



Adsorption Technology

Regenerable and non-regenerable adsorption are used for a variety of component removal steps throughout the entire Oil & Gas as well as Petrochemical industry, Upstream, Midstream and Downstream. Such units are typically installed to ensure that a certain specification is met, to protect downstream catalysts and equipment (e.g. cryogenic heat exchanger in an LNG plant), to prevent corrosion, hydrates, salt formation, etc.

A few examples are:-

- Regenerable dehydration with molecular sieves applied on platforms, gas plants, LNG, ASU's, refineries and petrochemical plants in gas as well as liquid phase streams
- Sulphur and Sulphur species removal in non-regenerable (e.g. by ZnO, promoted alumina's, etc.) as well as regenerable systems (by molecular sieves) on platforms, gas plants, refineries (e.g. H₂U), gas to liquids plants and petrochemical plants
- Hydrocarbon dew pointing using silicagel in gas plants
- Mercury removal on platforms, gas plants, LNG, refineries and petrochemical plants in gas as well as liquid phase streams
- Chloride and Fluoride removal in refineries and petrochemical plants
- Arsine removal in petrochemical plants

NAPTA can provide assistance during design, installation, operation and troubleshooting of these installations. In the project phase, NAPTA can support in technology selection. NAPTA's expertise covers making designs of such units such that these can be used as benchmark for Vendor proposals. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Ensure a proposed design will be able to meet the required specification and lifetime

- Increase unit capacity through better understanding of the operation of the unit
- Enhance the reliability of your adsorption unit as a result of targeting identified issues



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NAPTA Services

Amines Based Absorption Technology

Amines Based Absorption Technology is one of the main technologies for removal of acidic components (like H_2S , CO_2 , Mercaptans and COS) from gas and liquid hydrocarbons streams. It is a process which can be found in almost every plant in the entire Oil & Gas as well as Petrochemical industry, Upstream, Midstream and Downstream.

Amine units are used to remove in general almost all H_2S to very low levels, in order to meet treated gas specifications. CO_2 can be removed to low levels as well, but often only part of the CO_2 needs to be removed, depending on the specifications. COS and mercaptans are more difficult to remove by amine, but often additives are added (like Sulfolane) to enhance the removal.

A few examples are:-

- CO_2 removal in LNG application with mixture of MDEA and piperazine in water. Able to meet LNG specs of < 50 ppmv.
- H_2S and CO_2 removal from sour gas at high pressure with MDEA meeting spec of 5 ppmv of H_2S , while slipping part of the CO_2 in order to arrive at < 2 mol % in sales gas.
- Amine unit in TGTU where H_2S is removed to the required level (for SO_2 emission), while CO_2 slip is maximised in order to avoid large CO_2 recycle to Claus.
- Treating of LPG for removal of H_2S and COS with Amines. DIPA or DEA can be used for this purpose. Mercaptans present can be removed by the Caustic process or by molecular sieves.



NAPTA can provide assistance during design, installation, operation and troubleshooting of these installations. In the project phase, NAPTA can support in technology selection, solvent selection and line-up selection. Also NAPTA can advise on equipment design and selection and advice on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Identify causes of the problems encountered in your amine unit like foaming, fouling, corrosion and learn and experience how to prevent these problems.
- Optimise the operation of the unit and manage to increase the capacity of the unit. This can entail changing the solvent composition or switching to another amine solvent.
- Learn how to maintain the quality of the solvent and thereby improve the reliability of the unit.

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Caustic Based Mercaptan Removal Technology

Mercaptans are very weak acidic compounds which can be found in natural gas, NGL, LPG, condensate, and liquid hydrocarbon streams at refineries (LPG, gasoline and kerosene). Mercaptans are toxic and have a very bad smell and need to be removed to meet sulphur specification, reduce the corrosivity of the product or to remove the bad smell of the product.

Caustic based processes are often used to treat liquid hydrocarbon stream for mercaptans:-

- Light mercaptans (C1-C3 mercaptans) can be removed from the product stream (NGL, LPG, light condensate/naphtha) and converted into disulphide oil, which is produced as a separate product. This is done in the extractive caustic process.
- Heavier mercaptans (C4+ mercaptans) cannot be removed, but only converted into disulphides. This is called the sweetening caustic process.



Caustic based processes are already used for decades for the removal of mercaptans. It is often the most cost efficient and simple process. These processes can be found in almost every refinery and every sour gas plant which has to deal with mercaptans.

Caustic units can remove/convert mercaptans to very low levels. They will also remove H₂S, COS and CO₂ from these hydrocarbons streams. If required, caustic can also be used for mercaptan removal from gas streams.

A few examples are:-

- In a sour gas facility LPG is produced and treated with extractive caustic process to remove mercaptans.
- The Condensate of the same sour gas facility is first treated in an extractor to remove the light mercaptans. After that the condensate is treated in a sweetening caustic step to convert the remaining mercaptans in order to produce an odourless condensate ready for export.
- In traditional kerosene treating caustic plays an important role. It often has the following steps; caustic prewash, sand filter, caustic sweetening, settler, water wash, salt filter, clay filter, all required to produce kerosene on spec for aviation purposes.

NAPTA can provide assistance during design, installation, operation and troubleshooting of these installations. In the project phase, NAPTA can support in technology selection and line-up selection. Also NAPTA can advise on equipment design and selection and advice on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Identify causes of the problems encountered in your caustic unit like off spec product, high caustic losses, corrosion, etc.
- Optimise the operation of the unit, keep losses and make-up low, debottleneck, etc.

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Understanding the Effect of Heat Stable Amine Salts

Heat Stable Amine Salts (HSAS) are formed when the amine solvent reacts with acidic components stronger than H_2S and CO_2 . Typical acidic components (but not limited to) include acids that form salts of chloride, sulphate, formate, acetate, oxalate, cyanide, thiocyanate and thiosulphates. Heat Stable Salts (HSS) are slightly different from HSAS because they do not need to include an amine molecule in the salt. HSS in amine solvents can also be formed when the acids react with a strong base like $NaOH$, Na_2CO_3 , KOH or K_2CO_3 . Heat Stable Salts (HSS) are therefore a more general term than Heat Stable Amine Salts (HSAS).

Problems can occur when the salt stability decreases to the point where some disassociation takes place in a site-specific location in the unit. Corrosion occurs when the disassociation creates a corrosion cell with metals in the system.

Problems can also occur when the weakest bound salts dissociate in the reboiler and the acidic part of the salt evaporates. This can lead to the condensation of acidic vapours in colder parts of the reboiler and regenerator. As the amine solvent has a much lower volatility than for instance formic and acetic acid, no base is present in the vapour to neutralize the acid after condensation. The vapours condensing in cold part of the reboiler, the piping to the regenerator and the regenerator itself can therefore have a very low pH. The low pH of condensing vapours in relatively cold places in the reboiler and regenerator will significantly increase the corrosion and erosion rates. Besides increased corrosion, HSAS can increase the foaming tendency because particularly organic acids are surfactants.

The presence of strong acid anions in the amine solution can also influence in a positive way the regeneration of the solvent. In the regenerator strong acids will help to strip the solvent to very low levels of H_2S and CO_2 . Details of the limitations, disadvantages and advantages can be provided and simulated by NAPTA in a more detailed study.

How to deal with Heat Stable Amine Salts in amine systems?

There are five different methods to control the level of HSAS and corrosion in amine systems:

1. Bleed or purge amine to control the level of HSAS in the amine solvent. High OPEX.
2. Neutralise the HSAS with a strong base like inorganic base like KOH . If the ingress of HSAS is very high some bleed or purging of the amine solvent may be required. Very cost effective with no CAPEX and low OPEX.
3. Removal of HSAS by Ion Exchange. Medium CAPEX and medium OPEX.
4. Removal of HSAS by Electrodialysis. Requires less CAPEX than Ion Exchange and roughly the same medium OPEX.
5. Vacuum distillation. Highest CAPEX option and similar OPEX. The most important advantage is that it is the only way to remove non-ionic amine degradation products.

NAPTA will help you to evaluate the most cost-effective HSAS control technology based on the characteristics of your plant conditions.

Drawing on the NAPTA Corporation's know-how heritage, NAPTA's technology is designed to operate safely, reliably and efficiently, and to help maximise the return on investment during the entire life cycle of a unit.

In addition, we also offer after-service and operational support delivered by experienced personnel. NAPTA can provide assistance during design, installation, operation and troubleshooting units. In the project phase, NAPTA can support its customers by providing professional services such as P&ID, HAZOP review meetings, etc. NAPTA experts can conduct a site visit for better understanding of site-specific issues and training of local operational and technical staff.

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NAPTA Services

Hydrocracking

Hydrocracking is an established and reliable method for transforming low-value heavy oil fractions into valuable products. In today's market, refinery operators face a range of new technical, regulatory and commercial challenges: ensuring that their operations meet environmental standards; comply with new fuel specifications; and upgrading their refinery capability to meet capacity and quality targets.

NAPTA's hydrocracking process technology combines advanced process know-how with high-performance catalyst systems and efficient reactor internal designs. This combination provides high levels of availability that deliver consistently high yields of quality products in an energy-efficient manner. All are essential in enabling refinery performance to be optimised cost-effectively.

By applying the NAPTA's hydrocracking expertise gained by its highly experienced SMEs, we offer cutting-edge technology licenses for new units. This technology helps refiners around the world to achieve the products and the performance they need in today's market place and to meet ever-more stringent fuel-quality regulations.

In the NAPTA hydrocracking process, low-cost heavy oil fractions are reacted with hydrogen at high temperature (350-450°C) and pressure (90-200 barg) in the presence of an optimised catalyst system to yield high-level products such as diesel, jet fuel and naphtha for either gasoline production or as chemical feedstock. Several process configurations are available:

- The single-stage, recycle hydrocracker fully converts feedstock to components for automotive fuels. It can be designed for maximum middle distillate yield for diesel production; maximum kerosene production for jet aviation fuel; or maximum naphtha production for gasoline and chemical feedstocks.
- The one-through hydrocracking unit partially converts the feedstock to produce catalytic cracker, ethylene cracker or lubricant based oil feedstocks as well as high-quality distillates for automotive fuels.
- The two-stage hydrocracker offers complete conversion of feedstock through two distinct reactor stages with intermediate fractionation;

this results in maximum yield of high-quality products (naphtha to heavy diesel).

For each new application, we match the optimum configuration with the given feedstock and the required processing objectives. Additional flexibility in the product slate can be achieved through the choice of catalyst system or by adjusting the process conditions.

In addition, we also offer after-service and operational support delivered by experienced personnel.

NAPTA can provide assistance during design, installation, operation and troubleshooting of the hydrocracking units. In the project phase, NAPTA can support its customers by providing professional services such as P&ID, HAZOP review meetings, etc. Also NAPTA can advise on equipment design and selection and also advise on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:

- Identify causes of the problems encountered in your hydrocracking units.
- Optimise the operation of the unit.
- Provide long lasting solutions.

For more information, please contact with NAPTA's hydrocracking technology SME Mr Egbert van Hoorn via herein below contact details.

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Hydrotreating

Hydrotreating is an established refinery process for improving product qualities. The refining industry's efforts to meet the global trend for more-stringent clean fuels specifications, the growing demand for transportation fuels and the shift toward diesel have meant that hydrotreating has become an increasingly important refinery process in recent years.

NAPTA's hydrotreating process combines advanced process technology, high-performance catalyst systems and efficient reactor internal designs. This technology has helped many refiners to rise to the clean fuels challenges facing their businesses; operators around the world have licensed new units for their grassroots facilities as well as applying new catalyst and reactor internals technology to revamp their existing units.

Drawing on the NAPTA Corporation's know-how heritage, NAPTA's technology is designed to operate safely, reliably and efficiently, and to help maximise the return on investment during the entire life cycle of a unit. We have experience of a wide range of feedstocks and boiling ranges, including straight-run and cracked feedstocks such as from fluidised catalytic cracking (FCC) and coking, and boiling ranges from naphtha to FCC feedstocks.

In NAPTA's hydrotreating process, oil fractions are reacted with hydrogen in the presence of a catalyst to produce high-value clean products. The operating conditions will depend on the final application. For instance, temperature could range between 350 and 390°C and pressures between 60 and 90 barg for the production of ultra-low-sulphur diesel (<10 ppm). Several process configuration are available. Design conditions for other feedstocks like naphtha hydrotreatment will be different.

NAPTA's hydrotreating technology integrates successful operating practices with innovative designs that are based on research and development programs. The technology is designed to offer our customers benefits in several areas:

- **Energy efficiency:** The efficient use of energy is an increasingly important driver for refiners owing to high energy costs and the growing focus on businesses' carbon footprint. Our technology is designed by maximum efficiency

and incorporates lessons learned in refineries around the world.

- **Reliability:** Hydrotreater downtime is increasingly costly because today's stringent specifications mean that refiners have less processing flexibility. In comparison with similar technologies, NAPTA's hydrodesulphurisation (HDS) technology offers sustained advantages in terms of availability, onstream factor, utilisation and turnaround duration.
- **Catalyst selection:** We offer cutting-edge technology coupled with market-leading catalysts from our strategic business partner Ranido. We optimise the hardware design and select the best catalyst for an application.

In addition, we also offer after-service and operational support delivered by experienced personnel.

NAPTA can provide assistance during design, installation, operation and troubleshooting of the hydrotreating units. In the project phase, NAPTA can support its customers by providing professional services such as P&ID, HAZOP review meetings, etc. Also NAPTA can advise on equipment design and selection and also advise on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:

- Identify causes of the problems encountered in your hydrotreating units.
- Optimise the operation of the unit.
- Provide long lasting solutions.

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Process Integration and Optimisation

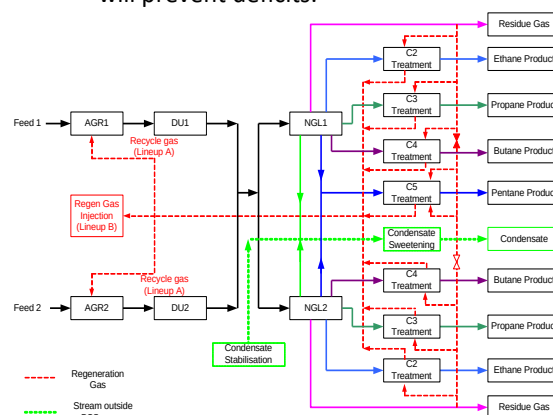
From well fluids to energy suppliers, chemical feedstock and final products, there is a sequence of separation of phases and removal of contaminants required to fulfil the specifications of the defined value products. In addition, removed contaminants may present its own value (e.g. Sulphur).

In practice there are two ways to develop a process scheme; by individual selection and optimisation of the critical steps including phase separation – contaminant removal – and conversion of the wastes. Alternatively it should be taken into account interrelationship and dependencies of the optional process steps while selecting the best optimised concept and process line-up right from the start of the project. Similar strategy is applicable for process optimisation of existing facilities; per process, or integrated approaches.

A few examples are:-

- Selection of an Amine process which can be integrated with the Tail Gas Treating Unit Amine step, or two independent processes.
- Selection of number of parallel processing trains; optimised per selected process (size, energy) resulting in different number of throughput size parallel units (connected with headers), or optimised in 'independent' parallel trains (equal throughput through all processing units).
- Optimisation for deeper Sulphur removal, a higher Sulphur recovery rate, usually executed in the Tail Gas Treating Unit, where the Amine unit may be able to solve the missing recovery rate instead of the traditional addition of more severe Tail Gas Treating.
- Energy optimisation envelop choice and future requirements like CO₂ capture or increased contaminants levels because of EOR may influence the selection of process units in the process line-up study. Optimisation of existing units with limited operational data – because critical givens are not measured – is a great and costly regret over the life time of a processing

unit. Definition of requirements upfront will prevent deficits.



NAPTA can provide engineering services on the setting up of objectives, boundaries, key decision factors and development of weighted risk tables for individual process requirements as well as integrated line-ups. NAPTA can provide assistance during execution of definition and evaluation of outcomes of process design.

The definition of processing test runs, whether for direct unit optimisation, as basis for process models (including the selection of suitable plant data and plant data consistency checks) can be provided by the NAPTA Process Integration Experts.

The provided services can help you to:-

- Define the project requirements in technology detail
- Optimise integrated designs
- Optimise process test runs for the purpose the data is required

For more information, please connect with NAPTA's Process Integration and Optimisation SME Mrs Jeanine Klinkenbijn via herein below contact details.

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Modelling Support

Simulation software can be used to create models of Gas Processing Units. The models can either be used in the design phase or during operation for trouble shooting and fine tuning of the process. These models can be extended with proprietary unit operations or proprietary physical property models. If these extensions are created with Cape-Open they can be used on multiple platforms. Cape-Open is becoming an industry standard for data exchange of user models and simulation platforms.

Support can be provided on:-

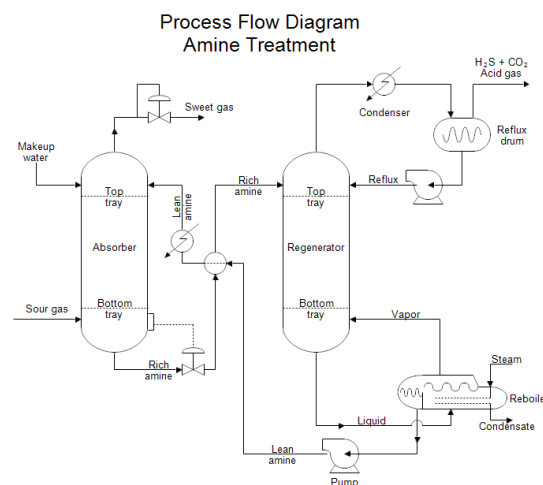
- Setting up and troubleshooting of simulations for Gas Processing.
- Interfacing simulation software with MS-Office to provide easy and standard reporting tools.
- Definition and coding of proprietary calculations in Excel.
- Definition and coding of user models in Cape-Open
- Using plant-data for model validation

NAPTA can provide assistance during design, installation, operation and troubleshooting of these installations. In the project phase, NAPTA can support in technology selection. NAPTA's expertise covers making designs of such units such that these can be used as benchmark for Vendor proposals. NAPTA subject matter experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Ensure a proposed design will be able to meet the required specification and lifetime
- Increase unit capacity through better understanding of the operation of the unit
- Generate standard reports throughout the whole line-up

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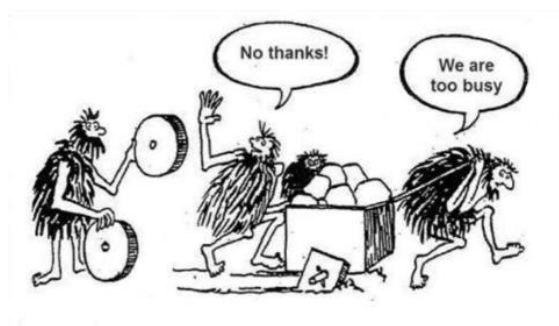


Operational Excellence

What is Operational Excellence?

- High Plant Availability. Avoid plant failure due to poor maintenance, low integrity, minimal people care and running the unit outside design capability.
- Good Safety Records. Good HSE policy, process safety guaranteed and good HSE awareness.
- Good Business Economics. Optimal cost control, plant capacity achieved and low product quality give away.
- Resilient Organisation. Good mix of people (operators, engineers and management).
- People Capability and Effectiveness. Have the right amount of FTE and disciplines.
- Plant Design. Do you have the correct plant design to achieve your goals?

Many sites are facing the below illustration.



- People Capability and challenge.
 - Do you have enough people and are they inspired?
 - Role and responsibilities known?
 - Incident investigations & lesson learned conducted?
- Sign and signals.
 - Process control and DCS
 - Lab data.
 - Knowledge management.
 - Refreshment trainings.
- Systems.
 - Document control.
 - Integrity team:-
 - ✓ Inspections.
 - ✓ Project.
 - ✓ Manuals
 - ✓ MOC procedure.
- Teams.
 - Mechanical.

- Automation.
- HSE
- Project Implementation.
- Lab
- Planning & Scheduling.

- Many sites are facing low plant availability due to:-
 - Poor plant design and are not able to invest due to investment restrictions.
 - Adjust your expectations.
 - Feed quality has changed.
 - Plant capability is a problems.
 - Missing the right people and tools.
 - No lessons learned and corrective actions.
- Best way to move forward:-
 - Understand your people and plant capability.
 - Develop vision where to be within 1, 5 and 10 years.
 - Investigate options and possibilities to become resilient.

NAPTA can provide assistance during design review, installation review, operation and troubleshooting of these installations. Also NAPTA can provide assistance on the path forward to understand operation status and what is achievable. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff could be considered.

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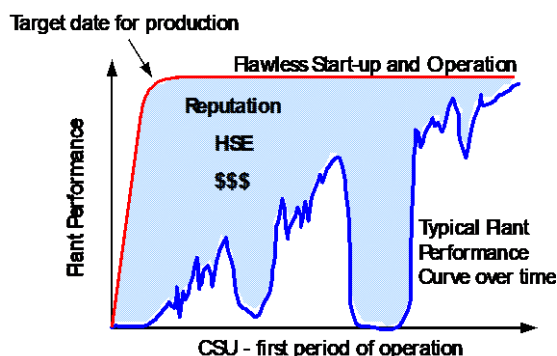
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Operations Readiness Management

The objective of Operations Readiness Management Process is a focused, proactive and systematic approach to successful integration of critical operations requirements during all the phases of project delivery, which if applied in a collaborative way will lead toward successful design, installation, commissioning, start-up and ramp-up to steady-state operation of a new facility to attain production as promised.

This is to address why many projects, while approaching their commissioning and start-up phases, are facing the below illustration!



What is Operations Readiness?

- The risks mitigated through application of Operations Readiness is to ensure that facilities (be it green field or brown field) are designed and built to agreed standards and are started-up flawlessly.
- Risk control framework will be set up and updated in each phase of project life cycle to ensure proper governance on expected delivery.
- Front End Loading driven by integration of Flawless Project Delivery (FPD) and Quality Assurance/Quality Control (QA/QC) will be rigorously applied to drive a step change in eliminating risks for failures in work specification and performance control of all production solutions.
- Critical lessons learned in past projects will be accurately compiled and communicated to stakeholders in projects for improvement.
- In addition, it is to address that the future Asset Owner is fully prepared and competent to receive, operate and maintain the facilities to deliver the production promise.

The Three-Pillar Model is used to deliver Operations Readiness Management Process in the all project life cycle. The three-pillar model can be briefed as follows:-

- Asset Owner Readiness. This pillar focuses on the readiness of the Asset Owner Organisation and represents the Operations involvement in the project from FEL1 up to and including the initial Operate Phase.
- CSU Readiness. This pillar focuses on the readiness of the Commissioning and Start-Up (CSU) organisation. The preparation includes early identification of the project CSU Team leader, the creation of a competent CSU organisation, the development of a system based CSU logic & schedule and preparation for the Project to Asset (P2A) Transfer.
- Flawless Project Delivery. The project will be delivered to the owner in a way that the commissioning and start-up will be a smooth process.

NAPTA can provide assistance during design review, installation review, operation and troubleshooting of these installations. Also NAPTA can provide assistance on the path forward to understand operation status and what is achievable. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff could be considered.

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Tail Gas Treating (TGT)

Direct Oxidation or also known as ProClaus® / SuperClaus® / EuroClaus®

Tail Gas Treating of a Sulphur Recovery Unit (SRU) is an established oil refinery process and gas plant process for improving the sulphur recovery efficiency of an SRU. The industry's efforts to meet the global trend for more-stringent SO₂ clean air specifications and the increased sulphur recovery from transportation fuels meant that tail gas treating has become an increasingly important process in recent years.

NAPTA's Tail Gas Treating processes combines advanced process technology and high-performance catalyst systems designs. This technology has helped many industry clients to rise the overall sulphur recovery efficiency to meet the required SO₂ emissions facing their businesses. Operators around the world have licensed new units for their grassroots facilities as well as applying this technology to revamp existing units.

Drawing on the NAPTA Corporation's know-how heritage, NAPTA's technology is designed to operate safely, reliably and efficiently, and to help maximise the return on investment during the entire life cycle of a unit. We have experience with a wide range of SRU tail gas compositions covering all different H₂S/CO₂ ratios as currently used in the industry.

In NAPTA's TGT process with direct oxidation (ProClaus®), the acid gas produced in the amine regenerator is first processed in a two or three catalytic stage conventional SRU. The number of catalytic stages, the catalyst and the operating conditions of the SRU will depend on the composition of the acid gas from the amine regenerator. For instance, a low H₂S concentration will typically require three SRU catalytic stages to meet the final overall sulphur removal efficiency. Several process configurations are available.

In the most important TGT part of the unit, the tail gas from the SRU is contacted with air and a proprietary selective oxidation catalyst to oxidize the remaining H₂S directly to elemental sulphur. **This TGT will increase the sulphur recovery efficiency of the SRU from 95-96% to 99.5% or 99.6%.** In addition, a final caustic scrubber can be installed to increase the efficiency further.

NAPTA's TGT technology integrates successful operating practices with innovative designs. The technology is designed to offer our customers benefits in several areas:

- **Sulphur Recovery Efficiency:** The overall efficiency of the SRU and TGT design is the most important driver to reduce the SO₂ emissions. Our technology is designed to maximise the overall efficiency and to include all streams containing mercaptan sulphur components.
- **Catalyst selection:** We offer cutting-edge technology coupled with market-leading catalysts from our strategic business partner Ranido. We optimise the hardware design and select the best catalyst for an application.

In addition, we also offer after-service and operational support delivered by experienced personnel.

NAPTA can provide assistance during design, installation, operation and troubleshooting of the SRU and TGT units. In the project phase, NAPTA can support its customers by providing professional services such as P&ID, HAZOP review meetings, etc. Also NAPTA can advise on equipment design and selection and also advise on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:

- Identify causes of the problems encountered in your SRU and TGT units.
- Optimise the operation of the unit.
- Provide long lasting solutions.

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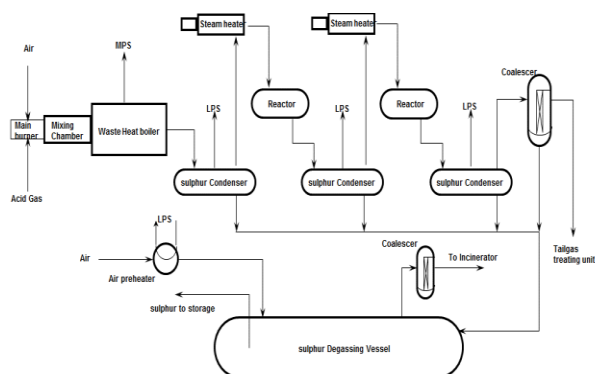


SRU, Claus Technology

SRU stands for Sulphur Recovery Unit. Claus Technology is a process where H_2S rich gas is being converted into elementary liquid sulphur and water. As liquid sulphur is being produced this product is recovered and routed to a sulphur degasser. In the degasser the liquid sulphur is stripped with steam to remove all dissolved H_2S .

The Claus process is a safe and environmental friendly process. Through-out the world many SRU's has been installed producing liquid sulphur and minimizing H_2S emission.

A sketch of the Claus process is provided below.



Claus based processes are already used for decades for the destruction of H_2S . It is often the most cost efficient and simple process. This process can be found in almost every refinery and every sour gas plant which has to deal with H_2S .

SRU can remove/convert H_2S to around 95% and the remaining 5% H_2S is routed to a Tail Gas Treating Unit to increase the sulphur recovery to around 99.9%. The Claus process also produces HP or LP steam for further usage.

The SRU contains the following main equipment:-

- Main burner for the Modified Claus process.
- Waste heat boiler for steam production.
- Condensers for elemental sulphur recovery.
- Reheaters to achieve optimal inlet temperature for the reactors.
- Reactors/converters to increase overall recovery.
- Coalescer drum to remove sulphur mist.

- Sulphur degasser to remove dissolved H_2S .

NAPTA can provide assistance during design, installation, operation and troubleshooting of the SRU installations. In the project phase, NAPTA can support in project development phases as P&ID, Hazop review etc. Also NAPTA can advise on equipment design and selection and also advise on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Identify causes of the problems encountered in your SRU.
- Optimise the operation of the unit.
- Provide long lasting solutions.

For more information, please contact with NAPTA's SRU, Claus Technology SME Mr Egbert van Hoorn via herein below contact details.

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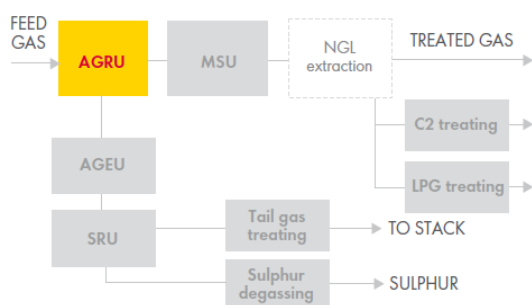
SulSolv® Hybrid Amine Technology

A simple, single-step, sour gas treating process

Gas development projects face growing challenges from increasingly sour resources, tighter sales specifications and stricter environmental emission standards. Meanwhile, operators are looking for solutions to debottleneck existing plants. The SulSolv® hybrid amine technology sour-gas-treating process can be an ideal solution in grassroots applications and solvent swap revamp situations.

Among these hybrid amine technologies, the SulSolv®-X solvent is one of the most efficient designed to leverage the advantages of SulSolv hybrid and accelerated methyl diethanolamine (MDEA) solvents in a single acid gas removal process. It employs two amines, MDEA as the main reactant and piperazine as the accelerator, along with sulfolane and water.

The application of SulSolv®-X technology offers many performance advantages compared with a conventional scheme for treating sour gas. Crucially, the treating line-up is simpler and it enables all-in-one removal of contaminants, which can help to reduce capital and operating expenditure.



Other advantages include:

- Faster CO₂ and COS removal through enhanced reaction kinetics;
- Quicker RSH removal due to enhanced solubility;
- Higher loading capacity, which reduces the solvent circulation rate and facilitates the use of smaller equipment;
- Reduced steam requirements due to its lower solvent circulation rate and heat of reaction;

- Lower hydrocarbon co-absorption through decreased solubility; and
- Reduced solvent degradation, so reclamation is not required.

In addition, all the solvent chemicals can be sourced on the open market.

NAPTA can provide assistance during design, installation, operation and troubleshooting of these installations. In the project phase, NAPTA can support in technology selection, solvent selection and line-up selection. Also NAPTA can advise on equipment design and selection and advice on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Identify causes of the problems encountered in your amine unit like foaming, fouling, corrosion and learn and experience how to prevent these problems.
- Optimise the operation of the unit and manage to increase the capacity of the unit. This can entail changing the solvent composition or switching to another amine solvent.
- Learn how to maintain the quality of the solvent and thereby improve the reliability of the unit.

For more information, please connect with NAPTA's Amine Technology SME Mr Egbert van Hoorn via herein below contact details.

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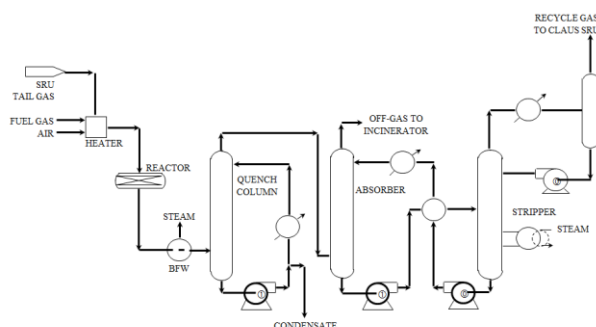
Tail Gas Treating (TGT)

Amine-Based TGT or also known as SCOT-Type TGT

The Tail Gas Treating Unit (TGTU) is there to enhance the overall sulphur recovery to around 99.9%. The tail gas from the SRU is being routed to a catalytic converter where all SO_2 is being converted into H_2S , which is routed to a quench column. In the quench column the majority of the water produced during the Claus process is being removed. The remaining components are then routed to an Amine Absorber which contains MDEA (selective absorption) to absorb all H_2S and slip around 80% of the CO_2 and some ppm H_2S . The H_2S rich MDEA is routed to a regenerator where the H_2S is removed and routed to the inlet of the SRU and cleaned MDEA is routed back to the Absorber.

The TGTU process is safe, environmental and proven technology. Through-out the world many TGTU has been installed to enhance liquid sulphur recovering and to minimize H_2S emission.

A sketch of the TGTU process is provided below.



TGTU are already being used for decades for meeting overall H_2S emission legislation. It is often the most cost effective and simple process to increase overall sulphur recovery. This process can be found in almost every refinery and every sour gas plant which has to deal with H_2S .

TGTU increase overall SRU recovery to around 99.9% and is basically at the back-end of a SRU.

The TGTU contains the following main equipment:-

- Heater and catalytic converter to convert all SO_2 into H_2S .

- Condensers to cool the process gas by producing LP steam.
- Quench Column, to remove water.
- Intermediate cooler as side exchanger in the quench column.
- Amine Absorber.
- Amine Regenerator.
- Tower bottom pumps.
- Lean/Rich Amine exchanger.
- Regenerator reboiler and overhead cooler.
- Lean Amine cooler.

NAPTA can provide assistance during design, installation, operation and troubleshooting of the TGTU installations. In the project phase, NAPTA can support in project development phases as P&ID, Hazop review etc. Also NAPTA can advise on equipment design and selection and also advise on the materials for construction. NAPTA experts can conduct a site visit for better understanding of site-specific issues; and training of local operational and technical staff.

The provided services can help you to:-

- Identify causes of the problems encountered in your TGTU.
- Optimise the operation of the unit.
- Provide long lasting solutions.

For more information, please contact with NAPTA's Tail Gas Treating Unit SME Mr Egbert van Hoorn via herein below contact details.

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