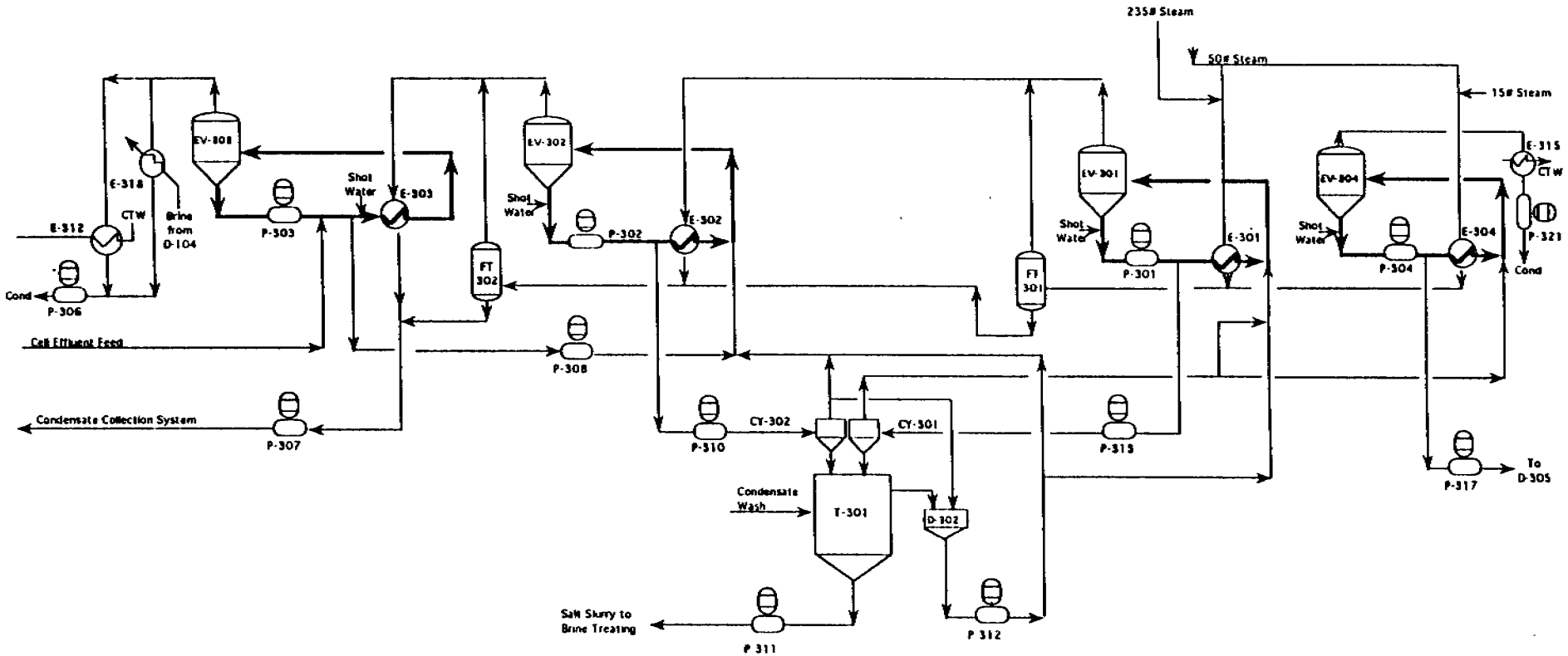
CAUSTIC I / CHLOR - ALKALI 2

1994

REACTIVE CHEMICALS REVIEW

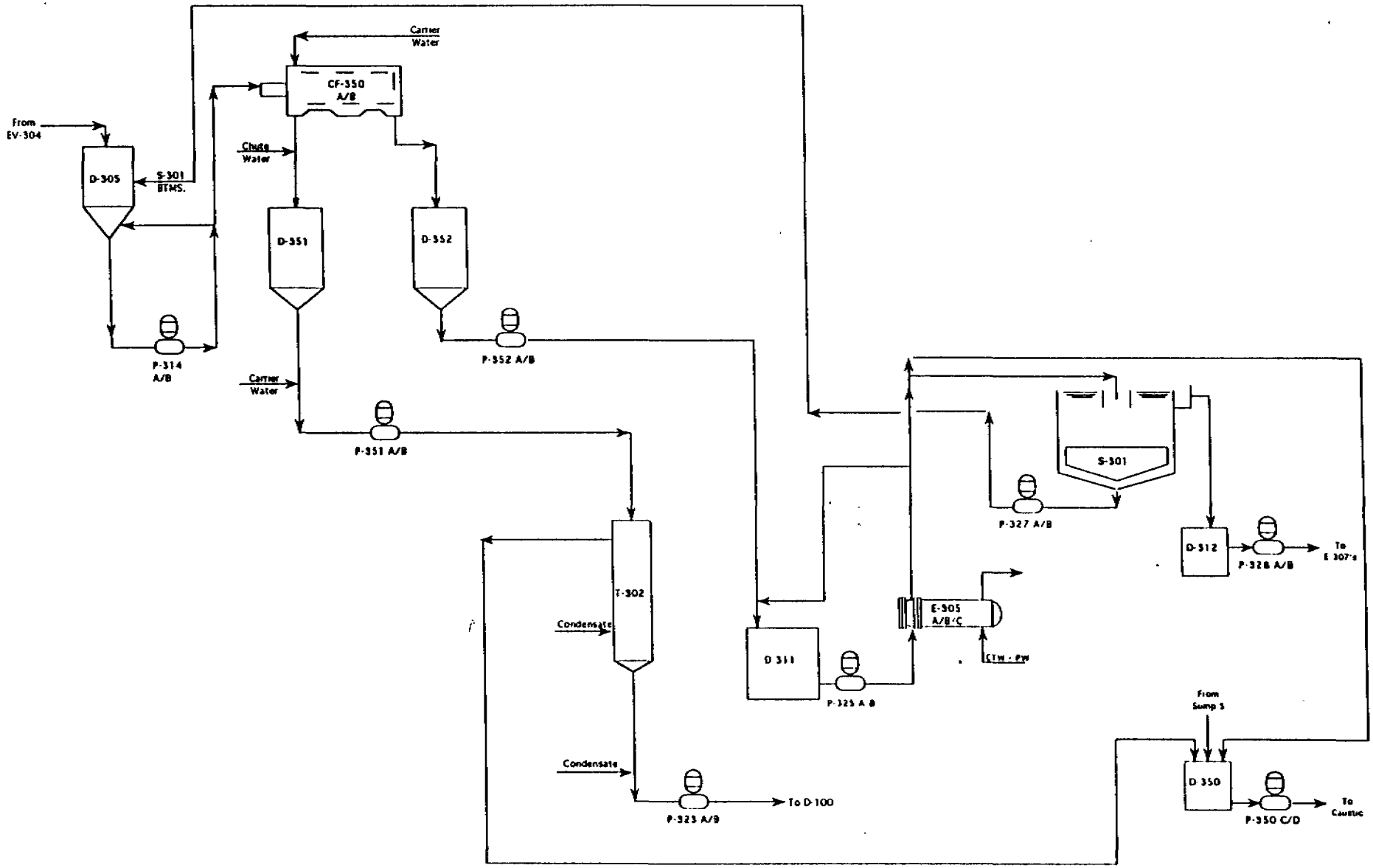
CAUSTIC AREA - both plants

NaOH EVAPORATOR AREA

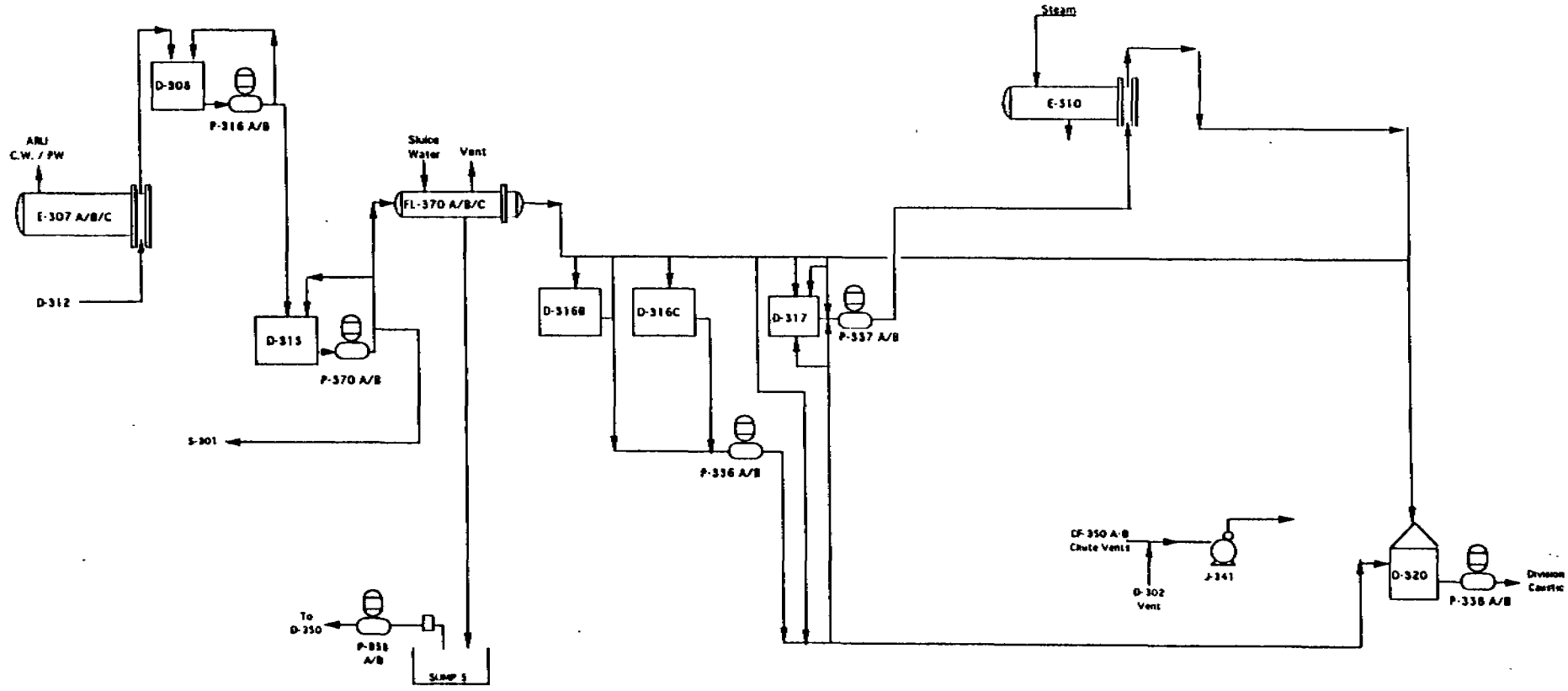


DO A 047406
CONFIDENTIAL

NaOH CENTRIFUGES & PRIMARY COOLING AREAS

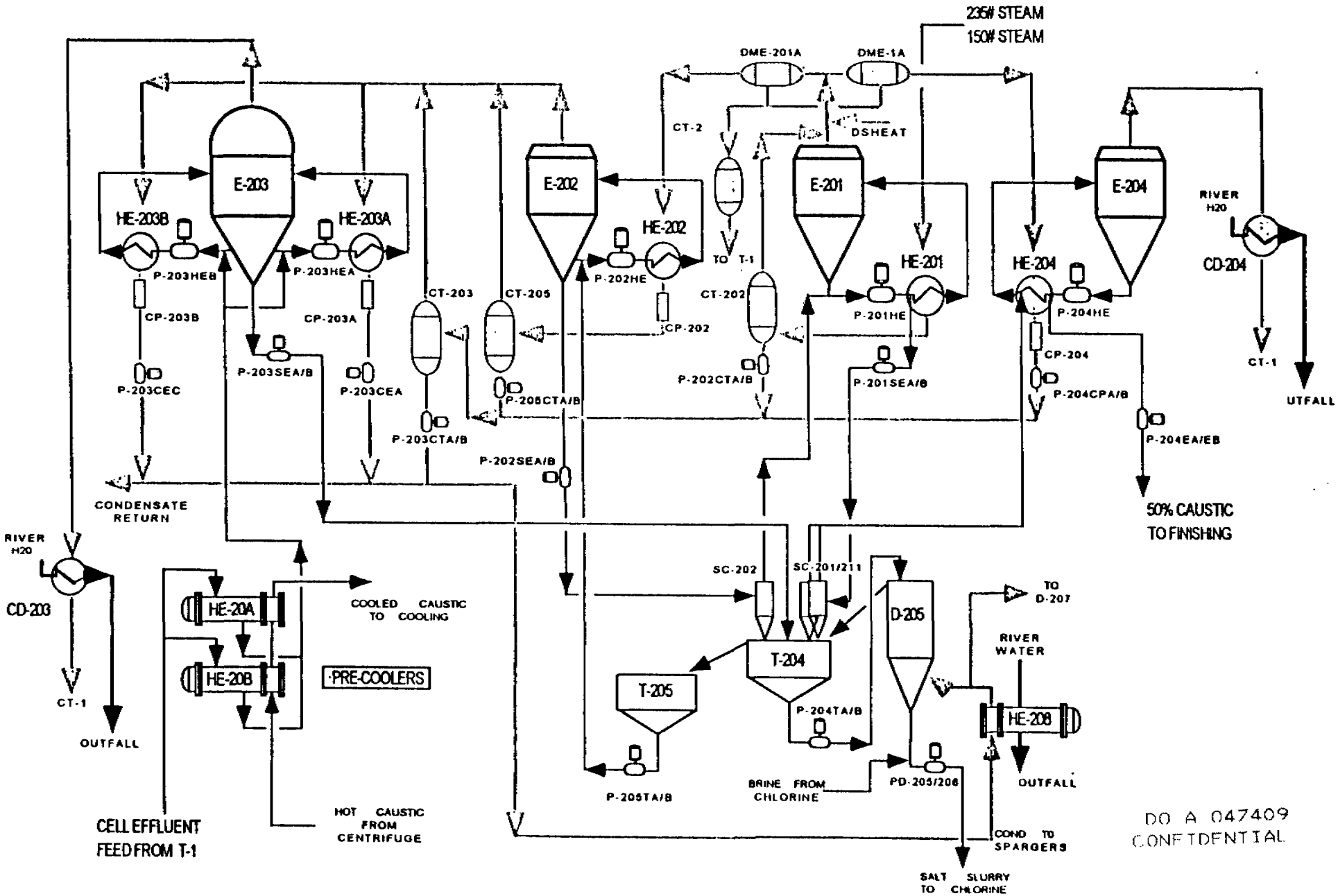


NaOH FINISHING AND STORAGE AREA



DO A 047408
CONFIDENTIAL

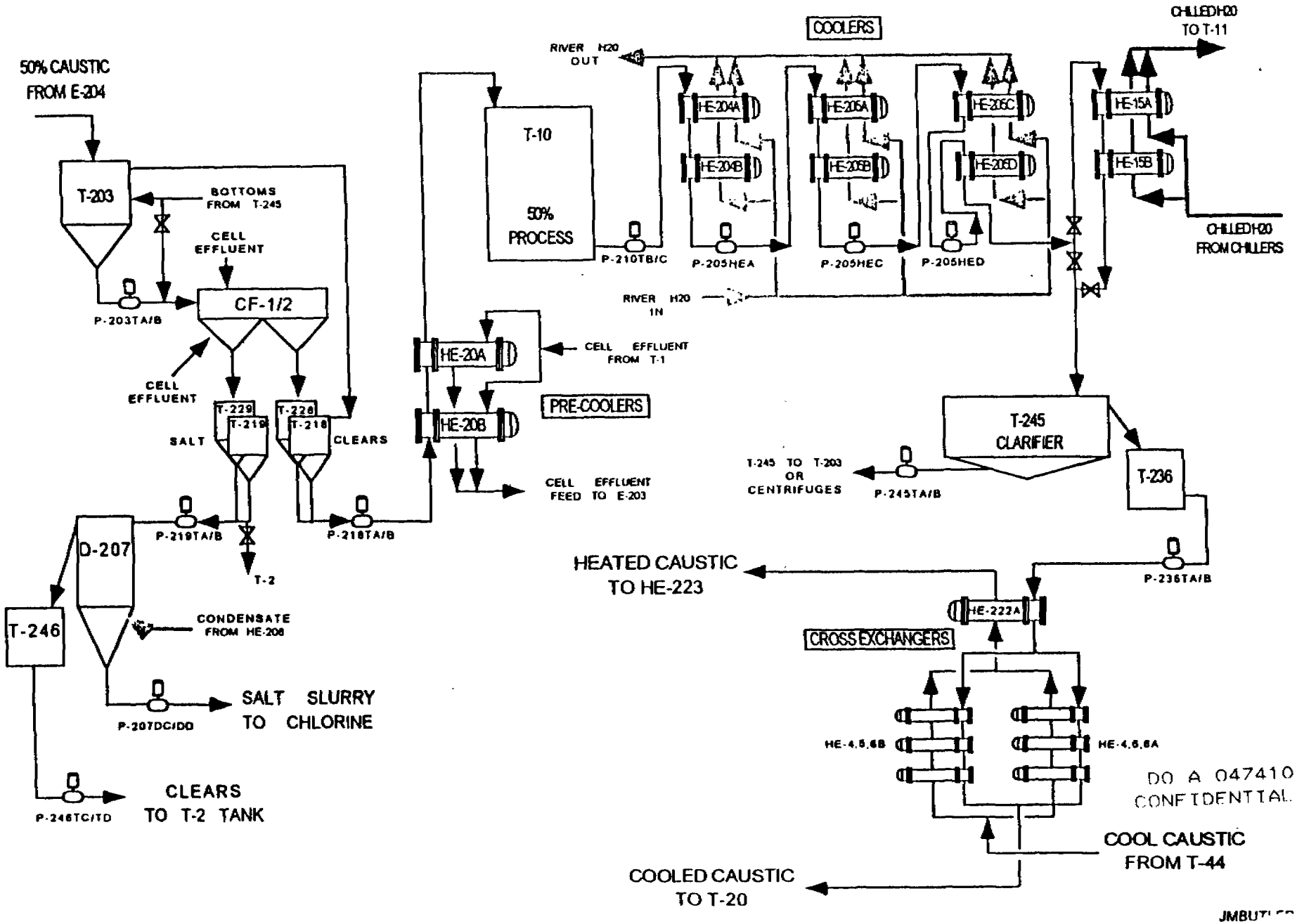
CAUSTIC 1 EVAPORATOR AREA



DO A 047409
CONFIDENTIAL

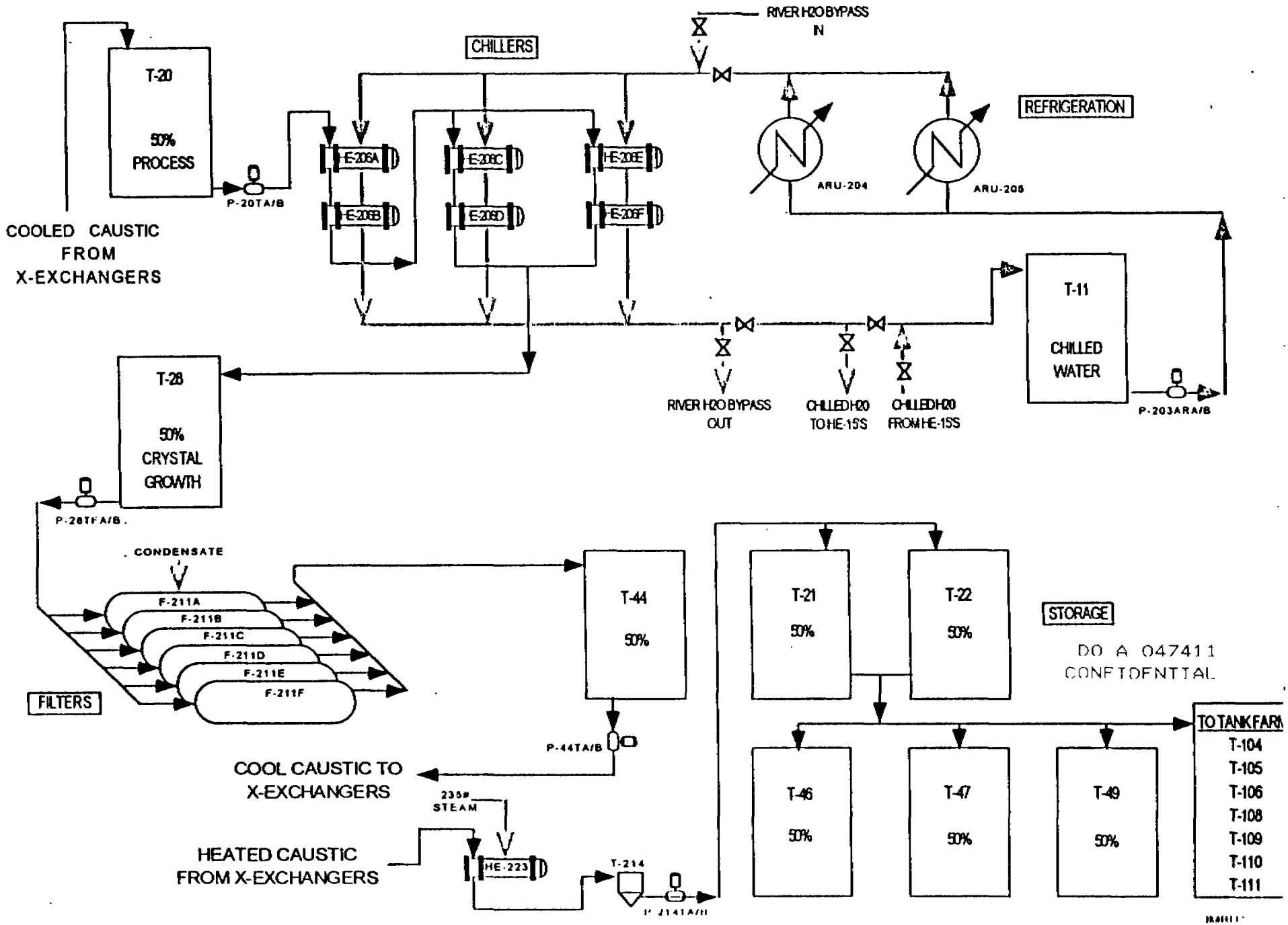
JMBUTLER

CAUSTIC 1 CENTRIFUGES/PRIMARY COOLING



JMBUTLER

CAUSTIC 1 CHILLING/FILTERING/STORAGE



DOW

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

RAW MATERIALS/PROCESS AIDS

- RAW MATERIALS
  - » Cell Effluent (8-11% NaOH, 15-17% NaCl, 72% Water)

- PROCESS AIDS
  - » Steam (150# and 235#)
  - » Carrier Brine (Caustic I Only)
  - » Process Water
  - » River Water
  - » Instrument Air
  - » Plant Air

- SUPPLIES
  - » HCL (Used for PH Control at Caustic I-Does Not Contact Process)
  - » Lithium Bromide (ARU-not in Contact With Process)

JMBUTLER
09/28/94

DOW

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

RAW MATERIALS/PROCESS AIDS: SOURCE AND STORAGE

- SOURCE
  - » Cell Effluent - CL2 and CA2 (Pipelines)
  - » Steam - Power I (Pipelines)
  - » Carrier Brine - CL2 (Caustic I Only-Pipeline)
  - » Process Water - Utilities (Pipeline)
  - » River Water - Plant Pumps (Caustic I Only-Pipeline)
  - » HCL - Solvents (Pipeline)
  - » Lith. Bromide - ARU (Contained Within Unit)
  - » CTW - Plant Pumps (CAII Only)

- BLOCK STORAGE
  - » Cell Effluent - T-1 (Plant Feed), T-2 (User Feed), T-1A, T-2A, T-3, T-109 Tanks @ Caustic; D-301, D-316A @ CAIII
  - » HCL, Steam, Carrier Brine, Process Water, River Water - No Storage: Supplied via Pipeline on Demand
  - » Lith. Bromide - Stored Within ARU

JMBUTLER
09/26/94

DOW

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

RAW MATERIAL: SPECIFICATIONS

Cell Effluent

Caustic (NaOH)	%	5-15
Iron (Fe)	PPM	1.0
Sodium Sulfate (Na2SO4)	PPM	2500
Sodium Sulfite (Na2SO3)	PPM	1-20
Sodium Chlorate (NaClO3)	%	0.03

JMBUTLER
09/28/94

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

PRODUCTS/BY-PRODUCTS

- PRODUCT
  - » 50% Caustic (50% NaOH, 0.5% NaCl, 49.5% Water)

- BY-PRODUCTS
  - » Condensate (Boiler and Non-boiler Grade)
  - » Salt Slurry
  - » Sulfate Purge

DOW

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

PRODUCTS/BY-PRODUCTS: IN-PLANT DISTRIBUTION

- PRODUCT
  - » Caustic - Pipelines to Storage Tanks in Plant and at Tank Farm
  - » Cell Effluent - Pipelines to Users (Backflow Protection Critical)

- BY-PRODUCTS
  - » Condensate
    - Boiler Grade Routed from Collection Tank to Power I or Used Internally
    - Non-Boiler Grade consumed in Process or Routed to Canal
  - » Salt Slurry
    - Routed from Two Salt Columns (D-205&D-207) to CL2 or Used Internally (CAII)
    - Brine from CL2 Mixed with Salt to Assist in Transfer
  - » Sulfate Purge - Routed to User Feed Tank (T-2) @ Caustic

DOW

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

PRODUCT SPECIFICATIONS

50% CAUSTIC

Caustic (NaOH)	%	49.0-51.0
Salt (NaCl)	%	1.0
Iron (Fe)	PPM	5.0
Sodium Carbonate (Na2CO3)	%	0.2
Sodium Sulfate (Na2SO4)	%	0.025
Sodium Chlorate (NaClO3)	%	0.15
Nickel/Copper (Ni/Cu)	PPM	1.0
Arsenic (As)	PPM	1.5
Mercury (Hg)	PPM	0.5
Lead (Pb)	PPM	5.0
Heavy Metals as Pb	PPM	15.0
Silicon (Si)	PPM	100
Manganese (Mn)	PPM	1.0

JMBUTLER
09/28/94

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

BY-PRODUCT SPECIFICATIONS

Salt Slurry

Caustic (NaOH)	%	1.25 Max
Salt Settle Volume (SV)	%	5-50

Boiler Grade Condensate

Conductivity	MMHOS	10 Max
Hydrazine	PPM	0

JMBUTLER
09/28/94

CAUSTIC I/CAII

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

REACTIVITY: 50% NaOH

- WATER
  - Dilution With Water is Exothermic
  - Rapid Temperature Increase Can Result
  - Heat of Dilution:

    $$Naoh*H2O+H2O \rightarrow NaOH*2H2O+175\ BTU/LB$$
- ACIDS
  - Reaction is Violent and/or Explosive
- ORGANIC COMPOUNDS
  - Potential Violent Reaction
- METALS
  - Rapid Reaction With Aluminum, Tin, and Zinc.
  - Can React with Amphoteric Metals in Water Solutions to Generate H2 Gas
  - Reaction With Bronze and Brass
- Flammability
  - Not Flammable

JMBUTLER
09/28/94

DOW

CAUSTIC 1

REACTIVE CHEMICALS REVIEW
OCTOBER, 1994

REACTIVE CHEMICAL CONCERNS

CONCERN	PREVENTIVE MEASURES
C II Effluent Distribution- Backflow From User Plants	User Plants Surveyed in May, 1994 to Ensure Backflow Protection is In-place.
Water/NaOH Heat of Dilution	Water is Added Throughout Process. Continuous Flow and Closed System Control Temperature Increase Near Normal and Eliminate Impact Of Boiling Action, Respectively.
Utility Systems- Caustic Contamination	Double Block and Bleed Used at All Cross Tie Points.
Corrosion of Nickel Clad Vessels by Hypochlorites in the Cell Effluent Feed	Cell Effluent Analyzed for Hypochlorites. Neutralized With Sodium Bisulfite.

JMBUTLER
09/28/94

CAUSTIC LOADING & DISTRIBUTION

POTENTIAL PROBLEMS	PREVENTIVE MEASURES
TANK TRUCKS	
TANK TRUCK CONSTRUCTED OF ALUMINUM.	1 - T. E. D. sheet requires truck to be constructed of nickel clad, stainless steel, or lined carbon steel (MC-304, 307, 311, 312, 316). 2 - Listed on loading checklist.
NON-CAUSTIC HEEL IN TANK TRUCKS FROM PREVIOUS LOAD. food grade Plastics	1 - Tank trucks required to have completed cleaning sheet. 2 - Visual inspection performed before loading each truck. 3 - Heel checked by chemical methods; litmus paper, mixed indicator, non-caustic heel verification tests. for approved trucks 4 - Written procedures for loading and checklist completed on each truck. 5 - Personnel training.
COMPARTMENTED TANK TRUCKS CONTAINING CHEMICAL REACTIVE WITH CAUSTIC IN ADJACENT COMPARTMENT.	1 - Staff approval required before loading compartmented trucks. 2. Contact reactive chemicals committee member.

CAUSTIC LOADING & DISTRIBUTION

POTENTIAL PROBLEMS	PREVENTIVE MEASURES
TANK CARS	
NON-CAUSTIC HEEL IN TANK CAR FROM PREVIOUS LOAD OR FROM CUSTOMER CONTAMINATION.	1 - Dedicated fleet of tank cars. 2 - Dow-owned tank cars not stenciled "CAUSTIC" only loaded after cleaning. 3 - Visual inspection before loading each car. 4 - Heel checked by lab. Procedures if necessary. 5 - Written procedures for loading and checklist completed on each car. 6 - Personnel training. 7 - Follow-up with customers in cases of car contamination. Cars cleaned before reloading.
BARGES	
NON-CAUSTIC HEEL IN BARGE FROM PREVIOUS LOAD.	1 - Dedicated fleet of barges. 2 - Visual inspection before loading. 3 - Heel checked by lab. Procedures. 4 - Written procedures for loading. 5 - Personnel training.

DO A 047422
CONFIDENTIAL

CAUSTIC LOADING & DISTRIBUTION

POTENTIAL PROBLEMS	PREVENTIVE MEASURES
SHIPS	
NON-CAUSTIC HEEL IN SHIP.	1 - Ships required to be cleaned before loading. 2 - Last cargo information supplied to LAD ship coordinator and caustic plant loading coordinator. 3 - Visual inspection before loading each ship. 4 - Written procedures for loading. 5 - Personnel training.

Dow IMT Imont

Matrix.XLS

	QAC Reviewed -->	Hydrocarbons August 93																				Solvents Sept. 93																							Caustic Sept. 93			Amine	Glycols Sept. 93										Notes
	To Load ---------->	Benzene	BTX	C-5 to Chem. Mrkt. Freeport	C-6 to Gasoline	Cumene	Dicyclopentadiene	Ethylbenzene	Fuel Oil	HC Blend 5-8	Isoprene	LA Blendstock	Naphtha	Piperylene	Pyrolysis Gasoline	Resin Oil	Styrene	Styrene Crude	Toluene to HDA	TX to Gas	TX to HDA	Acetone	Butanol	Methanol	Carbon Tetrachloride	Chloroform	Ethylene Dichloride	Methyl Chloroform (Note 1)	Methylene Chloride	Perchloroethylene	Trichloroethane	Trichloroethylene	Calcium Chloride	Caustic Soda Regular	Caustic Soda (Low Salt)	Dodecylbenzene	Ethanolamine	Dowanol EB	Dowanol PM	Dowfrath	Diethylene Glycol	Ethylene Glycol Fiber (Note 1)	Ethylene Glycol Mid	Ethylene Glycol Regular	Propylene Glycol Industrial	Propylene Glycol USP (Note 2)	
	Last Contained	QAC	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	33	34	35	36	37	38	39	40	41	42	43	44	45	
1	Benzene	440		0	0	0	2	44	1	0	1	2	1	0	2	0	2	44	1	0	1	0	5	3	6	5	5	5	5	5	5	5	3	5	3	5	6	6	5	5	5	6	5	5	5	5	5	Note 1: Use DC-352, DC-353
2	BTX	440	44		0	1	44	4	3	0	1	2	0	0	3	0	2	44	44	39	2	3	5	3	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	DC-730 thur DC-739
3	C-5 to Chem. Mrkt. Freeport (Isoprene/Pentadiene C	440	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	and WBC25,26,27,28
4	C-6 to Gasoline (Isoprene/Pentadiene Crude)	440	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	5	6	5	5	5	5	5	5	5	5	1	5	6	5	5	5	5	5	5	5	5	5	5	have Placte 3066 lined tanks
5	Cumene (Isopropylbenzene)	520	4	0	0	0		2	2	0	0	2	0	0	3	0	1	3	1	20	0	20	6	4	6	5	5	5	5	5	5	5	5	4	5	6	6	6	5	5	5	6	5	5	5	5	SS piping and SS
6	Dicyclopentadiene	440	4	0	0	0	44		4	0	0	84	0	0	3	0	1	3	3	3	3		5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	or nickel clad pump
7	Ethylbenzene	520	2	0	0	0	2	4		0	0	2	0	0	2	0	1	2	0	0	0	0	6	4	6	5	5	5	5	5	5	5	5	3	5	6	6	6	5	5	5	6	5	5	5	5	5	
8	Fuel Oil, Resin Oil 890	280	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	HC Blend 5-8 (Hydrocarbon Blend 5040 and 7000)	440	44	0	0	0	44	4	3	0		84	0	0	3	0	2	3	3	41	3	44	5	5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
10	Isoprene (2-methyl- 1,3 Butadiene)	440	44	0	0	0	44	28	28	0	44		44	0	28	0	28	44	44	44	28	44	6	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
11	LA Blendstock	440	44	2	0	0	4	4	4	0	0	84		0	3	0	0	3	3	44	3	44	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	
12	Naphtha (Petroleum Naphtha)	280	56	0	0	0	6	84	84	0	0	3	1		3	0	0	56	56	1	84	0	6	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
13	Piperylene (1,3 Pentadiene)	440	44	0	0	0	44	3	28	0	44	1	44	0		0	28	44	44	44	28	44	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	Note 2: DC-390 cannot be used
14	Pyrolysis Gasoline (Odpalene, DAC, BHB)	440	56	0	0	0	56	4	4	0	1	4	4	1	4		4	5	5	56	4	56	6	5	5	5	5	5	5	5	5	5	5	1	5	6	5	5	5	5	5	5	5	5	5	5	5	
15	Resin Oil (Resin 890,880), Aromatic RO	440	56	0	0	0	44	4	4	0	0	84	0	0	3	0		5	3	44	3	44	5	5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	Note 3: DC-352, DC-353
16	Styrene	520	44	0	0	0	44	44	28	0	44	28	44	28	28	28	28		28	44	28	44	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	DC-730 thur DC-739
17	Styrene (Crude)	320	44	0	0	0	44	44	28	0	44	28	44	28	28	28	28	28		44	28	44	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	and WBC25,26,27,28
18	Toluene to HDA (Call DAC for all others shipments)	440	2	0	0	0	2	2	2	0	0	2	0	0	2	0	1	2	1		0	0	6	4	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	have Placte 3066 lined tanks
19	TX to Gasoline (Toluene Xylene Mixture)	440	2	0	0	0	2	2	2	0	0	2	0	0	2	0	1	44	1	0		0	6	4	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	SS piping and SS
20	TX to HDA (Toluene Xylene Mixture)	440	2	0	0	0	2	2	2	0	0	2	0	0	2	0	1	44	1	0	0		6	4	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	or nickel clad pump.
21	Acetone	420	28	2	0	0	2	2	2	0	2	28	2	2	28	2	2	2	2	2	2	2		2	2	2	28	28	0	28	28	28	28	0	2	5	5	0	0	5	5	0	0	5	5	5	5	Chemicals will not be used
22	Butanol	270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2		3	5	35	35	6	35	35	35	35	6	35	5	5	6	6	5	5	6	5	5	5	5	5	to clean these barges
23	Methanol	710	28	2	0	0	2	2	2	0	2	2	0	1	2	0	2	2	2	2	0	2	2	2		28	28	28	6	28	28	28	28	28	28	5	5	6	6	5	5	6	5	5	5	5	5	since cleaning is easier due
24	Carbon Tetrachloride (Tetrachloromethane)	820	2	2	2	2	2	2	2	0	2	2	2	2	2	2	2	2	2	2	2	2	5	6	28		35	35	0	35	35	35	35	35	35	5	6	6	6	6	4	4	3	3	3	3	3	3	to the liner and the attack of
25	Chloroform (Trichloromethane)	820	5	5	5	5	5	5	5	0	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28		28	0	28	28	28	28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	the chemical on the liner.
26	Ethylene Dichloride	710	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28		0	28	28	28	28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	
27	Methyl Chloroform	710	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28	28		28	28	1	28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	
28	Methylene Chloride (Dichloromethane)	820	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28	28	6		28	28	28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	
29	Perchloroethylene (Dowper)	820	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28	28	6	28		28	28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	5
30	Trichloroethane (Acrylthene TT, Chloroethane)	710	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28	28	6	28	28		28	28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	5
31	Trichloroethylene 1,1,2 (Neu-T4, Hi-Tri)	710	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	28	28	28	6	28	28	28		28	28	5	6	6	6	6	4	4	3	3	3	3	3	3	5
32	Calcium Chloride	220	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	5	5	5	5	5	5	5	5		3	3	6	6	3	3	3	3	3	3	3	3	3	30	30
33	Caustic Soda (30%) Regular	481	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	3	3	3	3	3	3	3	3	3		3	6	6	3	3	3	3	3	3	3	3	3	3	
34	Caustic Soda (Low Salt)	481	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	28	3	3	3	3	3	3	3	3	3	0		6	6	3	3	3	3	3	3	3	3	3	3	
35	Diethanolamine	270	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	0	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	6	
36	Ethanolamine	270	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	0	6	6	6	6	6	6	6	6	6	6	6	6		6	6	6	6	6	6	6	6	6	6	
37	Dowanol EB (Ethylene Glycol Monobutyl Ether)	270	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	3	35	35	35	6	35	35	35	35	3	3	3	6	6		3	3	3	3	3	3	3	3	3	
38	Dowanol PM (Propylene Glycol Methyl Ether)	270	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3		3	3	3	3	3	3	3	3	
39	Dowfrath	330	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3		3	3	3	3	3	3	3	
40	Diethylene Glycol	810	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3		3	0	1	3	3	3	
41	Ethylene Glycol Fiber	810	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3	3		0	0	3	3	3	
42	Ethylene Glycol Mid	810	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3	3	0		0	3	3	3	
43	Ethylene Glycol Regular	810	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3	3	0	0		3	3	3	
44	Propylene Glycol Industrial	330	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3	3	3	3	3		3	3	
45	Propylene Glycol USP	330	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	3	3	3	35	35	35	6	35	35	35	35	3	3	3	6	6	3	3	3	3	3	3	3	3		3	

0. NO CLEANING REQUIRED

3. HOT WATER WASH.

DO A 047424 CONFIDENTIAL

11/2/93

5. CANNOT LOAD DIRECTLY BEHIND

6. [illegible]

Milton Rudolf 804-353 8639