Great Plains SYNFUELS

DAKOTA GASIFICATION COMPANY

5th Annual Ammonia Fuel Conference

Bob Fagerstrom

Dakota Gasification Company's Great Plains Synfuels Plant (GPSP)

- Concept started in early 1970s
- GPSP built by a consortium of 5 pipeline companies
- Construction began in 1981
- Synthetic Natural Gas (SNG) production began in 1984

Responsible Care

A new owner … DGC

- **A technological marvel but not a financial success…**
- **Original owners default**
  The original investors defaulted on August 1, 1985, about one year after first gas was put in the pipeline, due to the very low price of natural gas
- **DOE operation period**
  The DOE operated the plant from 1985 until 1988
- **Sold to Basin Electric Power Cooperative**
  Basin Electric purchased the plant from the DOE & formed DGC, a wholly owned subsidiary to operate the facility

Responsible Care

DGC's Great Plains Synfuels Plant
A Unique Facility

- Only commercial coal gasification facility producing synthetic natural gas
- Byproducts sales of anhydrous ammonia, liquid nitrogen, & sulfur
- Diversification of products began in 1989 with initial $25 million for capital projects for phenol/cresylic acid & xenon/krypton
- Installation of flue gas desulfurization project to produce DakSul45 in 1996
- 1,100 tons/day Anhydrous Ammonia Plant completed in 1997
- Carbon Dioxide (CO_2) Pipeline for Enhanced Oil Recovery (EOR) in 2000

Responsible Care

Committed to Health, Safety & the Environment

- Environmentally Compliant
- Enhanced Plant Efficiencies
- Adopted ACC's Responsible Care Policy 2007

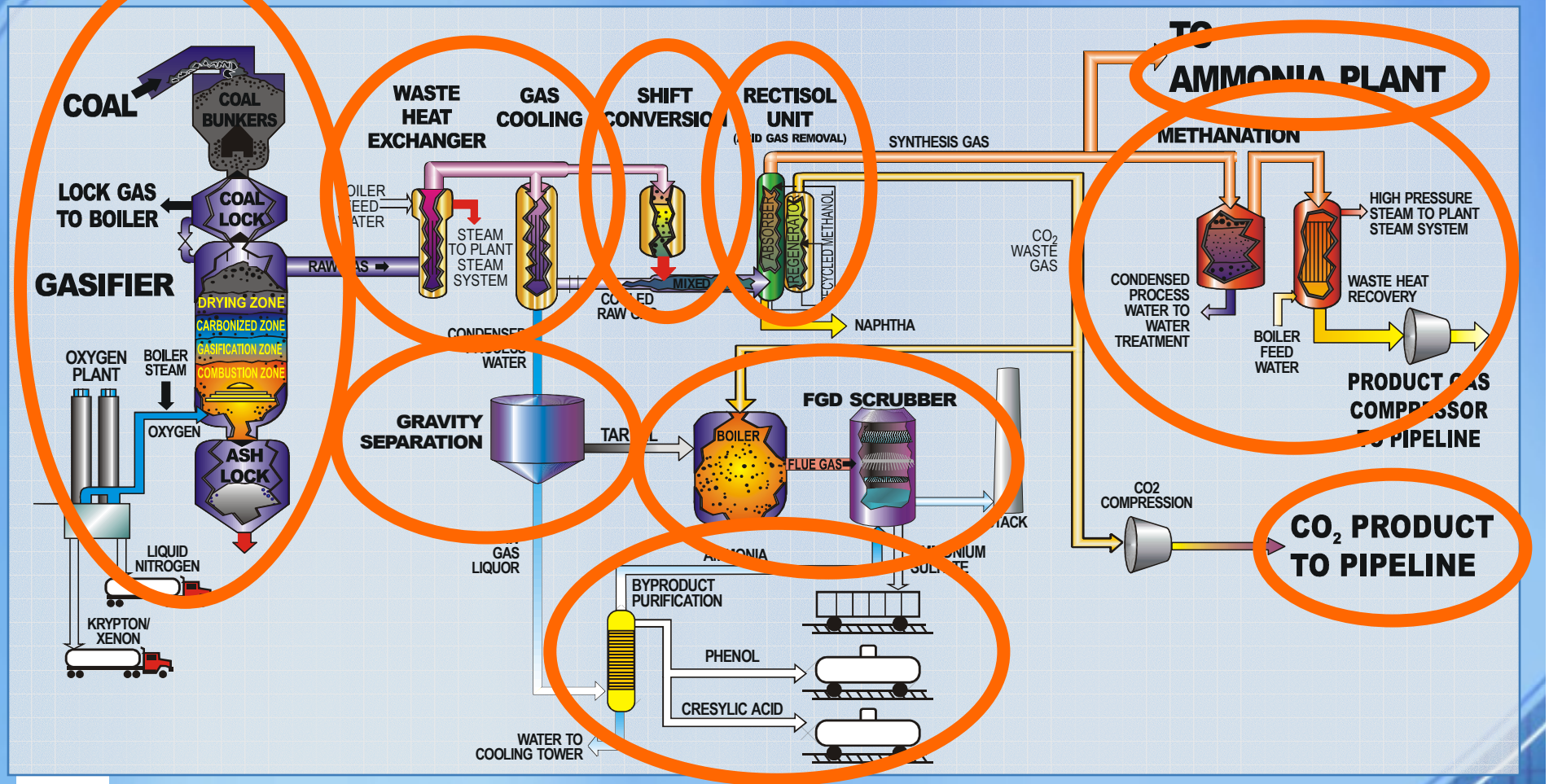
The Environment

- Ambient air is monitored continuously at four sites for SO_2 & NO_X
- Groundwater is monitored at more than 100 wells
- Reduced CO_2 emissions by 49% since 2000 through carbon capture and sequestration activities
- Ammonium Sulfate - an environmentally friendly product
- BNSF Railway 2007 Product Stewardship Award
- Surrounding communities outreach
- Reverse 911 system

GPSP Today

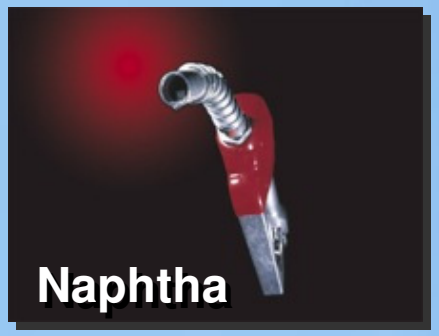
- Work Force: more than 700 people
- Coal Usage: ≈ 18,000 tons daily
- Daily Production Capacity: 170 mmscfd SNG, along with many byproducts
- Annual Plant Loading Factor: 90-92%
- Reduced CO_2 emissions by 49% since 2000

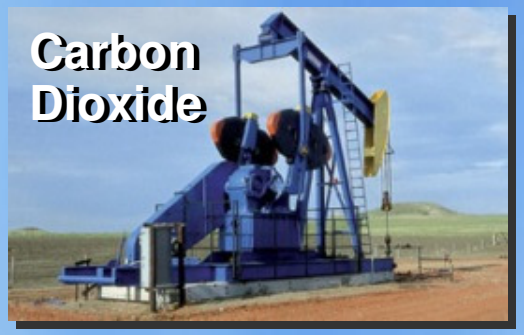
Great Plains Synfuels Plant Process Flow

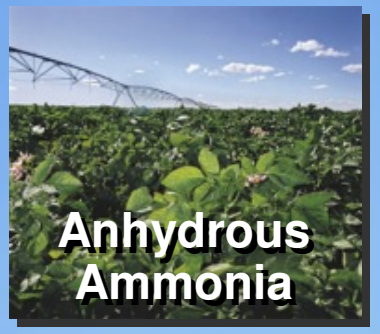


Responsible Care

Byproducts


Naphtha

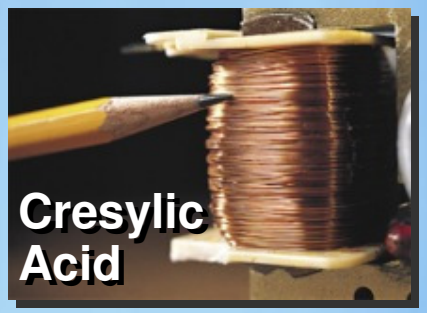

Carbon
Dioxide


Anhydrous
Ammonia


Liquid Nitrogen


Krypton/Xenon

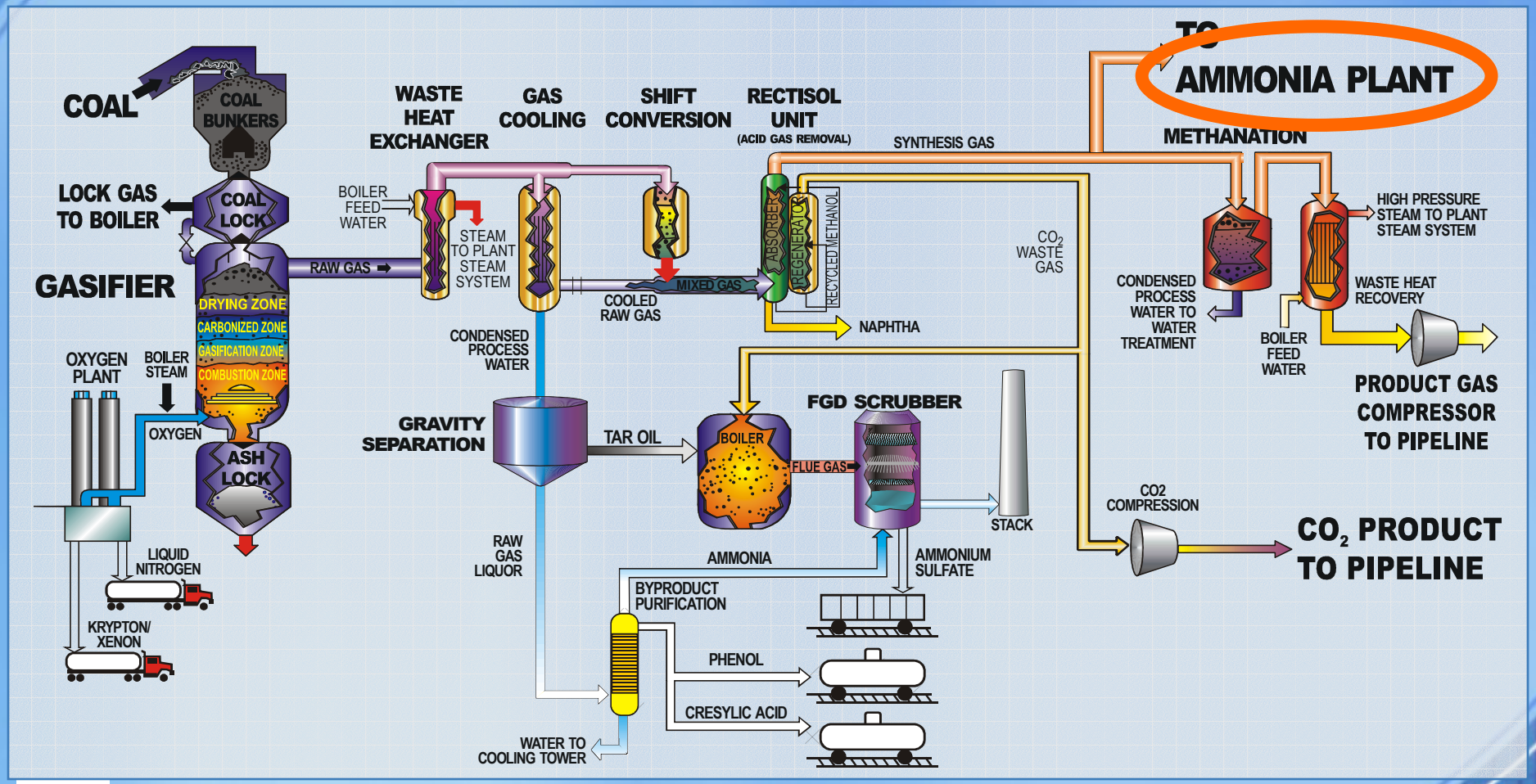

Natural Gas


Cresylic
Acid


Ammonium
Sulfate

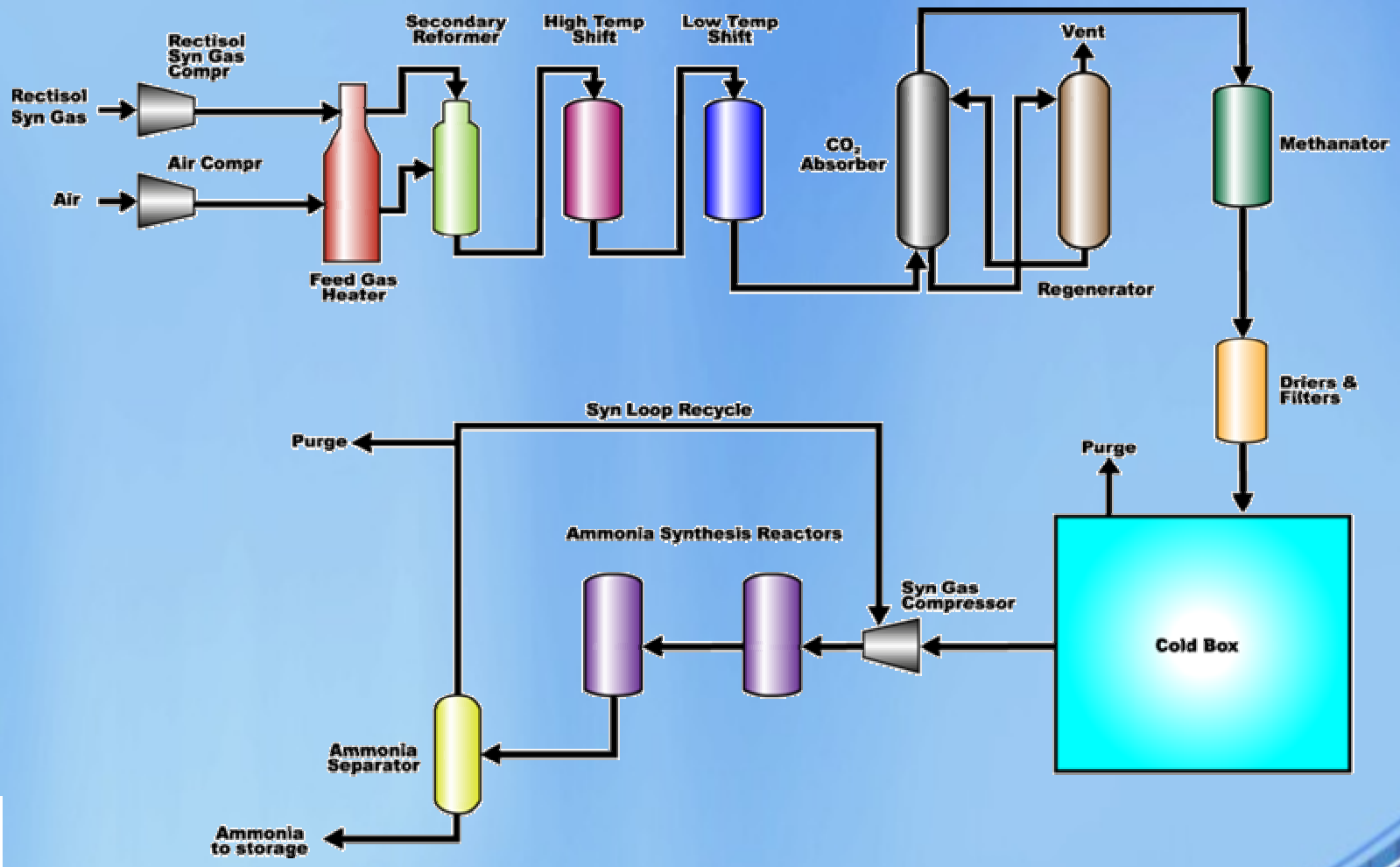

Phenols

Great Plains Synfuels Plant Process Flow

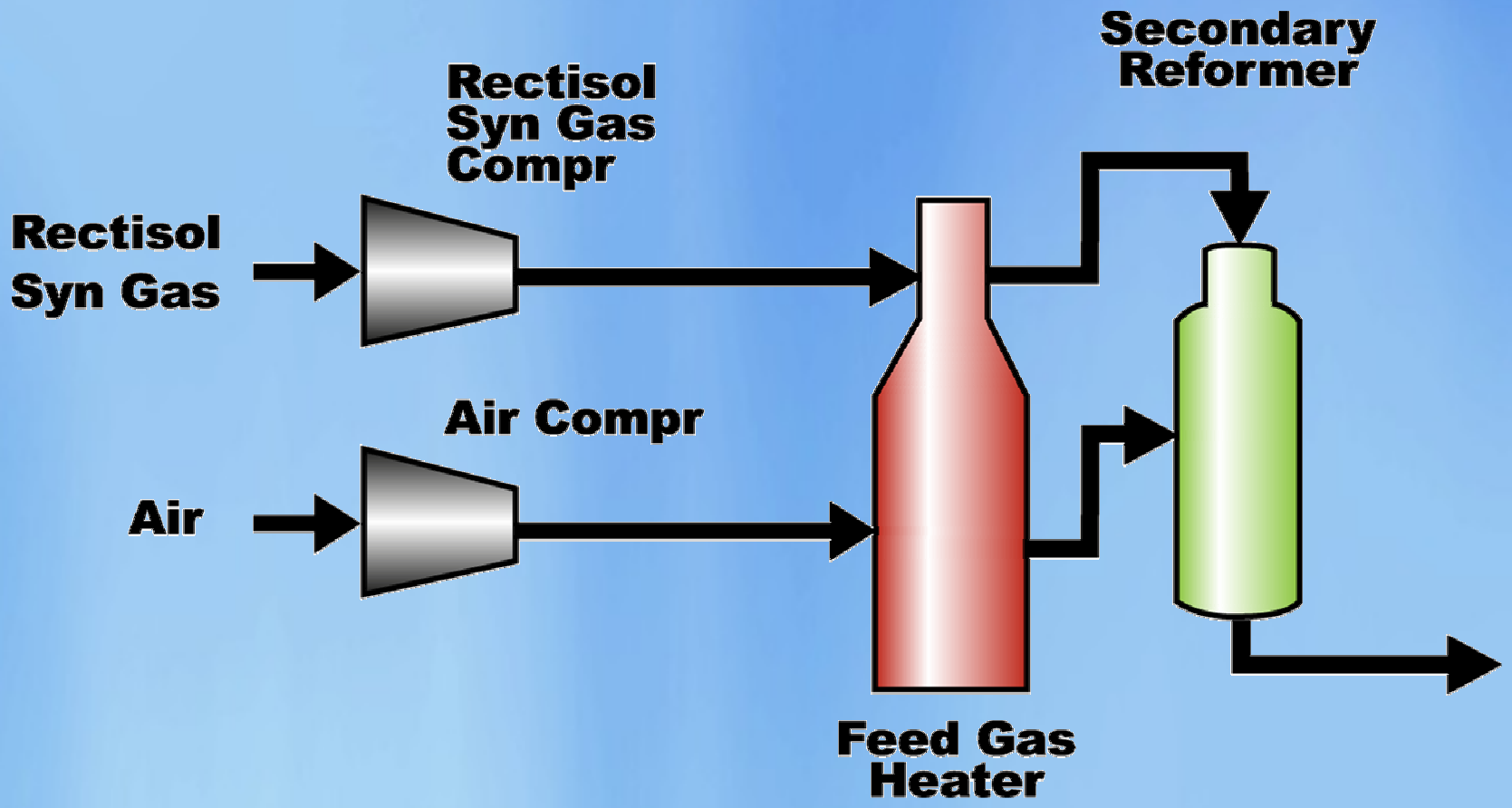


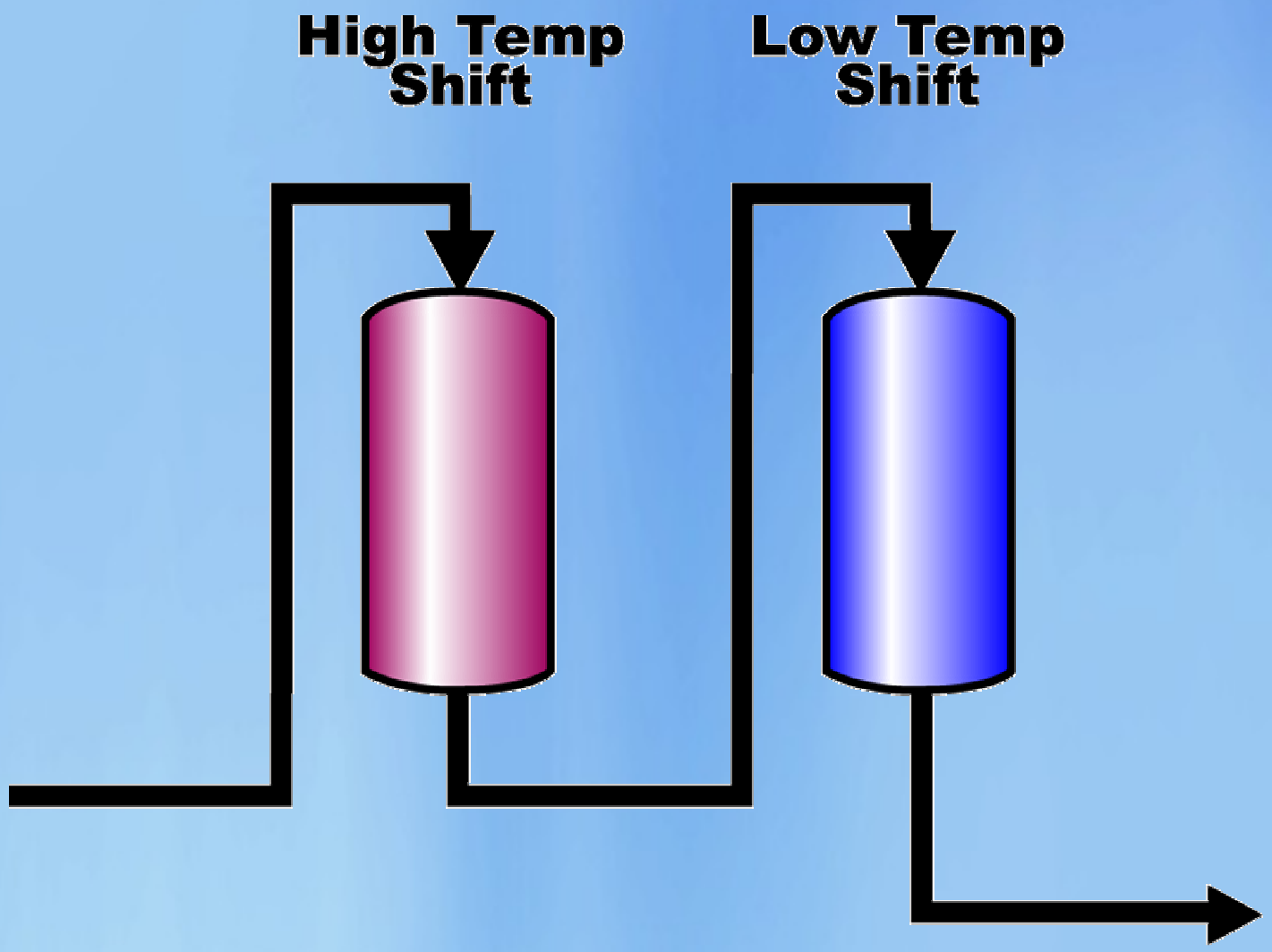
Responsible Care

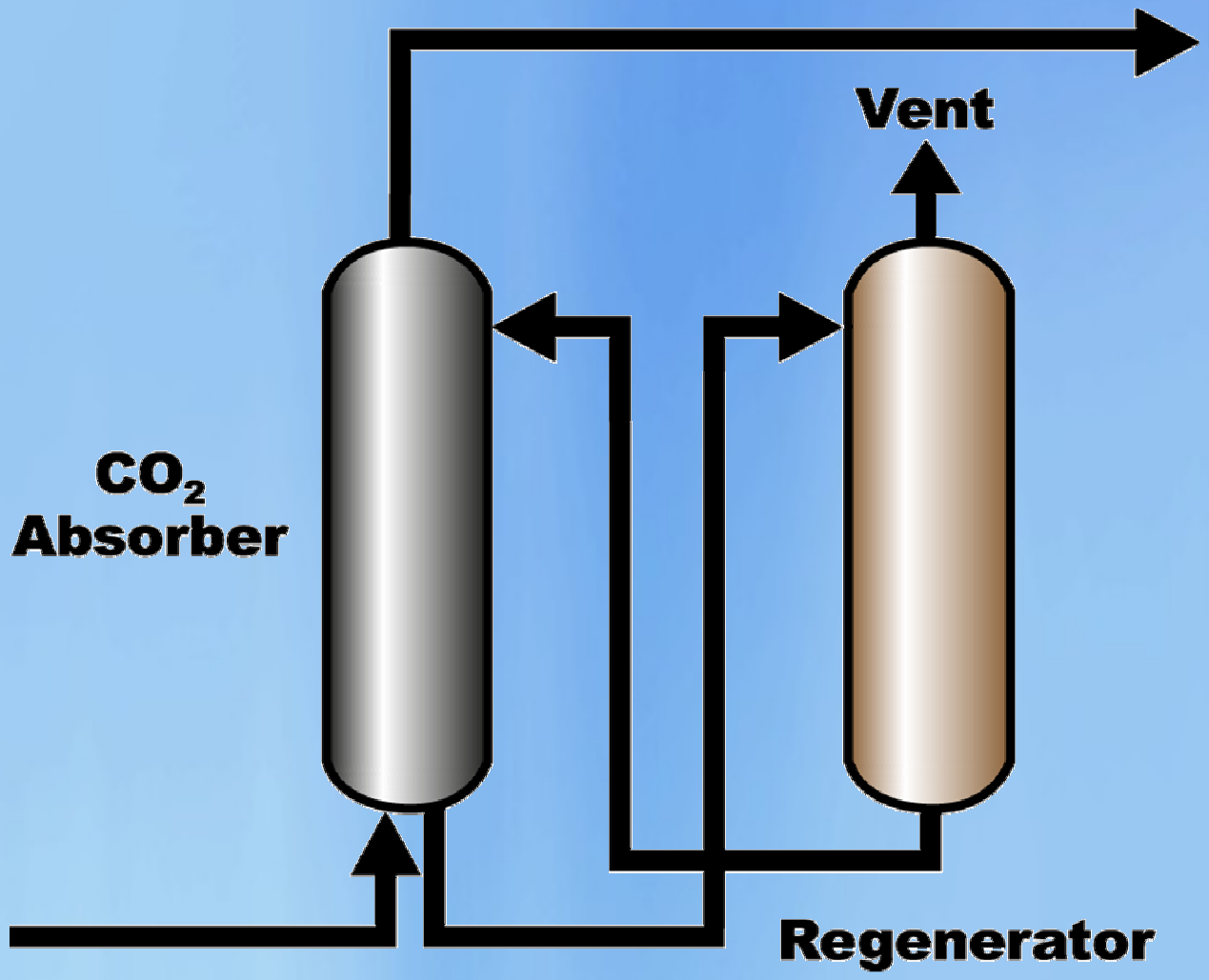
Simplified Ammonia Process

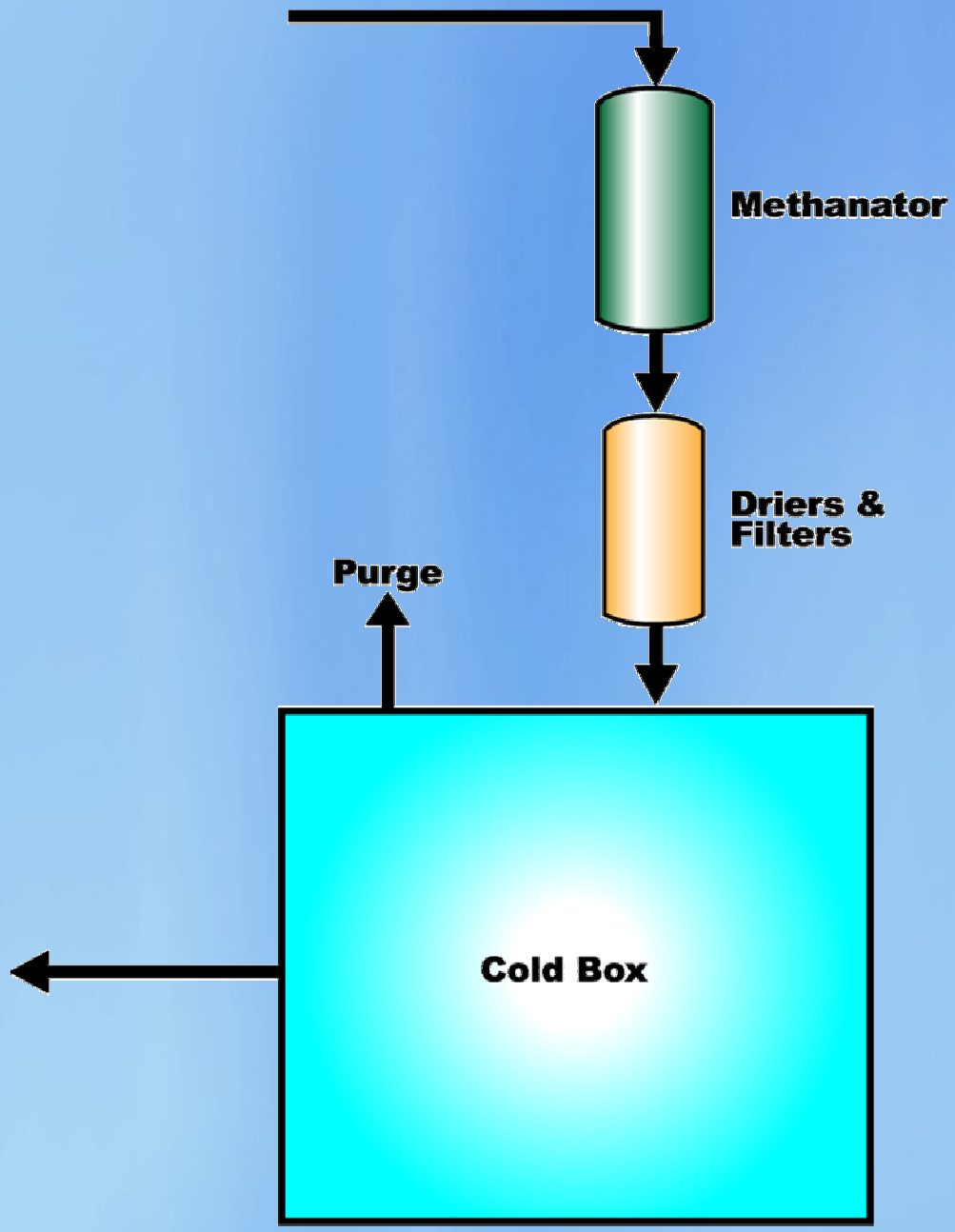


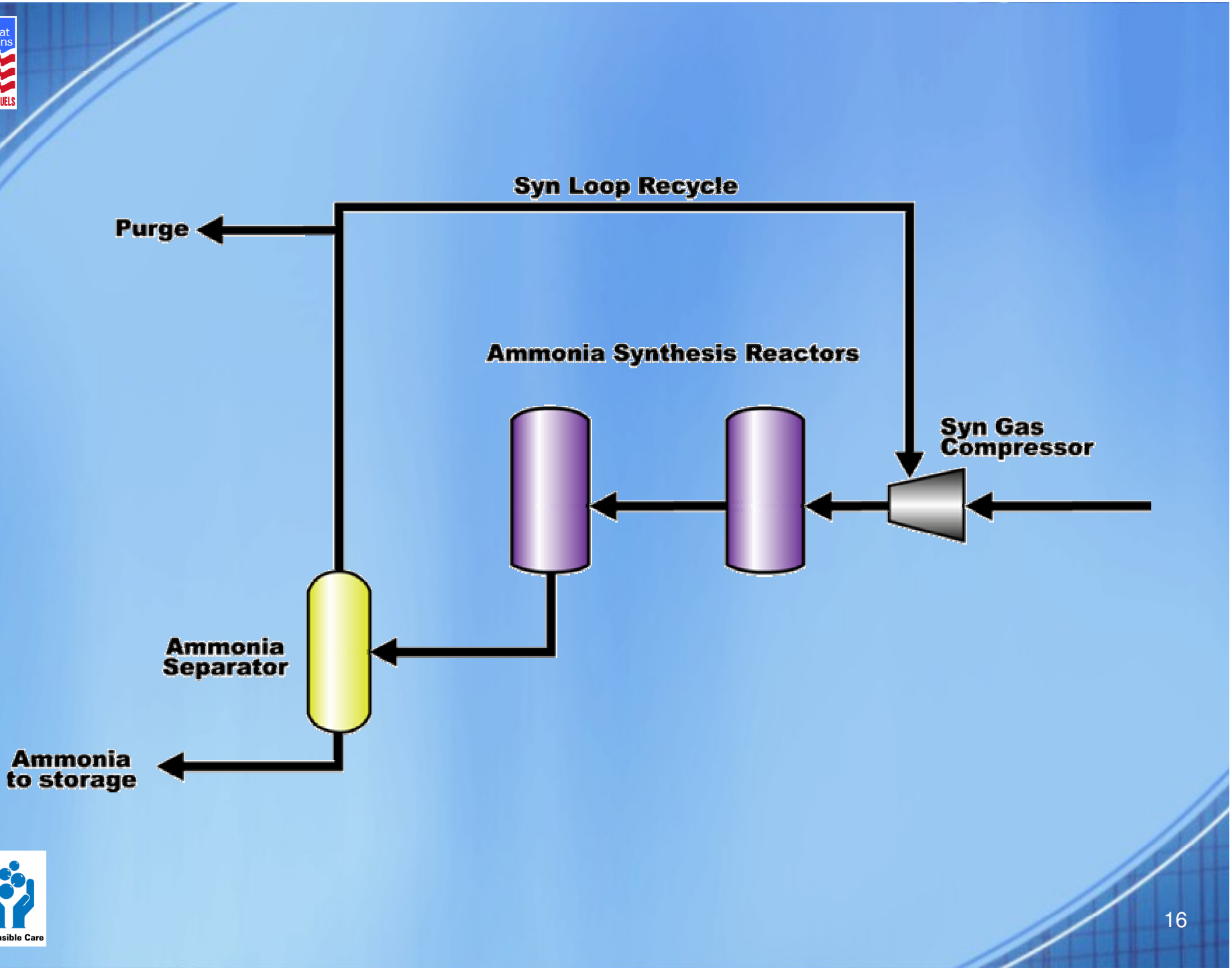
Responsible Care


Secondary
Reformer
Rectisol
Syn Gas
Compr
Rectisol
Syn Gas
Air Compr
Air
Feed Gas
Heater

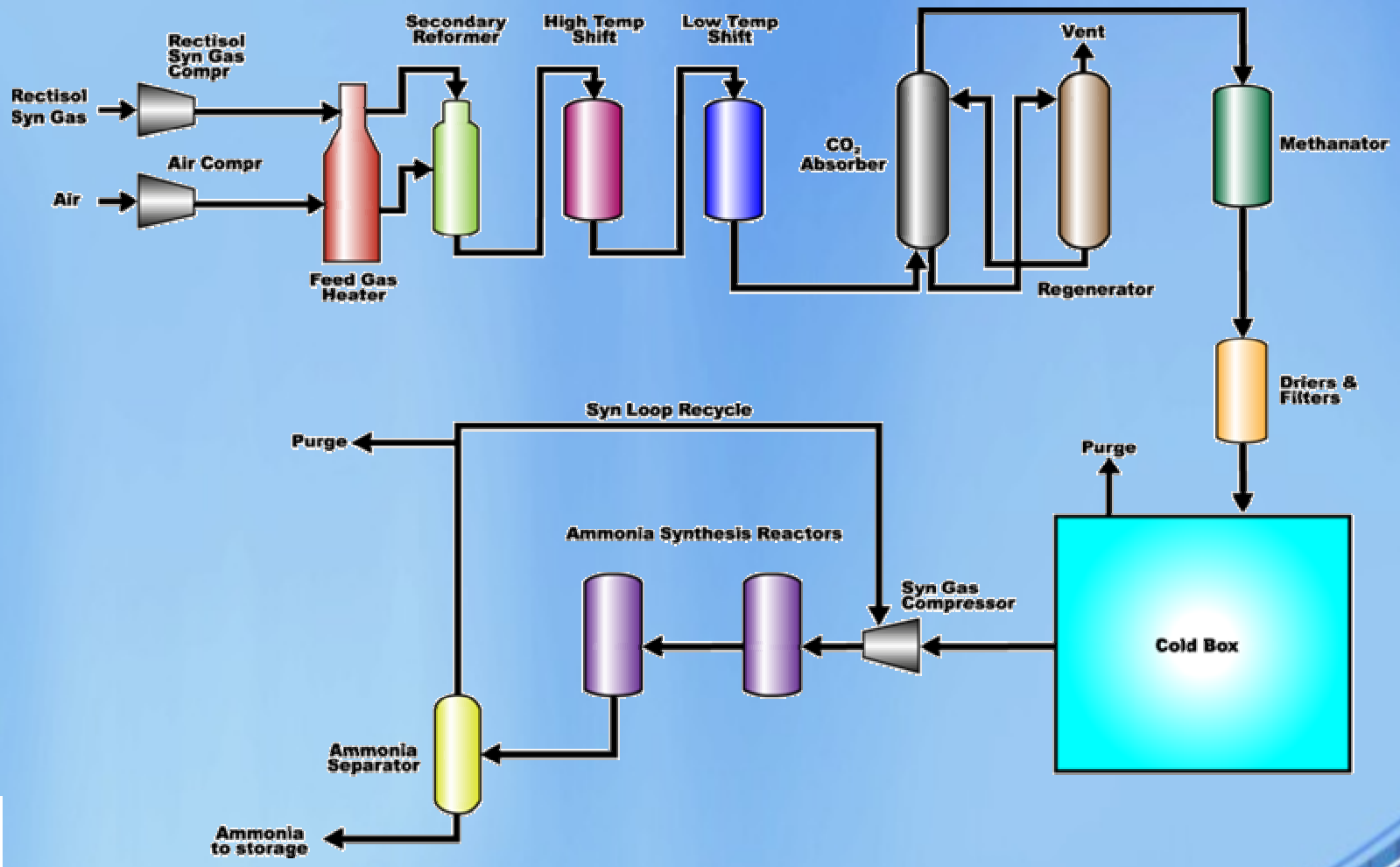

High Temp Shift
Low Temp Shift


Vent
CO_2
Absorber
Regenerator


Methanator
Driers &
Filters
Purge
Cold Box

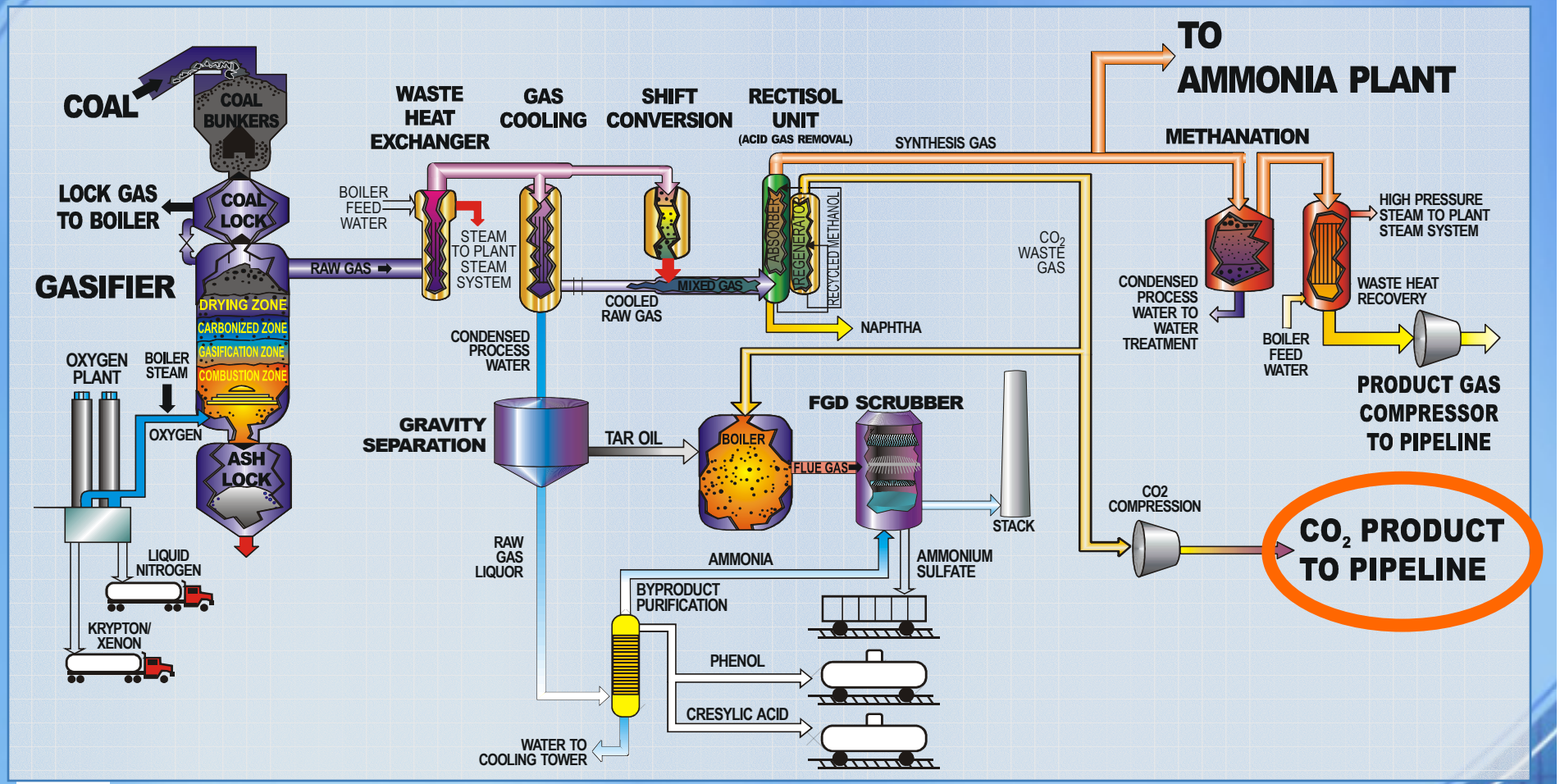

Syn Loop Recycle
Purge
Ammonia Synthesis Reactors
Syn Gas Compressor
Ammonia Separator
Ammonia to storage

Simplified Ammonia Process



Responsible Care

Great Plains Synfuels Plant Process Flow



Responsible Care

The Story of the CO_2 Project

- The sale of CO_2 from the Synfuels Plant for tertiary or enhanced oil recovery (EOR) had always been technically possible

Why does DGC's CO_2 have an advantage over other sources for EOR?

- Natural sources are often far from the oil fields that could use it
- Flue gas contains water vapor and nitrogen
- DGC Product CO_2:
  - -100º F Dew Point
  - 95.7% Carbon Dioxide
  - 1.0% Hydrogen Sulfide
  - 1.0% Ethane
  - 0.9% Methane
  - 1.4% Other

Responsible Care

The Story of the CO_2 Project

- Financial & contractual stumbling blocks
- July 1997 - DGC & PanCanadian (now EnCana Corporation) signed a contract for 95 MMSCFD of CO_2

CO_2 Pipeline

- 205 miles
- 14" and 12" carbon steel pipe
- MAOP 2,700 psig & 2,964 psig
- Strategically routed through Williston Basin oil fields

Responsible Care

Permissions were a challenge

- Landowners
  - 246 in ND
  - 65 in Canada
- International Boundary Commission
- ND Public Service Commission
- ND Water Commission
- ND Historical Society
- US Army Corps of Engineers
- US Dept. of Interior BLM
- US Dept. of Agriculture Forest Service
- Canadian NEB and other country/municipality agencies

Pipeline Safety

- Regulated by US DOT & Canadian NEB as a hazardous liquid
- Leak detection system (LDS) software
- Worst-case scenario modeling
- Reverse 911
- Public meetings for landowners, residence, and local emergency response personnel
- Pigging requirements

CO_2 Compressors

- 19,500 hp compressors
- 55 million scf per day each
- 2,700 psig discharge pressure

Responsible Care

Initial Project Startup – September 2000

Responsible Care

Additional Sales

- In late 2004/early 2005 negotiated new contracts with Apache and EnCana for additional CO_2 sales
- Total CO_2 deliveries are now about 152 mmscfd

Responsible Care

Added Equipment

- One additional 19,500 hp compressor at plant site
- Booster pump located near Tioga, ND
- Custody transfer station for Apache

Responsible Care

Tioga pump

Summary

- The DGC project uses an industrial source of CO_2 that would otherwise be emitted to the atmosphere
- Over 13 million normal tons of CO_2 sequestered through the end of 2007


Great Plains
SYNFUELS
Questions?
Responsible Care