



**urotek**  
Refining Services Ltd

*Our Business is Knowledge Transfer*

# Sulphur Recovery

A Eurotek training course



## ERS Sulphur Recovery

### An introduction:

ERS Sulphur Recovery is a comprehensive core skills course for professionals dealing with all aspects of the Claus unit. As Refiners meet the demand for lower Sulphur fuel along with lower SOX emissions from the Refinery this training course dealing with all aspects of sulphur recovery becomes increasingly important. The course covers the process fundamentals and mechanical systems used in the operation of the Sulphur Recovery and Tail Gas Clean-Up Plant. The course will also provide first hand experience of a few examples of Claus plants simulation.

### Learning objectives:

Upon completion of this course graduates will have gained an overview of the many Claus plant configurations available and acquire a solid understanding of the key elements associated with the design, operation and control of Claus plants. This will include the impact of the feed quality, catalysts, operating conditions and unit design on sulphur recovery rate and their commercial aspects. In addition they will have gained some valuable insight into how to optimise, debottleneck and troubleshoot their Claus unit

### Who should attend?

This course is for those who are involved in the design, process engineering, operations and maintenance of the Claus unit. The course will be highly valuable to all engineers involved in the process selection, design, start-up and operation of Claus plants, their tailgas treatment processes and suitable burners and Claus furnace configurations. Additionally the course will be useful for personnel having to make decisions about new investments and wishing to gain an overview of available options with their commercial, technical and environmental implications.



## Description:

Claus plants convert toxic H<sub>2</sub>S into harmless elemental sulphur. They are applied in a number of industries, notably in refineries, in natural gas plants and in the chemical industry. The course covers the role of Claus plants in refineries, chemistry of the Claus process, Claus plant configurations, the various tailgas treatment processes, start-up, shut-down and troubleshooting, optimisation of Claus operation, simulation of Claus plants on the computer, burners for Claus furnaces, the influence of clean. Also the carbon footprints of various tailgas treatment options are discussed. The course covers the role of Claus plants in refineries, chemistry of the Claus process, Claus plant configurations, the various tailgas treatment processes,

start-up, shut-down and troubleshooting, optimisation of Claus operation, simulation of Claus plants on the computer, burners for Claus furnaces, the influence of clean fuels production on Claus plants, reaction of the various tailgas treatment processes to clean fuels production, oxygen enrichment and its consequences for the Claus process and the various tailgas treatment processes, trace behaviour in Claus as NH<sub>3</sub> and NO<sub>x</sub>.

The simple Claus process is easy to understand and straight-forward, but changes in refining and environmental protection laws forced many changes on the Claus plants.

Nowadays efficient tailgas treatment processes, long turn-around cycles, low CO<sub>2</sub> and NO<sub>x</sub> emissions make these units a lot more sensitive. In addition as a by-product of clean fuels production ammonia also has to be converted in sulphur recovery units which influences the Claus furnace and its burner. The participants will be led through an example of a HAZOP study. Also covered are commercial aspects, including typical cost of tailgas treatment processes.



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## Course Presenter

Dr. Michael Heisel is general manager of ITS Reaktortechnik GmbH with experience in environmental protection, refining, engineering and contracting. He has 30 years experience in Claus design and operation. He also invented two new sulphur recovery processes which won Kirkpatrick Awards for being among the worldwide best novel processes introduced in the chemical industry. Michael received his diploma and PhD from the Technical University of Munich. He holds many patents in the fields of gas synthesis and purification. A number of the major chemical and EPC companies are his licensees.

Dr. Bernhard Schreiner obtained his PhD in Chemistry at the Ludwig-Maximilian-University in Munich, in 1991. He then started to work at Linde AG, first in the R&D department of the engineering group specializing on gas processing plants, mainly for gas desulphurisation. These activities included services as analytically based start-up assistance and pilot plant operation. Since 1999 he is project manager with the central application department of Linde Gas being active in the field of gas uses in the chemical process industry.

His focus there is on oxygen applications, e.g. for intensification of state-of-the-art technologies as air oxidations.



## Course programme

### Day 1

At the beginning of the course the presenters will try to find the areas of main interest of the participants. The course may be adjusted to best meet these interests.

#### **BASICS**

**Political Landscape of Refineries and the Oil Market**

**Why Claus Plants Gain Importance in Refineries**

**History of Sulphur**

**Chemistry of Claus**

**Basics of the Claus Process**

Amine scrubbers for Claus feed gas preparation

\* Reaction furnaces

\* Claus burners

\* Catalytic converters (types, catalysts)

\* Reheaters (direct, indirect heat exchange)

\* Condenser

\* Sulphur legs

\* Incinerators (thermal, catalytic, control)

**Processes for Tailgas Treatment**

\* Sub dew point

\* Hydrogenating recycle

\* Oxidising recycle

\* Direct oxidation

\* Carbon footprint of various Tailgas Treatment processes

### Day 2

**OPERATION, PLANT OPTIONS AND THEIR CONSEQUENCES FOR OPERATION**

**Start-up, Shut-down, Troubleshooting**

\* First start-up, second and later start-ups

\* Shut-down for stand-by, for short period, for long period

\* CatCool and simulation

**Optimising Claus Operation**

\* Air demand analyser

\* COS/CS<sub>2</sub>

\* Temperatures

\* Availability

\* Jacketing versus heat tracing

**Simulation of Claus Plants**

\* Claus Burners Revisited

\* SURE burners and double combustion

\* 2 lances, multiple lances

\* High turbulence

\* Split stream

\* Start-up

\* Igniters

\* Sour water stripper gas injection

\* Double combustion

### Day 3

**CLEAN FUELS AND THEIR CONSEQUENCES**

**Clean Fuels and Claus**

\* Capacity increase

\* Ammonia deposits

\* Ammonia destruction, improving availability

\* Cleaning Claus plants

\* Reaction of the various tailgas treatment processes to ammonia

**Oxygen Enrichment**

\* Safety, HAZOP

\* Hardware (ASU, O<sub>2</sub> tank, vaporiser, dosing O<sub>2</sub>, O<sub>2</sub> injection, piping)

\* Operating experience

\* Chemistry, trace behaviour

\* Reaction of tailgas treatment processes to oxygen enrichment

\* Tests in refineries

Costs (CAPEX, OPEX, savings versus O<sub>2</sub> cost)





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