SAFER Real-Time® CASE STUDY

NOVA Chemicals®

Case Study: NOVA Chemicals – Early Detection Leads to Prevention

"Here is a tool originally intended to help manage incidents, but which can also in fact be used to detect incidents at their earliest stages during the normal course of operations and maintenance work. "

— Andy Hart, Team Lead—Responsible Care
Nova Corunna Facility, Ontario; Nova Chemicals Canada

Summary

NOVA Chemicals has made ongoing investments in its SAFER Real-Time® systems in Canada and the U.S. since the late 1990s and, in 2005, the company was able to further leverage that investment.

Using SAFER's partnership with RAE Systems to add an integrated, wireless, GPS enabled monitoring component to the Real-Time system at its Corunna, Ontario, Canada site, NOVA Chemicals has been able to expand its system beyond the traditional scope of Emergency Management and Response.

NOVA Chemicals Corunna Site

Background

NOVA Chemicals is a worldwide corporation that produces plastics and chemicals with a focus on two product chains: ethylene and polyethylene, and styrene and polystyrene. Its commitment to be a corporate "neighbor of choice" includes providing leadership and resources to support community-focused Responsible Care® initiatives. One example is the community's Shelter-In-Place program, which focuses on a "life-safety" approach for residents in the event of severe weather or industrial emergencies.

Corunna Site is the largest of NOVA Chemicals' four manufacturing operations in Sarnia-Lambton and one of the most flexible petrochemical facilities in the world. Depending on market conditions, this facility can optimize its feedstock slate by switching between natural gas liquids and crude oil or crude oil derivatives to produce a full range of primary petrochemicals for use by NOVA Chemicals' downstream operations and for sale to customers.

Feedstocks for Corunna Site are obtained from a wide variety of sources and are delivered to the site by rail and pipeline. Crude oil (the main feedstock), condensates, ethane, propane, butane, naphtha, and gas oils are used to produce in excess of 3.5 billion pounds per year of basic petrochemicals such as ethylene, propylene, butadiene, isobutylene, n-butylene, benzene, toluene and xylene — the building blocks for plastic and synthetic rubber. The site also produces approximately 3 billion pounds annually of refinery and energy products such as gasoline components, home heating oil, and industrial fuel oils.

The Corunna Site produces a variety of specialty chemicals for the North American market. These include products for the rubber and hydrocarbon resins industries and resin oils used in the manufacture of printing inks and adhesives.

Approximately 500 employees work at the Corunna Site.

The Challenge: Pre-Event Maintenance Monitoring to Detect & Mitigate Situations

SAFER customers are familiar with using area and fenceline sensors in conjunction with their SAFER Real-Time® systems to monitor hazardous material storage locations and processes to detect leaks. The systems are also often tied into fixed fenceline sensors to feed SAFER's patented Advanced Back Calculation (ABC) algorithm and provide effective release rate estimation during an environmental or emergency event.

In this case, the challenge did not involve monitoring a plant process or a storage battery and responding to incidents but rather monitoring a series of maintenance and construction projects related to a site turnaround.

(A turnaround involves large numbers of people working on equipment that has been emptied and cleaned of chemical—usually hydrocarbon—hazards. The possibility of residual contamination, or of some systems needing to continue to operate, meant that additional safety measures would also be prudent.)

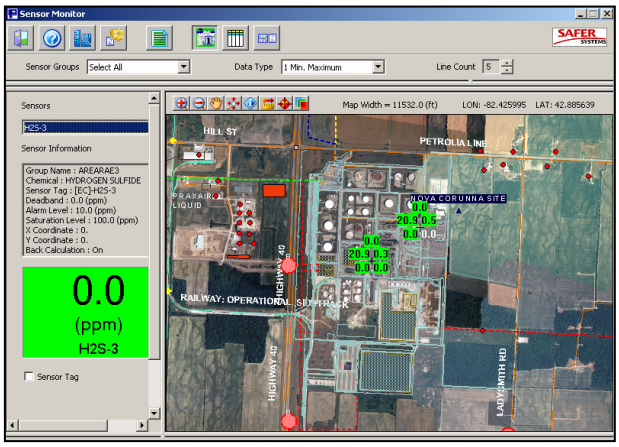
NOVA Chemicals' procedures, like those of most industrial sites, involve extensive monitoring of all non-standard work situations during turnarounds. The traditional "one man–one monitor" approach has, for years, been the way to monitor for hazardous conditions arising from work in the field. The limitation is that this works only when someone is present to monitor with the gas detector.

The Solution: SAFER Sensor Monitor and Wireless GPS-Enabled AreaRAE Sensor Technology

NOVA Chemicals had heard about AreaRAEs and how they could be integrated with a SAFER system and asked about how integrating the two would help in their situation. The final solution involved remote monitoring of specific field projects with the wireless, GPS enabled AreaRAE sensors and displaying the information on the GIS map, Plant AutoCAD, and high resolution aerial imagery in their SAFER system to provide an unprecedented, centralized, simultaneous control room based view of all the critical field projects that were underway.

Using the AreaRAE monitors in conjunction with the SAFER Real-Time® Sensor Monitor screen and GPS maps meant that the Central Control Center (CCR) emergency response panel provided 24/7 supervisory coverage of each location and piece of equipment involved, whether people were working there or not. Even if the unit was not scheduled for a maintenance crew at that specific time, the workplace conditions could still be monitored and logged, including the readings from the five sensors on each AreaRAE instrument (O2, LEL, CO, H2S and a PID for monitoring VOCs). The SAFER Real-Time® system's Sensor Monitor screen allowed for sensor concentration charting and displaying each monitored location with live concentration readings on the SAFER GIS Map screens.

Specific settings on the field instrument and the SAFER Sensor Monitor alarm points provided appropriate warning of an unfolding event, both in the field as well as at the CCR. The view of the sensor screens could be shared with other SAFER systems in the NOVA Sarnia network if needed. Any field alarm would be heard simultaneously in the Control Room with its exact location pinpointed on the SAFER Real-Time® screen, highlighting where emergency response resources were required for support and intervention.



Individuals with manual monitors would not have been as effective. They were not in the field continuously throughout the turnaround, but rather only positioned where planned work was ongoing or whenever vessel entry was to take place. With a manned monitor, if an event were detected, they would have to call by radio for assistance and report the specific location and nature of the situation. With the SAFER/AreaRAE combination working for them, the monitoring was centralized, more efficient, and effective. Response to any incident would simply become a natural evolution of monitoring that was already in place. Any detected concentrations would help gauge the scope of the event and could be integrated into the Advanced Back Calculation module in the ensuing response to estimate the release rate and plot the hazard area.

Match-Point Monitoring

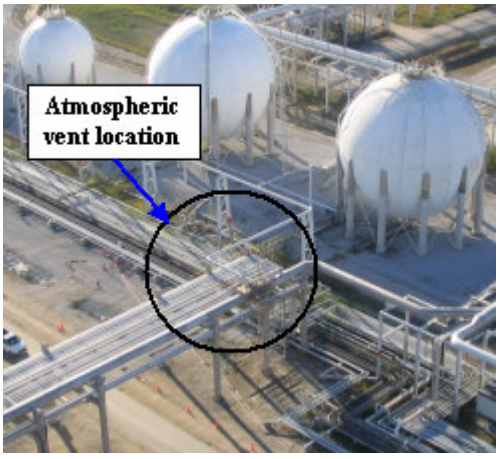
Specific alarm values were set to match the situation being monitored. These values were higher than the normal occupational health values. The purpose was to initiate a timely emergency response, not identify a potential ongoing exposure issue. The alarm was set to sound at the Central Control Room emergency response panel, as well as locally at the sensor itself.

The following are some of the situations in which AreaRAEs were used to monitor potential concerns:

Residual Pyrophorics:
Because of the risk of auto-ignition, newly opened catalyst towers were monitored for signs of carbon monoxide (product of incomplete combustion), reduced oxygen (due to combustion), and VOC (residual hydrocarbons).

Hydrocarbon-contaminated cooling water:
A slight leak from a heat exchanger tube was tracked to ensure that the ongoing operation of a nearby package boiler would not be compromised.

Atmospheric vent monitoring:
Some plant processes remained in operation during the Turnaround with a low risk of emission occurring during periods of manual control. An AreaRAE monitor was positioned at the vent opening during these periods to provide immediate detection.



Potential nitrogen contamination in an "out-of-service" flare:
Staged maintenance activities were occurring in parallel on both process and flare systems. An AreaRAE was installed at the flare drum manway as a precaution, to check for any nitrogen contamination during system dry-outs.

Potential hydrocarbon release during blind swing into a live flare:
After the system was nitrogen purged, maintenance personnel wore breathing apparatus to protect against nitrogen emissions when they were loosening the flanges. An AreaRAE monitor was used both to confirm system status prior to beginning the work as well as to ensure that there was no hazard with the exception of nitrogen when the flanges were opened.

Potential hydrocarbon release from a compressor seal chamber:
This was a similar hazard and approach to swinging the flare blinds. Nitrogen was purging through the labyrinth seal on the compressor shaft. Personnel wore breathing protection against the nitrogen, so they would not have known if hydrocarbon was present as well.

Hydrogen sulphide monitoring at a tank vent during pH adjustment of a sulphide solution:
A tank of sulphide containing water was off spec on pH and needed to be neutralized. An AreaRAE was put at the tank vent to provide an early warning of any problem.

Potential exchanger tube failure due to water hammer:
Difficulties in removing condensate from a steam heated process exchanger resulted in two AreaRAE monitors being stationed at a sewer drain for more than a week while an action plan was implemented.

Responsible Care®

NOVA Chemicals is an award-winning founding member and industry leader in Responsible Care®.

NOVA Chemicals is a member of several industry organizations that support and promote Responsible Care® in the countries in which they operate, including the American Chemistry Council (ACC) and the Canadian Chemical Producers Association (CCPA).

Field Issues

It was discovered that the high humidity in the air leaving the freshly steamed tower required the large filters on the AreaRAE inlet to be changed out every 12 hours, due to pressure differential (water destroys the monitor's sensing elements, which are expensive to replace). It was possible to dry out the filters and re-use them.

One practical problem was that on occasion when construction vehicle engines were nearby, they emitted Carbon Monoxide and gave a false positive on the VOC sensor. Alarm settings were modified to filter out the non-issues.

When field deployment of the AreaRAE monitors exceeded 24 hours, and the location classification permitted, batteries were replaced on location.

Full Value Flexibility

NOVA Corunna also uses its SAFER Real-Time® system with its integrated AreaRAEs for training and exercising EOC personnel .

The solution has now been expanded for use at a second site over 6 kilometers away by adding a receiver at the remote location and communicating sensor data and positions to the SAFER DAS (Data Acquisition Server) over the NOVA intranet.

Integration of SAFER Real-Time® with the Environmental Department procedures has been done to improve dispatching, positioning, and tracking of environmental responders sent out to collect samples during odor complaints and incidents.

Conclusion

During site Turnaround events, processes and procedures are implemented to minimize hazards and prevent incidents so that emergency situations do not occur. However, the incorporation of AreaRAEs into the SAFER Real-Time® system provided an additional level of protection and confidence that a problem would be detected and pinpointed in the incipient stages to help prevent the situation from escalating.

No problems occurred in the turnaround during the precautionary monitoring. However, a later similar monitoring protocol at a tower did detect the early stages of a pyrophoric reaction, which was then mitigated with no consequence. This is a valid early warning tool.

About SAFER Real-Time®

SAFER Real-Time® provides a response system designed to improve the management of a toxic emission from a loss of containment event. The program includes multiple strategies allowing evolution of the response activity based on what is known at the time. A patented technology provides release rate estimation, improving the accuracy of the predictions. Information regarding historical path, current impact, future impact, building infiltration, and detailed reporting improves response communication. Available options include terrain effects, liquid multi-component modeling, weather and gas sensor networks, and customized modeling for materials such as hydrogen fluoride. Areas of use include emergency response, drills, awareness with safety training, regulatory compliance, venue protection, workplace monitoring, and post-event legal defense. SAFER is a system integrator and can provide a scalable application that may be designed for anything from small repackaging facilities to major industrial sites to entire countries.