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Dow U.S.A.

The Dow Chemical Company
P O Box 400
Plaquemine Louisiana 70765-0400

July 30, 1991

Chip Troxclair
CA 2
Bldg. 3601

cc: Art Royals, 3502W
Kevin Johnson, 3601

REACTIVE CHEMICALS REVIEW - JULY 25, 1991

Chlor-Alkali 2 Plant - 2 Year Process Review

Project Rep: Chip Troxclair

Committee members present: Mark Mitchell, John Monroe,
Brian Witt, Buck Bailey, Alan Sandow (for Steve
Milligan), Gerald Wagener

Concerns:

1. Suggestion for Chlor-Alkali Reactive Chemicals training: Consider including discussions of the CA 2 Taffy Pot explosion which occurred in 1980 and also the CA 2 Gas Turbine HRU fire which occurred just a few years ago.
2. In the process of manually sampling individual cells to determine which cell is causing high hydrogen there is concern that a flammable mixture may exist in the sample cylinder. John Monroe offered his assistance in evaluating this potential hazard.
3. "Popping" in the iron cells from small hydrogen/oxygen explosions should be eliminated.
4. Review the taffy pot cleaning/inspection procedures to assure compliance with LAD Pressure Vessel Program requirements.
5. Concerning materials of construction: Review CA 2 procedures to ensure that metallic parts issued are compatible with process. Specifically, does CA 2 have a program for checking parts as they arrive and as they are dispensed to verify material of construction. Consider conducting a random audit of parts in stock - Mark Bartel has a portable x-ray analyzer which could be used for this purpose.

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Chip Troxclair
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6. Consider developing a written policy for critical instruments set point changes.

Please respond in writing to the committee chairman within one month as to action taken or planned in regard to these concerns.

Gerald Wagener

Gerald Wagener, Chairman
Reactive Chemicals Committee

cg



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The Dow Chemical Company

P.O. Box 150

Plaquemine, Louisiana 70765-0150

August 27, 1991

G. P. Wagener, Chairman
Reactive Chemicals Committee
Building 2511

xc: K. L. Johnson, 3601
W. T. Austin, 3701
A. L. Royals, III, 3502W

REACTIVE CHEMICALS REVIEW FOLLOW-UP ACTION

Chlor-Alkali II Plant - Two year process review, July 25, 1991

Responses to concerns of the Committee:

1. Suggestion for Chlor-Alkali Reactive Chemicals training: Consider including discussions of the CA II taffy pot explosion which occurred in 1980 and also the CA II gas turbine HRU fire which occurred just a few years ago.

RESPONSE: These items will be added to the reactive chemicals packet and will be available for the next review. Anita Dial should have this complete by November 1991. It is also requested that Gerald Wagener make a presentation in a 4th Quarter 1991 CA II safety meeting to explain the chemical reactions that caused the taffy pot incident.

2. In the process of manually sampling individual cells to determine which cell is causing high hydrogen there is concern that a flammable mixture may exist in the sample cylinder. John Monroe offered his assistance in evaluating this potential hazard.

RESPONSE: John Monroe has been contacted to calculate the maximum pressure rise that is expected in our cell gas sample cylinders. Based on his findings we will determine what we should be doing from an equipment and procedure standpoint. We intend to document our findings to the Tech Center.

3. "Popping" in the iron cells from small hydrogen/oxygen explosions should be eliminated.

RESPONSE: I agree that "popping" should be eliminated, but unfortunately this is easier said than done. Donnie Lambert is working on plans to modify the cathodes and anodes to include insulation to extend below the liquid level, which should eliminate the source of the "spark". These modifications will be incorporated in future cell overhauls. Donnie will also look into the possibility of increasing the capacity of the ejector to pull more air from the vapor space under the cell covers. Both of these are longer term solutions. "Popping" normally occurs on startup of the cells from a cold state when the load is being increased on the cells. Recently this has happened infrequently due to longer times between maintenance on the cells. Until equipment changes are made, the procedure for loading the cells will call for slowly raising the load to minimize popping.

G. P. Wagener
August 27, 1991
Page 2

4. Review the taffy pot cleaning/inspection procedures to assure compliance with LAD Pressure Vessel Program requirements.

RESPONSE: CA II currently does internal inspections every three years on taffy pots, at which time the pots are cleaned and dried. External inspections and NDT testing are done as per P.V. program guidelines as are the internal inspections.

5. Concerning materials of construction: Review CA II procedures to ensure that metallic parts issued are compatible with process. Specifically, does CA II have a program for checking parts as they arrive and as they are dispensed to verify material of construction. Consider conducting a random audit of parts in stock - Mark Bartel has a portable X-ray analyzer which could be used for this purpose.

RESPONSE: The main concern would have to be the misuse of titanium parts in dry chlorine service, but other concerns would also exist for misuse of monel, nickel, steel, etc. in caustic or chlorine services. On larger parts, titanium is easily detectable by its weight, but the problem comes in with small parts. The Texas Chlorine plants have purchased an X-ray analyzer to positively ID chlorine parts prior to installation. Ed Pittman is currently working with Mark Bartel and the Texas folks on a plan for the CA II plant to adequately ID its parts.

6. Consider developing a written policy for critical instruments setpoint changes.

RESPONSE: Monty Heins is working on a written policy to insure the integrity of the critical instrument loops. This will be complete by November 1991.

CA II would like to thank the Reactive Chemicals Committee for a thorough and helpful review. If any questions arise from the responses listed, please do not hesitate to call.



E. J. Troxclair, III
Production Supervisor
Chlor-Alkali II

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CHLOR - ALKALI 2

1991

REACTIVE CHEMICALS REVIEW
MAINTENANCE AND ENGINEERING
SPECIFICATIONS

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CA - 2
REACTIVE CHEMICAL REVIEW
AGENDA

JULY 25, 1991
8:30 AM

INTRODUCTIONS / GENERAL UPDATE FROM LAST REVIEW	8:30- 8:35	CHIP TROXCLAIR
GENERAL CONCERNS / MAINTENANCE	8:35- 9:05	DALE CROCHET
POWER / CELLS / ECOLOGY	9:05- 9:50	RANDY HALEY
-BREAK-		
BRINE / HYDROGEN / CAUSTIC	10:04- 10:30	DONNIE LAMBERT
CHLORINE	10 min. 10:30- 11:15	CHRIS FRYMIER

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CA - 2

REACTIVE CHEMICAL

REVIEW

GENERAL CONCERNS

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CHLOR-ALKALI 2 REACTIVE CHEMICAL MATRIX

☐ NO DATA ☒ Not known to be REACTIVE ☒ REACTIVE ☒ Potential Hazard	1)Acetone	2)Acetylene	3)Activated Alumina	4)Ammonia Water	5)Betz: 2020	6)20K	7)BP6409	8)Polymer 1131L	9)Foam Trol (144or275)	10)Carbon-Tet	11)Chlorine	12)Chloroform	13)Chlorothene	14)Derakane	15)Dichloromethane	16)Fluorolube	17)Freon 11 & 12	18)HCCD	19)HCE2	20)HCE	21)Hydrochloric Acid	22)Hydrogen	23)Hunter Soap	24)Kerosene	25)Lithium Bromide	26)Lube Oils	27)Marfax Grease	28)MEK Peroxide	29)Neverseze	30)Nitric Acid	31)Sodium Hydroxide	32)Sodium Thiosulfate	33)Sulfuric Acid	
1)Acetone	3	3	3	1	1	1	1	1	2	2	2	1	3	3	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2	3	1	2	
2)Acetylene		3	3	1	1	1	1	1	3	2	3	3	3	3	1	1	3	3	3	3	3	2	1	1	1	1	1	3	1	3	2	1	3	
3)Activated Alumina			3	3	3	3	3	3	2	2	2	2	3	3	3	3	2	3	3	3	2	1	3	3	3	3	2	3	2	2	3	2		
4)Ammonia Water				1	1	1	1	1	1	2	3	3	1	1	1	1	1	1	1	1	1	2	2	1	3	1	1	1	3	1	2	3	1	2
5)Betz: 2020										2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	
6)20K										2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	
7)BP6409								1	1	1	2	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	3	1	2	1	1	2	
8)Polymer 1131L								1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	2	1	2	
9)Foam Trol (144or275)									1	2	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	3	1	2	2	1	2	
10)Carbon-Tet										1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	3	
11)Chlorine											2	3	2	3	1	3	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
12)Chloroform												1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	2	
13)Chlorothene														3	3	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	1	2	
14)Derakane															1	1	1	1	1	1	3	1	1	1	1	1	1	2	1	3	3	1	2	
15)Dichloromethane																1	1	1	1	1	3	1	1	1	1	1	1	1	1	3	3	1	3	
16)Fluorolube																	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	3	
17)Freon 11 & 12																	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	3	
18)HCCD																		1	1	1	1	1	1	1	1	1	1	1	1	3	3	1	3	
19)																			1	1	1	1	1	1	1	1	1	1	1	3	3	1	3	
20)HCE																						1	1	1	1	1	1	1	1	3	3	1	3	
21)Hydrochloric Acid																						1	2	1	1	1	1	3	3	3	2	3	2	
22)Hydrogen																							1	1	1	1	1	2	1	3	1	1	1	
23)Hunter Soap																								1	1	1	1	3	1	2	1	1	2	
24)Kerosene																									1	1	1	2	1	2	3	1	2	
25)Lithium Bromide																										1	1	3	1	1	2	1	2	
26)Lube Oils																											1	2	1	2	2	1	2	
27)Marfax Grease																												2	1	2	2	1	2	
28)MEK Peroxide																													2	2	3	2	2	
29)Neverseze																														2	2	1	3	
30)Nitric Acid																															2	2	2	
31)Sodium Hydroxide																																1	2	
32)Sodium Thiosulfate																																	3	
33)Sulfuric Acid																																		
34)Water																																		

This chart is intended to be a general guide. In some instances it may be permissible to mix chemicals which show a potential Hazard. Check with your supervisor before doing so.

RECOMMEND CHANGING NUMBERING SO THAT:
 1 = LEAST REACTIVE
 2 =
 3 = MOST REACTIVE

BRINE

- HIGH AMMONIA CONCENTRATIONS CAUSE HIGH NCL_3 IN PURIFICATION
- NaOCL CONCENTRATIONS SHOULD BE KEPT UP TO NEUTRALIZE AMMONIA
- LOSS OF HYPO'S CAUSES AMMONIA LEVELS TO INCREASE BY A FACTOR OF TEN
- LOSS OF HYPO'S AND T-505 INCREASES AMMONIA LEVELS 20 TO 40 TIMES

HYDROGEN

FLAMMABILITY IN AIR	4 TO 75 %
FLAMMABILITY IN CHLORINE	5 TO 85 %
FLAMMABILITY IN AIR & CHLORINE	4 TO 85 %

- HYDROGEN - CHLORINE FIRES
- HYDROGEN STACK FIRES
- HYDROGEN COLLECTION UPSETS
- CROSS CONTAMINATION - AIR AND HYDROGEN
- CELL STARTUPS
- HCL AND SULFURIC ACID STORAGE TANKS
- HYDROGEN SAMPLING
- HYDROGEN FROM GENERATOR MIXING WITH OIL BEING
CONTAINED IN VAPOR SPACE IN OIL RESERVIOR

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CAUSTIC

- IRON / CAUSTIC WITH HEAT OF 150 C AND CAUSE HYDROGEN FIRE
- IRON CELLS GENERATE HYDROGEN
- EXCESSIVE HYPO'S IN CELL EFFLUENT CAN AND WILL CORRODE NICKLE CLADDING
- STAINLESS STEEL AND CAUSTIC CRACKING
- CAUSTIC AND CHLORINE PRODUCES THERMAL REACTION
- CAUSTIC, WATER, OR AIR CROSS CONTAMINATION
- WATER ADDITION TO HOT 50% CAUSTIC PRODUCES VIOLENT HEAT REACTION
- CAUSTIC AND ACIDS - THERMAL REACTION
- CAUSTIC AND ALUMINUM

CHLORINE

- CHLORINE AND HYDROGEN - FIRE**
- CHLORINE AND IRON AT HIGH TEMPERATURES - FIRE**
- CHLORINE AND LUBRICANTS - FIRE**
- DRY CHLORINE AND TITANIUM - FIRE**
- WET CHLORINE AND STEEL CAUSES CORROSION**
- HYDRAULIC RUPTURES DUE TO THERMAL EXPANSION OF LIQUID**

CA - 2

REACTIVE CHEMICAL

REVIEW

MAINTENANCE

MAINTENANCE PROCEDURES

SAFETY

LUBRICATION

METALS

CLEANING AND PURGING EQUIPMENT

REACTIVE MATERIALS

LUBRICANTS

**NON - SATURATED HYDROCARBON BASED OILS AND GREASES
REACT VIOLENTLY WITH CHLORINE UNDER MODERATE TO
EXTREME OPERATING CONDITIONS.
ONLY APPROVED LUBRICANTS WILL BE USED FOR CHLORINE
SERVICE.**

**APPROVED LUBRICANTS FOR CHLORINE SERVICE AT CA - 2
INCLUDE:**

GREASES:

**FLUOROLUBE GR 544 (Sealant for gaskets)
CLIMAX FL - 5**

OIL:

FLUOROLUBE FS - 5

**APPROVED MULTI-PURPOSE USAGE LUBRICANTS FOR CA - 2
INCLUDE (Not to be used for Chlorine service):**

**CAP32W
EMB
MULTI FAX GREASE
KOPPERS GREASE
MF EP2 GREASE
MF 2 GREASE (FITTING)
MN EP2 ADD GREASE
MO MIST 2
MERPA 220
PERMA 6 CARTRIDGE
R220 SEAL
REGAL R & O 32
OIL
SLIPKOTE GREASE
SOLLUBE OIL
M150 MEROPA
650T SAMPLE**

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METALS

DRY CHLORINE SERVICE:

SERVICE WHERE MATERIALS WILL BE IN CONTACT WITH CHLORINE WHERE THE MOISTURE CONTENT IS LESS THAN 5 PPM WATER BY WEIGHT IN CHLORINE.

RECOMMENDED MATERIALS:

CARBON STEEL - SAFE AT TEMPERATURES LESS THAN 155 C (311 F)

IRON - SAFETY AT TEMPERATURES BELOW 175 C (347 F)

DRY CHLORINE REACTS VIOLENTLY WITH HOT STEEL

- NO WELDING ON CHLORINE LINES THAT HAVE NOT BEEN ISOLATED AND DEPRESSURED**
- WELDING CABLES MUST NOT BE CLAMPED TO CHLORINE LINES**

WARNING:

AT ORDINARY TEMPERATURES, DRY CHLORINE REACTS WITH:

- ALUMINUM**
- ARSENIC**
- GOLD**
- MERCURY**
- SELENIUM**
- TELLURIUM**
- TIN**
- TITANIUM**

METALS

WET CHLORINE SERVICE:

RECOMMENDED MATERIALS:

TITINAUM - HIGH RESISTANCE TO WET CHLORINE GAS

**THE AMOUNT OF WATER NECESSARY TO PREVENT A
CHLORINE - TITANIUM REACTION WILL VARY WITH
TEMPERATURE AND PRESSURE**

**NOTE: TITANIUM IS HIGHLY REACTIVE WITH DRY CHLORINE
GAS AND LIQUID CHLORINE**

STORAGE:

**TITANIUM EQUIPMENT AND MATERIALS ARE CLEARLY
IDENTIFIED (PURPLE PAINT) AND STORED IN A DESIGNATED
AREA IN CA - 2 WAREHOUSE. THIS AREA IS SEPARATED
FROM OTHER PARTS AND LOCKED. MATERIAL
CONTROLLER IS RESPONSIBLE FOR THIS AREA.**

METALS

CAUSTIC SERVICE:

**SERVICE WHERE MATERIALS WILL BE IN CONTACT WITH
CAUSTIC VARYING IN CONCENTRATION FROM 8.5 % TO 50%.**

**NOTE: HIGH CORROSION RATES WILL BE CAUSED BY
ELEVATING TEMPERATURES AND / OR CONCENTRATIONS.**

RECOMMENDED MATERIALS:

**STEELPIPE - 8.5 % CAUSTIC LESS THAN 150 F AND STRONGER
CONCENTRATIONS OF CAUSTIC BELOW 120 F**

**NICKEL PIPE - CONCENTRATIONS ABOVE 8.5 % WITH A
TEMPERATURE GREATER THAN 120 F**

**ALUMINUM IS RAPIDLY ATTACKED BY CAUSTIC AND ITS USE
SHOULD BE AVOIDED.**

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MISCELLANEOUS APPLICATIONS

HEAT TRANSFER MATERIALS - HOT WATER, STEAM, AND "HI-TEC" SALT ARE RECOMMENDED FOR HEAT TRANSFER APPLICATIONS. AVOID ORGANIC MATERIALS THAT REACT WITH CHLORINE.

FILTER ELEMENTS - WOUND FIBER GLASS AND SINTERED METAL ARE RECOMMENDED AS FILTER ELEMENTS. AVOID USING POLYPROPYLENE AND ORGANIC MATERIALS THAT REACT WITH CHLORINE.

CLEANING / PURGING EQUIPMENT AND LINES

HOT WATER OR STEAM ^S~~IS~~ RECOMMENDED OVER SOLVENTS

**PREFERRED SOLVENT FOR CLEANING CHLORINE EQUIPMENT IS
CARBON TETRACHLORIDE**

**PURGE CHLORINE SYSTEMS WITH DRY AIR OR NITROGEN - TAKE
NECESSARY PRECAUTIONS TO PREVENT CONTAMINATING AN
INSTRUMENT AIR SYSTEM WHEN USING DRY AIR**

**DRY ALL CHLORINE EQUIPMENT WITH NITROGEN TO A DEW
POINT OF - 60 F**

REACTIVE MATERIALS

Listed below are soaps, solvents, and lubricants that will react in a hazardous manner with chlorine. Hydrocarbons and silicones in general should not be used without testing and consultation with the Reactive Chemicals Committee. Also, it should not be assumed a material is safe to use because it is not on the following list. The primary concern should be to use those materials which have been approved, and avoid those on the following list.

Acetone	Chlorothene
Activated Alumina	Chlorothene
Activated Charcoal	COP - Anti-Seize Compound
Alcohols	400
495 Syn. Lube Oil	600
500 Syn. Lube Oil	1 , 2 - Dichloroethane
Chemola Lubricant	Dibutylphthalate Dimethyl
(TFE #8155-2)	Polysiloxane
Climax 400	Drawing Wax
Climax 400 and Iron Powder	Ethylene Glycol / Aqueous
Climax 400 & Ferric Oxide	Fel-Pro C5-A Anti-Seize
Powder	
Climax 600	Freon 13
Climax 650	Freon 22
Climax 750	Glycerine
Climax 800	Humbletherm 500
Climax FS	Hydrocarbon oil
Kerosene	Dow Corning Molykote
Linseed Oil	Dow Corning FS 1281
Marfax #1	Dow Corning Stop Cock Grease
Mineral Oil	Dow Corning Valve Seal
Molykote BR - 2	Dow Corning Valve Lubricant
	FS-3452
Molykote Z Powder	Dowtherm G
Neversee Z	Silicone Oil
Perchloroethylene	Sisco 300
Permatex Form A	Solox Clean
Polychlorinated Biphenyl	Super Jet Detergent

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Polyethylene
Polypropylene with Zinc
Oxide Power
Silica Gel
Dow Corning Fluorosilicone
1-3907
Dow Corning FS-1265

Turpentine
Unirex

Varsol
Vitrea 33

ENGINEERING SPECIFICATIONS

UTILITY AND PROCESS PIPING

INSTRUMENT & ELECTRICAL

PIPING SPECIFICATIONS

UTILITY	ID LTR SPEC	PIPE MATERIAL	MAX TEMP (F)	MAX PRESS (PSIG)
Air	H	CS	300	150
Carbon Dioxide	H	CS	100	275
Condensate	D	CS	350	150
Freon 11	R	CS	250	165
Freon 12	R	CS	- 20 to 250	165
Freon 12	RR	CS	- 15 to - 20	150
Lube Oil	Z	CS	200	125
Lube Oil	ZZ	SS	200	150
Methane / Fuel Gas	J	CS	100	235
Nitrogen	H	CS	100	275
Steam or Condensate	DD	CS	500	170
Steam or Condensate	E	CS	650	250
Steam	F	CS	750	650
Water: Cooling Tower	B	CS	150	150
Water: Process	B	CS	150	150
Water: Potable	C	CS	150	150
Water: Waste	BB	TELON Line	150	150
Brine: Hot or Cold	A	CS	160	150
Brine: Salt Slurry	AX	PPL	140	150
Chlorinate Brine (no hypochlorites)	M	FRP	200	25
Cell Effluent	L	FRP	200	25
Caustic: No Solids from 10% @ 170 F Max to 50% @ 120 F Max	S	CS	-	150
Caustic: to 50%	W	NI	350	150
Caustic: Low Salt 50%	T	INC	300	550
Caustic: Low Salt 50%	TX	INC	400	180
Caustic: 50% to 75%	G	NI	400	150
Caustic: 50% to 75%	GH	NI	350	300

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UTILITY	ID LTR SPEC	PIPE MATERIAL	MAX TEMP (F)	MAX PRESS (PSIG)
Wet Chlorine Gas: 20" H ₂ O Vacuum to 25 PSIG	M	FRP	250	25
Dry Chlorine Gas: -20 F to 275 F	N	CS	275	150
Dry Chlorine: Liquid @ -50 F to 125 F Gas @ -50 F to 50 F	NN	CS	-	250
Carbon Tetrachloride - Dry	O	CS	-50 to 125	250
Dry Chlorine Gas	NH	CS	-20 to 260	300
Hydrogen	K	CS	300	150
Wet Hydrogen Gas: 20" H ₂ O Vacuum to 3 PSIG	MH	FRP	200	3
Scrubber Effluent with Hypochlorites	MX	FRP	230	25
Sodium Hypochlorites & Caustic: 180 F Continuous / 230 F Max	V	KY/PTFE	180	150
Hydrochloric Acid: 0 to 36%	Y	PPL/KY	180	150
Hydrochloric Acid: 0 to 36%	Y1	PVC	150	100
Sulfuric Acid: 91 to 98% and 50 to 90%	X	CS	100	125
Sulfuric Acid: > 96%	XY	Alloy 20	-20 to 400	150
Sodium Thiosulfate	EE	CS	150	150

CA - 2

REACTIVE CHEMICAL

REVIEW

POWER AREA

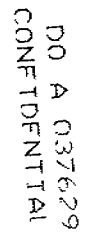
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POWER & UTILITIES REACTIVE CHEMICAL REVIEW

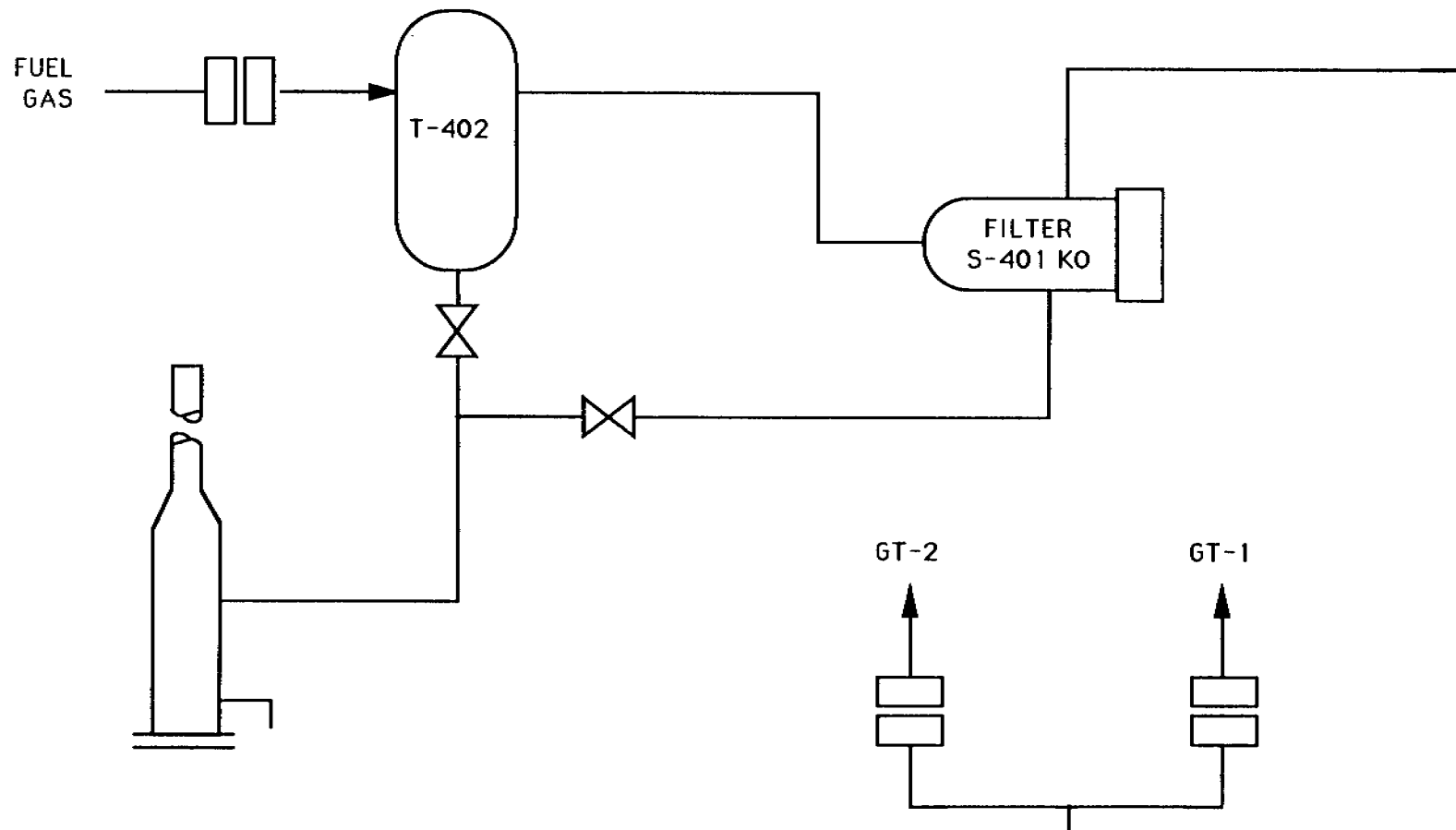
- 1 - Power Area Overview
- 2 - Gas Turbine / Generator / Steam Helper Turbine
- 3 - Main Fuel Gas System
- 4 - Gas Turbine Fuel System
- 5 - H2 Fill System
- 6 - Lube Oil System
- 7 - Seal Oil System
- 8 - Cooling Tower System - Chlorinator
- 9 - Betz Chemical Addition
 - A) Boilers
 - B) CTW
- 10- Reactive Chemical Considerations
- 11- Chemicals and Raw Materials
- 12 - Previous Reactive Incidents

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POWER AREA



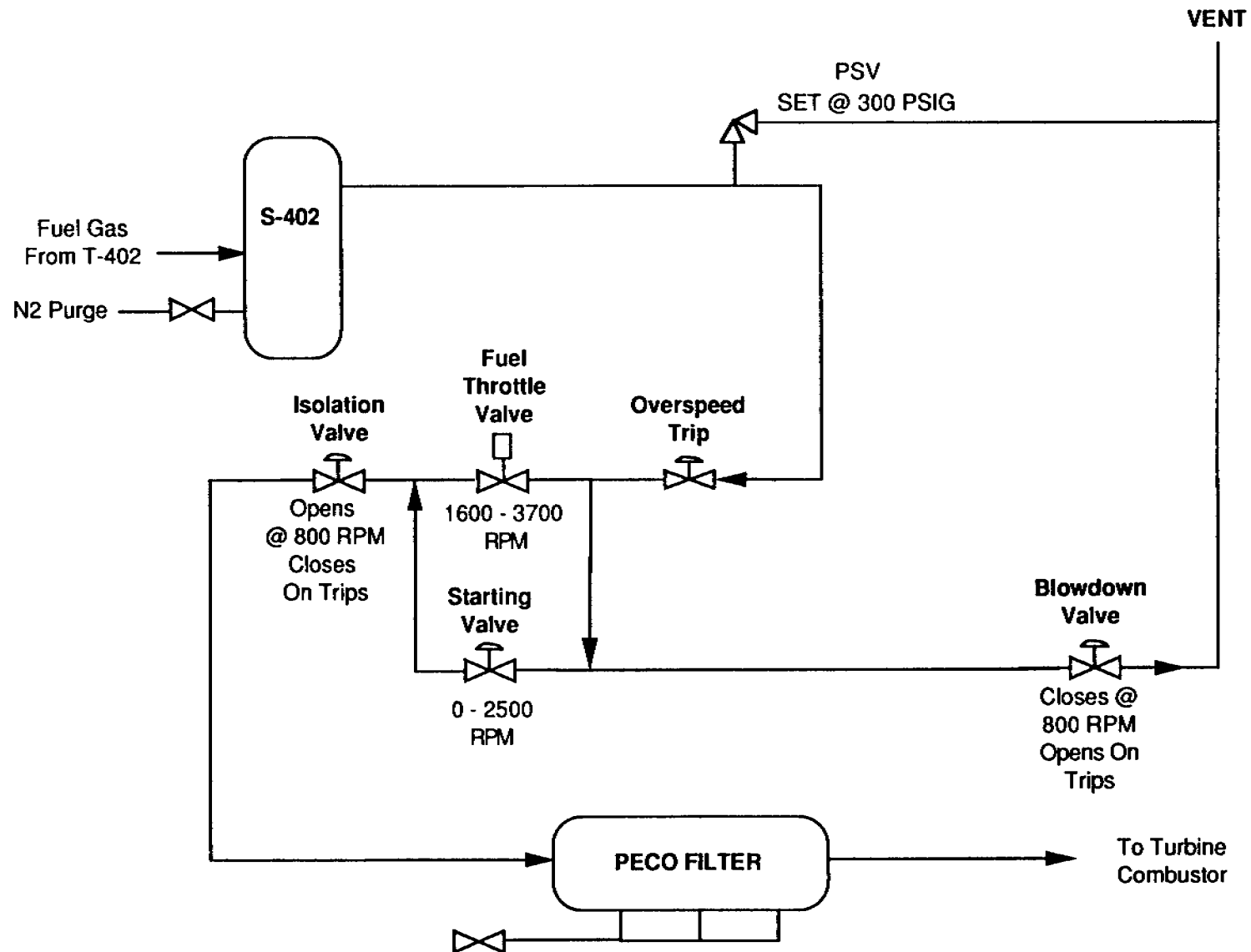
FUEL GAS SYSTEM



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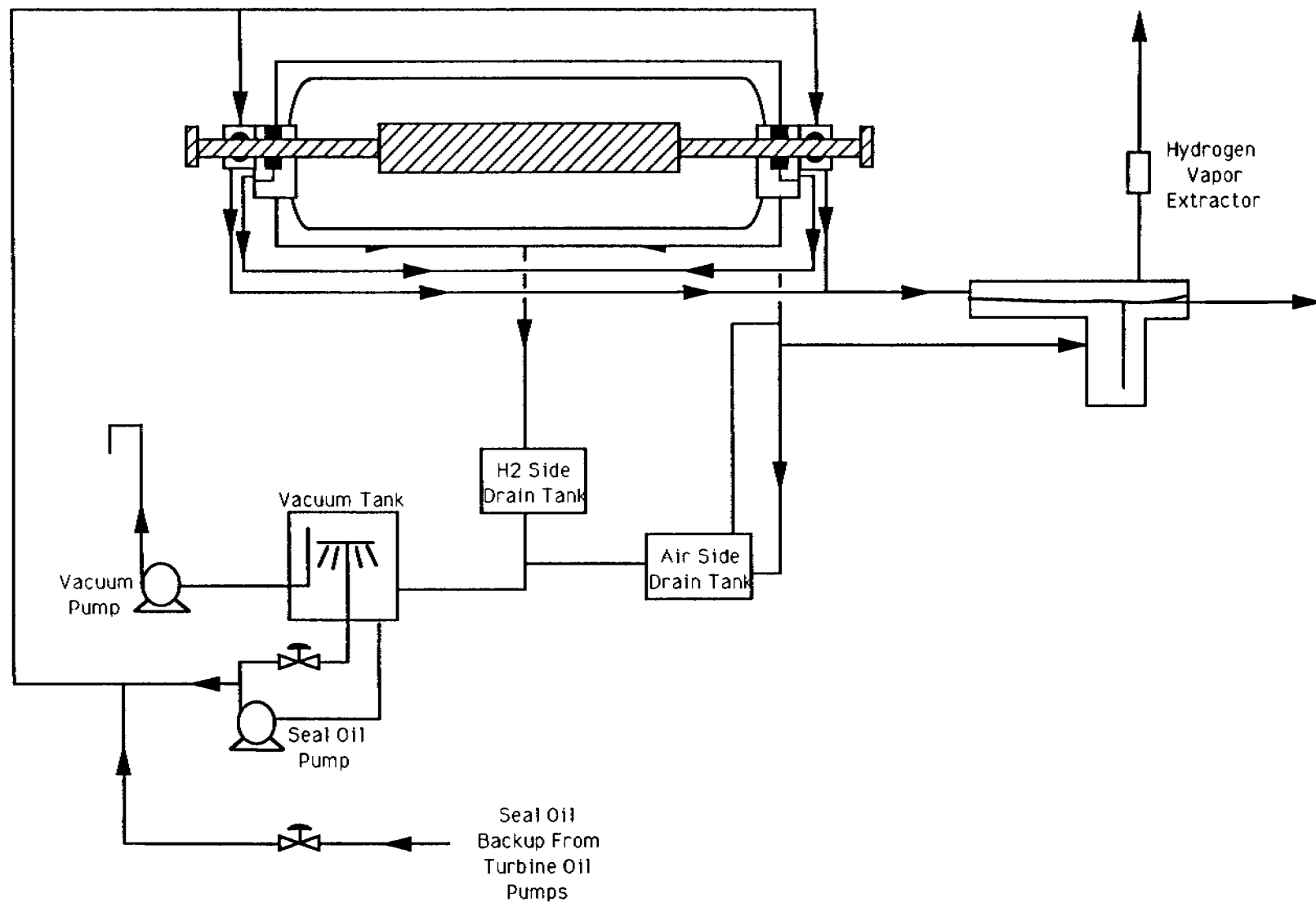
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FUEL GAS CONTROL SYSTEM



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GENERATOR SEAL OIL SYSTEM



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POWER & UTILITIES CHEMICALS AND RAW MATERIALS

CHEMICALS:

- 1 - Lube & Seal Oil "Regal 32"
- 2 - Detergent
- 3 - Sulfuric Acid
- 4 - Anit-foam
- 5 - Betz 6409A
- 6 - Betz 38K

RAW MATERIALS:

- 1 - Chlorine Gas
- 2 - Hydrogen Gas
- 3 - Methane
- 4 - Water
 - A) Condensate
 - B) Process Water
 - C) Steam 600/235/115/30 PSIG

POWER & UTILITIES

POTENTIAL PROBLEMS

POSSIBLE EXPLOSION/FIRE DUE TO METHANE - OXYGEN MIXTURE IN PIPE OR VESSEL

POSSIBLE EXPLOSION/FIRE DUE TO METHANE - OXYGEN MIXTURE IN GAS TURBINE DURING STARTUP OR SHUTDOWN

POSSIBLE EXPLOSION/FIRE DUE TO HYDROGEN - OXYGEN MIXTURE IN FILL SYSTEM AND COOLING SYSTEM FOR GENERATORS

POSSIBLE EXPLOSION/FIRE DUE TO HYDROGEN FROM SEAL OIL SYSTEM ENTERING INTO LUBE OIL SUMP

PREVENTIVE MEASURES

1 - Established procedures on purging fuel gas lines with nitrogen before taking out of service or returning to fuel gas service.

1 - Double block & bleed system integrated with startup and shutdown sequence.

2 - Compressor discharge press switch to insure adequate air supply before injecting fuel gas.

3 - Flame monitors to detect presence of flame in combustion section. Trips unit if flame not detected.

4 - Manual Air solenoid with time out function to enable fuel gas valves only during startup operation.

1 - Procedure for connecting/disconnecting hydrogen trailers from Air Products.

2 - Sampling procedure to verify H₂ purity.

3 - Purge procedures for pressuring/depressuring generators.

1 - Seal oil system is backed up by the gas turbine oil pumps.

2 - Hydrogen vapor extractor removes H₂ gas before oil reaches lube oil sump. System is protected by a dip leg to prevent gas from entering sump.

3 - Lube oil reservoir has a blower to remove hydrogen gas/oil vapor from sump.

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POWER & UTILITIES

POTENTIAL PROBLEMS

FIRE INSIDE LINES CAUSED BY
RESTRICTION OF AIR FLOW DUE TO OIL
IN COOLING AIR SYSTEM

PREVENTIVE MEASURES

- 1 - Seal air system has low pressure alarm to prevent oil leakage.
- 2 - Cooling air flow indication with high/low temperature alarms.
- 3 - Auto swap on plant air to seals for startup and shutdown.

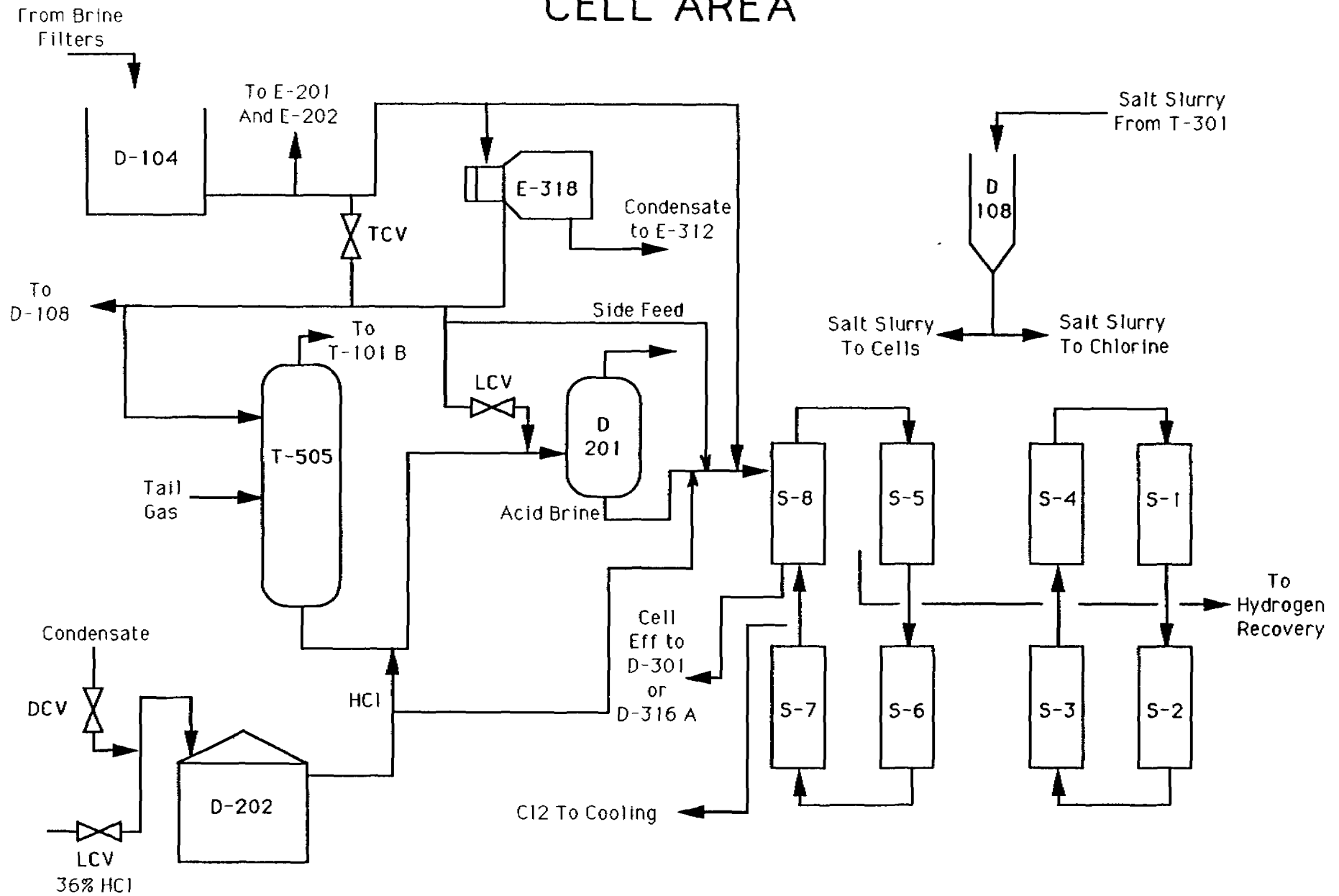
CA - 2

REACTIVE CHEMICAL

REVIEW

CELL AREA

CELL AREA



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CELL RAW MATERIALS

RAW MATERIALS:

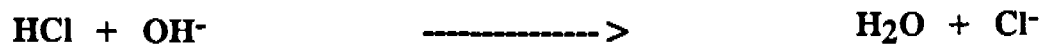
- 1 - Brine (Saturated)
- 2 - Electric Current - 68,000 AMPS/Circuit Maximum
- 3 - HCl - 16 %
- 4 - Salt Slurry

PRODUCTS:

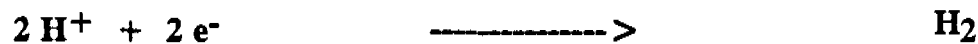
- 1 - Chlorine Gas - 95 %
- 2 - Hydrogen Gas - 99%
- 3 - Cell Effluent - 10 % NaOH

CELL AREA
CHEMICAL REACTIONS

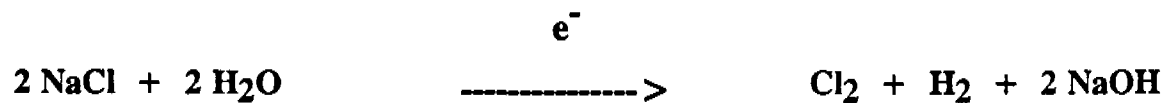
ANODE:



CATHODE:



TOTAL CELL:



CELL AREA

<u>EQUIPMENT</u>	<u>POTENTIAL PROBLEMS</u>	<u>PREVENTIVE MEASURES</u>
CHLORINE CELLS	LOSS OF BRINE LEVEL CAUSING ARCING	1 - Dual level transmitters (flange mounted with condensate purge) auto selection of lowest level 2 - Main brine level control plus side feed automatic backup level control 3 - Anolyte low level carbon probes on each series 4 - Six rounds/day check of level in level sightglass
	HYDROGEN FROM CATHODE COMPARTMENT ENTERING ANODE COMPARTMENT ALLOWING A CHLORINE- HYDROGEN REACTION	1 - Minimum standard cell head level is 4", except on flooded cathode cells where the minimum cell level is 6" 2 - Hydrogen Recovery is suction pressure controlled 3 - Seal legs on each H₂ vent stack to relieve pressure 4 - Seal pots on each H₂ log to relieve excessive pressure 5 - High H₂ pressure alarms for each series 6 - Anolyte low level carbon probes

CELL AREA

EQUIPMENT

POTENTIAL PROBLEMS

PREVENTIVE MEASURES

A CELL SERIES WITH HIGH GPL ANOLYTE SALT (>315 GPL) EXPERIENCES SALTING IN THE CELL EFFLUENT OUTLETS. H₂ PRESSURE BUILDS AT CATHODE. A HYDROGEN-CHLORINE REACTION OCCURS UNDER THE CELL COVERS.

- 1 - Six checks per day on anolyte salt
- 2 - D-108 maintains control over salt slurry density
- 3 - Voltage and volt-amp mismatch alarms on Mod5
- 4 - Series radial feed system flow controls salt slurry to cells
- 5 - Mod5 flushes radial feed if pressure or flow control is lost
- 6 - FCV and PCV leak-by is checked upon every flush (valve integrity)
- 7 - Mod5 flushes systems upon circuit shutdown

HYDROGEN LOGS

H₂-AIR EXPLOSION DUE TO HYDROGEN LOG GOING INTO A VACUUM CONDITION AND DRAWING IN AIR

- 1 - Hydrogen Recovery system shuts down at -1.5" H₂O or 1/8" H₂O for 3 seconds

H₂-AIR EXPLOSION DUE TO CIRCUIT STARTUP WITHOUT AN INERT ATMOSPHERE IN H₂ LOGS

- 1 - Detailed checklist for pre-startup to ensure N₂ purge system is operational
- 2 - Mod5 opens a N₂ purge valve (with flow meter) when circuit is de-energized. Purge stays on. Alarm activates if valve doesn't open

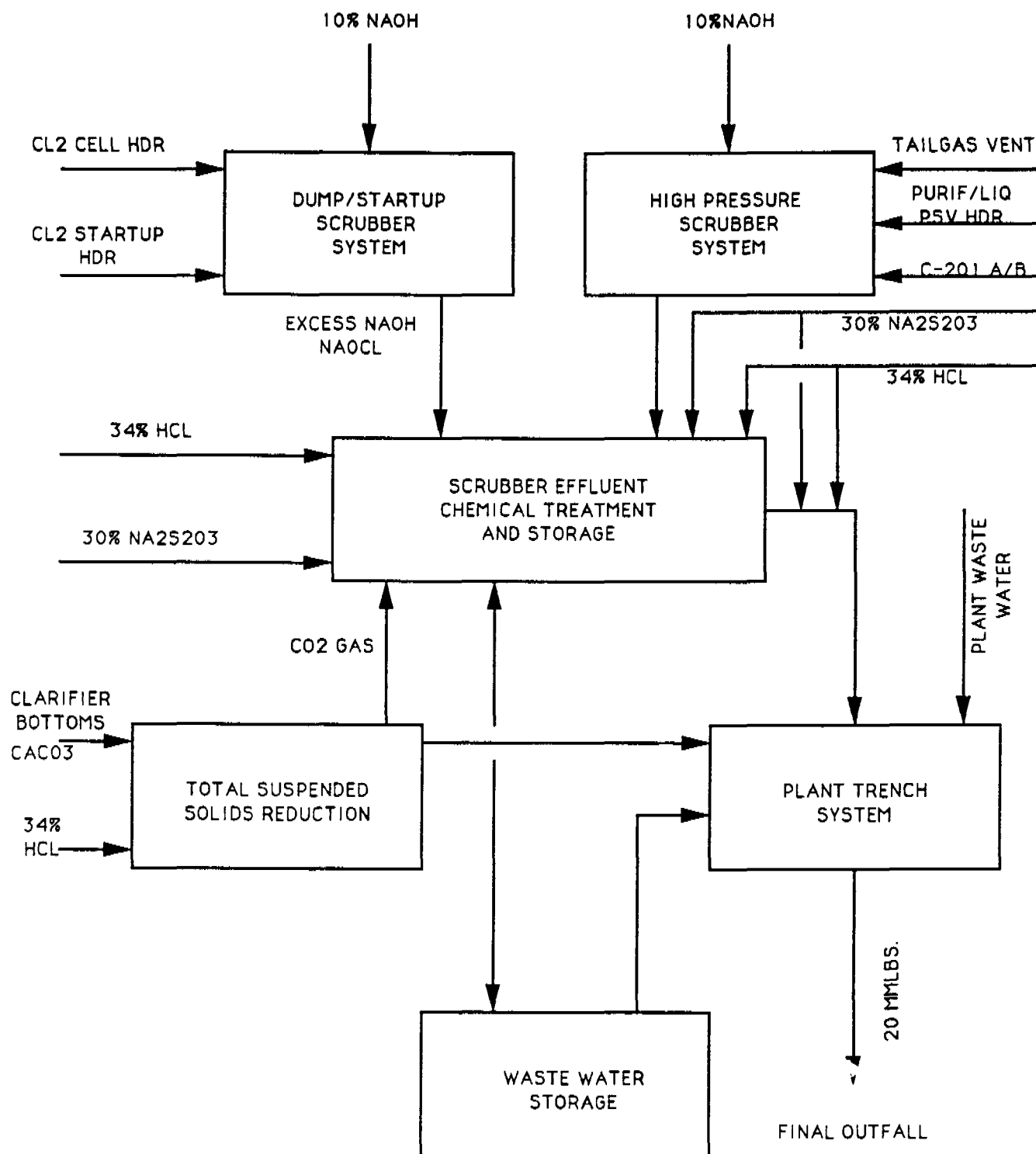
CA - 2

REACTIVE CHEMICAL

REVIEW

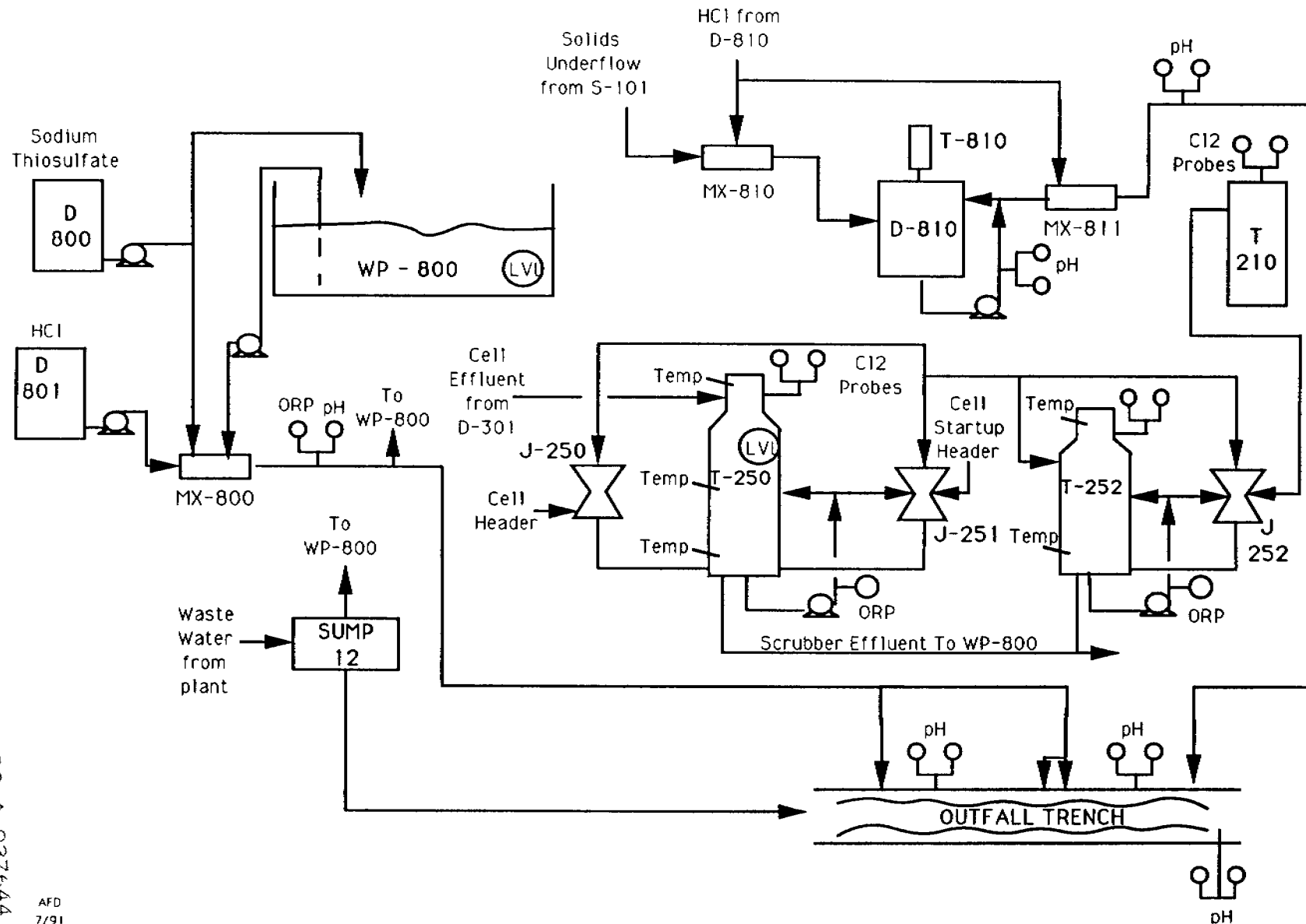
ECOLOGY AREA

ECOLOGY PROCESS FLOWSHEET



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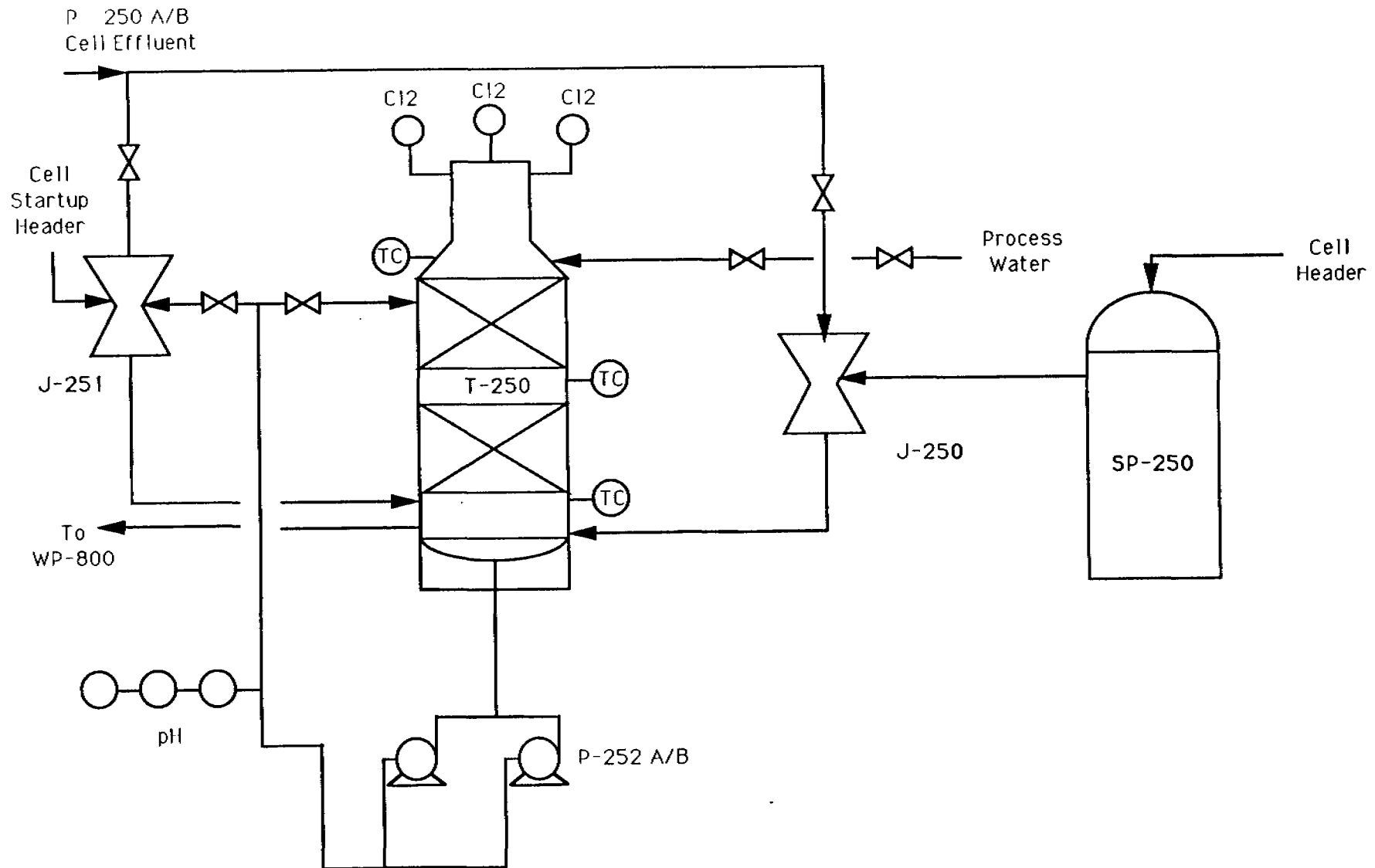
ECOLOGY AREA



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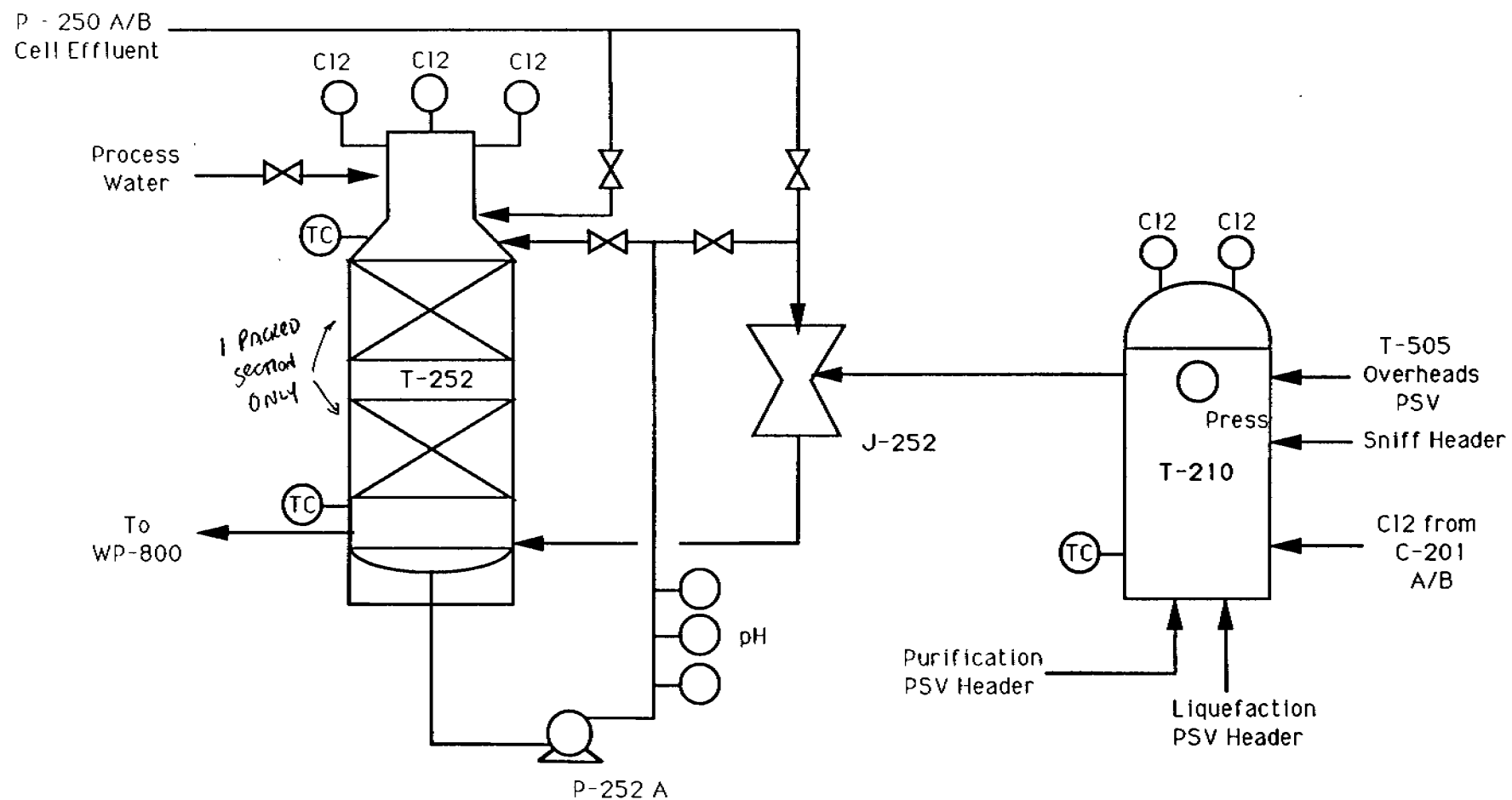
LOW PRESSURE SCRUBBER



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HIGH PRESSURE SCRUBBER



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ECOLOGY AREA CHEMICAL REACTIONS

SODIUM THIOSULFATE NEUTRALIZATION OF HYPOCHLORITES



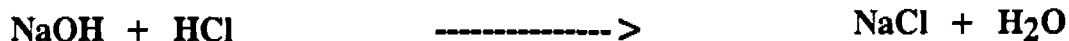
CALCIUM CARBONATE NEUTRALIZATION



CHLORINE NEUTRALIZATION WITH CAUSTIC



CAUSTIC NEUTRALIZATION WITH HYDROCHLORIC ACID



CAUSTIC NEUTRALIZATION WITH SULFURIC ACID



ECOLOGY AREA

POTENTIAL PROBLEMS

REACTION BETWEEN Cl_2 AND/OR CELL
EFFLUENT WITH SCRUBBER VESSELS
OR INTERNALS

HEAT OR REACTION BETWEEN Cl_2 AND
CELL EFFLUENT

LOW pH ON CELL EFFLUENT RECYCLE
TO SCRUBBERS COULD RELEASE Cl_2

HCL ADDITION TO WASTE WATER
CONTINUING NaOCl COULD RELEASE
 Cl_2

HCL ADDITION TO SCRUBBER
EFFLUENT TREATMENT TANK COULD
RESULT IN INTERNAL WALL
CORROSION IF pH TOO LOW

PREVENTIVE MEASURES

- 1 - Vessels are fabricated from Derakane FRP
- 2 - Titanium parts are only used on the wet Cl_2 scrubber
- 3 - Column Internals on the dry Cl_2 scrubber are Kynar or Fiberglass

- 1 - Fresh cell effluent addition and recycle rates are large enough to keep temperatures down

- 1 - pH control on scrubbers

- 1 - Sodium thiosulfate is used to neutralize NaOCl before NaOH neutralization using ORP/Hypo analyzer

- 1 - Mod5 logic stops treatment if pH falls below setpoint

CA - 2

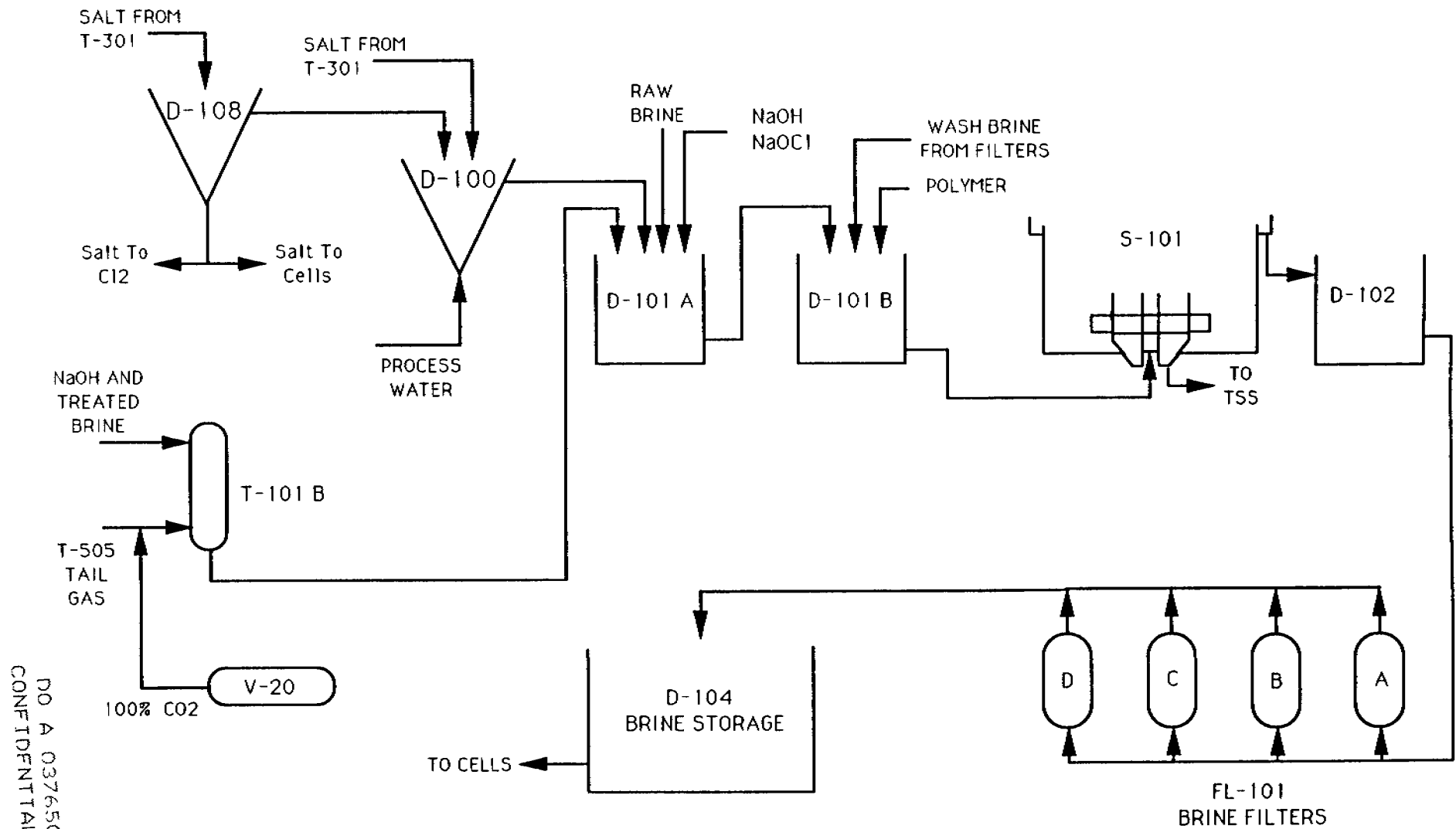
REACTIVE CHEMICAL

REVIEW

BRINE AREA

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CHLOR - ALKALI 2 BRINE AREA



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BRINE RAW MATERIALS

BRINE:

Ca	350 PPM
Mg	10 PPM
NaCl	300 GPL

RESATURATED BRINE:

NaCl	350 GPL
NaOH	1 - 5 GPL

CARBONATE:

NaOH	3 - 6 GPL
Na ₂ CO ₃	60 - 80 GPL

HCl:

15 - 18% Dilute from 35% with Condensate

NaOH: 10%

BETZ 90820

BRINE PRODUCTS

TREATED BRINE:

Total Hardness (Ca^{+2}) 2 - 5 PPM

NaOH	1.5 - 4 GPL
Na_2CO_3	2 - 2.5 GPL
NaOCl	60 -80 PPM
NH_3	< 1 PPM
NaCl	> 300 GPL

CLARIFIER UNDERFLOW:

H_2O	70.5 %
NaCl	23.7 %
CaCO_3	4.8 %
$\text{Mg}(\text{OH})_2$	0.5 %
Na_2CO_3	0.2 %
NaOH	0.1 %
SOLIDS	0.1 %
FLOC	0.01 %

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BRINE TREATING CHEMICAL REACTIONS



CA - 2

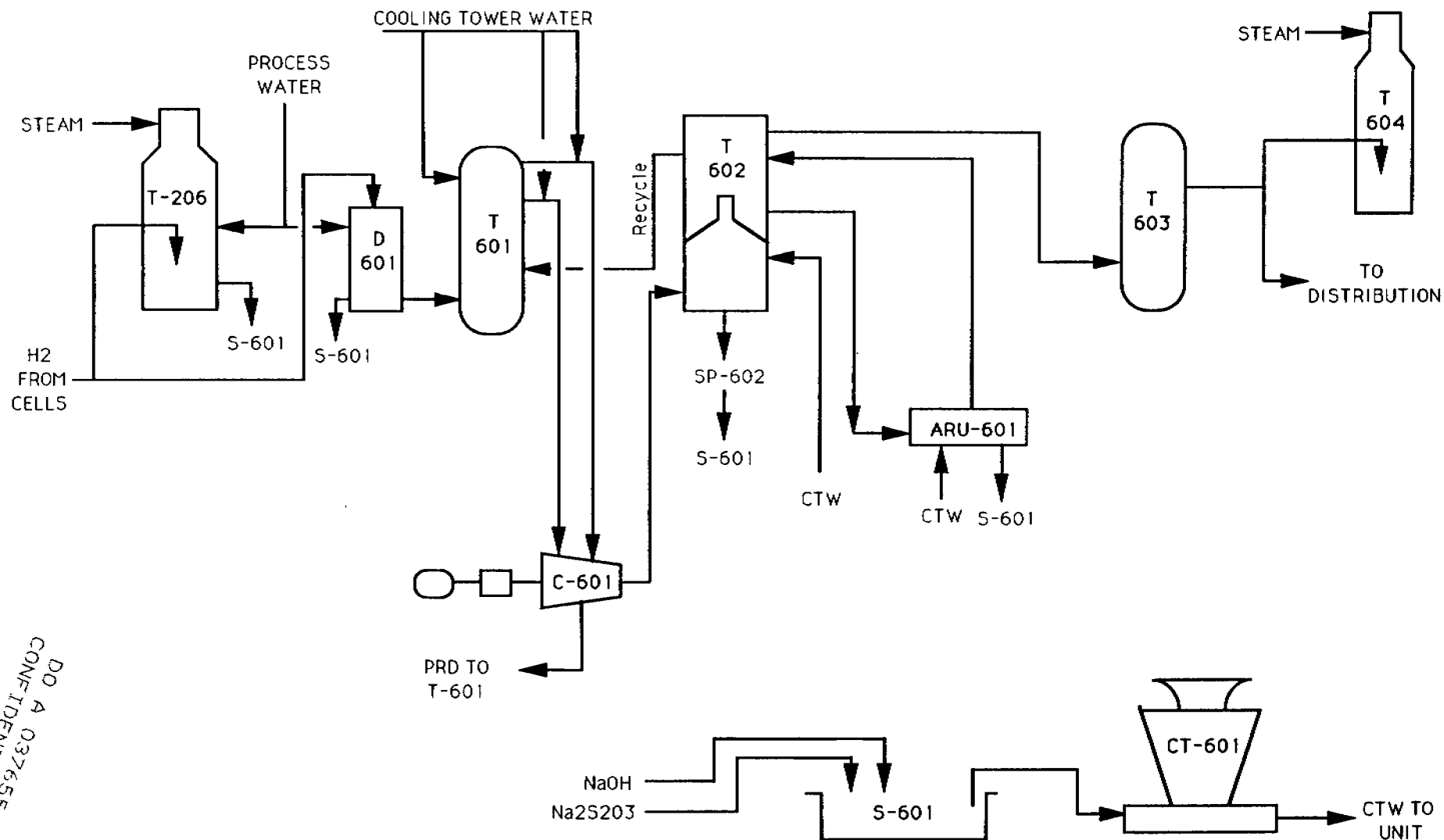
REACTIVE CHEMICAL

REVIEW

HYDROGEN RECOVERY
AREA

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HYDROGEN RECOVERY



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HYDROGEN RAW MATERIALS

HYDROGEN:

Temp	30 C
Pressure	1.5" H ₂ O

NITROGEN:

N ₂	100 %
----------------	-------

NaOH:

NaOH	10 %
------	------

Na₂S₂O₃:

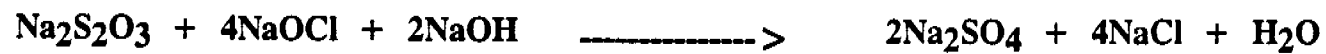
Na ₂ S ₂ O ₃	3 %
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HYDROGEN PRODUCT

Temp	15 C
Pressure	10 PSIG
Flow	2500 LB/HR
Hydrogen	99.9 %
O ₂	900 PPM
CO ₂	< 10 PPM
N ₂	< 100 PPM

HYDROGEN AREA
CHEMICAL REACTIONS



HYDROGEN AREA

POTENTIAL PROBLEMS

OXYGEN - HYDROGEN EXPLOSION

PREVENTIVE MEASURES

- 1 - Hydrogen Recovery trips when any two oxygen analyzers are above the trip point of 0.5%. The Mod5 alarms at 0.25%
- 2 - Automatic N₂ addition to H₂ Header when Hydrogen Recovery trips or is shutdown
- 3 - Hydrogen Recovery trips when two or more suction pressure analyzers are in service and see 1/8" H₂O pressure for two seconds
- 4 - Hydrogen Recovery trips when only one suction pressure analyzer is in service and sees 0.3" H₂O pressure for two seconds
- 5 - Hydrogen Recovery trips when a suction pressure analyzer sees - 1.5" H₂O for one second.

HYDROGEN - CHLORINE EXPLOSION

- 1 - Maintain excess chemicals in CT-601. Cooling tower water checked twice a day. Adjustments are made at that time.

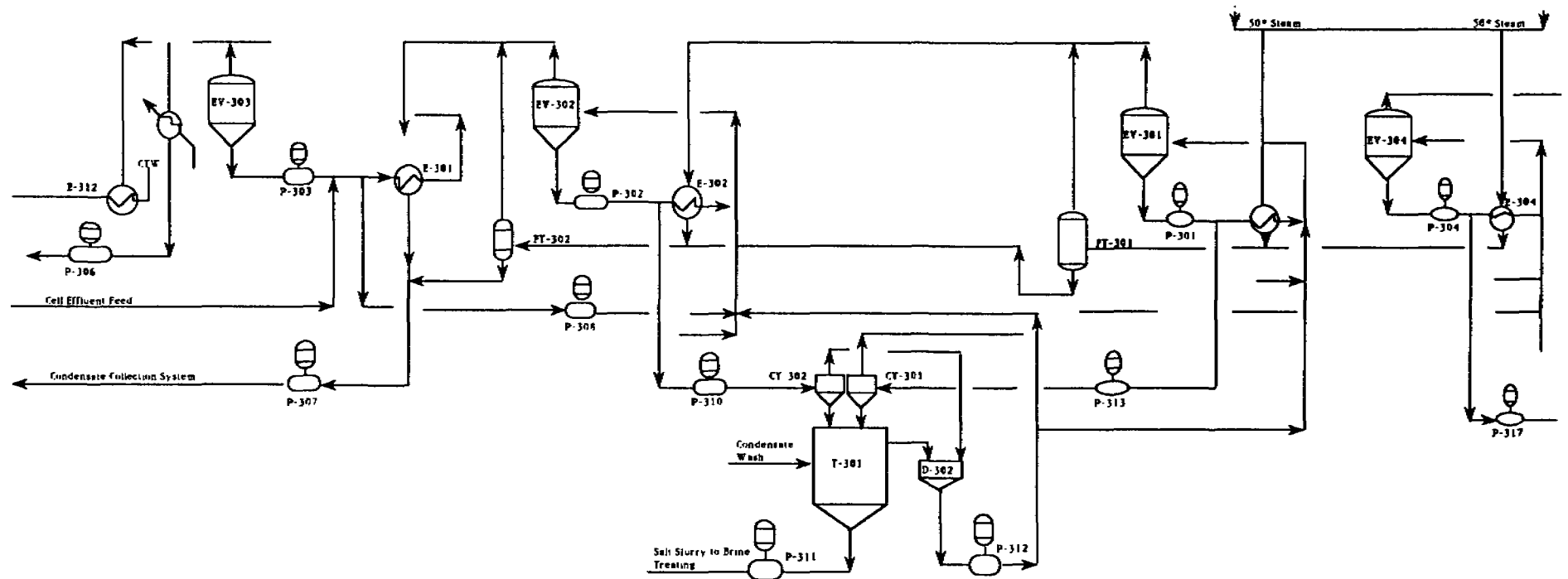
CA - 2

REACTIVE CHEMICAL

REVIEW

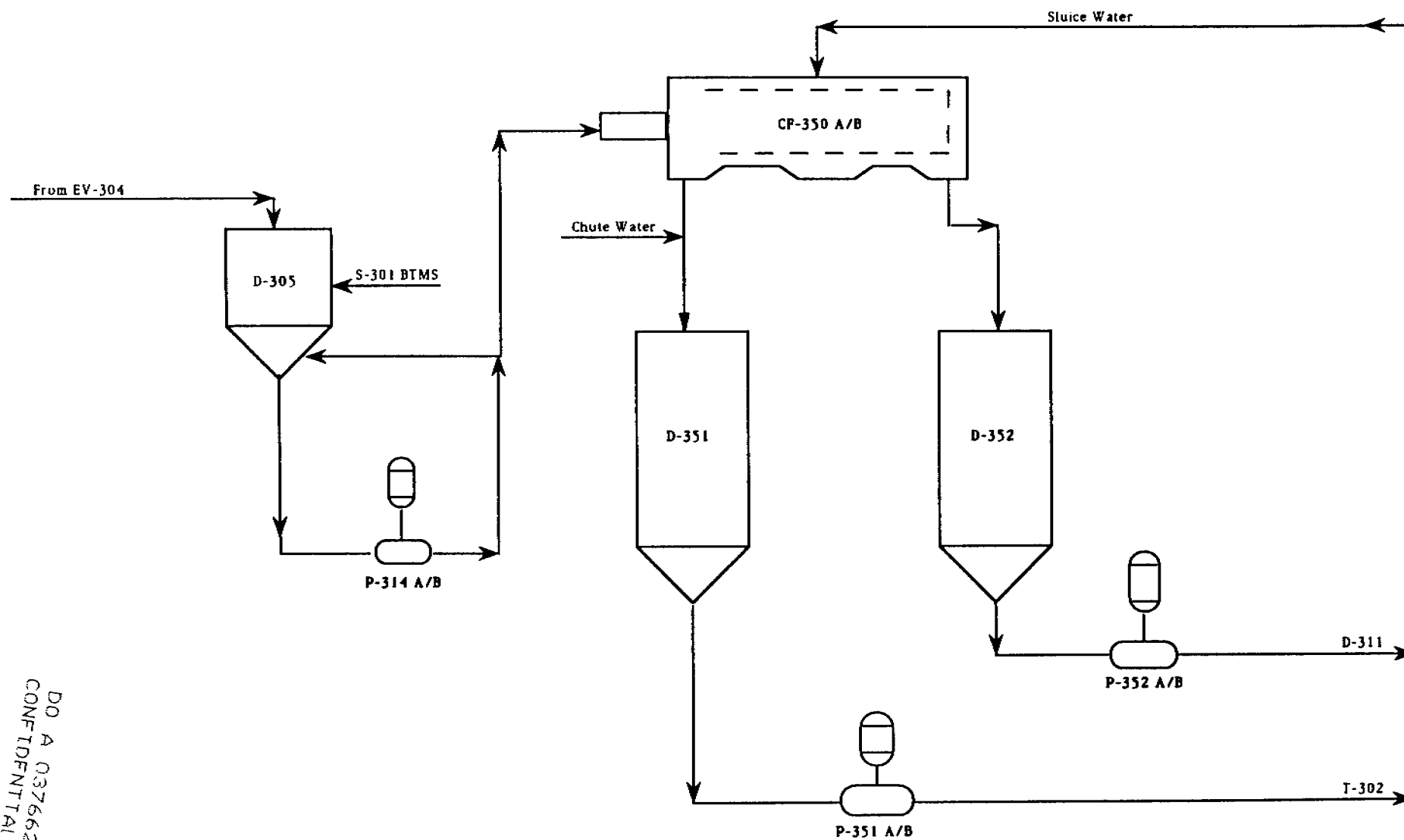
CAUSTIC AREA

NaOH EVAPORATOR AREA



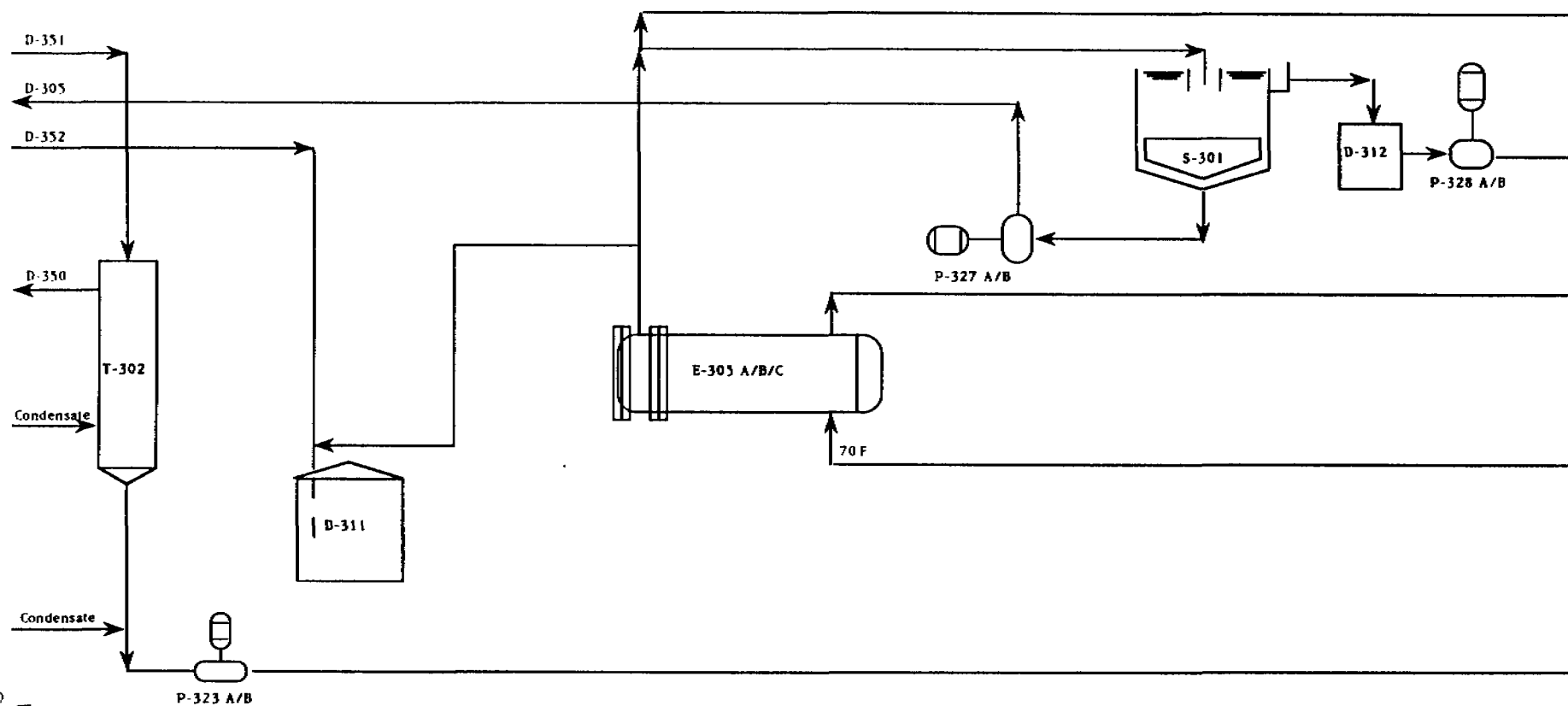
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NaOH Centrifuges



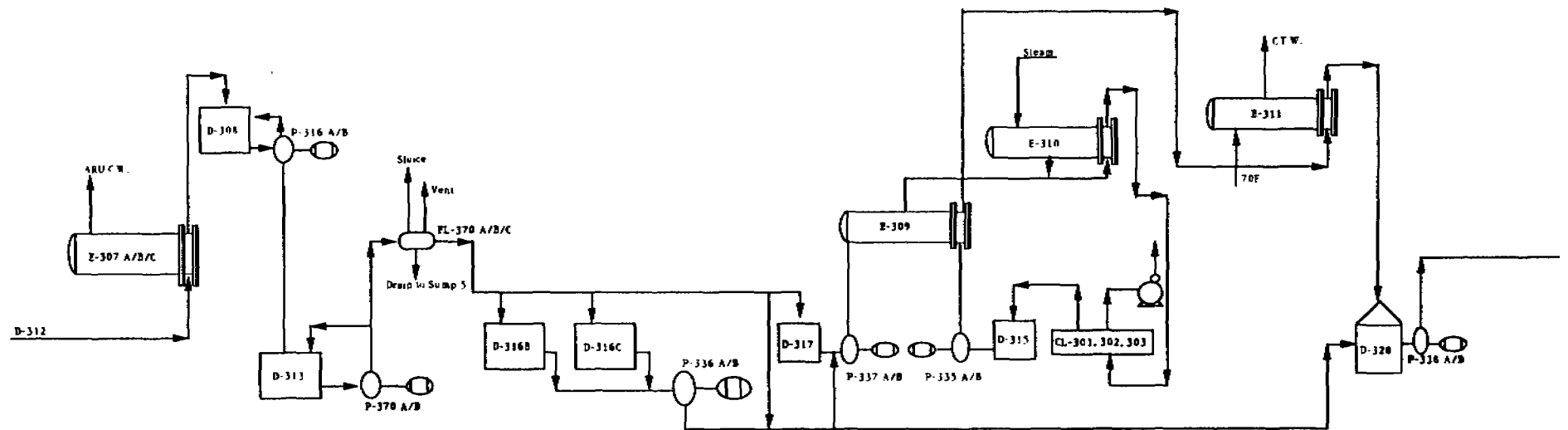
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NaOH FINISHING AREA



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CONFIDENTIAL

NaOH FINISHING AND STORAGE AREA



DO A 037664
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CAUSTIC AREA

POTENTIAL PROBLEMS

WATER WILL REACT VIOLENTLY WITH HEAT GENERATION WHEN MIXED WITH 50% CAUSTIC.

CAUSTIC ENTERING INTO THE PROCESS WATER HEADER. CAUSTIC COMING IN CONTACT WITH OTHER CHEMICALS AND PROCESS COULD CAUSE ADVERSE RESULTS.

CAUSTIC ENTERING THE CONDENSATE SYSTEM. CAUSTIC CONTAMINATION OF THE CONDENSATE SYSTEM WOULD RESULT IN SIGNIFICANT EQUIPMENT FAILURE.

CORROSION OF NICKLE CLAD BY HYPOCHLORITES WILL OCCUR WHEN EXCESSIVE HYPOCHLORITE CONTENT IS IN THE CELL EFFLUENT FEED TO THE CAUSTIC EVAPORATORS.

PREVENTIVE MEASURES

1 - Water is added to the Caustic Process throughout the plant. Most additions are closed systems and are kept flowing. The closed system eliminates any splashing. The continuous flow keeps the process temperatures near normal. When water is added to any open equipment, it is added slowly and protective measures are taken.

1 - A check valve is installed on the process water line to the Caustic Area.

1 - The wash water system is confined to the Caustic Area and uses CA - 2 product condensate. This condensate system runs a higher pressure than most of the process systems in the Caustic Area. Typically the places where the process is at a higher pressure than the condensate system are the condensate addition to pump suctions and other low pressure areas. In all cases, double block valve with bleeds are used on all condensate to caustic tie points.

1 - The cell effluent is analyzed for hypochlorites on a routine basis. The hypochlorites are neutralized with sodium thiosulfate before the cell effluent enters the Evaporator Feed Tank.

CAUSTIC AREA

POTENTIAL PROBLEMS

HCL - NAOH EXOTHERMIC REACTION
DUE TO HCL AND 50% CAUSTIC BEING
CROSS-TIED AT IRON CELLS.

HYDROGEN EXPLOSION COULD RESULT
IF HYDROGEN (GENERATED WITHIN
THE IRON CELLS) REACHED EXPLOSIVE
LIMITS.

PREVENTIVE MEASURES

- 1 - Caustic is always drained from the iron cells and the cells are flushed with water before being acidized. The HCl line includes a double block and bleed to isolate the HCl from the iron cells when not in use.
- 1 - A vacuum system is operated to remove the hydrogen. The system is designed to allow enough air input to keep the hydrogen concentration below the explosive range. The system is open with hoods over each iron cell. There is no way to seal the system and keep air out, therefore, a large amount of hydrogen cannot build up in the system.

CA - 2

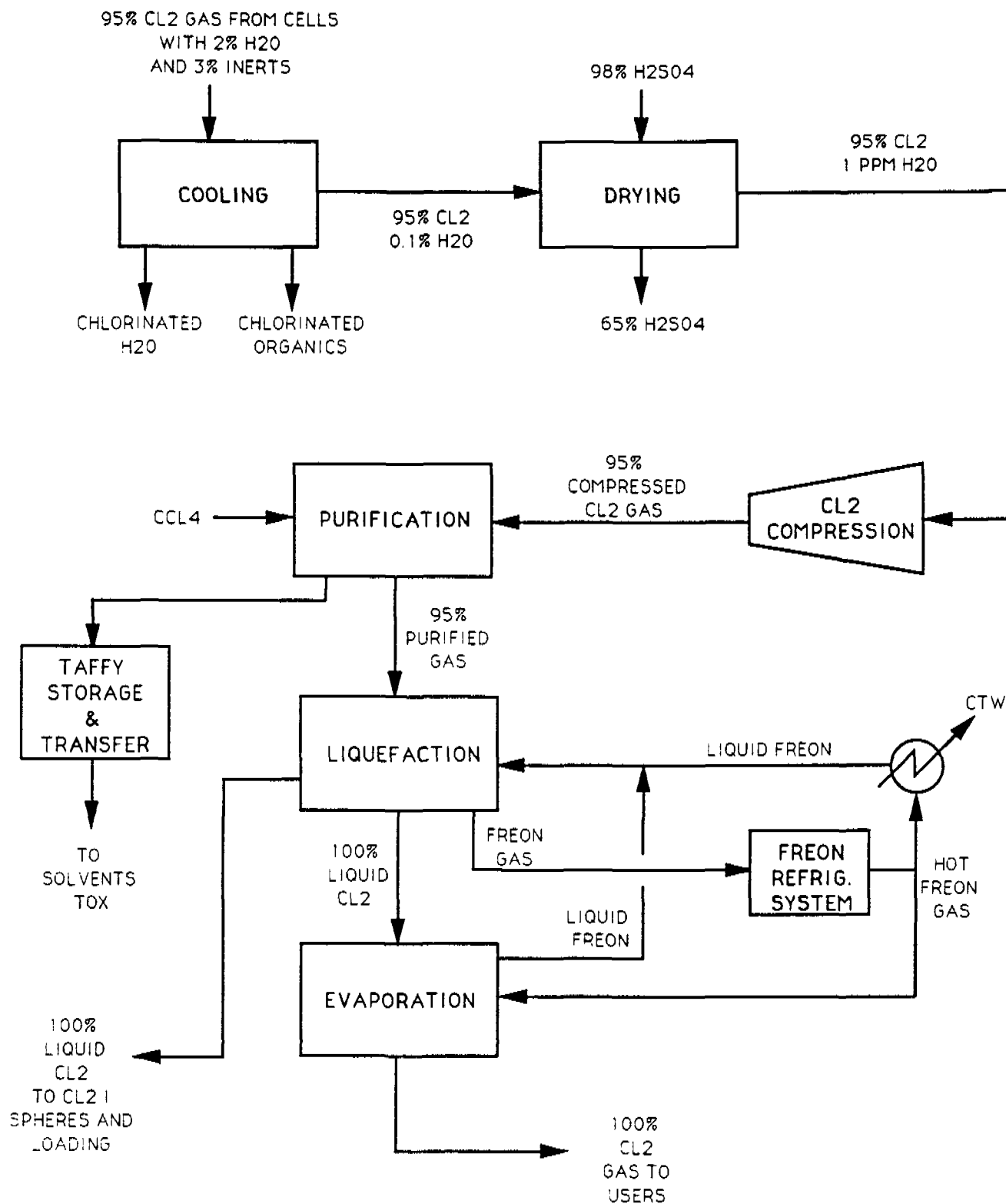
REACTIVE CHEMICAL

REVIEW

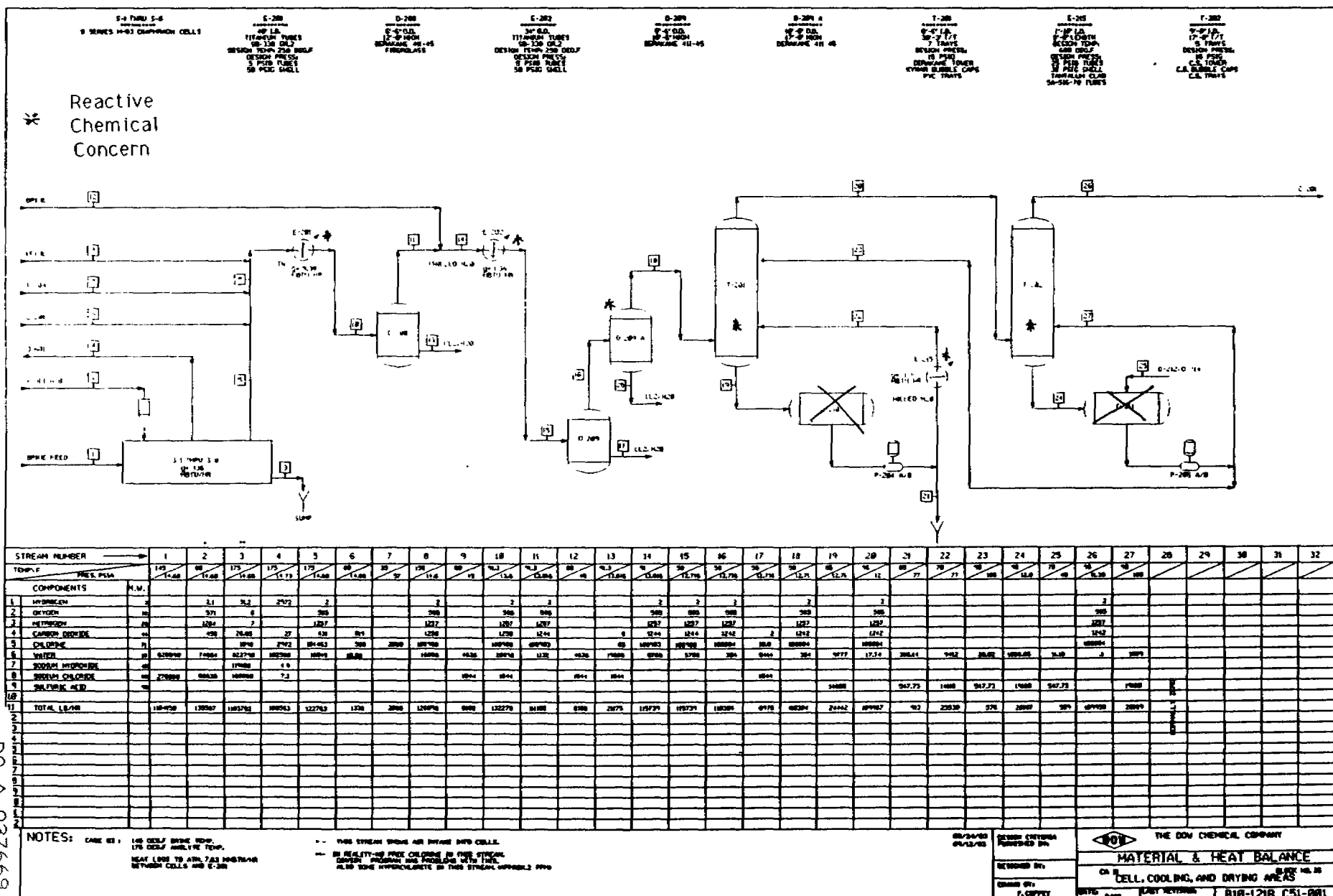
CHLORINE AREA

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CHLORINE AREA



DO A 037669
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CDC AREA

POTENTIAL PROBLEMS

TITANIUM IN THE PRESENCE OF DRY Cl_2 WILL BURN. BOTH Cl_2 EXCHANGERS, E-201 AND E-202, CONTAIN TITANIUM TUBES. D-209A CONTAINS TITANIUM BOLTS.

WET Cl_2 REACTS WITH STEEL IN A VERY CORROSIVE MANNER.

WEAK H_2SO_4 IS VERY CORROSIVE WHEN CONTACTED WITH STEEL.

TUBE FAILURE E-215/E-216

PREVENTIVE MEASURES

- 1 - Exchangers are in wet Cl_2 service.
- 2 - Water is continually sprayed into the Cl_2 side of both of these exchangers. This flow is monitored and alarmed.
- 3 - Titanium parts in security storage.
- 1 - All piping in wet Cl_2 service is of ~~Fiberglass~~ material. *Lined pipe*
- 2 - All vessels in wet Cl_2 service are ~~Fiberglass~~. *LINED*
- 3 - Mist eliminating elements in D-209A are Fiberglass.
- 4 - All chlorinated water piping is lined.
- 1 - The first drying tower, T-201, is an ~~FRP~~ vessel. *CPVC*
- 2 - Acid strengths/flows/temperature are monitored in both drying towers.
- 3 - Tray temperatures are monitored in both towers.
- 4 - Acid coolers for both towers.
- 1 - Conductivity probe on chill water with automatic dump.

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CDC AREA

POTENTIAL PROBLEMS

Cl₂ - IRON REACTION AT COMPRESSOR
C-201 A/B

Cl₂ - IRON REACTION IN PIPING

Cl₂ - LUBE OIL REACTION

Cl₂ - ORGANIC CHEMICAL REACTION

PREVENTIVE MEASURES

1 - Interstage coolers to keep Cl₂ temperature down.

2 - High temperature trip on the compressor. Triple redundant temperatures on 2nd and 3rd stages. Trips on two thermocouples at 325 F on 2nd or 3rd stage.

3 - Deluge system.

4 - Interstage and discharge temperatures alarmed and monitored.

5 - Moisture monitored and alarmed off of discharge.

1 - No steam tracing - only electrical.

2 - Drying procedures prior to startup.

1 - Bearing housing separated from compressor seals.

2 - N₂ purge on compressor seals; air purge on bearing housing.

1 - Prohibit use of hydrocarbon based compounds inside Cl₂ vessels and piping.

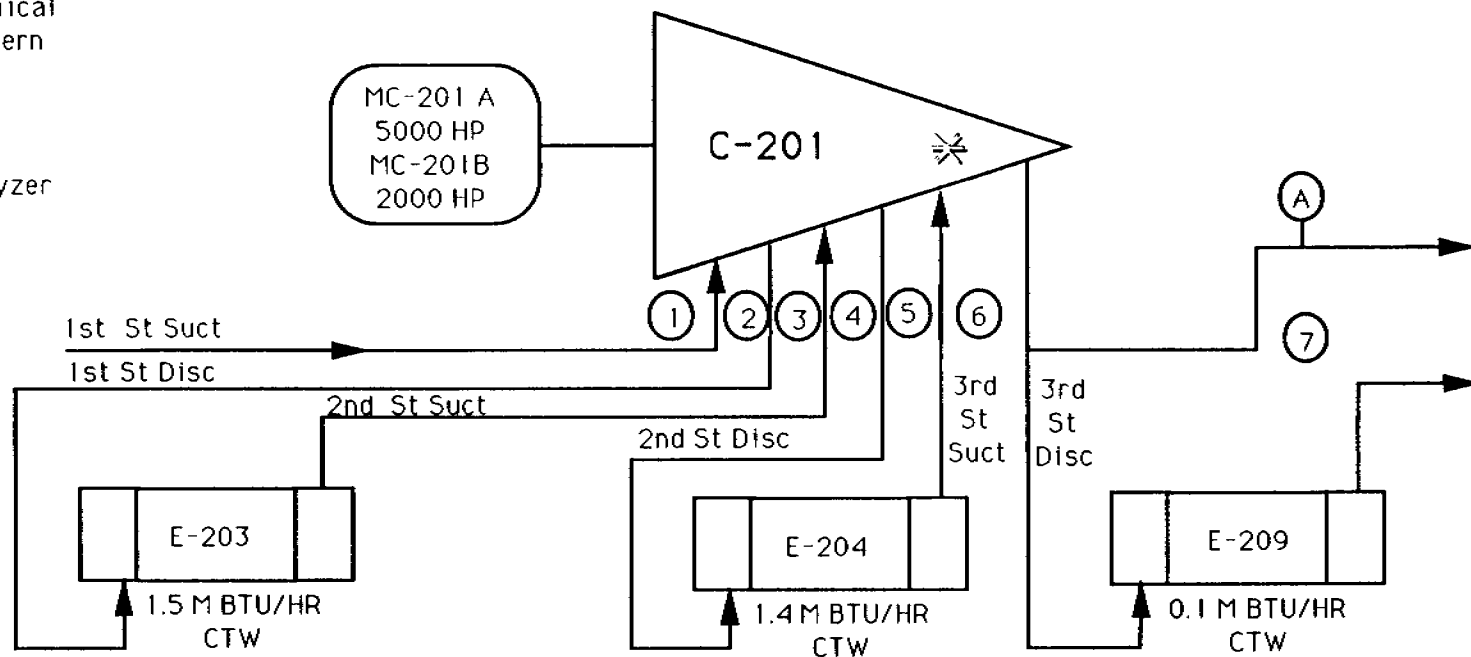
2 - Use Fluorolube as gasket lubricant and DP cell fill fluid.

3 - Use only water or steam for cleaning of equipment used in Cl₂ service.

CHLORINE COMPRESSION

✱ Reactive
Chemical
Concern

(A) Analyzer

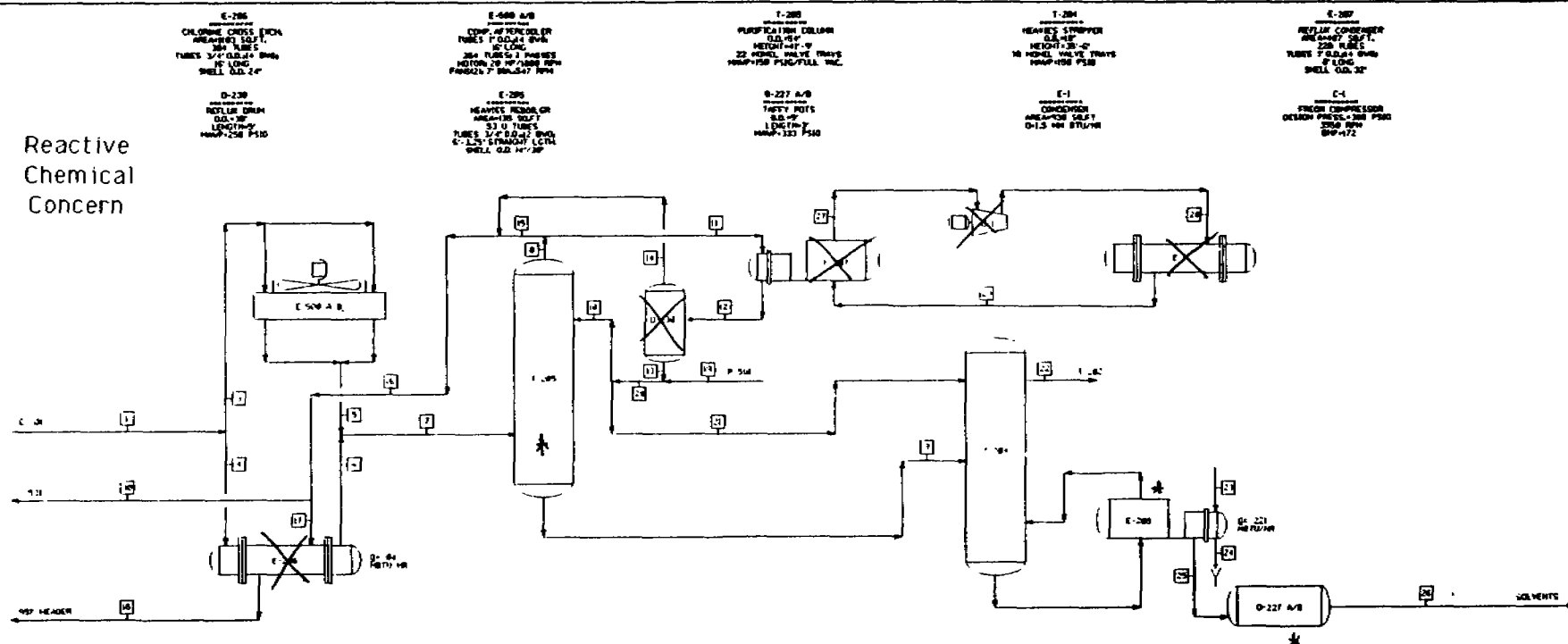


	(1) 1ST STAGE Suct	(2) 1ST STAGE Disc	(3) 2ND STAGE Suct	(4) 2ND STAGE Disc	(5) 3RD STAGE Suct	(6) 3RD STAGE Disc	(7) Suct Cont
Temp F	100	265	115	265	110	190	110
Press PSIA	-3.7	15	13	50	48	80	78
Flow #/HR	85,000	85,000	85,000	85,000	85,000	85,000	0-10,000
Enthalpy BTU/#	240	260	242	257	240	249	239
Total Enthalpy MBTU	20.4	22.1	20.6	21.8	20.4	21.16	2.39

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7/91

* Reactive
Chemical
Concern



STREAM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
TEMP. F	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8	164	87.8
COMPONENTS	N.W.																															
1	HYDROGEN	2.82	7	6	6	6	6	7	7	6	6				7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
2	NITROGEN	28.8	704	684	36	674	26	704	704	6	6				704	704	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
3	OXYGEN	38.8	644	726	46	676	26	644	644	6	6				644	644	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
4	CARBON DIOXIDE	64.8	1422	1326	106	1326	106	1422	1422	6	6				1422	1422	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
5	CHLORINE	64.8	604	604	6	604	6	604	604	6	6				604	604	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
6	WATER	64.8	6	6	6	6	6	6	6	6	6				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
7	METHYL. CHLORIDE	64.8	6	6	6	6	6	6	6	6	6				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
8	METHYLENE CHLORIDE	64.8	6	6	6	6	6	6	6	6	6				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
9	CHLOROFORM	64.8	6	6	6	6	6	6	6	6	6				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
10	CARBON TETRACHLORIDE	64.8	6	6	6	6	6	6	6	6	6				6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
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17	TOTAL LB-HOLES/HR	1224.6	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	
18	DENSITY LB/CUB.FT.	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	6.74	
19	GPM ON SHUTTER	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	1107.2	
20	TOTAL LB/HR	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	1482.2	

NOTES: DESIGN BASIS: 2.4 MILLION LB/DAY CHLORINE PLANT CAPACITY, C-202 AND C-1 DOWN.

NOT A COMPLETE FLOW-TRANSFER ON AT 400/200 LEVEL.

BY: J. L. W. / J. L. W. / J. L. W.

DATE: 10/10/63

REVISION: 1

BY: J. L. W. / J.

PROCESS DESCRIPTION

T-205:

- Heavies removed from hot gas by contact with cool Cl_2 liquid (20 trays).
- Purified gas sent to liquefaction unit.
- Bottoms liquid flow is adjusted to control overhead gas flow on T-204.
- Continuous CCl_4 addition to bottoms.

T-204:

- Remove Cl_2 from heavies (18 trays).
- Cl_2 vaporized via reboiling in E-205.
- Column pressure controlled to drying train at 40 psig.

E-205 REBOILER:

- Supplied with 15# steam heat source.
- EBV on steam inlet.
- Normally maintain 55% level, 170 F.
- Level control with steam.
- Temperature control into D-227's
- Sample point.
- Conductivity probe on condensate outlet.

PROCESS DESCRIPTION

TAFFY POTS:

- Bottom outlet - tangent to bottom of pots.
- Low temperature steel.
- 750 gallon capacity.
- Vented to T-204 except during transfer (40 psig).
- Normally run 60 - 90 F, depending on ambient temperature.
- Level - redundant remote seal transmitters on each pot.
- Rigidly piped to sniff header.
- Sample points on bottom outlets.
- Vapor phase PSV's, 4 X 6 set at 150 psig.
- Redundant pressure and temperature transmitters with alarms
- High "rate of rise" temperature alarms - impending reaction
- Pot will go to "emergency dilute" on extremely high temperature (≥ 195 F)
 - steam on reboiler will be shut off
 - reboiler contents will be dumped to pot with high temperature
 - liquid Cl_2 will be added to dumping reboiler to help cool pot ; level controlling T-204
 - option to dilute pot with CCl_4 by setting DK

CCL₄ ADDITION

OBJECTIVE:

- NCl₃ dilution
- CCl₄ in taffy to help alleviate solids deposits (acts as solvent)
- Amount of CCl₄ added is dependent (proportional to generator load)

PURIFICATION AREA

POTENTIAL PROBLEMS

NITROGEN TRICHLORIDE EXPLOSION IN TAFFY POT

PREVENTIVE MEASURES

- 1 - Monitor and alarm temperature in each pot (redundant).
- 2 - Alarm rate of temperature rise in pots.
- 3 - Analyze Brine for NH_3 content bi-monthly (R&D).
- 4 - Analyze Taffy weekly for NCl_3 .
- 5 - Monitor and alarm pressure on each pot (redundant).
- 6 - Lowered PSV setting to 150# to catch pot overpressure.
- 7 - Maintain 80 PPM hypochlorite in the Brine.
- 8 - Maintain level below 40% to allow room for diluent should a reaction take place.
- 9 - Capability to automatically add liquid chlorine to the Taffy Pot in the event of a reaction. Also have capability to add CCl_4 to pots.
- 10- Reboiler temperature controlled to decompose NCl_3 . Samples are always below 1000 PPM. Given 40 PSIG operating pressure, reboiler temperature set point is set at 170 F, over 30 degrees below the boiling point of the dilutant, CCl_4 .

PURIFICATION AREA

POTENTIAL PROBLEMS

ORGANIC IMPURITIES; WET CCl_4

CHLORINE - ORGANIC CHEMICAL
REACTION

PREVENTIVE MEASURES

- 1 - CCl_4 provided by Solvents from "check tank". Check tank analysis to be obtained for each load.
- 2 - In plant capability to analyze each load for organics and H_2O .
- 3 - Dedicated line from Solvent
- 1 - Prohibit use of hydrocarbon based compounds inside Cl_2 vessels and piping.
- 2 - Use fluorolube as gasket lubricant and DP cell fill fluid.
- 3 - Use only water or steam for cleaning of equipment used in Cl_2 service.

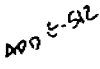
TAFFY POT INSTRUMENTATION

<u>PARAMETER</u>	<u>DESCRIPTION</u>	<u>ALARM SET POINT</u>
TEMPERATURE	1 - Redundant temperature transmitters	
	2 - High temperature alarm on Mod5	150 F
	3 - Temperature history plot VAX history scheme	
	4 - Change in temperature alarm based on pot temperature rate of rise vs. ambient temperature rate of rise.	
PRESSURE	1 - Redundant smart transmitters on Mod5	
	2 - High pressure alarm	135 PSIG in steps where the pot is pressured up for transfer 100 PSIG all other steps
	3 - Pressure history plot on VAX history scheme	
LEVEL	1 - Redundant remote seal smart transmitters on Mod5	
	2 - High level alarm on Mod5	70 %
	3 - Level history plot on VAX history scheme	
PSV	1 - 4 X 6	150 PSIG

E - 205 REBOILER INSTRUMENTATION

<u>PARAMETER</u>	<u>DESCRIPTION</u>	<u>ALARM SET POINT</u>
TEMPERATURE	1 - Redundant temperature transmitters to Mod5	
	2 - High temperature alarm on Mod5	195 F
	3 - Temperature controller may be trended on VAX history scheme	
	4 - Extremely High Temperature Alarm - Reboiler will dump contents and steam supply will close	200 F
PRESSURE	1 - Same as T-204 pressure	
LEVEL	1 - Redundant remote seal smart transmitters on Mod5	
	2 - High level alarm on Mod5	75 %
	3 - Level history plot on VAX history scheme	
	4 - Level controlled via automatic level control valve by steam to reboiler	
CONDUCTIVITY PROBES	1 - Probe on Condensate outlet to indicate a tube leak	400 μ MHo
	2 - Alarms on Mod5	
SAFETY VALVES	1 - 1 1/2 X 2	250 PSIG

*

[illegible]

NOTES:

DESIGN BASIS:	2.4 MILLION LB/DAY CHLORINE PLANT CAPACITY WITHOUT EVAPORATION
	2.3 MILLION LB/DAY MANUFACTURING CAPACITY

*SPECIFIC GRAVITY-1.21 OF SOLIDS HYDROGEN
2.5 OF SOLIDS (CALCULATED)

08/17/88	GREEN CARTON
07/16/88	FLUORENCE 87
07/08/88	
06/28/88	

EXHIBIT C-7

DECORATED BY:
 STAINED BY:
 F. C. C. C. C. C.

 THE ODM CHEMICAL COMPANY	
MATERIAL & HEAT BALANCE	
Co. #	BLOCK NO. 25
LIQUEFACTION / EVAPORATION	
DATE	LAST REVISION
B19-1519 C51-001	

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LIQUEFACTION AREA

POTENTIAL PROBLEMS

HYDROGEN - CHLORINE EXPLOSION IN
TAIL GAS

WATER/MOIST AIR ENTERING
LIQUEFACTION PROCESS FROM BRINE
SCRUBBER CREATING SEVERE
CORROSION PROBLEM

CHLORINE - IRON FIRE FROM LIQUID
CL₂ PUMPS OVERHEATING

HIGH MOISTURE CONTENT IN CL₂
CAUSING ACCELERATED CORROSION
TO CARBON STEEL

H₂O IMPURITIES ADMITTED TO
PROCESS VIA FREON

PREVENTIVE MEASURES

1 - Monitor hydrogen in cell continuously.

2 - Redundant hydrogen analyzers monitor and alarm tail gas to Brine Scrubber (set point - 3.5% H₂ in inerts) analyzers included on critical instrument program ; Generator runback: 4.75%

3 - Automatic N₂ dilution into tail gas.
Control at 2.4%

1 - Check valve installation on tail gas line to scrubber.

2 - High pressure alarm on Brine Scrubber.

3 - Moisture analyzer and alarm on T-505 tail gas inlet line.

4 - Liquefaction startup and shutdown procedures, on computer, call for blinding the liquefaction process from the brine scrubber when liquefaction is to be depressured.

1 - Alarm on low cooling flow.

2 - minimum flow lines provided to prevent dead-heading.

1 - Redundant moisture analyzers monitored and alarmed.

1 - Complete analysis on all freon shipments.

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LIQUEFACTION AREA

POTENTIAL PROBLEMS

CL₂ LEAK INTO R-12 REFRIGERATION
SYSTEM (C-520 LEADING TO REACTION
WITH COMPRESSOR OIL)

PREVENTIVE MEASURES

- 1 - Analyzer monitors and alarms Cl₂ in freon.
This analyzer and alarm scheme is included
in the critical instrument program.
- 2 - Cl₂ - R-12 exchangers have double tube
sheets.

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EVAPORATION AREA

POTENTIAL PROBLEMS

NCL₃ ACCUMULATION IN EVAPORATOR
BOTTOMS

HIGH PURITY GAS CONDENSING IN
USER HEADER

H₂O / IMPURITIES ADMITTED TO
PROCESS VIA FREON

PREVENTIVE MEASURES

1 - Flush evaporator bottoms once daily to T-204

1 - Redundant temperature transmitters.

2 - Superheater on R-11 system which operates independently of freon compressor.

3 - Computer monitoring of Cl₂ gas header pressure and temp to calculate dewpoint. Scam alarm when gas is 10 F from dewpoint.

4 - Electric heat tracing and good insulation on gas header to Cl₂ plant. Heat tracing designed to maintain 100 F heater temperature.

1 - Complete analysis on all freon shipments.

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