An overview of associated gas – its processing and treatment

Module 1

Summary description of module

- General overview about the process and importance of it
- Social and environmental issues of associated gas – its processing and treatment
- Waste sources and contingency planning, i.e., sulfur

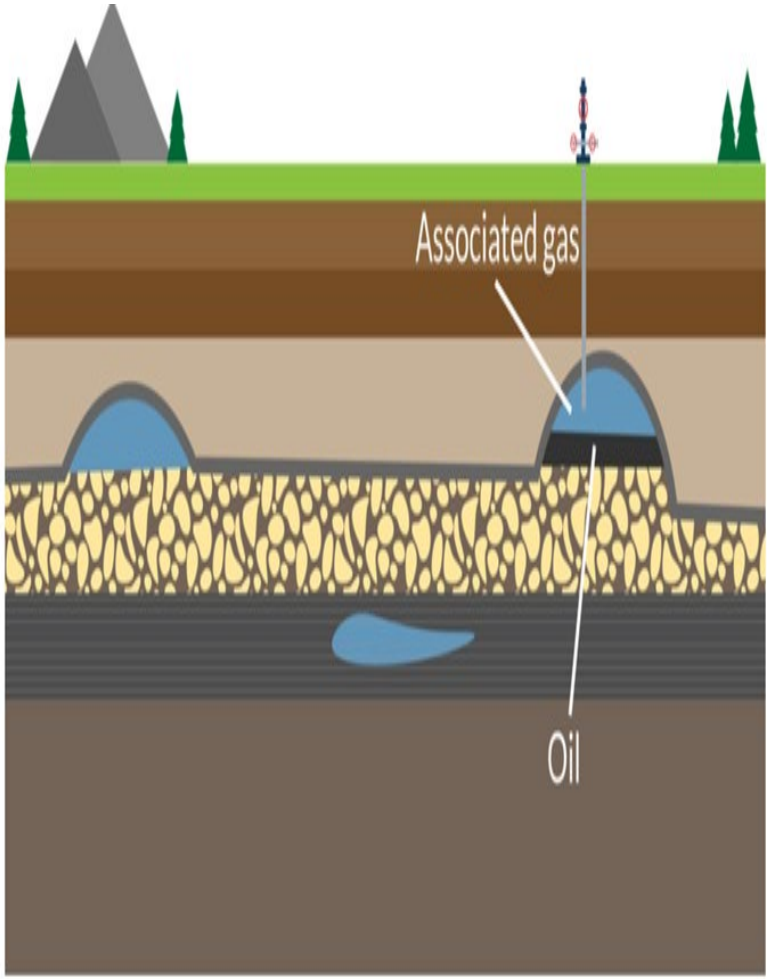
Objectives

- Analyze the importance of treating associated gas
- Describe environmental issues/concerns at each stage of Associated gas production, including possible impacts on health and safety
- Source the main concerns for trainees related to associated gas and industry in general

Basic concepts

- As identified in several publications, associated gas is defined as

Gas produced as a byproduct of crude oil production. Associated gas reserves are typically developed to produce crude oil, which pays for field development costs. Reserves typically produce at peak levels for a few years before declining.[1]



Major concerns

- In general, associated gas may contain
  - Sulfur above acceptable limits
  - Water content higher than natural gas fields
  - Oil droplets
  - Undesired capital investment
  - Major pitfalls for the oil production
  - Safety concerns
  - Environmental hiccups
  - Unsteady production (inconsistent intervals)

Major concerns (continued)

- Associated gas is considered a byproduct, which makes it unfavorable
- The fastest disposal option is to flare it. "***air pollution***?"
- Amounts of associated gas may not be adequate for re-injection
- If entrained in oil, it may disturb oil production rates, with major affects on the auxiliary units used for pumping oil for further processing
- Water content may be above limits. This adds environmental concerns, as wastewater requires treatment

Gas processing plant block diagram

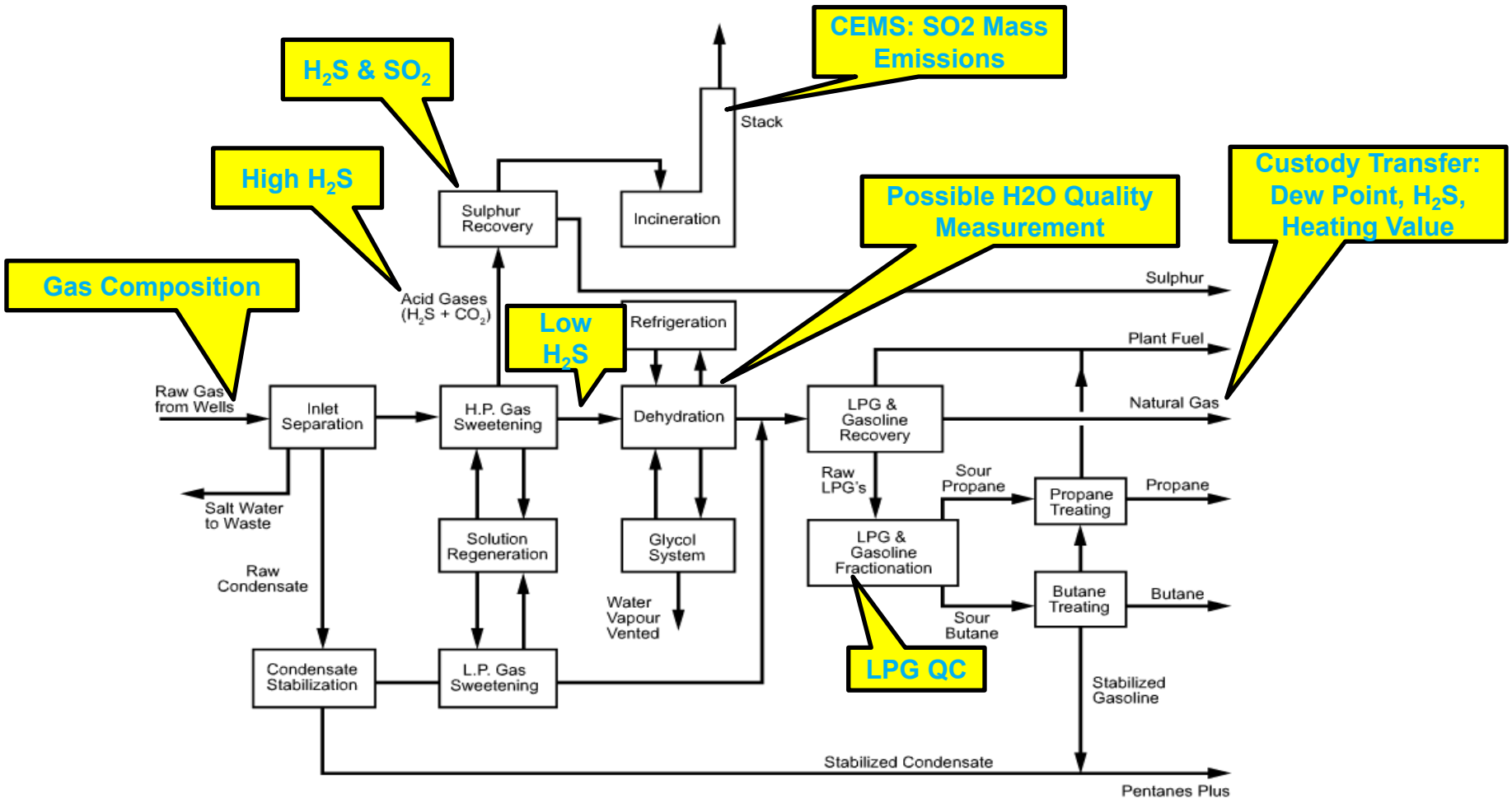


Figure 1. Gas Plant – Process Description

Gas sweetening – amine absorption

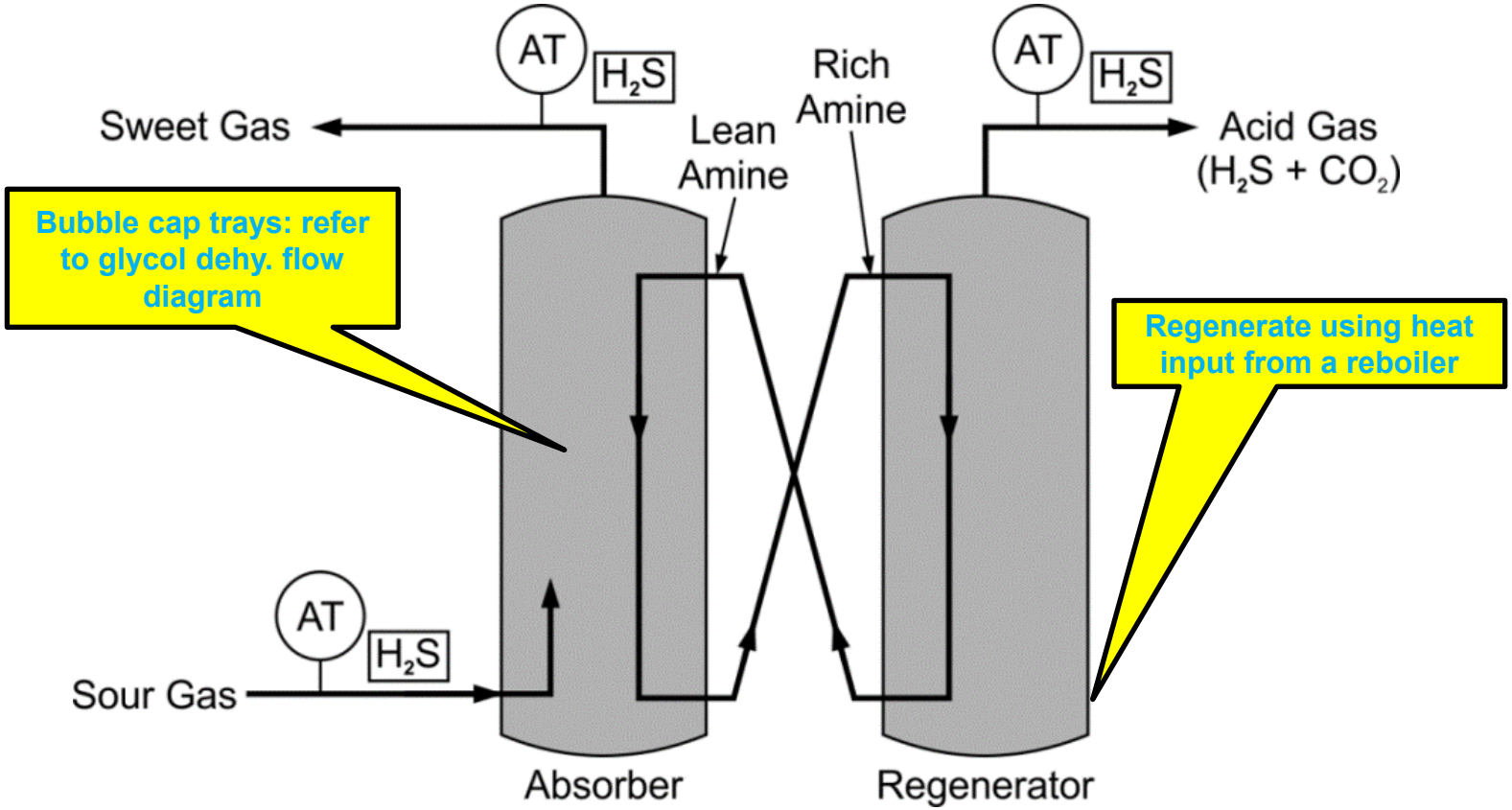


Figure 2. Natural gas treating process. Adapted from Instrument Technician

Natural gas dehydration – adsorption technique

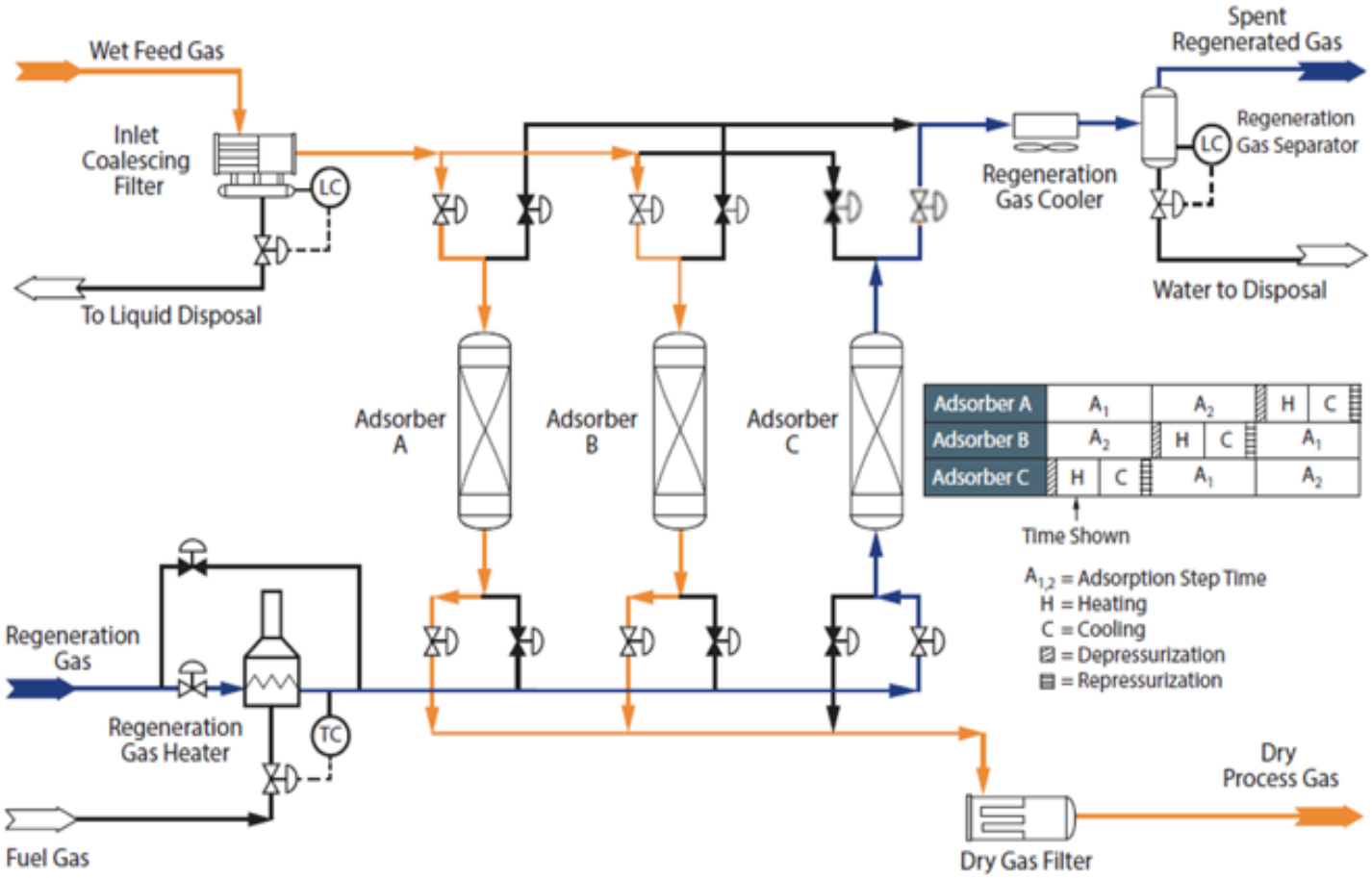


Figure 3. Adsorption Dehydration Two-Tower vs Three-Tower System

Natural gas dehydration – glycol absorption technique

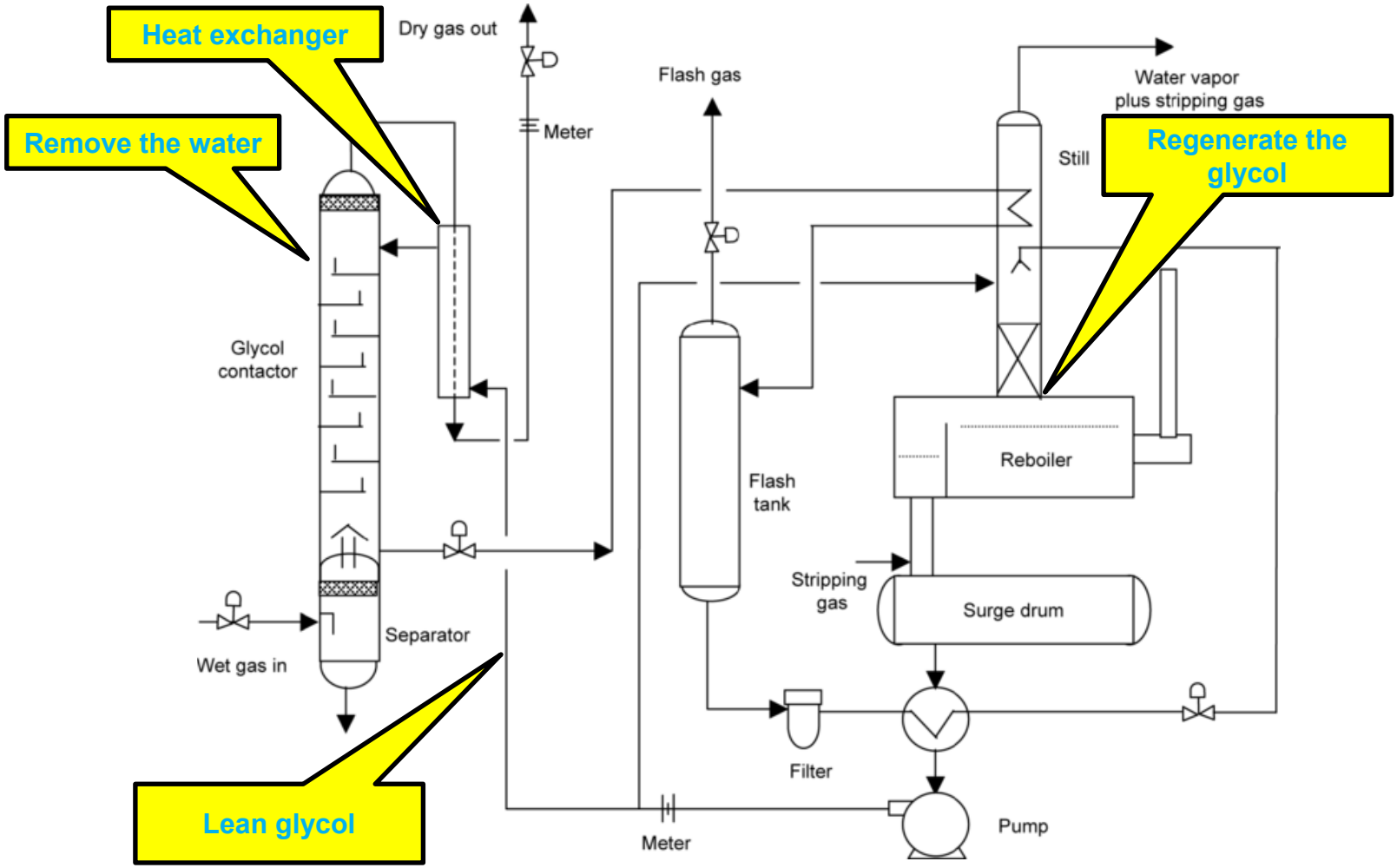


Figure 4. Dehydration With Glycol (Smith, 2013)

LPG recovery

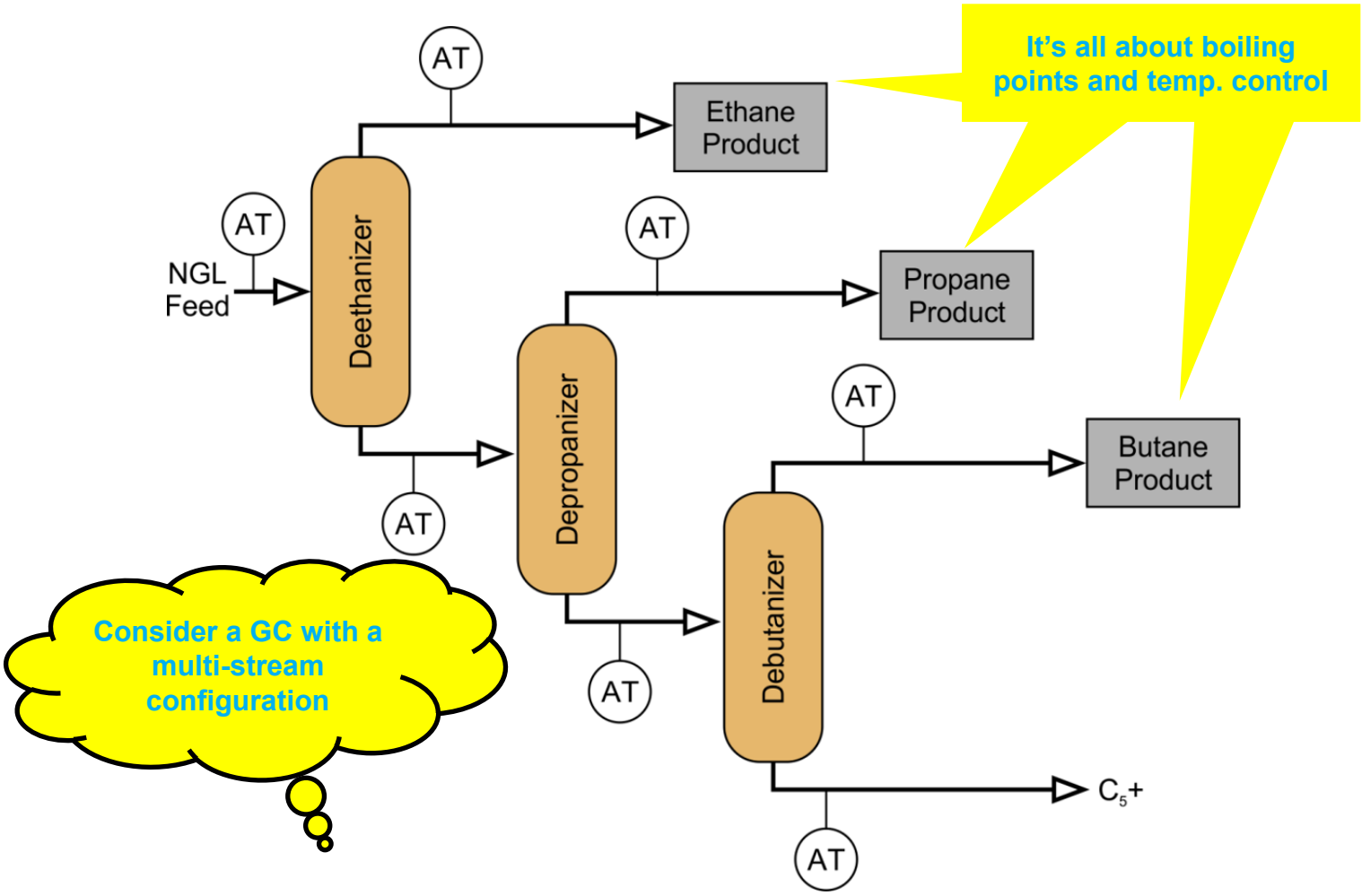


Figure 5. Fractionation train. Adapted from Instrument Technician ILM, Gas Analyzers – Part A, 310304cA, (2016)

Sulfur recovery

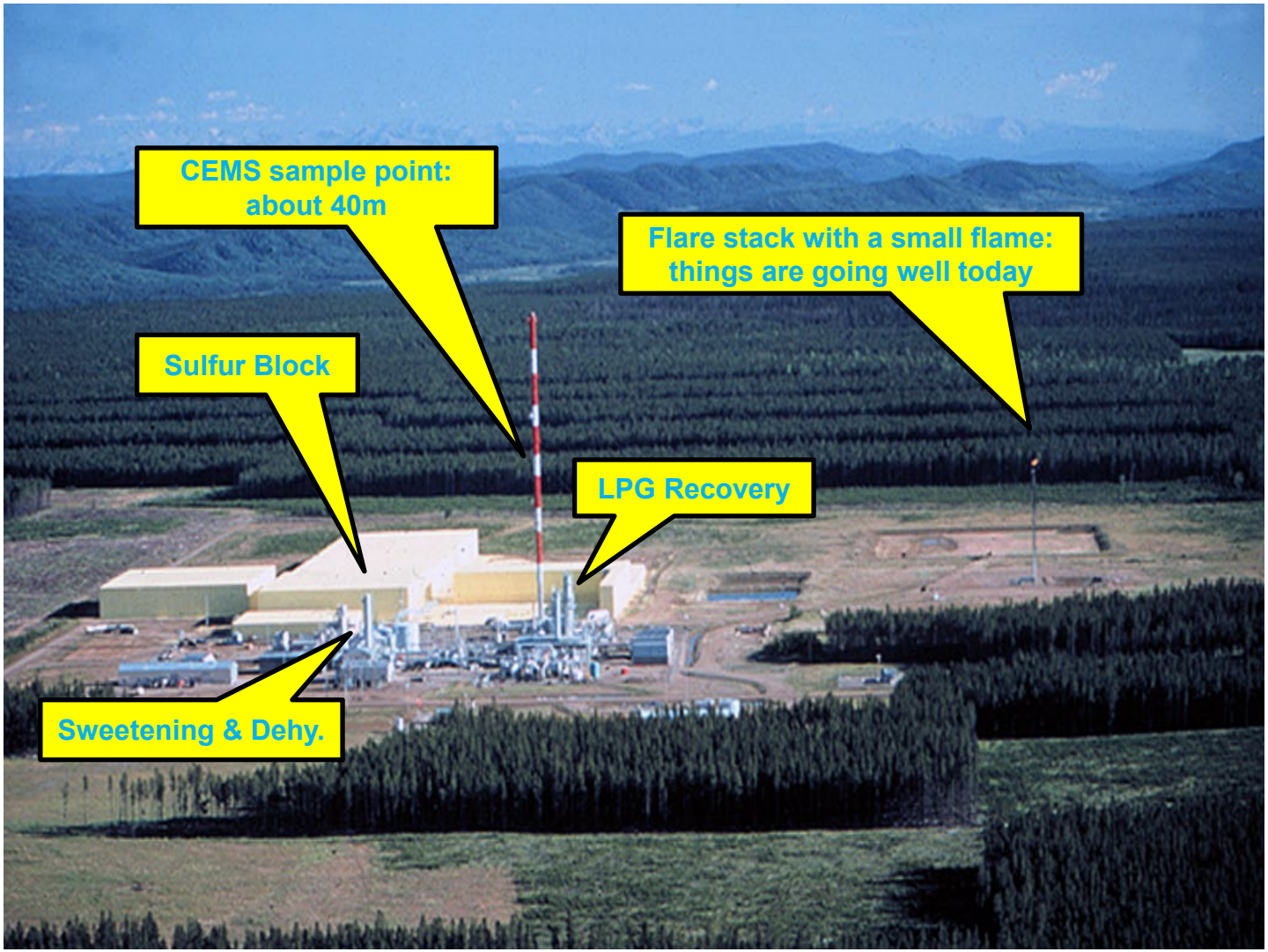


Figure 6. Natural Gas Processing Plant. Adapted from Hauer, Randy (2013). Claus Sulfur Recovery [PowerPoint Slides]

The reaction furnace – incomplete combustion by intent

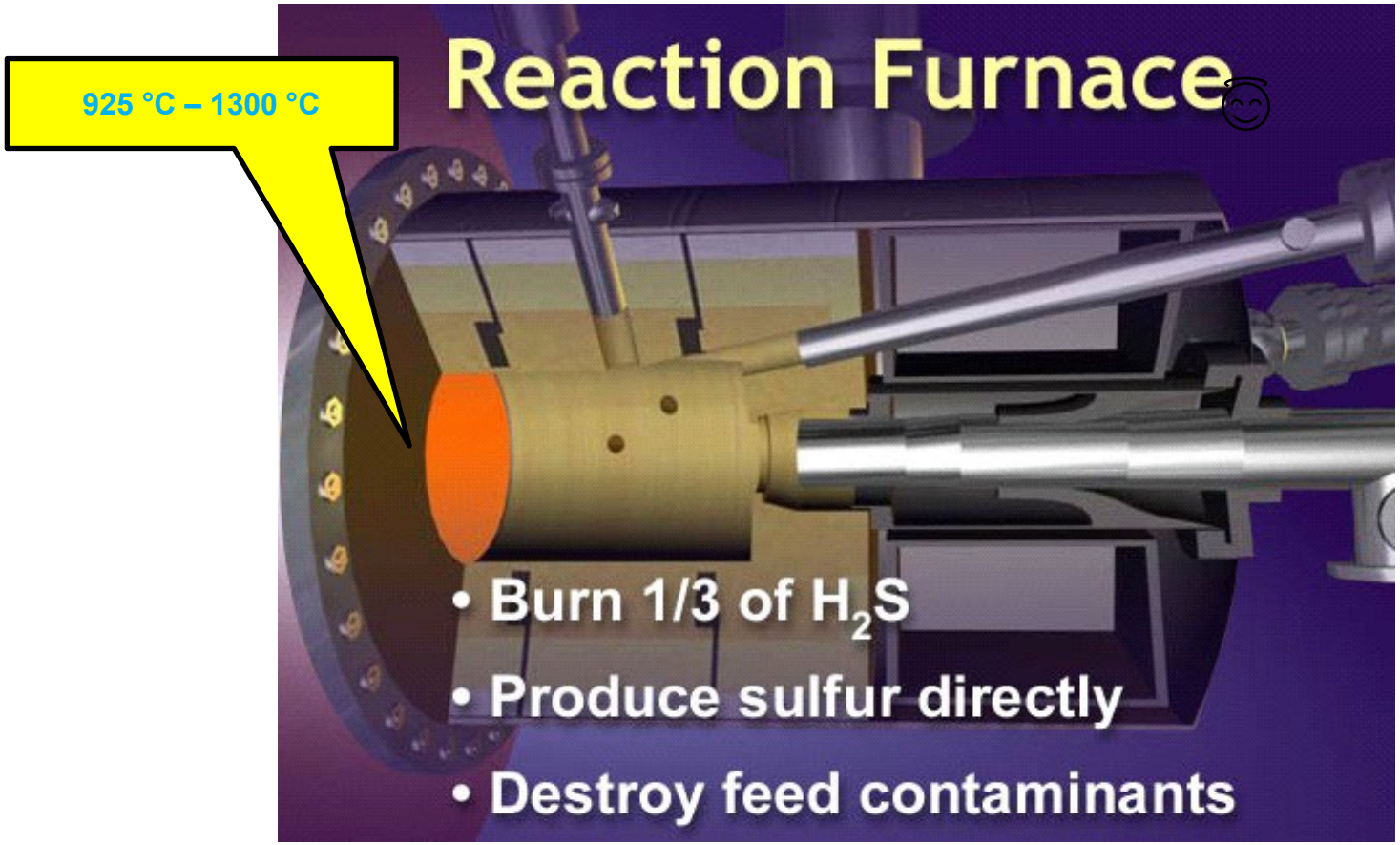


Figure 7. Natural Gas Processing Plant. Adapted from Hauer, Randy (2013). Claus Sulfur Recovery [PowerPoint Slides]

Modified Claus Process – The original process

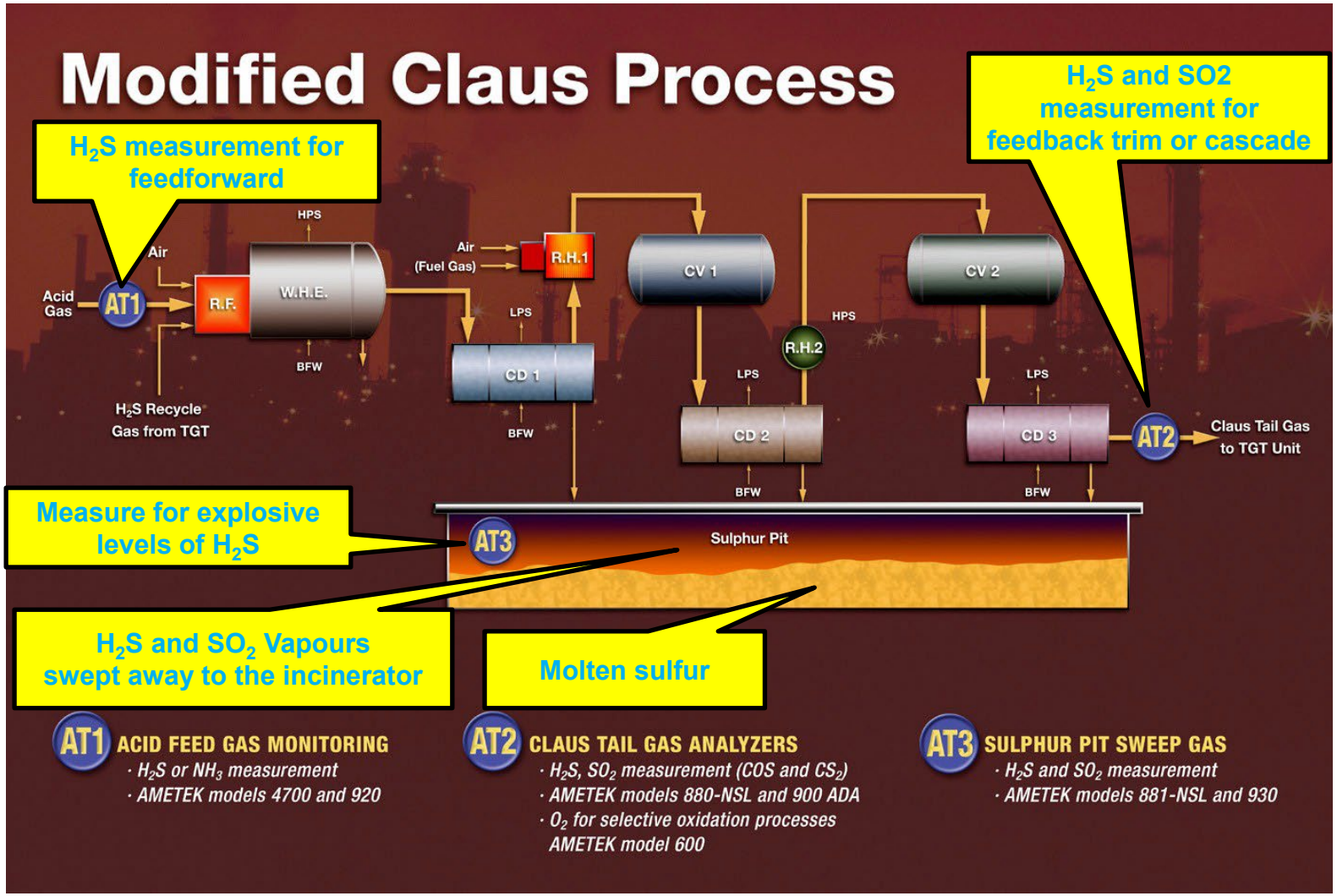


Figure 8. Natural Gas Processing Plant. Adapted from Hauer, Randy (2013). Claus Sulfur Recovery [PowerPoint Slides]

Tail gas treatment – improve on the Claus Process

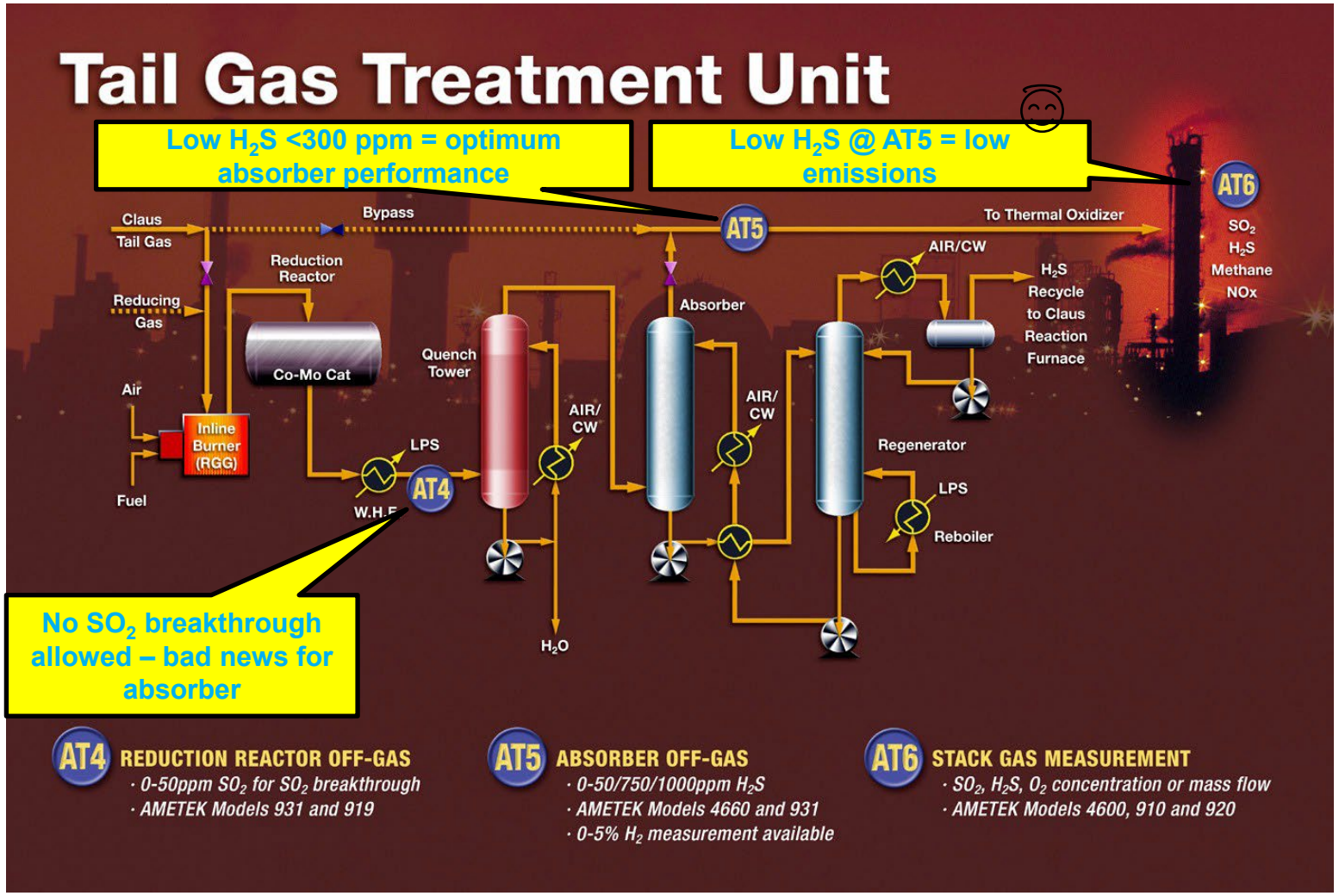


Figure 9. Natural Gas Processing Plant. Adapted from Hauer, Randy (2013). Claus Sulfur Recovery [PowerPoint Slides]

Why do we bother recovering sulfur?

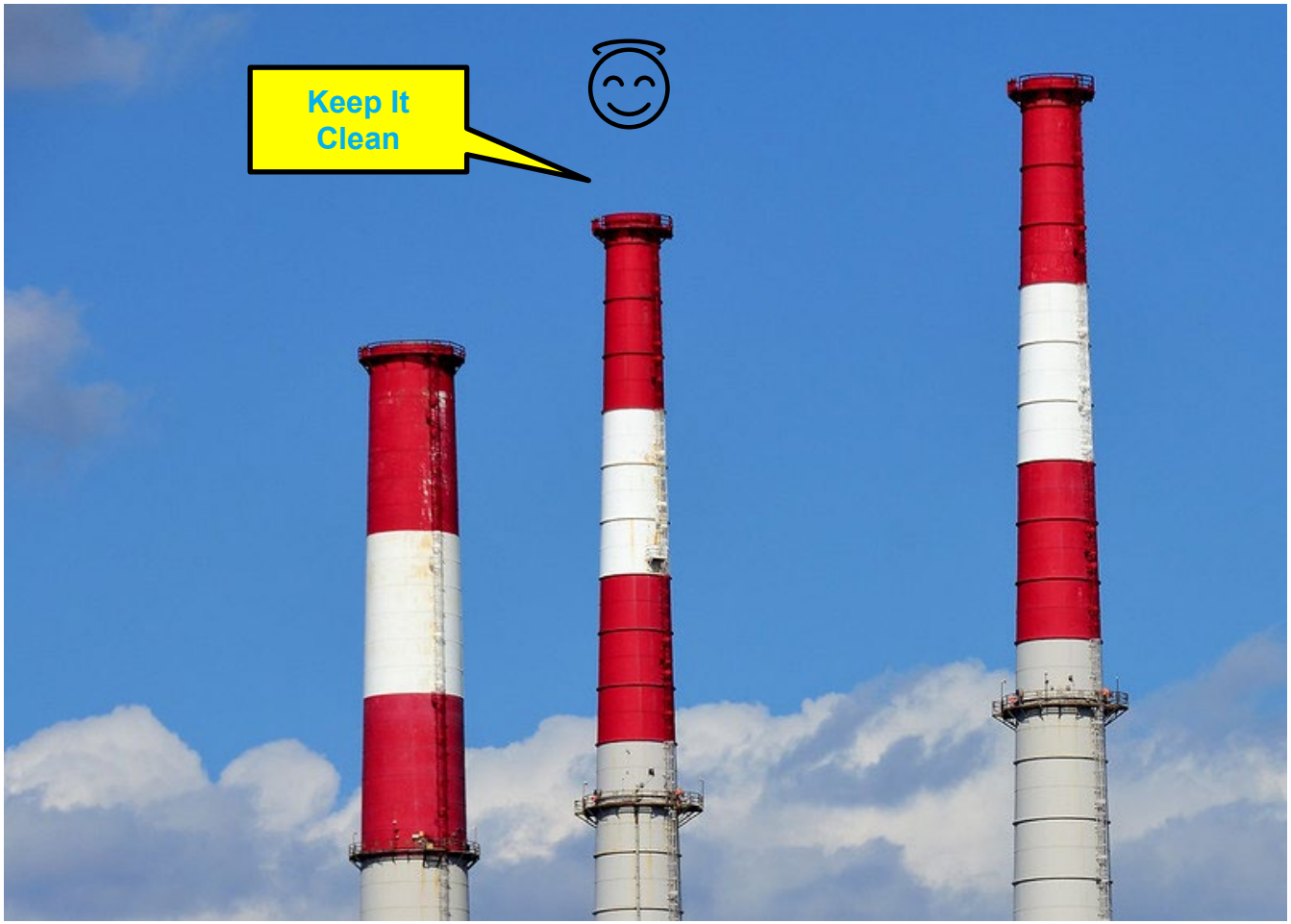


Figure 10 Stacked (Apergis, 2019)

Most energy-demanding industries

- Power generation consumes lots of energy, regardless of source. It's considered a national security issue for countries, regardless of their land size and population
- Certainly, refineries and petrochemical industries are also demanded highly
- As a result, concepts of energy efficiency, energy optimization, and energy recovery were developed. The Energy Consumption concept, along with supported technologies and tools, were invented

Several examples will be given as handouts.

Energy-demanding industries will result in major CO2-containing waste streams

- Power generation depends most on the actual burning of fossil fuel. Which results in major COx, NOx, SOx production
- As the demand for clean operations increased, technologies to reduce harmful effluents increased too
- The tools to determine the concentrations of those effluents are up to industries' expectations of quality and online measurements

Several examples will be given as handouts.

Major methane-containing waste streams

- It is very common among most countries, that the major methane-producing activity is landfill waste
- Several countries have other activities or industries that produce methane as waste. Gas flaring is one activity, but if we focus on the major one, we should consider leaks - also called fugitive emissions - of associated gas/natural gas fields and pipelines. It is a major concern for countries, especially with the lack of maintenance activities

Pollution mitigation strategies or waste stream minimization

- Having strict environmental policies is one way to control pollution and minimize environmental issues
- Several countries eliminated certain industries to stop the pollution coming from those industries
- The use of coal for power generation was stopped completely and replaced with natural gas in several European countries and Canada
- The concept of BAT “Best Available Technology” is implemented to minimize pollution. Several technologies disappeared and several others were modified due to the need for cleaner operations

Key take-aways

- Nothing is “waste” anymore; everything is valued
- Associated gas and natural gas are similar in nature, process, waste streams, and environmental concerns
- Associated gas is not a by-product; it is profitable with great potential
- Sustainable projects’ execution must be the norm for new initiatives

References

1. Apergis, Jana (2019). *Stacked-800x600[Image file.]* Retrieved from: https://www.flickr.com/photos/jana_apergis/49176821476

2. Government of Alberta – Advanced Education (2019). *Instrument Technician ILM, Gas Analyzers – Part A, 310304cA*

3. Hauer, Randy (2013). *AMETEK Claus Sulfur Recovery* [PowerPoint slides]

4. Moshfeghian, M (2015). Adsorption Dehydration: Two-Tower vs Three-Tower System. [Image file]. Retrieved from: https://www.jmcampbell.com/tip-of-the-month/wp-content/uploads/2015/10/fig2.png

5. Smith, G (2013). Dehydration with glycol. [Image file]. Retrieved from: https://petrowiki.org/images/thumb/4/47/Vol3_Page_202_Image_0001.png/759px-Vol3_Page_202_Image_0001.png