EDC PLANT SAFETY STUDY RESULTS

HANDOUT SLIDE AND CHECKLIST

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1990 CONFERENCE

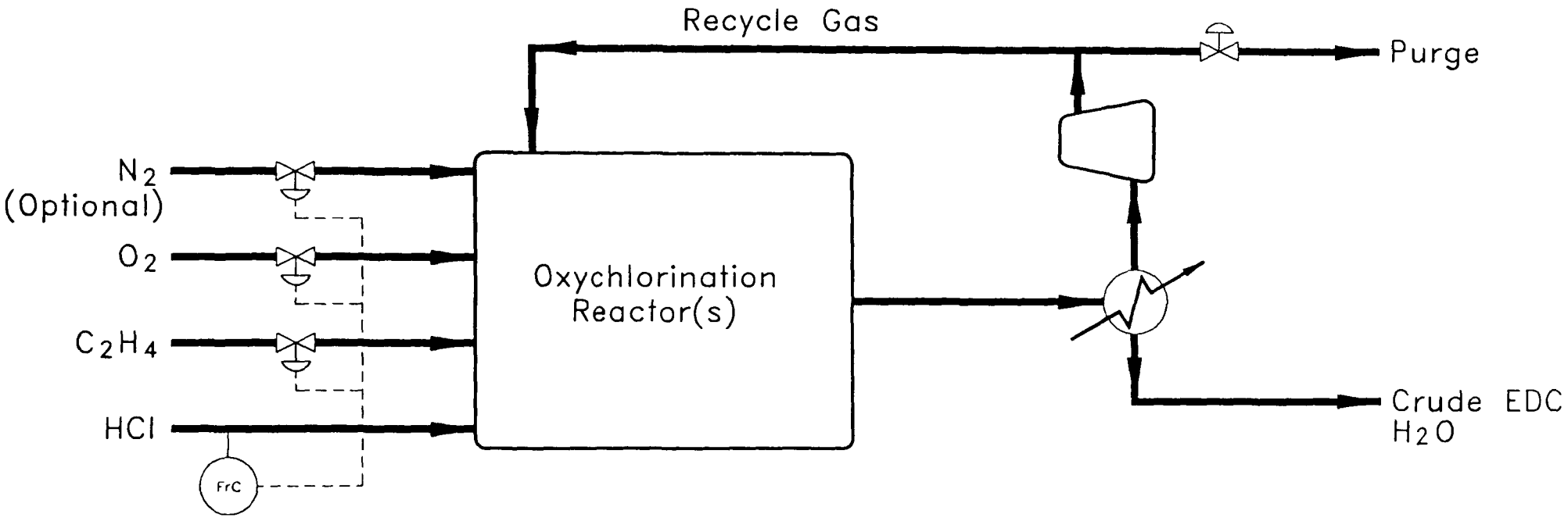
PREMISE NO. I

RTED FEEDSTOCKS ARE REASONABLY CONSTANT
)MPOSITION.

PREMISE NO. II

PLANT GAS MIXTURES ARE NOT EXPLOSIVE IF
CONTAIN NO OXYGEN.

Oxygen-Based Oxychlorination



$$C_2H_4 + 2HCl + \tfrac{1}{2}O_2 \longrightarrow EDC + H_2O$$

Feed Stream	Potential Impurity
C_2H_4	C_2H_6
HCl	VCM
O_2	N_2
N_2	O_2

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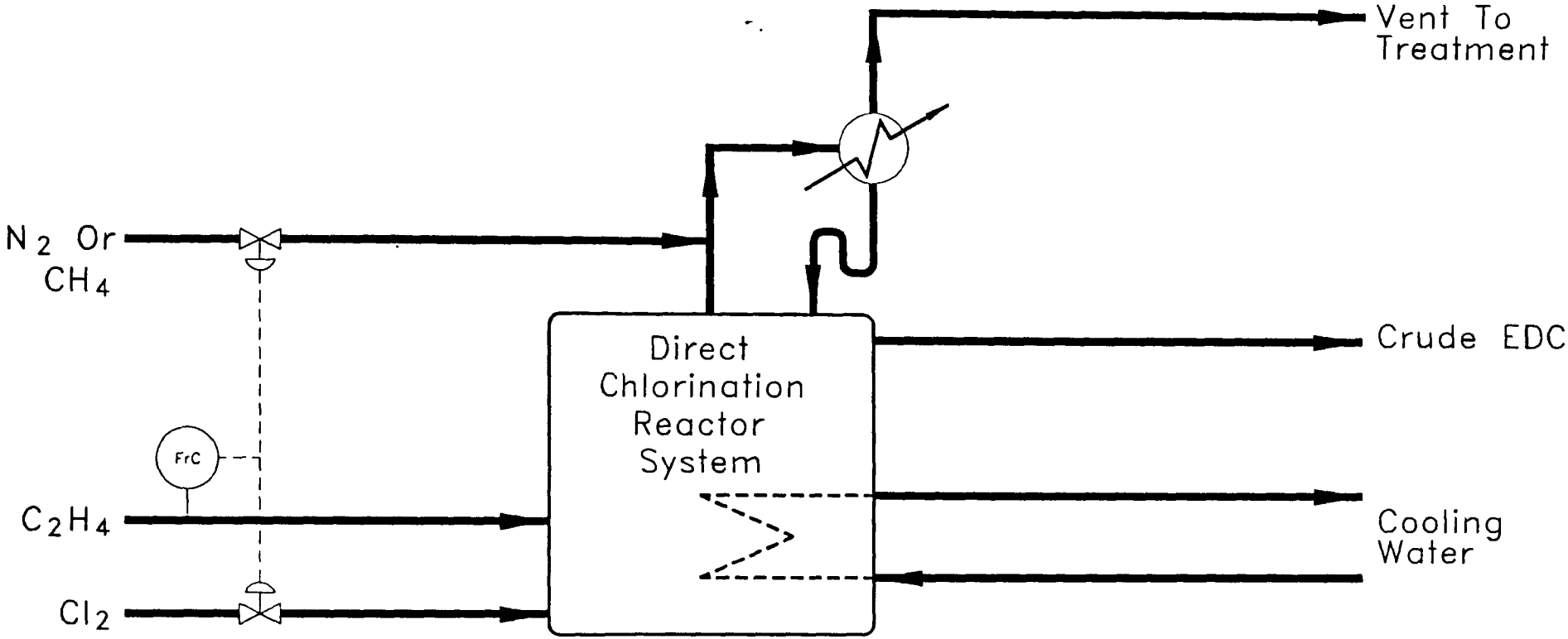
Low-Temperature Direct Chlorination



$$C_2H_4 + Cl_2 \longrightarrow EDC$$

Feed Stream	Potential Impurity
N_2	O_2
Cl_2	O_2
Cl_2	H_2
C_2H_4	C_2H_6

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Vapor–Phase Chlorination Reactions

	ΔH° 25°C, kcal/g mole
$CH_4 + 4Cl_2 \xrightarrow{h\nu} CCl_4 + 4HCl$	−104
$C_2H_4 + 6Cl_2 \xrightarrow{h\nu} 2CCl_4 + 4HCl$	−167
$C_2H_6 + 7Cl_2 \xrightarrow{h\nu} 2CCl_4 + 6HCl$	−179
$C_2H_4Cl_2$ (EDC) $+ 5Cl_2 \xrightarrow{h\nu} 2CCl_4 + 4HCl$	−124

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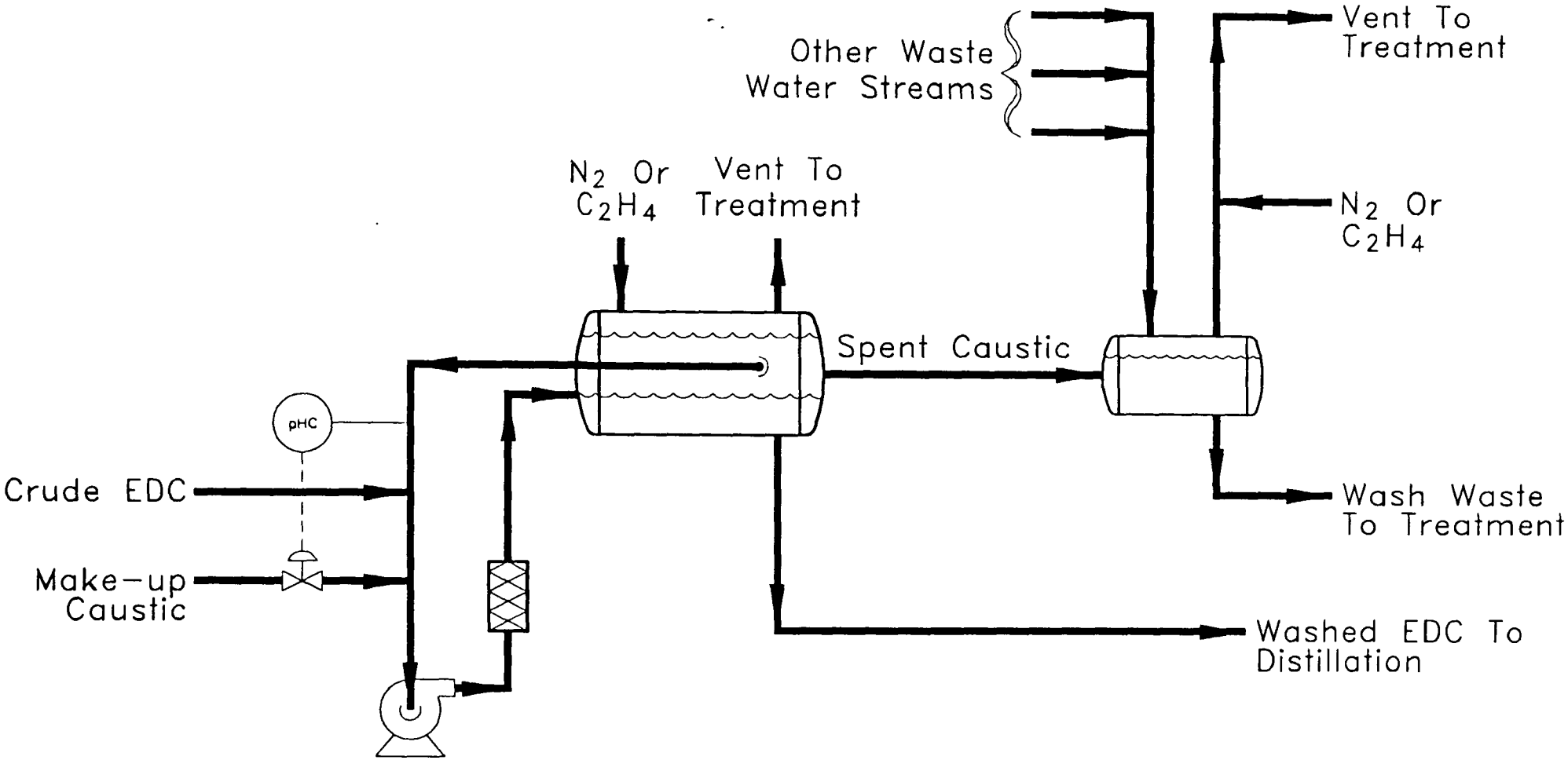
For Reference :

$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$	−337

Caustic Washing



$$2NaOH + Cl_2 \longrightarrow NaOCl + NaCl + H_2O$$ (At High pH)

$$NaOCl + 2HCl \longrightarrow NaCl + H_2O + Cl_2\uparrow$$ (At Low pH)

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RECOMMENDATIONS

I. PROTECTION AGAINST EXCURSIONS IN FEEDSTOCK COMPOSITION

- EVALUATE POSSIBLE DEVIATIONS AND THEIR POTENTIAL EFFECT ON THE PROCESS (SEE CHECKLIST).
- INSTALL ANALYZERS ON CRITICAL FEED STREAMS.

II. PROTECTION AGAINST CHLORINE-FUEL EXPLOSIONS

- GENERAL:
  1. REVIEW CHLORINATOR AND DOWNSTREAM UNITS FOR POTENTIAL Cl_2 BREAKTHROUGH OR GENERATION (SEE CHECKLIST).
  2. ELIMINATE SIGHT GLASSES.
  3. INSTALL Cl_2 ANALYZERS AT VULNERABLE POINTS.
  4. EXERCISE PARTICULAR CARE WHERE HYDROCARBON GAS IS USED FOR BLANKETING.
- IN DIRECT CHLORINATOR:
  1. REGULATE COOLING WATER PRESSURE TO AVOID WATER INGRESS.
  2. PROVIDE LEAK DETECTION DEVICES.
  3. INSTALL ALARMS/TRIPS ON HIGH PRESSURE AND/OR HIGH VENT FLOW.
- IN EDC WASHING:
  1. REVIEW INTEGRITY OF pH CONTROLS.
  2. EXAMINE SPENT CAUSTIC TREATMENT SYSTEM FOR HYPOCHLORITE DECOMPOSITION HAZARDS.
  3. EXAMINE EDC SYSTEM FOR CHLORINE BREAKTHROUGH HAZARDS.

EDC PLANT

FEEDSTOCK PURITY HAZARD CHECKLIST

IF THIS STREAM:	HAD A LARGE AND UNEXPECTED INCREASE IN CONTENT OF:	WHAT POTENTIAL HAZARDS MIGHT RESULT?	HOW CAN THESE BE AVOIDED?
C_2H_4 TO OXYCHLORINATION	C_2H_6		
HCl TO OXYCHLORINATION	VCM		
O_2 TO OXYCHLORINATION	N_2		
N_2 TO VARIOUS LOCATIONS	O_2		
C_2H_4 TO DIRECT CHLORINATION	C_2H_6		
Cl_2 TO DIRECT CHLORINATION	O_2		
Cl_2 TO DIRECT CHLORINATION	H_2		

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EDC PLANT

FUEL-CHLORINE MIXTURE HAZARD CHECKLIST

I. DIRECT CHLORINATION REACTOR

A. Is the vent stream normally diluted with natural gas or fuel gas? If so, could an instrument failure or process upset give rise to a fuel gas-chlorine mixture in the vent system?

B. Could loss of cooling lead to an EDC vapor-chlorine mixture in the reactor or vent system?

C. Could water ingress "kill" the reaction, giving rise to an ethylene-chlorine gas mixture in the reactor or in the vent system?

D. Could any other process upsets (e.g., low level in the reactor vessel) cause incomplete reaction?

II. CAUSTIC WASHING/SPENT CAUSTIC TREATMENT

A. Would a loss of pH control in the caustic washing unit produce "springing" of free chlorine from dissolved hypochlorite? If so, could this form an explosive gas mixture, either with a fuel gas blanket or with chlorcarbon vapors?

B. Follow the path of the spent caustic. Is there any point downstream where it might be acidified, releasing chlorine in the presence of hydrocarbon or chlorocarbon vapors?

C. Follow the path of the washed EDC. If, due to loss of pH control, dissolved chlorine were not removed from the EDC, where would it eventually concentrate? Could this be in a place (e.g., the azeotrope drying column overhead system) where it could form an explosive mixture with light ends vapors or with blanketing gas?