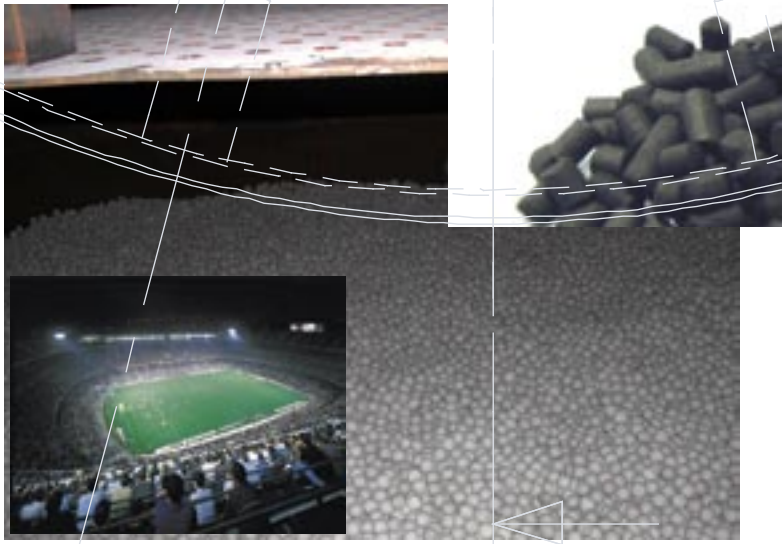
Volatile Organic Compounds (VOC)

Gasoline Vapour Recovery Unit (VRU) installed at Hammerfest, Norway



Activated carbon is a very porous material with an enormous surface area. Seven grams of activated carbon have an active surface the size of an international football arena

VOC Recovery

Aker Kvaerner Cool Sorption is a global centre of excellence for VOC abatement technology.

Aker Kvaerner Cool Sorption supplies a wide range of Vapour Recovery Units (VRU) for the recovery of gasoline or crude oil vapours to drastically reduce emission of environmentally hazardous substances.

With more than 200 VRUs in operation across the world, Aker Kvaerner is a recognised market leader. Highly skilled employees design, manufacture and supply Vapour Recovery Units for virtually all applications.

Land Based Gasoline Vapour Recovery

Gasoline vapours are normally recovered for the following three reasons:

- To reduce emission of environmentally hazardous substances
- To reduce safety risks in the distribution of gasoline
- To reduce significant losses of valuable energy resources

Investment in Vapour Recovery

The economic motivation for vapour recovery is that gasoline vapour contains a considerable amount of gasoline. Under normal circumstances, a gasoline terminal will have an average recovery potential of approx. 1,500 litres of gasoline for every 1,000 m^3 of transferred product.

The value of the recovered gasoline varies according to whether the recovered product is taxed or not. If the gasoline is taxed, the practice by EU authorities is to refund tax on the recovered product so the product is not subject to double taxation. This, in particular, makes vapour recovery attractive and it is not unusual for a single vapour recovery unit to have repaid itself in less than one year of service.

Vapour Recovery Technology

In the past decade, recovery by means of activated carbon has emerged as the prevailing technology and today, vapour recovery is almost synonymous with the Pressure Swing Technology.

Newly built VRU at Gothenburg, Sweden

Aker Kvaerner Cool Sorption has developed a highly efficient concept for Carbon Vacuum-regenerated Adsorption, the CVA system, which has formed the backbone in our product portfolio since the mid nineties and is now adopted by oil companies thoughout the world. Applications include storage tank vents, rail car and truck loading facilities, marine terminals and offshore ship loading.

Environmental Requirements

All Aker Kvaerner Cool Sorption VRUs comply with emission standards specified by the EU and the US.

Unless specified otherwise, all our VRU applications have a guaranteed maximum HC emission of 10 g/m^3. When requested, the carbon based VRUs are also able to meet the more stringent German and Danish regulations of maximum 150 mg/m^3, excluding of methane.

Our VRUs may even be fitted with a second stage system, reducing emission levels to just 50mg/m^3, including methane, as stipulated in the revised TA Luft regulations from 2002.

Availability

Availability is a measure of a unit's operational dependability. This is considered our ultimate quality parameter. The VRUs can be supplied with a feature measuring the availability factor as a percentage since the last reset.

A general survey shows that the average availability of all VRUs delivered by Aker Kvaerner Cool Sorption is above 98%, calculated over a one year span.

We ensure high availability by using a simple, well proven design, rigid components with high, documented reliability and easy access to spare parts.

Availability is further increased by a very advanced control system in which a large number of process parameters are recorded and logged. We can examine and diagnose all delivered VRUs via a normal phone line connection and advise clients on any problems. As a result of the remote diagnostics, correct spare parts can usually be delivered on the first service visit.

Picture to the right: Large gasoline and condensate unit installed at Lysekil, Sweden

Control System

The CVA units are equipped with an advanced Programmable Logic Controller (PLC), a bus communication between I/O station and PLC as well as a PC based user friendly Human Machine Interface (HMI). Online key process parameters and system operations of the unit are monitored and tracked.

Features such as event and alarm log settings and a record of the long term development are included. The system enables operational adjustments, accurate service diagnostics and remote supervision.

Marine based crude oil VRU on M/T Navion Europa

Crude oil VRU on the shuttle tanker DE/T Randgrid

Maritime Crude Oil Vapour Recovery

In recent years, Aker Kvaerner Cool Sorption has delivered several Vapour Recovery Units, based on the carbon bed adsorption technology, for VOC abatement applications in Norwegian waters and for onshore terminals.

Aker Kvaerner Cool Sorption has adapted the carbon bed adsorption technology for crude oil vapours. This has proven to be a very competitive solution with NMVOC recovery rates of 90 - 98%.

Our crude oil VRUs are individually designed to comply with specific safety and hazard requirements of each customer, e.g., those of DnV, ABS, USCG, etc.

Some of the largest single sources of Volatile Organic Compounds emissions are marine and terminal loading of crude oil and condensate. Depending on the properties of the loaded crude and its loading rate, typical VOC emissions are in the order of 2 kg vapours per ton of loaded oil.

UN-ECE, US EPA, the International Maritime Organization (IMO), the EU and many others continue to develop (non-prescriptive) regulations and directives on the prevention of air pollution from ships. Most of the larger oil companies world wide have established clear environmental strategies for this issue, with targets for VOC reductions.

Crude Oil Loading Services

- Conceptual studies and development based on any VOC recovery technology
- Turnkey delivery of complete VOC plants for shuttle tankers, FSOs, oil terminals, refineries and process plants
- Maintenance and service contracts
- Laboratory facilities
- Pilot plants
- Pressure swing, activated carbon filter adsorption system
- Combination of adsorption and condensation
- Atmospheric or pressurised cold liquid two stage absorption (CLA)

Safety

The VRUs are designed and built with maximum attention to all levels of safety:
The mineral based activated carbon has a high self ignition temperature for inherent safety. The vessels and piping are designed to withstand an internal explosion for passive safety.

The advanced control system constantly monitors all important parameters and shuts down the unit in case of a malfunction for active safety.

In case of temperature excursions or power failure, the unit will automatically take up safe position.

Aker Kvaerner Cool Sorption is currently installing the world's largest VRU at the Mongstad terminal in Norway. The picture shows a similar plant, which we have installed at the Norwegian Sture terminal, also among the world's largest VRUs

Continuous Product Enhancement

Aker Kvaerner Cool Sorption continues to develop new features for the VRU technology. This is done by constantly monitoring and following up on existing units in operation.

The product enhancement takes place in different parts of the organisation, ranging from on-site visits over our own laboratory to the highly skilled design department.

Through these efforts, we make sure that our customers are always supplied with the latest, best available technology and knowledge in the field of gasoline and crude oil vapour recovery.

We offer to assist with development of existing installations in connection with vapour control or other terminal installations.

Consultative Studies

Aker Kvaerner Cool Sorption takes pride in offering its wide experience and competence on a consultative basis and provide best available technology as well as cost efficient solutions for the task set.

We have performed a large number of concept screening and development studies for major oil companies world wide. This has proven to be of critical value in the client's decision process towards a final solution.

Top: Complete marine based VRUs.
Bottom left: Vacuum pump of a marine based VRU.
Bottom right: The Statoil shuttle tanker, Åsgard C, with its Aker Kvaerner Cool Sorption VRU in full operation during a heavy storm (picture courtesy of Statoil)

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