

CONF-840805--30

GAS CLEANUP FOR INDIRECT LIQUEFACTION*

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GAS CLEANUP FOR INDIRECT LIQUEFACTION

PRESENTED BY

ROBERT M. WHAM

OAK RIDGE NATIONAL LABORATORY

AUGUST 26, 1984

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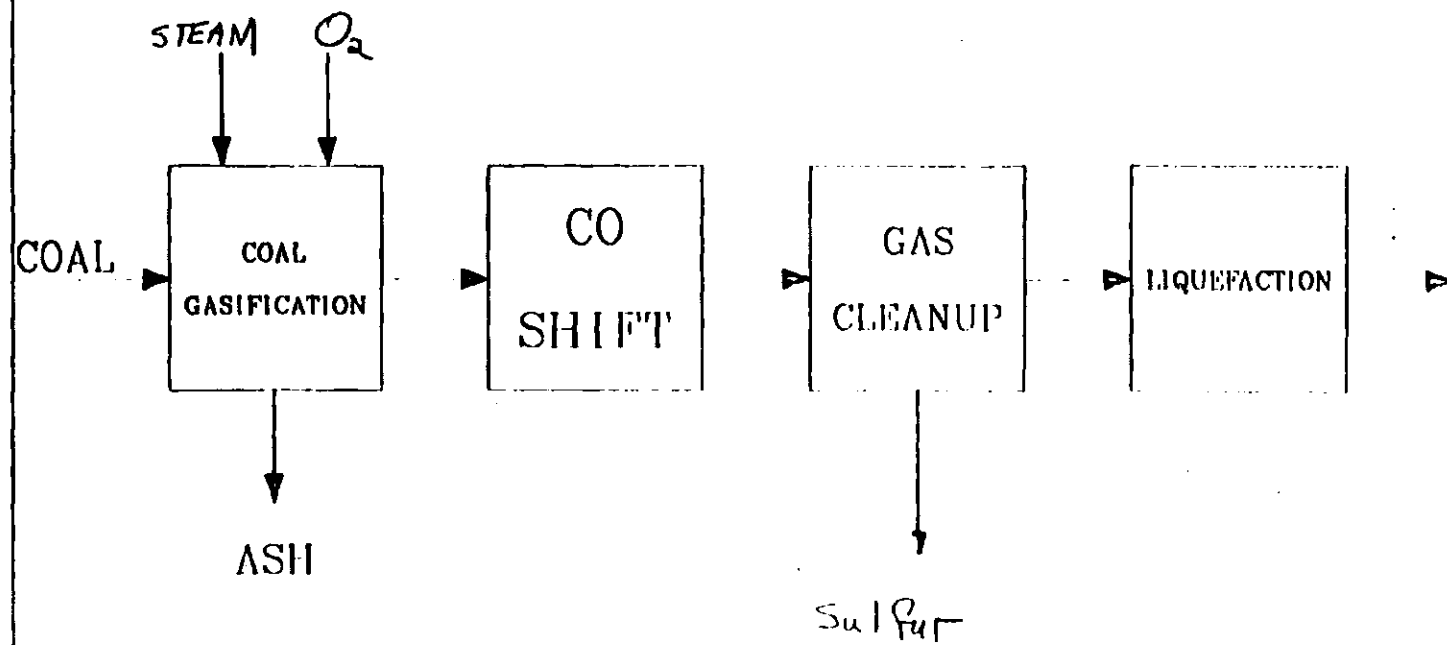
WHY IS ACID GAS TREATING REQUIRED ?

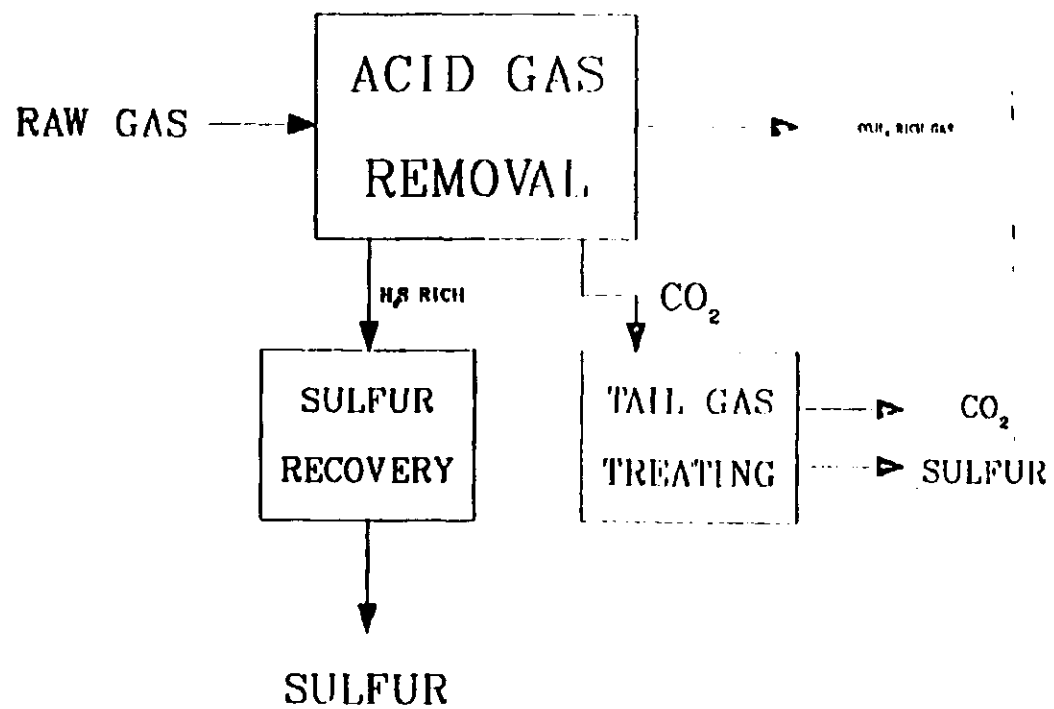
- CLEANUP GAS FOR HYDROCARBON PRODUCTION
- CATALYST USED IN HYDROCARBON PRODUCTION IS GENERALLY VERY SENSITIVE TO SULFUR (1 ppmv)
- COMPOUNDS WHICH MUST BE REMOVED INCLUDE:
 - HYDROGEN SULFIDE
 - CARBONYL SULFIDE
 - CARBON DIOXIDE
 - CARBON DISULFIDE
- CARBON DIOXIDE PASSES THROUGH AS AN INERT BUT REQUIRES EXTRA PROCESSING ENERGY

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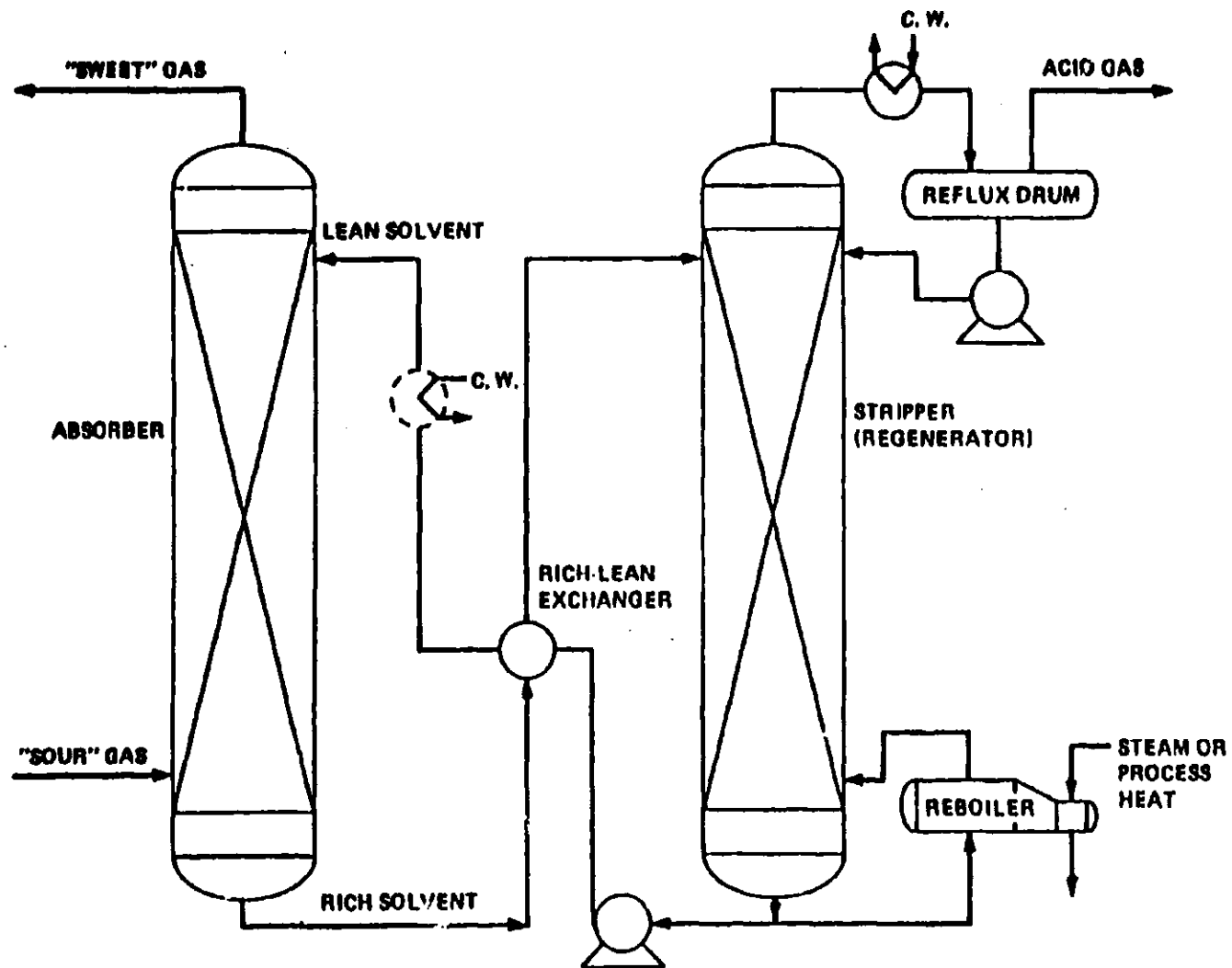
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CLASSES OF PRIMARY GAS CLEANUP

- **AMINE SYSTEMS**
- **ALKALI SALTS**
- **PHYSICAL ABSORPTION**
- **MIXED SOLVENTS**
- **ABSORPTION - OXIDATION**
-
- **HIGH TEMPERATURE SYSTEMS**
- **MOLECULAR SIEVES**

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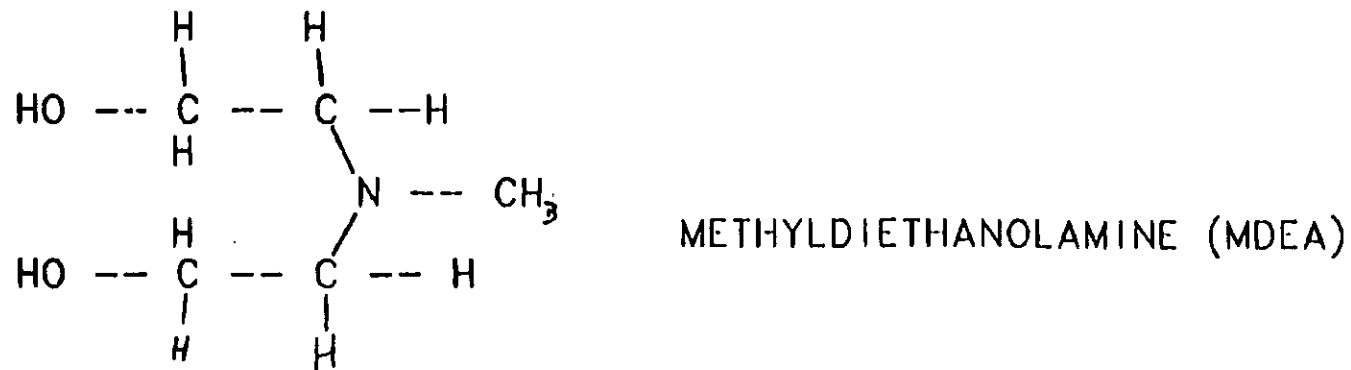
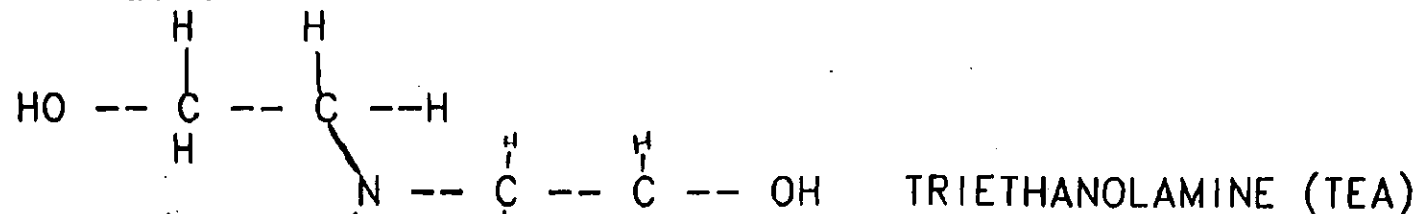
TYPICAL ACID GAS REMOVAL PROCESS (AMINE, CARBONATE, PHYSICAL)

AMINE SYSTEMS

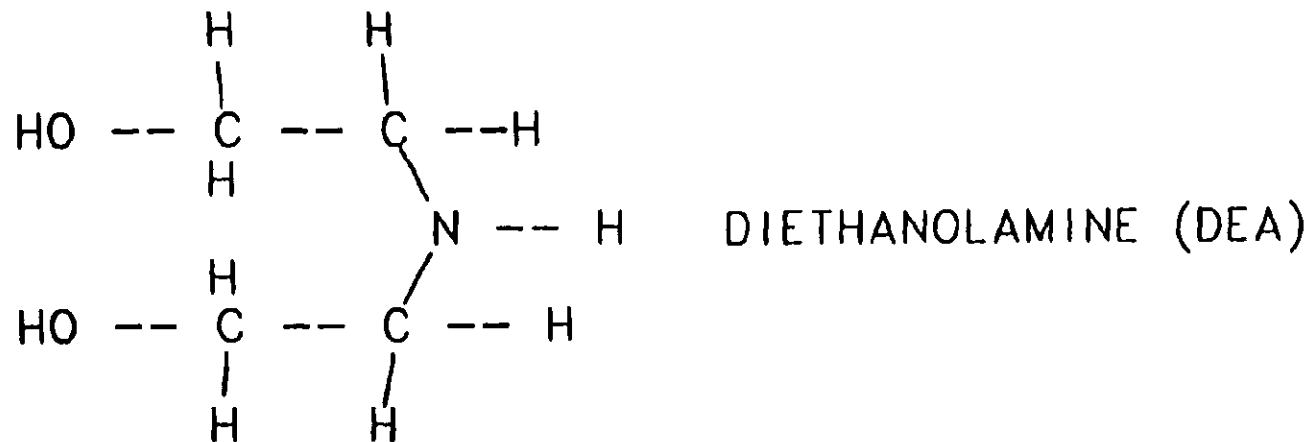
- AMINES REACT WITH ACID GASES AS GASES ARE FED THROUGH AN ABSORBER COLUMN
- SELECTIVITY GOES AS $3 > 2 > 1$
- REACTIVITY DECREASES WITH INCREASE IN NUMBER OF CARBON ATOMS IN CHAIN
- REGENERATION OCCURS THERMALLY IN A SEPARATE UNIT
STEAM REBOILER PROVIDES HEAT FOR REGENERATION
- MEA FORMS COMPOUNDS WITH CARBONYL SULFIDE
AND CARBON DISULFIDE WHICH DO NOT THERMALLY DECOMPOSE

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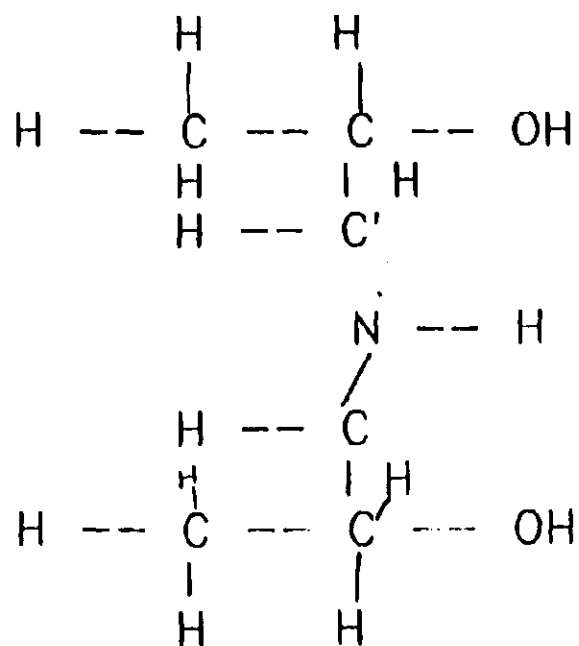
COMMONLY USED TERTIARY AMINES



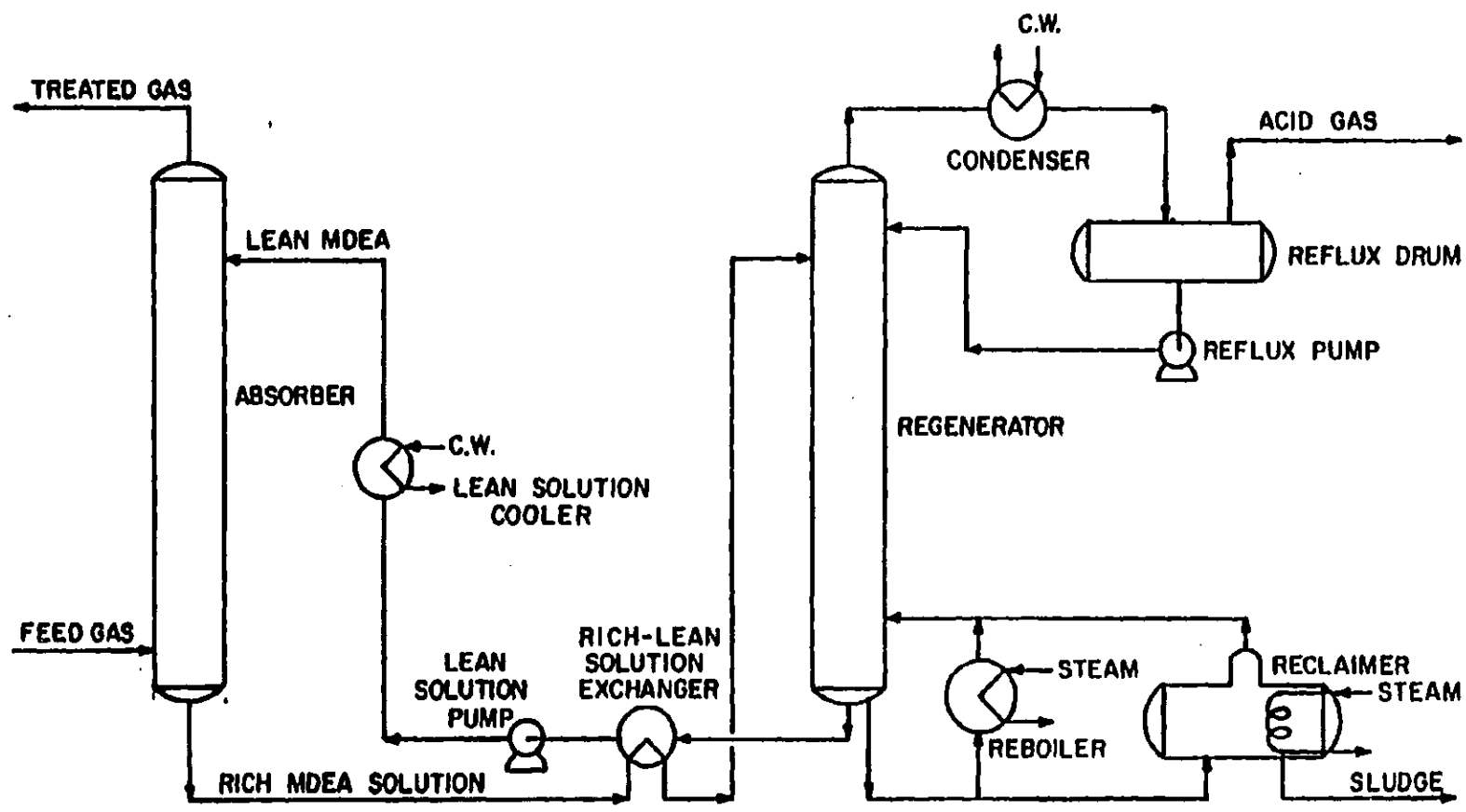
COMMONLY USED SECONDARY AMINES



DIISOPROPANOLAMINE
(DIPA)



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TYPICAL FLOWSHEET FOR MDEA PROCESS

Vendors

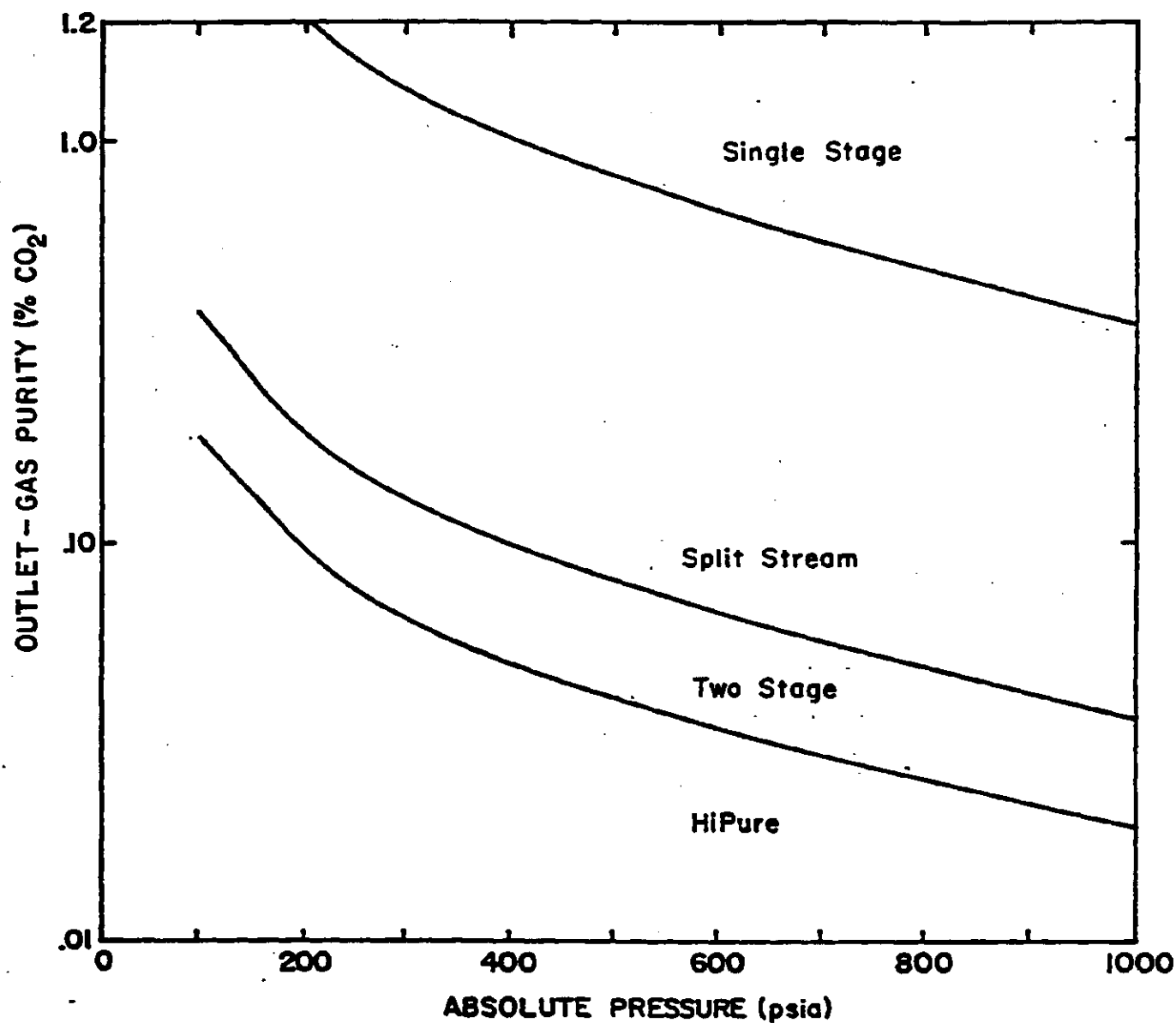
Dow MEDA

SKM DIPA

ALKALI SALT SYSTEMS

- SODIUM OR POTASSIUM CARBONATE, PHOSPHATE, PHENOLATE, AND BORATE WITH AMINE AND ACTIVATORS ARE USED IN SOLUTION
- POTASSIUM SALTS OF WEAK ORGANIC ACIDS ARE ALSO USED
- AMINE SYSTEMS CAN OPERATE AT HIGHER TEMPERATURES AND ACID GAS PARTIAL PRESSURES THAN AMINE SYSTEMS
- THERMAL REGENERATION OF SALT SOLUTION OCCURS IN SEPARATE VESSEL
 - ENERGY REQUIREMENT LESS THAN AMINE SYSTEMS

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GENERAL GUIDE TO BENFIELD PROCESS CONFIGURATION

COMMERCIAL ALKALI SALT SYSTEMS

- ALDAZID DIK DAVY POWERGAS, INC
- BENFIELD BENFIELD CORP.
- CATACARB A. G. EICKMEYER

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PHYSICAL ABSORPTION SYSTEMS

REMOVE ACID GASES BASED ON SOLUBILITY IN SELECTED SOLVENT

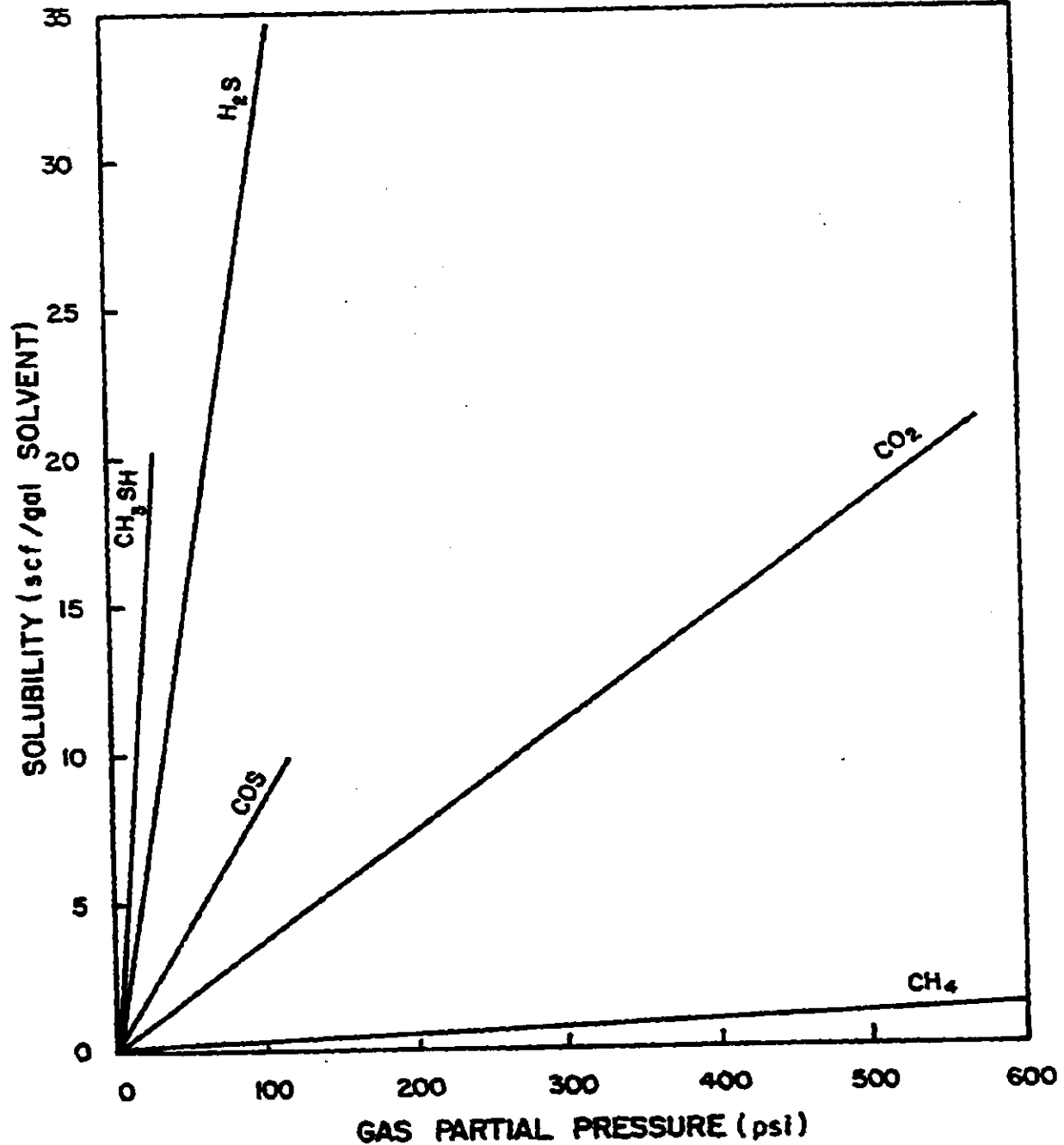
- COLD METHANOL IS USED IN RECTISOL
- SELEXOL USES DMPEG
(DIMETHYLETHER POLYETHYLENE GLYCOL)

SOLVENT REGENERATION OCCURS BY FLASHING
AT LOWER PRESSURES AND HIGHER TEMPERATURES

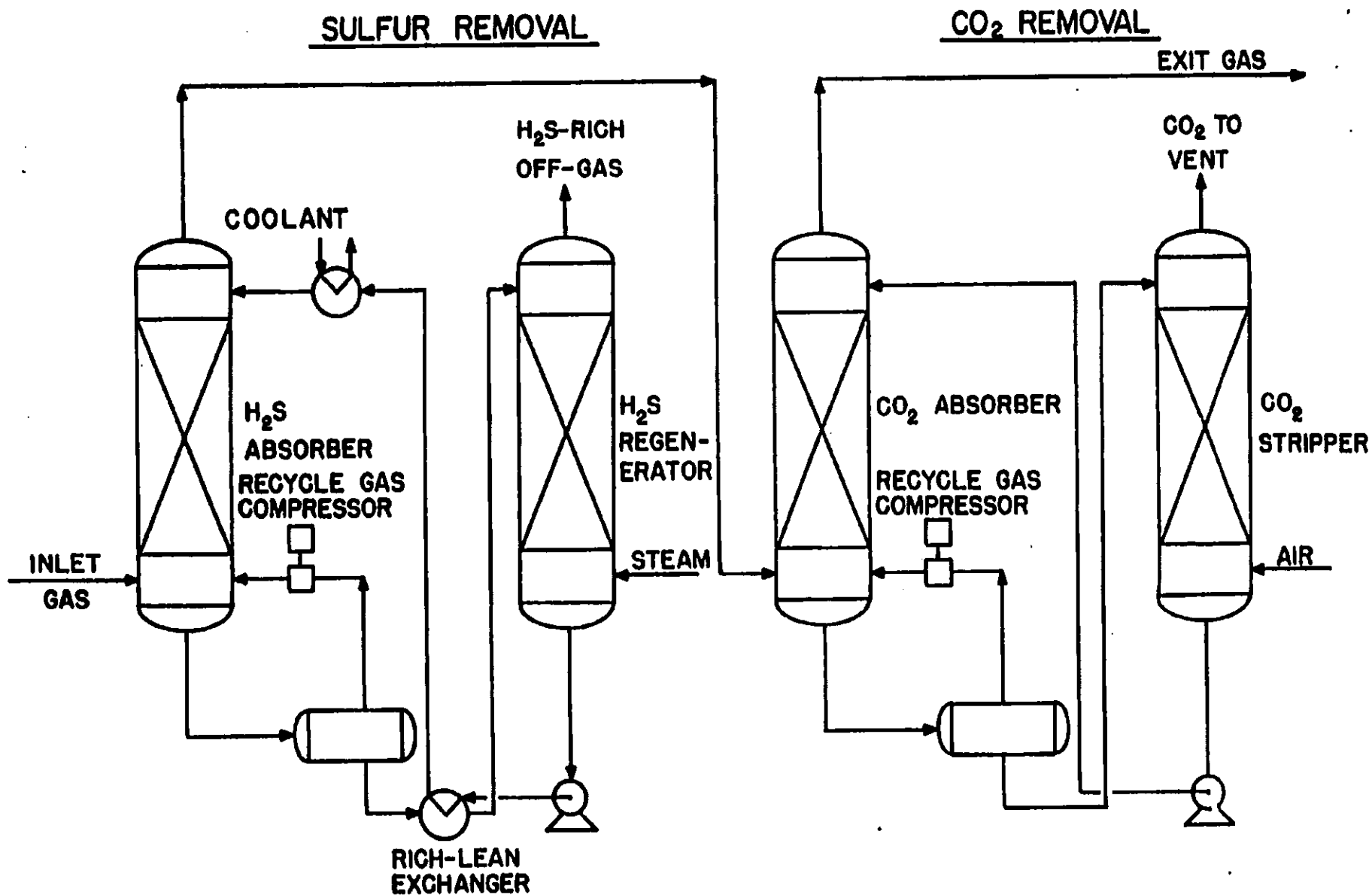
- BOTH PROCESSES ARE CAPABLE OF EITHER SELECTIVE
REMOVAL OR REGENERATION

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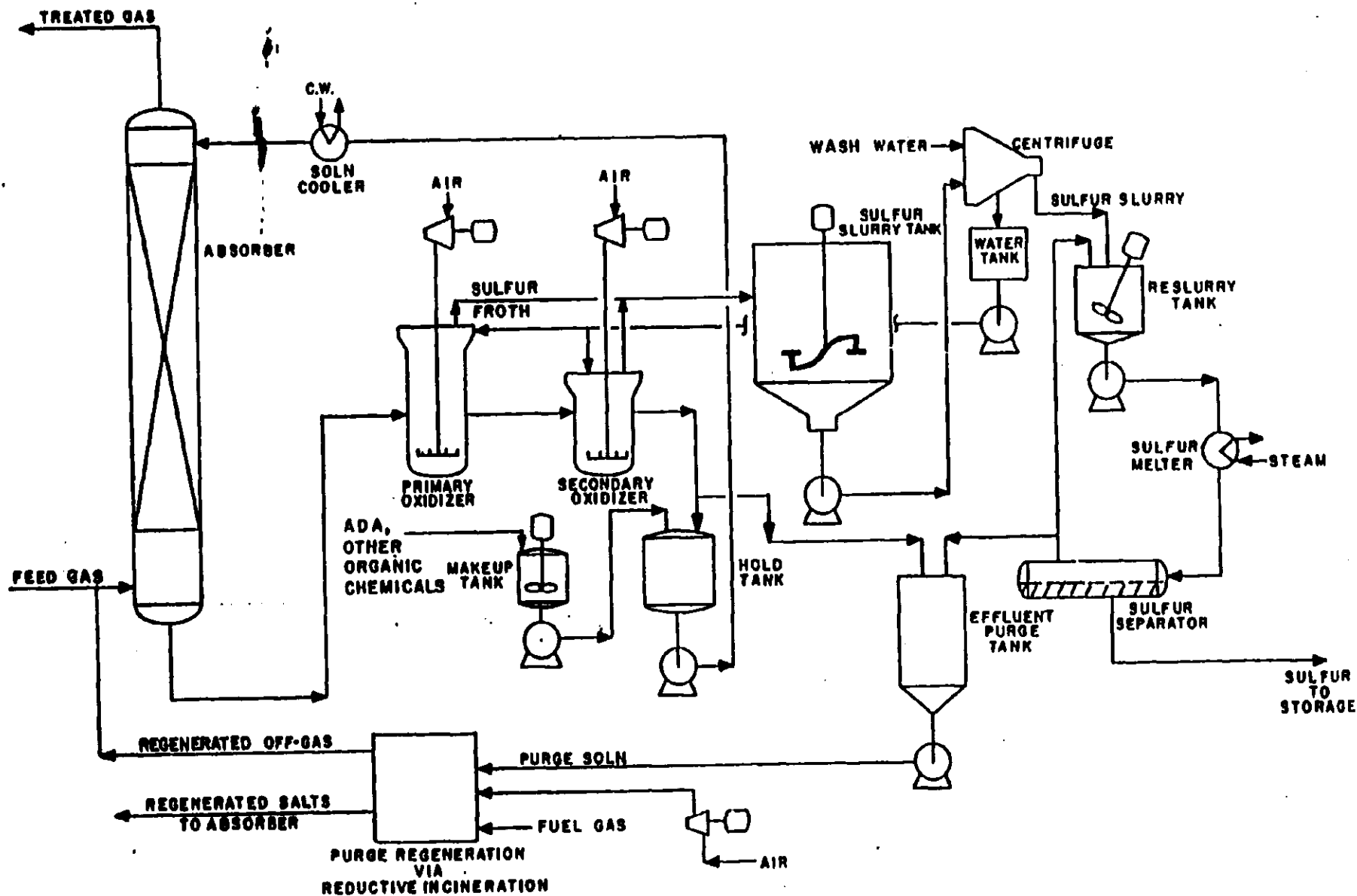
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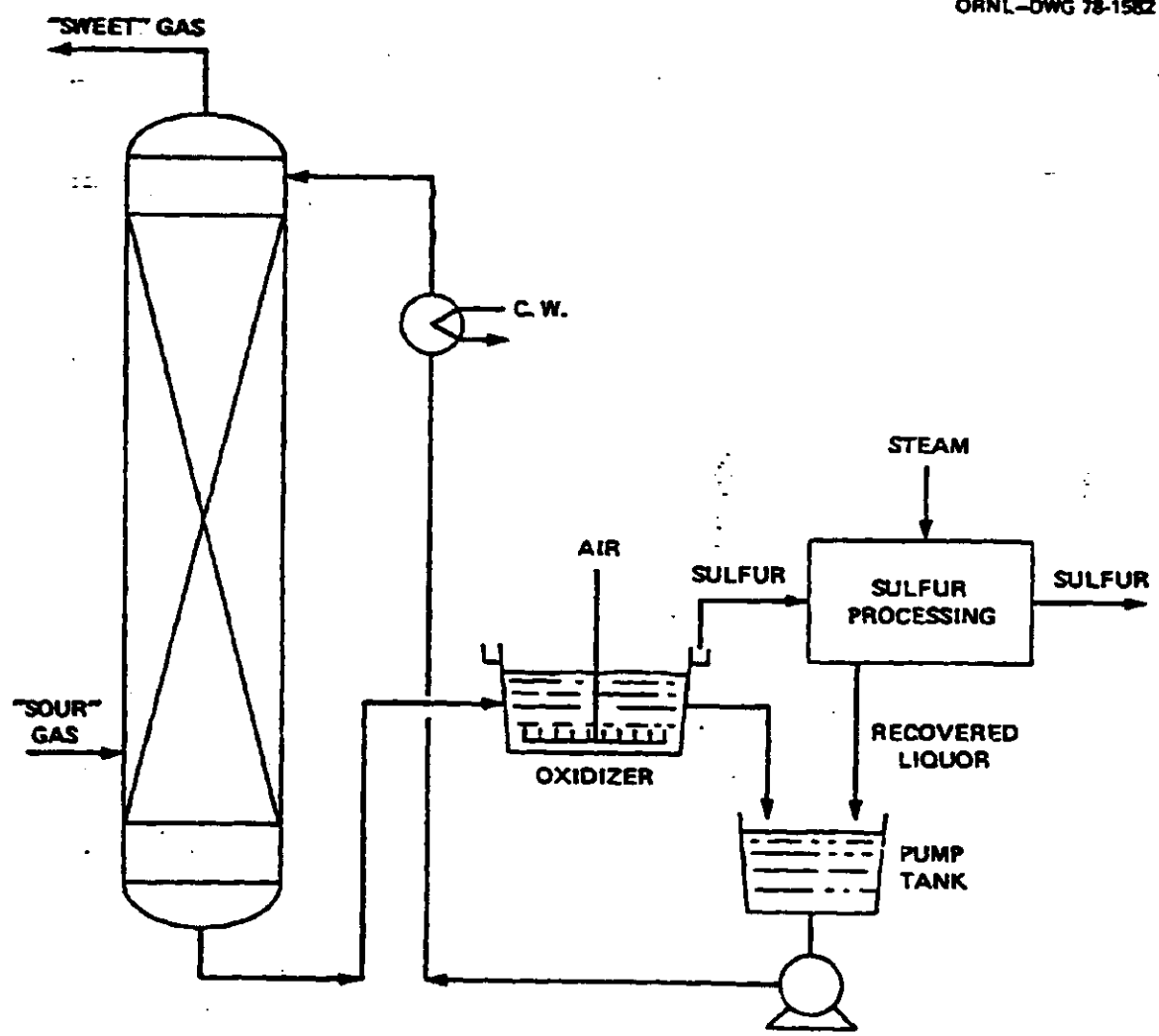
SOLUBILITY OF SELECTED GASES IN SELEXOL SOLVENT AT 70°F



SELEXOL SELECTIVE ACID GAS REMOVAL



STRETFORD PROCESS FLOWSHEET



SIMPLIFIED FLOWSHEET OF TYPICAL REDOX PROCESS (STRETFORD)

MIXED SOLVENT SYSTEMS

- PRIME INTEREST IS IN SULFINOL

SULFOLANE AND DIISOPROPANOLAMINE USED AS SOLVENT

- LOWER SOLVENT RECIRCULATION RATE AND LOWER SOLVENT

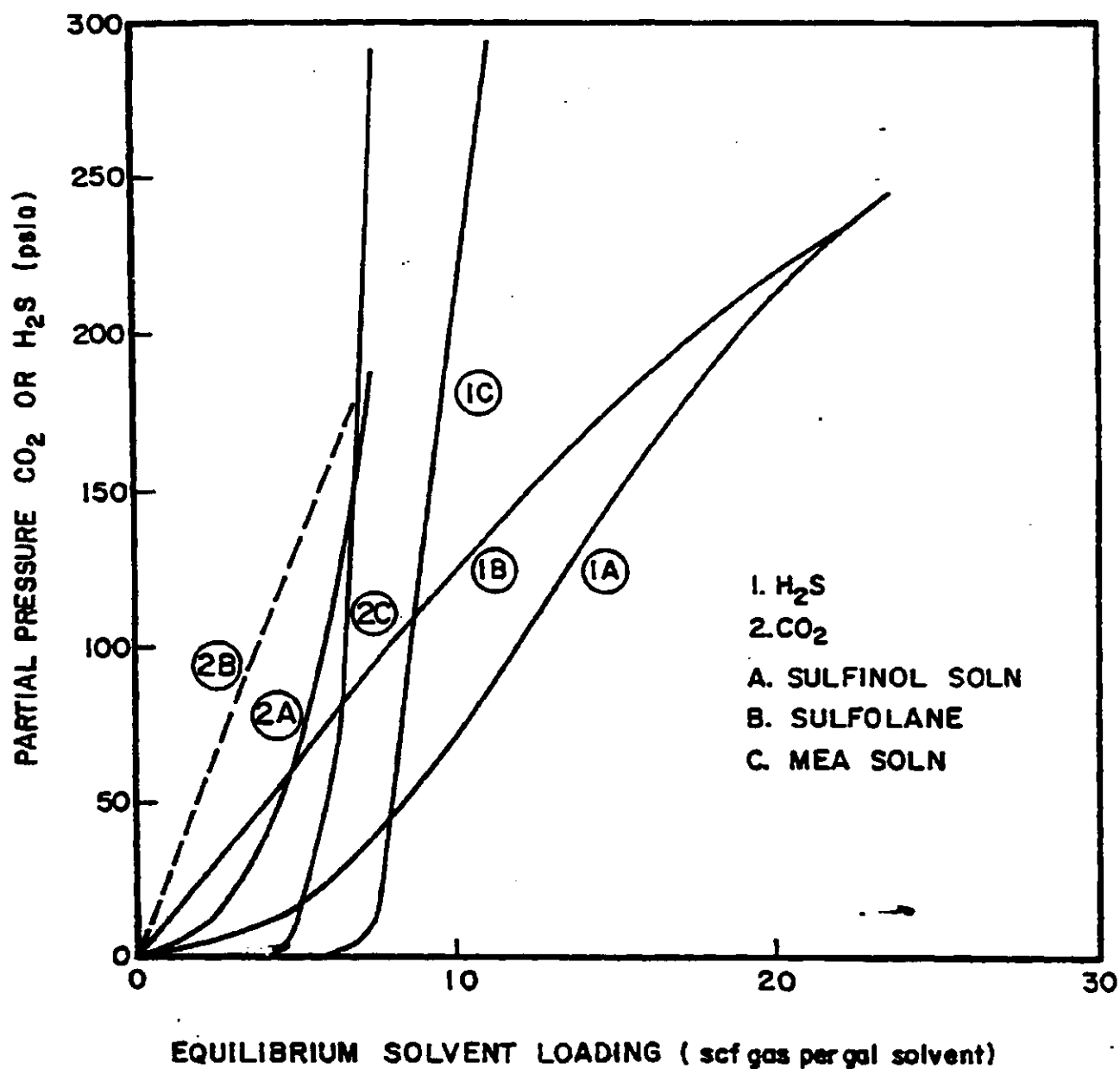
VAPORIZATION LOSSES ARE CLAIMED

- DISADVANTAGES INCLUDE -

- HIGHER SOLVENT COST

- ABSORPTION OF HEAVY HYDROCARBONS

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ACID GAS SOLUBILITIES IN VARIOUS SOLVENTS

SULFUR RECOVERY

○ CLAUS SULFUR RECOVERY

- OXIDIZE 1/3 OF H_2S TO SO_2
- REACT H_2S AND SO_2 CATALYTICALLY TO FORM SULFUR
- TEMPERATURE OF FEED GAS 900-1200 F
- REACTION IS EXOTHERMIC AND REQUIRES HEAT REMOVAL
- 92-95% SULFUR IN FEED GAS IS RECOVERED
- TAIL GAS SENT ON FOR FURTHER TREATING

○ MCRC SULFUR RECOVERY

- VARIATION ON CLAUS PROCESS

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