
CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD
SALUS POPULI
EST LEX SUPREMA

U. S. Chemical Safety Board

SONAT INVESTIGATION

Catastrophic Vessel OVERPRESSURIZATION (4 Deaths)

Sonat Investigation

INTRODUCTION

- March 4, 1998, near Pitkin, LA
- Startup of Oil / Gas Separation Equipment
- Natural Gas Purge of Vessels and Pipeline
- Oil / Gas Separator Overpressurized
- Catastrophic Vessel Failure
- Four Operators Killed

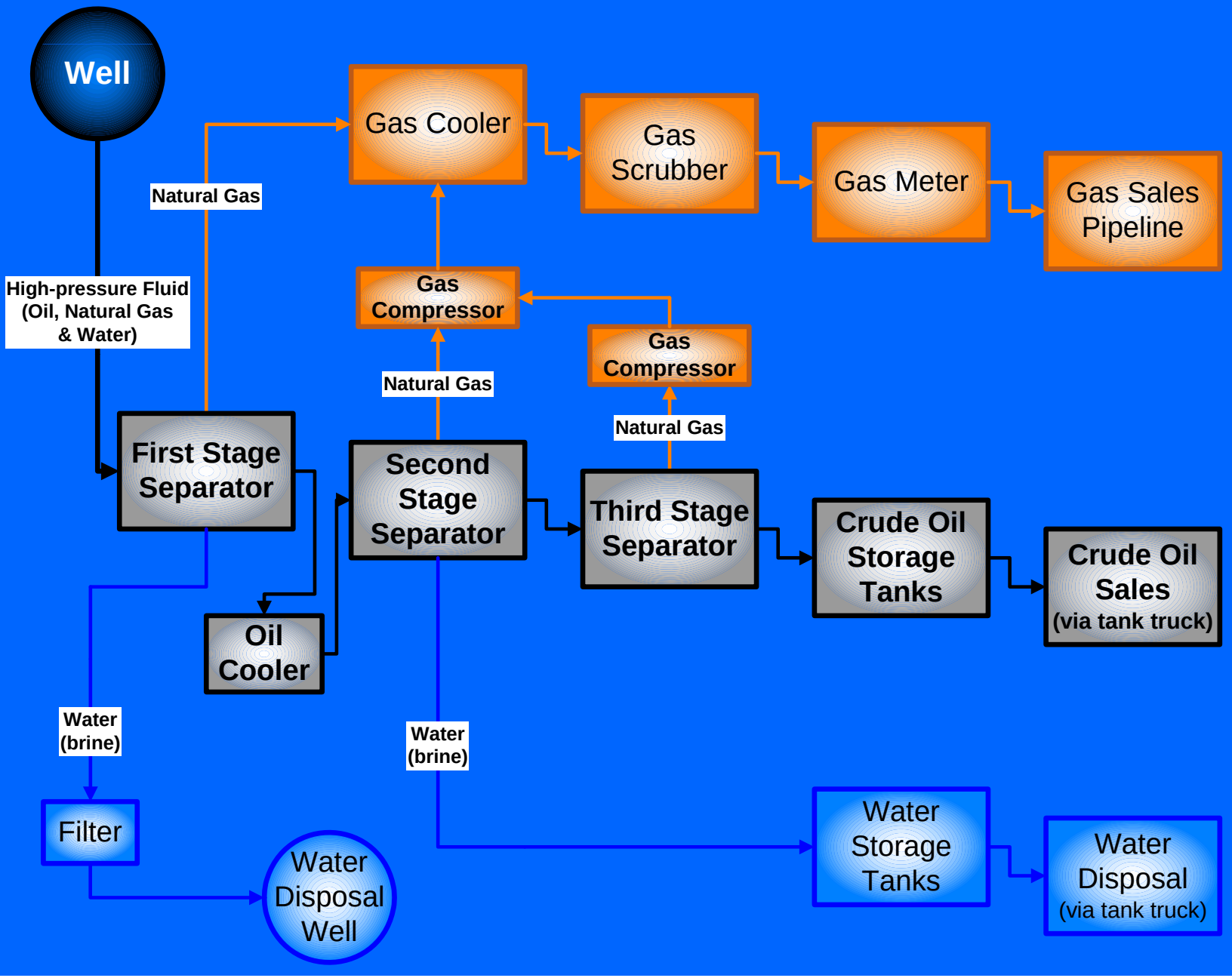
Sonat Investigation

INTRODUCTION

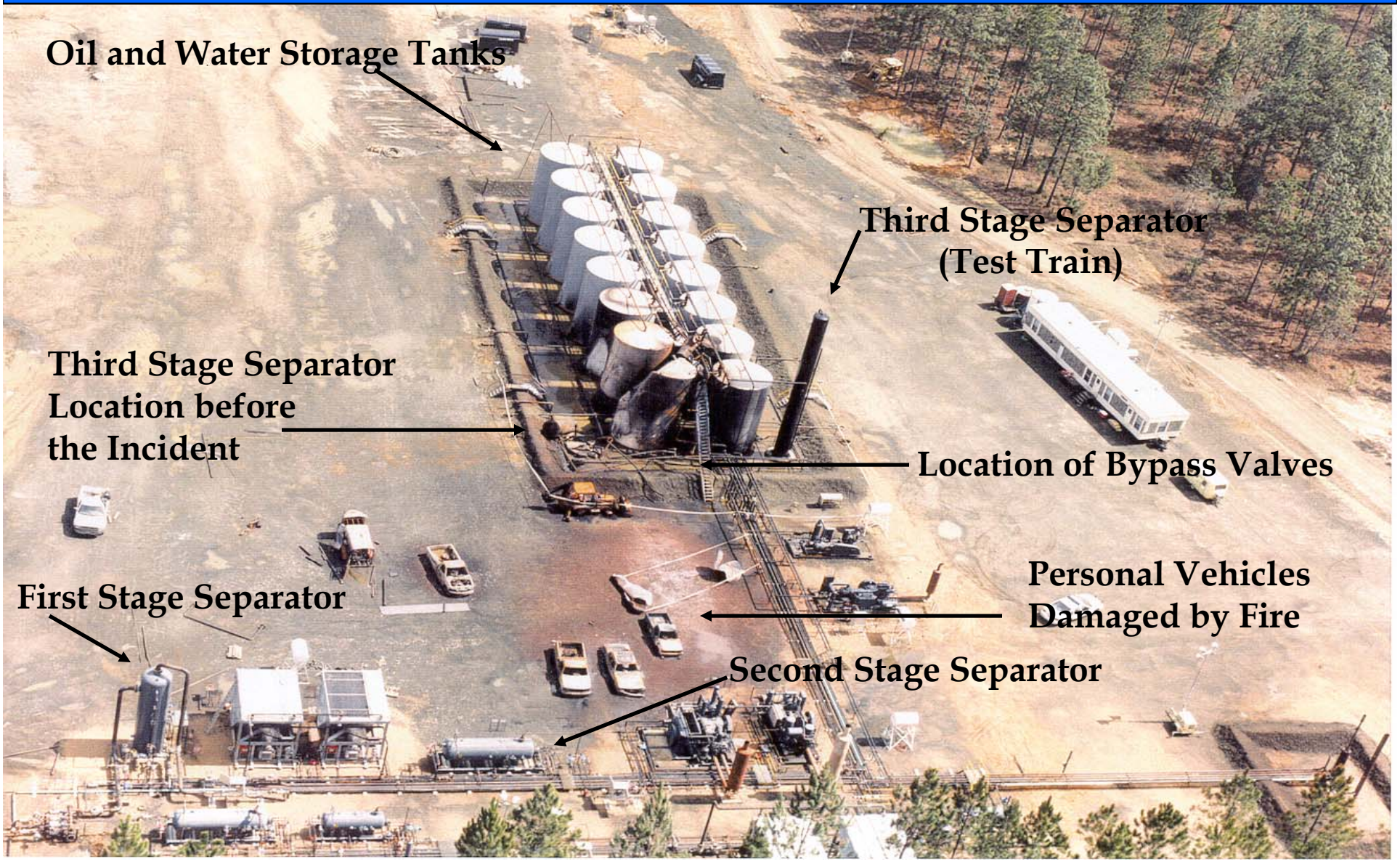
KEY ISSUES:

- DESIGN & HAZARD REVIEWS
- PRESSURE-RELIEF DEVICES
- OPERATING PROCEDURES

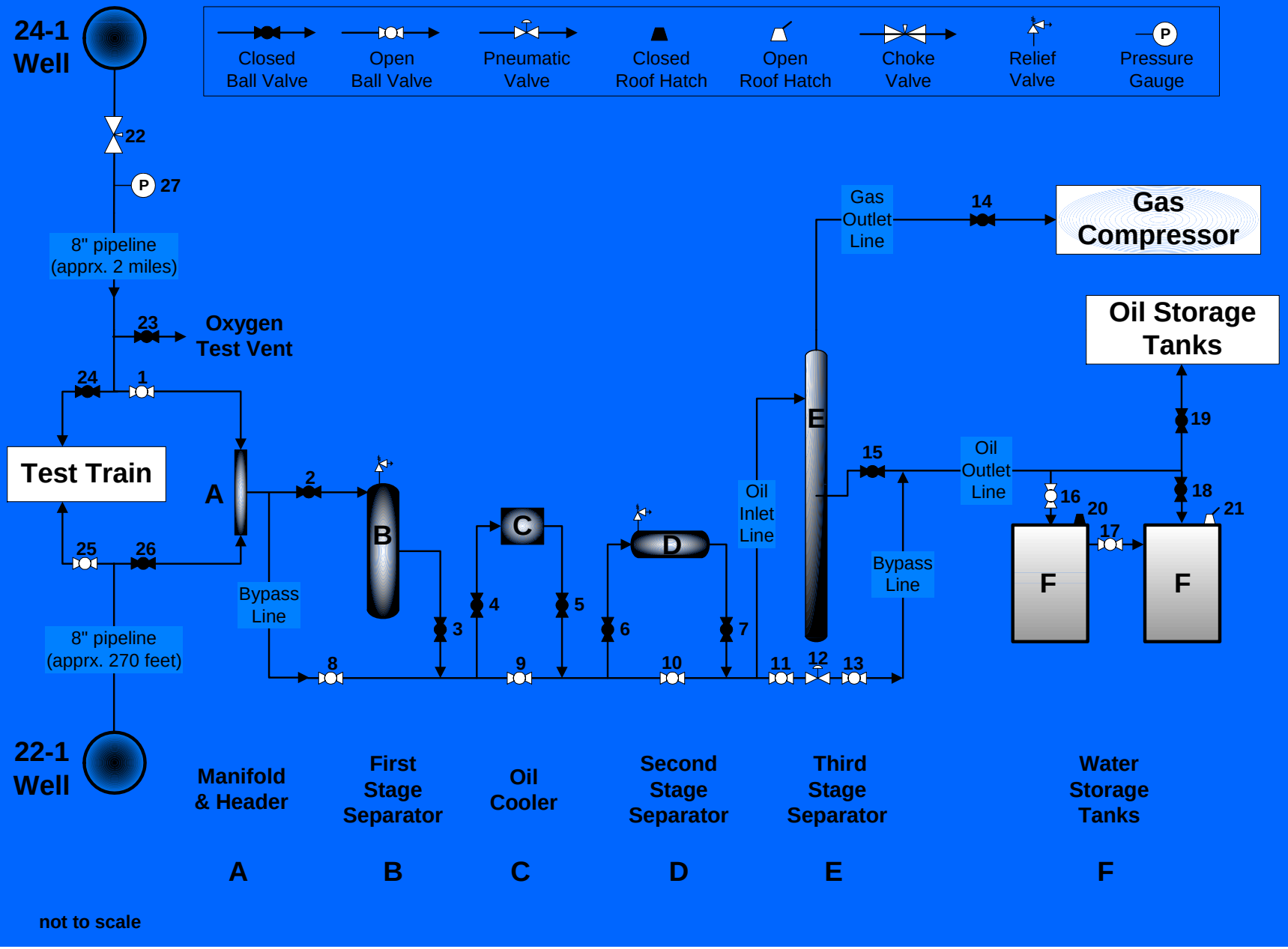
Block Flow Diagram of the Separation Process



Aerial View of Temple 22-1 Common Point Separation Facility



Intended Valve Positions after the Final Alignment



Sonat Investigation

TERMINOLOGY

- Sonat referred to the failed vessel as a "Vapor Recovery Tower" or storage tank

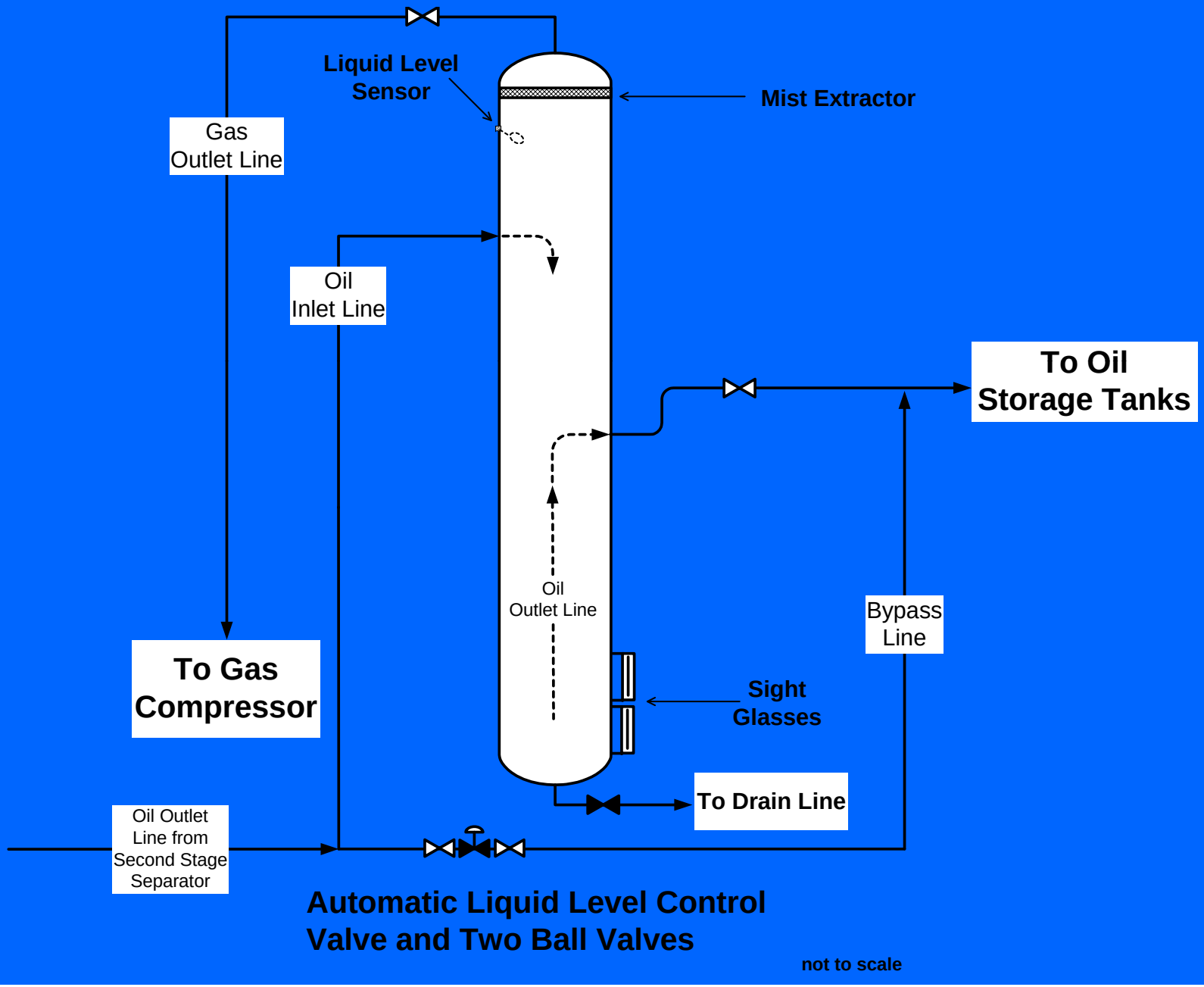
- CSB determined that the vessel actually fit the definition of an oil and gas separator

Sonat Investigation

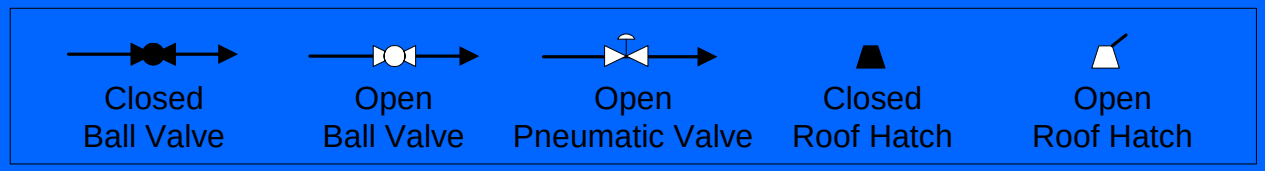
TERMINOLOGY

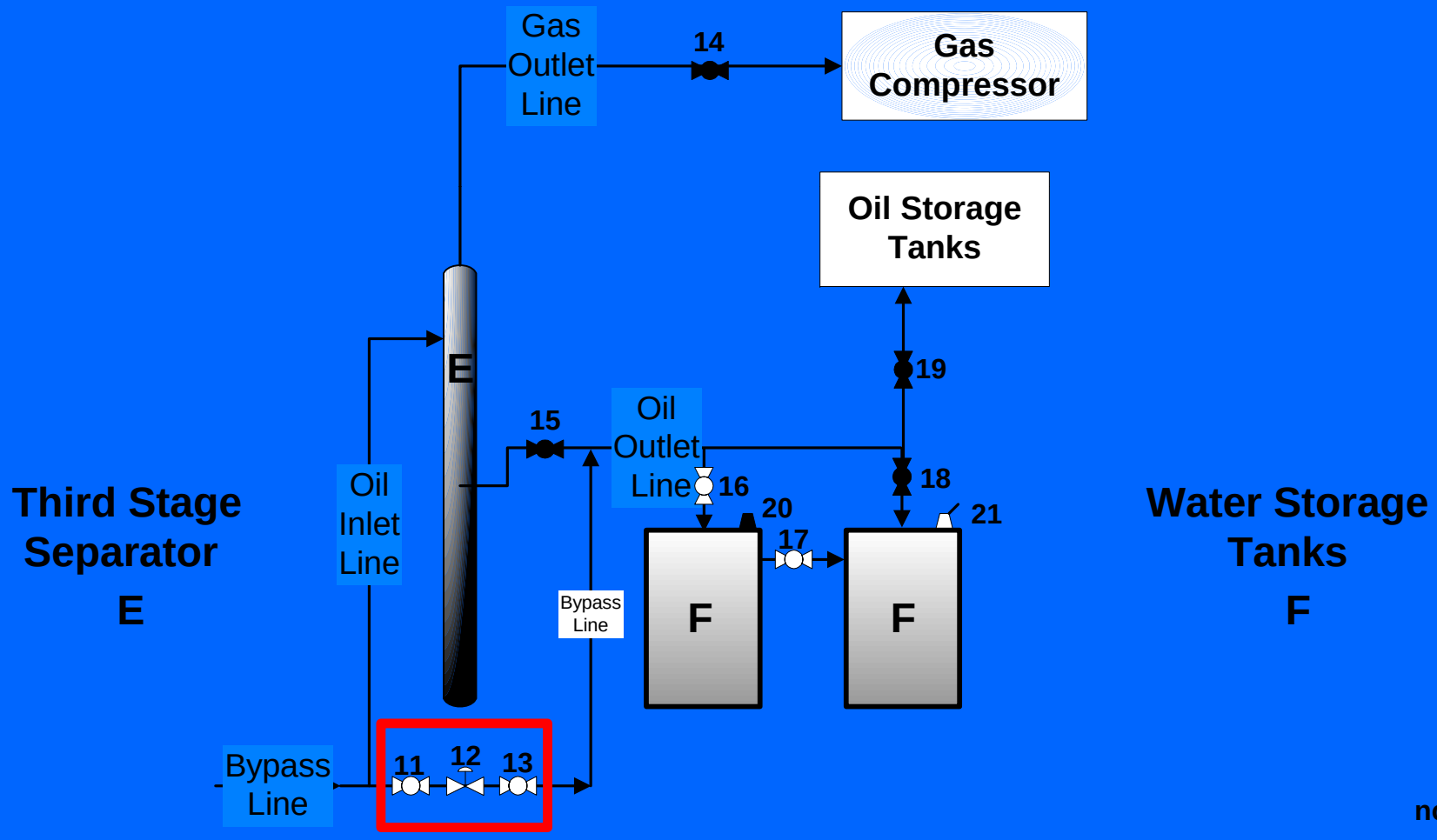
- Separator had a single inlet line for oil/gas mixture but two separate outlet lines
- Separator was not designed for permanent oil storage
- Separator was positioned upstream of the storage tanks in series with the 1st and 2nd stage separators

Third Stage Separator Schematic

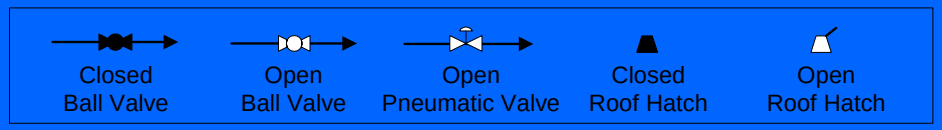


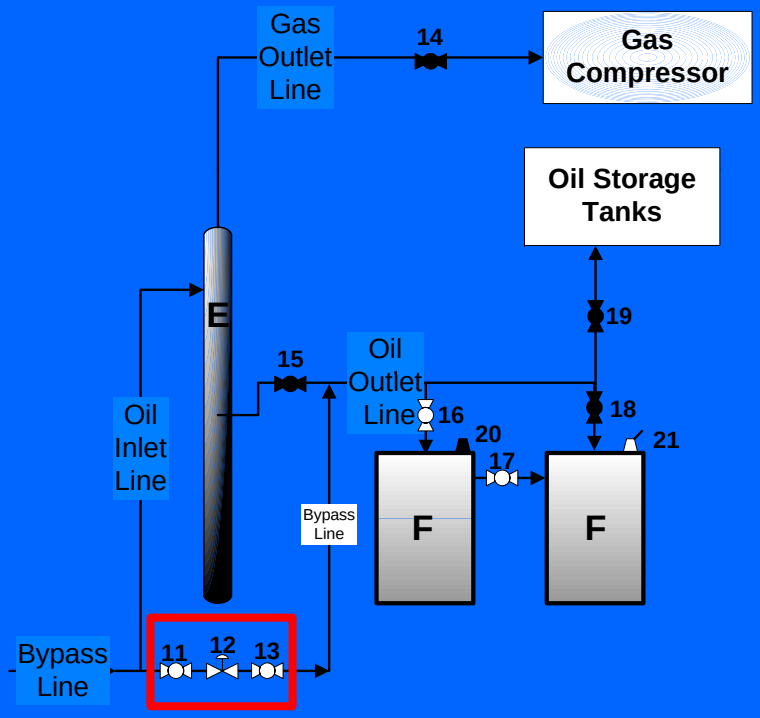
Intended Valve Positions after the Final Alignment





Comparison of Valve Alignments as "Planned" and as "Found"

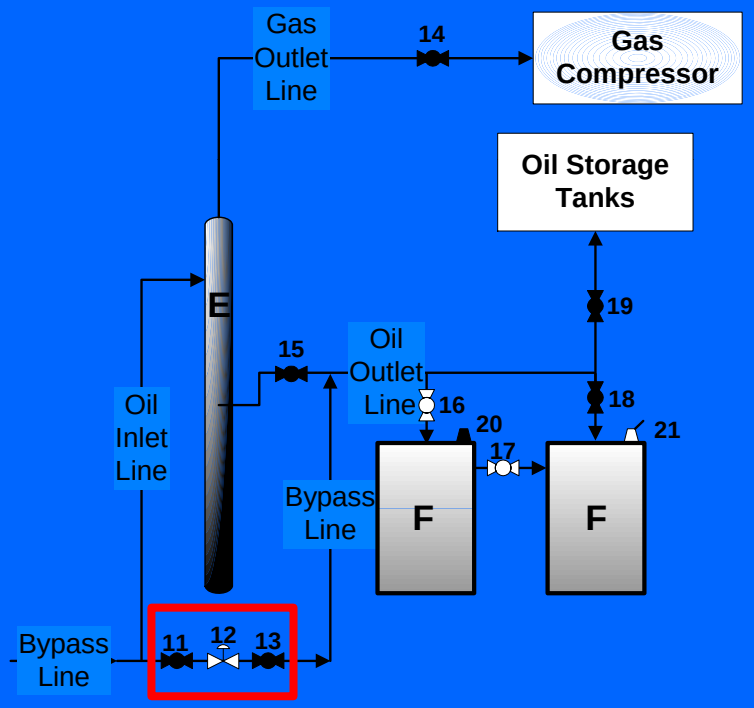




Third Stage Separator
E

Water Storage Tanks
F

Planned Valve Lineup



Third Stage Separator
E

Water Storage Tanks
F

As Found Valve Lineup

not to scale

Aerial View of Sonat's Temple 22-1 Common Point Separation Facility

Damaged Vehicles and Storage Tanks

Damaged Water Storage Tank

Sonat Investigation

KEY FINDINGS

: The vessel that failed, a third stage separator, lacked an inlet valve and could not be isolated from an adjacent bypass line, which at the time of the incident contained high-pressure purge gases.

Sonat Investigation

KEY FINDINGS

: At the time of the incident, two outlet block valves on the separator were closed, as were two block valves on the bypass line downstream of the separator. Accordingly the high-pressure purge gases could not be vented and the separator

Sonat Investigation

KEY FINDINGS

: The third-stage separator was only rated for atmospheric pressure service (0 psig).

The purge gas stream to which the separator was exposed had a pressure potentially as high as 800 psig.

Sonat Investigation

KEY FINDINGS

: The separator was not equipped with any pressure-relief devices, and overpressuization caused the separator to fail catastrophically.

Sonat Investigation

KEY FINDINGS

: The CSB could not conclusively determine the timing of the closure of the two bypass line block valves or establish any reason for this action.

Sonat Investigation

KEY FINDINGS

: The facility was designed and built without effective engineering design reviews or hazard analyses.

Sonat Investigation

KEY FINDINGS

: Workers at the facility were not provided with written operating procedures addressing the alignment of valves for purging operations.

Sonat Investigation

KEY FINDINGS

- Sonat operated third-stage separators that lacked adequate pressure-relief systems at other oil and gas production facilities for over a year prior to the incident.

Sonat Investigation

KEY FINDINGS

: ANSI/API Spec. 12J-1992, "Specification for Oil and Gas Separators", issued by the American Petroleum Institute describes recommended practices for the installation of pressure-relief devices

Sonat Investigation

KEY FINDINGS

0: OSHA's PSM Standard contains elements that are relevant to this incident, such as process hazard analysis and written operating procedures. However, PSM does not currently apply to oil and gas

Sonat Investigation

ROOT CAUSE #1

Sonat management did not use a formal engineering design review process or require effective hazard analyses in the course of designing and building the facility.

Sonat Investigation

ROOT CAUSE #2

Sonat engineering specifications did not ensure that equipment that could potentially be exposed to high-pressure hazards was adequately protected by pressure-relief devices.

Sonat Investigation

CONTRIBUTING CAUSE

Sonat management did not provide workers with written operating procedures for the start-up and operation of the facility.

Sonat Investigation

RECOMMENDATIONS

Paso Production Company
ormerly Sonat Exploration Co.)

Institute a formal engineering design review process for all oil and gas production facilities, following good engineering practices and including analyses of process hazards.

Sonat Investigation

RECOMMENDATIONS

Paso Production Company

Implement a program to ensure that all oil and gas production equipment that is potentially subject to overpressurization is equipped with adequate pressure-relief systems, and audit compliance with the program

Sonat Investigation

RECOMMENDATIONS

Paso Production Company

Develop written operating procedures for oil and gas production facilities and implement programs to ensure that all workers, including contract employees, are trained in the use of the procedures. Ensure that the procedures address, at a minimum, purging and start-up operations and provide information on process-related hazards

Sonat Investigation

RECOMMENDATIONS

nerican Petroleum Institute

Develop and issue recommended practice guidelines governing the safe start-up and operation of oil and gas production facilities. Ensure that the guidelines address project design review including hazard analyses, written operating procedures, employee and contractor training and pressure-relief requirements for all equipment exposed to

Sonat Investigation

RECOMMENDATIONS

nerican Petroleum Institute

Communicate the findings of this report to your membership.

CSB on the WWW

www.chemsafety.gov

The SONAT REPORT is available at the CSB web site in a variety of formats.


CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD
SALUS POPULI
EST LEX SUPREMA