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AGA is part of the Linde Group, which is the leading gas producer in Europe and the fourth largest gas producer in the world.

Safety First in CO_2 Production

Since excess carbon dioxide in our surroundings replaces the vital oxygen, carbon dioxide needs to be monitored in all places where it is produced, stored, shipped, or used. The AGA CO_2 production plant recognizes this fact and has been monitoring their indoor CO_2 levels since the facility opened in 1991. AGA's safety alarm system integrates the Vaisala CARBOCAP® Carbon Dioxide Modules GMM221.

The AGA corporation in Finland is part of the Linde Group, the leading gas producer in Europe and the fourth largest gas producer in the world. AGA's main gas products are oxygen, nitrogen and argon, which together generate half of the company's revenue. These so-called air gases are produced by distilling air in very low, cryogenic temperatures. In addition to the air gases, other important AGA products include hydrogen and carbon dioxide.

The Kilpilahti process industry cluster

AGA's carbon dioxide production plant is located in a very secure facility inside a Neste Oil refinery in Kilpilahti near Porvoo, Finland. The Kilpilahti area is situated roughly 35 kilometers east of Helsinki, and is the biggest process industry cluster in Northern Europe. The area has its own power plant and harbor. The Kilpilahti industry cluster covers 13 square kilometers and employs over 3500 people. Since many noxious and inflammable products are handled in the area, it is vital that safety issues are taken very seriously. Each of the 3500 employees has passed a safety and security test in order to acquire a permit to work in Kilpilahti.

In addition to the Neste Oil

refinery, a broad range of other petrochemical companies and supporting companies operate in the Kilpilahti area. AGA operates in the area both inside and outside the actual oil refinery. Atmospheric gases are manufactured in an air separation plant, whereas CO_2 is produced next to a Neste Oil hydrogen reformer at the very heart of the refinery.

CO_2 has many uses

AGA and Neste Oil operate side by side at the refinery. Neste Oil uses methane in its reformer to produce the hydrogen. Carbon monoxide is formed as a by-product. A converter is used to transform the carbon monoxide and water into carbon dioxide. The crude carbon dioxide needs to be washed, pressurized, distilled, and cooled to become commercially sold carbon dioxide. This is the responsibility of the AGA CO_2 production facility. The resulting end product is pressurized high-purity CO_2, which is ready for any commercial use. The hydrogen reformer and the carbon dioxide production plant are in operation 24 hours a day and over 8000 hours annually, resulting in almost constant operation except for short maintenance breaks.

The carbon dioxide produced at the Kilpilahti production plant has several uses. For example, greenhouse farmers use it to fertilize their crop. The food industry uses the high purity substance as a protective gas in food packaging and the beverage industry for the bubbles in soft drinks. Carbon dioxide is also used as a refrigerant and the paper industry uses CO_2 to produce bicarbonate of soda used in pulp production. AGA also processes a part of the gaseous carbon dioxide into a solid dry ice. Dry ice is the solid form of carbon dioxide, which melts at -79°C and directly sublimates into gaseous carbon dioxide. It is commonly used for cooling and refrigeration purposes, for example in the food industry.

Investing in safety

Safety is of the utmost importance around the whole Kilpilahti area and AGA's CO_2 production plant is no exception. The safety system design of the plant has been made in co-operation with a company specializing in gas monitoring systems. At the heart of the safety alarm system are the CO_2 sensors. AGA selected infra-red gas transmitters based on the Vaisala CARBOCAP® Carbon Dioxide Modules GMM221.

"Typically the CO_2 concentration here is less than 1000 ppm, which is a very good indoor air quality. Rising levels are constantly monitored with the Vaisala sensors. We have been extremely happy with their operation", says Hannu Rimaila of AGA, who is in charge of instrumentation and automation at the liquid production and process plants.

The carbon dioxide sensors at the AGA CO_2 production plant are monitoring the environment in all occupied spaces. The transmitters are placed at head level, since CO_2 is heavier than air and first accumulates near floor level. As a supplement and for early detection of rising CO_2 levels, the sensors have been placed close to potential leakage points, such as pipelines and valves.

The number of transmitters required in the monitored area depends upon the ventilation system and air flow. At the AGA carbon dioxide production plant, there is a total of ten CO_2 transmitters monitoring the area. Although no leakages have ever occurred, the risk remains and therefore the CO_2 levels are constantly monitored.

Future plans

The future will bring changes to carbon dioxide production at Kilpilahti. Neste Oil will be building a new hydrogen reformer and to ensure that their cooperation continues, AGA will also be constructing a new CO_2 manufacturing plant adjacent to the reformer. The new plant will be fully operational by 2007. Because of the good experiences from the old plant, the new plant will also be equipped with CO_2 monitoring equipment from Vaisala. Once the new plant is operating at full capacity in 2007, the CO_2 production of AGA in Kilpilahti will increase to the extent of being able to cater for CO_2 requirements throughout the entire Baltic Sea region.

Although CO_2 is produced as a by-product of many combustion, brewing, and fermentation processes, it is very difficult to collect efficiently from these small sources. For example, the CO_2 concentration in combustion gas is often very low for efficient recovery and the gas itself contain impurities such as sulphur and nitrogen compounds, which may be difficult to remove. The proximity of a large source of high concentration CO_2 in Kilpilahti allows AGA to utilize the waste from the hydrogen reformer for a commercial product. Globally, these types of CO_2 manufacturing facilities are very often found next to oil refineries, chemical or petrochemical process facilities. ●

Hannu Rimaila is in charge of instrumentation and automation at the AGA liquid production and process plants.