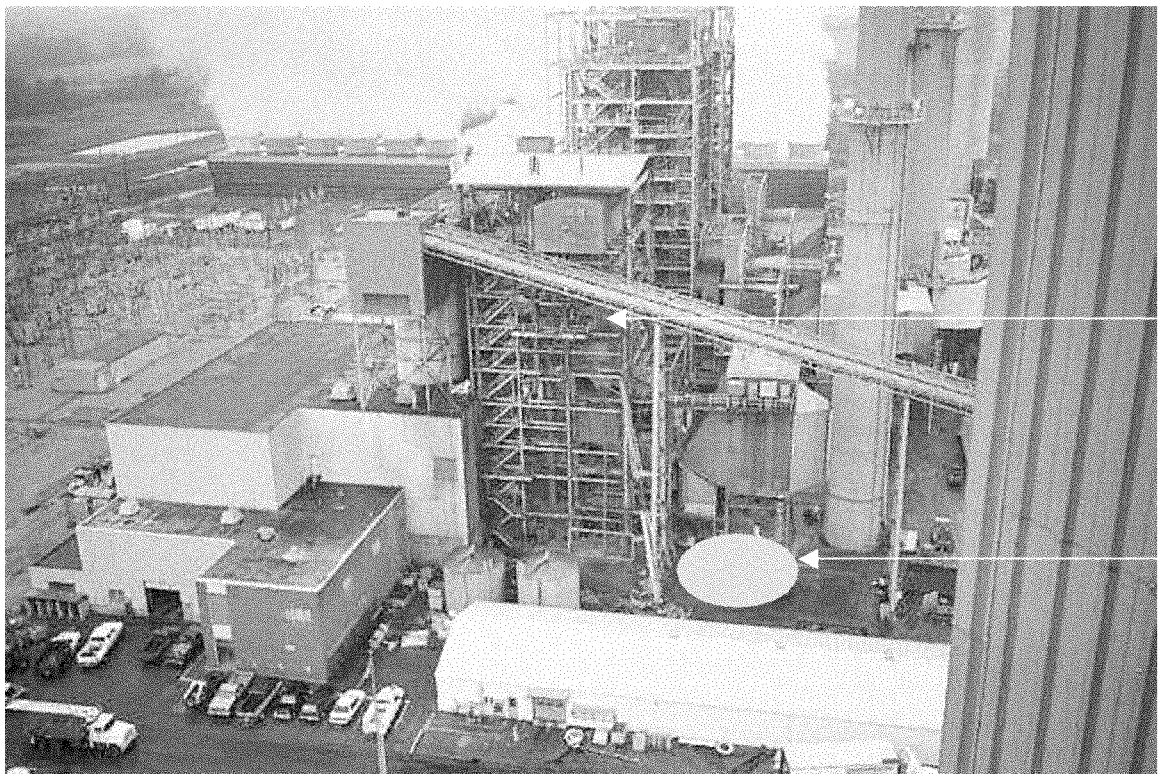
Reid Plant Boiler Penetration Schematic



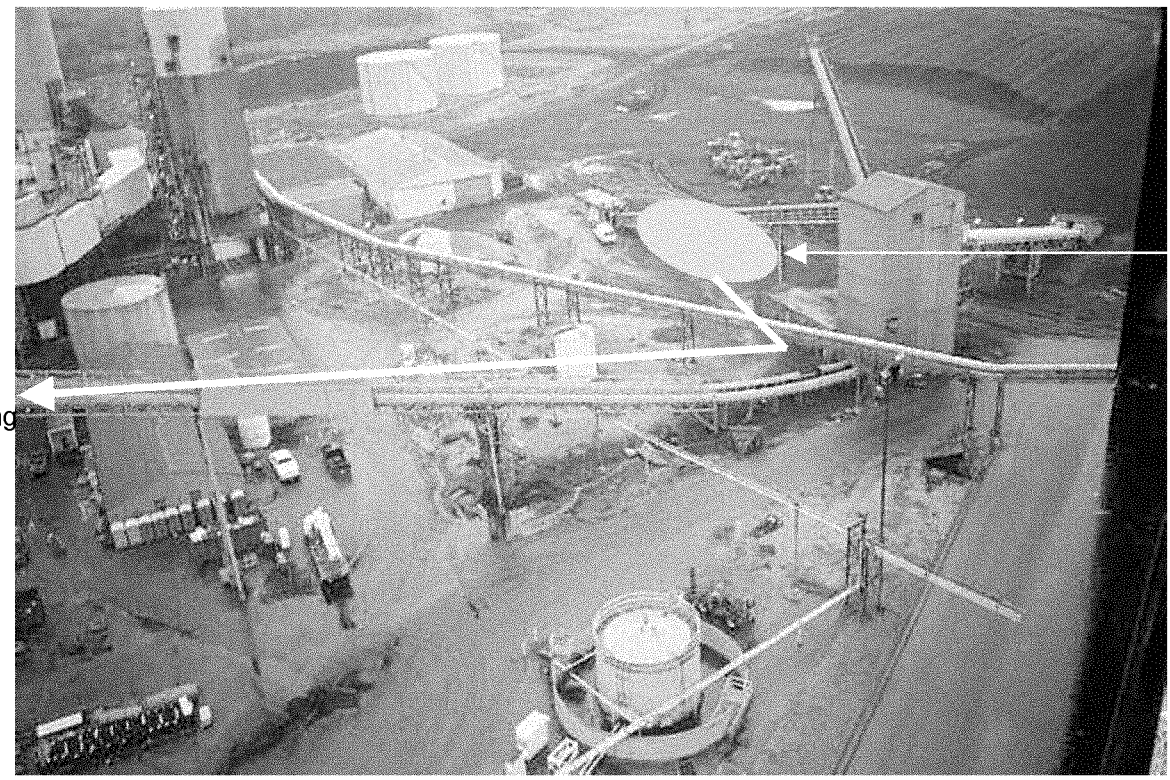
Boiler Penetration Sizing Nomogram



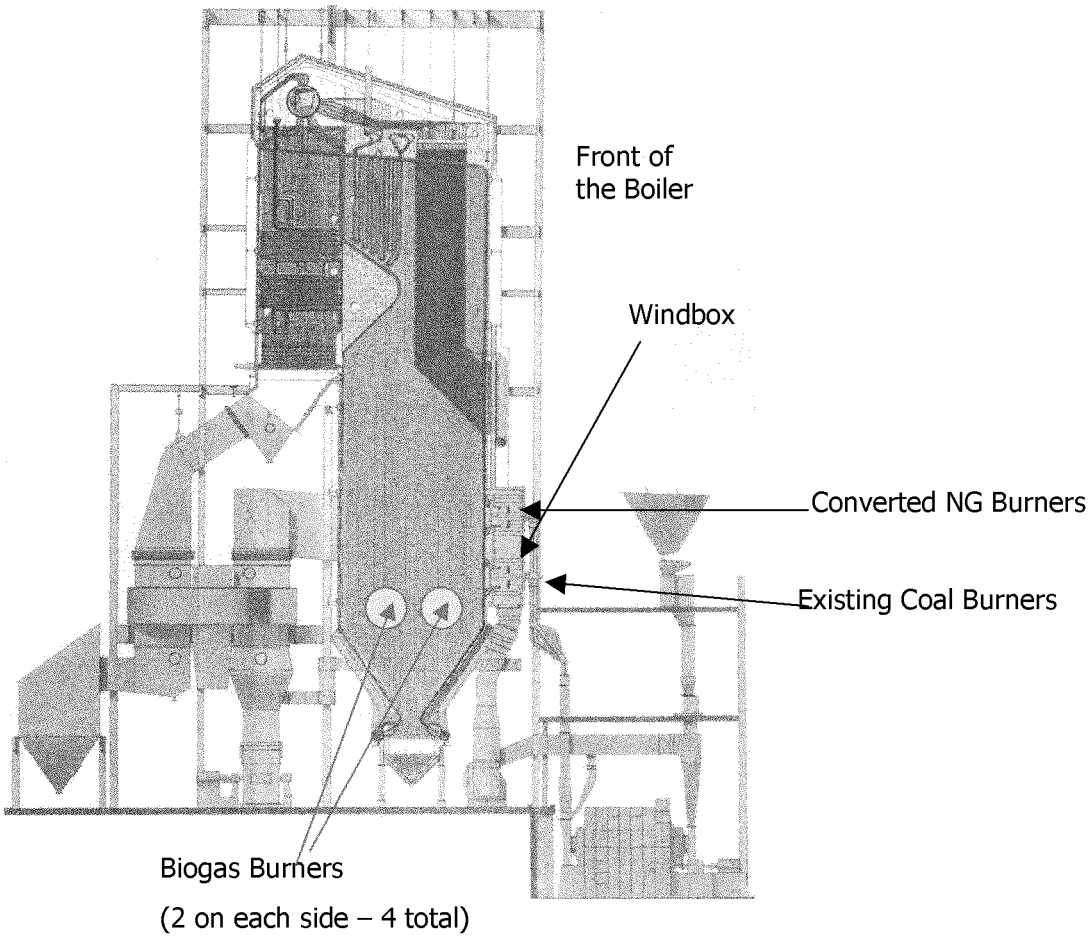
Proposed Gasifier Location at Reid Plant



Fuel Receiving and Storage

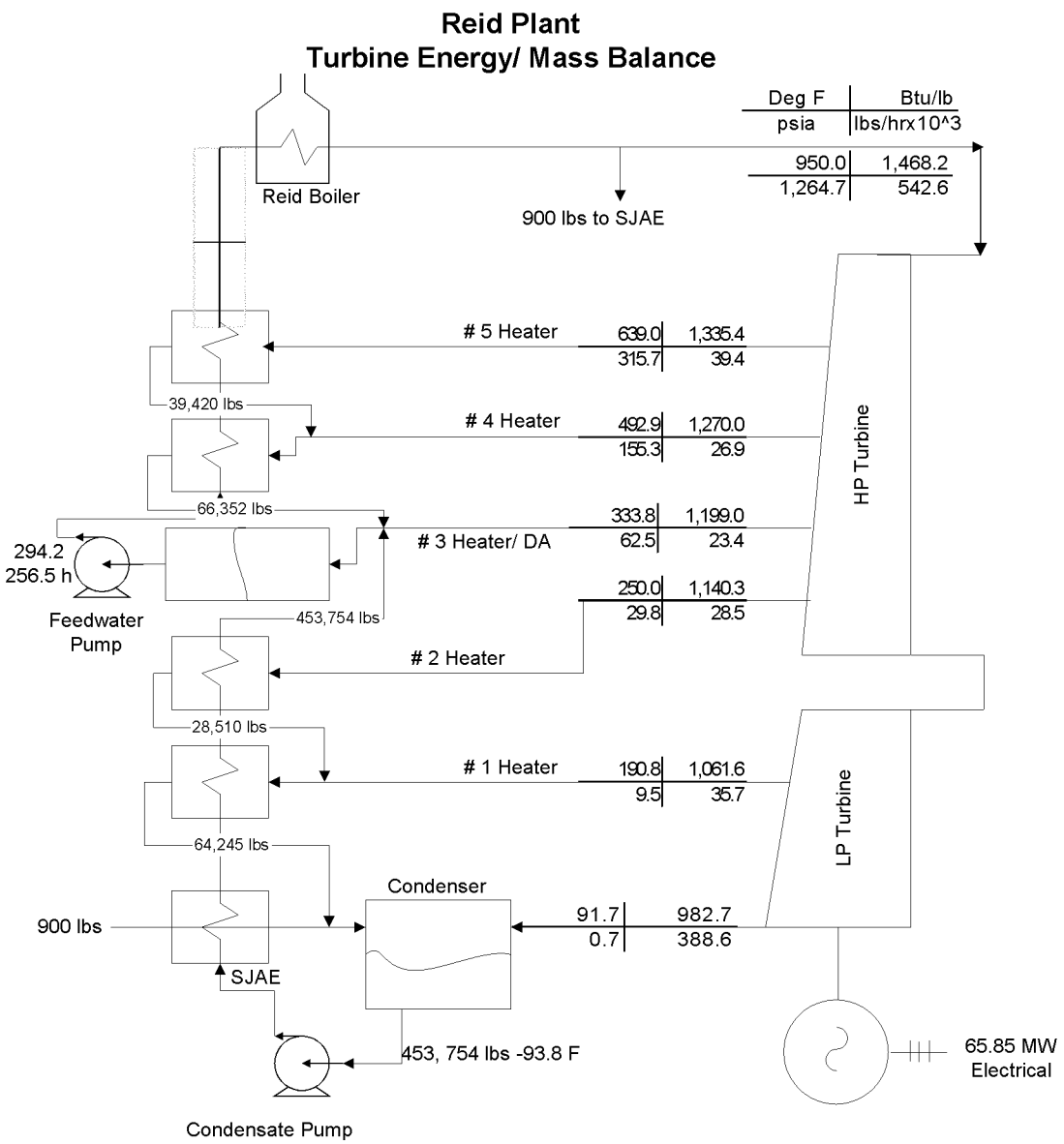


Reid Plant Boiler Penetrations



- Four Penetrations
- 2 on each side of the boiler
- Just below the lower windbox line
- Pressure at the burner –10”-12” of WC
- Velocity at the burner 150~300 ft/sec
- Flow 70,000~100,000 scfm

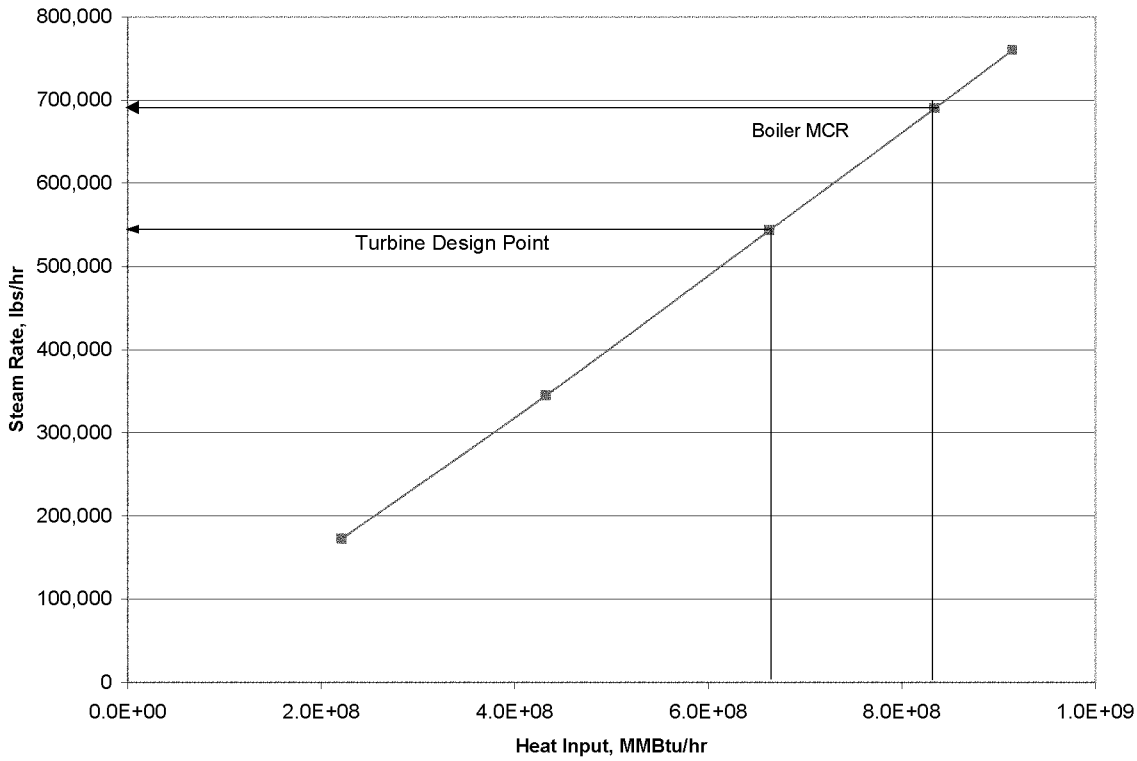
Reid Plant Turbine Energy Balance
Turbine Name Plate Data by GE

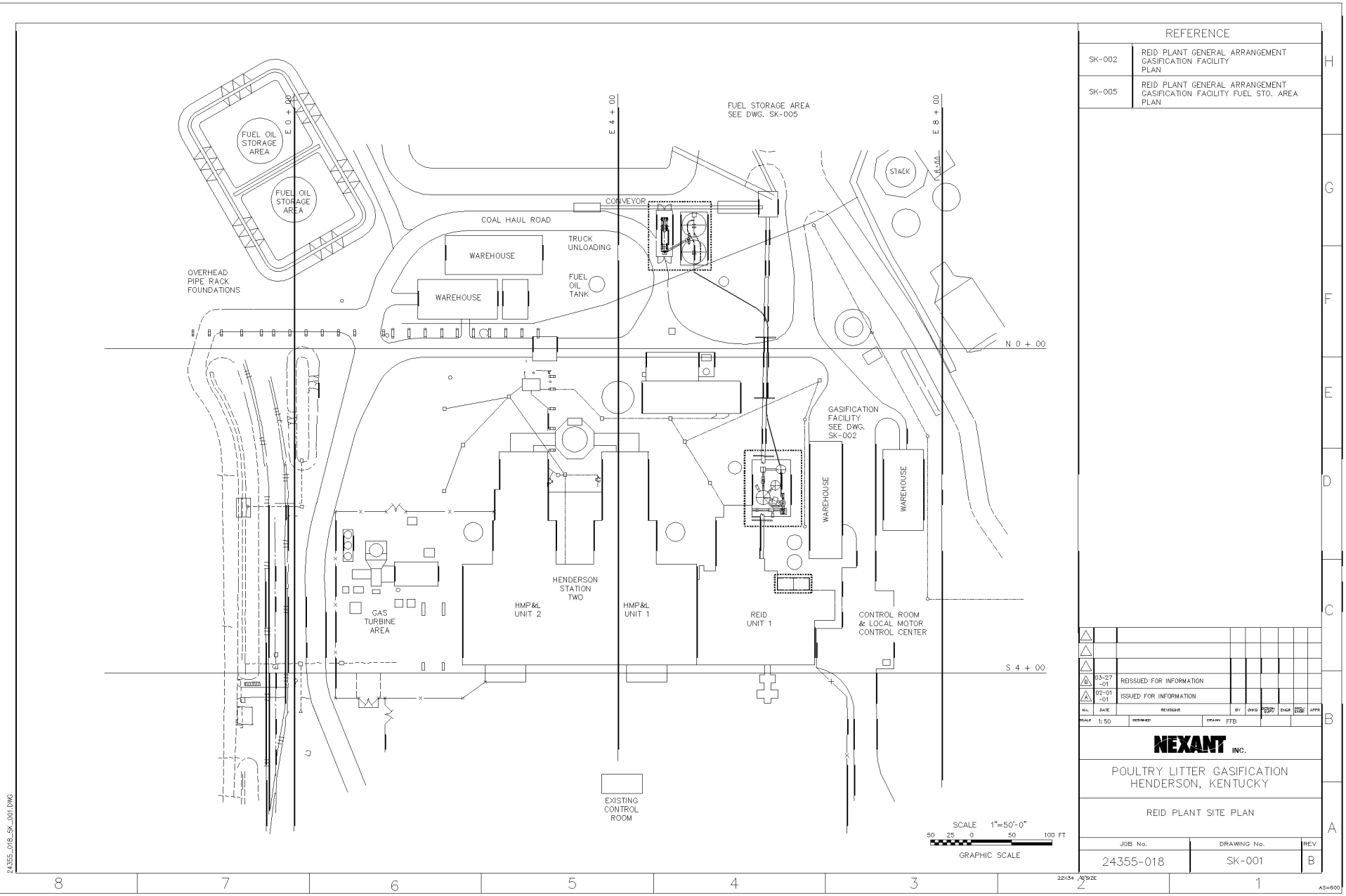


Ref: GE Design Case @ 65.85 MW Gross Turbine Output

B. Patel/ 3/23/01
Nexant Inc.

Turbine Design Point steam Load v/s Boiler heat Input




REFERENCE
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SK-005 REID PLANT GENERAL ARRANGEMENT GASIFICATION FACILITY FUEL STO. AREA PLAN
FUEL OIL STORAGE AREA
FUEL OIL STORAGE AREA
E 0 + 00
E 4 + 00
E 8 + 00
FUEL STORAGE AREA SEE DWG. SK-005
STACK
CONVEYOR
COAL HAUL ROAD
TRUCK UNLOADING
WAREHOUSE
WAREHOUSE
FUEL OIL TANK
OVERHEAD PIPE RACK FOUNDATIONS
N 0 + 00
S 4 + 00
GASIFICATION FACILITY SEE DWG. SK-002
WAREHOUSE
WAREHOUSE
HENDERSON STATION TWO
HMP&L UNIT 2
HMP&L UNIT 1
REID UNIT 1
GAS TURBINE AREA
CONTROL ROOM & LOCAL MOTOR CONTROL CENTER
EXISTING CONTROL ROOM
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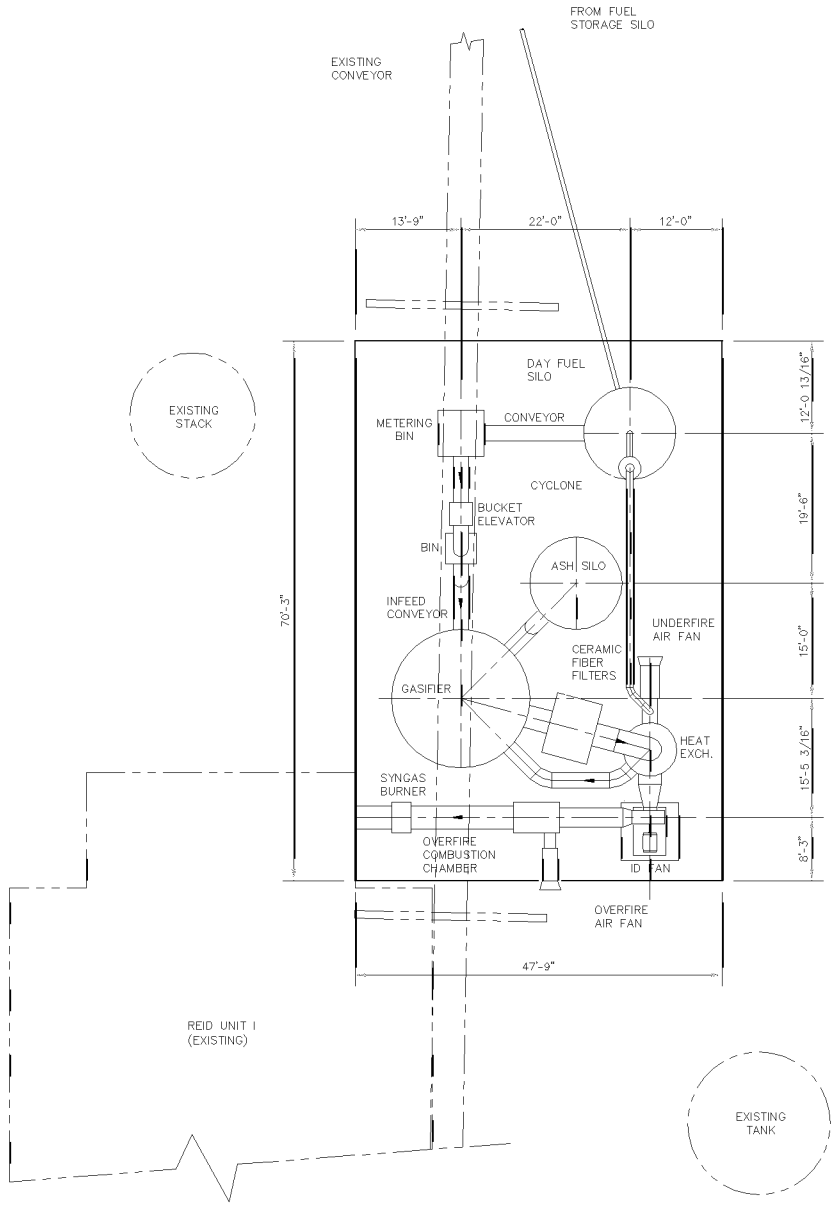
50 25 0 50 100 FT
GRAPHIC SCALE
03-27-01 REISSUED FOR INFORMATION
02-01-01 ISSUED FOR INFORMATION
SCALE 1:50
DRAWN FFB
NEXANT INC.
POULTRY LITTER GASIFICATION
HENDERSON, KENTUCKY
REID PLANT SITE PLAN
JOB No. 24355-018
DRAWING No. SK-001
REV B
24355_018_SK_001.DWG
22X34 A1 SIZE
AS=600



NOTES

1. FOR REFERENCE SEE DRAWING SK-001.

NO.	DATE	REVISIONS	BY	CHKD	ENGR	APPR
B	03-27-01	REISSUED FOR INFORMATION				
A	02-01-01	ISSUED FOR INFORMATION				

SCALE 1/8"=1'-0" | DESIGNED | DRAWN FFB

SCALE 1/8"=1'-0"
8 4 0 8 16 FT
GRAPHIC SCALE

Gasification Based Biomass Cogeneration, Phase

NEXANT Inc.

POULTRY LITTER GASIFICATION
HENDERSON, KENTUCKY

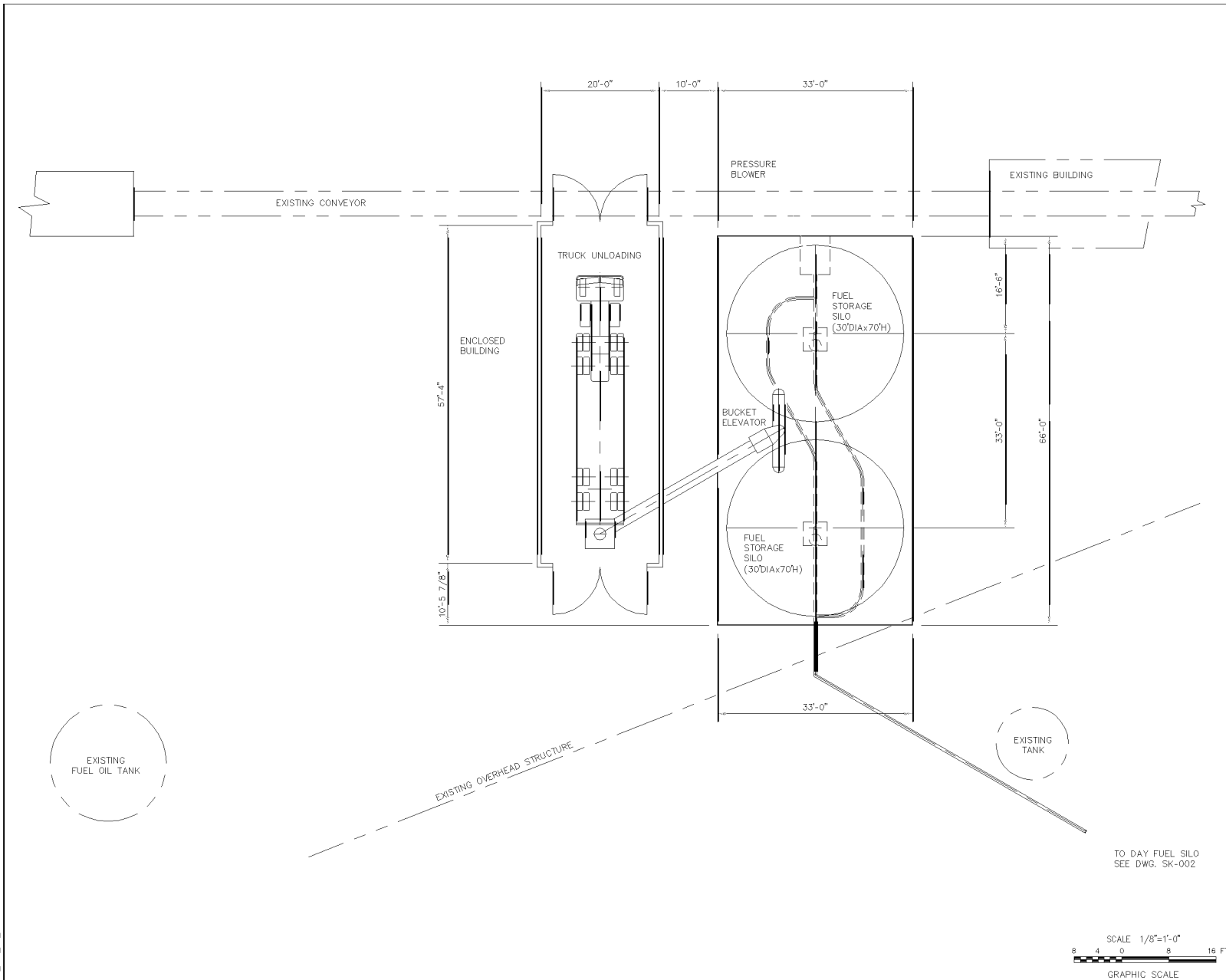
REID PLANT GENERAL ARRANGEMENT
GASIFICATION FACILITY
PLAN

JOB No.	DRAWING No.	REV
24355-018	SK-002	B

22X34 B SIZE

24355_018_SK_002.DWG

8 7 6 5 4 3 2 1



NOTES

1. FOR REFERENCE SEE DRAWING SK-001.

No.	DATE	REVISIONS	BY	CHKD	DESIGN SUPV	ENGR	PROJ MGR	APPR
A	03-27-01	ISSUED FOR INFORMATION						

SCALE 1/8"=1'-0" | DESIGNED | DRAWN FFB

NEXANT INC.

POULTRY LITTER GASIFICATION
HENDERSON, KENTUCKY

REID PLANT GENERAL ARRANGEMENT
GASIFICATION FACILITY FUEL STORAGE AREA PLAN

JOB No.	DRAWING No.	REV
24355-018	SK-005	A

22X34 (D) SIZE

24355_018_SK_005.DWG

Appendix B – TXU Case

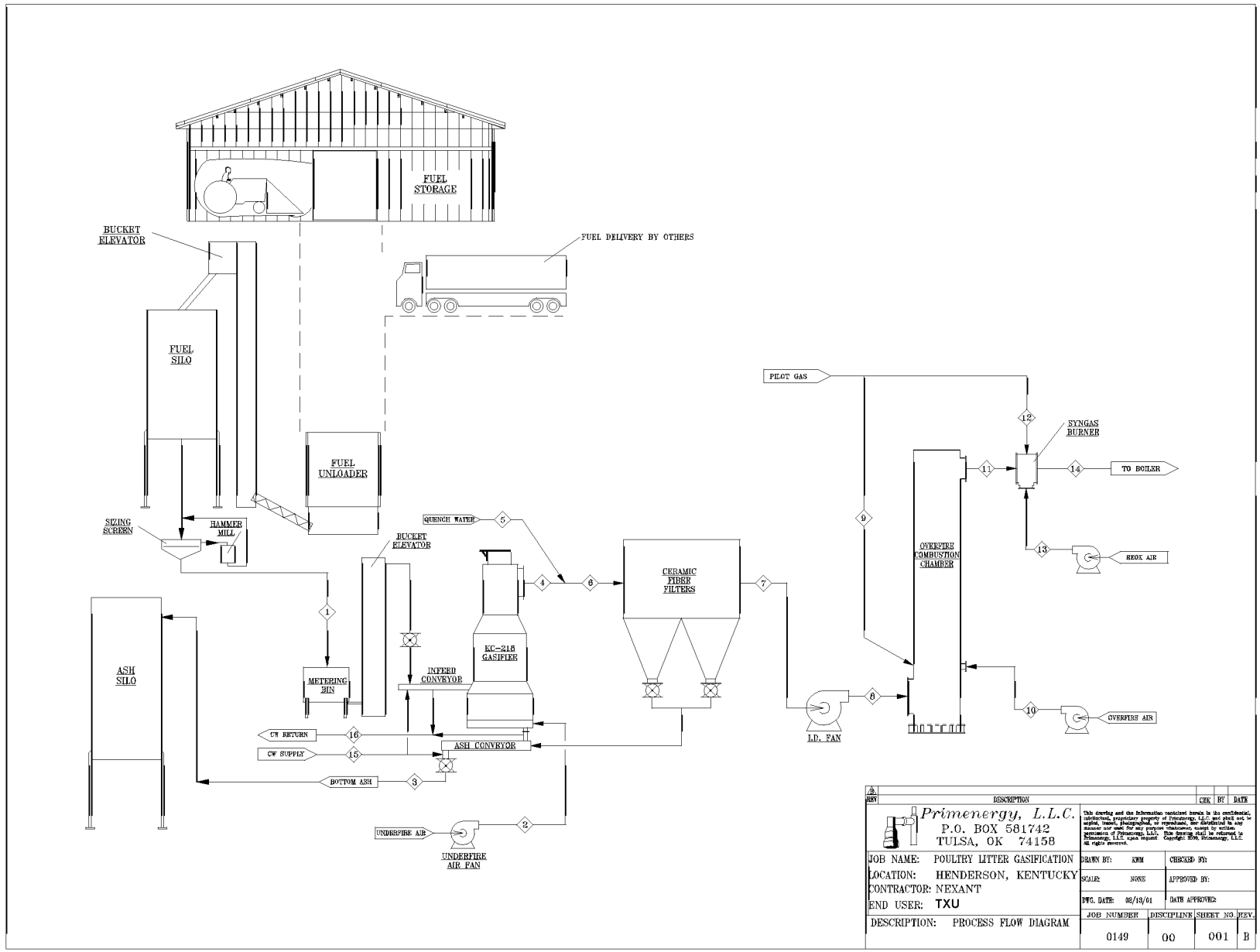

FUEL STORAGE
BUCKET ELEVATOR
FUEL DELIVERY BY OTHERS
FUEL SILO
FUEL UNLOADER
SIZING SCREEN
HAMMER MILL
BUCKET ELEVATOR
QUENCH WATER
5
4
6
CERAMIC FIBER FILTERS
7
PILOT GAS
12
SYNGAS BURNER
11
14
TO BOILER
9
OVERFIRE COMBUSTION CHAMBER
13
REDX AIR
ASH SILO
1
METERING BIN
INFEED CONVEYOR
KC-21S GASIFIER
I.D. FAN
8
10
OVERFIRE AIR
CW RETURN
16
CW SUPPLY
15
ASH CONVEYOR
BOTTOM ASH
3
UNDERFIRE AIR
2
UNDERFIRE AIR FAN
REV
DESCRIPTION
CHK
BY
DATE
Primenergy, L.L.C.
P.O. BOX 581742
TULSA, OK 74158
JOB NAME: POULTRY LITTER GASIFICATION
LOCATION: HENDERSON, KENTUCKY
CONTRACTOR: NEXANT
END USER: TXU
DESCRIPTION: PROCESS FLOW DIAGRAM
DRAWN BY: KWM
CHECKED BY:
SCALE: NONE
APPROVED BY:
PTG. DATE: 02/13/01
DATE APPROVED:
JOB NUMBER
DISCIPLINE
SHEET NO.
REV.
0149
00
001
B

Table B-1 Material and Energy Balance for Monticello Case

Stream ID	1	2A	3	4	5	6	7	8	8A	9	10	11
Stream	BROILER	HEATED	GASIFIER	QUENCH	SYNGAS	HEAT	ID	OVERFIRE	HEATED	OVERFIRE	HEATED	COMB
Name	LITTER	GASIFIER	BOTTOM	WATER	SCRUBBER	EXCH	FAN	& REOX	OVERFIRE	SYNGAS	REOX	PROD TO
		AIR	ASH		EXHAUST	EXHAUST	EXHAUST	AIR	AIR		AIR	BOILER
Pressure, psig ("w.c.-g)	----	(20.0)	----	50	(-10.0)	(-13.0)	(8.0)	(15.0)	(12.0)	(7.0)	(12.0)	(6.0)
Temperature, °F	77	650	300	77	1400	662	662	77	650	2400	650	2379
Molecular Weight (lb/lbmole)	---	28.68	75.25	18.02	24.39	24.39	24.39	28.68	28.68	27.56	28.68	28.33
Component	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
Carbon	10,151		927									
Hydrogen	1,019											
Nitrogen	1,041											
Oxygen	7,135											
Sulfur	221		111									
Chlorine												
Carbon Monoxide					10,293	10,293	10,293			1,200		
Carbon Dioxide					17,628	17,628	17,628			31,914		33,799
Hydrogen					971	971	971			329		
Water (v)		510			10,795	10,795	10,795	435	435	16,966	480	20,386
Nitrogen		39,813			40,854	40,854	40,854	33,982	33,982	74,836	37,490	112,326
Oxygen		12,053						10,287	10,287		11,349	8,053
Sulfur Dioxide					221	221	221					
Ash	4,216		4,110									
Water (l)	7,927			1,928								
TOTAL	31,710	52,376	5,147	1,928	80,761	80,761	80,761	44,704	44,704	125,245	49,319	174,564

Table B-1 Material and Energy Balance for Monticello Case (contd.)

Stream ID	1	2A	3	4	5	6	7	8	8A	9	10	11
Stream	BROILER	HEATED	GASIFIER	QUENCH	SYNGAS	HEAT	ID	OVERFIRE	HEATED	OVERFIRE	HEATED	COMB
Name	LITTER	GASIFIER	BOTTOM	WATER	SCRUBBER	EXCH	FAN	& REOX	OVERFIRE	SYNGAS	REOX	PROD TO
		AIR	ASH		EXHAUST	EXHAUST	EXHAUST	AIR	AIR		AIR	BOILER
Pressure, psig ("w.c.-g)	----	(20.0)	----	50	(-10.0)	(-13.0)	(8.0)	(15.0)	(12.0)	(7.0)	(12.0)	(6.0)
Temperature, °F	77	650	300	77	1400	662	662	77	650	2400	650	2379
Molecular Weight (lb/lbmole)	---	28.68	75.25	18.02	24.39	24.39	24.39	28.68	28.68	27.56	28.68	28.33
Component	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr	lb/hr
TOTAL	31,710	52,376	5,147	1,928	80,761	80,761	80,761	44,704	44,704	125,245	49,319	174,564
AVAIL ENERGY VALUE (LHV-Hv), Btu/lb	4,537				1,181	1,181	1,181			178		
AVAILABLE ENERGY MMBtu/hr	143.85		13.06		95.35	95.35	95.35			22.32		
SENSIBLE ENERGY MMBtu/hr		7.47			35.43	14.90	14.90		6.37	93.47	7.03	122.86
FLOW RATE, scfm (gpm)		11,551		(3.86)	20,940	20,940	20,940	9,859	9,859	28,743	10,877	38,968
FLOW RATE, acfm		24,656			74,899	45,190	45,190	10,181	21,045	158,087	23,217	212,766

Table B-2 Electrical Usage for Monticello Case

SYSTEM MOTOR LIST & ELECTRICAL REQUIREMENT					
ITEM	MOTOR SIZE Hp	QTY SUPLD	QTY OPRTG	OPRTG FACTOR	ELCTL USAGE Kw
Fuel Receiving Hopper	15	1	1	0.40	4.5
Fuel Receiving Hopper Discharge Conveyor	15	1	1	0.40	4.5
Storage Silo Bucket Elevator	20	1	1	0.40	6.0
Separation Screen	5	1	1	0.40	1.5
Hammer mill	50	1	1	0.40	14.9
Hammer mill Air System	15	1	1	0.40	4.5
Silo Unloader	15	2	2	0.40	9.0
Silo Discharge Conveyor	10	2	2	0.40	6.0
Metering Bin Discharge Screw	5	2	2	0.50	3.7
Bucket Elevator	5	2	2	0.50	3.7
Fuel Feed Rotary Valve	5	2	2	0.50	3.7
Fuel Infeed Auger	5	2	2	0.50	3.7
Agitator	5	2	2	0.50	3.7
Ash Cooling Auger	5	2	2	0.50	3.7
Underfire Air Fan	50	2	2	0.79	58.9
Cooling Water Pump	15	2	1	0.70	7.9
Syngaas Compressor	150	1	1	0.75	84.0
Fly Ash Discharge Valve	1	4	4	0.50	1.5
Final Ash Conveyor	10	1	1	0.50	3.7
Ash Bucket Elevator	10	1	1	0.50	3.7
ID Fan	250	2	2	0.69	256.1
Reox / Overfire Air Fan	60	2	2	0.73	65.6
Air Compressor	25	1	1	0.75	14.0
Miscellaneous Electrical Usage	----	----	----	----	5.0
Total					**573.7**

Table B-2 Texas Lignite Analysis (Monticello Boiler Fuel)

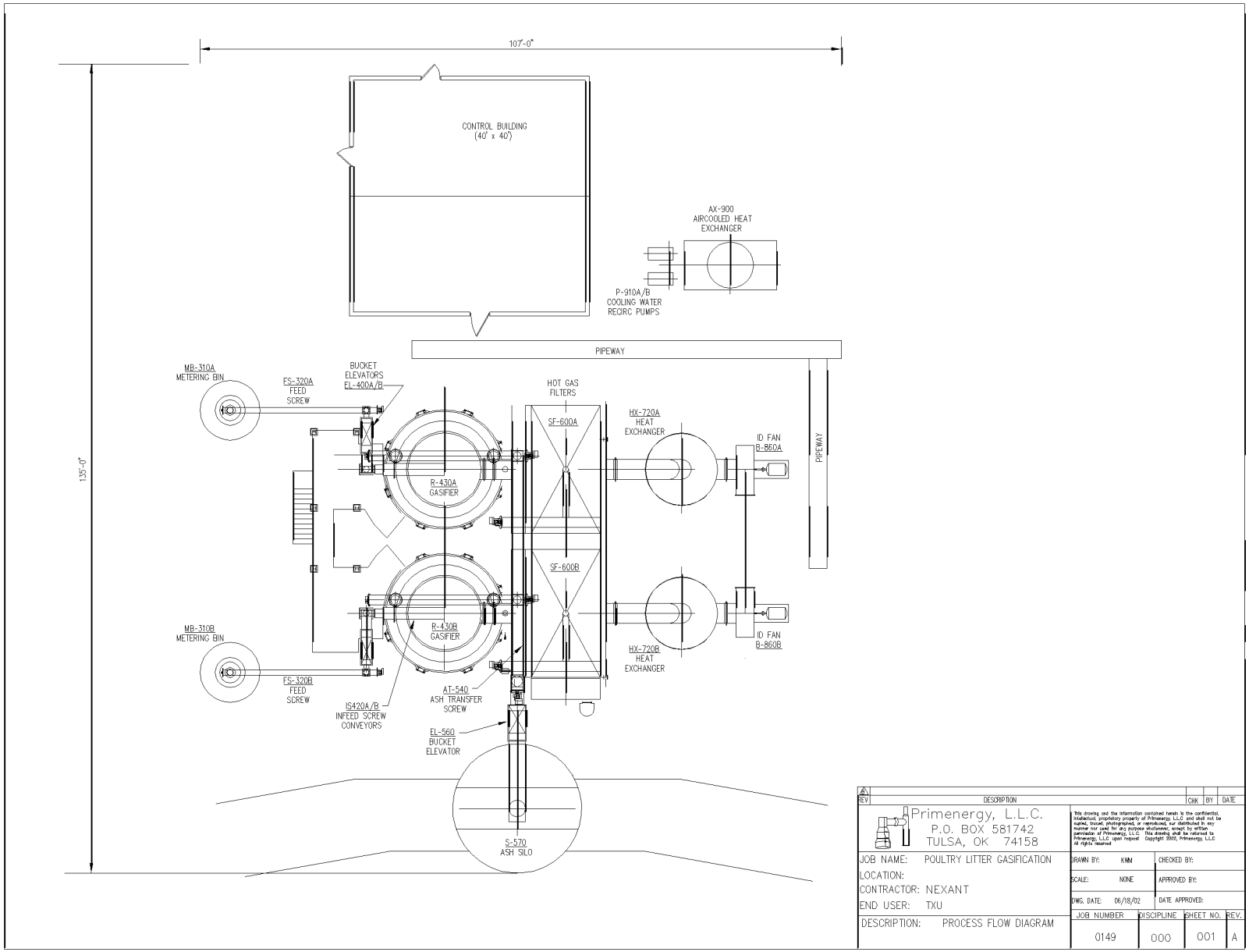
Texas Lignite	Value	Units
Fuel HHV	15 738 (6,767)	kJ/kg (Btu/lb)
C	39.20	%
H	2.99	
O	11.04	
N	0.58	
S	0.61	
Ash	14.31	
Moisture	31.27	
Total	100.00	

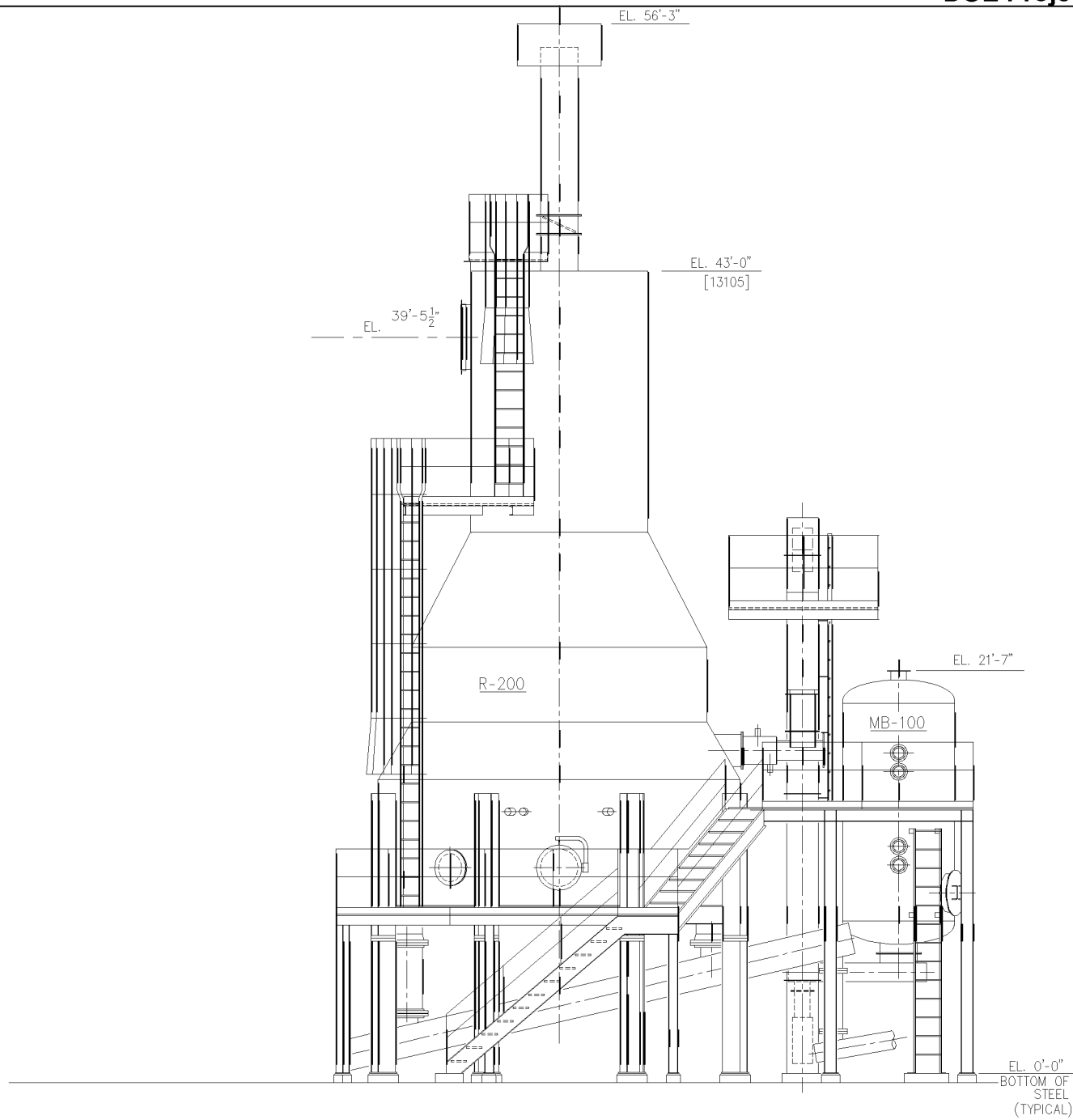
Table B-3 Monticello Boiler Design Data

Monticello Unit 1 & 2	Units	Control Point	MCR
Fuel		Texas Lignite	Texas Lignite
Evaporation	lbs/h	3,200,000	4,025,000
FW Temp	F	478	501
FW Pressure (calc)	psig	3,750	4,068
SH Outlet Temp	F	1,005	1,005
SH Outlet Press	psig	3,595	3,825
SH Pressure Drop	psig	141	222
Reheat Flow	lbs/h	2,814,000	3,520,000
Reheat inlet Temp	F	550	572
Reheat Inlet Press	psig	542	682
Reheat Outlet Temp	F	1,005	1,005
Reheater Press Drop	psig	28	35
Econmizer Press Drop	psi	14	21
Gas Drop - Furnace to Econ	"wg	2.45	3.65
Gas Drop Econ Outlet to AH Outlet	"wg	4.80	6.85
Gas Temp Entering AH	F	805	860
Gas Temp Leaving AH	F	327	351
Gas Temp Leaving AH	F	311	336
Air Temp Air Heater	F	85	85
Air Temp Leaving	F	701	730
Air Press Air Heater	"wg	7.90	10.35
Amb. Air Temp	F	80	80
Excess Air Econ	%	20	20
Fuel Fired	lbs/h	681,000	836,000
Efficiency	%	82.69	82.06

Table B-4 Monticello Plant Sensitivity Case

Case	Litter Cost	Ash Credits	Capital Cost	TXU Cost Share	Interest	Period	Fuel	O&M	Capital	Total
	$/ton	$/Ton			%	Years	c/kWh	c/kwh	c/kwh	c/kwh
Base Case	8	0	$14,882,622	$14,882,622	7.5%	10	1.00	0.78	2.69	4.47
2	8	(6)	$ 4,882,622	$14,882,622	7.5%	10	0.83	0.78	2.69	4.30
3	8	0	$14,882,622	$ 7,441,311	7.5%	10	1.00	0.78	1.34	3.13
4	6	(6)	$14,882,622	$14,882,622	7.5%	10	0.58	0.78	2.69	4.05
5	6	(6)	$14,882,622	$ 7,441,311	7.5%	10	0.58	0.78	1.34	2.71
6	4	0	$14,882,622	$14,882,622	7.5%	10	0.50	0.78	2.69	3.97
7	4	0	$14,882,622	$ 7,441,311	7.5%	10	0.50	0.78	1.34	2.63
8	0	(6)	$14,882,622	$14,882,622	7.5%	10	-0.17	0.78	2.69	3.30


107'-0"
135'-0"
CONTROL BUILDING
(40' x 40')
AX-900
AIRCOOLED HEAT
EXCHANGER
P-910A/B
COOLING WATER
RECIRC PUMPS
PIPEWAY
MB-310A
METERING BIN
FS-320A
FEED
SCREW
BUCKET
ELEVATORS
EL-400A/B
HOT GAS
FILTERS
SF-600A
HX-720A
HEAT
EXCHANGER
ID FAN
B-860A
R-430A
GASIFIER
PIPEWAY
SF-600B
MB-310B
METERING BIN
R-430B
GASIFIER
HX-720B
HEAT
EXCHANGER
ID FAN
B-860B
FS-320B
FEED
SCREW
IS420A/B
INFEED SCREW
CONVEYORS
AT-540
ASH TRANSFER
SCREW
EL-560
BUCKET
ELEVATOR
S-570
ASH SILO
REV
DESCRIPTION
CHK
BY
DATE
Primenergy, L.L.C.
P.O. BOX 581742
TULSA, OK 74158
JOB NAME: POULTRY LITTER GASIFICATION
LOCATION:
CONTRACTOR: NEXANT
END USER: TXU
DESCRIPTION: PROCESS FLOW DIAGRAM
DRAWN BY: KWM
CHECKED BY:
SCALE: NONE
APPROVED BY:
DWG. DATE: 06/18/02
DATE APPROVED:
JOB NUMBER
DISCIPLINE
SHEET NO.
REV.
0149
000
001
A

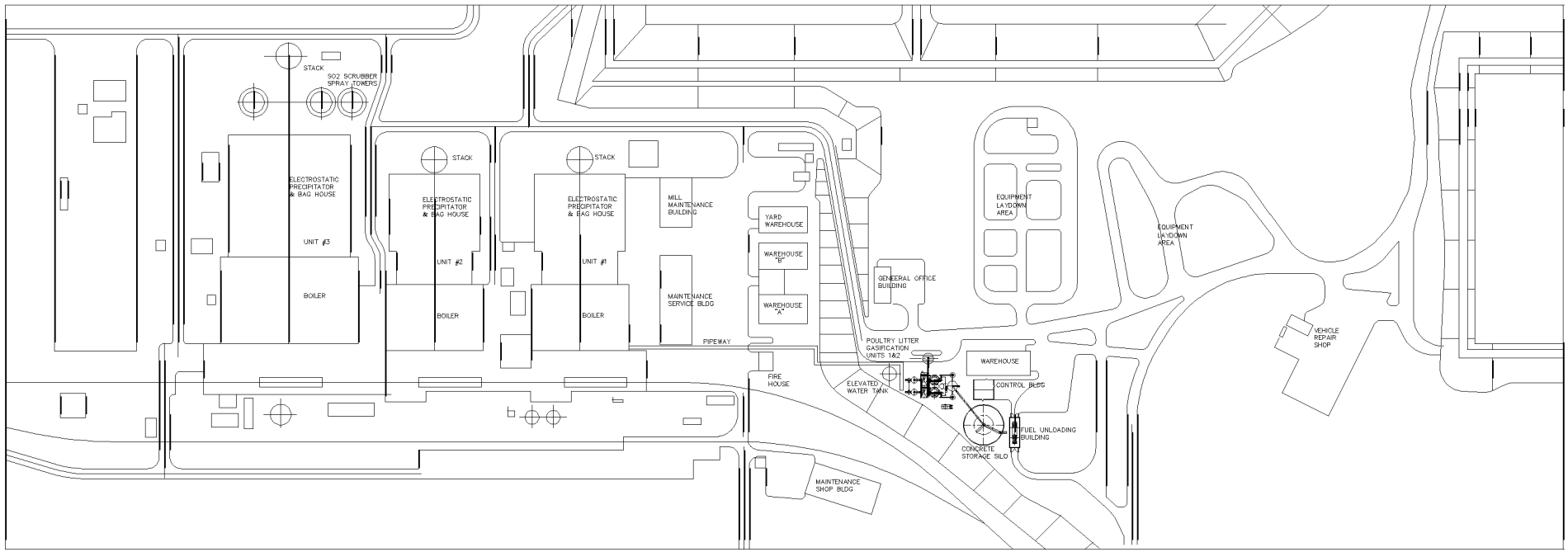


Primenery Gasifier Elevation


Producer gas to boiler


Monticello
Unit 1
Gasifier Island Location

REFERENCE	
SK-C-501	LOCAL SITE PLAN FULLY AUTOMATED
SK-P-700	FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION PLAN BELOW EL 20'-0"
0149-000-001	PRIMENERGY,LLC. P.O. BOX 581742, TULSA OK. POULTRY LITTER GASIFICATION PROCESS FLOW DIAGRAM



No	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LMAES
A		ISSUED FOR INFORMATION					

SCALE 1"=100' CAGE No

Bechtel

San Francisco

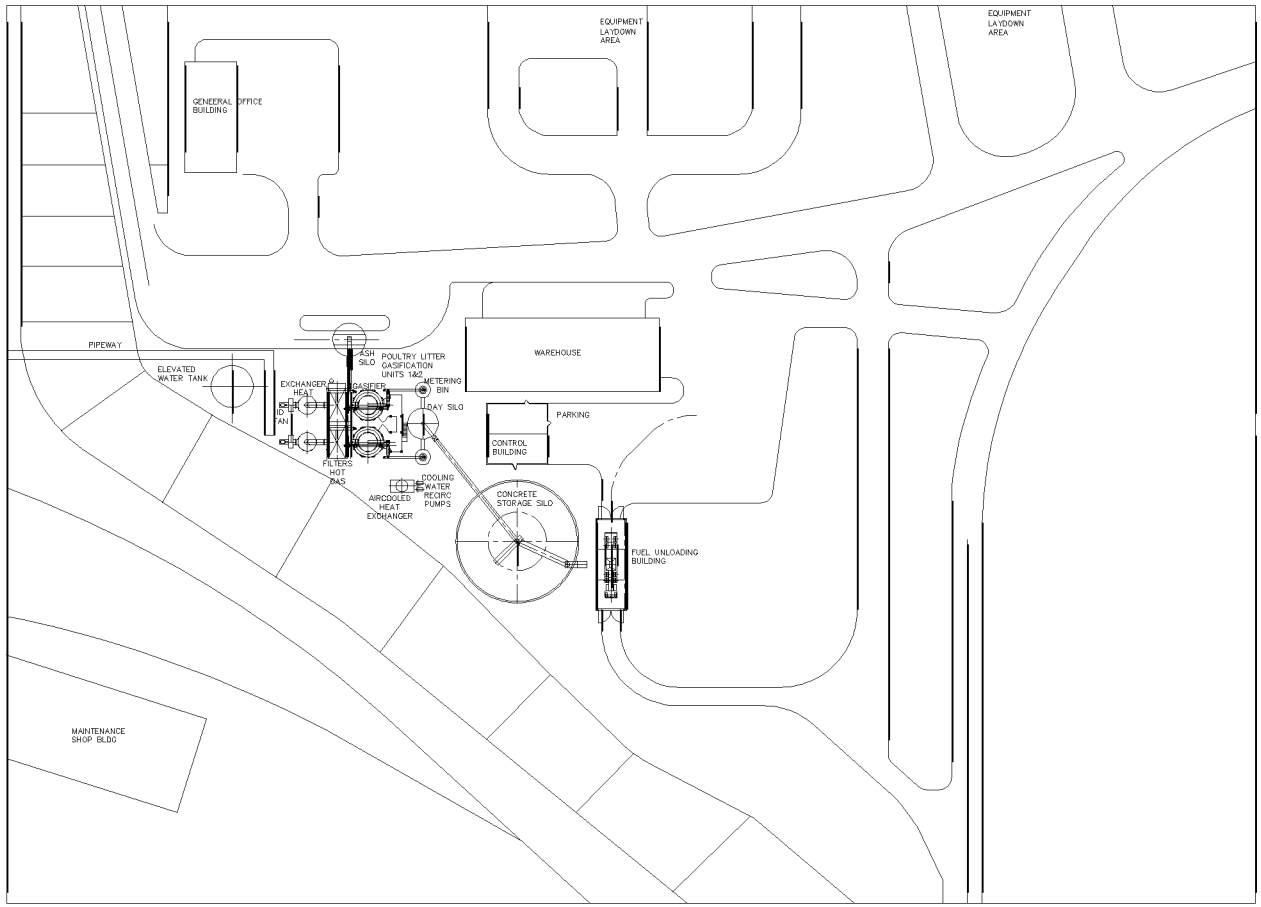
MONTICELLO PLANT
POULTRY LITTER GASIFICATION

OVERALL
SITE PLAN
FULLY AUTOMATED

JOB No	DRAWING No	REV
24355	SK-C-500	A

34x22 'D' SIZE

SK-C-500.DWG



NOTES:
1. FOR NOTES AND REFERENCE SEE DWG SK-C-500

No.	DATE	REVISIONS	DRAWN	ENGR	CHK'D	PROJ ENGR
0		ISSUED FOR INFORMATION				

SCALE 1"=40'-0" CAGE No.

Bechtel San Francis

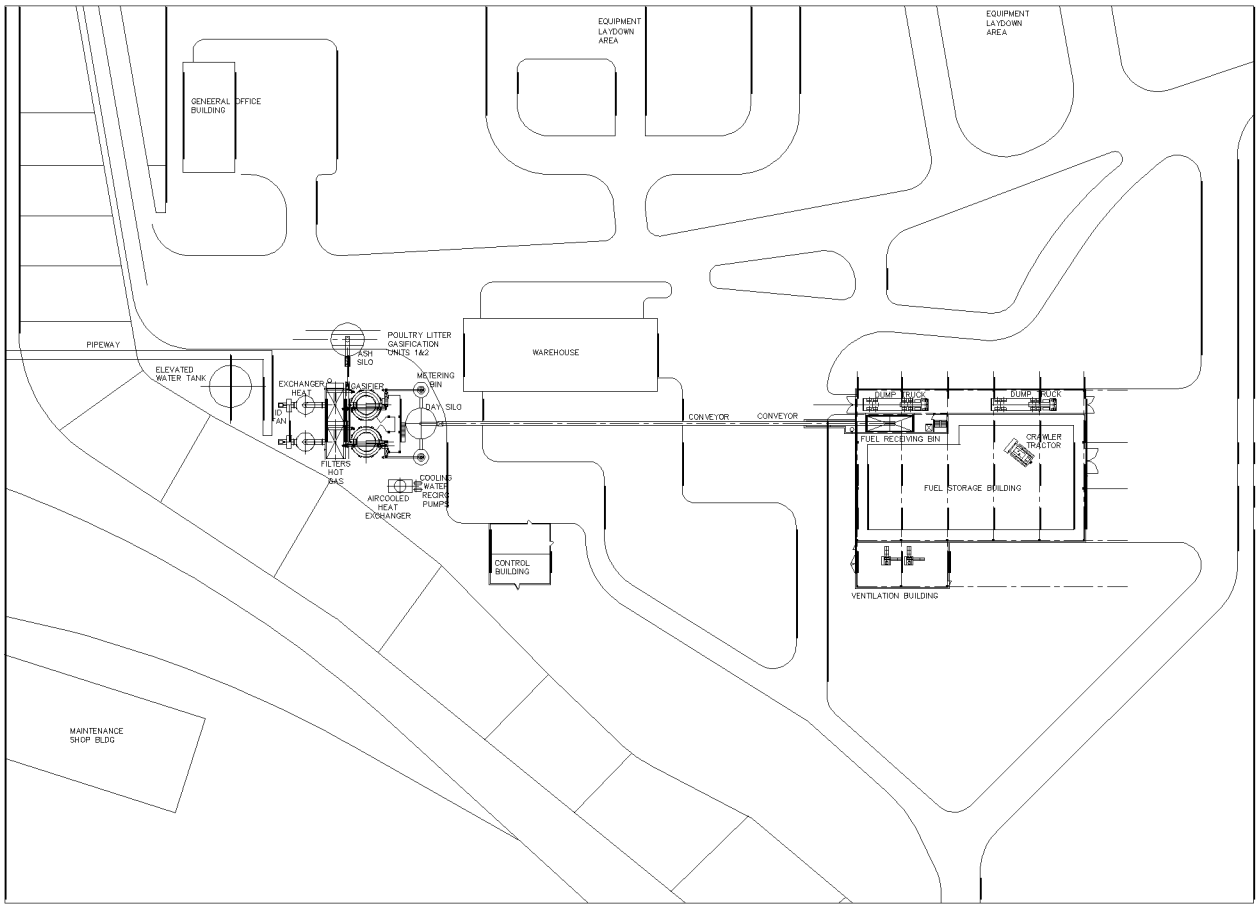
MONTICELLO PLANT
POULTRY LITTER GASIFICATION

LOCAL SITE
PLAN
FULLY AUTOMATED

JOB No. 24355 DRAWING No. SK-C-501

34x22 'D' SIZE

SK-C-501.DWG



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1. FOR NOTES AND REFERENCE SEE DWG SK-C-100

No.	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LMA
1		ISSUED FOR INFORMATION					

SCALE 1"=40'-0" CADD No.

Bechtel

San Francisco

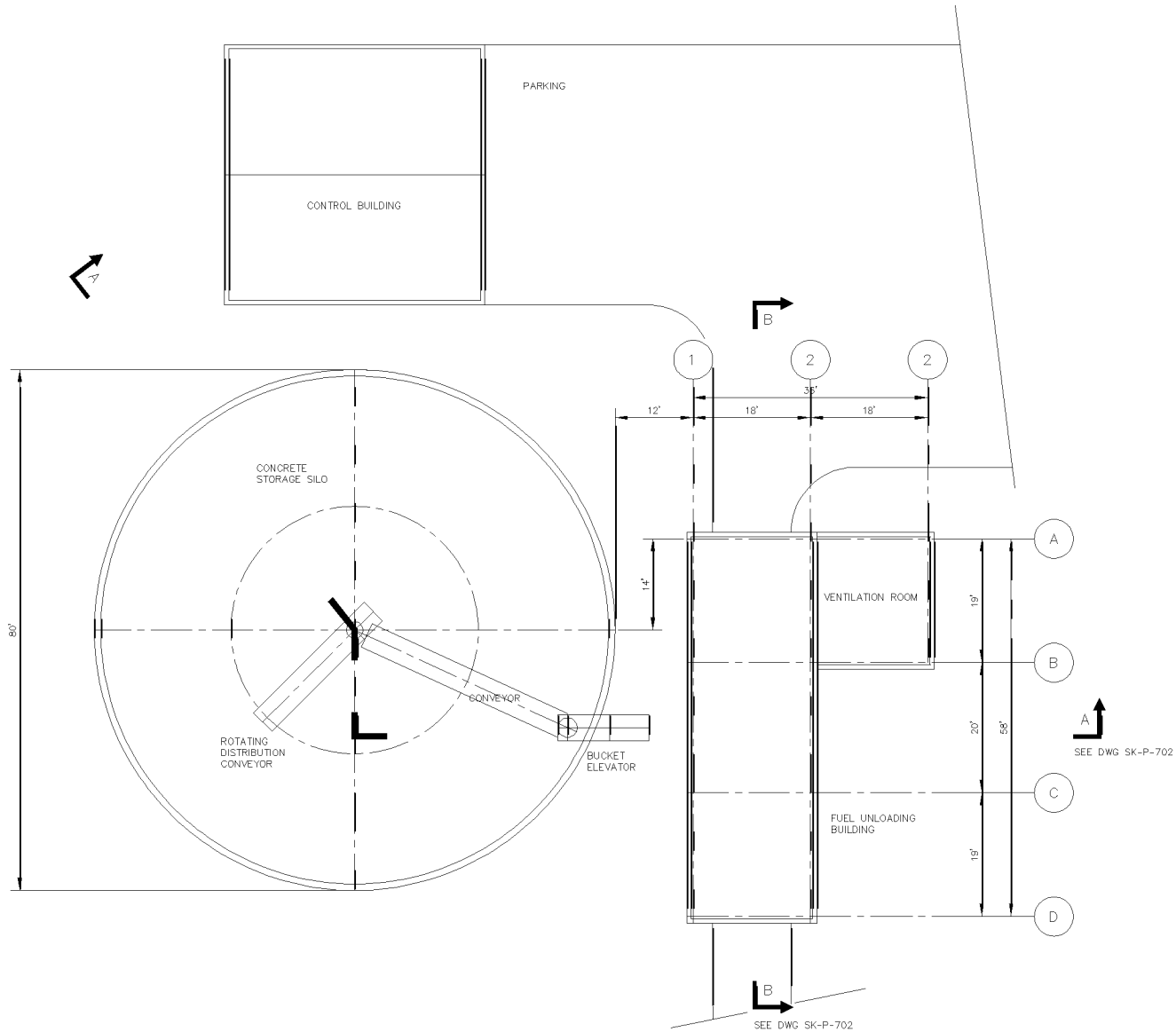
MONTICELLO PLANT
POULTRY LITTER GASIFICATION

LOCAL SITE
PLAN
PARTIALLY AUTOMATED

JOB No. 24355 DRAWING No. SK-C-101 REV A

34x22 'D' SIZE

SK-C-101.DWG



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SK-P-701	FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION PLAN BELOW ELEV. 19'-0"
SK-P-702	FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION SECTION A-A, B-B
SK-C-500	OVERALL SITE PLAN FULLY AUTOMATED
SK-C-501	LOCAL SITE PLAN FULLY AUTOMATED
SK-M-002	PROCESS FLOW DIAGRAM FULLY AUTOMATED

No.	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LMAES
4		ISSUED FOR INFORMATION					

SCALE 1/8"=1'-0" CAGE No.

Bechtel San Francisco

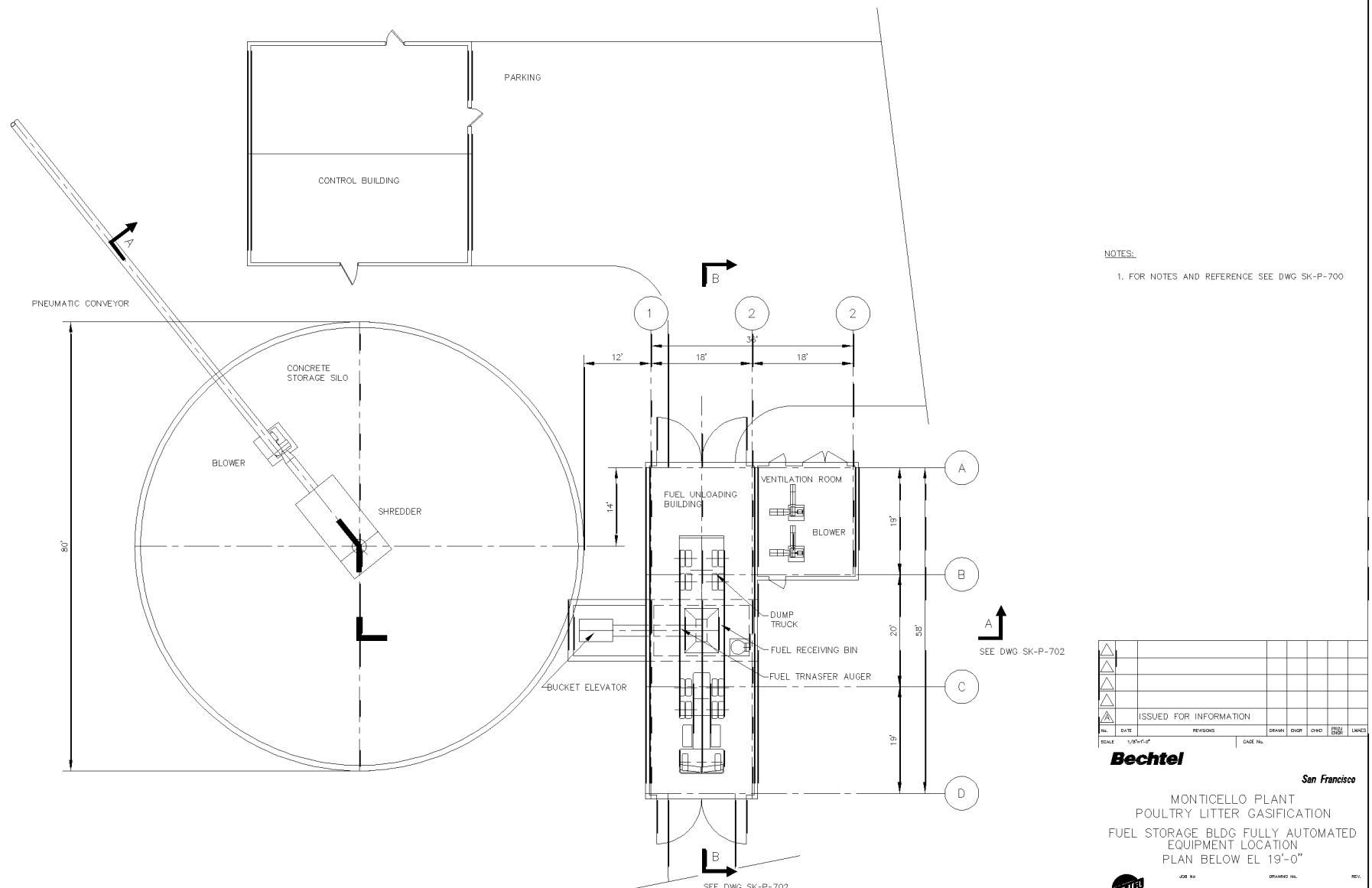
MONTICELLO PLANT
POULTRY LITTER GASIFICATION

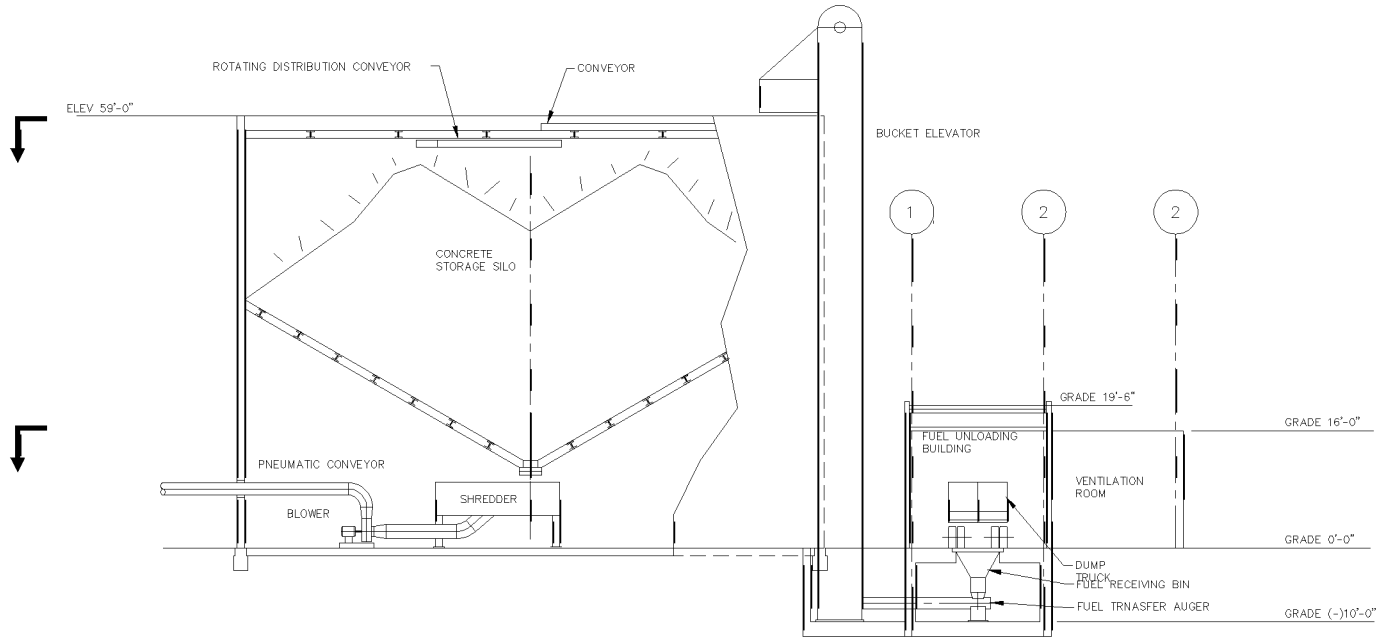
FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION
PLAN BELOW EL 50'-0"

JOB No.	DRAWING No.	REV.
24355	SK-P-700	A

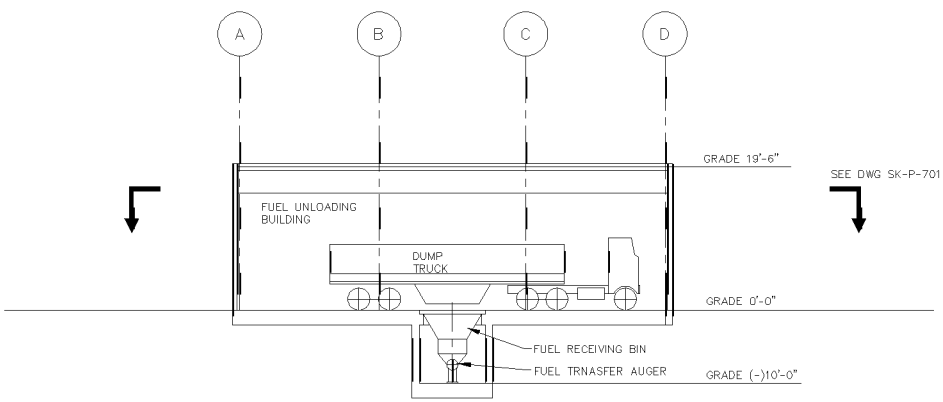
34x22 "D" SIZE

SK-P-700.DWG


PARKING
CONTROL BUILDING
PNEUMATIC CONVEYOR
CONCRETE STORAGE SILO
BLOWER
SHREDDER
80'
FUEL UNLOADING BUILDING
VENTILATION ROOM
BLOWER
DUMP TRUCK
FUEL RECEIVING BIN
FUEL TRNASFER AUGER
BUCKET ELEVATOR
SEE DWG SK-P-702
SEE DWG SK-P-702
12'
18'
18'
36'
14'
19'
20'
58'
19'
1
2
2
A
B
C
D
NOTES:
1. FOR NOTES AND REFERENCE SEE DWG SK-P-700
ISSUED FOR INFORMATION
Bechtel
San Francisco
MONTICELLO PLANT
POULTRY LITTER GASIFICATION
FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION
PLAN BELOW EL 19'-0"
24355
SK-P-701
A
SK-P-701.DWG



SECTION A-A



SECTION B-B

NOTES:

1. FOR NOTES AND REFERENCE SEE DWG SK-P-700

No.	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LM/ES
A		ISSUED FOR INFORMATION					

SCALE 1/8"=1'-0" CAGE No

Bechtel San Francisco

MONTICELLO PLANT
POULTRY LITTER GASIFICATION
FUEL STORAGE BLDG FULLY AUTOMATED EQUIPMENT LOCATION
SECTION A-A & B-B

JOB No.	DRAWING No.	REV.
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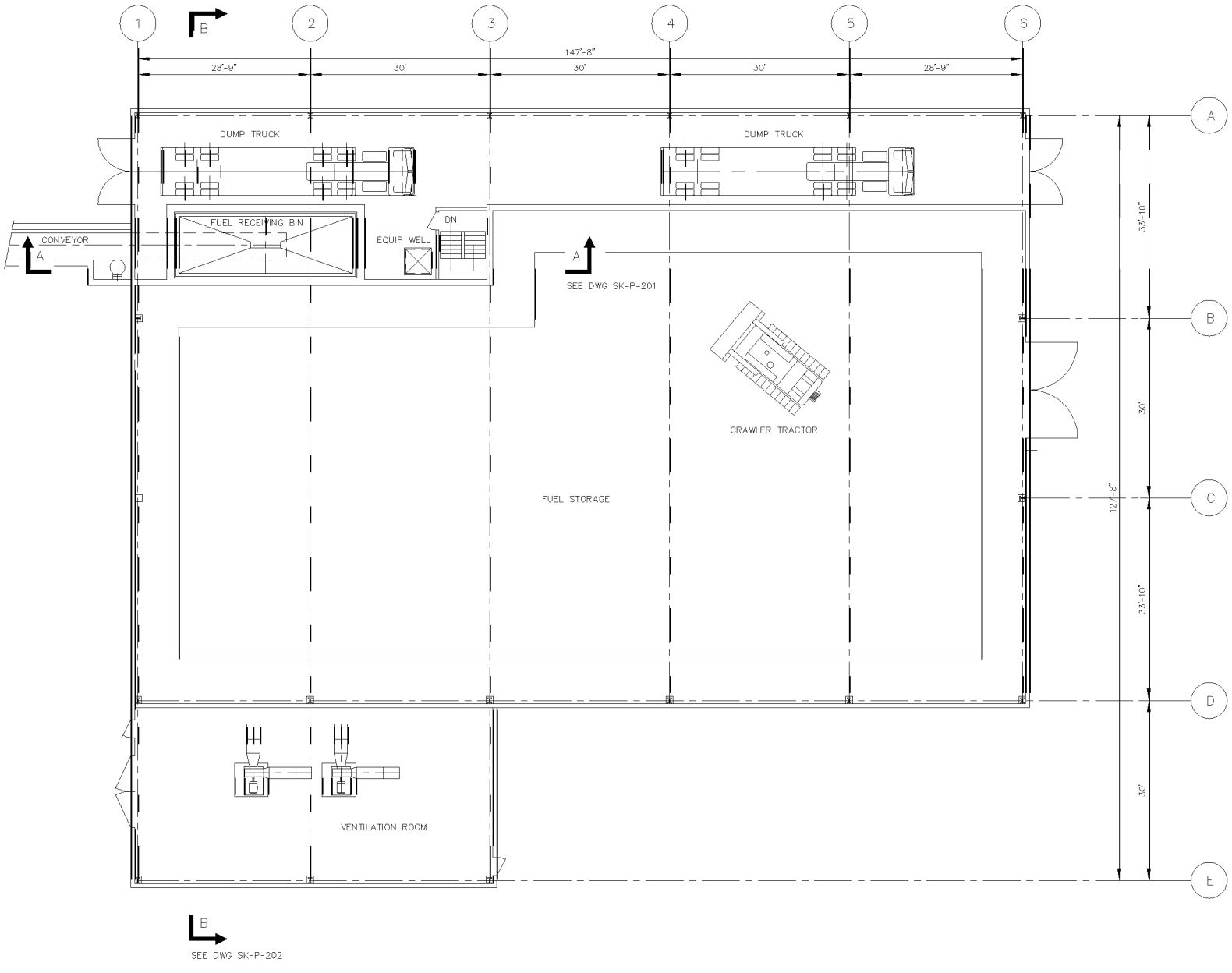
34x22 'D' SIZE

SK-P-702.DWG



REFERENCE	
SK-P-201	FUEL STG BLDG PARTIALLY AUTOMATED EQUIPMENT LOCATION PARTIAL PLAN & SECTION A-A
SK-P-202	FUEL STG BLDG PARTIALLY AUTOMATED EQUIPMENT LOCATION SECTION B-B
SK-C-100	OVERALL SITE PLAN PARTIALLY AUTOMATED
SK-C-101	LOCAL SITE PLAN PARTIALLY AUTOMATED
SK-M-001	PROCESS FLOW DIAGRAM PARTIALLY AUTOMATED

No	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LMA
4							
3							
2							
1							
A		ISSUED FOR INFORMATION					

SCALE 1/8"=1'-0" CAGE No.

Bechtel

San Francisco

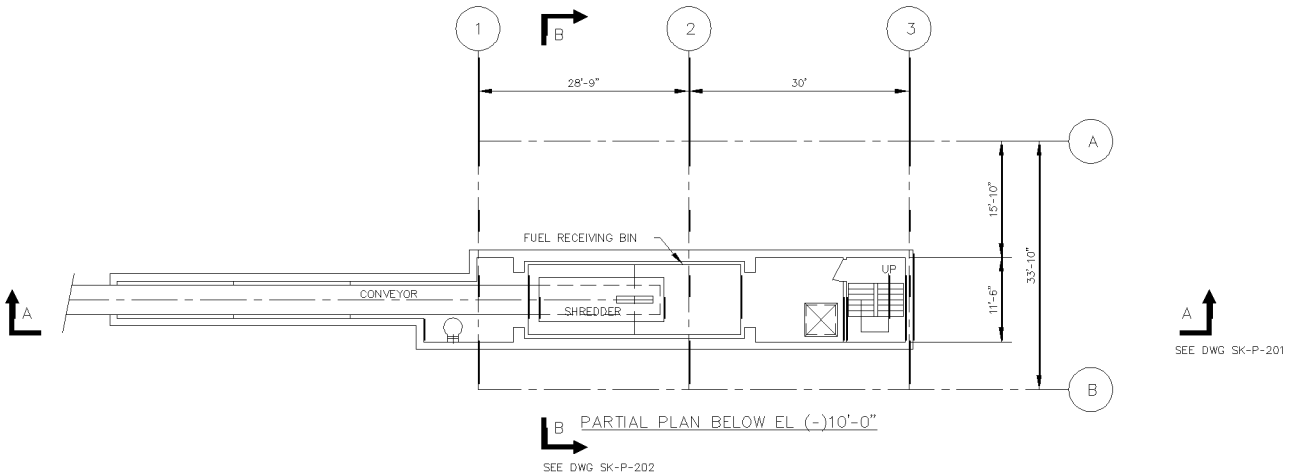
MONTICELLO PLANT
POULTRY LITTER GASIFICATION

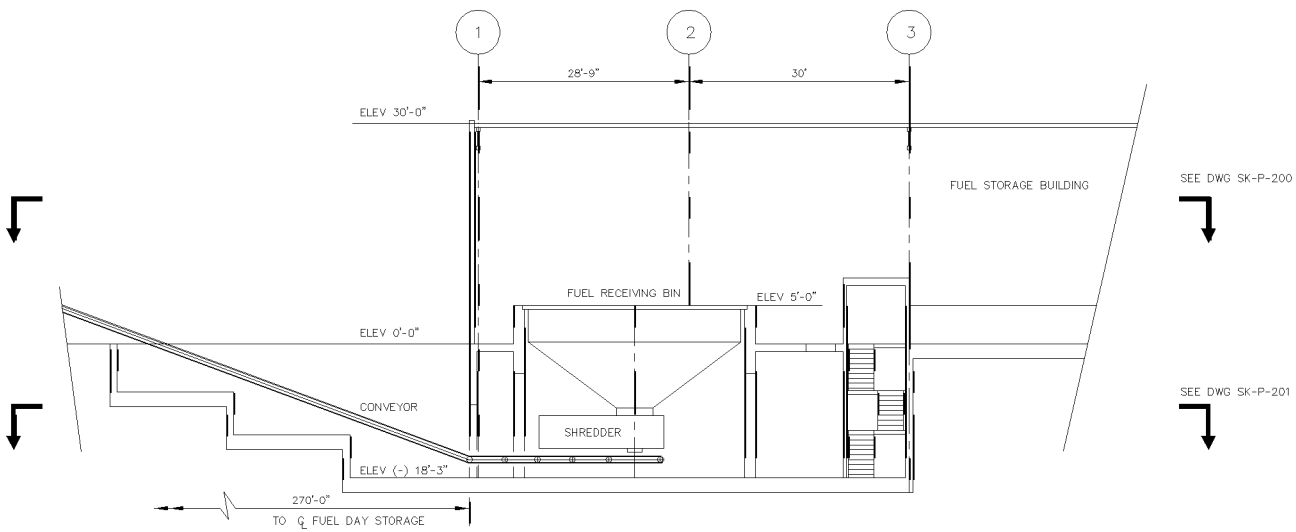
FUEL STG BLDG PARTIALLY AUTOMATED EQUIPMENT LOCATION
PLAN BELOW EL 20'-0"

JOB No.	DRAWING No	REV
24355	SK-P-200	A

34x22 'D' SIZE

SK-P-200.DWG





SECTION A-A

SEE DWG SK-P-201

SEE DWG SK-P-200

SEE DWG SK-P-201

NOTES:

1. FOR NOTES AND REFERENCE SEE DWG SK-P-200

No.	DATE	REVISIONS	DRAWN	ENGR	CHKD	PROJ ENGR	LMAER
1		ISSUED FOR INFORMATION					

SCALE 1/8"=1'-0" CAGE No.

Bechtel San Francisco

MONTICELLO PLANT
POULTRY LITTER GASIFICATION
FUEL STG BLDG PARTIALLY AUTOMATED EQUIPMENT LOCATION
PARTIAL PLAN & SECTION A-A

JOB No	DRAWING No	REV
24355	SK-P-201	A

34x22 'D' SIZE

SK-P-201.DWG

Appendix C – BB Power Report

BABCOCK BORSIG POWER, INC.

PRELIMINARY ENGINEERING STUDY FOR FEASIBILITY OF MODULAR BIO-GASIFIER HOT PRODUCER GAS INJECTION INTO PULVERIZED COAL FIRED FLAT WALL FURNACE

FOR:

NEXANT INC.

AT

WESTERN KENTUCKY ENERGY
REID PLANT
SEBREE POWER COMPLEX
SEBREE, KENTUCKY

BBP CONTRACT No. 200756
Original Contract Riley Stoker Corp. B2502

Date Issued: 31 May 2001

PRELIMINARY ENGINEERING STUDY FOR FEASIBILITY OF MODULAR BIO-GASIFIER HOT PRODUCER GAS INJECTION INTO PULVERIZED COAL FIRED FLAT WALL FURNACE

FOR
NEXANT INC.
AT

WESTERN KENTUCKY ENERGY
REID PLANT
SEBREE POWER COMPLEX
SEBREE, KENTUCKY

BBP CONTRACT NO. 200756
Original Contract Riley Stoker Corp. B2501

DATE ISSUED: 31 May 2001

Prepared By:

25 May 01
Frank Zone, Jr., P.E.
Sr. Staff Engineer
Boiler Design

Prepared By:

Richard J. Dube, P.E.
Richard J. Dube, P.E.
Sr. Consultant
Fuel Burning

Approved By:

29 MAY 2001
Brian Vitalis
Manager
Boiler Design

BABCOCK BORSIG POWER

May 31, 2001

NEXANT, Inc.
45 Fremont Street, 7th Floor
San Francisco, CA 94105-2210

Attn: Mr. Babul Patel

Subject: Phase 1 Engineering Study for Feasibility of Modular Bio-Gasifier Hot Producer Gas Injection into Pulverized Coal Fired Flat Wall Furnace
At Western Kentucky Energy, Reid Plant
Sebree Power Complex, Sebree, Kentucky
NEXANT, Inc. PO #0104-NEX-133
Original Contract Riley Stoker Corp, B2502
DB Riley Contract 200756

Dear Babul,

Thank you for using Babcock Borsig Power's engineering services; attached please find three copies of engineering's report that provides NEXANT assistance and recommendations in determining feasible locations, size, and number of penetrations required to flow syn gas into a pressurized type furnace.

As mentioned in today's conversation, once you have reviewed the report, call me a day ahead of time and I will set up a teleconference with engineering (Frank and Dick) to answer any questions that you may have.

Thank you for the opportunity to be of service to you, BBP looks forward to perhaps working with NEXANT on Phase 2 of this project.

Sincerely,

Babcock Borsig Power, Inc.

Elaine Strzelewicz

Elaine K. Strzelewicz
Job Manager, Field Engineering and Services Department

CC: K. Davis, P. Knight/1, J. Scott/1, E. Vega/1

Babcock Borsig Power, Inc.
Energy Systems and Services Division

Mailing Address:
Post Office Box 15040
Worcester, MA 01615-0040

Shipping Address:
5 Neponset Street
Worcester, MA 01606

Telephone: (508) 852-7100
Fax: (508) 852-7548

www.bbpwr.com

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Nexant Inc.
WKE Reid Plant
BBP Contract 200756
DISTRIBUTION LIST

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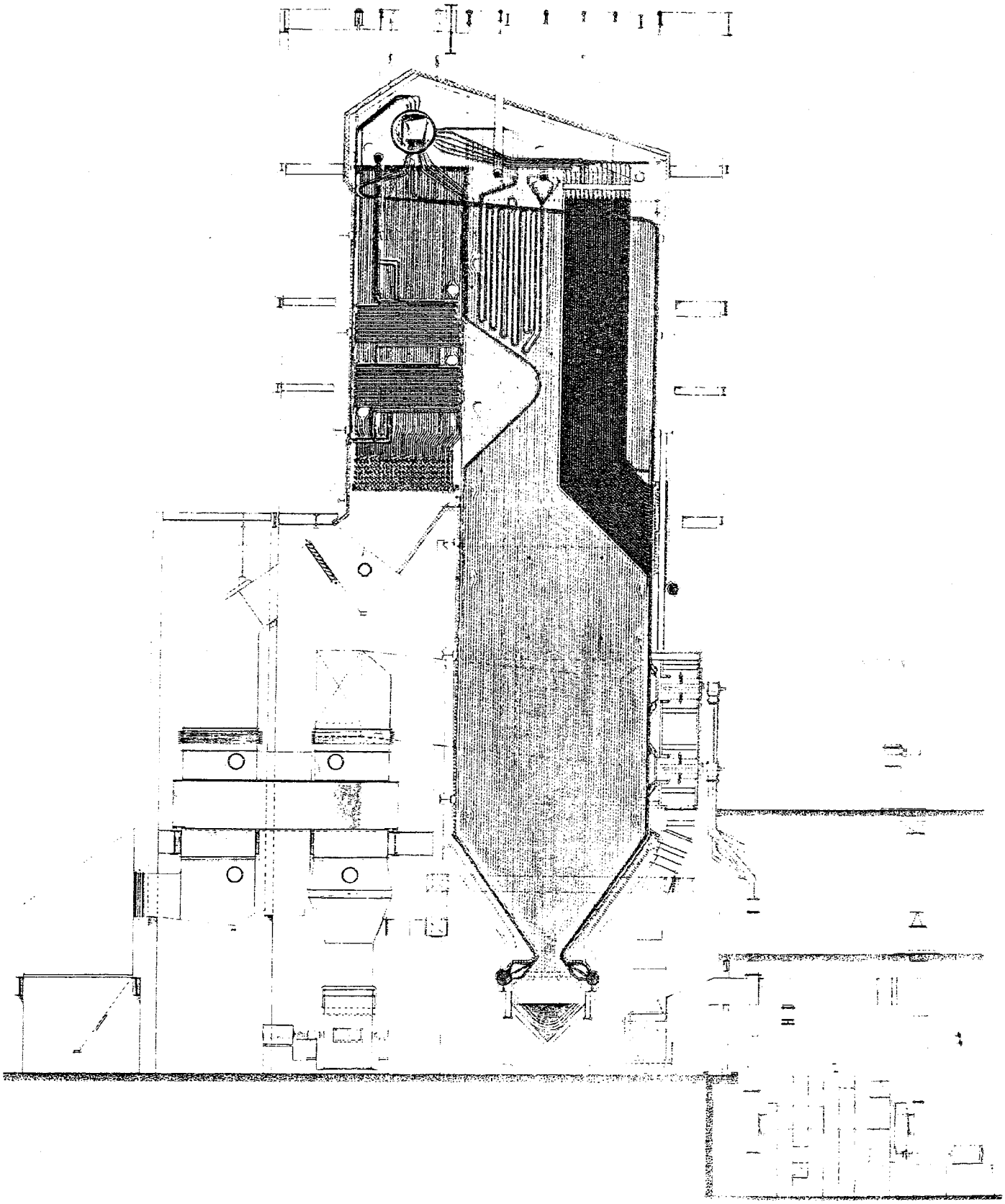

BIG RIVERS RURAL ELECTRIC COOPERATIVE CORP.
SEBREE, KENTUCKY
690,000 lbs/hr—1475 psig design—1300 psig operating—955F
Burns & McDonnell Engineering Co., Consulting Engineers

BABCOCK BORSIG POWER, INC.
Nexant Inc.
WKE Reid Plant
BBP Contract 200756

TABLE OF CONTENTS

BABCOCK BORSIG POWER, INC.
Nexant Inc.
WKE Reid Plant
BBP Contract 200756

LIST OF TABLES

LIST OF FIGURES

BABCOCK BORSIG POWER, INC.
Nexant Inc.
WKE Reid Plant
BBP Contract 200756

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

NEXANT, Inc. and its partners, Western Kentucky Energy and Primenergy, are working with DOE-NETL to develop a biomass cofiring project at the Western Kentucky Energy Reid Plant located near Henderson, Kentucky. The cofiring project is a proposal for the installation of modular bio-gasifier(s) adjacent to the existing boiler and injecting the hot producer gas from the gasifier into the boiler. As part of phase 1, Nexant is seeking assistance in modeling the expected boiler operation post gasifier(s) installation. The specific tasks for BBP (subcontractor scope of work) as a part of phase 1 are as follows:

- Determine feasible locations for boiler penetration(s) to minimize the impact on existing boiler equipment
- Size the penetrations
- Determine pressure requirements at the penetrations
- Provide preliminary recommendations on required stiffening/strengthening at the boiler penetrations.

1.2 Background

The Western Kentucky Energy Reid Plant was designed by Riley Stoker Corporation under contract B-2502 (1962). It consists of one steam generating unit at a maximum continuous rating of 690,000 Lb/hr steam flow, 1300 psig outlet steam pressure, 955 °F outlet steam temperature, 440 °F feedwater temperature entering the economizer, while firing West Kentucky Bituminous coal. The boiler has two (2) Riley ball tube mills, eight (8) Riley type 60 flare burners, and one (1) Ljungstrom 25VIx48 air heater.