GTI ENERGY

REQUEST FOR PROPOSAL (RFP) PART 3 OF 3:

APPENDIX 2 THROUGH APPENDIX 5

REVISION: 0

ISSUED: AUGUST 15, 2025

BID DUE DATE: SEPTEMBER 12, 2025, 7 PM CENTRAL TIME

RFP to Support Engineering-Scale ROTA-CAP™ System for CO_2 Capture

Detailed Design, Procurement, Fabrication, Installation, Commissioning, & Start-up Support

In support of DOE Contract Number: DE-FE0032466

Project Title:
ROTA-CAP™: Engineering -Scale Testing of Carbon Capture Technology in Iron and Steel Production

GTI Energy Project Number:
23654

GTI Energy Principal Investigator:
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www.gti.energy

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APPENDIX 2 – EXISTING BLOWER SPECIFICATIONS

Flowserve US Inc.

PROPOSAL

EPIC Systems, INC
4142 Meramec Bottom Rd.
St. Louis, MO 63129

Proposal No: 201606-56841-ASE-GPH Rev. 2
Date: July 15, 2016
Reference: 4000042548

Attention: Michael Wodicker

SCOPE OF SUPPLY:

Retrofit for 150 HP motor

The following changes will be made to system SC2003064

1x - 150 HP, 1800 RPM, TEFC enclosure, 1.15 SF, energy efficient, 3/60/460 volt, belt driven motor will replace 125 HP, 1800 RPM, TEFC enclosure, 1.15 SF, energy efficient, 3/60/460 volt, belt driven motor

1x - Driver sheave replaced with 13.2” driver sheave.

1x - Pressure relief valve will be reset with new spring for 20 PSIG set point.

Note: Please note that there will be a disposal fee for the components that cannot be re-used from the previous system.

Optional:

1x - Witnessed volumetric air flow system test.

MATERIALS OF CONSTRUCTION:

Painting:	SIHI standard alkyd enamel on all carbon steel surfaces only.
Baseplate:	Carbon steel

Flowserve US Inc.
5757 Genoa-Red Bluff Road
Pasadena, TX 75039

Tel: 519-824-4600
Fax: 519-824-7250
www.sihi-pump.com

Flowserve Canada Corp.
225 Speedvale Rd W.
Guelph, ON, Canada N1H 6L8

PERFORMANCE DATA

Requirements:

Medium:	NO_2, CO_2, H_2O, O_2	
Capacity:	1100	SCFM
Suction Pressure:	15 (0.5)	in WC (psig)
Suction Temperature:	160	°F
Service Liquid:	Water	@ 85°F

Retrofit Performance

Pump Performance:

Capacity:	1210	SCFM
Suction Pressure:	15 (0.5)	in WC (psig)
Suction Temperature:	160	°F
Discharge Pressure:	17.5	PSIG
Pump Speed:	616	RPM
BHP:	143.4	
Service Liquid Rate:	42	USGPM

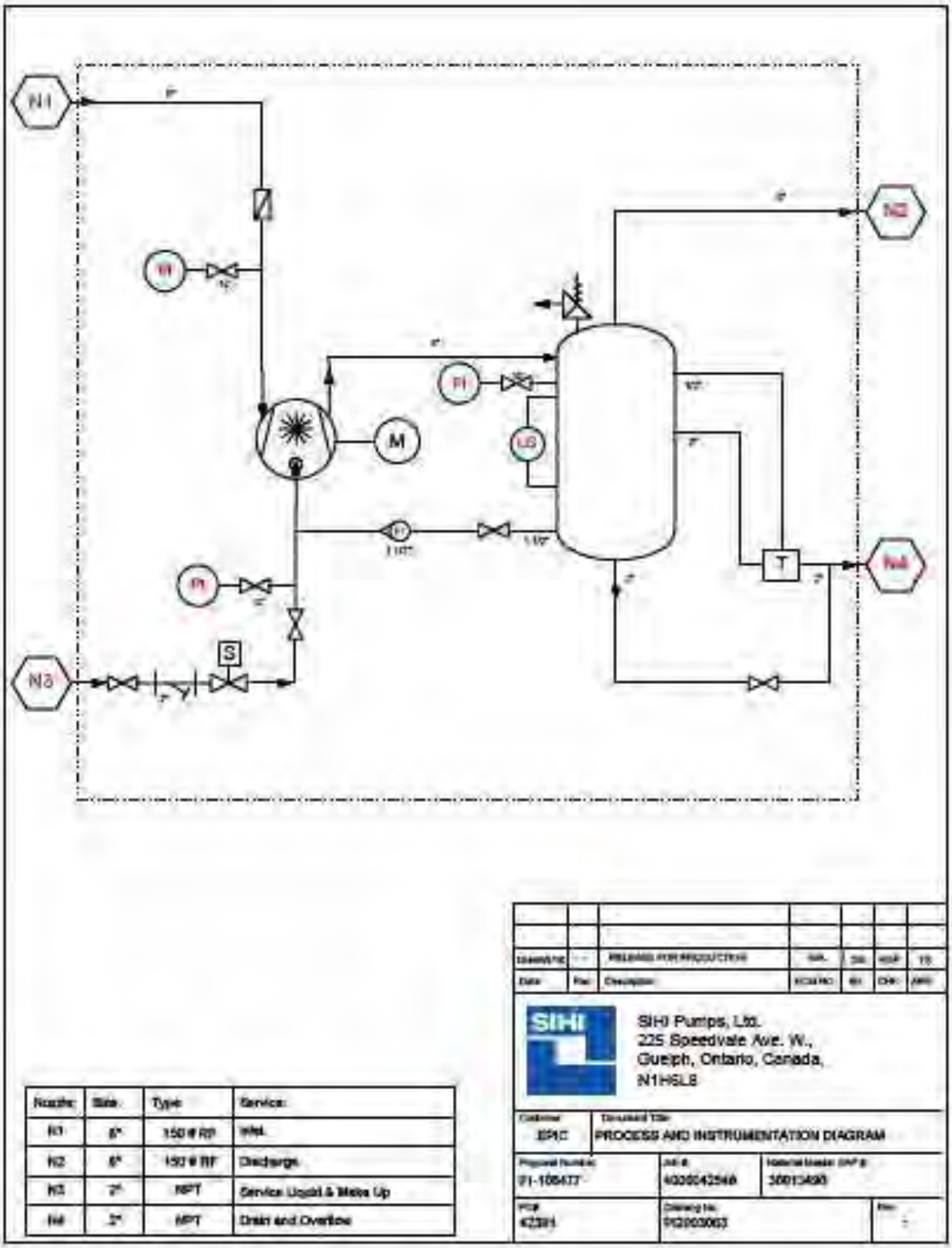
Current Performance

Pump Performance:

Capacity:	1293	SCFM
Suction Pressure:	15 (0.5)	in WC (psig)
Suction Temperature:	160	°F
Discharge Pressure:	14	PSIG
Pump Speed:	600	RPM
BHP:	124.3	
Service Liquid Rate:	39	USGPM

Note:

1. Assumed particulate are small enough to pass through pump to discharge.
2. Assumed less than 10 GPM of liquid load. Additional liquid load beyond 10GPM will change the conditions of the compressor and therefore change its performance.


N1
N2
N3
N4
M
PI
LS
T
S
SIHI Pumps, Ltd.
225 Speedvale Ave. W.,
Guelph, Ontario, Canada,
N1HSL8
PROCESS AND INSTRUMENTATION DIAGRAM
EPIC
Nozzle
Size
Type
Service
N1
6"
150 # RF
Inlet
N2
6"
150 # RF
Discharge
N3
2"
NPT
Service Liquid & Make Up
N4
2"
NPT
Drain and Overflow

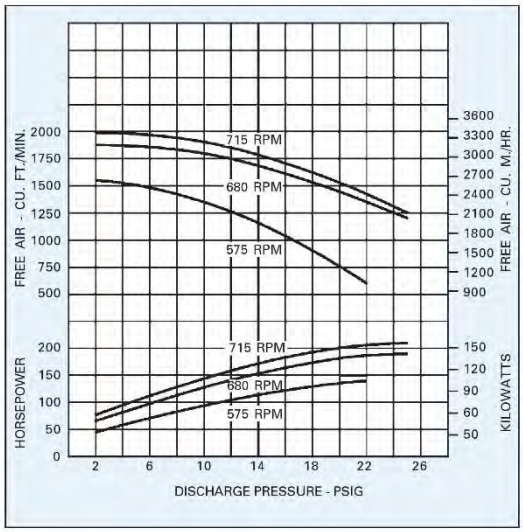
Retrofit for 150 HP

Stream No.	1	3	5	6
Name	Suction	SL Inlet	Vent	Drain
- - Overall - -				
Molar flow lbmol/h	173.4112	1164.8071	158.3066	1179.9120
Mass flow lb/h	5000.0000	20984.0000	4725.3198	21258.6816
Temp F	160.0000	85.0000	118.2807	118.2807
Pres psig	0.5498	0.5000	17.0000	17.0000
Vapor mole fraction	1.000	0.0000	1.000	0.0000
Enth MMBtu/h	-5.8560	-143.06	-4.3392	-144.21
Tc F	-94.5042	705.5600	-149.9013	705.4713
Pc psig	494.9584	3193.2808	558.9392	3192.5142
Std. sp gr. wtr = 1	0.839	1.000	0.831	1.000
Std. sp gr. air = 1	0.996	0.622	1.031	0.622
Degree API	37.2061	10.0000	38.7595	10.0062
Average mol wt	28.8332	18.0150	29.8492	18.0172
Actual dens lb/ft3	0.0662	62.1473	0.1528	61.7075
Actual vol ft3/hr	75563.6563	337.6494	30933.8008	344.5071
Std liq ft3/hr	95.4918	336.1319	91.0768	340.5469
Std vap 60F scfh	65805.8438	442019.4063	60073.9648	447751.3750

Current System

Stream No.	1	3	5	6
Name	Suction	SL Inlet	Vent	Drain
- - Overall - -				
Molar flow lbmol/h	173.4112	1081.6097	159.0463	1095.9746
Mass flow lb/h	5000.0000	19485.1992	4739.0376	19746.1621
Temp F	160.0000	85.0000	117.6282	117.6282
Pres psig	0.5498	0.5000	14.0000	14.0000
Vapor mole fraction	1.000	0.0000	1.000	0.0000
Enth MMBtu/h	-5.8560	-132.84	-4.4172	-133.97
Tc F	-94.5042	705.5600	-147.0391	705.4792
Pc psig	494.9584	3193.2808	555.5622	3192.5803
Std. sp gr. wtr = 1	0.839	1.000	0.831	1.000
Std. sp gr. air = 1	0.996	0.622	1.029	0.622
Degree API	37.2061	10.0000	38.6805	10.0057
Average mol wt	28.8332	18.0150	29.7966	18.0170
Actual dens lb/ft3	0.0662	62.1473	0.1382	61.7188
Actual vol ft3/hr	75563.6563	313.5325	34290.5234	319.9374
Std liq ft3/hr	95.4918	312.1234	91.2988	316.3163
Std vap 60F scfh	65805.8438	410447.7813	60354.6680	415898.9375

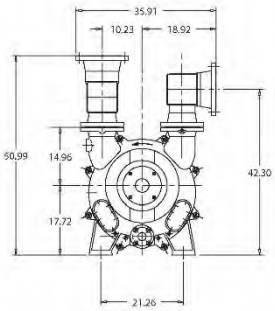
MEDIUM PRESSURE — SIHI ENGINEERING DATA — KPH 80557

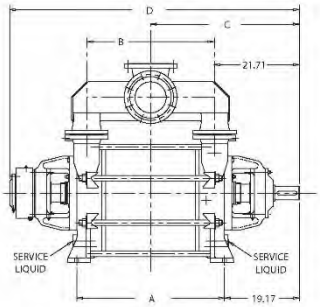


Dimensions (inches)

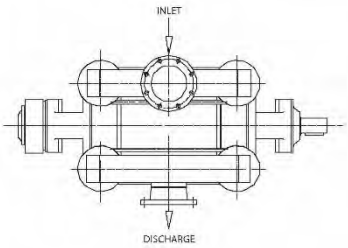
Pump Model	A	B	C	D
80557	37.87	32.80	38.11	74.25

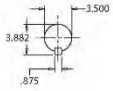
For connection sizes/ratings and motor sizes refer to engineering data table on reverse.





For baseplate mounting, please obtain factory certified dimensions.





Capacity Table

Pump Model - KPH 80557

Speed (RPM)	2 PSIG		5 PSIG		10 PSIG		15 PSIG		20 PSIG		22 PSIG		25 PSIG	
	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP
715	1988	77	1988	105	1925	145	1755	180	1535	202	1425	207	1250	210
680	1875	66	1875	90	1820	130	1655	160	1450	183	1375	188	1200	190
575	1550	45	1525	66	1365	95	1120	120	765	137	600	140		

This data represents average values for pumps in standard materials. Capacity in cubic feet per minute free air at 68°F (20°C) using 60°F (16°C) water as a service liquid. Discharge pressure measured at the pump discharge flange.

All data subject to change without notice.

Printed in U.S.A.

05.KPH 80557.01

DATA-KPH 80557-2013JAN10

ENGINEERING DATA

	PUMP MODEL	80557
	Gas Conn. Size/Rating (U)	8" / 150 RF
	Service Liq. Line Size/Rating (U_B)	2" / NPT
	Cont. Drain Size/Rating (U_{se})	1/2" / NPT
4	Motor (@ 1750 rpm) HP	200
	Bare Pump Wt. (lb)	3050
4	V-Belt Dr. Basemount (lb)	6255
	Min. V-Belt Sheave Dia.	Upon Request
	Separator/Trap Model	Upon Request
	Separator Size - Recirc. (Gal.)	140
1/2	Norm. Max. Gas Temp. (°F)	176
2	Max. Service Liq. Temp. (°F)	140
3	Sound Level (dBA)	87
	Moment of Inertia Wr^2 (lb. ft^2)	249.2
	Casing Max. WP / Hydro (psi)	30 / 45

1. Max. gas temperature with saturated gases.
2. Higher temperatures possible on request.
3. At 3 ft., 735 RPM w/o motor (not certified).
4. Basemount includes pump, motor, base, belt drive, belt guard, and motor slide base. Based on 680 RPM pump speed, and TEFC motor with 1800 RPM synchronous speed.

SERVICE LIQUID RATES (USGPM)

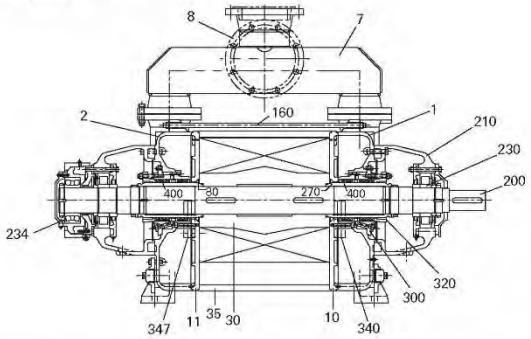
PUMP MODEL - KPH 80557

Pump Speed	5 PSIG			10 PSIG			15 PSIG			20 PSIG			25 PSIG		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
715		17	13		24	18		28	21.5		31.5	24		34	26
680	25	16	12	35	23	17	40	27	20	45	30.5	23	50	33	25
575		14.5	10		20.5	14.5		24	17.5		27.5	19.5			

Column 'A' is the flow in USGPM required - once through.
Column 'B' is the make-up flow required when make-up water is 5°C (9°F) cooler than service water.
Column 'C' is the make-up flow when make-up water is 10°C (18°F) cooler than service water.
For continuous operation, the service liquid supply pressure should be at least the suction pressure, plus 80% of the differential pressure from suction to discharge.

Note: The service liquid supply pressure may vary with pump speed and discharge pressure. Please consult factory engineering department for additional information.

SECTIONAL



Standard rotation 'AB' (clockwise) viewed from driven end. 'AL' (counter clockwise) upon request.

PARTS LIST

1. Suction Cover
2. Discharge Cover
7. Suction Manifold
8. Discharge Manifold
10. Intermediate
11. Intermediate
30. Impeller
35. Centerbody
80. O-ring
160. Tie Bolt Assembly
200. Shaft
210. Bearing Housing
230. Bearing
234. Bearing
270. Shaft Sleeve
300. Stuffing Box Flange
320. Gland
340. Orifice Plate Assembly
347. Orifice Plate Assembly
400. Packing
404. Lantern Ring

MATERIALS

ITEM	0B	4B
Casing-Wetted	Cast Iron	316 SS
Intermediates	Cast Iron	316 SS
Impeller(s)	Ductile iron	316 SS
Centerbody	Steel	316 SS
Shaft[5]	Steel	Steel
Shaft Sleeves	420 SS	316 SS
Shaft Sealing	041[6]	ADG[7]
Casing-Non Wetted	Cast Iron	Cast Iron

[5] Shaft is a non-wetted part [6] 041 = Packing (GFO or Equal) with liquid seal from the pump internals [7] ADG = single o-ring pusher seal with viton o-rings, carbon vs. ceramic faces

All data subject to change without notice.

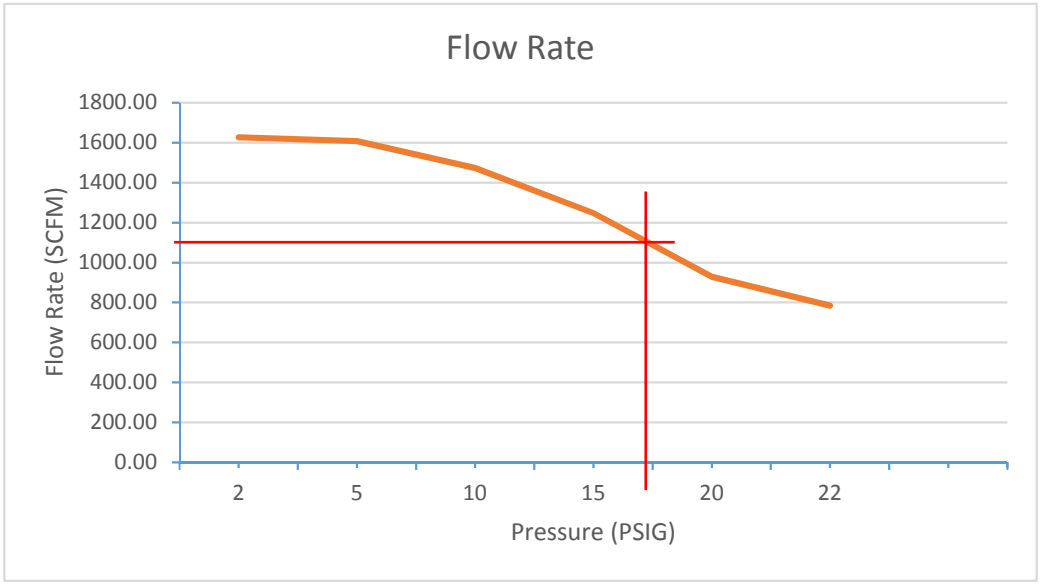
Pump Model - KPH 80557
Pump Performance Table

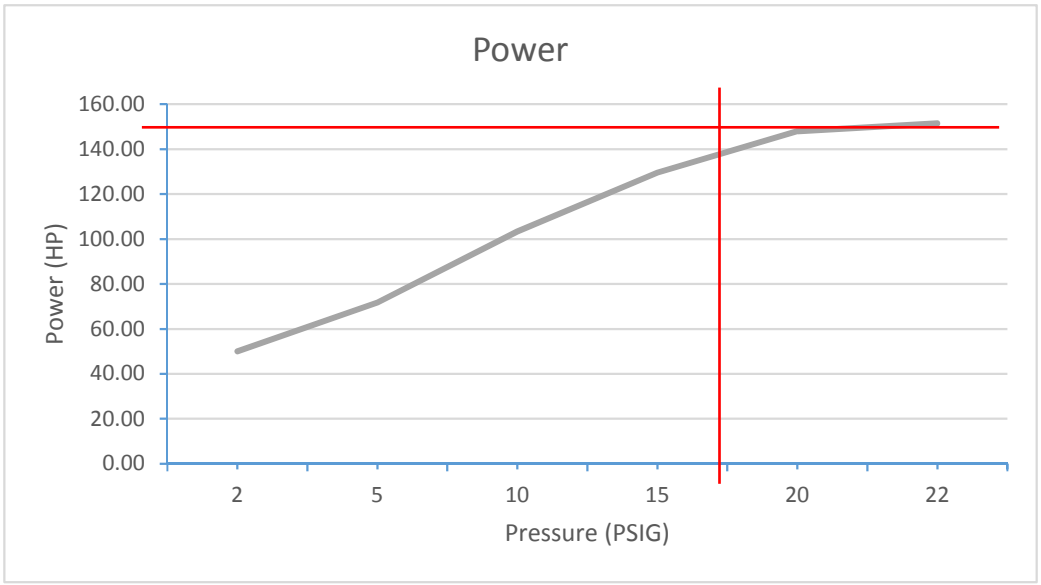
Speed	2 PSIG		5 PSIG		10 PSIG		15 PSIG		20 PSIG		22 PSIG		25 PSIG	
(RPM)	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP	scfm	HP
600	1627.38	50.00	1608.33	71.71	1473.33	103.33	1247.38	129.52	928.10	147.95	784.52	151.43	0	0
680	1875	66	1875	90	1820	130	1655	160	1450	183	1375	188	1200	190
575	1550	45	1525	66	1365	95	1120	120	765	137	600	140		

Pump Model - KPH 80557
Pump Performance Curve

600 RPM

Pressure	Flow Rate	Power
PSIG	SCFM	HP
2	1627.38	50.00
5	1608.33	71.71
10	1473.33	103.33
15	1247.38	129.52
20	928.10	147.95
22	784.52	151.43





APPENDIX 3 – HOST SITE REQUIREMENTS & DOCUMENTATION

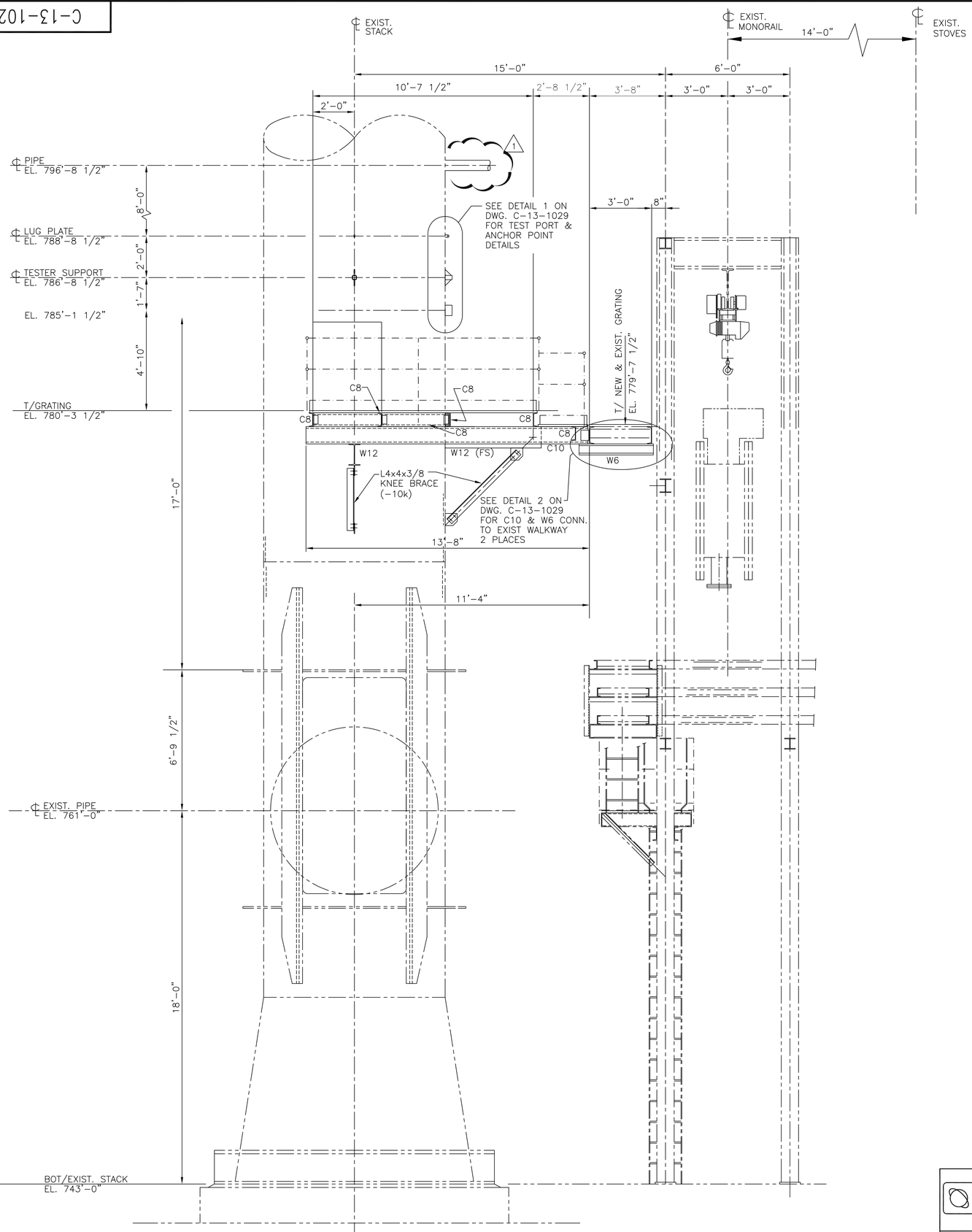
Photographs of Intended System Location


PEPSI

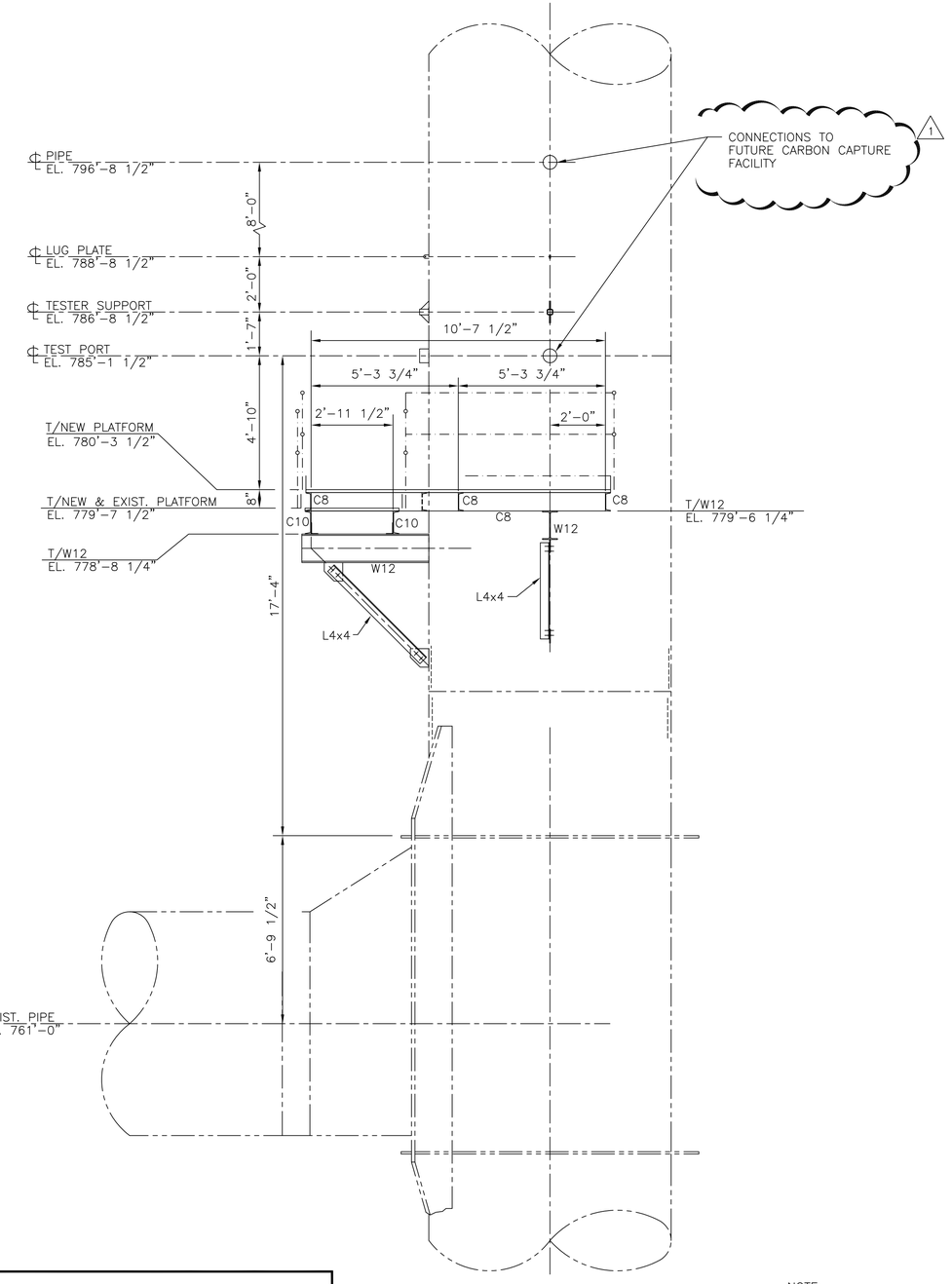

Safety
is a way of life!
72
COMPRESSED
PEPSI

Diagrams

C-13-1028



SECTION A-A



SECTION B-B

BILL OF MATERIAL

MARK	PC MK	REQ'D	DESCRIPTION	MAT'L	REMARKS	WEIGHT EA.	WEIGHT TOTAL

FOR CONSTRUCTION
8/25/2011

NOTE:
WORK THIS DRAWING WITH DRAWINGS C-13-1027, C-13-1029 & C-13-1030

ORBITAL ENGINEERING,® INC.
PITTSBURGH • CHICAGO • PHILADELPHIA
DETROIT • TOLEDO

PROJECT 01-2277

DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	1	FUTURE CARBON CAPTURE	DWB/NP
8/25/11	0	FOR CONSTRUCTION	

United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania.

IRON PRODUCING DIVISION
BLAST FURNACE NO. 3
HOT BLAST STOVES
WASTE GAS STACK TEST PORTS & ACCESS PLATFORM
SECTIONS

APPROP. NO.
JOB NO.
SCALE 3/8"=1'-0"

CLASSIFICATION

NO. C-13-1028

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R
GK	6/14/11	JL	8/24/11		

A-8-958

COOLING WATER STRAINERS					
STRAINER	SERIAL NO.	CAPACITY GPM	△P (PSI)	STRAINER MEDIA	DWG
WEST S-1	3688	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1405
CENTER S-2	3507	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1405
EAST S-2A	2365	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1404

COOLING WATER PUMPS	
HIGH PRESSURE (HP)	MEDIUM PRESSURE (MP)
PUMP HP-1 & HP-2	PUMP MP-1 & MP-2
HP-1 MOTOR DRIVEN (OPERATING) HP-2 STEAM TURBINE (STAND-BY) 7,400 GPM AT 289 TDH 450 HP	MP-1 MOTOR DRIVEN (OPERATING) MP-2 STEAM TURBINE (STAND-BY) 7,400 GPM AT 175 TDH 450 HP

PIPING CODE
LP - LOW PRESSURE
MP - MEDIUM PRESSURE
HP - HIGH PRESSURE

DRAWING INDEX:
BF3-01450
WORK THIS DWG WITH DWG:
A-8-1367, BF3-00572 & 573

7 2019 REPAIR:
REDRAWN IN CAD.
MOVED HBV TO CLOSE LOOP COOLING.

5 2001 REPAIR:
AS BUILT 16" LP BACK-UPS, 14" BYPASS.
REMOVED LCV-430 REPLACED WITH MANUAL VALVE.
CHANGED STRAINER S-2A TO AUTOMATED STRAINER.
REMOVED (2) 16" STRAINER BYPASS LINES.

6 FIELD CHANGES AS NOTED:
REMOVED 24" STRAINER BYPASS & 24" LP SUPPLY

4 ADDED BY PASS AT MAKE UP EMERGENCY LINE 8".

middough®
Performance You Trust™
www.middough.com

PROJECT No. USS1615 | DRAWING No.

DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	9	FUTURE CARBON CAPTURE	DWB/NP
7/27/20	8	ADD SERV. WTR. REF.	DWB/NP
8/30/19	7	2019 MAJOR REPAIR	MIDD
9/8/01	6	FIELD CHANGES	ATSI
5/14/01	5	2001 REPAIR	ATSI
8/20/82	4	ADDED BYPASS	KPM
1/22/82	3	REVISED FLOW QTY.	MAG
10/9/81	2	GENERAL REVISION	NA
7/23/81	1	GENERAL REVISION	MAG

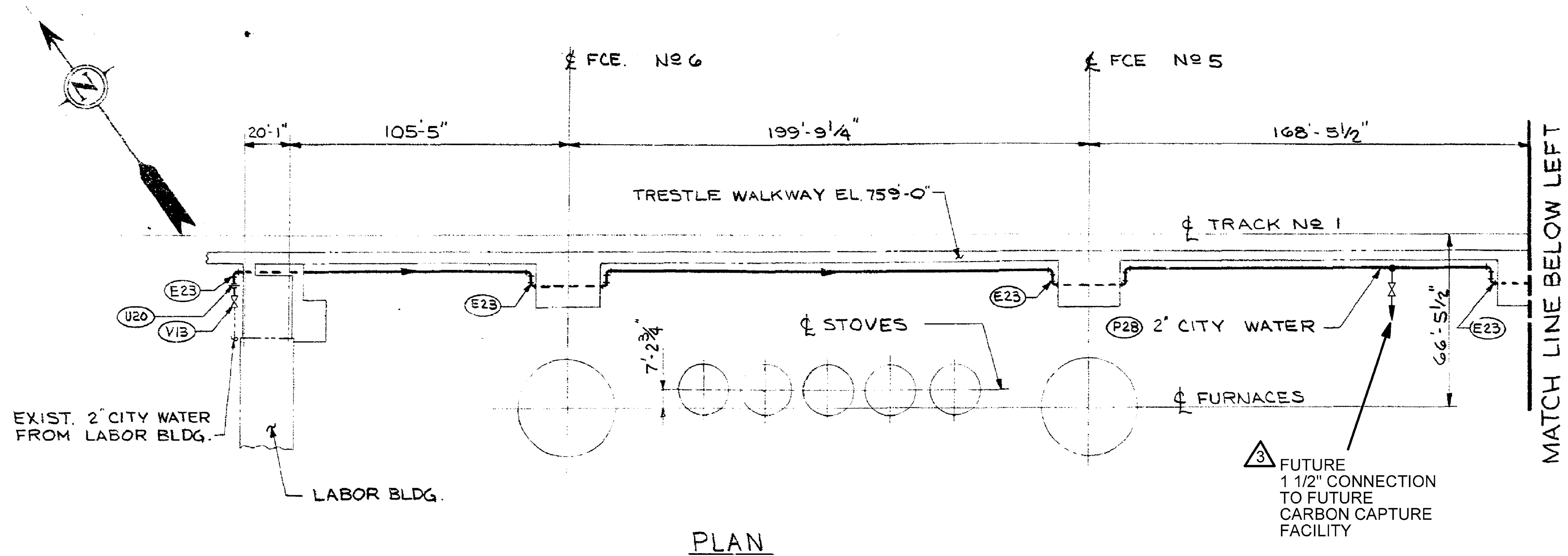
United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania

BLAST FURNACE NO.3
2019 MAJOR REPAIR
FURNACE PROPER
COOLING WATER FLOW DIAGRAM
PUMP HOUSE AREA

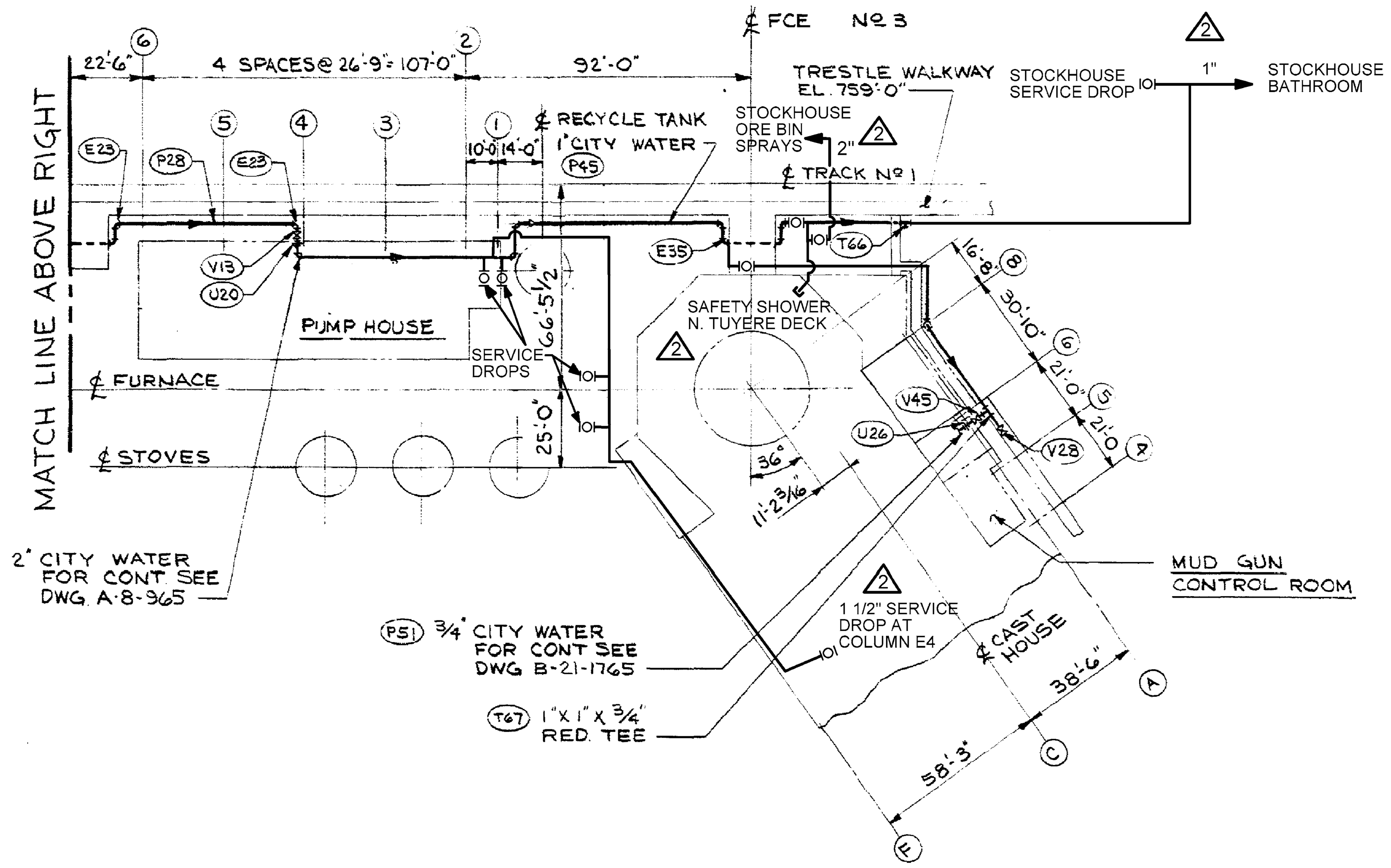
DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R
S. ISCH	8/19/19	BEAL	8/30/19		

APPROP. NO.
JOB NO.
SCALE AS NOTED
CLASSIFICATION
NO. A-8-958

A-8-1144



PLAN



PLAN

NOTES:

1. FOR GENERAL NOTES & REFERENCE DWG'S. SEE DWG. E-18-226
2. FOR BILL OF MATERIAL SEE DWG. A-8-1143
3. THIS DWG. IS SHOWN DIAGRAMATICALLY ONLY. CONTRACTOR IS TO ROUTE & SUPPORT IN FIELD.

BIDDING RELEASE ONLY	Dwg. Rev. No.	CONSTRUCTION RELEASE	Dwg. Rev. No.
SPEC. No. 757 ADD. - DATE 6-1-84 By RJM	1	SPEC. No. 536-6062 ADD. A DATE 2-9-82 By RWC	0
SPEC. No. ADD. DATE By		SPEC. No. 757 ADD. A DATE 7/20/84 By RJM	1

SEAL

REV.	DATE	MADE / CHKD.	DESCRIPTION	FILM ROLL No.
8				
7				
6				
5				
4				
3	6/30/25	DWB / NP	FUTURE CARBON CAPTURE	
2	8/12/20	DWB / NP	ADD GENERAL CITY WATER PIPING	
1	11-3-82	WTO / RWC	DWG. № WAS A-8-1154	830902

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
R.R.F	1-14-82	MAG	1/26/82	RWC	2/2/82	1" = 30'-0"
VENDOR P. O.		VENDOR DWG. No.		APPROP. No.		ACCT. No.

L.K. COMSTOCK ENGINEERING
5350334
536-95879

BLAST FURNACE DIVISION
BLAST FURNACE № 3-1981 RELINE
CITY WATER
TRESTLE PLAN
EDGAR THOMSON WORKS

PROJECT No.	DRAWING No.	REV.
536-6062	A-8-1144 3	1

ON ORIGINAL 0" 1" 2" 3"

RPC 0201 2736 E 5M 151 019

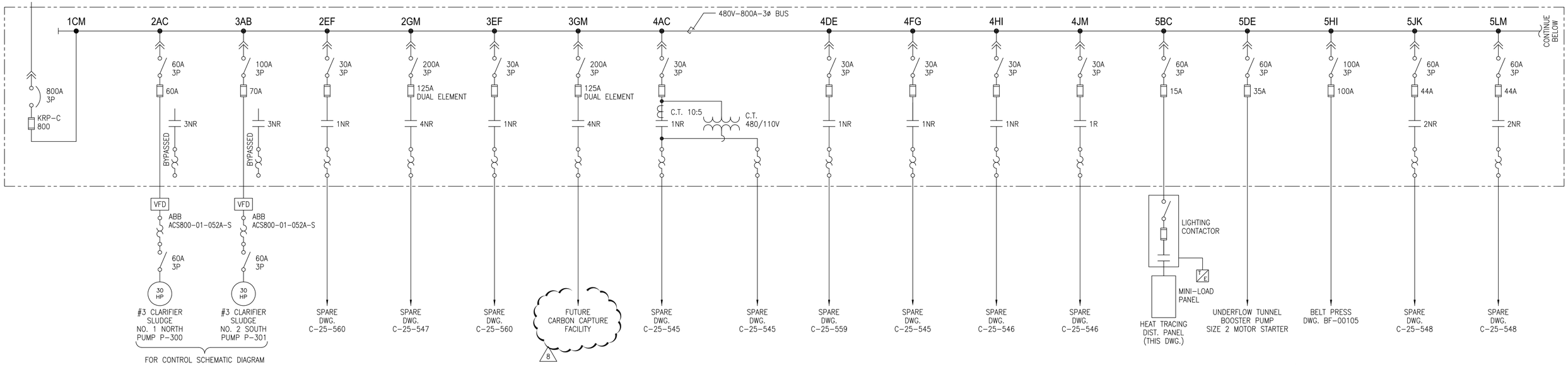
C-25-415

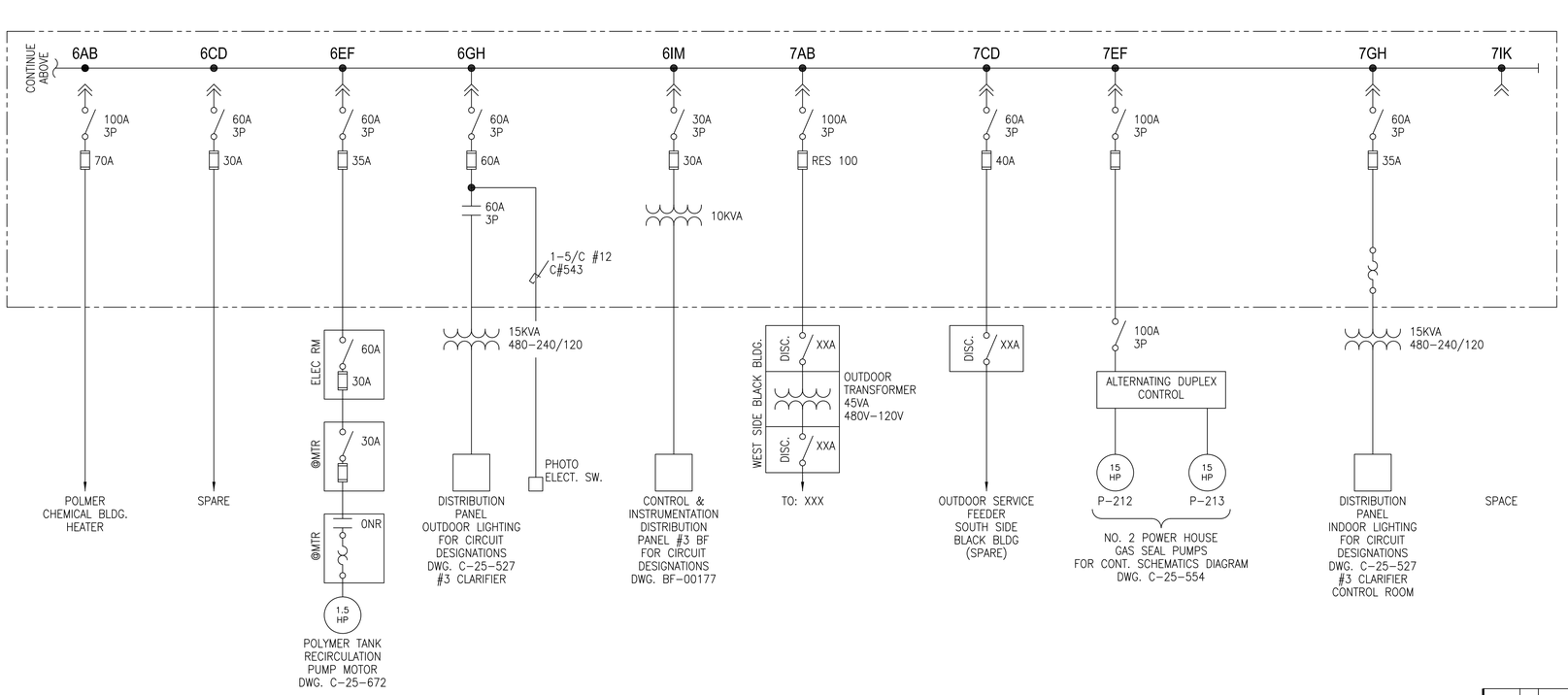
FROM BF 480V
WQC SUBSTATION NO. #3A
BREAKER 5-3 (DWG. D-18-576)
C-391 3 1/C 500 MCM
C-392 3 1/C 500 MCM

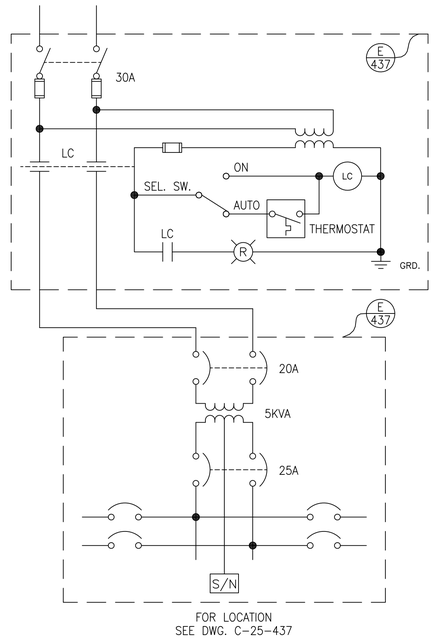
BILL OF MATERIAL								ORACLE DATA	
MARK	PC MK	REQ'D	DESCRIPTION	MAT'L	REMARKS	WEIGHT EA.	WEIGHT TOTAL	UOM	ORACLE ITEM NO.

MOTOR CONTROL CENTER - MCC A3 - 480V

NO. 3 CLARIFIER ELECTRICAL CONTROL ROOM - C-25-437







DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	8	FUTURE CARBON CAPTURE	DWB/NP
10/12/23	7	GENERAL UPDATE	DWB/DK
7/6/22	6	REDRAWN IN CAD / UPDATED	DWB/NP

United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania.

BLAST FURNACE NO. 3
WATER QUALITY CONTROL FACILITY - WQC
NO. 3 CLARIFIER CONTROL AND CHEMICAL ROOMS
MOTOR CONTROL CENTER - MCC A3
SINGLE LINE DIAGRAM

APPROP. NO.
JOB NO.
SCALE NA

CLASSIFICATION

ORACLE ASSET

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF. ENG'R

NO.
C-25-415

A-8-1003

TO BLAST FURNACE WEST END ORE BRIDGE SHANTY

FROM NO. 2 POWERHOUSE B-3-529

6" PLANT AIR

6" COMING PAST NO. 3 HOIST HOUSE

6" PLANT AIR

RECEIVER TANK

LOCATED SOUTH SIDE BELOW NO. 3 HOIST HOUSE

TO WEST END OF PLANT AND BOP L-26-475

2" 22

FURNACE NO. 3 INSTRUMENT AIR SHUT OFF

4" PLANT AIR

A-8-1000

1 1/2"

3/4"

AIR RECEIVER

4" PLANT AIR A-8-979

3/8" EQUALIZING

1" CONDENSATE

1" 3" 1"

AUTOMATIC DRAIN TRAP

LUBE OIL ROOM

2" BY-PASS

250# STEAM PRESS. RED. STATION A-8-1179

CLAY GUN ELECT. ROOM
A-8-979

4" BY-PASS

BF3IA1 17

SKIP CAR WATERING VALVES

1 1/2"

STOCKHOUSE
D-25-3409, D-25-3410

3/4" A-8-967

CASTHOUSE

A-8-997 2" INST. AIR

1" INST. AIR TO FUEL STATION AND TOP SPRAY FCV

A-8-997 A-8-1058

2" INST. AIR TO TAP HOLE DRILL

E-20-300

4"x2" RED.

A-8-966

4"x3" RED.

4"

PUMP HOUSE
A-8-965, A-8-980

TO DIAPHRAMS ON (3) STEAM CONTROL & SHUT-OFF VALVES

A-8-1000

A-8-1027

PRESSURE CONTROLLER

FILTER REGULATOR

PRESSURE REDUCER

1/4"

1"x1/4" RED.

1/4" INST. AIR

1" A-8-1027

3/8"

A-8-961

LAVAL SEPARATOR BLOWDOWN A-8-1021

A-8-1021

A-8-983

21

3" MANUAL SHUTOFF BALL VALVE

2" INST. AIR A-8-965, A-8-966

FILTER REGULATOR A-8-969

STOVE GAS SAFETY SHUT-OFFS

2"x1" RED.

1" INST. AIR A-8-969

ACCUM. TANK

D-17-325
D-17-326

FCE TOP AREA

ME 603

2" INST. AIR A-8-969

3" INST. AIR A-8-969

2" INST. AIR A-8-969

1 1/2"

D-12-120

TO BLEEDER VALVE ROOM

ME 604

RADIAMATICS

2" INSTRUMENT AIR A-8-974

3"x2" RED.

TE 147.2 TE 147.1 TE 127.2 TE 127.1 TE 107.2 TE 107.1

1" 1" 1" 1" 1" 1" 1" 1" 1" 1" 1" 1"

3/4" 3/4" 3/4" 3/4" 3/4" 3/4"

1" INST. AIR (TYP. 6 PLACES)

1"x3/4" REDUCER (TYP. 6 PLACES)

3"x2" RED.

A-8-1012

1" INST. AIR

1 1/2" INST. AIR A-8-968

2"x1 1/2" RED.

GAS CLEANING AREA

3" C-24-2275

C-24-2420

C-24-228

SAFETY LOCK-OUT VALVES

1/2" SAFETY VENTS (4 TYP.)

GAS COOLER

C-24-2424

C-24-2280

1 1/2" INST. AIR

3" INST. AIR C-24-2276

20

HOIST HOUSE

B-22-771

C-24-2276 C-24-2281

HOIST HOUSE INST. AIR SHUT OFF

C-24-2276 C-24-2282 C-24-2283

3"x2" RED.

19

TO GAS ANALYZER ROOM

FURNACE NO. 3 PLANT AIR SHUT OFF

A-8-967 BF3CA1 17

6" PLANT AIR A-8-977

3" PLANT AIR

STOVE WASTE GAS 02 SENSORS
B-20-451

FCV 102 FV 102 FCV 122 FV 122 FCV 142 FV 142

C-22-2054

1/2" 1/2" 1/2" 1/2" 1/2" 1/2"

1" INST AIR

STOVE GAS ENRICH. CONTROL VALVES

STOVE AREA

16

FROM NO. 2 POWER HOUSE AIR COMPRESSORS B-3-529

4" BALL VALVE

AIR CYL. FOR ORE SURGE HOPPER

AIR CYL. FOR COKE WEIGH HOPPER

4" SUMP DISCHARGE

SERVICE DROPS A-8-1017E

1/2" SAFETY VENTS (TYP. 8 PLACES)

L 3/4" 1 1/2"

1 1/2" PLANT AIR D-25-3049 D-25-3410

FILTER – REG. LUBRICATOR

STOCK HOUSE
D-25-3409, D-25-3410, D-25-3413

A-8-1009G

STOVE TOP

3/4"

1" PLANT AIR

A-8-974 A-8-975

1" SERVICE DROPS AT FURNACE TOP T/PLAT. EL. 859'-8 1/2"

A-8-1017B

FURNACE TOP

1 1/2"x1" RED.

A-8-1018

A-8-973 A-8-976

1 1/2"

A-8-1015 A-8-1016

A-8-1057 1 1/2" PLANT AIR

3/4" GALLERIES (TYP.)

A-8-1009B & A-8-1009G

FURNACE GALLERIES

(1) A-8-1017A

1 1/2" PLANT AIR

CASTHOUSE

3" PLANT AIR A-8-967

3/4"

3"x2" RED.

A-8-1009C

A-8-1009D

A-8-1009A

1" (TYP.)

IRON LADLE LEVEL MONITORING

18

2" PLANT AIR A-8-970

C-24-2423

DUST CATCHER AND PUG MILL PLATFORM SERVICE DROP – C-24-2421A

3" PLANT AIR A-8-966, A-8-967

4" RECEIVER TANK

23

ON GROUND NE OF NO. 3 BLAST FURNACE CASTHOUSE

TO BLAST FURNACE BAGHOUSE AND SOUTH SIDE OF NO. 1 BLAST FURNACE A-8-904

TO NO. 1 BLAST FURNACE A-8-904

PUMP HOUSE
A-8-965, A-8-980

A-8-1009B

3/4"

1" A-8-966

1 1/2" PLANT AIR

3" PLANT AIR A-8-966

A-8-1009A

3/4" 3/4"

STOVE PLATFORM

A-8-968, A-8-969, A-8-983, A-8-1012 AND A-8-1013

SOUTH STOVES

LOWER STOVE AREA

3/4" 3/4"

A-8-1017F

24

FUTURE CONNECTION TO CARBON CAPTURE FACILITY

3"

1 1/2" PLANT AIR C-24-2275

3/4" VENTURI SCRUBBER STRUCTURE PLATFORM

C-24-2421A

3/4" 3/4" 3/4"

C-24-2278, 2418, 2423

B-22-1017C

3/4"

EXIST. AIR RECEIVER B-22-771

HOIST HOUSE

1"

TO TOP BELL AIR CONT. D-18-466

3"x1 1/2" RED.

2" PLANT AIR C-24-2275 C-24-2276

C-24-2276

1 1/2"

C-24-2421A

3/4"

SNORT VALVE PLATFORM

1 1/2" PLANT AIR C-24-2275, C-24-2276

LEGEND

- PLANT AIR
- INSTRUMENT AIR
- GATE VALVE
- BALL VALVE
- CHECK VALVE
- L — SAFETY LOCKOUT DEVICE
- S — 3-WAY SOLENOID VALVE
- SPEED CONTROL VALVE
- PRESSURE REDUCING VALVE
- PRESSURE RELIEF VALVE
- REDUCER
- FLEX HOSE
- HOSE CONNECTION
- PRESSURE GAUGE
- PRESSURE CONTROLLER

	REV	DESCRIPTION	CHECKED BY
7/1/25	24	FUTURE CARBON CAPTION	DWB/NP
6/6/25	23	GENERAL REV AT RECEIVER TANK	DWB/NP
1/26/23	22	ADD 2" VALVE	DWB/NP
10/10/22	21	ADD 3" MANUAL SHUTOFF VALVE	DWB/NP
6/16/22	20	ADD LINE FROM HOIST HOUSE	DWB/NP
3/17/22	19	ADD 2" VALVE TO GAS ANALYZER	DWB/NP
2/7/22	18	GENERAL REVISION	DWB/NP

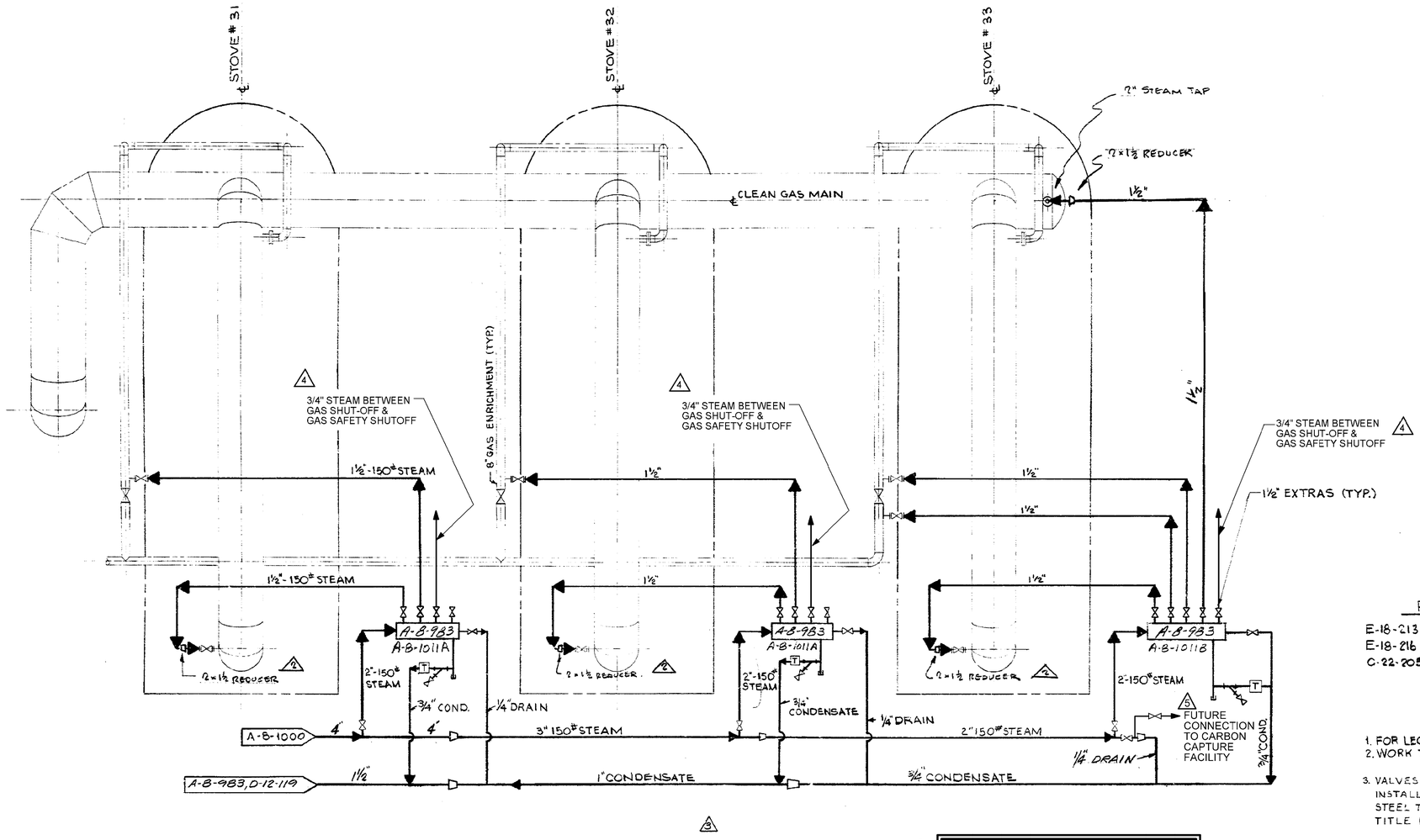
United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania

BLAST FURNACE NO. 3 PLANT AND INSTRUMENT AIR PIPING SCHEMATIC – FLOW DIAGRAM

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R

APPROP. NO.
JOB NO.
SCALE
CLASSIFICATION
NO. A-8-1003

A-8-1002



REFERENCE DWG'S.

E-18-213 GEN'L. ARRG'T. - PLOT PLAN
E-18-216 PIPING KEY PLAN
C-22-2059 GAS MAIN & ENRICHMENT GAS MAIN

NOTES:

1. FOR LEGEND SEE DWG. A-8-1000
2. WORK THIS DWG. WITH A-8-1000 & A-8-1001
3. VALVES MARKED THUS ⬭ ARE TO BE INSTALLED WITH A PUNCHED STAINLESS STEEL TAG WIRE TO VALVE; TAG TO READ TITLE INSIDE; EXAMPLE (OXYGEN SHUTOFF)

4 RECORD OF DOCUMENTED FIELD CONSTRUCTION CHANGES RECORDED SEPTEMBER 8, 2001

WORK THIS DWG WITH DWGS. A-8-1001 & C-22-2053 & C-22-2052 & C-22-2059

FOR REFERENCE ONLY
SPEC. 757 6-1-84

5350334 536-95879
M. Radovich 3/19/81 R. G. Havans

ON ORIGINAL 0" 1" 2" 3" CM

BIDDING RELEASE ONLY	Dwg. Rev. No.
SPEC. No. 6062-340 ADD. O DATE 3/25/81 By RWC	0
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	

CONSTRUCTION RELEASE	Dwg. Rev. No.
SPEC. No. 6062-340 ADD. A DATE 8/14/81 By RWC	0
SPEC. No. 6062-340 ADD. A DATE 2/19/82 By RWC	1
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By	

SEAL

REV.	DATE	MADE	CHKD.	DESCRIPTION	FILM ROLL No.
8					
7					
6					
5	7/10/25	DWB	NP	FUTURE CARBON CAPTURE	
4	9-8-01	ATSI		FIELD CHANGES NOTED	
3	5-11-84	D'N	JS	REMOVED DRAIN LINE	
2	10-12-82	KPM	MR	ADDED REDUCER AT 42" GAS LINE STEAM PURGE	[illegible]
1	1/19/82	WDJ	MAG	GENERAL REVISION	

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

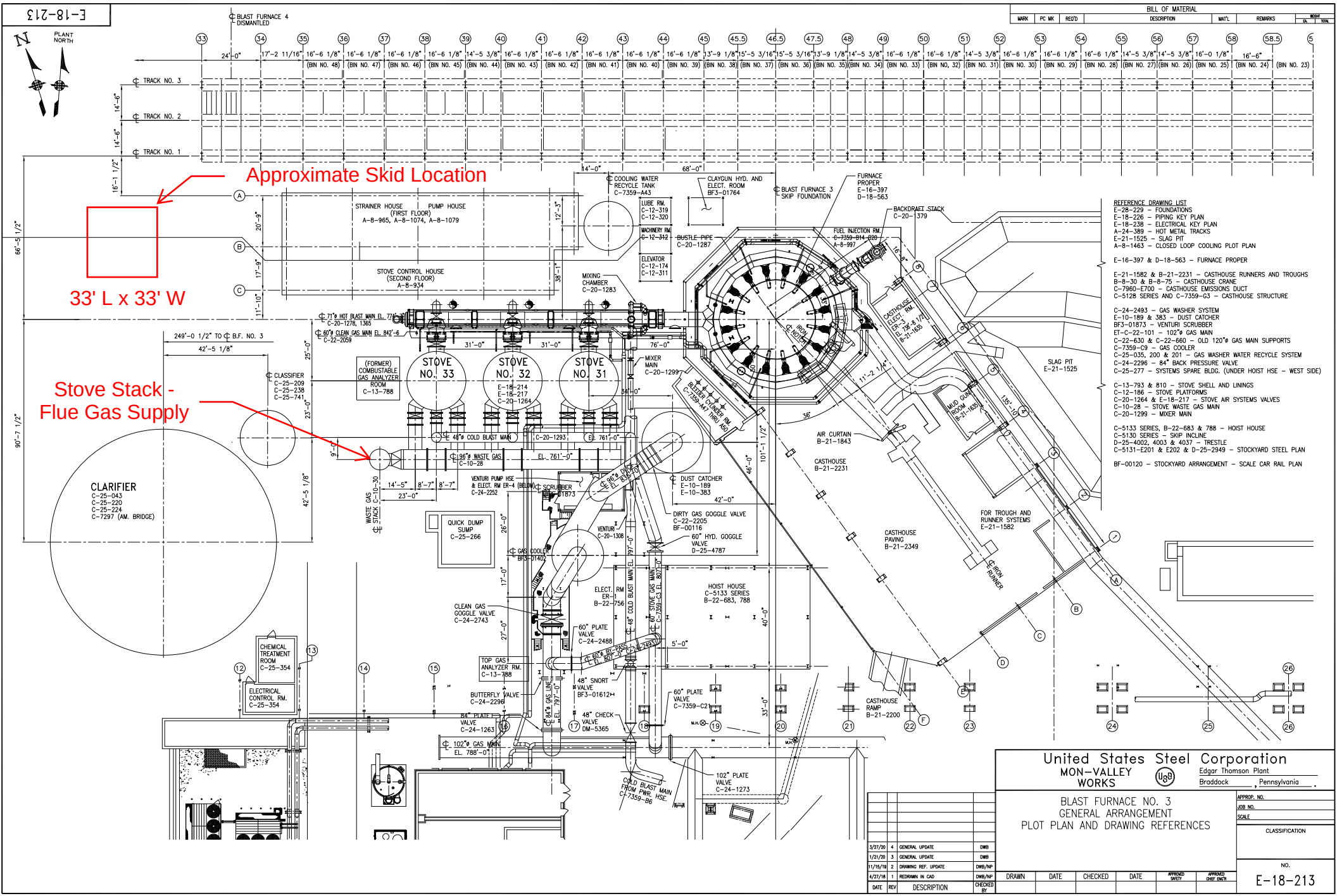
PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
HOODER	2-2-81	MAG	8/11/81	RWC	8/12/81	NONE

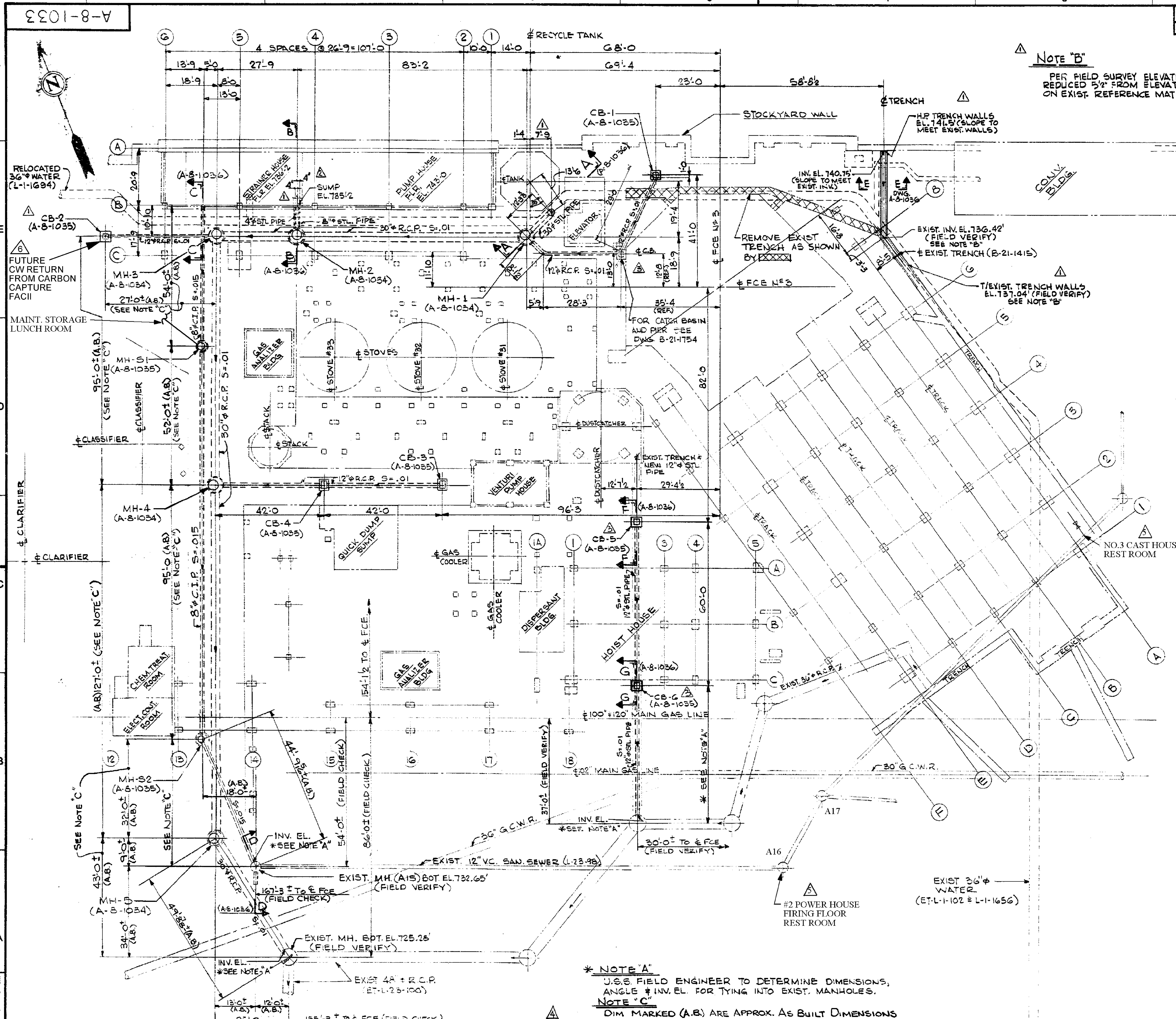
VENDOR P. O.	VENDOR DWG. No.	APPROP. No.	ACCT. No.

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 - 1981 RELINE
STEAM PURGING
SCHEMATIC SHEET #3
EDGAR THOMSON WORKS

PROJECT No.	DRAWING No.	REV.
536-6062	A-8-1002	4

RPC-0201-2736-E-5N-1080-35S


E-18-213
Approximate Skid Location
33' L x 33' W
Stove Stack - Flue Gas Supply
BLAST FURNACE 4 DISMANTLED
TRACK NO. 3
TRACK NO. 2
TRACK NO. 1
STRAINER HOUSE PUMP HOUSE (FIRST FLOOR) A-8-965, A-8-1074, A-8-1079
STOVE CONTROL HOUSE (SECOND FLOOR) A-8-934
COOLING WATER RECYCLE TANK C-7359-A43
CLAYGUN HYD. AND ELECT. ROOM BF3-01764
BLAST FURNACE 3 SKIP FOUNDATION
FURNACE PROPER E-16-397 D-18-563
BACKDRAFT STACK C-20-1379
FUEL INJECTION RM. C-7359-B14-B20 A-8-997
LUBE RM. C-12-319 C-12-320
MACHINERY RM. C-12-312
ELEVATOR C-12-174 C-12-311
BUSTLE PIPE C-20-1287
MIXING CHAMBER C-20-1283
71"ø HOT BLAST MAIN EL. 774'-6" C-20-1278, 1365
60"ø CLEAN GAS MAIN EL. 842'-6" C-22-2059
STOVE NO. 33
STOVE NO. 32
E-18-214 E-18-217 C-20-1264
STOVE NO. 31
(FORMER) COMBUSTABLE GAS ANALYZER ROOM C-13-788
MIXER MAIN C-20-1299
BLEEDER RUNNER RM. C-7359-A47 THRU A50
CASTHOUSE ELECT. ROOM ER-3 EL. 796'-1 1/2" B-21-1635
IRON RUNNER
SLAG PIT E-21-1525
MUD GUN ROOM B-21-1630
AIR CURTAIN B-21-1843
CASTHOUSE B-21-2231
CASTHOUSE PAVING B-21-2349
FOR TROUGH AND RUNNER SYSTEMS E-21-1582
CASTHOUSE RAMP B-21-2200
CLASSIFIER C-25-209 C-25-238 C-25-741
CLARIFIER C-25-043 C-25-220 C-25-224 C-7297 (AM. BRIDGE)
249'-0 1/2" TO ℄ B.F. NO. 3
42'-5 1/8"
48"ø COLD BLAST MAIN C-20-1293 EL. 761'-0"
96"ø WASTE GAS C-10-28 EL. 761'-0"
WASTE GAS STACK C-10-30
VENTURI PUMP HSE & ELECT. RM ER-4 (BELOW) C-24-2252
SCRUBBER BF3-01873
QUICK DUMP SUMP C-25-266
GAS COOLER BF3-01402
VENTURI C-20-1308
DUST CATCHER E-10-189 E-10-383
DIRTY GAS GOGGLE VALVE C-22-2205 BF-00116
60" HYD. GOGGLE VALVE D-25-4787
ELECT. RM ER-1 B-22-756
HOIST HOUSE C-5133 SERIES B-22-683, 788
CLEAN GAS GOGGLE VALVE C-24-2743
60" PLATE VALVE C-24-2488
48" COLD BLAST MAIN EL. 797'-0"
60" STOVE GAS MAIN C-7359-C3 EL. 807'-0"
60" BY-PASS EL. 807'-0" C-24-2493
CHEMICAL TREATMENT ROOM C-25-354
ELECTRICAL CONTROL RM. C-25-354
TOP GAS ANALYZER RM. C-13-788
BUTTERFLY VALVE C-24-2296
84" PLATE VALVE C-24-1263
84"ø GAS LINE EL. 797'-0"
48" SNORT VALVE BF3-01612
48" CHECK VALVE DM-5365
60" PLATE VALVE C-7359-C2
102"ø GAS MAIN EL. 788'-0"
102" PLATE VALVE C-24-1273
COLD BLAST MAIN FROM PWR. HSE C-7359-B6
REFERENCE DRAWING LIST
E-28-229 – FOUNDATIONS
E-18-226 – PIPING KEY PLAN
E-18-238 – ELECTRICAL KEY PLAN
A-24-389 – HOT METAL TRACKS
E-21-1525 – SLAG PIT
A-8-1463 – CLOSED LOOP COOLING PLOT PLAN
E-16-397 & D-18-563 – FURNACE PROPER
E-21-1582 & B-21-2231 – CASTHOUSE RUNNERS AND TROUGHS
B-8-30 & B-8-75 – CASTHOUSE CRANE
C-7960-E700 – CASTHOUSE EMISSIONS DUCT
C-5128 SERIES AND C-7359-G3 – CASTHOUSE STRUCTURE
C-24-2493 – GAS WASHER SYSTEM
E-10-189 & 383 – DUST CATCHER
BF3-01873 – VENTURI SCRUBBER
ET-C-22-101 – 102"ø GAS MAIN
C-22-630 & C-22-660 – OLD 120"ø GAS MAIN SUPPORTS
C-7359-C9 – GAS COOLER
C-25-035, 200 & 201 – GAS WASHER WATER RECYCLE SYSTEM
C-24-2296 – 84" BACK PRESSURE VALVE
C-25-277 – SYSTEMS SPARE BLDG. (UNDER HOIST HSE – WEST SIDE)
C-13-793 & 810 – STOVE SHELL AND LININGS
C-12-186 – STOVE PLATFORMS
C-20-1264 & E-18-217 – STOVE AIR SYSTEMS VALVES
C-10-28 – STOVE WASTE GAS MAIN
C-20-1299 – MIXER MAIN
C-5133 SERIES, B-22-683 & 788 – HOIST HOUSE
C-5130 SERIES – SKIP INCLINE
D-25-4002, 4003 & 4037 – TRESTLE
C-5131-E201 & E202 & D-25-2949 – STOCKYARD STEEL PLAN
BF-00120 – STOCKYARD ARRANGEMENT – SCALE CAR RAIL PLAN
BILL OF MATERIAL
MARK PC MK REQ'D DESCRIPTION MAT'L REMARKS WEIGHT EA. TOTAL
United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania
BLAST FURNACE NO. 3
GENERAL ARRANGEMENT
PLOT PLAN AND DRAWING REFERENCES
APPROP. NO.
JOB NO.
SCALE
CLASSIFICATION
NO.
E-18-213
3/27/20 4 GENERAL UPDATE DWB
1/21/20 3 GENERAL UPDATE DWB
11/15/19 2 DRAWING REF. UPDATE DWB/NP
4/27/18 1 REDRAWN IN CAD DWB/NP
DATE REV DESCRIPTION CHECKED BY
DRAWN DATE CHECKED DATE APPROVED SAFETY APPROVED CHIEF ENGR.



Note "B"

PER FIELD SURVEY ELEVATIONS ARE REDUCED 5½" FROM ELEVATIONS SHOWN ON EXIST. REFERENCE MATERIAL.

GENERAL NOTES FOR UNDERGROUND SEWERS

1. ALL CONCRETE AND SEWER WORK SHALL BE IN ACCORDANCE WITH U.S.S. SPEC. 536-6062-720 SECTION 44, UNLESS NOTED.
2. ALL STORM SEWER PIPE TO BE R.C.P. CLASS IV ASTM C-76 (30" PIPE ~3½" WALLS & 12" PIPE ~2" WALLS). JOINTS SHALL BE FLEXIBLE RUBBER GASKET TYPE - ASTM C-361 (LATEST REV.). GASKET MATERIAL SHALL BE BUNA-N DESIGNATED MILL TYPE. PIPE TO BE LAID ON MINIMUM 6" WELL TAMPED SAND.
3. ALL SANITARY SEWER PIPE TO BE CAST IRON EXTRA HEAVY, BELL & SPIGOT - ASTM A-74 (LATEST REV.). PIPE JOINTS SHALL BE RUBBER GASKET PUSH-ON TYPE - ASTM C564. PIPE TO BE LAID ON MINIMUM 6" WELL TAMPED SAND.
4. ALL STEEL PIPE TO BE EXTRA STRONG, COATED & WRAPPED.
5. MANHOLE SECTIONS TO BE PRECAST, REINFORCED CONCRETE IN ACCORDANCE WITH ASTM C478. JOINTS SHALL BE "O" RING RUBBER GASKETS MEETING REQUIREMENTS OF ASTM C-443.
6. CAST IN PLACE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSION STRENGTH OF 3000 P.S.I. @ 28 DAYS.
7. REINFORCING BARS SHALL BE GRADE 60 DEFORMED, MEETING ASTM A-615 SPEC. & SHALL BE PLACED ACCORDING TO LATEST ACI CODE.
8. STORM SEWER, SANITARY SEWER & CATCH BASIN FRAMES & COVERS TO BE "NEENAH" SERIES (OR APPROVED EQUAL) AS SHOWN ON MANHOLE AND CATCH BASIN DETAILS.
9. ALL EXPOSED UNDERGROUND FACILITIES TO BE SUPPORTED BY CONTRACTOR DURING CONSTRUCTION. CAUTION TO BE EXERCISED WHILE EXCAVATING. EXACT LOCATION OF ALL UNDERGROUND FACILITIES IS UNKNOWN. CONTACT DESIGN ENG., PGH. FOR ANY INTERFERENCE.

REFERENCE DWG'S.

NEW DWG'S
- A-8-1034 ~ UNDERGROUND SEWERS - DETAILS & SECTIONS
- A-8-1035 ~ " " - "
- A-8-1036 ~ " " - SECTIONS
- A-8-940 ~ PUMP & STRAINER HOUSE - FDN. PLAN
- A-8-941 ~ " " " " - "
- C-13-780 ~ STOVE FDN. PLAN
- A-24-391 ~ YARD PAVING & GRADING

EXIST. DWG'S
- ET-L-1-102 ~ PLANT WATER SUPPLY PIPING
- ET-L-23-100 ~ STORM SEWER SYSTEM
- L-23-98 ~ SANITARY SEWER SYSTEM
- E-16-101 ~ FCE № 3 FDN.
- B-21-1615 ~ CONCRETE PAVING & DRAINAGE TRENCH @ CAST HSE

* NOTE "A"

U.S.S. FIELD ENGINEER TO DETERMINE DIMENSIONS, ANGLE & INV. EL. FOR TYING INTO EXIST. MANHOLES.

NOTE "C"

DIM MARKED (A.B.) ARE APPROX. AS BUILT DIMENSIONS

BILL OF MATERIAL

MK.	REQ'D.	DESCRIPTION	MAT'L.	REMARKS	WT. EA.	ORDER NO.

REV.	DATE	MADE / CHKD.	DESCRIPTION
8			
7			
6	8-5-25	DWB / NP	FUTURE CARBON CAPTURE
5	3-14-07	DWB / GF	GENERAL REVISION
4	9-16-86	RWM	REVISED M.H. LOCATIONS & ADDED NOTE "C"
3	5-20-81	GK / BK	ADDED CB-5 & CB-6 @ HOIST HOUSE AREA & REVISED LOCATION OF C.B. @ FCE. CO. FDN.
2	4-30-81	RG	SPACE BETWEEN 4"φ & 8"φ PIPES TO ¢ MH-2 CHANGED.
1	3-26-81	BK	REMOVED HOLD, RELOCATED 4"φ PIPE TO MH-2, RELOCATED CB-2, ADDED DRAINAGE TRENCH

FILM ROLL No. 83C923

BIDDING RELEASE ONLY / CONSTRUCTION RELEASE: SPEC. No. 536-6062-720-B DATE 1/20/81 By HLS

United States Steel Corporation
Engineering
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
GJK	12-23-80	B.K.	1-19-81	JGM	1-19-81	1/16" = 1'-0

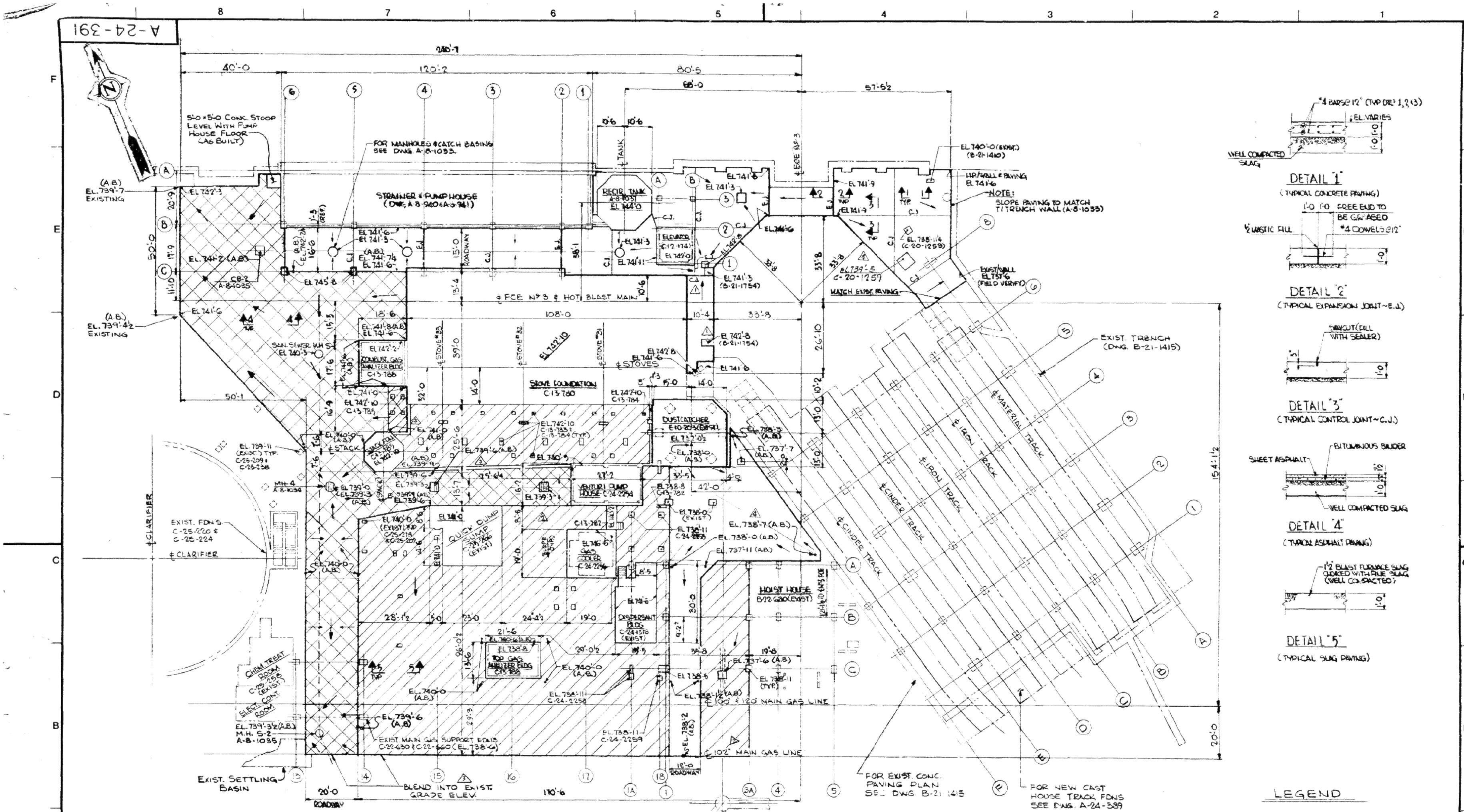
VENDOR P. O.	VENDOR DWG. No.	APPROP. No.	ACCT. No.
		E1-0233	5001

SCOPE №. M12

L.K. COMSTOCK ENGINEERING COMPANY INC.
CONTRACT No. 5350334 — 536-95879

BLAST FURNACE DIVISION
BLAST FURNACE № 3 1981 RELINE
UNDERGROUND SEWERS
PLAN
EDGAR THOMSON WORKS

PROJECT No. 536-6062 — DRAWING No. A-8-1033 — REV. 4



NOTE: ⚠5

ALL ELEVS. MARKED (A.B.) ARE AS BUILT ELEVS. ALL SLOPES SHOWN ON DWG. WERE CALCULATED USING ORIGINAL DESIGN ELEVATIONS. AS BUILT SLOPES ARE NOT SHOWN

NOTES:

1. FOR GENERAL CONCRETE NOTES SEE DWG. E-18-229.
2. NEW FOUNDATIONS, UNDERGROUND SEWERS AND PIPING TO BE IN PLACE BEFORE PAVING IS PLACED.
3. FOR UNDERGROUND SEWERS SEE DWG. A-8-1033.
4. ½" EXP. JOINT MAT'L. TO BE PLACED WHERE CONC. PAVING BUTTS AGAINST NEW OR EXIST. FDN'S.

LEGEND

- SLAG AREA (SLOPE TO DRAIN)
- CONCRETE
- ASPHALT

REV.	DATE	MADE	CHKD.	DESCRIPTION	FILM ROLL No.
8					
7					
6					
5	9-24-85	RM	SM	ADDED AS BUILT ELEVS. & NOTE	
4	7-12-84	[illegible]	JT	REMOVED SLAG PIT FDN., ADDED BLOWER FDN.	
3	5-3-84	JT		INCREASED LGTH. OF ROADS & ADDED L SHAPED RETAINING WALL	
2	8-12-82	MRS	KPM	ADDED 12'-0 ROAD TO D.C. CH'GD CONC. ROAD TO ASPHALT	830003
1	5-20-81	GK	BK	RELEASED DWG. FOR CONST. & REMOVED HOLDS	

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
GJK	3/18/81	B.K.	4-21-81	JGM	4-22-81	1/16" = 1'-0

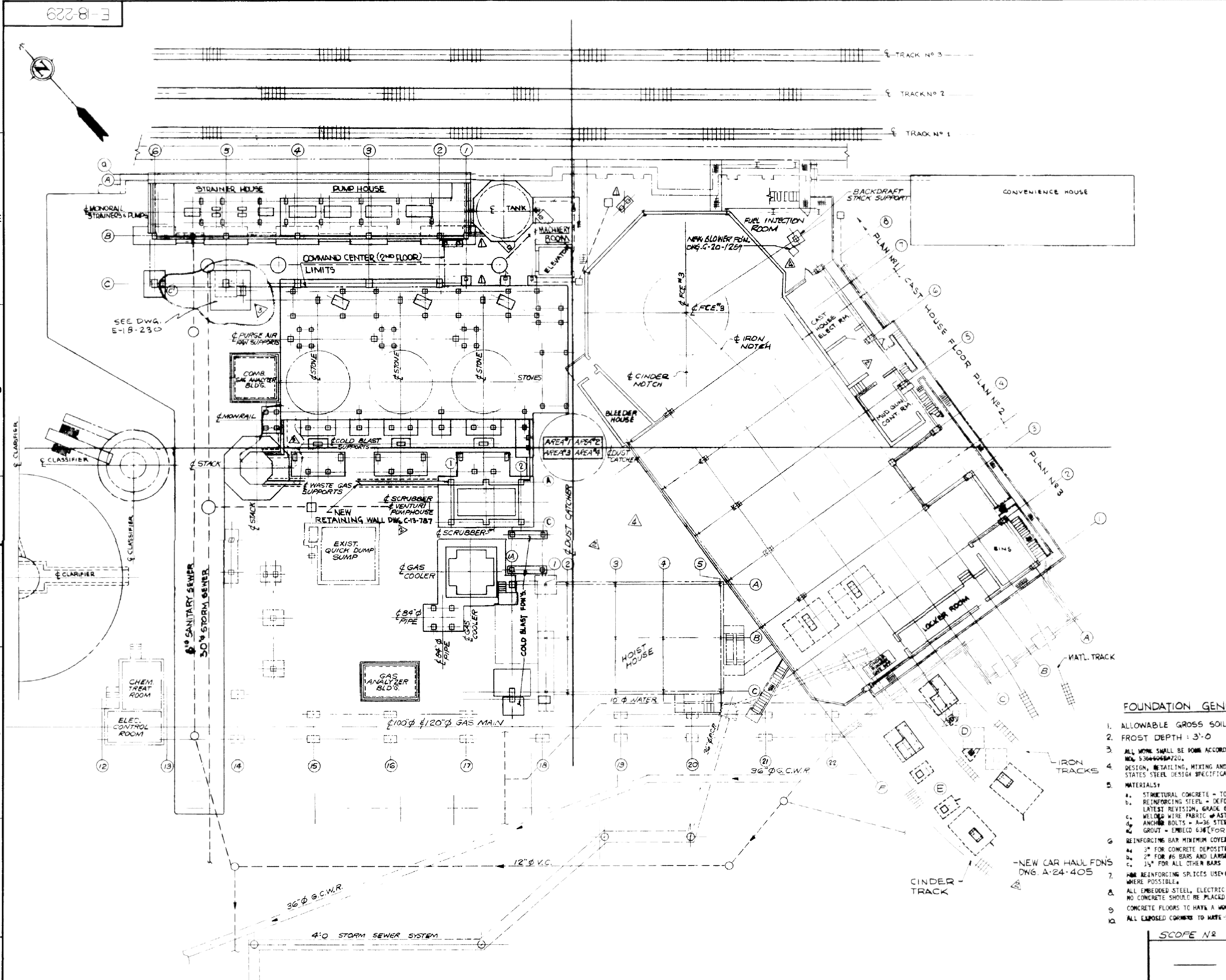
VENDOR P. O. | VENDOR DWG. No | APPROP. No. | ACCT. No. 9800

SCOPE Nº M9

L.K. COMSTOCK ENGINEERING COMPANY, INC.
5350334 536-95879

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 1981 RELINE
YARD PAVING & GRADING
PLAN & DETAILS
EDGAR THOMSON WORKS

PROJECT No. 536-6062 DRAWING No. A-24-391 REV 5



CIVIL GENERAL DRAWING INDEX

DWG. Nº	DESCRIPTION
A-8-933	MISC. BLDG PLOT PLAN
A-8-1033	UNDERGROUND SEWERS PLAN
A-24-384	RAILROAD TRACK REMOVAL PLAN
A-24-388	RAILROAD TRACK ALIGNMENT PLAN
A-24-389	CAST HOUSE RAILROAD TRACK PLAN
C-13-775	EXCAVATION & DEMOLITION PLAN
C-13-776	EXCAVATION & DEMOLITION PLAN
E-18-230	FOUNDATION PLAN AREA 1
E-18-231	FOUNDATION PLAN AREA 2
E-18-232	FOUNDATION PLAN AREA 3
E-18-233	FOUNDATION PLAN AREA 4
A-24-391	YARD PAVING & GRADING
E-18-226	PIPING GENERAL ARRG'T
E-18-239	ELECTRICAL DWG. INDEX
ABD-C7359-INDEX4	LIST OF INDEXES

FOUNDATION GENERAL NOTES:

1. ALLOWABLE GROSS SOIL BEARING PRESSURE = 2.5 K.S.F.
2. FROST DEPTH : 3'-0
3. ALL WORK SHALL BE DONE ACCORDING TO UNITED STATES STEEL CORPORATION SPECIFICATION NO. 536-6062-720.
4. DESIGN, DETAILING, MIXING AND PLACING OF CONCRETE SHALL BE IN ACCORDANCE WITH UNITED STATES STEEL DESIGN SPECIFICATION FOR CONCRETE CE-101.
5. MATERIALS:
   a. STRUCTURAL CONCRETE - TO HAVE A MINIMUM COMPRESSION STRENGTH OF 4000 psi AT 28 DAYS
   b. REINFORCING STEEL - DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO ASTM A615, LATEST REVISION, GRADE 60
   c. WELDED WIRE FABRIC - ASTM A185, LATEST REVISION
   d. ANCHOR BOLTS - A-36 STEEL (UNLESS NOTED)
   e. GROUT - EMBECO 636 (FOR EQUIP.) (STRUCT GROUT) - PORTLAND CEMENT
6. REINFORCING BAR MINIMUM COVER
   a. 3" FOR CONCRETE DEPOSITED AGAINST SOIL OR ROCK
   b. 2" FOR #6 BARS AND LARGER (UNLESS NOTED)
   c. 1½" FOR ALL OTHER BARS (UNLESS NOTED)
7. FOR REINFORCING SPLICES USE CLASS C SPLICE UNLESS SHOWN OTHERWISE, STAGGER ALL SPLICES WHERE POSSIBLE.
8. ALL EMBEDDED STEEL, ELECTRIC CONDUIT AND PIPES ARE TO BE IN PLACE BEFORE PLACING CONCRETE. NO CONCRETE SHOULD BE PLACED UNTIL RELEASED BY UNITED STATES STEEL FIELD ENGINEER.
9. CONCRETE FLOORS TO HAVE A WOOD FLOAT OR EQUIVALENT FINISH. (UNLESS NOTED)
10. ALL EXPOSED CORNERS TO HAVE 1" CHAMFER. (UNLESS NOTED)

SCOPE Nº

L.K. COMSTOCK ENGINEERING COMPANY, INC.
L.K.C.E. CONTRACT No. 5350334 — CUSTOMER'S ORDER No. 536-[illegible]

REV.	DATE	MADE	DESCRIPTION	FILM ROLL No.
8				
7				
6				
5				
4	7-10-84	LG JT	RELOCATED BLOWER FDN'S, REMOVED SLAG PIT FDN	
3	3-28-84	R.W.C. JT	ADDED FDTN. FOR DIAGONAL STRUT @ COL. ROW C' ADDED L SHAPED RET. WALL & GROUT NOTE	
2	8-11-82	MPJ	ADDED SLAG PIT, CAR HAUL, BLOWER & RETAINING WALL FDN'S	
1	12-16-81	DR GK	ADDED PIPE SUPPORT FDNS	

BIDDING RELEASE ONLY — SPEC. No. 536-6062-720 ADD. A DATE 10-28-80; SPEC. No. 757 ADD. — DATE 6/11/84; SPEC. No. 757 ADD. B DATE 7/27/84

CONSTRUCTION RELEASE — SPEC. No. 536-6062-720-B DATE 1/26/81; SPEC. No. 757 ADD. B DATE 7/27/84

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
B.K.	11/18/80	FWA	12/8/80	JGM	1-16-81	1/16" = 1'-0"

VENDOR P. O.	VENDOR DWG. No.	APPROP. No.	ACCT. No.
		E1-0233	—

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 - 1981 RELINE
FOUNDATIONS
KEY PLAN
EDGAR THOMSON WORKS

PROJECT No.	DRAWING No.	REV.
536-6062	E-18-229	4

Mon Valley Works Contractor & Outsourcing Safety Requirement

Safety & I.H. Process Document	Title:	Mon Valley Works Contractor & Outsourcing Safety Requirement		
	Document Number:	SMS-MVW-CON-01		
	Revision:	003	Plant:	Mon Valley Works
	Review Frequency:	Annual	Issue Date:	7/22/2020
	Owner/Approver:	John Preffer	Date Reviewed/Revised:	1/18/2023
	Reviewer/Participants:	J. Preffer, G. Hilliard		

1.0 Purpose

The purpose of this document is to define Mon Valley Works (MVW) specific requirements for contractors coming into a Mon Valley Works facility to work. Corporate level requirements are not outlined in this document and are defined in our S00-1.

2.0 Scope

This document will apply to all contractors who perform any type of work in a Mon Valley Works facility. The requirements in this document does not apply to consultants, visitors, delivery drivers, or employees who will not perform work and/or will be escorted by a USS representative. The Visitors Protocol will address those scenarios. Plant Medical is not included in the scope defined in this document.

3.0 References

3.1 Hazardous Job Meeting Safety Standard Practices
3.2 S-001
3.3 Visitors Protocol
3.4 Contractor Safety Management Standard Practice (USS-SAF-SP-018)
3.5 Mon Valley Works Contractor Line-Up Form (MVW-CLFRM-01)

4.0 Definitions

4.1 N/A

5.0 Responsibilities

5.1 Safety Department

5.1.1 Is responsible to review and maintain this document.
5.1.2 Will oversee and manage the Working Team and Quarterly Safety meeting and will send all affected contractor's invitations.
5.1.3 Manage and approve any specific exemption requests when contractors can/do not comply with requirements in this document.
5.1.4 Will consult with USS Safety, USS Procurement, USS Risk Management, and MTS as/if needed.
5.1.5 Will initiate and follow-up with contractor incidents as needed.

5.2 USS Shift Managers, Coordinators, Area Managers Division Managers, Plant Managers:

5.2.1 Will contact Mon Valley Works Safety Department for any questions or issues with contractor safety requirements.
5.2.2 Will ensure contractors brought into their respected areas to work in a Mon Valley Works facility meet the requirements in this document.
5.2.3 Notify the Safety Department for emergency scenarios or any other scenarios where an exemption to these requirements may be needed.

5.3 Contracting Employees

5.3.1 Contractors are responsible to comply with the requirements outlined in this document and notify USS management and/or Safety Department if they have questions or are not able to comply.

6.0 Contracting Company Pre-Requisites

6.1 All contractors performing work in a Mon Valley Works facility must be listed as an approved Mon Valley Works Contractor in ISN with an acceptable grade.

6.1.1 Visitors, delivery drivers, and consultants being escorted by USS employees do not need to be in ISN. The USS Visitors Protocol will apply in these scenarios.

6.1.2 Other exemptions for ISN requirements, such as an emergency scenario, may be given but must be approved by the Mon Valley Works Safety Department. Corporate Safety, Procurement, and other applicable departments will be consulted as needed.

6.2 An acceptable ISN grade is an “A” or “B” grade listed for the company in ISN. Contractors are responsible for all Subcontractors they bring in according to S00-1 guidelines.

6.2.1 Any exemptions to ISN “A” or “B” grades for contractors will be given by Mon Valley Works Safety Department.

6.2.2 Requirements that determine a contractor’s grade is managed by Corporate Safety.

6.3 For new contracting companies coming into USS Mon Valley Works for the first time must go through USS Procurement. USS Procurement is responsible and will initiate any new contracting company to be listed as a USS Mon Valley Works approved contractor in ISN. ISN and the contractor company will then work to ensure all safety programs, insurance information, safety statistics, and other pre-requisite documents are submitted through ISN. Once documents are submitted, ISN will verify that the contractor meets all USS pre-requisites and will issue the contractor a grade.

6.3.1 The Mon Valley Works Safety Department will address any safety specific requirements, questions, or exemption requests that the contractor has.

6.4 For contractors who are listed in ISN as an approved contractor for other USS locations but not listed for the Mon Valley Works, must be added to the Mon Valley Works in ISN.

6.4.1 USS Procurement will initiate and approve all requests.

6.5 A contractor representative(s) must sign up for SteelTrack access.

6.5.1 This person/persons should be someone in a supervision role that is able/capable of communicating the information that is sent out through SteelTrack by USS to the affected contractors working in the Mon Valley Works.

7.0 Contracting Employee and Job Pre-Requisites

7.1 Prior to being allowed access to any Mon Valley Works facility, each contractor employee must watch and complete the Mon Valley Works Contractor Orientation Video in the MTS Con-Track system. Once completed, the employee will be automatically recorded in the Con-Track system. The intent is that contractor employees watch this prior to arriving to a USS facility.

7.1.1 Gas Hazards training is including in the MTS Con-Track system and all contractors are required to watch this training no matter what area they will work in.

7.1.2 Test Questions are embedded into the training video and the employee must pass with at least an 80% competency.

7.1.3 Test questions will be reviewed annually by the Mon Valley Works Safety Department.

7.1.4 Test questions will be reviewed at least annually and modified/ changed as needed.

7.2 Pass Control and/or the employees who work at the Main gate are responsible to verify that the contractor has successfully passed and completed the USS Mon Valley Contractor Safety and Gas Hazards Awareness Video prior to issuing any contractor or visitor's badge.

7.3 If a contractor company is not listed in the Con-Track system in order to complete the Contractor Video, the Mon Valley Works Safety Department will add them.

7.4 For any exemptions to the Con-Track system will be managed and approved by the Mon Valley Works Safety Department.

7.5 The Contractor Orientation Video can be found: **https://ussmonvalley.mtssafety.com**.

7.6 For work being done in a PSM Regulated Areas at the Clairton Plant, separate training and tests are required and are not included into the Con-Track system. These requirements are managed/conducted by the Clairton Plant PSM Manager.

7.7 Once all Mon Valley Works training is complete, the contractor and employees must have the following done prior to any work, according to S00-1 guidelines:

7.7.1 Hold a Contractor Line-up with the Contractor using the Mon Valley Works Contractor Line-up Form (*MVW-CLFRM-01)*. Attendants of the Contractor Line-Up must sign the front. All contractor employees must review the line-up and sign the Verification of Line-Up Review on page 12 of *MVW-CLFRM-01.*

7.7.2 Contractor's must have a Job Step Analysis (JSA) developed for every job that they perform in a USS Mon Valley Works facility.

7.7.3 Each JSA must include:
- 7.7.3.1.1 List of each job step
- 7.7.3.1.2 Hazard associated with each step
- 7.7.3.1.3 Control measures that will be put into place to address each hazard.

NOTE: Contractors can use their own JSA template as long as it contains all items in listed in 7.7.3.

7.7.4 Contractors can use an existing JSA if it addresses all items listed in 7.7.3. This includes contractors using a safe job procedure.

7.7.5 JSA's must be reviewed and signed off by all affected contractor employees performing the job. Acceptable sign-off methods are:
- 7.7.5.1.1 Employees signing a sign-off sheet that lists the JSA/ Job
- 7.7.5.1.2 Signing the JSA document – anywhere on the document is acceptable.
- 7.7.5.1.3 Listing the JSA/job on the Pre-task Planning document that the JSA for the job has been reviewed and having the employees sign the Pre-Task Form.

7.7.6 Completed Contractor Work Permit that is signed by a USS Point of Contact (POC) every shift/day that authorizes the job can begin. The Work Permit must also be signed by a Point of Contact (POC) when work is completed each day.
7.7.6.1 POC will verify that a JSA has been completed when signing the crew into the area and document it on Section 3 of the Contractor Work Permit.

7.7.7 Any other specific requirements outlined in S00-1.

8.0 Contractor Incident Reporting

8.1 Contractors must immediately report all incident with or without injury, including near misses to the Mon Valley Works Emergency Services Department, Plant Safety Supervisors, and the U.S. Steel representative of the department or area where the work is being performed as outlined below:

8.1.1 Preliminary written report shall be prepared and sent by the Contractor prior to the end of shift to the Plant Safety Department listed in attachment A.

8.1.2 If a contractor cannot fulfill the incident reporting requirements due to the investigation still being conducted, the Mon Valley Works Safety Department must be notified.

8.1.3 Significant incidents, incident trends with a contractor, may required a follow-up meeting by Mon Valley Works management, Safety Department, and contractor management to review key findings and corrective actions.

9.0 Contractor Safety Meetings

9.1 Mon Valley Works has two major communication safety meetings with its contracting companies. The Mon Valley Works Safety Department will manage these meetings and will send invites to appropriate contractors. Contractors are responsible to engage in these meetings and inform their affected employees of any information or follow-up needed that are brought up or presented during these meetings.

9.1.1 Monthly Working Team Meetings – all major contractors who work routinely/daily in a Mon Valley Works facility will be sent an invite to this meeting and will send a supervisor and/or safety represented to attend.

9.1.2 Quarterly Safety Meetings – all contractor who are approved and does/can work in a Mon Valley Works facility must send a supervisor and/or safety representative to attend.

Attachment A:

Mon Valley Works Safety Department Incident Notification List:

- Glen Hilliard ghilliard@uss.com
- John Preffer jrpreffer@uss.com
- Bob Reed rareed@uss.com
- Aaron Flaitz ajflaitz@uss.com
- Brian Turpin beturpin@uss.com
- Brendan Murdock bcmurdock@uss.com
- Pat Cole prcole@uss.com
- Brenda Smouse blsmouse@uss.com

Safety & I.H. Process Document	**Title:**	Mon Valley Works Contractor & Outsourcing Safety Requirement		
	Document Number:	SMS-MVW-CON-01		
	Revision:	003	**Plant:**	Mon Valley Works
	Review Frequency:	Annual	**Issue Date:**	7/22/2020
	Owner/Approver:	John Preffer	**Date Reviewed/Revised:**	1/18/2023
	Reviewer/Participants:	J. Preffer, G. Hilliard		

REVISION REGISTER

Date	Description of Change	Page No.	Initials
7/22/20	Developed written protocol.	All	JRP
9/7/21	Updated section 7.7 to include JSA and new contractor requirements. Attachment A was also updated.	3,4	JRP
11/1/22	Deleted 7.7.5. Added 7.7.1 Mon Valley Works Contractor Line-Up Form *(MVW-CLFRM-01)*	3	JRP

Contractor Safety Requirements - Mon Valley Works

Below are TWELVE (12) REQUIREMENTS that Contractors are to meet before beginning work at any U. S. Steel Mon Valley Works (MVW) plant. Failure to provide this information can result in denial of access to the facilities.

1. ISNETWORLD

Contractors working at USS must subscribe to ISNetworld (www.isnetworld.com). You will identify your companies work type (services your company provides U. S. Steel) complete the Management System Questionnaire (MSQ) and submit required documents (OSHA Forms and EMR letters). Your company's written health and safety programs will be reviewed by ISNetworld's RAVS team to ensure conformance with regulatory and/or U. S. Steel standards. You can also contact the ISN Customer Service Team at (214) 303-4900 or (800) 976-1303.

2. CONTRACTOR ONLINE TRAINING COURSE (ORIENTATION & GAS AWARENESS VIDEOS)

****GAS AWARENESS training will no longer be conducted by the Gas Services Department or require hard hat stickers ******

United States Steel requires your employees to take online training courses **prior to arriving at our plant.** The training courses can be taken on a **personal computer, tablet or smartphone.** The course is comprised of two videos followed by a post-test. An 80% score is required to pass the test, and all contractor employees are required to pass the test in order to be allowed to enter the plant. There will be a $5 fee for each employee taking the online safety training course and will not be re-charged if the employee does not pass the test and needs to take it again.

When contract employees sign into the MTS online training system, two options will appear until both courses are taken.

1. "**USS Mon Valley Contractor Safety Video"** (60 minutes)
2. "**USS Mon Valley Gas Hazards Awareness for Contractors**" (25 minutes)

If you/your employees have already registered into the system and completed the USS Mon Valley Contractor Safety Video, there is no additional charge to watch the "USS Gas Hazard Awareness for Contractors" video and will show that 1 of 2 videos are complete.

The training courses can be accessed: https://ussmonvalley.mtssafety.com.

Key Points:

- This will replace the "MVW Orientation Video" and "Plant Specific Safety Videos".
- Gate access/badges will not be issued unless the contractor employee has completed the training course. USS Pass Control will verify this is complete.
- There will not be any USS computers provided at/in USS Pass Control facilities for contracting employees to use/ complete the training course.
- All contractor **employees** registering for the training course for first time must choose their company from a drop down menu. If the company they are working for is not listed, contact MTS so that the company can be added to the contractor drop down list.

Paying for the $5 training fee:

Contracting companies can register their credit card information so that the $5 fee can be paid to Multimedia Training Systems online. To do this, companies must go to the following site: ***https://accounts.con-track.net/ussmonvalley.***

When your employees access the training website they will register to take the training and they will select your company name from a drop-down list. This will result in a $5 per employee charge against the credit card that you put on file. Multimedia Training Systems will submit these charges to your credit card provider on a monthly basis. If your company has not registered and there is no credit card on file, your employees will not be able to take the training course and subsequently, not be able to enter the plant unless a special dispensation is given by an authorized United States Steel Safety Department representative. If your company has registered but there is no credit card on file, your employees will not be able to take the training course unless they use their own credit cards to pay the fee.

Multimedia Training Systems (MTS) can be reached at 412-567-2160 with any questions or issues regarding registering your employees and company.

(See attached file: USS Mon Valley Contractor Letter.docx)

3. PROCESS SAFETY MANAGEMENT (PSM)

Everyone working at **CLAIRTON** in the **#1 CONTROL ROOM, #2 CONTROL ROOM or #5 CONTROL ROOM**, or within 100 feet of any of these processes, must view the applicable PSM video. A passing grade on a written test is also required prior to entry, and *ANNUALLY* thereafter. The videos and testing will be conducted by U. S. Steel Management. Classes will be held every Monday and Wednesday at 9:00 am in the **Coke Works Office Building – 3rd Floor Conference Room**. Call (412) 233-1743 to schedule additional classes. Once accomplished, all contract employees working in the PSM areas are required to have a PSM sticker on the outside of their hard hat. Below is the link to the PSM video.

Ussmvw.mtssafety.com

4. STEELTRACK & STANDARD SPECIFICATION S-001 SAFETY

You must sign up for **STEELTRACK** access. Make sure the contractor representative who requests access is the appropriate person you want to receive notifications/contacts that will be sent out by MVW Contractors. **The Standard Specification S-001 Contractor Safety documents can be found on STELLTRACK and must be reviewed.** Be advised that a formal S-001 review meeting may be requested as part of the approval process before entering the plant.

(See attached file: SteelTrack Instructions 2018.docx)

5. DRUG TESTING PROCEDURES

Contractor companies must have a Drug Testing Policy submitted through ISN. For contractor

convenience, Mobile Medical is located at the Clairton Plant Pass Control Trailer, and will provide drug and alcohol testing Monday & Wednesday from 6:00AM -10:00 AM. Call (412) 233-1092.
Refer to "Minimum Contractor Training Requirements" attachment (under #5) for more details.

6. CONTRACTOR LINE-UP MEETINGS & HAZARDOUS JOB MEETINGS (HJM)

PRIOR TO THE START OF WORK, a contractor representative must attend one or both of these meetings, based on the hazards of the job. Additionally, each contractor employee must review a written copy of the meeting and sign off on it prior to starting work. Please be advised that Contractors are not permitted to use U. S. Steel-owned equipment without written approval.

7. INCIDENT REPORTING

Follow the attached **INCIDENT PROCEDURE GUIDELINES** for reporting incidents. All incidents, regardless of severity must be reported *IMMEDIATELY*. A preliminary **CONTRACTOR INCIDENT WITH/WITHOUT INJURY REPORT** must be submitted PRIOR to the END of the SHIFT. A final report must be entered into their ISN account within *24 HOURS* of the incident.

(See attached file: Contractor incident reporting letter 08-20-19.docx)
(See attached file: Contractor Incident with Injury Report Form.doc)
(See attached file: Contractor Incident without Injury Report Form.doc)

8. JOINT/USS CONTRACTOR SAFETY & HEALTH MEETINGS

A contractor representative(s) is required to attend each *QUARTERLY* meeting at the MVW Training HUB (off Route 837 in Duquesne), Room 1900.

(See attached file: 2019 Contractor Quarterly Meetings - HUB.doc)
(See attached file: HUB Driving Directions.pdf)

MVW SAFETY DEPARTMENT CONTACT LIST

(See attached file: MVW Safety Department Contact List 8-20-19.docx)

Daily Work Permit - Mon Valley Works

U. S. STEEL WORK PERMIT *(Valid for one (1) shift only)*

[ ] Contractor Work Permit **[ ] Interdepartmental Work Permit**

Section 1 – Work Area and Contact

Plant: **Division/Department:**

Work Area and Job Activity to Be Performed:

USS Manager or Point of Contact (POC): **Phone:**

Section 2 – Contractor, USS External Department Contacts

Contractor/USS Department: **Supervisor: (Print)**

Office/Trailer Phone: **Cell Phone:**

Section 3 – Safety Line-up/JSA Confirmation

Date of Contractor Safety Line-up Meeting: _____ **Person Who Conducted Meeting:**_____

JSA in place: Yes _____ **No** _____ ***Note: JSA must be in place prior to work.***

Section 4 – Work Crew Identification

Name of Personnel	Badge #	Name of Personnel	Badge #
1.		6.	
2.		7.	
3.		8.	
4.		9.	
5.		10.	

Section 5 – Work Scope Change

Changes may be related, but are not limited, to (list):

[ ] Confined Space	[ ] Fall Prevention	[ ] Isolation, Purging, Reintroduction	[ ] Railroad
[ ] Crane	[ ] Gas Hazards	[ ] Mobile Equipment	[ ] Tools & Equipment
[ ] Emergency Procedures	[ ] Hot Work	[ ] Molten Metal	[ ] Other: _____
[ ] Energy Control	[ ] Industrial Hygiene	[ ] Personal Protective Equipment	[ ] Other: _____

Details of Change (Consider operational changes or maintenance work impacting work)

Environmental

Does this task have the potential to impact the environment? **YES** ____ **NO** ____ **N/A** ____
Is the Waste Disposal method approved? **YES** ____ **NO** ____ **N/A** ____
Are sewers identified & protected? **YES** ____ **NO** ____ **N/A** ____
What is the potential impact & mitigation action(s)? **Comments:**

Section 6 – Authorization

USS Manager/POC Authorizing Work Permit: Name (Print): **Signature:**

Contact Number: **Badge #:** **Date:** **Time In:**

[ ] Operating Management Contacted Name: **Initials:**

Section 7 – Termination Acknowledgment

USS Manager/POC Terminating Work Permit: Name (Print): **Signature:**

Contact Number: **Badge #:** **Date:** **Time Out:**

[ ] Work Completed	**[ ] Post-Job Safety / Housekeeping Inspection Completed**	**[ ] Work Not Completed**

Emergency Numbers for Mon Valley Works

Ambulance, Fire, Medical & Security

Clairton Works	(412) 233-1000
Edgar Thomson Works	(412) 273-7200
Irvin Works	(412) 675-2500
Fairless Works	(215) 736-6222

Permit Instructions

Each new/relief crew will complete a new permit for each work site.

Note: This form may be used as an Interdepartmental Work permit for work crews working outside their home division, or a Contractor Work Permit.

Section 1: The Sign-In location is the designated area that the work force listed as providing the service is to report to prior to the start of any work. The work permit is only valid for the specified area listed on the permit. A new permit is required if the location, or work scope changes. The USS Manager or Point of Contact (POC) and phone number is the person at the Sign-In location to contact when entering the work area.

The USS Manager or POC is responsible for the following: Provide information on evacuation routes, emergency telephone numbers, telephone locations, and ambulance station to be used (if applicable) or give a common descriptive name of the area that will be readily recognizable by emergency service responders. The USS Manager or POC has the responsibility to maintain an accurate head count in the case of an emergency or an evacuation. The USS Manager or POC will ensure that personnel working in the same and adjoining areas as the listed work force are notified of the work activity. The USS Manager or POC may appoint an authorized person to complete these tasks.

Section 2: The Outside Contractor or the USS Contracted Department shall complete this section to include Company or Department Name, identify who the site supervisor is, and list the supervisor's office and cell phone number.

Section 3: The most recent Contractor Safety Line-Up meeting with the date held and the name of the person conducting the meeting must be documented when applicable. Manager or POC must verify that the contractor has completed the Job Safety Analysis for the specific job to be completed. **No work shall be started without a completed JSA.**

Section 4: List all of the employees who will be assigned to the work area. If necessary, list all additional personnel on an additional sheet. Any changes to the work task or location shall be communicated promptly to the USS Manager or POC for approval and a new work permit. The JSA must be updated to reflect all changes. In addition, a new safety line-up meeting may be required in which applicable sections of the line-up document are updated to reflect the change in work scope and/or new hazards. It is required that the work crew listed on the permit to check in/out with the USS Manager or POC.

Section 5: Management of Change. This section shall be used to capture any changes or issues that arise that may have not been discussed/addressed during the Contactor Safety Line Up/Job Safety Analysis. All changes must be reviewed with the USS Manager or POC and documented prior to work reconvening.

Note: Changes to HJM's may not be covered in this section. All parties involved in the HJM development must meet and approve actions prior to work reconvening.

Identify special safety contacts, evacuation routes, assembly areas, gas alarms, etc. for the area at the time of issuing the permit. If necessary, attach additional instructions on a separate sheet to the work site copy.

Section 6: The USS Manager or POC **Authorizing** the Work Permit is the USS employee that initiated the work or their designee. This person is assigned to line up and guide the work crew to the work site. Badge number, date the permit is issued, phone and/or pager number and the current time the work crew enters the department must be provided.

If the Operations Manager in the specific area where the work will be performed is not the person authorizing this permit, then the Operations Manager of the area must be notified of the work. This contact serves as notification to the operating area that work is being performed and allows operating management to identify any additional information to allow the work crew to safely perform the job.

Section 7: It is the work crew's responsibility to communicate to the USS Manager or POC that initiated the work permit or designated departmental representative that the work activity has concluded. It is the designated USS manager, POC or departmental representative's responsibility to sign off and terminate the work permit. The individual closing the permit can be a member of Management or a Union Representative who is authorized by Management. They may be identified as a Team Leader, A Group Leader, etc. Any question about who has the authority to sign the permit shall be referred to the Area Manager of the Department.

Mon Valley Works Contractor Line-Up Meeting Requirements

Mon Valley Works Contractor Line-Up Meeting

MEMORANDUM OF MEETING

Plant: _____ Date: _____

Contractor(s): _____ Job Description: _____

Dept. Location: _____ Job Duration: _____

Job Start Date: _____

Contractor Safety Representative Name/Phone/Cell: _____

_____

Meeting Conducted By: _____

USS Point of Contact: _____

Emergency Contact Information

Plant Emergency Numbers: _____
USS Representative: _____
USS Safety Representative: _____
Evacuation Location(s): _____

All incidents must be reported to Security/Plant Protection, Operating Department Management and the Plant Safety Department. A preliminary incident report must be submitted to Plant Safety within 8 hours or end of shift. A final incident report must be completed and submitted within 24 hours of the event. All reports must also be submitted through ISNetworld.

_____

Safety & IH Department Phone Email

Injured or ill employees are not to be transported off-site without Security/Plant Protection involvement.

Meeting Attendants

Print Name	Signature	Company / Department	Phone Number

Contractor personnel will use designated parking lots. Authorized walkways will be used while entering and exiting the plant. Designated Parking areas include:

_____

Contractors will sign in and out of all operating areas using the USS Work Permit. Contractors will sign in at the following location(s):

_____

Mon Valley Works Contractor Line-Up Meeting

GENERAL

☐ 1. The contractor is responsible for communicating all material discussed in this meeting with each of their employees and subcontractors. All material discussed in this meeting will apply equally to any subcontractors working for the contractor. Contractors are required to maintain this Line-up Meeting Form at the job site. If the work scope changes or a changed condition occurs, a subsequent line-up meeting must be held to discuss the changes, identify any additional potential hazards, and the parties must agree on the method of hazard elimination or control. An addendum must be approved by all involved parties and maintained with this document. Copies must also be distributed to all meeting attendees.

☐ 2. Work may require the use of a Hazardous Job Meeting (HJM) when the job includes the potential for a fatality, multiple injuries, severe fire, explosion, shutdown of the facility, or significant impact to other operating areas due to the severity of the hazard including, but not limited to one or more of the following:

- □ No SJP or ECP and there is significant safety risk.
- □ Hot Work on piping, vessels, and/or equipment containing flammable or highly hazardous material.
- □ Burning and/or welding in hazardous areas where a Hot Work Permit does not address the hazards.
- □ Opening, blanking, or working on a pipe, vessel, and/or equipment containing flammable or highly hazardous materials.
- □ Purging of flammable or highly hazardous materials from a location inside an enclosed area or building.
- □ Non-emergency situation, where an IDLH atmosphere exists, but the work can be performed under breathing air.
- □ Working on live energized conductors or circuit parts inside the limited approach boundary (except for troubleshooting, testing or voltage measuring).
- □ When there is known or suspected accumulation of water on the steel bath inside a steel vessel.
- □ Mobile Crane lifts directly above, below, or close to:
  - □ Pipelines containing gas, steam, or flammable materials
  - □ Electrical Distribution Centers
  - □ Occupied Buildings
  - □ Tanks or vessels containing flammable materials or compressed gases
  - □ Exposed live power transmission lines within required boundaries
- □ Excavations within 50 ft of building/railroad tracks or excavations greater than 25 ft.
- □ Hot tap on pipelines
- □ Diving Operations

☐ 3. Contractors are responsible for maintaining a clean and orderly work area. Access to emergency equipment (fire hydrants, fire extinguishers, stretchers, control valves, gas rescue shelters, electrical switch boxes, etc.) shall not be blocked. Designated passages, walkways or aisles shall not be blocked or obstructed with any materials or items.

☐ 4. Contractor must obtain permission from USS Management before connecting to any plant utilities.
Note: Nitrogen is used as a back-up supply for some of the plant air systems.
Permission Granted By: _____
For the Following Utilities: _____

☐ 5. Contractor Equipment Loan Agreement – Prior to using U.S. Steel owned equipment or tools, contractors must receive permission from U. S. Steel Management and complete the Equipment Loan Agreement.

Mon Valley Works Contractor Line-Up Meeting

	1.0 Energy Control	N/A ☐
1.1	Is lockout, tagout, tryout required? Yes_____ No _____	
1.2	What sources of energy need to be controlled? 1.2.1 Electrical: Yes_____ No _____ Equipment: _____ 1.2.2 Mechanical: Yes_____ No _____ Equipment: _____ 1.2.3 Hydraulic: Yes_____ No _____ Equipment: _____ 1.2.4 Pneumatic: Yes_____ No _____ Equipment: _____ 1.2.5 Gravity: Yes_____ No _____ Equipment: _____ 1.2.6 Thermal: Yes_____ No _____ Equipment: _____ 1.2.7 Radiation: Yes_____ No _____ Equipment: _____ 1.2.8 Stored: Yes_____ No _____ Equipment: _____ 1.2.9 Other: Yes_____ No _____ Equipment: _____	
1.3	Is there an associated ECP(s) for the equipment to be isolated? Yes_____ No _____ 1.3.1 List associated ECP(s): _____ **Note:** If no ECP exists, an interim ECP must be created, detailing the isolation of the necessary equipment.	
1.4	Each lock shall be identified and have a consistent color. 1.4.1 Personal: _____ Department: _____ Continuity: _____	
1.5	Does adjacent equipment exist, and does it need to be isolated to protect the work area(s) where the contractor work is to be conducted? Yes_____ No _____ Equipment: _____ Control: _____	
-----	General Notes: 1. Positive isolation (goggle valve, double block/bleed only with specific requirements, line break, blank) is required for confined space entry work & hot work on flammable or oxygen lines. 2. Voltage verification utilizing proper arc flash PPE is required when within limited approach boundary or working directly on exposed electrical conductors. 3. Any energy control related to IPR regarding flammable or O2 gas will require a Hazardous Job Meeting. 4. Anytime a lock box/board is used a Lock Placement and Verification Form (LPVF) must be utilized. 5. If ANY safety lock needs to be forcibly removed, USS Management must be involved, and the USS Forcible Lock Removal Form must be completed. 6. A hot tap on ANY utility or electrical line will require a Hazardous Job Meeting and approval from the Safety & IH Department.	

Mon Valley Works Contractor Line-Up Meeting

2. Fall Protection & Elevated Work		N/A ☐
2.1	Does the work scope involve fall protection applications? 2.1.1 Working at unguarded heights 6 feet or greater. Yes_____ No _____ 2.1.2 Working on unguarded platform 4 feet or greater. Yes_____ No _____ 2.1.3 Working on a ladder 6' or greater and <u>not</u> maintaining 3-points of contact. Yes_____ No _____ Documented Control Method: (Hand Railing/Fall Protection/Fall Restraint/etc. & Designated Anchor Point/Lifeline, etc.) _____	
2.2	What is the fall distance(s) to the nearest object(s)/level(s): _____ Feet: _____ Note: A fall distance of 18.5 Feet or less, requires a Self-Retracting Lanyard (SRL).	
2.3	Does the work scope involve the removal/opening of hatches/floor plates/grating etc.? Yes_____ No _____ What is the fall protection plan prior to the exposure and creation of the fall potential? Control Method: _____	
2.4	Can peripheral personnel be exposed to the fall hazard created by the work scope? Yes_____ No _____ Control Method: _____	
-----	General Notes: 1. All fall protection plans must require 100% tie off at all times when exposed to a fall hazard. All prevention methods to fall hazards (i.e., handrail, cover plates, etc.) must be included in the fall protection plan. 2. All personal fall protection must be inspected prior to use and per manufacturers recommendations. 3. Lifeline systems utilized must be either manufacturer designed or engineered. 4. Any uncontrolled fall hazard must be protected by a hard barricade (not flagging or tape) and must be illuminated if located in a dark area. 5. If working off a roof, personnel must follow the OSHA/MSHA Construction and Roofing Standards. 6. All work requiring the use of personal fall protection must have a rescue plan.	

3. Confined Space		N/A ☐
3.1	Does the work scope require the entry into a confined space? Yes_____ No _____	
3.2	Is the space Permit Required (PRCS) or Non-Permit Required Confined Space (NPRCS)? _____ 3.2.1 If PRCS, what atmospheric hazards exist? _____ Control: _____ 3.2.2 If NPRCS, does the work scope within the space affect the Non-permit status? Yes_____ No _____ (IE: Hot work, Chemicals, etc.) If YES, it is a PRCS, identify Hazard & Control: _____ 3.2.3 Define any other hazards and controls in the space _____	

Mon Valley Works Contractor Line-Up Meeting

3.3	Atmospheric testing minimum requirements: CO, LEL, O2, & H2S Any other requirements? (HCN, HCL, SO2, NH3, etc.)? _____ Yes_____ No _____
3.4	Are any other utilities (not defined in Section 1) running into/through the Confined Space? Yes_____ No _____ If YES, identify the Utility(s) & Control(s): _____
3.5	What is the confined space non-entry rescue plan? (Fire Department, tripod/winch, tagline, other) Control: _____
3.6	Notification must be made to Emergency Services prior to entry and when closing the permit. Define plant specific means of communication: _____ Note: An initial side by side test of the space must be performed prior to entry.
----	General Notes: 1. All personnel must be qualified & trained for their role (Entry Supervisor, Attendant, Gas Tester). 2. Gas testing equipment must be bumped prior to use & calibrated monthly or per manufacturer spec. 3. Permit spaces must be continuously monitored, and readings documented at least every 2 hours. 4. Entry is considered when any portion of the body breaks the entry plane of the space. 5. When left unattended, entrances to confined spaces must be barricaded to prevent inadvertent passage. 6. Confined Space Gas Testing must be performed in the immediate area of work.

4. Gas Hazards	N/A ☐
4.1	Is the work located in a High Gas, Low Gas, or No Gas Area? High _____ Low _____ No _____
4.2	In the work scope & area, what gases/vapors may be encountered? (i.e., CO, LEL, O2, N2, H2S, SO2, HCL, AR, BF, COG, other) _____
4.3	Is there a requirement for personal gas detection equipment? Yes_____ No _____ Define Required Monitor(s): _____
4.4	Is there fixed gas detection within the work area? Yes_____ No _____ Define Gases Monitored: _____
4.4	Is the use of respiratory protection required? (air purifying & cartridge or supplied air/hip air) Yes_____ No _____ Define Required Protection: _____

Mon Valley Works Contractor Line-Up Meeting

4.5	Does the work have potential to be performed in an IDLH atmosphere? Yes_____ No _____ Define Hazard (If yes, HJM required): _____
4.6	Is there a sign in procedure required for personnel? Yes_____ No _____ Define Required Procedure: _____
----	General Notes: 1. All personnel entering a high or low gas hazard area must have annual Gas Awareness Training. 2. All personnel entering a high gas hazard area must comply with the facial hair policy. 3. Personal gas testing equipment must be bumped prior to use & calibrated per manufacturers recommendations not to exceed one month. 4. Personal gas meters must be worn in the breathing zone. 5. Contractor personal gas monitors must be capable of data logging. The contractor must be able to provide an electronic record of the data to the Safety and IH Department upon request.

5. Scaffolding	N/A ☐
5.1	Will the work require the use of scaffolding to access the area? Yes_____ No _____
5.2	Who will be the competent person to perform the inspection and tag the scaffolding (not to exceed 16 hours)? Competent Person: _____
5.3	What is the maximum intended load, including personnel and materials? _____ (lbs.)
5.4	During use, is the scaffold intended to be yellow or green tagged? _____ If intended to be yellow tagged, define the hazards or restrictions: _____
5.5	During the construction, use, or dismantling of the scaffold, are all components and parts positioned away from adjacent energized equipment? Yes _____ No _____ If no, the adjacent equipment must be de-energized and locked out.
----	General Notes: 1. **Green Tag** = Inspected and ready for use, fully built with no restrictions or hazards. 2. **Yellow Tag** = Inspected and ready for use, but has a hazard or restrictions (100% tie off, low overhead clearance, gaps or missing deck planks, tripping hazards, other) 3. **Red Tag** = Scaffold is not ready for use and use is prohibited. 4. Scaffolds must maintain a minimum clearance of 10’ for 0-50Kv & 15’ from 50,001-200KV powerlines. 5. Scaffolds must be erected, dismantled, modified, and inspected by trained, competent personnel only.

Mon Valley Works Contractor Line-Up Meeting

6. In-Plant Railroad		N/A ☐
6.1	Will the work require equipment or personnel within 6' horizontal or 22' vertical from rail tracks? Yes_____ No _____ If Yes, the lockout and isolation of the track is required. Control:_____	
6.2	Identify who needs to be contacted that the tracks are out of service (exp: trainmaster, operations, maintenance, etc.). _____	
6.3	Other site-specific rules regarding rail operation and protection: _____	
----	General Notes: 1. A blue flag, fluorescent orange cone, or blue light must be placed at least 125' from the location of where the work is being performed and at least 10' ahead of any derailer or locked railroad switch. 2. Night work requires the use of a warning light. 3. If guidelines within this section cannot be followed and a local plant protocol does not exist, Plant Safety must approve the work scope prior to commencing work.	

7. Excavation		N/A ☐
7.1	Will the work scope require the creation of a man-made cut, cavity, trench, or concrete removal including concrete saw cutting for the purpose of exposing soil, which requires an excavation permit? Yes _____ No _____ What is the depth of the excavation? _____	
7.2	Who is the Competent Person responsible for inspecting and completing the excavation inspection sheet? _____	
7.3	If entry is required, what protective system will be used (sloping, shoring, shields, etc.)? _____	
----	General Notes: 1. Inspection of the site must be conducted prior to entry and at least daily. 2. All soil at U. S. Steel is considered Type 3 Soil (compressive strength 0.5 tons per square foot or less). 3. Excavations more than 20' deep require Engineering to review and approve protection method. 4. Excavations more than 4' deep shall be protected from cave-ins by an engineered protective system or appropriately sloped. 5. Excavations more than 4' deep are considered Permit Required Confined Spaces. 6. Trenches more than 4' deep require a stairway, ladder, ramp etc. at least every 25' horizontal. 7. Soil probing each foot will be required the last 1' – 4' of excavation to uncover or expose utility lines. The first foot can be dug by powered excavation equipment, the last 3' must be hand dug. 8. Spoil piles must be placed with a 4' minimum setback and maintain a 34-degree slope from excavation. 9. Excavations created must be hard barricaded (not flagging or tape) and must be illuminated if in a dark area or left overnight.	

Mon Valley Works Contractor Line-Up Meeting

8. Industrial Hygiene		N/A ☐
8.1	Does the work involve the disturbance of known or suspected asbestos containing material? Yes_____ No _____ If yes, the material must be abated prior to performing work. If you are unsure, contact the plant Safety Department for inspection and testing prior to disturbing material. Identify Material(s): _____	
8.2	Does the work involve the use of or demolition of respirable crystalline silica? Yes _____ No _____ Control Method (wetting area, HEPA vac, etc.): _____ PPE Required: _____	
8.3	Does the work involve welding on stainless steel which yields hexavalent chromium? Yes _____ No _____ Control Method (respiratory protection, HEPA vac, etc.): _____	
8.4	Does the work involve working on or near any radioactive devices, x-rays, or lasers? Yes _____ No _____ If yes, what are the controls or precautions? _____ Note: Any radioactive device, x-ray or laser must be approved through plant Safety and IH prior to bringing onto plant property.	
8.5	Does the work involve encountering Coke Oven Emissions? Yes_____ No _____ If yes, what are the controls or precautions? _____	
8.6	Is work being performed in a Benzene regulated area? Yes_____ No _____ If yes, what are the controls or precautions? _____	
8.7	Does the work involve burning/welding/or heating of chemicals or chemical process tanks (even if drained)? Yes _____ No _____	
8.8	Does the work involve working on lead-based material? Yes_____ No _____ If yes, the material must be abated prior to performing work. If you are unsure, contact the plant Safety Department for inspection and testing prior to disturbing material. Identify Material(s): _____	
8.9	Are there any plant specific IH rules? Yes_____ No _____ If yes, list: _____	

Mon Valley Works Contractor Line-Up Meeting

----	General Notes: 1. Contractors must submit an SDS for all chemicals/products prior to bringing them into the plant. 2. Burning on process tanks (rubber lined or not & even if drained) can possibly create hazardous fumes. 3. Upon request, the contractor is responsible for producing copies of silica sampling and control plans. 4. Will the work being performed affect surrounding employees? 5. Do any workers have medical devices that may be affected by Electro Magnetic Fields (EMF)?

9. Molten Metal	N/A ☐
9.1	Is the work scope taking place in an area where molten metal is created, processed, or handled? Yes _____ No _____
9.2	Is the work scope taking place within a restricted access boundary? Yes_____ No _____ If yes, define area and any controls/precautions: _____
9.3	Within the general molten metal area, is there any areas that are strictly prohibited? Yes_____ No _____ If yes, define area(s): _____
9.4	Within the molten metal area, is there any specific alarms, warning lights, or emergency procedures that personnel should be aware? Yes_____ No _____ If yes, identify: _____
9.5	Are there any other plant protocols regarding molten metal personnel should be aware? Yes_____ No _____ If yes, identify: _____
-----	General Notes: 1. Fire Retardant Clothing is required in all molten metal areas. All clothing underneath must be 100% natural fiber (cotton or wool). 2. All oxygen lancing activities require the use of aluminized PPE (hood, jacket, & spats). 3. Working directly under full BF troughs & full Steel vessels is prohibited.

10. Cranes, Mobile Equipment & Rigging	N/A ☐
10.1	Is the work scope taking place require the use of a crane or other mobile equipment? Yes _____ No _____
10.2	What is the capacity of the equipment versus the load it will be moving or carrying?: _____
10.3	Will rigging be necessary to use (come-a-longs, shackles, wire ropes/straps, etc.)? Yes_____ No _____ If yes, what is the capacity of all components vs load?: _____

Mon Valley Works Contractor Line-Up Meeting

10.4	What configuration will the rigging be used & is this within the load rating of the device (basket, choked, etc). _____
10.5	Will personnel be located within the area of operation or final positioning of load? Yes_____ No _____ If yes, define the safe positioning of person:_____
10.6	What devices (if any) are necessary to control the load and comply with No hands-on lift policy? (IE tag lines, no touch tools, etc.) _____
10.7	Will work involve the use or mobile cranes, elevating work platforms, or other equipment that shall be elevated within 7 feet of the lowest solid structure of the crane or crane path? Yes_____ No _____ If yes, positive protection is required. Define controls: _____ If positive protection cannot be defined, contact Plant Safety for review.
10.8	Will work involve the elevation of personnel or equipment in a bay with an EOT crane, but staying at least 7 feet away from the rigid structure of the crane? Yes_____ No _____ If yes, a ground safety person and red strobe lights on both side of the work 25' away is required. Authorization through the safe work zone will be given to the EOT Cranes prior to pass through the area.

11. Hot Work	N/A ☐
11.1	Will the work involve burning, welding, grinding, heat treating, thawing pipes, powder driven fasteners, hot riveting, torch applied roofing, drilling or punching, spark producing tools or hot surfaces (above 450 degrees Fahrenheit? Yes_____ No _____
11.2	Is hot work taking place in a designated high fire hazard area? Yes ____ No ____ If yes, what additional safety precautions must be taken? _____
11.3	A USS Permit Authorizing Individual will issue a Hot Work Permit for all Hot Work activities. Name: _____
11.4	Based upon the hot work activities, what type of fire extinguishing agents will be used? _____
----	General Notes: 1. Inspection of the site must be conducted prior to any hot work activity. 2. A Hot Work Permit must accompany all hot work activities outside of designated hot work locations. 3. All combustibles and flammables must be a minimum of 35' away from hot work area and or protected from ignition. 4. All Fire Watch personnel must be trained on their roles and responsibilities. 5. Ensuring that sparks from burning and welding activity are contained in a manner to prevent exposure of U. S. Steel and other personnel.

Mon Valley Works Contractor Line-Up Meeting

12. Environmental		N/A ☐
12.1	Contractor must comply with all applicable Plant, Federal, State and Local environmental control rules, and regulations.	
12.2	Contractors are required to immediately call the plant emergency number and notify the Operating Department, Plant Environmental Department and Safety & Security Department of any spill or release. Contractors are also responsible for immediate control and containment when possible. Contractors are required to adhere to any applicable spill prevention/control regulations and all U.S. Steel spill prevention/control policies.	
12.3	Contractors are responsible for ensuring that no materials, liquid or solid, are discharged into sewers, waterways, including potential for groundwater contamination.	
12.4	Contractors must notify Environmental and obtain approval before any tank or oil-containing equipment is installed or removed, and before the status of any tank or oil-containing equipment, changes (contact Environmental for more information). Contractors are responsible for all necessary registrations/permits/inspections for contractor-owned tanks.	
12.5	All waste(s) generated during contractor activities must be handled and disposed of in accordance with all applicable laws. Contact USS Environmental for more information.	
12.6	Contractor shall be knowledgeable of all materials associated with all work to be performed for USS to insure the proper handling, use, storage, clean-up, and disposal of these materials. If the Contractor is unsure how to properly dispose of any materials, Contact the Plant Environmental Department.	
12.7	Contractor is responsible for the proper labeling and containment of their portable storage tanks, drums, and all portable containers. Labeling will include contractor's name, phone number, commodity (material), associated warnings, required PPE, and capacity of the portable storage tank. Transportation and storage of small quantities must be in approved containers and labeled with the material it contains.	
12.8	Certain abrasive blasting activities require permitting. Contractors must notify Environmental and obtain approval prior to any abrasive blasting activities.	
12.9	For USS ISO14001 Certified Plants, Contractors must be trained and knowledgeable of applicable ISO procedures and ISO plant policies. All training must be provided annually and documented.	

PERSONAL PROTECTIVE EQUIPMENT (*mark all that apply*):									
☐	Hard Hat	☐	Safety Glasses	☐	Gloves	☐	Face Shield	☐	Flame Retardant Clothing
☐	Metatarsal Boots	☐	Fall Protection	☐	Respirators	☐	Special Clothing	☐	Personal Gas Monitor
☐	Long Sleeve/Shirt Plans	☐	Other:						

Note – Tinted Safety glasses are prohibited unless approved by the Manager of Safety Department

Safety Department Representative _____ Date _____

Mon Valley Works Contractor Line-Up Meeting
Verification of Lineup Review

Company Name	Print Name	Signature	Date

(Keep this sheet attached to the Line-up Meeting that is posted at the job site)

Mon Valley Works Contractor Line-Up Meeting

JOB SAFETY ANALYSIS

DATE: _____ **COMPANY NAME:** _____

JOB LOCATION: _____

PROJECT NAME: _____

TASK DESCRIPTION: _____

Job Step(s)	Potential Hazard(s)	Control Measure(s)

Water Quality Analysis for Cooling Water Supply

10041 Lickinghole Road - Ashland, Virginia 23005 · t/ 804.935.2418 · www.chemtreat.com

Analytical Lab

Certificate of Analysis

May 31, 2024

Laboratory No. W-240528-060
Company USS - EDGAR THOMSON PLANT (C25060.00)
Address 13TH STREET & BRADDOCK AVENUE
DELIVERY STATION 004, BRADDOCK, PA, 15104, USA
Account Manager Matthew Howells
Request Date May 28, 2024
Sample Class Water

Analysis	RIVER	#1 ONCE THROUGH	#3 ONCE THROUGH	COG
	May 15, 2024	May 15, 2024	May 15, 2024	May 15, 2024
Lab pH	6.19	6.22	6.22	6.28
Total Dissolved Solids	228 mg/L	232 mg/L	238 mg/L	230 mg/L
Conductivity	341 umho	346 umho	355 umho	343 umho
P-Alkalinity, as CaCO3	<1 mg/L	<1 mg/L	<1 mg/L	<1 mg/L
M-Alkalinity, as CaCO3	59 mg/L	60 mg/L	61 mg/L	59 mg/L
Calcium Hardness, as CaCO3	87 mg/L	87 mg/L	89 mg/L	85 mg/L
Total Calcium, as CaCO3	89 mg/L	90 mg/L	96 mg/L	92 mg/L
Magnesium Hardness, as CaCO3	39 mg/L	38 mg/L	39 mg/L	38 mg/L
Total Magnesium, as CaCO3	45 mg/L	46 mg/L	49 mg/L	47 mg/L
Iron, as Fe	0.09 mg/L	0.09 mg/L	0.16 mg/L	0.11 mg/L
Total Iron, as Fe	0.41 mg/L	0.60 mg/L	8.1 mg/L	0.42 mg/L
Copper, as Cu	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Copper, as Cu	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Zinc, as Zn	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Zinc, as Zn	<0.01 mg/L	0.02 mg/L	0.04 mg/L	<0.01 mg/L
Sodium, as Na	26 mg/L	27 mg/L	27 mg/L	27 mg/L
Potassium, as K	2.3 mg/L	2.3 mg/L	2.3 mg/L	2.3 mg/L
Chloride, as Cl	20 mg/L	20 mg/L	21 mg/L	24 mg/L
Sulfate, as SO4	102 mg/L	103 mg/L	104 mg/L	103 mg/L

Comments

Respectfully Submitted,

JO Phillips

Joel Phillips
Director, Analytical Lab
ChemTreat International, Inc.

Certificate of Analysis

May 31, 2024

Laboratory No. W-240528-060
Company USS - EDGAR THOMSON PLANT (C25060.00)
Address 13TH STREET & BRADDOCK AVENUE
DELIVERY STATION 004, BRADDOCK, PA, 15104, USA
Account Manager Matthew Howells
Request Date May 28, 2024
Sample Class Water

Analysis	RIVER	#1 ONCE THROUGH	#3 ONCE THROUGH	COG
	May 15, 2024	May 15, 2024	May 15, 2024	May 15, 2024
Nitrate, as NO3	2.7 mg/L	3.0 mg/L	3.0 mg/L	2.9 mg/L
Ortho-Phosphate, as PO4	<0.25 mg/L	<0.25 mg/L	<0.25 mg/L	0.73 mg/L
Silica, as SiO2	4.8 mg/L	4.8 mg/L	4.9 mg/L	4.7 mg/L
Total Phosphate, as PO4	<0.5 mg/L	<0.5 mg/L	<0.5 mg/L	0.85 mg/L
Fluoride, as F	0.12 mg/L	0.15 mg/L	0.15 mg/L	0.25 mg/L
Bromide, as Br	-	<0.1 mg/L	<0.1 mg/L	0.11 mg/L
Ammonia, as NH3	-	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Aluminum, as Al	0.08 mg/L	0.05 mg/L	0.10 mg/L	0.07 mg/L
Total Aluminum, as Al	0.24 mg/L	0.22 mg/L	2.3 mg/L	0.25 mg/L
Barium, as Ba	0.04 mg/L	0.03 mg/L	0.03 mg/L	0.03 mg/L
Total Boron, as B	0.04 mg/L	0.04 mg/L	0.07 mg/L	0.04 mg/L
Total Barium, as Ba	0.04 mg/L	0.04 mg/L	0.07 mg/L	0.05 mg/L
Total Cadmium, as Cd	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Chromium, as Cr	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Cobalt, as Co	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Lithium, as Li	0.02 mg/L	0.02 mg/L	0.02 mg/L	0.02 mg/L
Manganese, as Mn	0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Manganese, as Mn	0.07 mg/L	0.06 mg/L	0.61 mg/L	0.07 mg/L
Molybdenum, as Mo	-	<0.05 mg/L	<0.05 mg/L	<0.05 mg/L

Comments

Respectfully Submitted,

J O Phillips

Joel Phillips
Director, Analytical Lab
ChemTreat International, Inc.

Certificate of Analysis

May 31, 2024

Laboratory No. W-240528-060
Company USS - EDGAR THOMSON PLANT (C25060.00)
Address 13TH STREET & BRADDOCK AVENUE
DELIVERY STATION 004, BRADDOCK, PA, 15104, USA
Account Manager Matthew Howells
Request Date May 28, 2024
Sample Class Water

Analysis	RIVER	#1 ONCE THROUGH	#3 ONCE THROUGH	COG
	May 15, 2024	May 15, 2024	May 15, 2024	May 15, 2024
Total Molybdenum, as Mo	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Nickel, as Ni	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Lead, as Pb	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Strontium, as Sr	0.25 mg/L	0.24 mg/L	0.25 mg/L	0.24 mg/L
Total Strontium, as Sr	0.24 mg/L	0.24 mg/L	0.26 mg/L	0.24 mg/L
Total Vanadium, as V	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Arsenic, as As	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Titanium, as Ti	<0.01 mg/L	<0.01 mg/L	0.08 mg/L	<0.01 mg/L
Total Tin, as Sn	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
Total Antimony, as Sb	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L	<0.1 mg/L
Total Thallium, as Tl	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L	<0.01 mg/L
TOC	1.9 mg/L	1.9 mg/L	1.9 mg/L	1.8 mg/L
Turbidity, as NTU	-	7.1 ntu	76 ntu	6.1 ntu

Comments

Respectfully Submitted,

Joel Phillips
Director, Analytical Lab
ChemTreat International, Inc.

Host Site Interface HAZOP Topical Report

GTI ENERGY

solutions that transform

GTI ENERGY PROJECT NUMBER 23654

ROTA-CAP™: Engineering-Scale Testing of Carbon Capture Technology in Iron and Steel Production

U. S. Steel Site Interface HAZOP Topical Report
23654-000-REP-0005

Date of Issue:
August 6th, 2025

Revision No.:
B

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Rev.	Date	Description	Prepared	Checked	Approved
B	8/6/2025	Issued for Bid	AJK	DK	MM
A	8/2/2025	Issued for Review	AJK	DK	MM

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The results within this report relate only to any items specifically evaluated or tested.

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Terms and Acronyms

Acronym	Description
CO_2	Carbon Dioxide
CWR	Cooling Water Return
CWS	Cooling Water Supply
GTI	GTI Energy
LOTO	Lock-Out/Tag-Out
PPE	Personnel Protective Equipment
PSV	Pressure Safety Valve
RPB	Rotating Packed Bed
SOP	Standard Operating Procedure
SDS	Safety Data Sheets

Referenced Documents

The following attachments contain supplemental material and are referenced throughout this document. These attached documents are expected to be read in parallel with this HAZOP report.

Table 1. Referenced Documents

Reference	File Name	Revision	Description
1	23654-0000-REP-0005	A	ROTA-CAP™ System HAZOP Topical Report
1	23654-0000-DOC-0022	A	Site Interface HAZOP Recommendation Tracker

1.0 Executive Summary

This document covers a preliminary HAZOP study of the interface points between the subsystems of the selected Host Site, U. S. Steel's Edgar Thomson industrial iron and steel production facility in Braddock, Allegheny County, PA, and the Engineering-Scale ROTA-CAP™ carbon capture system designed by GTI Energy (GTI). The ROTA-CAP™ system is to be fabricated and then installed and tested with real flue gas at the Host Site.

The objective of this preliminary HAZOP was to cover hazard and operability concerns associated with the interface points between the Host Site and the ROTA-CAP™ system, as well as identify the consequences and any designed safeguards for deviations to the process. A team from GTI knowledgeable in the process worked together with Host Site personnel to conduct this study over the course two half-day review sessions.

As part of this preliminary HAZOP of the site interface points, the team identified a list of recommendations that should be evaluated. These recommendations will aid in the improvement of the design during site engineering and coordination with Vendors and Contractors.

2.0 Introduction

Under DOE award DE-FE0032466, GTI shall design, fabricate and test an engineering-scale carbon capture technology that will be implemented in an iron and steel production facility. GTI will be implementing the ROTA-CAP™ carbon capture technology at U. S. Steel's Edgar Thomson industrial iron and steel production facility, which has been identified as the Host Site for this project. The objective of the project is to demonstrate the capability of the ROTA-CAP™ system to capture 10 tonnes of CO_2 per day from flue gas coming off the iron and steel plant.

ROTA-CAP™, a process intensification technology, utilizes rotating packed beds (RPBs) for post-combustion carbon capture. The centrifugal force generated by the RPBs rotating around an axis allows for the use of advanced solvents with higher viscosities for carbon capture, ultimately achieving much higher mass transfer rates than conventional absorption columns. ROTA-CAP™ RPBs also allows for a smaller contactor volume requirement, as well as taking up a much smaller footprint for the overall system.

The 10 tonne/day ROTA-CAP™ system will accept flue gas from the Host Site and utilize utilities such as cooling water, potable water, steam, electricity, and instrument air. Host Site personnel will also assist with chemical transport and waste disposal activities.

3.0 HAZOP Scope and Objectives

A HAZOP was conducted on the interface points between GTI's ROTA-CAP™ system and the subsystems and utility headers of the Host Site to review hazards and operability concerns. This study was focused specifically on the interface points between the ROTA-CAP™ system and the Host Site, and the new tie-ins required. This study does not encompass the whole of the Host Site's utility supply systems, as those are existing systems which have previously undergone their own hazard assessments. The ROTA-CAP™ system itself was also evaluated in separate HAZOP. Refer to the associated Topical Report in document 23654-0000-REP-0005 for a detailed discussion of the HAZOP performed on the ROTA-CAP™ system.

This was conducted utilizing a set of drawings developed by U. S. Steel, which depict the location of planned tie-in points and interconnections between the existing Host Site facilities and the ROTA-CAP™ system to be installed at the site. The drawings depict things such as utility supply and return systems, flue gas supply and return lines, drain locations, and plot layouts of the site.

The systems evaluated in this HAZOP were broken down into nodes, allowing for a more detailed review of each part of the system. The team were guided through a systematic approach utilizing guidewords to look for process deviations and hazards, and their potential risk to personnel safety, environmental and business effects, and finally the reputation of the Host Site.

As the interface points and systems evaluated in the HAZOP are specific to the U. S. Steel facility, the Host Site's risk evaluation and assessment criteria were utilized in this study. These criteria are presented in Section 6.0 Risk Assessment Criteria & Guidelines.

The HAZOP worksheets developed for each node evaluated in this study are presented in Section 7.0 HAZOP Worksheets. Within the HAZOP worksheets presented in Section 7.0, the evaluations of some nodes reference causes & consequences from other deviations or nodes. This indicates that similar or identical causes and consequences are present for a similar or identical process configurations. This also indicates that similar or identical safeguards and recommendations are considered. This methodology allows for this report to be streamlined and easier to follow.

4.0 Team

The HAZOP was conducted in July of 2025, split into two virtual sessions. The list below outlines the attendees:

- Alexander Koutsostamatis, Sr. Engineer, GTI Energy – Process Engineering
- Danielle Kohler, Sr. Engineer, GTI Energy – Operations
- Neil Pergar, Project Manager, U. S. Steel
- Brian Turpin, Safety Manager, U. S. Steel

5.0 Summary of HAZOP Recommendations

The complete list of recommendations that were identified in this study are presented in Section 8.0 Recommendations. A total of 16 recommendations were identified through this study. These recommendations will aid in progressing the design process to further stages and ensuring a safe and reliable interface between the Host Site and the ROTA-CAP™ system is designed and developed. The recommendations are merely suggestions to be taken up by the respective engineering teams and implemented as deemed necessary.

As this study was completed during the initial stages of design, the recommendations identified shall be revisited during detailed design of the ROTA-CAP™ system with the selected system fabricator as well as the Host Site and the Host Site's selected construction contractor.

Refer to the Site Interface HAZOP Recommendation Tracker in document 23654-0000-DOC-0022 for a summary of the priority and status of each recommendation identified. The "priority" refers to the intended timeframe for when the recommendation shall be addressed, for example during detailed design with the system fabricator and equipment vendors during the next Budget Period. The "status" indicates whether the recommendation has been incorporated or whether evaluation of the recommendation is still open. During detailed design, all the recommendations shall be reviewed to ensure they have been appropriately evaluated and addressed as required, and another HAZOP review on the finalized system design shall be completed.

6.0 Risk Assessment Criteria & Guidelines

Table 2: U. S. Steel Risk Assessment Matrix

		Frequency				
		Rare or Improbable (1)	Unlikely or Remote (2)	Possible or Occasional (3)	Likely or Probable (4)	Almost Certain or Frequent (5)
		Very low, very unlikely during the next twenty five years	Not impossible, likely to occur during the next ten to twenty five years	Possible, may occur at least once in a one to ten year period	High, may occur about once a year	Very high, may occur at least several times per year
Severity	Insignificant (1)	1	2	3	4	5
	Minor (2)	2	4	6	8	10
	Moderate (3)	3	6	9	12	15
	Major (4)	4	8	12	16	20
	Critical (5)	5	10	15	20	25

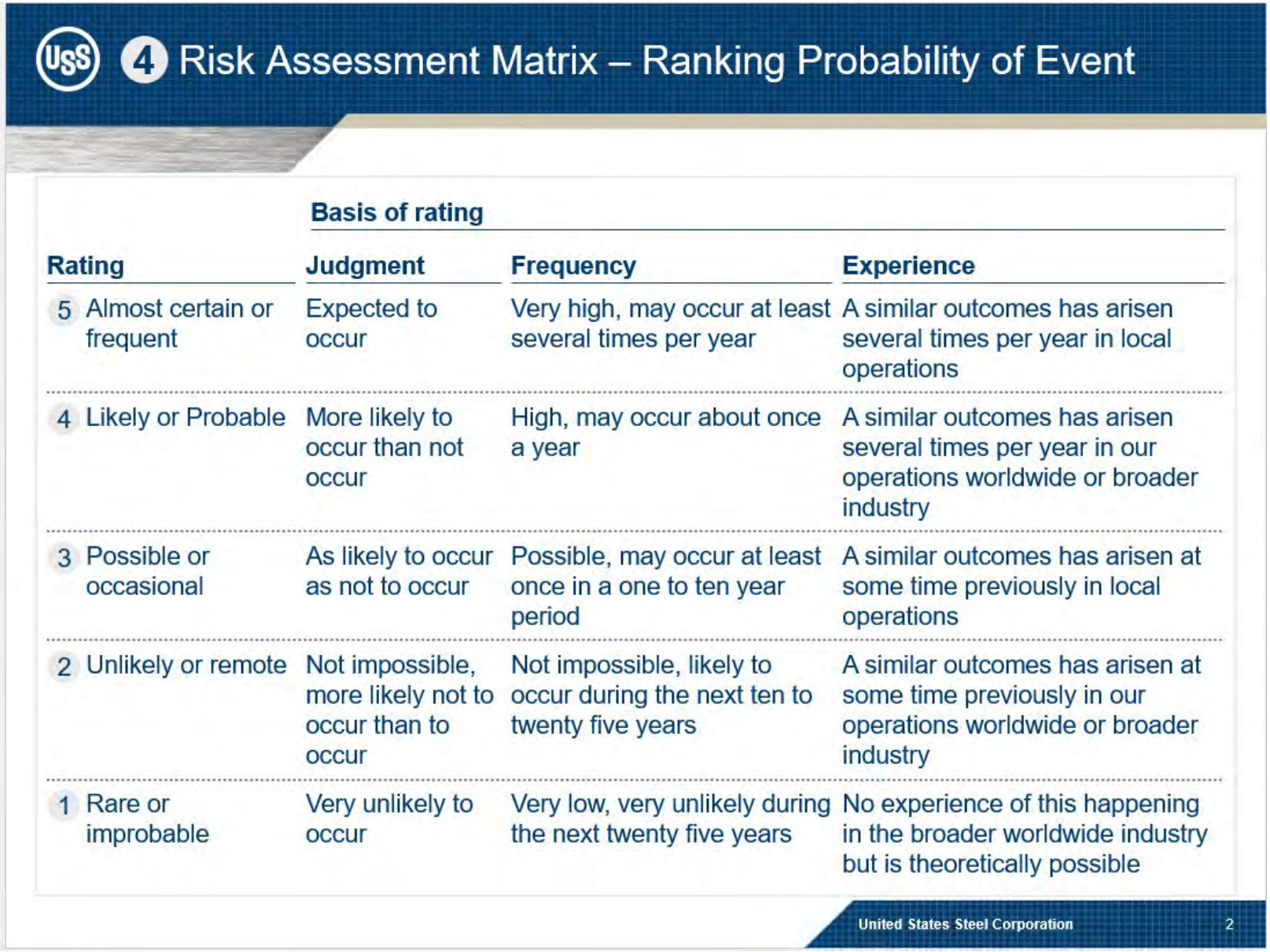

Figure 1: U. S. Steel Risk Assessment Matrix – Event Probability Ranking Criteria

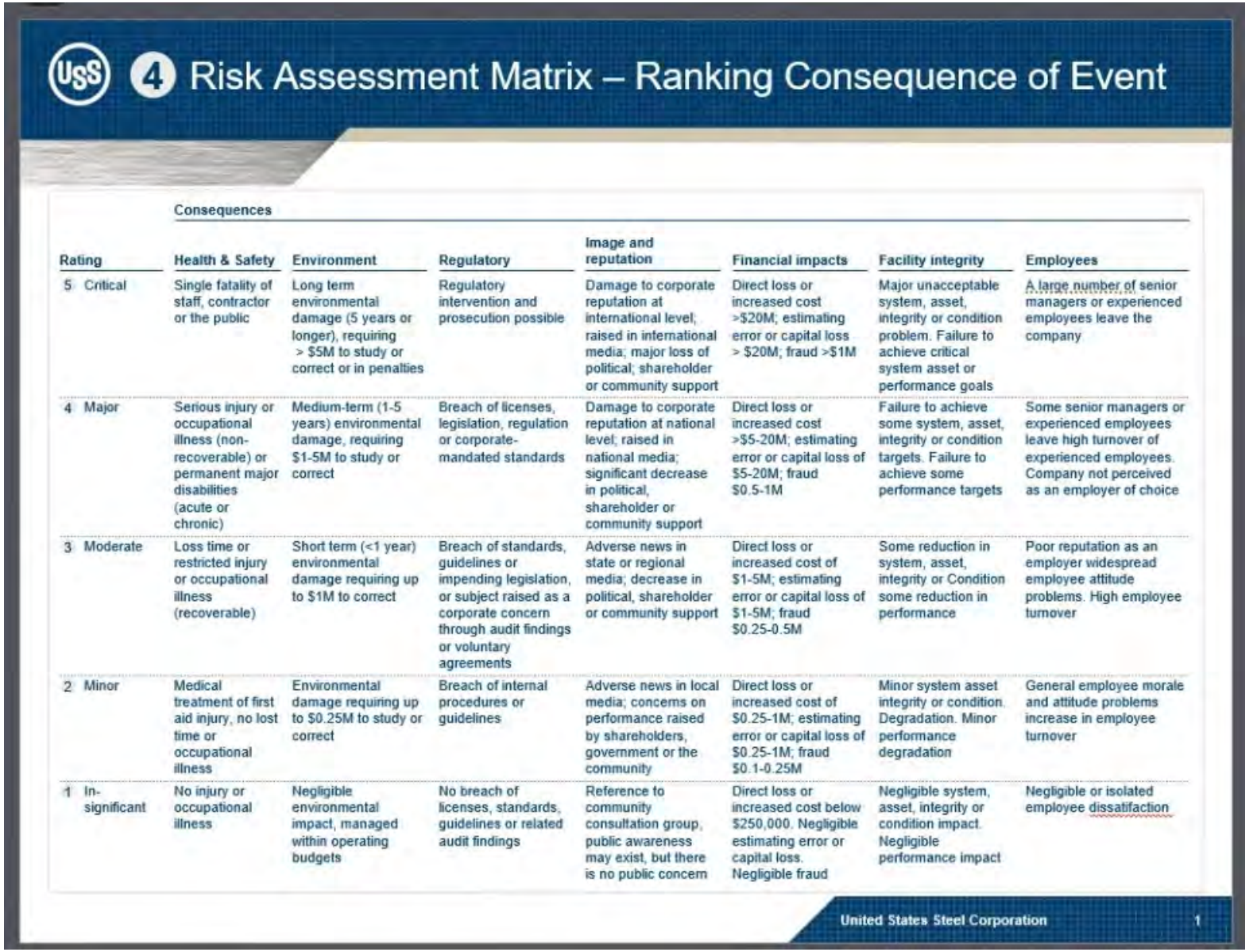

Figure 2: U. S. Steel Risk Assessment Matrix – Consequence Ranking Criteria

7.0 HAZOP Worksheets

7.1 HAZOP Node 1: Cooling Water Supply

This node evaluates the utility tie-in to the Host Site's cooling water supply header. The tie-in point consists of a branch off the Host Site's existing cooling water header, with a new isolation valve to be installed at the branch connection. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of flanged piping from the tie-in point on the Host Site's cooling water header to the battery limit of the ROTA-CAP™ unit.

The HAZOP worksheet developed for Node 1 is presented below.

	Deviation		Cause	UL (Unmitigated Likelihood)		Consequence	Severity				Highest Severity	UR (Unmitigated Risk)			Safeguard	ML (Mitigated Likelihood)	MR (Mitigated Risk)			Recommendation
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Isolation valve is closed.	Almost Certain or Frequent (5)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Upstream supply system is shut off	Almost Certain or Frequent (5)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	Under-dosing of treatment chemical.	Possible or Occasional (3)	1	Corrosion of cooling water supply piping, resulting in a leak of water on the ground, potential slipping hazard, injury to personnel.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	6	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1	(1)	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.
													2	(2)	Personnel Protective Equipment (PPE)			2		
					2	Contamination of ROTA-CAP system, potential corrosion or damage to equipment over time.	Insignificant (1)	Insignificant (1)	Minor (2)	Insignificant (1)	Minor (2)	6	1	(1)	SOPs Exist	Unlikely or Remote (2)	4	1	(1)	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.
													2					2	(2)	Evaluate the materials specified for the cooling water supply/return systems in the ROTA-CAP unit with the system fabricator and ensure they are appropriate.
12	High Concentration	1	Over-dosing of chemical.	Possible or Occasional (3)	1	Corrosion of cooling water supply piping. Leak of water on the ground, potential slipping hazard and/or contact with corrosive dosing chemical. Risk injury to personnel.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	6	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1	(1)	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.
													2	(2)	Personnel Protective Equipment (PPE)					
					2	Contamination of ROTA-CAP system, potential corrosion or damage to equipment over time.	Insignificant (1)	Insignificant (1)	Minor (2)	Insignificant (1)	Minor (2)	6	1	(1)	SOPs Exist	Unlikely or Remote (2)	4	1	(1)	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.
													2					2	(2)	Evaluate the materials specified for the cooling water supply/return systems in the ROTA-CAP unit with the system fabricator and ensure they are appropriate.
13	Leak	1	Manual valves left open.	Almost Certain or Frequent (5)	1	Spill of water on the ground, potential slipping hazard, injury to personnel.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
		2	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	See Cause 1, Consequence 1.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
		3	Fitting, pipe, or valve integrity failure.	Rare or Improbable (1)	1	See Cause 1, Consequence 1.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	2	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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	Deviation		Cause	UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	During start-up or commissioning, isolation valve is open when it should not be, resulting in a release of water.	Almost Certain or Frequent (5)	1	See Leak Deviation, Cause 1, Consequence 1.							1					1		
17	Shutdown	1	See Start-up.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	See Low/No Flow		1								1					1		

7.2 HAZOP Node 2: Cooling Water Return and Pressure Safety Valve Blowdown

This node evaluates the tie-in to the Host Site's cooling water return header. The tie-in point consists of flanged piping from the battery limits of the ROTA-CAP™ unit to the Host Site's cooling water return header. Any cooling water returned from the ROTA-CAP™, or blowdown from the cooling water line pressure safety valves (PSVs) within the system, are returned to U. S. Steel via this interconnection. The interface at the cooling water return header consists of a new branch connecting to the Host Site's existing water header. No new valving or obstructions are expected to be included within the scope of this interface.

The HAZOP worksheet developed for Node 2 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	ROTA-CAP system is not running, no CWS/CWR.	Almost Certain or Frequent (5)	1	No consequences							1					1		
		2	Potential fouling or buildup of material in cooling water return lines.	Rare or Improbable (1)	1	Restriction or blockage of flow, loss of cooling water flow to ROTA-CAP system, system shutdown, loss of data/delays, no other consequences.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	1	1			Insignificant (1)	1	1		
		3	No valving expected to be in place, free draining to sewer system. No other credible causes.		1								1					1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	Spill of water on the ground, potential slipping hazard, injury to personnel.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
		2	Fitting or pipe integrity failure.	Rare or Improbable (1)	1	See Cause 1.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	2	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	The cooling water is the main process flow. See Low/No Flow.		1								1					1		

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7.3 HAZOP Node 3: Potable Water Supply

This node evaluates the utility tie-in to the Host Site's potable water supply header. The tie-in point consists of a branch off the Host Site's existing potable water header, with a new isolation valve to be installed at the branch connection. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of flanged piping from the tie-in point on the Host Site's potable water header to the battery limit of the ROTA-CAP™ unit.

The HAZOP worksheet developed for Node 3 is presented below.

	Deviation		Cause	UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)			Safeguard	ML (Mitigated Likelihood)	MR (Mitigated Risk)			Recommendation
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Isolation valve is closed.	Almost Certain or Frequent (5)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Loss of city water supply.	Rare or Improbable (1)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	1	1	(3)	Redundant water supply sources.	Rare or Improbable (1)	1	1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See No/Low Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Manual valves left open.	Almost Certain or Frequent (5)	1	Spill of water on the ground, potential slipping hazard, injury to personnel.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
		2	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	See Cause 1, Consequence 1.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
		3	Fitting, pipe, or valve integrity failure.	Rare or Improbable (1)	1	See Cause 1, Consequence 1.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	2	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1		
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	During start-up or commissioning, isolation valve is open when it should not be, resulting in a release of water.	Almost Certain or Frequent (5)	1	See Leak Deviation, Cause 1, Consequence 1.							1					1		
17	Shutdown	1	See Start-up.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	See Low/No Flow.		1								1					1		

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7.4 HAZOP Node 4: Steam Supply

This node evaluates the utility tie-in to the Host Site's steam supply header. The tie-in point consists of a branch off the Host Site's existing steam header, with a new isolation valve to be installed at the branch connection. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of welded piping from the tie-in point on the Host Site's potable steam header to the battery limit of the ROTA-CAP™ unit. The connections between the new isolation valve and piping are also expected to be welded.

The HAZOP worksheet developed for Node 4 is presented below.

	Deviation		Cause	UL (Unmitigated Likelihood)		Consequence	Severity				Highest Severity	UR (Unmitigated Risk)			Safeguard	ML (Mitigated Likelihood)	MR (Mitigated Risk)			Recommendation
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Isolation valve is closed.	Almost Certain or Frequent (5)	1	ROTA-CAP can't system can't run, loss of heating to reboiler. Loss of data, test delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Upstream supply system is shut off	Almost Certain or Frequent (5)	1	ROTA-CAP can't system can't run, loss of heating to reboiler. Loss of data, test delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	Valves on steam supply to COG & BFG are left open and steam supply is off, while the steam supply isolation valves to the ROTA-CAP unit are open.	Unlikely or Remote (2)	1	Potential backflow of COG or BFG to steam header, and flow of these gases to steam piping/reboiler in the the ROTA-CAP unit. Loss of heating to ROTA-CAP unit, loss of data/delay. Potential damage to reboiler/steam equipment.	Insignificant (1)	Insignificant (1)	Minor (2)	Insignificant (1)	Minor (2)	4	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	See Low/No Flow		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid that would impact steam quality.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid that would impact steam quality.		1								1					1		
13	Leak	1	Fitting, pipe, or valve integrity failure.	Rare or Improbable (1)	1	500 °F steam is released, personnel come into contact with steam, severe burns and/or injury.	Major (4)	Insignificant (1)	Insignificant (1)	Moderate (3)	Major (4)	4	1	(1)	SOPs Exist	Rare or Improbable (1)	4	1	(3)	Evaluate if the insulation jacketing on the piping serves as a physical barrier can be considered a safeguard.
													2	(2)	Personnel Protective Equipment (PPE)			2	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	During start-up or commissioning, isolation valve is open when it should not be, resulting in a release of steam.	Almost Certain or Frequent (5)	1	500 °F steam is released, personnel come into contact with steam, severe burns and/or injury.	Major (4)	Insignificant (1)	Insignificant (1)	Moderate (3)	Major (4)	20	1	(1)	SOPs Exist	Possible or Occasional (3)	12	1	(5)	Consider locking the isolation valve on the steam supply line to the ROTA-CAP system closed during periods when the ROTA-CAP system is not installed and connected to the steam utility, to ensure that the steam line cannot be inadvertently opened when the system is not connected.
													2	(2)	Personnel Protective Equipment (PPE)			2	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
17	Shutdown	1	See Start-up.		1								1					1	(5)	Consider locking the isolation valve on the steam supply line to the ROTA-CAP system closed during periods when the ROTA-CAP system is not installed and connected to the steam utility, to ensure that the steam line cannot be inadvertently opened when the system is not connected.

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Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	See No/Low Flow.		1								1					1		

7.5 HAZOP Node 5: Steam Condensate Return

This node evaluates the steam condensate return line from the battery limit of the ROTA-CAP™ unit to the Host Site. The condensate leaving the ROTA-CAP™ unit is routed to an appropriate drain/sewer line with the scope of the Host Site. The interface evaluated consists of the flanged piping between the ROTA-CAP™ unit and the drain/sewer connection point. No new valving or obstructions are expected to be included within the scope of this interface.

The HAZOP worksheet developed for Node 5 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	ROTA-CAP system is not running, no steam/condensate flow.	Almost Certain or Frequent (5)	1	No consequences							1					1		
		2	Potential fouling or buildup of material in condensate return lines.	Rare or Improbable (1)	1	Restriction or blockage of flow, loss of steam flow to ROTA-CAP system, system shutdown, loss of data/delays, no other consequences.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	1	1			Insignificant (1)	1	1		
		3	No valving expected to be in place, free draining to sewer system. No other credible causes.		1								1					1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	Release of condensate on the ground, potential slipping hazard or contact of personnel with hot condensate leading to injury or burns.	Moderate (3)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Moderate (3)	15	1	(1)	SOPs Exist	Possible or Occasional (3)	9	1	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
													2	(2)	Personnel Protective Equipment (PPE)			2		
		2	Fitting or pipe integrity failure.	Rare or Improbable (1)	1	See Cause 1.	Moderate (3)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Moderate (3)	3	1	(1)	SOPs Exist	Rare or Improbable (1)	3	1	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	The condensate is the main process flow. See Low/No Flow.		1								1					1		

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7.6 HAZOP Node 6: Instrument Air Supply

This node evaluates the utility tie-in to the Host Site's compressed air supply header used to supply instrumentation with compressed air necessary for operation. The tie-in point consists of a branch off the Host Site's existing instrument header, with a new isolation valve to be installed at the branch connection. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of flanged piping from the tie-in point on the Host Site's instrument air header to the battery limit of the ROTA-CAP™ unit.

The HAZOP worksheet developed for Node 6 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Isolation valve is closed.	Almost Certain or Frequent (5)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Upstream supply system is shut off	Almost Certain or Frequent (5)	1	Unable to run ROTA-CAP system, loss of data / testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow.		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	Loud jet of air, can cause long term hearing loss to personnel standing nearby.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
													2	(2)	Personnel Protective Equipment (PPE)			2		
		2	Fitting, pipe, or valve integrity failure.	Rare or Improbable (1)	1	Loud jet of air, can cause long term hearing loss to personnel standing nearby.	Minor (2)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Minor (2)	2	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1	(4)	Ensure that piping is routed away from walkways and locations where personnel can be impacted.
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	During start-up or commissioning, isolation valve is open when it should not be, resulting in a release of air.	Almost Certain or Frequent (5)	1	See Leak Deviation, Cause 1, Consequence 1.							1					1		
17	Shutdown	1	See Start-up.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	See Low/No flow.		1								1					1		

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7.7 HAZOP Node 7: Flue Gas Supply

This node evaluates the tie-in to the Host Site's waste gas stack used to supply flue gas to the ROTA-CAP™ system. An existing port connection is present on the waste gas stack, and shall be used for this tie-in. A new isolation valve to be installed at the port on the stack. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of welded piping from the isolation valve to the battery limit of the ROTA-CAP™ unit. The connections between the new isolation valve and piping are expected to be flanged.

The HAZOP worksheet developed for Node 7 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Isolation valve is closed.	Almost Certain or Frequent (5)	1	No feed to ROTA-CAP system. Loss of test data, test delays.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Unplanned shut down of blast furnace stoves.	Almost Certain or Frequent (5)	1	No feed to ROTA-CAP system. Loss of test data, test delays.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	See Low/No Flow.		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	Potential for air infiltration through seals, not in scope of interface, refer to ROTA-CAP system HAZOP for potential causes/consequences of high air/O2 concentration		1								1					1		
13	Leak	1	Improper torquing of flanges.	Almost Certain or Frequent (5)	1	Infiltration of air into the flue gas supply piping. Increase in the concentration of air/O2 in the flue gas supply to the ROTA-CAP unit. Impact on system performnance & test results, potential loss of data/test delay. Long term exposure to excess oxygen may lead to solvent degradation over time.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1		
		2	Fitting, pipe, weld, or valve integrity failure.	Rare or Improbable (1)	1	Infiltration of air into the flue gas supply piping. Increase in the concentration of air/O2 in the flue gas supply to the ROTA-CAP unit. Impact on system performnance & test results, potential loss of data/test delay. Long term exposure to excess oxygen may lead to solvent degradation over time.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	1	1	(1)	SOPs Exist	Rare or Improbable (1)	1	1		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

7.8 HAZOP Node 8: Flue Gas Return

This node evaluates the flue gas return tie-in to the Host Site's waste gas stack. A new port connection will be installed on the waste gas stack and shall be used for this tie-in. A new isolation valve to be installed at the port on the stack. The remainder of the interface between the Host Site and the ROTA-CAP™ system consists of welded piping from the battery limit of the ROTA-CAP™ unit to the waste gas stack. The connections between the new isolation valve and piping are expected to be flanged.

The HAZOP worksheet developed for Node 8 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Flue gas return port on the stack is closed (isolation valve closed)	Almost Certain or Frequent (5)	1	No escape path for relieved flue gas return stream. Buildup of pressure in the flue gas return header, potential for leaks from valve seals at stack isolation point, which is elevated on the stack and away from personnel. Piping is welded, valve is the main location of potential leakage.	Incidental (1)	Minor (2)	Incidental (1)	Incidental (1)	Minor (2)	10	1	(1)	SOPs Exist	Likely or Probable (4)	8	1	(6)	Consider having the isolation valve on the return port locked open when the ROTA-CAP system is intended to be running.
													2					2	(7)	Evaluate the coverage of existing gas monitors and determine if any additional monitors are required.
					2	Potential overpressure in ROTA-CAP flue gas return header, resulting in shutdown via ROTA-CAP system safeguards. Loss of test data, test delays.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1	(6)	Consider having the isolation valve on the return port locked open when the ROTA-CAP system is intended to be running.
		2	ROTA-CAP system is not running.	Almost Certain or Frequent (5)	1	No consequences.							1					1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
6	High Pressure	1	See Low/No Flow.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Improper torquing of flanges on isolation valve at flue gas return port on stack.	Rare or Improbable (1)	1	See Low/No Flow Deviation, Cause 1, Consequence 1.							1					1	(7)	Evaluate the coverage of existing gas monitors and determine if any additional monitors are required.
		2	Pipe or weld integrity failure.	Rare or Improbable (1)	1	Leak of flue gas to the area, potential asphyxiation and potential fatality.	Critical (5)	Minor (2)	Insignificant (1)	Major (4)	Critical (5)	5	1	(1)	SOPs Exist	Rare or Improbable (1)	5	1	(7)	Evaluate the coverage of existing gas monitors and determine if any additional monitors are required.
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

7.9 HAZOP Node 9: Chemical Feed Tote Handling

This node consists of the acceptance, transport, and handling of new chemical feed totes required for the ROTA-CAP™ system. Both caustic solution and amine solvent are utilized within the carbon capture unit, and totes of these chemicals will be shipped to the site and transported to their final location so that these chemicals can be added to the system as required. Host Site personnel will be involved in the transport and handling of these totes across the site.

The HAZOP worksheet developed for Node 9 is presented below.

	Deviation		Cause	UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)			Safeguard	ML (Mitigated Likelihood)	MR (Mitigated Risk)			Recommendation
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Tote container itself fails.	Unlikely or Remote (2)	1	Leak of solvent and/or caustic, potential injury to personnel (corrosive materials, slip & fall), release of chemicals to the environment.	Minor (2)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	4	1	(1)	SOPs Exist	Rare or Improbable (1)	2	1	(8)	Ensure that totes are equipped with proper containment, both during transport and in final placement next to the skid, in accordance with U. S. Steel's typical practices.
													2	(2)	Personnel Protective Equipment (PPE)			2		
													3	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			3		
		2	Impact during transit, damaging the container/tote.	Almost Certain or Frequent (5)	1	Leak of solvent and/or caustic, potential injury to personnel (corrosive materials, slip & fall), release of chemicals to the environment.	Minor (2)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Unlikely or Remote (2)	4	1	(8)	Ensure that totes are equipped with proper containment, both during transport and in final placement next to the skid, in accordance with U. S. Steel's typical practices.
													2	(2)	Personnel Protective Equipment (PPE)			2		
													3	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			3		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	Solvent or Caustic totes are switched during transit, or wrong tote installed for caustic and/or amine makeup.	Almost Certain or Frequent (5)	1	Introduction of wrong chemical to process. Refer to ROTA-CAP system HAZOP for detailed language. Potential for amine waste to enter non-amine waste drains.	Minor (2)	Minor (2)	Minor (2)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Likely or Probable (4)	8	1	(9)	Ensure that the two different tote types are not stored next to each other, and are stored and potentially operated in different areas of the plant, to prevent any mix up.
													2					2	(10)	Provide clear labeling and signage to identify chemicals and their appropriate storage location and connection points.
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
19	Loss of Utilities	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

7.10 HAZOP Node 10: Non-Amine Waste Handling

This node consists of the handling and transport of neutralized, non-amine wastewater collected in the ROTA-CAP™ system. Temporary hoses and pumps shall be utilized to transport the wastewater to an appropriate drainage location. Host Site personnel shall assist with these disposal activities.

The HAZOP worksheet developed for Node 10 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Pump malfunctions, waste note removed from ROTA-CAP system.	Possible or Occasional (3)	1	Non-amine waste is not removed from the ROTA-CAP system, eventual buildup of level in V-1001 on ROTA-CAP system. Eventual ESD of ROTA-CAP system based on high-high level interlock, loss of data, testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	3	1			Possible or Occasional (3)	3	1	(11)	During detailed design, revisit the level control scheme for vessel V-1001 within the ROTA-CAP system to ensure control scheme is aligned with U. S. Steel's operational plan for removing and collecting waste.
													2					2	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
		2	Accidental shut off of pump, or pump is not started when needed.	Almost Certain or Frequent (5)	1	See Cause 1, Consequence 1.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1	(11)	Revisit the level control scheme for V-1001 in detailed design to ensure control scheme is aligned with U. S. Steel's operational plan for removing and collecting waste.
													2					2	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	Waste is misdirected to an inappropriate location (storm sewer or other).	Almost Certain or Frequent (5)	1	Release of non-amine waste (neutralized wastewater) to drain or environment.	Insignificant (1)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(13)	Ensure that tanks are appropriately labeled with signage and instructions dictating what they contain and where they should be disposed of.
													2	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			2		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid. No valves in place on discharge piping/hosing.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Leak from equipment piping/hosing, resulting from operator error and/or impact.	Almost Certain or Frequent (5)	1	Release of non-amine waste (neutralized wastewater) to drain or environment.	Insignificant (1)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
													2	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			2		
					2	Leak of non-amine waste, potential injury to personnel due to a slip & fall, release of waste water to the environment.	Minor (2)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	Performing service or maintenance on rotating equipment (pumps) that is still running or has not been properly locked out/tagged out for maintenance.	Almost Certain or Frequent (5)	1	Personnel injury resulting from coming into contact with rotating equipment.	Moderate (3)	Insignificant (1)	Minor (2)	Minor (2)	Moderate (3)	15	1	(1)	SOPs Exist	Possible or Occasional (3)	9	1	(14)	Ensure that appropriate Lock Out/Tag Out (LOTO) procedures are in place so that equipment can be physically locked to prevent operation when maintenance is required.
													2	(2)	Personnel Protective Equipment (PPE)			2		

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	Deviation		Cause	UL (Unmitigated Likelihood)		Consequence	Severity				Highest Severity	UR (Unmitigated Risk)		Safeguard		ML (Mitigated Likelihood)	MR (Mitigated Risk)		Recommendation	
							Safety	Environment	Business	Reputation										
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

7.11 HAZOP Node 11: Amine Waste Tote Handling

This node consists of the handling and transport of amine waste collected within a tote in the ROTA-CAP™ system. Temporary hoses and pumps shall be utilized to transport the waste from the tote to an appropriate drainage location. Host Site personnel shall assist with these disposal activities.

The HAZOP worksheet developed for Node 11 is presented below.

	Deviation		Cause	UL (Unmitigated Likelihood)		Consequence	Severity				Highest Severity	UR (Unmitigated Risk)			Safeguard	ML (Mitigated Likelihood)	MR (Mitigated Risk)			Recommendation
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	Pump malfunctions, waste note removed from ROTA-CAP system.	Possible or Occasional (3)	1	Amine waste is not removed from the ROTA-CAP system, eventual buildup of level in TK-1001 on ROTA-CAP system. Eventual ESD of ROTA CAP system based on high-high level interlock, loss of data, testing delay.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	3	1			Possible or Occasional (3)	3	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
		2	Accidental shut off of pump, or pump is not started when needed.	Almost Certain or Frequent (5)	1	See Cause 1, Consequence 1.	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	Insignificant (1)	5	1	(1)	SOPs Exist	Likely or Probable (4)	4	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	Waste is misdirected to an inappropriate location (storm sewer or other).	Almost Certain or Frequent (5)	1	Release of amine waste to drain or environment.	Insignificant (1)	Moderate (3)	Minor (2)	Minor (2)	Moderate (3)	15	1	(1)	SOPs Exist	Possible or Occasional (3)	9	1	(13)	Ensure that tanks are appropriately labeled with signage and instructions dictating what they contain and where they should be disposed of.
													2	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			2		
5	Low/No Pressure	1	See Low/No Flow		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid. No valves in place on discharge piping/hosing.		1								1					1		
7	Low/No Temperature	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
8	High Temperature	1	No credible causes		1								1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Leak from equipment piping/hosing, resulting from operator error and/or impact.	Almost Certain or Frequent (5)	1	Release of amine waste to drain or environment.	Insignificant (1)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
													2	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			2		
					2	Leak of amine waste, potential injury to personnel due to a slip & fall or contact with amine (corrosive/toxic), release of amine waste to the environment.	Minor (2)	Minor (2)	Insignificant (1)	Insignificant (1)	Minor (2)	10	1	(1)	SOPs Exist	Possible or Occasional (3)	6	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
													2	(2)	Personnel Protective Equipment (PPE)			2		
14	Contamination	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
15	Maintenance Hazards	1	Performing service or maintenance on rotating equipment (pumps) that is still running or has not been properly locked out/tagged out for maintenance.	Almost Certain or Frequent (5)	1	Personnel injury resulting from coming into contact with rotating equipment.	Moderate (3)	Insignificant (1)	Minor (2)	Minor (2)	Moderate (3)	15	1	(1)	SOPs Exist	Possible or Occasional (3)	9	1	(14)	Ensure that appropriate Lock Out/Tag Out (LOTO) procedures are in place so that equipment can be physically locked to prevent operation when maintenance is required.
													2	(2)	Personnel Protective Equipment (PPE)			2		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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	Deviation		Cause	UL (Unmitigated Likelihood)		Consequence	Severity				Highest Severity	UR (Unmitigated Risk)		Safeguard		ML (Mitigated Likelihood)	MR (Mitigated Risk)		Recommendation		
							Safety	Environment	Business	Reputation										
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
19	Loss of Utilities	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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7.12 HAZOP Node 12: Global

The global node evaluates deviations that can occur plant wide. This considers items that would affect all nodes, hence placing them in the global node would allow for all consequences to be covered once. The type of things evaluated include weather related events and hazards (rain, snow, ice, etc.), ambient temperature, loss of power to the facility, and electrical fires.

The HAZOP worksheet developed for Node 12 is presented below.

Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
1	Low/No Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
2	High Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
3	Reverse Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
4	Misdirected Flow	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
5	Low/No Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
6	High Pressure	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
7	Low/No Temperature	1	Low ambient air temperatures during winter.	Almost Certain or Frequent (5)	1	Any solvent or water lines/vessels/totes that do not have continuous flow will freeze, potential damage to piping/equipment or rupture and release to environment.	Minor (2)	Moderate (3)	Minor (2)	Minor (2)	Moderate (3)	15	1			Almost Certain or Frequent (5)	15	1	(15)	Need to evaluate for freeze protection. Consider items like heat tracing, enclosing key equipment in containers with some even with temperature controlled areas.
		2	Winter weather and/or snow results in formation of ice at or around the process area.	Almost Certain or Frequent (5)	1	Slip hazard, risk of personnel slipping and injuring themselves, potentially seriously.	Major (4)	Insignificant (1)	Minor (2)	Minor (2)	Major (4)	20	1	(2)	Personnel Protective Equipment (PPE)	Possible or Occasional (3)	12	1		
													2	(5)	Winter weather plan in place, crews maintain the site to prevent buildup of snow or ice.			2		
8	High Temperature	1	High ambient temp during summer.		1	No credible consequences, ambient temperatures are not expected to be high enough to significantly impact the system.							1					1		
9	Low/No Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
10	High Level	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
11	Low/No Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
12	High Concentration	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
13	Leak	1	Refer to the prior nodes for specific causes of leaks within the interface between the U. S. Steel site and the ROTA-CAP system.		1	Refer to the prior nodes for specific consequences of leaks within the interface between the U. S. Steel site and the ROTA-CAP system.							1					1	(16)	Evaluate the need for eyewash stations and safety showers either in the scope of the U. S. Steel interface or on the ROTA-CAP system itself.
14	Contamination	1	Rainfall resulting in runoff of chemicals into drains.	Almost Certain or Frequent (5)	1	Release of amine to drain or environment.	Insignificant (1)	Moderate (3)	Minor (2)	Minor (2)	Moderate (3)	15	1	(1)	SOPs Exist (Good practices to prevent spills and/or immediately clean up spills to avoid runoff to environment)	Possible or Occasional (3)	9	1	(12)	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.
													2	(4)	Safety Data Sheets (SDS) are in place, readily available to personnel.			2		
15	Maintenance Hazards	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
16	Start-up	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
17	Shutdown	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		
18	Temporary Operations	1	No credible causes within scope of interface with ROTA-CAP skid.		1								1					1		

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Deviation		Cause		UL (Unmitigated Likelihood)	Consequence		Severity				Highest Severity	UR (Unmitigated Risk)	Safeguard			ML (Mitigated Likelihood)	MR (Mitigated Risk)	Recommendation		
							Safety	Environment	Business	Reputation										
19	Loss of Utilities	1	Loss of power in circuit, resulting in loss of power supply to interface subsystems.	Possible or Occasional (3)	1	No serious consequences outside of consequences already defined in individual nodes.							1					1		
		2	Electrical fire.	Unlikely or Remote (2)	1	Damage to equipment or total equipment loss, Serious injury or fatality.	Critical (5)	Moderate (3)	Minor (2)	Major (4)	Critical (5)	10	1	(6)	Fire extinguishers located every 75 ft.	Rare or Improbable (1)	5	1		
													2	(7)	Suppression systems in place to activate in the event of a fire.			2		
													3	(8)	Fire department presence on site for rapid response.			3		
													4	(2)	Personnel Protective Equipment (PPE)			4		

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8.0 Recommendations

Table 3: List of Identified Recommendations

Recommendation No.	Recommendation	References
1	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.	**HAZOP: Node 1, Low/No Concentration: 1.1.1**
		HAZOP: Node 1, Low/No Concentration: 1.2.1
		HAZOP: Node 1, High Concentration: 1.1.1
		HAZOP: Node 1, High Concentration: 1.2.1
2	Evaluate the materials specified for the cooling water supply/return systems in the ROTA-CAP unit with the system fabricator and ensure they are appropriate.	**HAZOP: Node 1, Low/No Concentration: 1.2.2**
		HAZOP: Node 1, High Concentration: 1.2.2
3	Evaluate if the insulation jacketing on the piping serves as a physical barrier can be considered a safeguard.	**HAZOP: Node 4, Leak: 1.1.1**
4	Ensure that piping is routed away from walkways and locations where personnel can be impacted.	**HAZOP: Node 4, Leak: 1.1.2**
		HAZOP: Node 4, Start-up: 1.1.2
		HAZOP: Node 5, Leak: 1.1.1
		HAZOP: Node 5, Leak: 2.1.1
		HAZOP: Node 6, Leak: 1.1.1
		HAZOP: Node 6, Leak: 2.1.1
5	Consider locking the isolation valve on the steam supply line to the ROTA-CAP system closed during periods when the ROTA-CAP system is not installed and connected to the steam utility, to ensure that the steam line cannot be inadvertently opened when the system is not connected.	**HAZOP: Node 4, Start-up: 1.1.1**
		HAZOP: Node 4, Shutdown: 1.1.1
6	Consider having the isolation valve on the return port locked open when the ROTA-CAP system is intended to be running.	**HAZOP: Node 8, Low/No Flow: 1.1.1**
		HAZOP: Node 8, Low/No Flow: 1.2.1
7	Evaluate the coverage of existing gas monitors and determine if any additional monitors are required.	**HAZOP: Node 8, Low/No Flow: 1.1.2**
		HAZOP: Node 8, Leak: 1.1.1
		HAZOP: Node 8, Leak: 2.1.1
8	Ensure that totes are equipped with proper containment, both during transport and in final placement next to the skid, in accordance with U. S. Steel's typical practices.	**HAZOP: Node 9, Leak: 1.1.1**
		HAZOP: Node 9, Leak: 2.1.1

Recommendation No.	Recommendation	References
9	Ensure that the two different tote types are not stored next to each other and are stored and potentially operated in different areas of the plant, to prevent any mix up.	**HAZOP: Node 9, Maintenance Hazards: 1.1.1**
10	Provide clear labeling and signage to identify chemicals and their appropriate storage location and connection points.	**HAZOP: Node 9, Maintenance Hazards: 1.1.2**
11	During detailed design, revisit the level control scheme for vessel V-1001 within the ROTA-CAP system to ensure control scheme is aligned with U. S. Steel's operational plan for removing and collecting waste.	**HAZOP: Node 10, Low/No Flow: 1.1.1** **HAZOP: Node 10, Low/No Flow: 2.1.1**
12	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.	**HAZOP: Node 10, Low/No Flow: 1.1.2** **HAZOP: Node 10, Low/No Flow: 2.1.2** **HAZOP: Node 10, Leak: 1.1.1** **HAZOP: Node 10, Leak: 1.2.1** **HAZOP: Node 11, Low/No Flow: 1.1.1** **HAZOP: Node 11, Low/No Flow: 2.1.1** **HAZOP: Node 11, Leak: 1.1.1** **HAZOP: Node 11, Leak: 1.2.1** **HAZOP: Node 12, Contamination: 1.1.1**
13	Ensure that tanks are appropriately labeled with signage and instructions dictating what they contain and where they should be disposed of.	**HAZOP: Node 10, Misdirected Flow: 1.1.1** **HAZOP: Node 11, Misdirected Flow: 1.1.1**
14	Ensure that appropriate Lock Out/Tag Out (LOTO) procedures are in place so that equipment can be physically locked to prevent operation when maintenance is required.	**HAZOP: Node 10, Maintenance Hazards: 1.1.1** **HAZOP: Node 11, Maintenance Hazards: 1.1.1**
15	Need to evaluate for freeze protection. Consider items like heat tracing, enclosing key equipment in containers with some even with temperature controlled areas.	**HAZOP: Node 12, Low/No Temperature: 1.1.1**
16	Evaluate the need for eyewash stations and safety showers either in the scope of the U. S. Steel interface or on the ROTA-CAP system itself.	**HAZOP: Node 12, Leak: 1.1.1**

9.0 Safeguards

The complete list of safeguards that were identified in this study are presented in Table 4.

Table 4: List of Identified Safeguards

Safeguard Number	Safeguard Description	Reference
1	SOPs Exist	HAZOP: Node 1, Low/No Flow: 1.1.1
		HAZOP: Node 1, Low/No Flow: 2.1.1
		HAZOP: Node 1, Low/No Concentration: 1.1.1
		HAZOP: Node 1, Low/No Concentration: 1.2.1
		HAZOP: Node 1, High Concentration: 1.1.1
		HAZOP: Node 1, High Concentration: 1.2.1
		HAZOP: Node 1, Leak: 1.1.1
		HAZOP: Node 1, Leak: 2.1.1
		HAZOP: Node 1, Leak: 3.1.1
		HAZOP: Node 2, Leak: 1.1.1
		HAZOP: Node 2, Leak: 2.1.1
		HAZOP: Node 3, Low/No Flow: 1.1.1
		HAZOP: Node 3, Leak: 1.1.1
		HAZOP: Node 3, Leak: 2.1.1
		HAZOP: Node 3, Leak: 3.1.1
		HAZOP: Node 4, Low/No Flow: 1.1.1
		HAZOP: Node 4, Low/No Flow: 2.1.1
		HAZOP: Node 4, Reverse Flow: 1.1.1
		HAZOP: Node 4, Leak: 1.1.1
		HAZOP: Node 4, Start-up: 1.1.1
		HAZOP: Node 5, Leak: 1.1.1
		HAZOP: Node 5, Leak: 2.1.1
		HAZOP: Node 6, Low/No Flow: 1.1.1
		HAZOP: Node 6, Low/No Flow: 2.1.1
		HAZOP: Node 6, Leak: 1.1.1
		HAZOP: Node 6, Leak: 2.1.1
		HAZOP: Node 7, Low/No Flow: 1.1.1
		HAZOP: Node 7, Low/No Flow: 2.1.1
		HAZOP: Node 7, Leak: 1.1.1
		HAZOP: Node 7, Leak: 2.1.1
		HAZOP: Node 8, Low/No Flow: 1.1.1
		HAZOP: Node 8, Low/No Flow: 1.2.1
		HAZOP: Node 8, Leak: 2.1.1
		HAZOP: Node 9, Leak: 1.1.1
		HAZOP: Node 9, Leak: 2.1.1
		HAZOP: Node 9, Maintenance Hazards: 1.1.1
		HAZOP: Node 10, Low/No Flow: 2.1.1
		HAZOP: Node 10, Misdirected Flow: 1.1.1
		HAZOP: Node 10, Leak: 1.1.1
		HAZOP: Node 10, Leak: 1.2.1
		HAZOP: Node 10, Maintenance Hazards: 1.1.1
		HAZOP: Node 11, Low/No Flow: 2.1.1
		HAZOP: Node 11, Misdirected Flow: 1.1.1
		HAZOP: Node 11, Leak: 1.1.1
		HAZOP: Node 11, Leak: 1.2.1
		HAZOP: Node 11, Maintenance Hazards: 1.1.1
		HAZOP: Node 12, Contamination: 1.1.1

Safeguard Number	Safeguard Description	Reference
2	Personnel Protective Equipment (PPE)	HAZOP: Node 1, Low/No Concentration: 1.1.2
		HAZOP: Node 1, High Concentration: 1.1.2
		HAZOP: Node 1, Leak: 1.1.2
		HAZOP: Node 1, Leak: 2.1.2
		HAZOP: Node 1, Leak: 3.1.2
		HAZOP: Node 2, Leak: 1.1.2
		HAZOP: Node 2, Leak: 2.1.2
		HAZOP: Node 3, Leak: 1.1.2
		HAZOP: Node 3, Leak: 2.1.2
		HAZOP: Node 3, Leak: 3.1.2
		HAZOP: Node 4, Leak: 1.1.2
		HAZOP: Node 4, Start-up: 1.1.2
		HAZOP: Node 5, Leak: 1.1.2
		HAZOP: Node 5, Leak: 2.1.2
		HAZOP: Node 6, Leak: 1.1.2
		HAZOP: Node 6, Leak: 2.1.2
		HAZOP: Node 9, Leak: 1.1.2
		HAZOP: Node 9, Leak: 2.1.2
		HAZOP: Node 10, Leak: 1.2.2
		HAZOP: Node 10, Maintenance Hazards: 1.1.2
		HAZOP: Node 11, Leak: 1.2.2
		HAZOP: Node 11, Maintenance Hazards: 1.1.2
		HAZOP: Node 12, Low/No Temperature: 2.1.1
		HAZOP: Node 12, Loss of Utilities: 2.1.4
3	Redundant water supply sources.	HAZOP: Node 3, Low/No Flow: 2.1.1
4	Safety Data Sheets (SDS) are in place, readily available to personnel.	HAZOP: Node 9, Leak: 1.1.3
		HAZOP: Node 9, Leak: 2.1.3
		HAZOP: Node 10, Misdirected Flow: 1.1.2
		HAZOP: Node 10, Leak: 1.1.2
		HAZOP: Node 11, Misdirected Flow: 1.1.2
		HAZOP: Node 11, Leak: 1.1.2
		HAZOP: Node 12, Contamination: 1.1.2
5	Winter weather plan in place, crews maintain the site to prevent buildup of snow or ice.	HAZOP: Node 12, Low/No Temperature: 2.1.2
6	Fire extinguishers located every 75 ft.	HAZOP: Node 12, Loss of Utilities: 2.1.1
7	Suppression systems in place to activate in the event of a fire.	HAZOP: Node 12, Loss of Utilities: 2.1.2
8	Fire department presence on site for rapid response.	HAZOP: Node 12, Loss of Utilities: 2.1.3

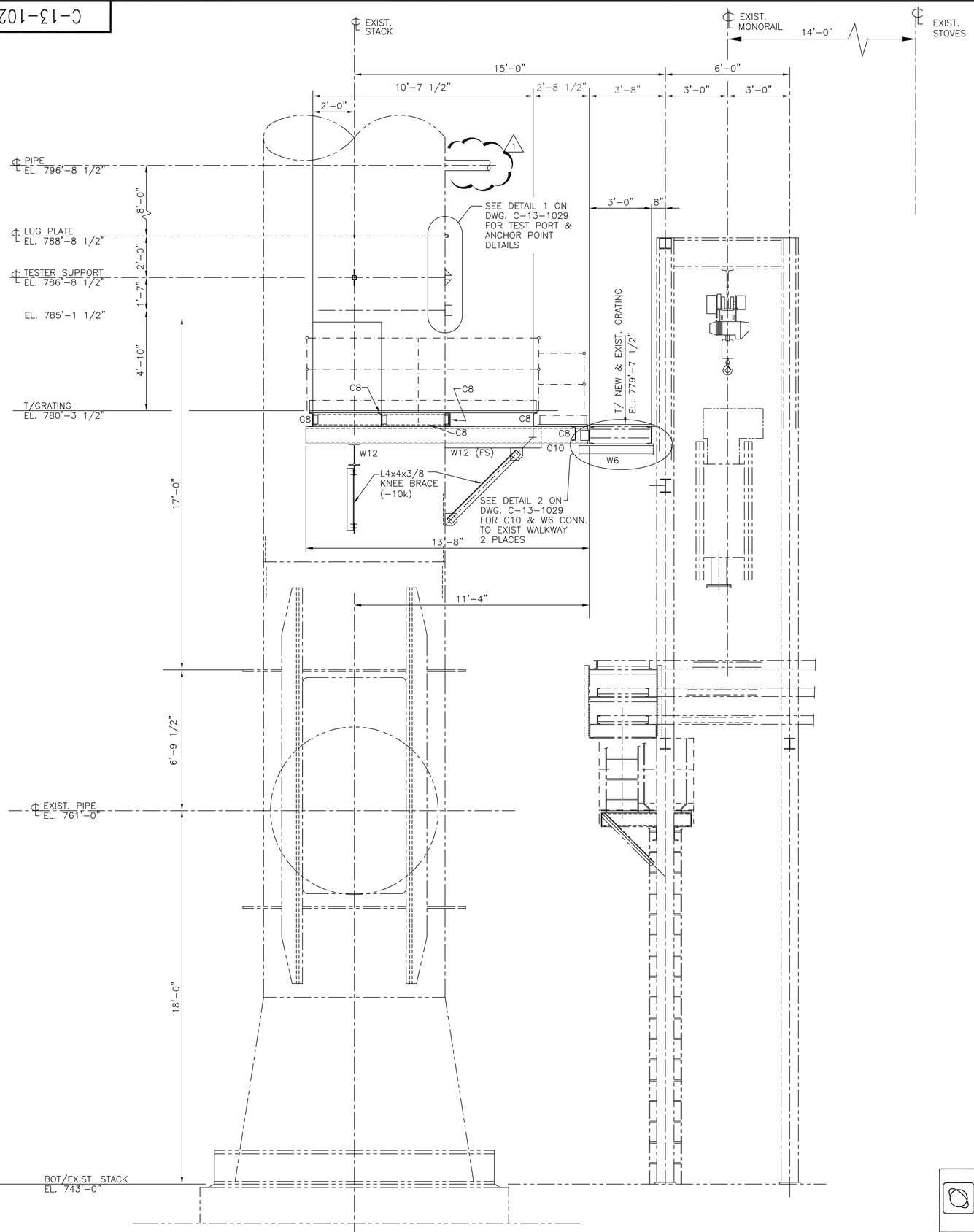
10.0 Drawing Set

The drawing set developed by U. S. Steel and referenced during this evaluation are supplied with this report for reference.

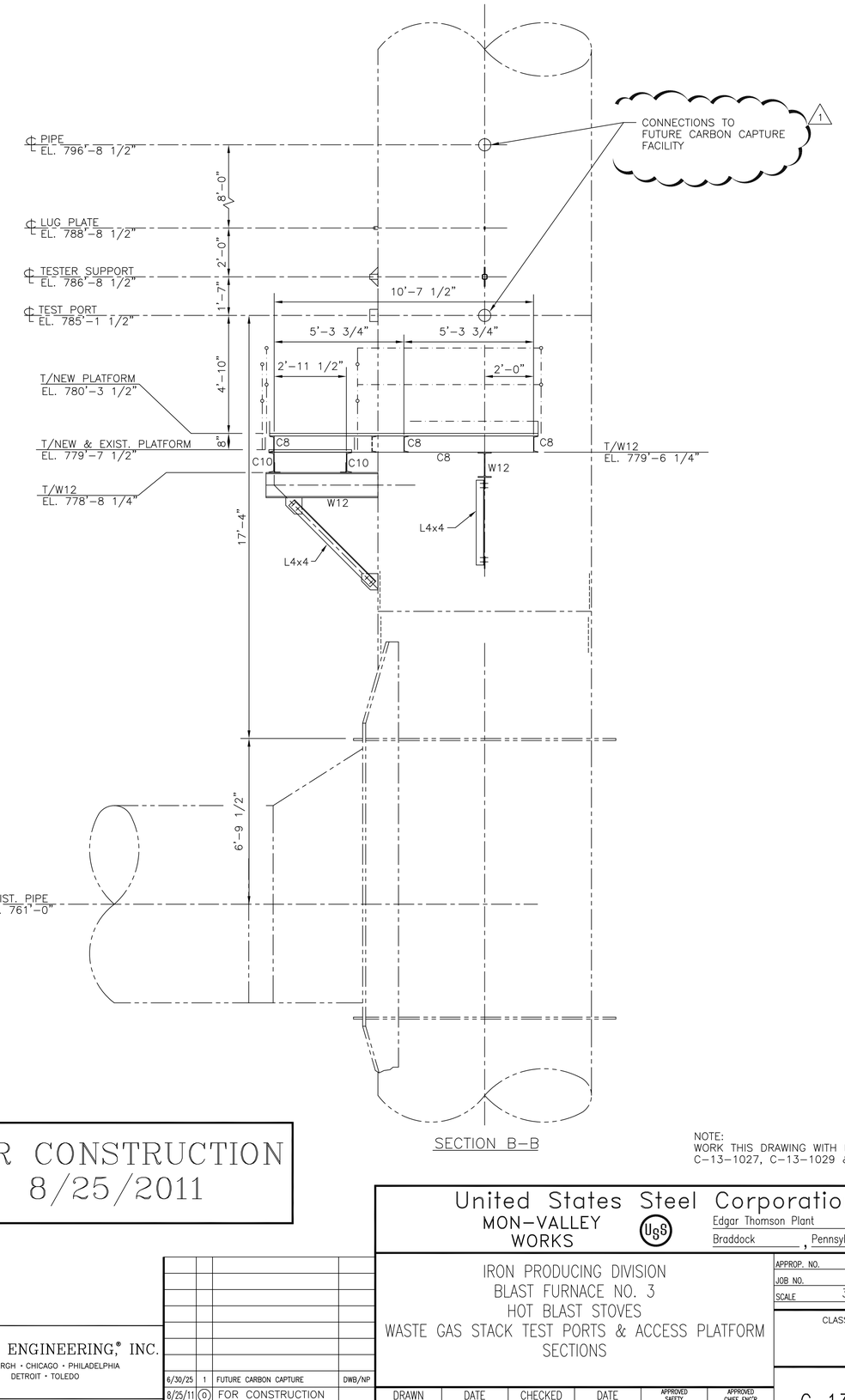

PEPSI


Safety
is a way of life!
72
COMPRESSED
PEPSI

C-13-1028



SECTION A-A



SECTION B-B

BILL OF MATERIAL							
MARK	PC MK	REQ'D	DESCRIPTION	MAT'L	REMARKS	WEIGHT EA.	WEIGHT TOTAL

FOR CONSTRUCTION
8/25/2011

NOTE:
WORK THIS DRAWING WITH DRAWINGS C-13-1027, C-13-1029 & C-13-1030

ORBITAL ENGINEERING,® INC.
PITTSBURGH • CHICAGO • PHILADELPHIA
DETROIT • TOLEDO

PROJECT 01-2277

DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	1	FUTURE CARBON CAPTURE	DWB/NP
8/25/11	0	FOR CONSTRUCTION	

United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania.

IRON PRODUCING DIVISION
BLAST FURNACE NO. 3
HOT BLAST STOVES
WASTE GAS STACK TEST PORTS & ACCESS PLATFORM
SECTIONS

APPROP. NO.
JOB NO.
SCALE 3/8"=1'-0"
CLASSIFICATION

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R
GK	6/14/11	JL	8/24/11		

NO. C-13-1028

A-8-958

COOLING WATER STRAINERS

STRAINER	SERIAL NO.	CAPACITY GPM	△P (PSI)	STRAINER MEDIA	DWG
WEST S-1	3688	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1405
CENTER S-2	3507	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1405
EAST S-2A	2365	8300	3	3/16" DIA SST SLOTTED CONE	A-8-1404

COOLING WATER PUMPS

HIGH PRESSURE (HP)	MEDIUM PRESSURE (MP)
PUMP HP-1 & HP-2	PUMP MP-1 & MP-2
HP-1 MOTOR DRIVEN (OPERATING) HP-2 STEAM TURBINE (STAND-BY) 7,400 GPM AT 289 TDH 450 HP	MP-1 MOTOR DRIVEN (OPERATING) MP-2 STEAM TURBINE (STAND-BY) 7,400 GPM AT 175 TDH 450 HP

PIPING CODE
LP - LOW PRESSURE
MP - MEDIUM PRESSURE
HP - HIGH PRESSURE

DRAWING INDEX:
BF3-01450
WORK THIS DWG WITH DWG:
A-8-1367, BF3-00572 & 573

7 — 2019 REPAIR:
REDRAWN IN CAD.
MOVED HBV TO CLOSE LOOP COOLING.

5 — 2001 REPAIR:
AS BUILT 16" LP BACK-UPS, 14" BYPASS.
REMOVED LCV-430 REPLACED WITH MANUAL VALVE.
CHANGED STRAINER S-2A TO AUTOMATED STRAINER.
REMOVED (2) 16" STRAINER BYPASS LINES.

6 — FIELD CHANGES AS NOTED:
REMOVED 24" STRAINER BYPASS & 24" LP SUPPLY

4 — ADDED BY PASS AT MAKE UP EMERGENCY LINE 8".

middough®
Performance You Trust™
www.middough.com

PROJECT No. USS1615
DRAWING No.

DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	9	FUTURE CARBON CAPTURE	DWB/NP
7/27/20	8	ADD SERV. WTR. REF.	DWB/NP
8/30/19	7	2019 MAJOR REPAIR	MIDD
9/8/01	6	FIELD CHANGES	ATSI
5/14/01	5	2001 REPAIR	ATSI
8/20/82	4	ADDED BYPASS	KPM
1/22/82	3	REVISED FLOW QTY.	MAG
10/9/81	2	GENERAL REVISION	NA
7/23/81	1	GENERAL REVISION	MAG

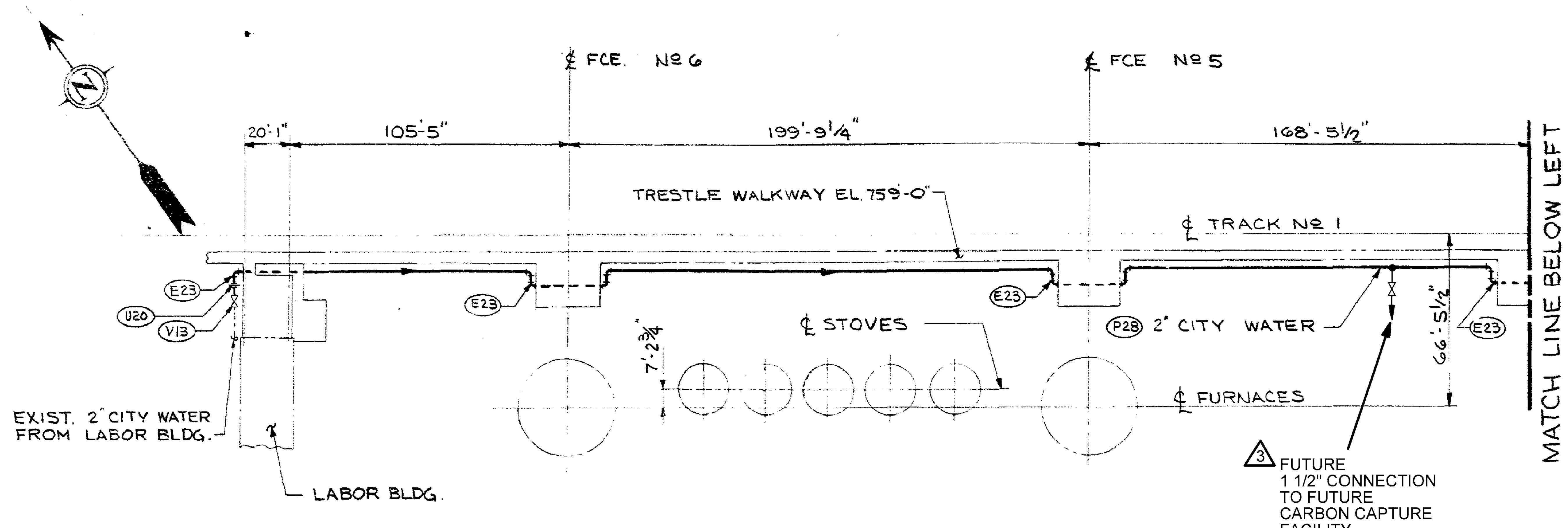
United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania

BLAST FURNACE NO.3
2019 MAJOR REPAIR
FURNACE PROPER
COOLING WATER FLOW DIAGRAM
PUMP HOUSE AREA

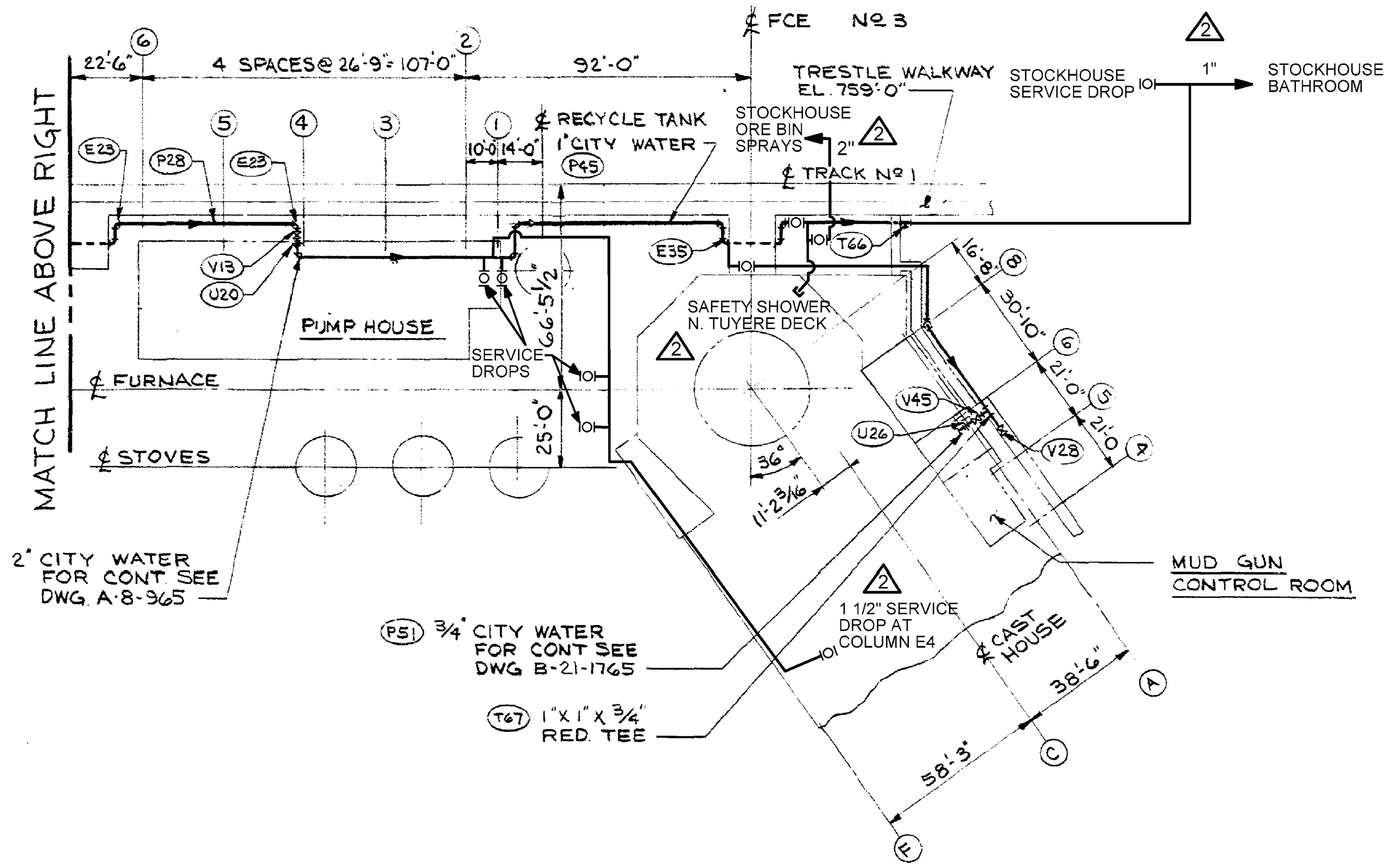
DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R
S. ISCH	8/19/19	BEAL	8/30/19		

APPROP. NO.
JOB NO.
SCALE AS NOTED
CLASSIFICATION
NO. A-8-958

A-8-1144



PLAN



PLAN

NOTES:

1. FOR GENERAL NOTES & REFERENCE DWG'S. SEE DWG. E-18-226
2. FOR BILL OF MATERIAL SEE DWG. A-8-1143
3. THIS DWG. IS SHOWN DIAGRAMATICALLY ONLY. CONTRACTOR IS TO ROUTE & SUPPORT IN FIELD.

L.K. COMSTOCK ENGINEERING
5350334 536-95879

REV.	DATE	MADE	CHKD.	DESCRIPTION
3	6/30/25	DWB	NP	FUTURE CARBON CAPTURE
2	8/12/20	DWB	NP	ADD GENERAL CITY WATER PIPING
1	11-3-82	WTO	RNC	DWG. Nº WAS A-8-1154

FILM ROLL No. 83C902

BIDDING RELEASE ONLY: SPEC. No. 757 ADD. – DATE 6-1-84 By RJM
CONSTRUCTION RELEASE: SPEC. No. 536-6062 ADD. A DATE 2-9-82 By RWC; SPEC. No. 757 ADD. A DATE 7/20/84 By RJM

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
R.R.F.	1-14-82	MAG	1/26/82	RWC	2/2/82	1" = 30'-0"

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 - 1981 RELINE
CITY WATER
TRESTLE PLAN
EDGAR THOMSON WORKS

PROJECT No. 536-6062 DRAWING No. A-8-1144 REV. 1

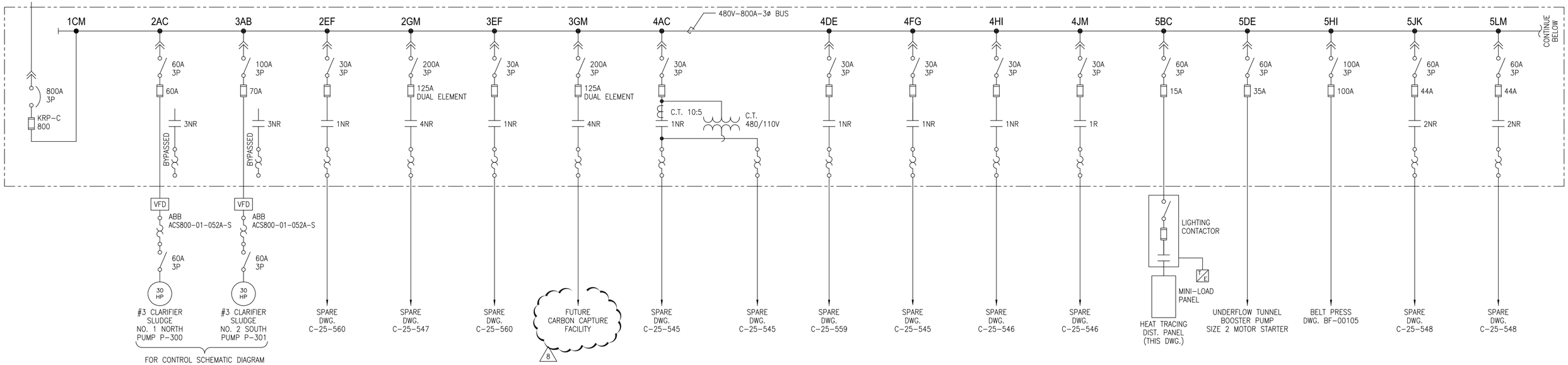
C-25-415

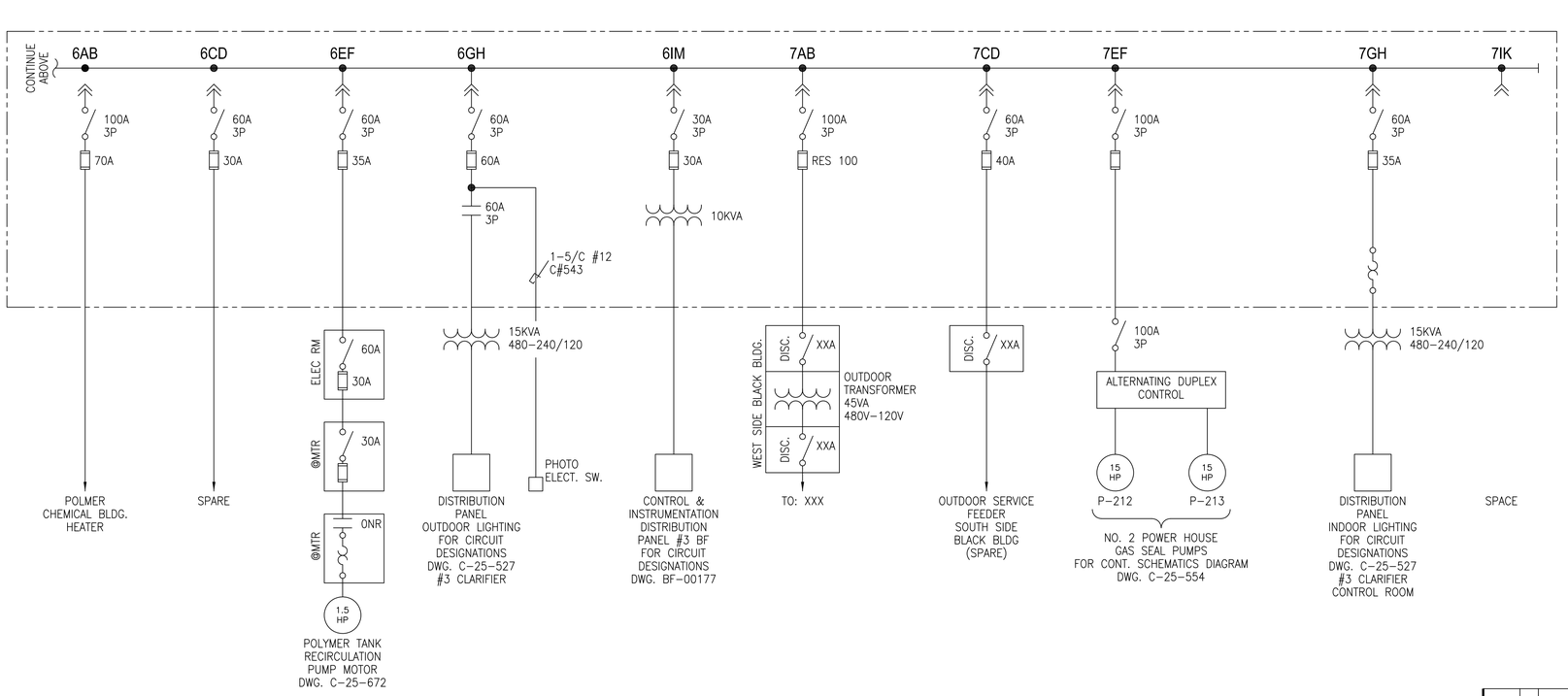
FROM BF 480V
WQC SUBSTATION NO. #3A
BREAKER 5-3 (DWG. D-18-576)
C-391 3 1/C 500 MCM
C-392 3 1/C 500 MCM

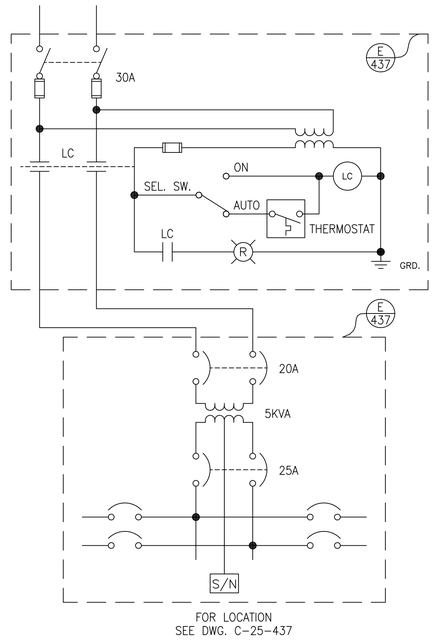
BILL OF MATERIAL								ORACLE DATA	
MARK	PC MK	REQ'D	DESCRIPTION	MAT'L	REMARKS	WEIGHT EA.	WEIGHT TOTAL	UOM	ORACLE ITEM NO.

MOTOR CONTROL CENTER - MCC A3 - 480V

NO. 3 CLARIFIER ELECTRICAL CONTROL ROOM - C-25-437







DATE	REV	DESCRIPTION	CHECKED BY
6/30/25	8	FUTURE CARBON CAPTURE	DWB/NP
10/12/23	7	GENERAL UPDATE	DWB/DK
7/6/22	6	REDRAWN IN CAD / UPDATED	DWB/NP

United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania.

BLAST FURNACE NO. 3
WATER QUALITY CONTROL FACILITY - WQC
NO. 3 CLARIFIER CONTROL AND CHEMICAL ROOMS
MOTOR CONTROL CENTER - MCC A3
SINGLE LINE DIAGRAM

APPROP. NO.
JOB NO.
SCALE NA

CLASSIFICATION

ORACLE ASSET

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF. ENG'R

NO.
C-25-415

A-8-1003

TO BLAST FURNACE WEST END ORE BRIDGE SHANTY

FROM NO. 2 POWERHOUSE B-3-529

6" PLANT AIR

6" COMING PAST NO. 3 HOIST HOUSE

6" PLANT AIR

RECEIVER TANK

LOCATED SOUTH SIDE BELOW NO. 3 HOIST HOUSE

TO WEST END OF PLANT AND BOP L-26-475

2" 22

FURNACE NO. 3 INSTRUMENT AIR SHUT OFF

4" PLANT AIR

A-8-1000

1 1/2"

3/4"

AIR RECEIVER

4" PLANT AIR A-8-979

3/8" EQUALIZING

1" CONDENSATE

1" 3" 1"

AUTOMATIC DRAIN TRAP

LUBE OIL ROOM

2" BY-PASS

250# STEAM PRESS. RED. STATION A-8-1179

CLAY GUN ELECT. ROOM
A-8-979

4" BY-PASS

BF3IA1 17

SKIP CAR WATERING VALVES

1 1/2"

STOCKHOUSE
D-25-3409, D-25-3410

3/4" A-8-967

CASTHOUSE

A-8-997 2" INST. AIR

1" INST. AIR TO FUEL STATION AND TOP SPRAY FCV

A-8-997 A-8-1058

2" INST. AIR TO TAP HOLE DRILL

E-20-300

4"x2" RED.

A-8-966

4"x3" RED.

4"

PUMP HOUSE
A-8-965, A-8-980

TO DIAPHRAMS ON (3) STEAM CONTROL & SHUT-OFF VALVES

A-8-1000

A-8-1027

PRESSURE CONTROLLER

FILTER REGULATOR

PRESSURE REDUCER

1/4"

1"x1/4" RED.

1/4" INST. AIR

1" A-8-1027

3/8"

A-8-961

LAVAL SEPARATOR BLOWDOWN A-8-1021

A-8-1021

A-8-983

21

3" MANUAL SHUTOFF BALL VALVE

2" INST. AIR A-8-965, A-8-966

FILTER REGULATOR A-8-969

STOVE GAS SAFETY SHUT-OFFS

2"x1" RED.

1" INST. AIR A-8-969

ACCUM. TANK

D-17-325
D-17-326

FCE TOP AREA

ME 603

2" INST. AIR A-8-969

3" INST. AIR A-8-969

2" INST. AIR A-8-969

1 1/2"

D-12-120

TO BLEEDER VALVE ROOM

ME 604

RADIAMATICS

2" INSTRUMENT AIR A-8-974

3"x2" RED.

TE 147.2 TE 147.1 TE 127.2 TE 127.1 TE 107.2 TE 107.1

1" 1" 1" 1" 1" 1" 1" 1" 1" 1" 1" 1"

3/4"

1" INST. AIR (TYP. 6 PLACES)

1"x3/4" REDUCER (TYP. 6 PLACES)

3"x2" RED.

A-8-1012

1 1/2" INST. AIR A-8-968

2"x1 1/2" RED.

1"

GAS CLEANING AREA

3" C-24-2275

C-24-2420

C-24-228

SAFETY LOCK-OUT VALVES

1/2" SAFETY VENTS (4 TYP.)

GAS COOLER

1" L

C-24-2424

1 1/2" INST. AIR

C-24-2280

HOIST HOUSE

1" 2" 20

2" B-22-771

C-24-2276 C-24-2281

HOIST HOUSE INST. AIR SHUT OFF

C-24-2276 C-24-2282 C-24-2283

3" 2" 19

3"x2" RED. 2"

TO GAS ANALYZER ROOM

3" INST. AIR C-24-2276

STOVE WASTE GAS 02 SENSORS
B-20-451

FCV 102 FV 102 FCV 122 FV 122 FCV 142 FV 142

C-22-2054 C-22-2054

1/2" 1/2" 1/2" 1/2" 1/2" 1/2"

1" INST AIR

STOVE GAS ENRICH. CONTROL VALVES

STOVE AREA

FURNACE NO. 3 PLANT AIR SHUT OFF

A-8-967 BF3CA1 17

6" PLANT AIR A-8-977

3" PLANT AIR

AIR CYL. FOR ORE SURGE HOPPER

AIR CYL. FOR COKE WEIGH HOPPER

4" SUMP DISCHARGE

3/4"

SERVICE DROPS A-8-1017E

1/2" SAFETY VENTS (TYP. 8 PLACES)

L 3/4"

1 1/2"

F R L

FILTER – REG. LUBRICATOR

STOCK HOUSE
D-25-3409, D-25-3410, D-25-3413

16

FROM NO. 2 POWER HOUSE AIR COMPRESSORS B-3-529

4" BALL VALVE

1 1/2" PLANT AIR D-25-3049 D-25-3410

3" PLANT AIR A-8-966, A-8-967

A-8-1009G

STOVE TOP

3/4"

1" PLANT AIR

A-8-974 A-8-975

1" SERVICE DROPS AT FURNACE TOP T/PLAT. EL. 859'-8 1/2"

A-8-1017B

FURNACE TOP

A-8-1018

1 1/2"x1" RED.

A-8-973 A-8-976

1 1/2"

A-8-1015 A-8-1016

1 1/2"

A-8-1057 1 1/2" PLANT AIR

3/4" GALLERIES (TYP.)

A-8-1009B & A-8-1009G

FURNACE GALLERIES

(1) A-8-1017A

1 1/2" PLANT AIR

CASTHOUSE

3" PLANT AIR A-8-967

3/4"

3"x2" RED.

2"

A-8-1009C

A-8-1009D

A-8-1009A

3/4"

2" PLANT AIR A-8-970

C-24-2423

1" (TYP.)

18

IRON LADLE LEVEL MONITORING

2"

3/4"

DUST CATCHER AND PUG MILL PLATFORM SERVICE DROP – C-24-2421A

4" BALL VALVE

4" 4"

RECEIVER TANK

23

ON GROUND NE OF NO. 3 BLAST FURNACE CASTHOUSE

TO NO. 1 BLAST FURNACE A-8-904

TO BLAST FURNACE BAGHOUSE AND SOUTH SIDE OF NO. 1 BLAST FURNACE A-8-904

PUMP HOUSE
A-8-965, A-8-980

A-8-1009B

3/4"

1" A-8-966

3" PLANT AIR A-8-966

1 1/2" PLANT AIR

A-8-1009A

3/4" 3/4"

STOVE PLATFORM

A-8-968, A-8-969, A-8-983, A-8-1012 AND A-8-1013

SOUTH STOVES

LOWER STOVE AREA

3/4" 3/4"

A-8-1017F

24

FUTURE CONNECTION TO CARBON CAPTURE FACILITY

3/4" VENTURI SCRUBBER STRUCTURE PLATFORM

C-24-2421A

3/4" 3/4" 3/4"

C-24-2278, 2418, 2423

3"

1 1/2" PLANT AIR C-24-2275

B-22-1017C

3/4"

EXIST. AIR RECEIVER B-22-771

HOIST HOUSE

1"

TO TOP BELL AIR CONT. D-18-466

3"x1 1/2" RED.

2" PLANT AIR C-24-2275 C-24-2276

1 1/2" C-24-2276 C-24-2421A 3/4"

SNORT VALVE PLATFORM

1 1/2" PLANT AIR C-24-2275, C-24-2276

LEGEND

- PLANT AIR
- INSTRUMENT AIR
- GATE VALVE
- BALL VALVE
- CHECK VALVE
- L — SAFETY LOCKOUT DEVICE
- S — 3-WAY SOLENOID VALVE
- SPEED CONTROL VALVE
- PRESSURE REDUCING VALVE
- PRESSURE RELIEF VALVE
- REDUCER
- FLEX HOSE
- HOSE CONNECTION
- PRESSURE GAUGE
- PRESSURE CONTROLLER

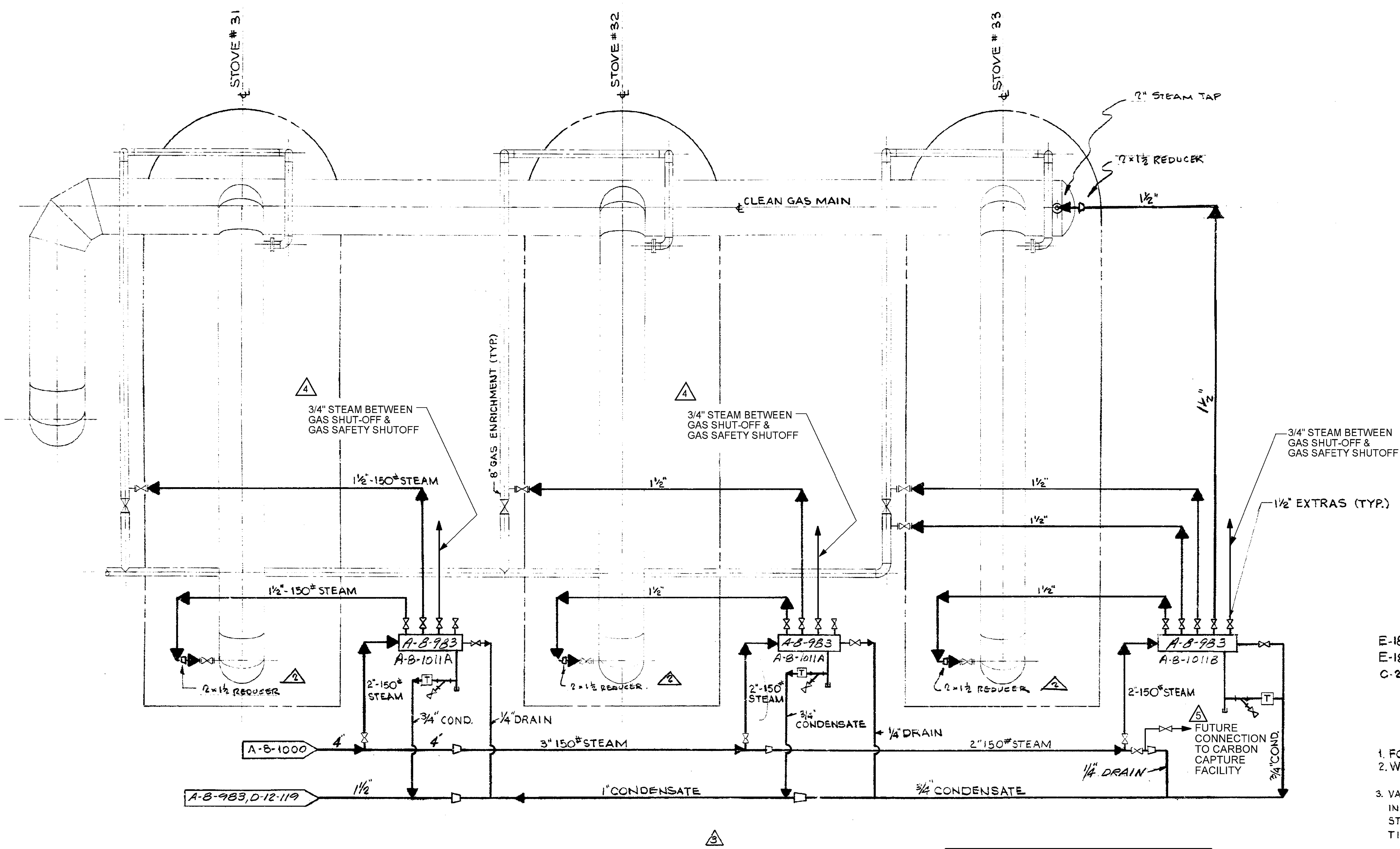
DATE	REV	DESCRIPTION	CHECKED BY
7/1/25	24	FUTURE CARBON CAPTION	DWB/NP
6/6/25	23	GENERAL REV AT RECEIVER TANK	DWB/NP
1/26/23	22	ADD 2" VALVE	DWB/NP
10/10/22	21	ADD 3" MANUAL SHUTOFF VALVE	DWB/NP
6/16/22	20	ADD LINE FROM HOIST HOUSE	DWB/NP
3/17/22	19	ADD 2" VALVE TO GAS ANALYZER	DWB/NP
2/7/22	18	GENERAL REVISION	DWB/NP

United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania

BLAST FURNACE NO. 3 PLANT AND INSTRUMENT AIR PIPING SCHEMATIC – FLOW DIAGRAM

DRAWN	DATE	CHECKED	DATE	APPROVED SAFETY	APPROVED CHIEF ENG'R

APPROP. NO.
JOB NO.
SCALE
CLASSIFICATION
NO. A-8-1003



RECORD OF DOCUMENTED FIELD CONSTRUCTION CHANGES RECORDED SEPTEMBER 8, 2001

REFERENCE DWG'S.

E-18-213 GEN'L. ARRG'T. - PLOT PLAN
E-18-216 PIPING KEY PLAN
C-22-2059 GAS MAIN & ENRICHMENT GAS MAIN

NOTES:

1. FOR LEGEND SEE DWG. A-8-1000
2. WORK THIS DWG. WITH A-8-1000 & A-8-1001
3. VALVES MARKED THUS ⬭ ARE TO BE INSTALLED WITH A PUNCHED STAINLESS STEEL TAG WIRE TO VALVE; TAG TO READ TITLE INSIDE; EXAMPLE (OXYGEN SHUTOFF)

WORK THIS DWG WITH DWGS. A-8-1001 & C-22-2053 & C-22-2052 & C-22-2059

FOR REFERENCE ONLY
SPEC. 757 6-1-04

5350334 536-95879

BIDDING RELEASE ONLY	Dwg. Rev. No.	CONSTRUCTION RELEASE	Dwg. Rev. No.
SPEC. No. 6062-340 ADD. O DATE 3/25/61 By RWC	O	SPEC. No. 6062-340 ADD. A DATE 8/14/81 By RWC	O
SPEC. No. ADD. DATE By		SPEC. No. 6062-340 ADD. A DATE 2/19/82 By RWC	1
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	
SPEC. No. ADD. DATE By		SPEC. No. ADD. DATE By	

SEAL

REV.	DATE	MADE / CHKD.	DESCRIPTION	FILM ROLL No.
8				
7				
6				
5	7/10/25	DWB / NP	FUTURE CARBON CAPTURE	
4	9-8-01	ATSI	FIELD CHANGES NOTED	
3	5-11-84	DW / JS	REMOVED DRAIN LINE	
2	10-12-82	KPM / MB	ADDED REDUCER AT 42" GAS LINE STEAM PURGE	830002
1	1/19/82	WDJ / MAG	GENERAL REVISION	

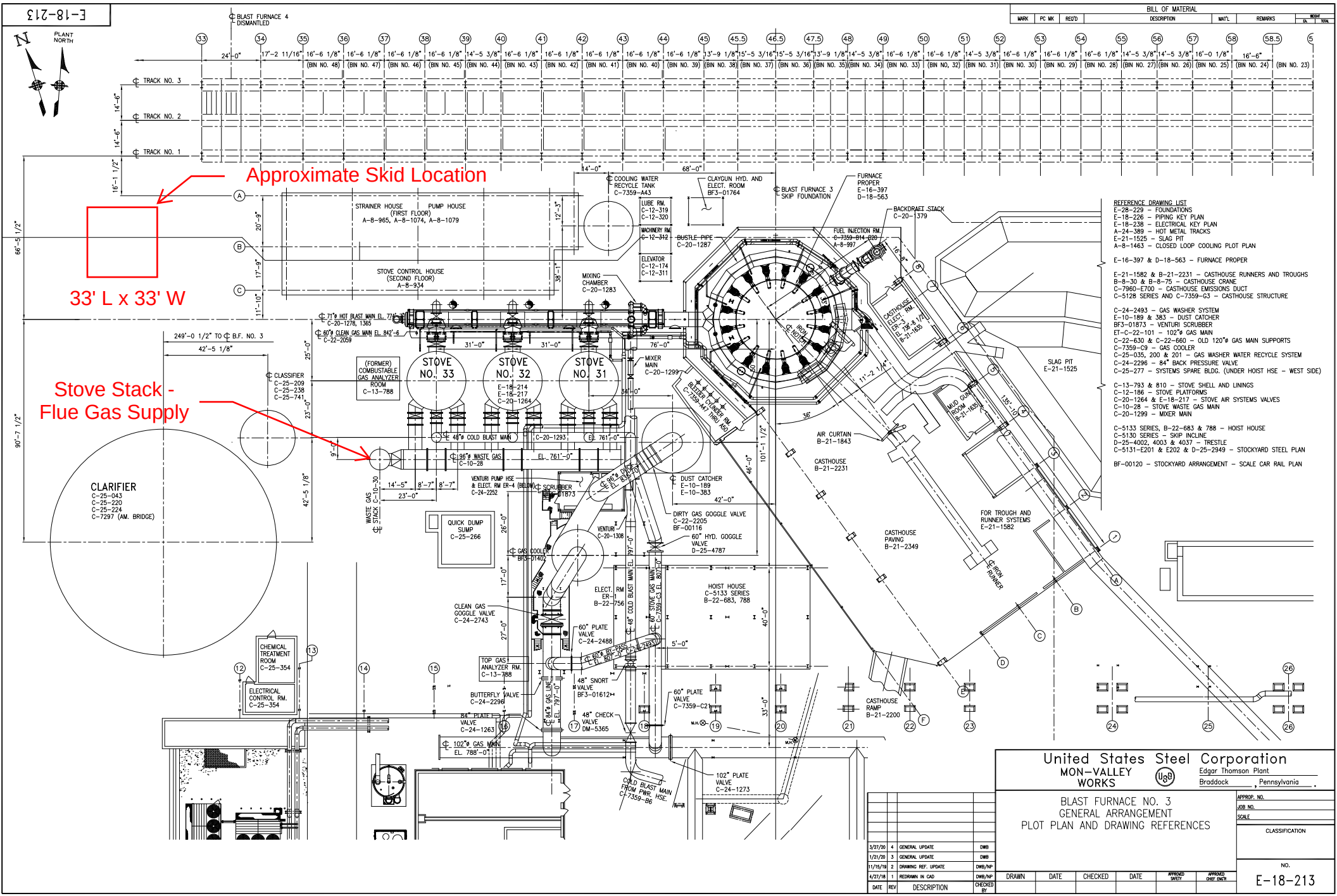
Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
HOODER	2-2-81	MAG	8/11/81	RWC	8/12/81	NONE
VENDOR P. O.		VENDOR DWG. No.		APPROP. No.		ACCT. No.

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 - 1981 RELINE
STEAM PURGING
SCHEMATIC SHEET # 3
EDGAR THOMSON WORKS

PROJECT No.	DRAWING No.	REV.
536-6062	A-8-1002	4

RPC-0201-2736-E-5M-1080-35S


E-18-213
Approximate Skid Location
33' L x 33' W
Stove Stack - Flue Gas Supply
BLAST FURNACE 4 DISMANTLED
TRACK NO. 3
TRACK NO. 2
TRACK NO. 1
STRAINER HOUSE PUMP HOUSE (FIRST FLOOR) A-8-965, A-8-1074, A-8-1079
STOVE CONTROL HOUSE (SECOND FLOOR) A-8-934
COOLING WATER RECYCLE TANK C-7359-A43
CLAYGUN HYD. AND ELECT. ROOM BF3-01764
BLAST FURNACE 3 SKIP FOUNDATION
FURNACE PROPER E-16-397 D-18-563
BACKDRAFT STACK C-20-1379
FUEL INJECTION RM. C-7359-B14-B20 A-8-997
LUBE RM. C-12-319 C-12-320
MACHINERY RM. C-12-312
ELEVATOR C-12-174 C-12-311
BUSTLE PIPE C-20-1287
MIXING CHAMBER C-20-1283
71"ø HOT BLAST MAIN EL. 774'-6" C-20-1278, 1365
60"ø CLEAN GAS MAIN EL. 842'-6" C-22-2059
249'-0 1/2" TO ℄ B.F. NO. 3
42'-5 1/8"
STOVE NO. 33
STOVE NO. 32
STOVE NO. 31
E-18-214 E-18-217 C-20-1264
(FORMER) COMBUSTABLE GAS ANALYZER ROOM C-13-788
CLASSIFIER C-25-209 C-25-238 C-25-741
CLARIFIER C-25-043 C-25-220 C-25-224 C-7297 (AM. BRIDGE)
48"ø COLD BLAST MAIN C-20-1293 EL. 761'-0"
96"ø WASTE GAS C-10-28 EL. 761'-0"
WASTE GAS STACK C-10-30
VENTURI PUMP HSE & ELECT. RM ER-4 (BELOW) C-24-2252
SCRUBBER BF3-01873
QUICK DUMP SUMP C-25-266
GAS COOLER BF3-01402
VENTURI C-20-1308
DUST CATCHER E-10-189 E-10-383
DIRTY GAS GOGGLE VALVE C-22-2205 BF-00116
60" HYD. GOGGLE VALVE D-25-4787
ELECT. RM ER-1 B-22-756
HOIST HOUSE C-5133 SERIES B-22-683, 788
CLEAN GAS GOGGLE VALVE C-24-2743
60" PLATE VALVE C-24-2488
48" SNORT VALVE BF3-01612
48" CHECK VALVE DM-5365
60" PLATE VALVE C-7359-C2
CHEMICAL TREATMENT ROOM C-25-354
ELECTRICAL CONTROL RM. C-25-354
TOP GAS ANALYZER RM. C-13-788
BUTTERFLY VALVE C-24-2296
84" PLATE VALVE C-24-1263
102"ø GAS MAIN EL. 788'-0"
102" PLATE VALVE C-24-1273
COLD BLAST MAIN FROM PWR. HSE C-7359-B6
CASTHOUSE ELECT. RM. ER-3 B-21-1635
IRON RUNNER
BLEEDER RUNNER RM. C-7359-A47 THRU A50
MUD GUN ROOM B-21-1630
AIR CURTAIN B-21-1843
CASTHOUSE B-21-2231
SLAG PIT E-21-1525
CASTHOUSE PAVING B-21-2349
FOR TROUGH AND RUNNER SYSTEMS E-21-1582
CASTHOUSE RAMP B-21-2200
REFERENCE DRAWING LIST
E-28-229 – FOUNDATIONS
E-18-226 – PIPING KEY PLAN
E-18-238 – ELECTRICAL KEY PLAN
A-24-389 – HOT METAL TRACKS
E-21-1525 – SLAG PIT
A-8-1463 – CLOSED LOOP COOLING PLOT PLAN
E-16-397 & D-18-563 – FURNACE PROPER
E-21-1582 & B-21-2231 – CASTHOUSE RUNNERS AND TROUGHS
B-8-30 & B-8-75 – CASTHOUSE CRANE
C-7960-E700 – CASTHOUSE EMISSIONS DUCT
C-5128 SERIES AND C-7359-G3 – CASTHOUSE STRUCTURE
C-24-2493 – GAS WASHER SYSTEM
E-10-189 & 383 – DUST CATCHER
BF3-01873 – VENTURI SCRUBBER
ET-C-22-101 – 102"ø GAS MAIN
C-22-630 & C-22-660 – OLD 120"ø GAS MAIN SUPPORTS
C-7359-C9 – GAS COOLER
C-25-035, 200 & 201 – GAS WASHER WATER RECYCLE SYSTEM
C-24-2296 – 84" BACK PRESSURE VALVE
C-25-277 – SYSTEMS SPARE BLDG. (UNDER HOIST HSE – WEST SIDE)
C-13-793 & 810 – STOVE SHELL AND LININGS
C-12-186 – STOVE PLATFORMS
C-20-1264 & E-18-217 – STOVE AIR SYSTEMS VALVES
C-10-28 – STOVE WASTE GAS MAIN
C-20-1299 – MIXER MAIN
C-5133 SERIES, B-22-683 & 788 – HOIST HOUSE
C-5130 SERIES – SKIP INCLINE
D-25-4002, 4003 & 4037 – TRESTLE
C-5131-E201 & E202 & D-25-2949 – STOCKYARD STEEL PLAN
BF-00120 – STOCKYARD ARRANGEMENT – SCALE CAR RAIL PLAN
BILL OF MATERIAL
MARK PC MK REQ'D DESCRIPTION MAT'L REMARKS WEIGHT EA. TOTAL
United States Steel Corporation
MON-VALLEY WORKS
Edgar Thomson Plant
Braddock, Pennsylvania
BLAST FURNACE NO. 3
GENERAL ARRANGEMENT
PLOT PLAN AND DRAWING REFERENCES
APPROP. NO.
JOB NO.
SCALE
CLASSIFICATION
NO.
E-18-213
3/27/20 4 GENERAL UPDATE DWB
1/21/20 3 GENERAL UPDATE DWB
11/15/19 2 DRAWING REF. UPDATE DWB/NP
4/27/18 1 REDRAWN IN CAD DWB/NP
DATE REV DESCRIPTION CHECKED BY
DRAWN DATE CHECKED DATE APPROVED SAFETY APPROVED CHIEF ENGR.

A-8-1033

BILL OF MATERIAL						
MK.	REQ'D.	DESCRIPTION	MAT'L.	REMARKS	WT. EA.	ORDER NO.

⚠ NOTE "B"

PER FIELD SURVEY ELEVATIONS ARE REDUCED 5½' FROM ELEVATIONS SHOWN ON EXIST. REFERENCE MATERIAL.

GENERAL NOTES FOR UNDERGROUND SEWERS

1. ALL CONCRETE AND SEWER WORK SHALL BE IN ACCORDANCE WITH U.S.S. SPEC. 536-6062-720 SECTION 44, UNLESS NOTED.
2. ALL STORM SEWER PIPE TO BE R.C.P. CLASS IV ASTM C-76 (30" PIPE - 5½" WALLS & 12" PIPE - 2" WALLS). JOINTS SHALL BE FLEXIBLE RUBBER GASKET TYPE - ASTM C-361 (LATEST REV.). GASKET MATERIAL SHALL BE BUNA-N DESIGNATED MILL TYPE. PIPE TO BE LAID ON MINIMUM 6" WELL TAMPED SAND.
3. ALL SANITARY SEWER PIPE TO BE CAST IRON EXTRA HEAVY, BELL & SPIGOT - ASTM A-74 (LATEST REV.). PIPE JOINTS SHALL BE RUBBER GASKET PUSH-ON TYPE - ASTM C564. PIPE TO BE LAID ON MINIMUM 6" WELL TAMPED SAND.
4. ALL STEEL PIPE TO BE EXTRA STRONG, COATED & WRAPPED.
5. MANHOLE SECTIONS TO BE PRECAST, REINFORCED CONCRETE IN ACCORDANCE WITH ASTM C-478. JOINTS SHALL BE "O" RING RUBBER GASKETS MEETING REQUIREMENTS OF ASTM C-443.
6. CAST IN PLACE CONCRETE SHALL DEVELOP A MINIMUM COMPRESSION STRENGTH OF 3000 P.S.I. @ 28 DAYS.
7. REINFORCING BARS SHALL BE GRADE 60 DEFORMED, MEETING ASTM A-615 SPEC. & SHALL BE PLACED ACCORDING TO LATEST ACI CODE.
8. STORM SEWER, SANITARY SEWER & CATCH BASIN FRAMES & COVERS TO BE "NEENAH" SERIES (OR APPROVED EQUAL) AS SHOWN ON MANHOLE AND CATCH BASIN DETAILS.
9. ALL EXPOSED UNDERGROUND FACILITIES TO BE SUPPORTED BY CONTRACTOR DURING CONSTRUCTION. CAUTION TO BE EXERCISED WHILE EXCAVATING. EXACT LOCATION OF ALL UNDERGROUND FACILITIES IS UNKNOWN. CONTACT DESIGN ENG., PGH. FOR ANY INTERFERENCE.

REFERENCE DWG'S.

NEW DWG'S
- A-8-1034 ~ UNDERGROUND SEWERS - DETAILS & SECTIONS
- A-8-1035 ~ " " - " "
- A-8-1036 ~ " " - SECTIONS
- A-8-940 ~ PUMP & STRAINER HOUSE - FDN. PLAN
- A-8-941 ~ " " " - " "
- C-18-780 ~ STOVE FDN. PLAN
- A-24-391 ~ YARD PAVING & GRADING

EXIST. DWG'S
- ET-L-1-102 ~ PLANT WATER SUPPLY PIPING
- ET-L-13-100 ~ STORM SEWER SYSTEM
- L-23-98 ~ SANITARY SEWER SYSTEM
- E-18-101 ~ FCE 138 & FDN.
- B-21-1415 ~ CONCRETE PAVING & DRAINAGE TRENCH @ CAST HSE

* NOTE "A"

U.S.S. FIELD ENGINEER TO DETERMINE DIMENSIONS, ANGLE & INV. EL. FOR TYING INTO EXIST. MANHOLES.

NOTE "C"

DIM. MARKED (A.B.) ARE APPROX. AS BUILT DIMENSIONS

SIDING RELEASE ONLY — SPEC. No. ____ ADD. ____ DATE ____ By ____ (Dwg. Rel. No.)

CONSTRUCTION RELEASE — SPEC. No. 536-6062-720-B ADD. ____ DATE 11/20/81 By HLS (Cons. Rel. No. 0)

SEAL

REV.	DATE	MADE	CHK'D.	DESCRIPTION	FILM ROLL No.
8					
7					
6	8-5-25	DWB	NP	FUTURE CARBON CAPTURE	
5	3-14-07	DWB	GF	GENERAL REVISION	
⚠4	9-16-86	RMM		REVISED M.H. LOCATIONS & ADDED NOTE "C"	
⚠3	5-20-81	GK	BK	ADDED CB-5 & CB-6 @ HOIST HOUSE AREA & REVISED LOCATION OF C.B. @ FCE. COL. FDN.	B30903
⚠2	4-30-81	RG		SPACE BETWEEN 4'-6⅝" PIPES TO MH-2 CHANGED.	
⚠1	3-24-81	BK		REVISED WELD RELOCATED 4" PIPE TO MH-2, RELOCATED CB-2 ADDED DRAINAGE TRENCH	

USS Engineering — United States Steel Corporation — Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
G.J.K.	12-23-80	B.K.	1-19-81	J.G.M.	1-19-81	1/16" = 1'-0

VENDOR P. O. — VENDOR DWG. No. — APPROP. No. E1-0233 — ACCT. No. 5001

SCOPE No. M12

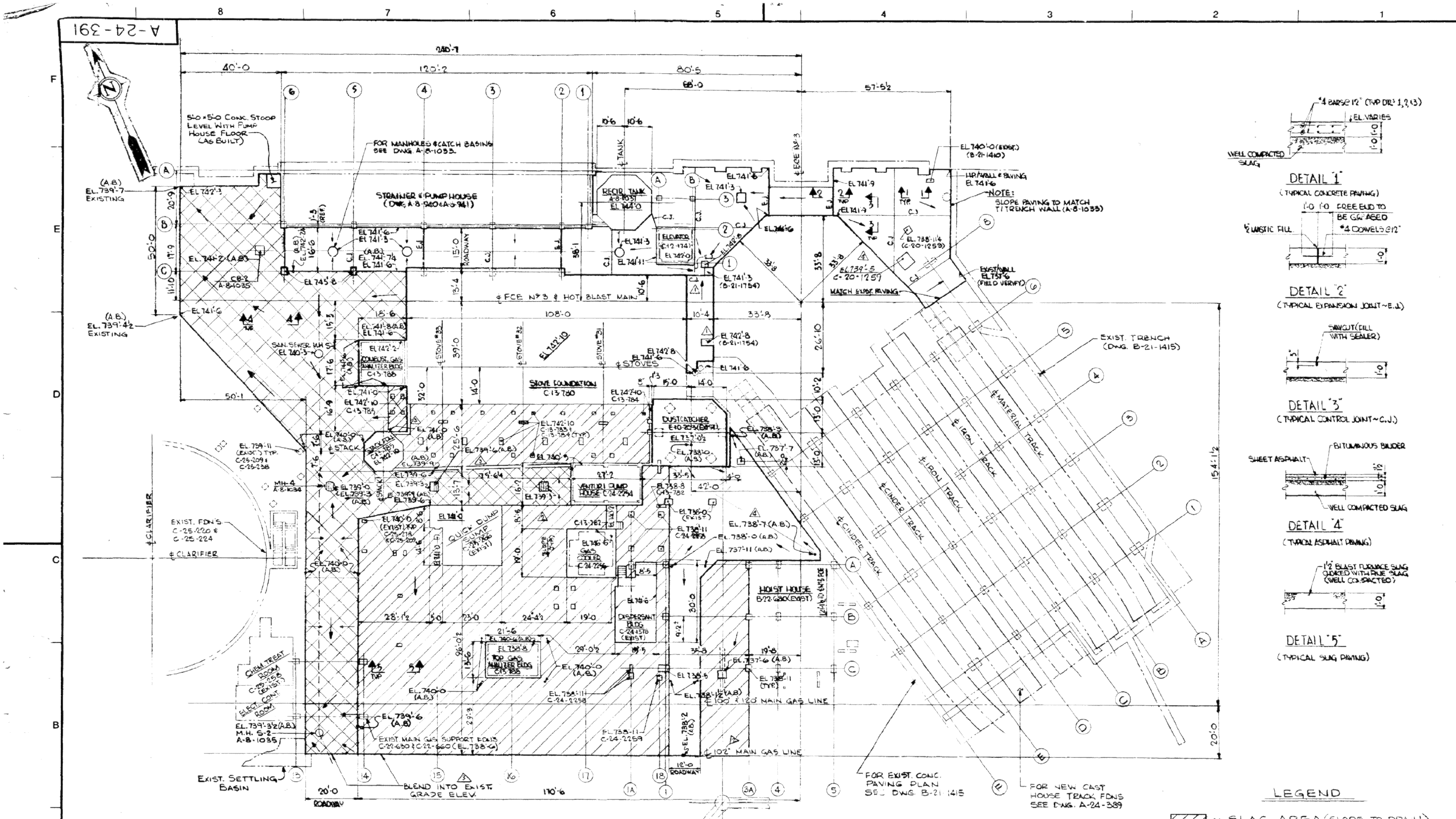
L.K. COMSTOCK ENGINEERING COMPANY, INC.

CODE CONTRACT No. 5350334 — JOB No. 536-95879

ENGR. APPROVAL

BLAST FURNACE DIVISION
BLAST FURNACE No 3 1981 RELINE
UNDERGROUND SEWERS
PLAN
EDGAR THOMSON WORKS

PROJECT No. 536-6062 — DRAWING No. A-8-1033 — REV. 4



Note: △5

All Elevs. Marked (A.B.) Are As Built Elevs. All Slopes Shown On Dwg. Were Calculated Using Original Design Elevations. As Built Slopes Are Not Shown

NOTES:

1. FOR GENERAL CONCRETE NOTES SEE DWG. E-18-229.
2. NEW FOUNDATIONS, UNDERGROUND SEWERS AND PIPING TO BE IN PLACE BEFORE PAVING IS PLACED.
3. FOR UNDERGROUND SEWERS SEE DWG. A-8-1033.
4. ½" EXP. JOINT MAT'L. TO BE PLACED WHERE CONC. PAVING BUTTS AGAINST NEW OR EXIST. FDNS.

LEGEND

- ~ SLAG AREA (SLOPE TO DRAIN)
- ~ CONCRETE
- ~ ASPHALT

SCOPE Nº M9

L.K. COMSTOCK ENGINEERING COMPANY, INC.

5350334 — 536-95879

REV.	DATE	MADE	CHKD.	DESCRIPTION	FILM ROLL No.
8					
7					
6					
5	9-24-85	RM	SM	ADDED AS BUILT ELEVS. & NOTE	
4	7-12-84	[illegible]	JT	REMOVED SLAG PIT FDN., ADDED BLOWER FDN.	
3	5-3-84	JT		INCREASED LGTH. OF ROADS & ADDED L SHAPED RETAINING WALL	
2	8-12-82	NPS	KPM	ADDED 12'-0 ROAD TO D.C. CHG'D CONC. ROAD TO ASPHALT	830003
1	5-20-81	GK	BK	RELEASED DWG. FOR CONST. & REMOVED HOLDS	

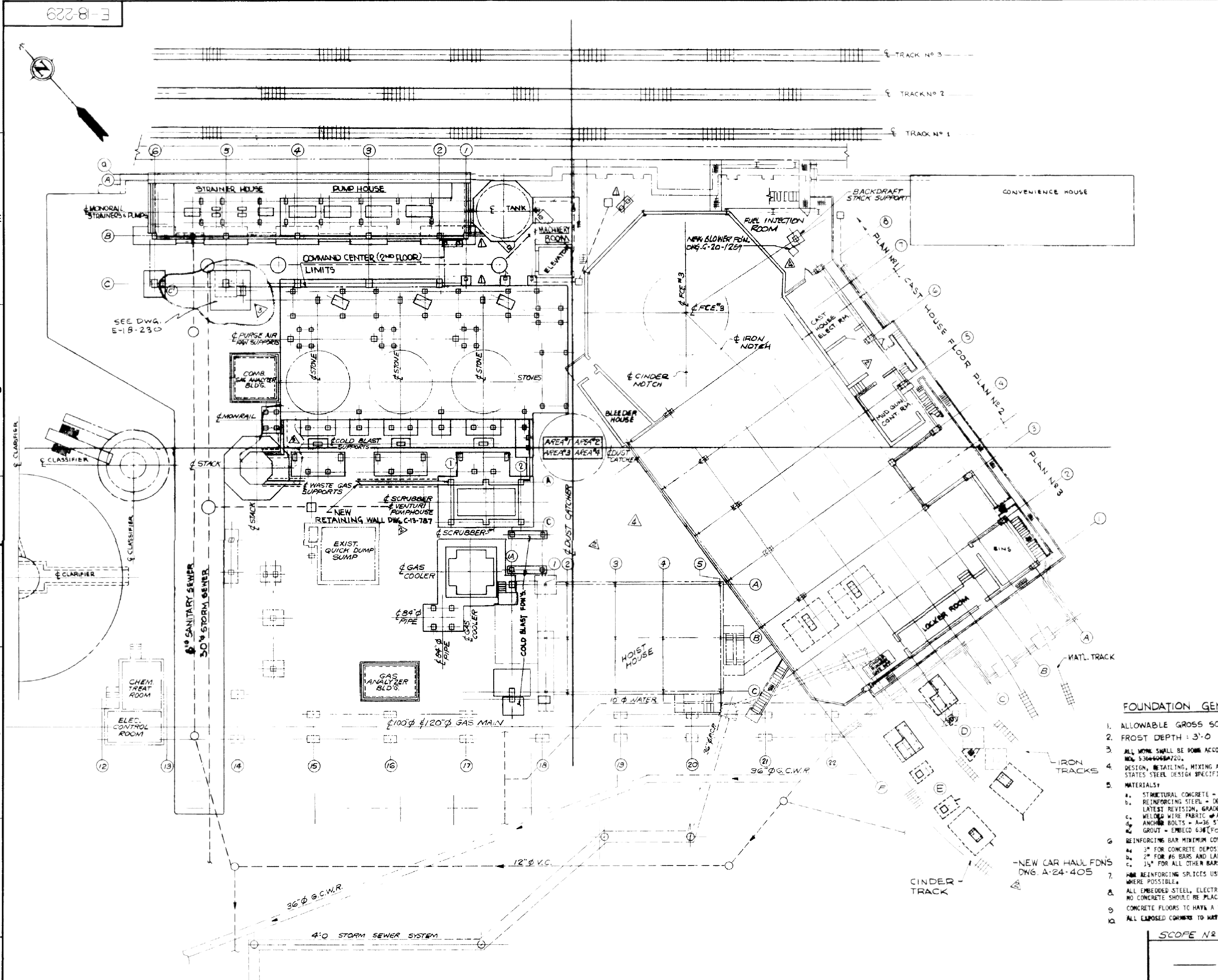
Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
GJK	3/19/81	BK	4-21-81	JGM	4-22-81	1/16" = 1'-0

VENDOR P. O.	VENDOR DWG. No	APPROP. No.	ACCT. No.
			9800

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 1981 RELINE
YARD PAVING & GRADING
PLAN & DETAILS
EDGAR THOMSON WORKS

PROJECT No. 536-6062 — DRAWING No. A-24-391 — REV 5



E-18-229

CIVIL GENERAL DRAWING INDEX

DWG. Nº	DESCRIPTION
A-8-933	MISC. BLDG PLOT PLAN
A-8-1033	UNDERGROUND SEWERS PLAN
A-24-384	RAILROAD TRACK REMOVAL PLAN
A-24-385	RAILROAD TRACK ALIGNMENT PLAN
A-24-389	CAST HOUSE RAILROAD TRACK PLAN
C-13-775	EXCAVATION & DEMOLITION PLAN
C-13-776	EXCAVATION & DEMOLITION PLAN
E-18-230	FOUNDATION PLAN AREA 1
E-18-231	FOUNDATION PLAN AREA 2
E-18-232	FOUNDATION PLAN AREA 3
E-18-233	FOUNDATION PLAN AREA 4
A-24-391	YARD PAVING & GRADING
E-18-226	PIPING GENERAL ARRG'T
E-18-239	ELECTRICAL DWG. INDEX
ABD-C1359-INDEX4	LIST OF INDEXES

FOUNDATION GENERAL NOTES:

1. ALLOWABLE GROSS SOIL BEARING PRESSURE = 2.5 K.S.F.
2. FROST DEPTH : 3'-0
3. ALL WORK SHALL BE DONE ACCORDING TO UNITED STATES STEEL CORPORATION SPECIFICATION NO. 536-6062A720.
4. DESIGN, DETAILING, MIXING AND PLACING OF CONCRETE SHALL BE IN ACCORDANCE WITH UNITED STATES STEEL DESIGN SPECIFICATION FOR CONCRETE CE-101.
5. MATERIALS:
   a. STRUCTURAL CONCRETE - TO HAVE A MINIMUM COMPRESSION STRENGTH OF 4000 psi AT 28 DAYS
   b. REINFORCING STEEL - DEFORMED BARS OF NEW BILLET STEEL CONFORMING TO ASTM A615, LATEST REVISION, GRADE 60
   c. WELDED WIRE FABRIC - ASTM A185, LATEST REVISION
   d. ANCHOR BOLTS - A-36 STEEL (UNLESS NOTED)
   e. GROUT - EMBECO 636 (FOR EQUIP.) (STRUCT GROUT) - PORTLAND CEMENT
6. REINFORCING BAR MINIMUM COVER
   a. 3" FOR CONCRETE DEPOSITED AGAINST SOIL OR ROCK
   b. 2" FOR #6 BARS AND LARGER (UNLESS NOTED)
   c. 1½" FOR ALL OTHER BARS (UNLESS NOTED)
7. FOR REINFORCING SPLICES USE CLASS C SPLICE UNLESS SHOWN OTHERWISE, STAGGER ALL SPLICES WHERE POSSIBLE.
8. ALL EMBEDDED STEEL, ELECTRIC CONDUIT AND PIPES ARE TO BE IN PLACE BEFORE PLACING CONCRETE. NO CONCRETE SHOULD BE PLACED UNTIL RELEASED BY UNITED STATES STEEL FIELD ENGINEER.
9. CONCRETE FLOORS TO HAVE A WOOD FLOAT OR EQUIVALENT FINISH. (UNLESS NOTED)
10. ALL EXPOSED CORNERS TO HAVE 1" CHAMFER. (UNLESS NOTED)

SCOPE Nº

L.K. COMSTOCK ENGINEERING COMPANY, INC.

LKCE CONTRACT No. 5350334 — CUSTOMERS ORDER No. 536-

REV.	DATE	MADE	DESCRIPTION	FILM ROLL No.
8				
7				
6				
5				
4	7-10-84	LG JT	RELOCATED BLOWER FDN'L REMOVED SLAG PIT FDN	
3	3-28-84	R.W.C. JT	ADDED FDTN. FOR DIAGONAL STRUT @ COL. ROW C' ADDED L SHAPED RET. WALL & GROUT NOTE	
2	8-11-82	NPS	ADDED SLAG PIT, CAR HAUL, BLOWER & RETAININGWALL FDN'S	
1	12-16-81	DR GAK	ADDED PIPE SUPPORT FDNS	

BIDDING RELEASE ONLY: SPEC No. 536-6062-720 ADD A DATE 10-28-80; SPEC No. 757 ADD — DATE 6/11/84; SPEC No. 757 ADD B DATE 7/27/84 — Dwg Rev No. 4

CONSTRUCTION RELEASE: SPEC No. 536-6062-720-B DATE 1/20/81; SPEC No. 757 ADD B DATE 7/27/84 — Dwg Rev No. 0, 4

SEAL

Engineering
United States Steel Corporation
Pittsburgh, Pennsylvania

PREPARED BY	DATE	CHECKED BY	DATE	ENGINEER APPROVAL	DATE	SCALE
B.K.	11/18/80	FWA	12/8/80	JGM	1-16-81	1/16" = 1'-0"
VENDOR P. O.		VENDOR DWG. No.		APPROP. No. E1-0233		ACCT. No.

BLAST FURNACE DIVISION
BLAST FURNACE Nº 3 - 1981 RELINE
FOUNDATIONS
KEY PLAN
EDGAR THOMSON WORKS

PROJECT No. 536-6062 — DRAWING No. E-18-229 — REV. 4

Host Site Interface HAZOP Recommendation & Status Tracker

GTI ENERGY solutions that transform	**Site Interface HAZOP Recommendation Tracker** **10 MTPD-scale** **ROTA-CAP™ Carbon Capture System**	

Client: Department of Energy (DOE)

Project: ROTA-CAP™: Engineering-Scale Testing of Carbon Capture Technology in Iron and Steel Production

Location: U. S. Steel Edgar Thomson Works
Braddock, PA, USA

DOE Contract Number: DE-FE0032466

GTI Energy Contract Number: 23654

Document Number: 23654-0000-DOC-0022

Rev	Date	Issue State	Made By	Checked	Approved
B	8/6/2025	Issued for Bid	AJK	DK	MM
A	8/2/2025	Issued for Review	AJK	DK	MM
			Sheet:	1 of 3	

U. S. Steel Site Interface HAZOP Recommendation Tracker

		REVISIONS					
GTI ENERGY PROJECT TITLE:	ROTA-CAP™: ENGINEERING SCALE TESTING OF CARBON CAPTURE TECHNOLOGY IN IRON AND STEEL PRODUCTION	Issued for Review	A	8/1/2025	AJK	DK	MM
CLIENT:	Department of Energy (DOE)	Issued for Bid	B	8/6/2025	AJK	DK	MM
DOE PROJECT NO:	DE-FE0032466						
GTI ENERGY PROJECT NO:	23654						
PLANT SIZE:	10 MTPD CARBON CAPTURE						
REFERENCE DOCUMENT:	23654-0000-REP-0006	**STATUS**	**REV**	**DATE**	**BY**	**CHECKED**	**APPROVED**

Revision	Recommendation No.	Recommendation	References	Priority/Urgency	Status	Comments
A	1	Evaluate the need for monitoring of the concentration of the dosing chemical in the cooling water supply to prevent corrosion over time.	**HAZOP: Node 1, Low/No Concentration: 1.1.1** **HAZOP: Node 1, Low/No Concentration: 1.2.1** **HAZOP: Node 1, High Concentration: 1.1.1** **HAZOP: Node 1, High Concentration: 1.2.1**	To be evaluated in detailed design.	Open	
A	2	Evaluate the materials specified for the cooling water supply/return systems in the ROTA-CAP unit with the system fabricator and ensure they are appropriate.	**HAZOP: Node 1, Low/No Concentration: 1.2.2** **HAZOP: Node 1, High Concentration: 1.2.2**	To be evaluated in detailed design.	Open	
A	3	Evaluate if the insulation jacketing on the piping serves as a physical barrier can be considered a safeguard.	**HAZOP: Node 4, Leak: 1.1.1**	To be evaluated in detailed design.	Open	
A	4	Ensure that piping is routed away from walkways and locations where personnel can be impacted.	**HAZOP: Node 4, Leak: 1.1.2** **HAZOP: Node 4, Start-up: 1.1.2** **HAZOP: Node 5, Leak: 1.1.1** **HAZOP: Node 5, Leak: 2.1.1** **HAZOP: Node 6, Leak: 1.1.1** **HAZOP: Node 6, Leak: 2.1.1**	To be incorporated into the piping layout during detailed design.	Open	
A	5	Consider locking the isolation valve on the steam supply line to the ROTA-CAP system closed during periods when the ROTA-CAP system is not installed and connected to the steam utility, to ensure that the steam line cannot be inadvertently opened when the system is not connected.	**HAZOP: Node 4, Start-up: 1.1.1** **HAZOP: Node 4, Shutdown: 1.1.1**	To be evaluated in detailed design.	Open	
A	6	Consider having the isolation valve on the return port locked open when the ROTA-CAP system is intended to be running.	**HAZOP: Node 8, Low/No Flow: 1.1.1** **HAZOP: Node 8, Low/No Flow: 1.2.1**	To be evaluated in detailed design.	Open	
A	7	Evaluate the coverage of existing gas monitors and determine if any additional monitors are required.	**HAZOP: Node 8, Low/No Flow: 1.1.2** **HAZOP: Node 8, Leak: 1.1.1** **HAZOP: Node 8, Leak: 2.1.1**	To be evaluated in detailed design.	Open	
A	8	Ensure that totes are equipped with proper containment, both during transport and in final placement next to the skid, in accordance with U. S. Steel's typical practices.	**HAZOP: Node 9, Leak: 1.1.1** **HAZOP: Node 9, Leak: 2.1.1**	To be incorporated into the detailed operating procedures developed in the next phase of design.	Open	U. S. Steel's standard practice involves the use of individual containment for totes during transport and in final placement.
A	9	Ensure that the two different tote types are not stored next to each other and are stored and potentially operated in different areas of the plant, to prevent any mix up.	**HAZOP: Node 9, Maintenance Hazards: 1.1.1**	To be confirmed during definition of the equipment and skid layout of the ROTA-CAP system.	Open	
A	10	Provide clear labeling and signage to identify chemicals and their appropriate storage location and connection points.	**HAZOP: Node 9, Maintenance Hazards: 1.1.2**	To be incorporated and confirmed during system fabrication.	Open	
A	11	During detailed design, revisit the level control scheme for vessel V-1001 within the ROTA-CAP system to ensure control scheme is aligned with U. S. Steel's operational plan for removing and collecting waste.	**HAZOP: Node 10, Low/No Flow: 1.1.1** **HAZOP: Node 10, Low/No Flow: 2.1.1**	To be evaluated during detailed design of the ROTA-CAP control system.	Open	
A	12	Ensure there is proper containment around units in the ROTA-CAP system to prevent any spills from contaminating the site.	**HAZOP: Node 10, Low/No Flow: 1.1.2** **HAZOP: Node 10, Low/No Flow: 2.1.2** **HAZOP: Node 10, Leak: 1.1.1** **HAZOP: Node 10, Leak: 1.2.1** **HAZOP: Node 11, Low/No Flow: 1.1.1** **HAZOP: Node 11, Low/No Flow: 2.1.1** **HAZOP: Node 11, Leak: 1.1.1** **HAZOP: Node 11, Leak: 1.2.1** **HAZOP: Node 12, Contamination: 1.1.1**	To be incorporated during detailed design and construction.	Open	
A	13	Ensure that tanks are appropriately labeled with signage and instructions dictating what they contain and where they should be disposed of.	**HAZOP: Node 10, Misdirected Flow: 1.1.1** **HAZOP: Node 11, Misdirected Flow: 1.1.1**	To be incorporated into the detailed equipment layout and specifications.	Open	

	U. S. Steel Site Interface HAZOP Recommendation Tracker		REVISIONS					
GTI ENERGY solutions that transform	**GTI ENERGY PROJECT TITLE:**	ROTA-CAP™: ENGINEERING SCALE TESTING OF CARBON CAPTURE TECHNOLOGY IN IRON AND STEEL PRODUCTION	Issued for Review	A	8/1/2025	AJK	DK	MM
	CLIENT:	Department of Energy (DOE)	Issued for Bid	B	8/6/2025	AJK	DK	MM
	DOE PROJECT NO:	DE-FE0032466						
	GTI ENERGY PROJECT NO:	23654						
	PLANT SIZE:	10 MTPD CARBON CAPTURE						
	REFERENCE DOCUMENT:	23654-0000-REP-0006	**STATUS**	**REV**	**DATE**	**BY**	**CHECKED**	**APPROVED**

Revision	Recommendation No.	Recommendation	References	Priority/Urgency	Status	Comments
A	14	Ensure that appropriate Lock Out/Tag Out (LOTO) procedures are in place so that equipment can be physically locked to prevent operation when maintenance is required.	**HAZOP: Node 10, Maintenance Hazards: 1.1.1** **HAZOP: Node 11, Maintenance Hazards: 1.1.1**	To be evaluated in detailed design.	Open	To be confirmed with U. S. Steel. Appropriate procedures to be developed if not already part of standard procedures.
A	15	Need to evaluate for freeze protection. Consider items like heat tracing, enclosing key equipment in containers with some even with temperature controlled areas.	**HAZOP: Node 12, Low/No Temperature: 1.1.1**	To be evaluated in detailed design.	Open	Winterization and insulation needs for piping and equipment are TBD based the final equipment layout and pipe routing (indoor/outdoor) and enclosure/module design. The winterization requirements will be influenced by which items are in enclosures vs outdoor, as well as whether the enclosures have any temperature control.
A	16	Evaluate the need for eyewash stations and safety showers either in the scope of the U. S. Steel interface or on the ROTA-CAP system itself.	**HAZOP: Node 12, Leak: 1.1.1**	To be evaluated in detailed design.	Open	

APPENDIX 4 – FLOW THROUGH REQUIREMENTS FROM DOE SPONSOR

Title 2 —Federal Financial Assistance
Subtitle A —Office of Management and Budget Guidance for Federal Financial Assistance
Chapter II —Office of Management and Budget Guidance
Part 200 —Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards
Subpart F —Audit Requirements
Management Decisions

Authority: 31 U.S.C. 503; 31 U.S.C. 6101-6106; 31 U.S.C. 6307; 31 U.S.C. 7501-7507.
Source: 89 FR 30136, Apr. 22, 2024, unless otherwise noted.

Appendix II to Part 200—Contract Provisions for Non-Federal Entity Contracts Under Federal Awards

In addition to other provisions required by the Federal agency or non-Federal entity, all contracts made by the non-Federal entity under the Federal award must contain provisions covering the following, as applicable.

(A) Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

(B) All contracts in excess of $10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement.

(C) Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”

(D) Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, “Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction”). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part

3, "Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States"). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

(E) Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

(F) Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of "funding agreement" under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the recipient or subrecipient must comply with the requirements of 37 CFR Part 401, "Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements," and any implementing regulations issued by the awarding agency.

(G) Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended—Contracts and subgrants of amounts in excess of $150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

(H) Debarment and Suspension (Executive Orders 12549 and 12689)—A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

(I) Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)—Contractors that apply or bid for an award exceeding $100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any

other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

(J) See § 200.323.

(K) See § 200.216.

(L) See § 200.322.

[78 FR 78608, Dec. 26, 2013, as amended at 79 FR 75888, Dec. 19, 2014; 85 FR 49577, Aug. 13, 2020]

Department of Energy Interim Conflict of Interest Policy

December 20, 2021

A. Overview

Under the interim COI policy, each non-Federal entity must have an up-to-date, written, and enforced administrative process to identify and manage conflicts of interest with respect to all projects for which financial assistance funding is sought or received from DOE. At a minimum, the non-Federal entity's policy must address financial and organizational conflicts of interest.

The non-Federal entity must require all investigators disclose significant financial interests. The non-Federal entity's designated official must review and manage any financial conflicts of interest and provide reports to DOE as required in the interim COI policy. Investigators on a project funded by a DOE award are required to update the disclosures at least annually, in accordance with the specific time period prescribed by the non-Federal entity, during the period of the award and also within thirty days of discovering or acquiring (e.g., through purchase, marriage, or inheritance) a new significant financial interest.

The interim COI policy requires the non-Federal entity provide DOE with ongoing financial conflict of interest (FCOI) reports, which identify any unmanaged or unmanageable financial conflicts of interest. DOE has discretion to require that the FCOI report also include managed financial conflicts of interest, and the requirement to do so will be specified in the applicable Funding Opportunity Announcement and/or terms and conditions of the financial assistance award. In addition to the standard FCOI report, DOE may require a non-Federal entity to routinely submit all or some investigator disclosures of significant financial interests.

In addition to the FCOI requirements, non-Federal entities must also address organizational conflicts of interest in accordance with the interim COI policy. Further, the recipient non-Federal entity must flow down the requirements of the interim COI policy to any subrecipient non-Federal entities.

Understanding that some technology/research areas have greater risks, specific sections of the policy allow DOE program offices discretion to apply stricter requirements. For example, the definition of "investigator" (i.e., the individuals who must disclose significant financial interests) may be expanded to also include any person who *participates* in the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. These two categories may include, for example, collaborators, consultants, or graduate (master's or PhD) students.

B. Implementation

The interim COI policy is applicable to all DOE funding opportunity announcements (FOAs) issued on or after the effective date of this FAL and new and renewal financial assistance awards selected from those FOAs, except Office of Indian Energy and Phase 1 SBIR/STTR FOAs and financial assistance awards. It is also applicable to all DOE formula financial assistance awards and financial assistance awards selected non-competitively on or after the effective date of this FAL. Non-Federal entities and individuals receiving DOE financial assistance awards will have one hundred and eighty (180) days from the effective date of this FAL to come into full compliance with this interim COI policy, with extensions of time available from

the DOE program office through the cognizant Contracting Activity.

For the interim COI policy, it is recognized that non-Federal entities with fewer than fifty employees; State and local governments; Indian Tribes; and disadvantaged communities[1] may experience a greater implementation burden. DOE program offices have discretion to provide flexibility on the implementation of the interim COI policy to reduce barriers for those non-Federal entities, with the approval of the cognizant Head of Contracting Activity. These flexibilities could include eliminating the requirement to have a written policy or the requirement to post the policy on a website. Further, DOE program offices have discretion to provide technical assistance, to provide extensions to reach compliance, and to reduce reporting requirements for those non-Federal entities. The flexibilities will be set forth in the FOAs or by term and condition of award.

1. Funding Opportunity Announcements

DOE Grants Officers must incorporate the FOA language (Appendix 2) in FOAs issued on or after the effective date of this FAL. Program offices have discretion to amend open FOAs issued prior to the effective date of this FAL. In the event a program office exercises discretion to include increased requirements (e.g., increased reporting), the cognizant Contracting Activity has discretion to modify the FOA language to reflect the increased requirements.

2. Special Award Term and Condition

DOE Grants Officers must incorporate the Special Award Term and Condition (Appendix 3) in financial assistance awards. In the event a program office exercises discretion to include increased requirements (e.g., increased reporting), the cognizant Contracting Activity has discretion to modify the term and condition to reflect the increased requirements.

(End of Document)

[1] *Disadvantaged communities* means communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care.

APPENDIX 1

DEPARTMENT OF ENERGY
Interim Conflict of Interest Policy for Financial Assistance

I. Purpose.

This DOE Interim Conflict of Interest Policy for Financial Assistance ("DOE Interim COI Policy" or "Policy") establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects wholly or in part funded under Department of Energy (DOE) financial assistance awards (e.g., a grant, cooperative agreement, or technology investment agreement) will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest.

II. Applicability.

This DOE Interim COI Policy is applicable to each non-Federal entity that is applying for or that receives a DOE financial assistance award and, through the implementation of this policy by the non-Federal entity, to each Investigator who is planning to participate in or is participating in the project funded wholly or in part under the DOE financial assistance award, and to each non-federal entity sub-recipient under the award. The DOE Interim COI Policy does not apply to Office of Indian Energy and Phase I Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) applications and awards. In those few cases where an individual, as opposed to a non-Federal entity, is applying for or receives DOE financial assistance funding for a project, DOE program offices will make case-by-case determinations on the steps to be taken, consistent with this Policy, to provide a reasonable expectation that the design, conduct, and reporting of the project will be free from bias resulting from a financial conflict of interest of the individual or organizational conflict of interest.

III. Definitions.

As used in this Policy:

Award, financial assistance award or Federal award means the same as the definition provided in 2 CFR 200.1 for Federal award.

Contracting Activity means an organizational element that has the authority to award and administer contracting and financial assistance instruments.

Disclosure of significant financial interests means an individual's disclosure of significant financial interests to a non-Federal entity.

DOE means the U.S. Department of Energy, the National Nuclear Security Administration (NNSA), and any components of the DOE to which the authority involved may be delegated.

DOE program office means the organizational unit of DOE, led by an officer of the Department who has been appointed by the President by and with the advice and consent of the Senate, that funds and/or manages the awards subject to this Policy. For purposes of this Policy, the term *DOE program office* includes the organization responsible for executing program management functions; the cognizant contracting activity; and the field elements in safety and health, administrative, management, and technical areas.

Financial conflict of interest (FCOI) means a situation in which an Investigator or the Investigator's spouse or dependent children has a significant financial interest or financial relationship that could directly and significantly affect the design, conduct, reporting or funding of a project.

FCOI report means a non-Federal entity's report of a financial conflict of interest to the DOE program office.

Financial interest means anything of monetary value, whether or not the value is readily ascertainable.

Institution of Higher Education means the same as the definition provided at 20 U.S.C. § 1001(a).

Investigator means the principal Investigator (PI) and any other person, regardless of title or position, who is responsible for the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. DOE program offices have the discretion to expand the definition to include also any person who *participates* in the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. Such expansion will be specified in the applicable funding opportunity announcement and/or terms and conditions of the financial assistance award.

Investigator's non-Federal entity responsibilities means an Investigator's professional responsibilities on behalf of the non-Federal entity, and as defined by the non-Federal entity in its policy on financial conflicts of interest, which may include: activities such as research, research consultation, teaching, professional practice, institutional committee memberships, and service on panels such as Institutional Review Boards or Data and Safety Monitoring Boards.

Manage means taking action to address a financial conflict of interest, which can include mitigating or eliminating the conflict of interest, to ensure, to the extent possible, that the purpose, design, conduct, and reporting of a project will be free from bias.

Non-Federal entity means a State, local government, Indian tribe, Institution of Higher Education, nonprofit organization, or for-profit organization that carries out a DOE award as a recipient or subrecipient.

Non-Federal entity's designated official means the individual designated by the non-Federal entity with the authority and responsibility to act on behalf of the non-Federal entity to ensure compliance with the DOE Interim COI Policy.

Organizational conflict of interest means a situation where because of relationships with a parent company, affiliate, or subsidiary organization, the non-Federal entity is unable or appears to be unable to be impartial in conducting a procurement action involving a related organization. 2 CFR 200.318(c)(2).

Potential conflict of interest exists when an impartial observer reasonably believes that actual or apparent past, present, or currently planned interests could constitute a conflict of interest with a project funded under a DOE award.

Principal Investigator (PI) means a principal investigator of a project funded under a DOE financial assistance award; PI is included in the definitions of *senior/key personnel* and *Investigator*.

Project means the interdependent activities funded wholly or in part under the DOE financial assistance award. A project has a defined start and end point with objectives described in an application or in an approved scope that, when attained, signify completion and achievement of a specific goal, and creation of a unique product, service, or result. For awards that include recipient cost share as part of the approved budget, activities funded with that recipient cost share are included.

Recipient means an entity, usually but not limited to non-Federal entities, that receives a Federal award directly from a Federal awarding agency. The term recipient does not include subrecipients or individuals that are beneficiaries of the award.

Senior/key personnel means the PI; any other person who significantly influences the design, conduct, or reporting of a project funded under a DOE award; and any other person identified as senior/key personnel by the non-Federal entity in the application for financial assistance, approved budget, progress report, or any other report submitted to the DOE by the non-Federal entity under this Policy.

Significant financial interest means:

(1) A financial interest consisting of one or more of the following interests of the Investigator (and those of the Investigator's spouse and dependent children) that reasonably appears to be related to the Investigator's non-Federal entity responsibilities:

(i) With regard to any foreign or domestic publicly traded entity, a *significant financial interest* exists if the value of any remuneration received from the entity in the twelve months preceding the disclosure and the value of any equity interest in the entity as of the date of disclosure, when aggregated, exceeds $5,000. For purposes of this definition, remuneration includes salary and any payment for services not otherwise identified as salary (e.g., consulting fees, honoraria, paid authorship); equity interest includes any stock, stock option, or other ownership interest, as determined through reference to public prices or other reasonable measures of fair market value;

(ii) With regard to any foreign or domestic non-publicly traded entity, a *significant financial interest* exists if the value of any remuneration, not otherwise disclosed as current, pending, or other support, received from the entity in the twelve months preceding the disclosure, when aggregated, exceeds $5,000, or when the Investigator (or the Investigator's spouse or dependent children) holds any equity interest (e.g., stock, stock option, or other ownership interest);

(iii) Intellectual property rights and interests (e.g., patents, copyrights), upon receipt of income related to such rights and interests.

(2) Investigators also must disclose the occurrence of any reimbursed or sponsored travel (*i.e.*, that which is paid on behalf of the Investigator and not reimbursed to the Investigator so that the exact monetary value may not be readily available) related to their institutional responsibilities that is not otherwise disclosed in current and pending or other support disclosures, provided that this disclosure requirement does not apply to travel that is reimbursed or sponsored by a Federal, state, or local government agency of the United States; a domestic Institution of Higher Education; or a domestic research institute that is affiliated with a domestic Institution of Higher Education. The non-Federal entity's FCOI policy will specify the details of this disclosure, which will include, at a minimum, the purpose of the trip, the identity of the sponsor/organizer, the destination, and the duration. In accordance with the non-Federal entity's FCOI policy, the non-Federal entity official(s) will determine if further information is needed, including a determination or disclosure of monetary value, in order to determine whether the travel constitutes a FCOI with the project funded under the DOE award.

(3) The term *significant financial interest* does not include the following types of financial interests: salary, royalties, or other remuneration paid by the non-Federal entity to the Investigator if the Investigator is currently employed or otherwise appointed by the non-Federal entity, including

intellectual property rights assigned to the non-Federal entity and agreements to share in royalties related to such rights; any ownership interest in the non-Federal entity held by the Investigator, if the non-Federal entity is a commercial or for-profit organization; income from investment vehicles, such as mutual funds and retirement accounts, as long as the Investigator does not directly control the investment decisions made in these vehicles; income from seminars, lectures, or teaching engagements sponsored by a Federal, state, or local government agency of the United States, a domestic Institution of Higher Education, or a domestic research institute that is affiliated with a domestic Institution of Higher Education; or income from service on advisory committees or review panels for a Federal, state, or local government agency of the United States, a domestic Institution of Higher Education, or a domestic research institute that is affiliated with a domestic Institution of Higher Education.

Small Business Innovation Research (SBIR) Program and *Small Business Technology Transfer* (STTR) Program mean the extramural research programs for small businesses that are run by the DOE Office of Science and the Advanced Research Projects Agency-Energy and certain other Federal agencies under Public Law 97-219, the Small Business Innovation Development Act, as amended, and Public Law 102-564.

Subrecipient means an entity, usually but not limited to non-Federal entities, that receives a subaward from a pass-through entity to carry out part of a Federal award, but does not include an individual that is a beneficiary of such award. A subrecipient may also be a recipient of other Federal awards directly from a Federal awarding agency.

IV. Responsibilities of non-Federal entities regarding Investigator financial conflicts of interest.

Each non-Federal entity shall:

(a) Maintain an up-to-date, written, enforced policy on financial conflicts of interest that complies with the DOE Interim COI Policy, and make such policy available via a publicly accessible website. If the non-Federal entity does not have any current presence on a publicly accessible website (and only in those cases), the non-Federal entity shall make its written policy available to any requestor within five business days of a request. If, however, the non-Federal entity acquires a presence on a publicly accessible website during the time of the DOE award, the requirement to post the information on that website will apply within thirty calendar days of the acquisition of the publicly accessible website. If a non-Federal entity maintains a policy on financial conflicts of interest that includes standards that are more stringent than this Policy (e.g., that require a more extensive disclosure of financial interests), the non-Federal entity shall adhere to its policy and shall provide FCOI reports regarding identified financial conflicts of interest to the DOE program office in accordance with the non-Federal entity's own standards and within the timeframe prescribed by this Policy.

(b) Inform each Investigator of the non-Federal entity's policy on financial conflicts of interest, the Investigator's responsibilities regarding disclosure of significant financial interests, and of DOE’s Interim COI Policy; and require each Investigator to complete training regarding the same prior to engaging in projects related to any DOE financial assistance award and at least every four years, and immediately when any of the following circumstances apply:

(1) The non-Federal entity revises its financial conflict of interest policies or procedures in any manner that affects the requirements of Investigators;

(2) An Investigator is new to a non-Federal entity; or

(3) A non-Federal entity finds that an Investigator is not in compliance with the non-Federal entity's financial conflict of interest policy or management plan.

(c) If the non-Federal entity carries out the DOE award through or with the assistance of one or more subrecipient, the recipient non-Federal entity must take reasonable steps to ensure that each subrecipient Investigator complies with this Policy by:

(1) Incorporating as part of a written agreement with the subrecipient terms that establish whether the financial conflict of interest policy of the recipient non-Federal entity or that of the subrecipient will apply to the subrecipient's Investigators.

(i) If the subrecipient's Investigators must comply with the subrecipient's financial conflict of interest policy, the subrecipient shall certify as part of the agreement referenced above that its policy complies with this DOE Interim COI Policy and the subrecipient shall make such policy available via a publicly accessible website. If the subrecipient does not have any current presence on a publicly accessible website (and only in those cases), the subrecipient shall make its written policy available to any requestor within five business days of a request. If the subrecipient cannot provide such certification, the agreement shall state that subrecipient Investigators are subject to the financial conflict of interest policy of the recipient non-Federal entity for disclosing financial conflicts of interest;

(ii) Additionally, if the subrecipient's Investigators must comply with the subrecipient's financial conflict of interest policy, the agreement referenced above shall specify time period(s) for the subrecipient to report all identified financial conflicts of interest to the recipient non-Federal entity. Such time period(s) shall be sufficient to enable the recipient non-Federal entity to provide timely FCOI reports, as necessary, to DOE, as required by this DOE Interim COI Policy;

(iii) Alternatively, if the subrecipient's Investigators must comply with the recipient non-Federal entity's financial conflict of interest policy, the agreement referenced above shall specify time period(s) for the subrecipient to submit all Investigator disclosures of significant financial interests to the recipient non-Federal entity. Such time period(s) shall be sufficient to enable the recipient non-Federal entity to comply timely with its review, management, and reporting obligations under this DOE Interim COI Policy.

(2) Providing FCOI reports to the DOE program office regarding all financial conflict of interest of all subrecipient Investigators consistent with this Policy, *i.e.*, prior to the expenditure of funds and within sixty days of any subsequently identified FCOI.

(d) Designate a non-Federal entity official(s) to solicit and review disclosures of significant financial interests from each Investigator who is planning to participate in, or is participating in, the project funded under a DOE award, including disclosures of subrecipient investigators pursuant to paragraph (c) of this section.

(e) Require that:

(1) Each Investigator who is planning to participate in the DOE award disclose to the non-Federal entity's designated official(s) the Investigator's significant financial interests (and those of the Investigator's spouse and dependent children) no later than the time of application for the DOE award. In the event a non-Federal entity seeks to add an Investigator after the time of application, the non-Federal entity must require the Investigator make such disclosures prior to participating in a project funded under a DOE award.

(2) Each Investigator who is participating in the DOE award to submit an updated disclosure of significant financial interests at least annually, in accordance with the specific time period prescribed by the non-Federal entity, during the period of the award. Such disclosure shall include any information that was not disclosed initially to the non-Federal entity pursuant to paragraph (e)(1) of this section, or in a subsequent disclosure of significant financial interests (e.g., any financial conflict of interest identified on a DOE award that was transferred from another non-Federal entity), and shall include updated information regarding any previously disclosed significant financial interest (e.g., the updated value of a previously disclosed equity interest).

(3) Each Investigator who is participating in the DOE award to submit an updated disclosure of significant financial interests within thirty days of discovering or acquiring (e.g., through purchase, marriage, or inheritance) a new significant financial interest.

(4) Each disclosure and updated disclosure be signed and dated by the Investigator and include a certification statement that reads:

> I understand that this Disclosure is required to obtain funding from the U.S. Government. I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Disclosure Statement is true, complete, and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims, or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3730 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to U.S. Government's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

(f) Provide guidelines consistent with this Policy for the designated non-Federal entity's designated official(s) to determine whether an Investigator's significant financial interest is related to a project funded under a DOE award and, if so related, whether the significant financial interest is a financial conflict of interest. An Investigator's significant financial interest is related to a project funded under a DOE award when the non-Federal entity, through its designated official(s), reasonably determines that the significant financial interest could be affected by the project, could affect the project, is in an entity whose financial interest could affect the project, or is in an entity whose financial interest could be affected by the project. The non-Federal entity may involve the Investigator in the designated official(s)'s determination of whether a significant financial interest is related to the project funded under the DOE award. A financial conflict of interest exists when the non-Federal entity, through its designated official(s), reasonably determines that the significant financial

interest could directly and significantly affect the purpose, design, conduct, or reporting of the project funded under a DOE award.

(g) Take such actions as necessary to manage financial conflicts of interest, including any financial conflicts of a subrecipient Investigator pursuant to paragraph (c) of this section. Management of an identified financial conflict of interest requires development and implementation of a management plan and, if necessary, a retrospective review and a mitigation report pursuant to Section V(a).

(h) Provide initial and ongoing FCOI reports to DOE as required pursuant to Section V(b).

(i) Maintain records relating to all Investigator disclosures of financial interests and the non-Federal entity's review of and response to such disclosures (whether or not a disclosure resulted in the non-Federal entity's determination of a financial conflict of interest) and all actions under the non-Federal entity's policy or retrospective review, if applicable, for the time period specified in 2 CFR 200.334 or, where applicable, from other dates specified in the individual award terms and conditions.

(j) Establish adequate enforcement mechanisms and provide for employee sanctions or other administrative actions to ensure Investigator compliance as appropriate.

(k) Certify, prior to award, that the non-Federal entity:

(1) Has in effect an up-to-date, written, and enforced administrative process to identify and manage conflicts of interest with respect to all projects for which financial assistance funding is sought or received from DOE;

(2) Shall promote and enforce Investigator compliance with this Policy's requirements including those pertaining to disclosure of significant financial interests;

(3) Shall manage financial conflicts of interest and provide initial and ongoing FCOI reports to DOE consistent with this Policy;

(4) Agrees to make information available, promptly upon request, to DOE relating to any Investigator disclosure of financial interests and the non-Federal entity's review of, and response to, such disclosure, whether or not the disclosure resulted in the non-Federal entity's determination of a financial conflict of interest; and

(5) Shall fully comply with the requirements of this Policy.

V. Management and reporting of financial conflicts of interest.

(a) Management of financial conflicts of interest.

(1) Prior to the non-Federal entity's expenditure of any funds under a DOE award, the designated official(s) of a non-Federal entity shall, consistent with Section IV(f): review all Investigator disclosures of significant financial interests; determine whether any of the disclosures relate to the project funded under the DOE award; determine whether a financial conflict of interest exists; and, if so, develop and implement a management plan that shall specify the actions that have been, and shall be, taken to manage such financial conflict of interest. A nonexclusive list of conditions or restrictions, one or more of which might be imposed to manage a financial conflict of interest, includes:

(i) Public disclosure of the financial conflict of interest (e.g., when presenting or publishing the project);

(ii) For projects involving human subjects, disclosure of financial conflicts of interest directly to participants;

(iii) Appointment of an independent monitor or oversight committee capable of taking measures to protect the purpose, design, conduct, and reporting of the project against bias resulting from the financial conflict of interest;

(iv) Modification of the project plan;

(v) Change of personnel or personnel responsibilities, or disqualification of personnel from participation in all or a portion of the project;

(vi) Reduction or elimination of the financial interest (e.g., sale of an equity interest); or

(vii) Severance of relationship(s) that create financial conflicts of interest.

(2) Whenever, in the course of an ongoing project funded under a DOE award, an Investigator who is new to participating in the project discloses a significant financial interest or an existing Investigator discloses a new significant financial interest to the non-Federal entity, the designated official(s) of the non-Federal entity shall, within sixty days: review the disclosure; determine whether it is related to the project funded under the DOE award; determine whether a financial conflict of interest exists; and, if so, implement, on at least an interim basis, a management plan that shall specify the actions that have been, and will be, taken to manage such financial conflict of interest. Depending on the nature of the significant financial interest, a non-Federal entity may determine that additional interim measures are necessary with regard to the Investigator's participation in the project funded under the DOE award between the date of disclosure and the completion of the non-Federal entity's review.

(3) Whenever a non-Federal entity identifies a significant financial interest that was not disclosed timely by an Investigator or, for whatever reason, was not previously reviewed by the non-Federal entity during an ongoing project funded under a DOE award (e.g., was not timely reviewed or reported by a subrecipient), the designated official(s) shall, within sixty days: review the significant financial interest; determine whether it is related to the project funded under a DOE award; determine whether a financial conflict of interest exists; and, if so:

(i) Implement, on at least an interim basis, a management plan that shall specify the actions that have been and will be taken to manage such financial conflict of interest going forward;

(ii)(A) In addition, whenever a financial conflict of interest is not identified or managed in a timely manner, including failure by the Investigator to disclose a significant financial interest that is determined by the non-Federal entity to constitute a financial conflict of interest; failure by the non-Federal entity to review or manage such a financial conflict of interest; or failure by the Investigator to comply with a financial conflict of interest management plan, the non-Federal entity shall, within 120 days of the non-Federal entity's determination of noncompliance, complete a retrospective review of the Investigator's activities and the project funded under the DOE award to determine whether any project activity, or portion thereof, conducted during the time period of the noncompliance, was biased in the purpose, design,

conduct, or reporting of such project.

(B) The non-Federal entity is required to document the retrospective review; such documentation shall include, but not necessarily be limited to, all of the following key elements:

(*1*) DOE award number;

(*2*) Project title;

(*3*) PI or contact PI if a multiple PI model is used;

(*4*) Name of the Investigator with the FCOI;

(*5*) Name of the entity with which the Investigator has a financial conflict of interest;

(*6*) Reason(s) for the retrospective review;

(*7*) Detailed methodology used for the retrospective review (e.g., methodology of the review process, composition of the review panel, documents reviewed);

(*8*) Findings of the review; and

(*9*) Conclusions of the review.

(iii) Based on the results of the retrospective review, if appropriate, the non-Federal entity shall update the previously submitted FCOI report, specifying the actions that will be taken to manage the financial conflict of interest going forward. If bias is found, the non-Federal entity is required to notify the DOE program office promptly and submit a mitigation report to the DOE program office. The mitigation report must include, at a minimum, the key elements documented in the retrospective review above, a description of the impact of the bias on the project, and the non-Federal entity's plan of action or actions taken to eliminate or mitigate the effect of the bias (e.g., impact on the project; extent of harm done, including any qualitative and quantitative data to support any actual or future harm; analysis of whether the project is salvageable). Thereafter, the non-Federal entity will submit FCOI reports annually, as specified elsewhere in this Policy. DOE program offices may, by language in Funding Opportunity Announcements (FOAs) or by term and condition of award, require more frequent reporting for awards. Depending on the nature of the financial conflict of interest, a non-Federal entity may determine that additional interim measures are necessary with regard to the Investigator's participation in the project funded under the DOE award between the date that the conflict of interest or the Investigator's noncompliance is determined and the completion of the non-Federal entity's retrospective review.

(4) Whenever a non-Federal entity implements a management plan pursuant to this Policy, the non-Federal entity shall monitor Investigator compliance with the management plan on an ongoing basis until the completion of the DOE award.

(5)(i) Prior to the non-Federal entity's expenditure of any funds under a DOE award, the non-Federal entity shall ensure public accessibility, via a publicly accessible website or written response to any

requestor within five business days of a request, of information concerning any significant financial interest disclosed to the non-Federal entity that meets the following three criteria:

(A) The significant financial interest is still held by the senior/key personnel as defined by this Policy;

(B) The non-Federal entity determined that the significant financial interest is related to the project funded under the DOE award; and

(C) The non-Federal entity determined that the significant financial interest is a financial conflict of interest.

(ii) The information that the non-Federal entity makes available via a publicly accessible website or written response to any requestor within five business days of a request, shall include, at a minimum, the following: the Investigator's name; the Investigator's title and role with respect to the project; the name of the entity in which the significant financial interest is held; the nature of the significant financial interest; and the approximate dollar value of the significant financial interest (dollar ranges are permissible: $0-$4,999; $5,000-$9,999; $10,000-$19,999; amounts between $20,000-$100,000 by increments of $20,000; amounts above $100,000 by increments of $50,000), or a statement that the interest is one whose value cannot be readily determined through reference to public prices or other reasonable measures of fair market value.

(iii)(A) If the non-Federal entity uses a publicly accessible website for the purposes of this subsection, the information that the non-Federal entity posts shall be updated at least annually. In addition, the non-Federal entity shall update the website within sixty days of the non-Federal entity's receipt or identification of information concerning any additional significant financial interest of the senior/key personnel for the project funded under the DOE award that was not previously disclosed, or upon the disclosure of a significant financial interest of senior/key personnel new to the project, if the non-Federal entity determines that the significant financial interest is related to the project and is a financial conflict of interest. The website shall note that the information provided is current as of the date listed and is subject to updates, on at least an annual basis and within sixty days of the non-Federal entity's identification of a new financial conflict of interest.

(B) If the non-Federal entity responds to written requests for the purposes of this subsection, the non-Federal entity will note in its written response that the information provided is current as of the date of the correspondence and is subject to updates, on at least an annual basis and within sixty days of the non-Federal entity's identification of a new financial conflict of interest, which should be requested subsequently by the requestor.

(iv) Information concerning the significant financial interests of an individual subject to paragraph (a)(5) of this section shall remain available, for responses to written requests or for posting via the non-Federal entity's publicly accessible website, for at least three years from the date that the information was most recently updated.

(6) In addition to the types of financial conflicts of interest as defined in this Policy that must be managed pursuant to this section, a non-Federal entity may require the management of other conflicts

of interest in its policy on financial conflicts of interest, as the non-Federal entity deems appropriate.

(b) Reporting of financial conflicts of interest.

(1) Prior to the non-Federal entity's expenditure of any funds under a DOE-funded project, the non-Federal entity shall provide to the DOE program office a FCOI report regarding any Investigator's unmanaged or unmanageable significant financial interest found by the non-Federal entity to be conflicting. DOE program offices may, by language in FOAs or term and condition of award, require a non-Federal entity's FCOI report also list any Investigator's significant financial interest found by the non-Federal entity to be conflicting and addressed by a management plan in accordance with this Policy. The non-Federal entity shall provide, on request, FCOI reports and supporting documentation about any significant financial interest found by the non-Federal entity to be conflicting, regardless of whether or not the conflict has been managed, mitigated, or eliminated. In cases in which the non-Federal entity identifies a financial conflict of interest and eliminates it prior to the expenditure of DOE-awarded funds, the non-Federal entity need not submit a FCOI report to the DOE program office.

(2) For any significant financial interest that the non-Federal entity identifies as conflicting subsequent to the non-Federal entity's initial FCOI report during an ongoing project funded under a DOE award (e.g., upon the participation of an Investigator who is new to the project), the non-Federal entity shall:

(i) [Applicable when a DOE program office requires the non-Federal entity to include only unmanaged or unmanageable Investigator FCOIs in the FCOI Report] Provide to DOE within sixty days an FCOI report regarding the financial conflict of interest if the non-Federal entity's designated official determines that the FCOI is unmanageable. Pursuant to paragraph (a)(3)(ii) of this section, where such FCOI report involves a significant financial interest that was not disclosed timely by an Investigator or, for whatever reason, was not previously reviewed or managed by the non-Federal entity (e.g., was not timely reviewed or reported by a subrecipient), the non-Federal entity also is required to complete a retrospective review to determine whether any project funded under a DOE award or portion thereof conducted prior to the identification of the financial conflict of interest was biased in the purpose, design, conduct, or reporting of such project. Additionally, pursuant to paragraph (a)(3)(iii) of this section, if bias is found, the non-Federal entity is required to notify the DOE program office promptly and submit a mitigation report to the DOE program office.

(ii) [Applicable when a DOE program office requires the non-Federal entity to include all Investigator FCOIs – including managed and unmanaged/unmanageable FCOIs – in the FCOI Report] Provide to DOE within sixty days, an FCOI report regarding the financial conflict of interest and ensure that the non-Federal entity has implemented a management plan in accordance with this Policy. Pursuant to paragraph (a)(3)(ii) of this section, where such FCOI report involves a significant financial interest that was not disclosed timely by an Investigator or, for whatever reason, was not previously reviewed or managed by the non-Federal entity (e.g., was not timely reviewed or reported by a subrecipient), the non-Federal entity also is required to complete a retrospective review to determine whether any project funded under a DOE award, or portion thereof, conducted prior to the identification and management of the

financial conflict of interest was biased in the purpose, design, conduct, or reporting of such project. Additionally, pursuant to paragraph (a)(3)(iii) of this section, if bias is found, the non-Federal entity is required to notify the DOE program office promptly and submit a mitigation report to the DOE program office.

(3) Any FCOI report required under paragraphs (b)(1) or (b)(2) of this section shall include sufficient information to enable DOE to understand the nature and extent of the financial conflict, and to assess the appropriateness of the non-Federal entity's management plan. Elements of the FCOI report shall include, but are not necessarily limited to the following:

(i) DOE award number;

(ii) PI or Contact PI if a multiple PI model is used;

(iii) Name of the Investigator with the financial conflict of interest;

(iv) Name of the entity with which the Investigator has a financial conflict of interest;

(v) Nature of any applicable financial interest (e.g., equity, consulting fee, travel reimbursement, honorarium) and/or applicable external relationships or activities;

(vi) Value of any applicable financial interest (dollar ranges are permissible: $0-$4,999; $5,000-$9,999; $10,000-$19,999; amounts between $20,000-$100,000 by increments of $20,000; amounts above $100,000 by increments of $50,000), or a statement that the interest is one whose value cannot be readily determined through reference to public prices or other reasonable measures of fair market value;

(vii) A description of how the financial interest relates to the project funded under a DOE award and the basis for the non-Federal entity's determination that there is a conflict with such project; and

(viii) [Applicable when a DOE program office requires the non-Federal entity to include all Investigator FCOIs – including managed and unmanaged/unmanageable FCOIs – in the FCOI Report] A description of the key elements of the non-Federal entity's management plan, including:

(A) Role and principal duties of the conflicted Investigator in the project;

(B) Conditions of the management plan;

(C) How the management plan is designed to safeguard objectivity in the project;

(D) Confirmation of the Investigator's agreement to the management plan;

(E) How the management plan will be monitored to ensure Investigator compliance; and

(F) Other information as needed.

(4) For any financial conflict of interest previously reported by the non-Federal entity with regard to an ongoing project funded under a DOE award, the non-Federal entity shall provide DOE with an annual FCOI report that addresses the status of the financial conflict of interest and, if applicable, any changes to the management plan for the duration of the DOE award. The annual FCOI report shall

specify whether the financial conflict is still being managed or if it remains unmanaged/unmanageable. Alternatively, the annual FCOI report shall explain why the financial conflict no longer exists. The non-Federal entity shall provide annual FCOI reports to DOE for the duration of the project period (including extensions with or without funds) in the time and manner required by term and condition of award.

(5) In addition to the annual FCOI report, DOE may require a non-Federal entity to routinely submit all or some Investigator disclosures of financial interests. Circumstances when DOE may require a non-Federal entity to submit all or some of such Investigator disclosures include but are not limited to:

(i) As part of monitoring the non-Federal entity's compliance with this Policy;

(ii) Bankruptcy of the non-Federal entity;

(iii) Other legal winding down of the non-Federal entity;

(iv) Acquisition of the non-Federal entity by a foreign entity, where "acquisition" includes a foreign entity obtaining a controlling interest in the non-Federal entity; or

(v) As otherwise set forth in 2 CFR 200, as amended by 2 CFR 910.

(6) In addition to the types of financial conflicts of interest as defined in this Policy that must be reported pursuant to this section, a non-Federal entity may require the reporting of other conflicts of interest in its policy, as the non-Federal entity deems appropriate.

VI. Responsibilities of non-Federal entities regarding organizational conflicts of interest.

(a) If the non-Federal entity has a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe, the non-Federal entity must maintain written standards of conduct covering organizational conflicts of interest. 2 CFR 200.318(c)(2).

(b) The existence of written policies or procedures requiring that certain procurements or transactions be made with a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe is an effective manner of mitigating an organizational conflict of interest.

(c) The non-Federal entity must disclose in writing any potential or actual organizational conflict of interest to the DOE program office. The non-Federal entity must provide the disclosure to DOE in an application for financial assistance or prior to engaging in a procurement or transaction using DOE funds with a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe. The elements of the disclosure shall include, but are not limited to the following:

(i) The name, address, and website (as applicable) of the entity that presents a potential or actual organizational conflict of interest;

(ii) The relationship between the non-Federal entity and the entity at issue;

(iii) The nature of the anticipated procurement or other transaction with the parent, affiliate, or subsidiary organization; the anticipated value of the procurement or other transaction; and the basis

for making the procurement or other transaction with a parent, affiliate, or subsidiary organization;

(iv) The basis for the non-Federal entity's determination regarding the existence of an organizational conflict of interest; and

(v) How the non-Federal entity will avoid, neutralize, or mitigate the organizational conflict of interest.

(d) If the effects of the potential or actual organizational conflict of interest cannot be avoided, neutralized, or mitigated, the anticipated procurement or other transaction using DOE funds may not be made. Where there is an organizational conflict of interest that cannot be avoided, neutralized, or mitigated, the non-Federal entity must procure goods and services from other sources when using DOE funds.

VII. Remedies.

(a) If the failure of an Investigator to comply with a non-Federal entity's financial conflict of interest policy or a management plan appears to have biased the purpose, design, conduct, or reporting of the project funded under a DOE award, the non-Federal entity shall promptly notify the DOE of the failure to comply and of the corrective action taken or to be taken. DOE will consider the situation and, as necessary, take appropriate action, or refer the matter to the non-Federal entity for further action, which may include directions to the non-Federal entity on how to maintain appropriate objectivity in the project funded under the DOE award. DOE may, for example, require non-Federal entities employing such an Investigator to enforce any applicable corrective actions prior to a DOE award or when the transfer of a DOE award involves such an Investigator.

(b) DOE may inquire, at any time before, during, or after an award, into any Investigator's disclosure of financial interests and the non-Federal entity's review (including any retrospective review) of and response to such disclosure, regardless of whether the disclosure resulted in the non-Federal entity's determination of a financial conflict of interest. A non-Federal entity is required to submit or permit on-site review of, all records pertinent to compliance with this Policy. To the extent permitted by law, DOE will maintain the confidentiality of all records of financial interests. Based on its review of records or other information that may be available, the DOE program office may decide that a particular financial conflict of interest will bias the objectivity of or adversely impact the project funded under the DOE award to such an extent that further corrective action is needed or that the non-Federal entity has not managed the financial conflict of interest in accordance with this Policy. The DOE may determine that the imposition of specific award conditions under 2 CFR 200.208 is necessary. The DOE may also take one or more the actions specified under 2 CFR 200.339, as appropriate in the circumstances.

(c) If a non-Federal entity fails to disclose an organizational conflict of interest to DOE prior to engaging in a procurement or transaction using DOE funds with a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe, the costs of such procurement or transaction may be disallowed. If a non-Federal entity fails to disclose an organizational conflict of interest to DOE prior to engaging in a procurement or transaction using DOE funds with a parent, affiliate, or subsidiary organization that is not a state, local government, or Indian tribe, and the organizational conflict of interest is not avoided, neutralized, or managed, DOE may determine that imposition of specific award conditions under 2 CFR 200.208 is necessary. DOE may also take one or more actions specified under 2 CFR 200.339, as appropriate in the circumstances.

(d) Any false, fictitious, or fraudulent information, or the omission of any material fact, on a disclosure, report, or other record required under this Policy may be subject to criminal, civil, or administrative penalties for fraud, false statements, false claims or otherwise. (U.S. Code Title 18, Sections 287 and 1001; and Title 31, 3729-3730 and 3801-3812).

APPENDIX 2

DEPARTMENT OF ENERGY (DOE)
Conflict of Interest Policy for Financial Assistance
Funding Opportunity Announcement Language

Include the following text in [FOA Section] Part VI:

[FOA section #] Interim Conflict of Interest Policy for Financial Assistance

a. Policy

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy) can be found at [Link to FAL]. This policy is applicable to all non-Federal entities applying for, or that receive, DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment agreement) and, through the implementation of this policy by the entity, to each Investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. DOE's interim COI Policy establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects funded wholly or in part under DOE financial assistance awards will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest. The applicant is subject to the requirements of the interim COI Policy and within each application for financial assistance, the applicant must certify that it is, or will be by the time of receiving any financial assistance award, compliant with all requirements in the interim COI Policy. The applicant must flow down the requirements of the interim COI Policy to any subrecipient non-Federal entities.

APPENDIX 3

DEPARTMENT OF ENERGY (DOE)
Interim Conflict of Interest Policy for Financial Assistance
Special Term and Condition

[Term #] Interim Conflict of Interest Requirements for Financial Assistance

a. Policy

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy) can be found at [Link to FAL]. The interim COI Policy is applicable to all non-Federal entities that receive DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment agreement) and, through the implementation of this interim COI Policy by the entity, to each Investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. The interim COI Policy establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects funded wholly or in part under DOE financial assistance awards will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest. The Recipient is subject to the requirements of the interim COI Policy, and the Recipient must certify that it is compliant with all requirements in the interim COI Policy. The Recipient must flow down the requirements of the interim COI Policy to any subrecipient non-Federal entities.

b. Additional Requirements (optional)

The Recipient is required to disclose, manage, and report conflicts of interest as per the DOE interim COI Policy. In addition, the Recipient is required to:

APPENDIX 5 - BUY AMERICA REQUIREMENTS

BUY AMERICAN REQUIREMENT FOR INFRASTRUCTURE PROJECTS (MAY 2024)

A. ***Definitions***

Components See 2 CFR 184.3 “Definitions.”

Construction Materials See 2 CFR 184.3 “Definitions.”

Buy America Preference, Buy America Requirement, or domestic content procurement preference” means a requirement that no amount of funds made available through a program for federal financial assistance may be obligated for an infrastructure project unless—

(A) all iron and steel used in the project are produced in the United States;
(B) the manufactured products used in the project are produced in the United States; or
(C) the construction materials used in the project are produced in the United States.

Infrastructure See 2 CFR 184.4 (c) and (d).

Manufactured Products See 2 CFR 184.3 “Definitions.”

Predominantly of iron or steel See 2 CFR 184.3 “Definitions."

Infrastructure Project- See 2 CFR 184.3 “Definitions."

Public- The Buy America Requirement does not apply to non-public infrastructure. For purposes of this guidance, infrastructure should be considered “public” if it is: (1) publicly owned or (2) privately owned but utilized primarily for a public purpose. Infrastructure should be considered to be “utilized primarily for a public purpose” if it is privately operated on behalf of the public or is a place of public accommodation.

B. ***Buy America Requirement for Infrastructure Projects (Buy America Requirement)***

None of the funds provided under this award (federal share or recipient cost-share) may be used for a project for infrastructure unless:

1. All iron and steel used in the project is produced in the United States—this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

2. All manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is

greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation. See 2 CFR 184.5 for determining the cost of components for manufactured products; and

3. All construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. See 2 CFR 184.6 for construction material standards.

The Buy America Requirement only applies to those articles, materials, and supplies that are consumed in, incorporated into, or permanently affixed to the infrastructure in the project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought into the construction site and removed at or before the completion of the infrastructure project. Nor does a Buy America Requirement apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

The Buy America Requirement only applies to an article, material, or supply classified into one of the following categories* based on its status at the time it is brought to the work site for incorporation into an infrastructure project:

(i) Iron or steel products;
(ii) Manufactured products; or
(iii) Construction materials;

The Buy America Requirement only applies to the iron or steel products, manufactured products, and construction materials used for the construction, alteration, maintenance, or repair of public infrastructure in the United States when those items are consumed in, incorporated into, or permanently affixed to the infrastructure. An article, material, or supply incorporated into an infrastructure project should not be considered to fall into multiple categories, but rather must meet the Buy America Preference Requirement for only the single category in which it is classified.

All iron and steel, manufactured products, and construction materials used in the infrastructure project must be produced in the United States.

* Section 70917(c) of the BABA states that “construction materials” do not include cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives. Section 70917(c) materials are excluded from Construction materials. Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel. Accordingly, asphalt is also excluded from the definition of Construction materials.

Section 70917(c) materials, on their own, are not manufactured products. Further, Section 70917(c) materials should not be considered manufactured products when they are used at or combined proximate to the work site—such as is the case with wet concrete or hot mix asphalt brought to the work site for incorporation. However, when certain Section 70917(c) materials (such as stone, sand, and gravel) are used to produce a

manufactured product, such as is precast concrete processed into a specific shape or form, and is in such state when brought to the work site, then that product is subject to the BABA requirements.
Further clarification is provided in 2 CFR 184 on the circumstances under which a determination is made that Section 70917(c) materials should be treated as components of a manufactured product. That determination is based on consideration of: (i) the revised definition of the "manufactured products" at 2 CFR 184.3; (ii) a new definition of "section 70917(c) materials" at 2 CFR 184.3; (iii) new instructions at 2 CFR 184.4(e) on how and when to categorize articles, materials, and supplies; and (iv) new instructions at 2 CFR 184.4(f) on how to apply the Buy America preference by category.

Recipients are responsible for administering their award in accordance with the terms and conditions, including the Buy America Requirement. The recipient must ensure that the Buy America Requirement flows down to all subawards and that the subawardees and subrecipients comply with the Buy America Requirement. The Buy America Requirement term and condition must be included all sub-awards, contracts, subcontracts, and purchase orders for work performed under the infrastructure project.

C. *Certification of Compliance*

Recipients must certify or provide equivalent documentation for proof of compliance that a good faith effort was made to solicit bids for domestic products used in the infrastructure project under this award.
Recipients must also maintain certifications or equivalent documentation for proof of compliance that those articles, materials, and supplies that are consumed in, incorporated into, affixed to, or otherwise used in the infrastructure project, not covered by a waiver or exemption provided in 2 CFR 184.8, are produced in the United States. The certification or proof of compliance must be provided by the suppliers or manufacturers of the iron, steel, manufactured products and construction materials and flow up from all subawardees, contractors and vendors to the recipient. Recipients must keep these certifications with the award/project files and be able to produce them upon request from DOE, auditors or Office of Inspector General.

D. *Waivers*

When necessary, recipients may apply for, and DOE may grant, a waiver from the Buy America Requirement. Waiver requests are subject to review by DOE and the Office of Management and Budget, as well as a public comment period of no less than 15 calendar days.

1. Waivers must be based on one of the following justifications:
    a) Public Interest- Applying the Buy America Requirement would be inconsistent with the public interest;
    b) Non-Availability- The types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
    c) Unreasonable Cost- The inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

2. Requests to waive the Buy America Requirement must include the following:
    - Waiver type (Public Interest, Non-Availability, or Unreasonable Cost);
    - Recipient name and Unique Entity Identifier (UEI);
    - Award information (Federal Award Identification Number, Assistance Listing number);
    - A brief description of the project, its location, and the specific infrastructure involved;
    - Total estimated project cost, with estimated federal share and recipient cost share breakdowns;

- Total estimated infrastructure costs, with estimated federal share and recipient cost share breakdowns;
- List and description of iron or steel item(s), manufactured goods, and/or construction material(s) the recipient seeks to waive from the Buy America Preference, including name, cost, quantity(ies), country(ies) of origin, and relevant Product Service Codes (PSC) and North American Industry Classification System (NAICS) codes for each;
- A detailed justification as to how the non-domestic item(s) is/are essential the project;
- A certification that the recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and non-proprietary communications with potential suppliers;
- A justification statement—based on one of the applicable justifications outlined above—as to why the listed items cannot be procured domestically, including the due diligence performed (e.g., market research, industry outreach, cost analysis, cost-benefit analysis) by the recipient to attempt to avoid the need for a waiver. This justification may cite, if applicable, the absence of any Buy America-compliant bids received for domestic products in response to a solicitation;
- A description of the market research conducted that includes who conducted the market research, when it was conducted, sources that were used, and the methods used to conduct the research; and
- Anticipated impact to the project if no waiver is issued.

3. How to submit a waiver
   Requests to waive the application of the Buy America Requirement must be submitted in writing to your cognizant Contracting Officer or Grants Officer.

DOE may request, and the recipient must provide, additional information for consideration of this wavier. DOE may reject or grant waivers in whole or in part depending on its review, analysis, and/or feedback from OMB or the public. DOEs final determination regarding approval or rejection of the waiver request may not be appealed. Waiver requests may take up to 90 calendar days to process.

GTI ENERGY

End of RFP Part 3