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Always Take the Weather: CFD Modeling for Better Fire and Gas Detection Coverage

Case Study

JX Nippon used Computer Fluid Dynamics modelling (CFD) for more effective, efficient and scientific detection analysis to configure its fire and gas detector location on the Helang offshore platform in Malaysia.

Background

As with all offshore production facilities, safety is critical on JX Nippon Oil & Gas Exploration (M) Ltd. Helang Integrated Platform, offshore Sarawak on Borneo, Malaysia. It began production in 2003 and today produces 23,000 BOED, supplying gas to the Malaysia LNG Terminal in Bintulu, Sarawak. It also has facilities for export of commingled condensate through a pipeline shared with the Jintan Gas Field Development.
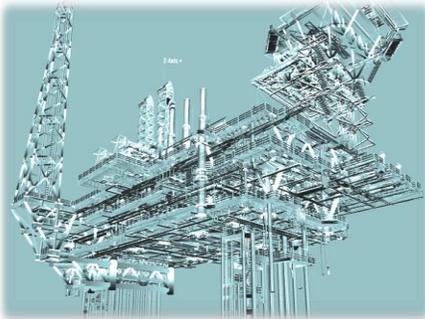
The facility is one of two JX Nippon has in the area. Approximately 7 km east of the Helang field is the Layang oil and gas field, where the company started commercial gas production in May 2017.

The Helang platform has a single central processing platform (HCP) and an integrated deck unit topside, complete with living quarter for 50 workers.
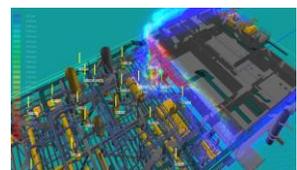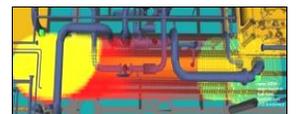
Challenge

Effective detection of fire and gas leaks is essential to keep those workers safe, to protect the environment and to meet regulatory requirements and international standards. Under ISA 84.00.07, evaluation of the safety system requires consideration of not just the hardware and software components, but also the basic design of fire & gas system. Detector numbers, types, range settings and allocation must all be considered.

The input and expertise of senior engineers is fundamental to this process. However, even with the most experienced engineers an effective method to quantitatively evaluate the design is required.

JX Nippon used other mapping software to achieve this. The static (geographic) mapping software employed, however, gave little flexibility to assess the impact of moving detectors, requiring complex changes to do so. It also was unable to account for the impact of weather and wind on the movement of gas vapor. A static analysis concluded a large number of detectors would have to be added or repositioned. Yet the platform operators had little confidence the result would optimize placement of the detectors.

The quote on the right side.

"Honeywell combined an in-depth understanding on the detector technology with a sophisticated model that accurately represents conditions on site. Its solution has given us assurance that detection around our hazardous sites is based not only on sound judgment but scientific rigor."

Solution

JX Nippon turned to Honeywell for a mapping analysis report, which was completed in January 2018.

It asked Honeywell to perform a re-evaluation and possible optimization of the detectors on the platform using a 3D dispersion model. This included scenario-base fire and gas mapping analysis and was based on computer fluid dynamics (CFD).

CFD is able to model the movement of gases, taking into account a wide range of factors, including temperature, weather, wind speed and wind directions – drawn from local meteorological records – as well as the composition, concentration, flow and direction of the leak. All these factors determine the dispersion of any leak, and the shape, size and concentration of any vapor cloud. The result is a far more accurate model of the ability of the detectors in any position to detect a leak, based on a variety of scenarios.

Using this analysis, Honeywell could determine areas without adequate detection, but, crucially, where existing detectors would identify leaks based on the dispersion under any realistic scenario. The intuitive software also allowed JX Nippon to move detectors within the model to quickly assess the impact of adding or repositioning detectors, with the ability to generate results numerically and graphically for the percentage of coverage at any location.

Benefits

Based on the CFD and scenario analysis JX Nippon was able to significantly reduce the disruption and cost of implementing an effective detection configuration.

The number of new fire detectors required was reduced by a third, compared to the static analysis, while the number of new gas detectors was reduced from 33 to just one. This delivers significant capex and opex savings, reducing investment in new devices as well as on-going maintenance costs.

The dynamic analysis also greatly reduced the number of fire and gas detectors that required repositioning, from 35 to 11 in the case of the former, and from 66 to just one again, in the case of the latter. Disruption was therefore kept at a minimum.

More importantly, Honeywell's solution delivered a quantitative approach to evaluation of the fire and gas safety system. It enables JX Nippon to not only satisfy regulatory requirements, but also have confidence that its workers are protected by optimized and truly effective detection.

Chow Yik Thong, Senior system & Telecom Engineer at Helang, said: "Honeywell combined an in-depth understanding on the detector technology with a sophisticated model that accurately represents conditions on site. Its solution has given us assurance that detection around our hazardous sites is based not only on sound judgment but scientific rigor."

About Honeywell's Fire & Gas Detection

Honeywell's products and services include a comprehensive range of fire and gas detectors, software and services to make your facility safer.

For mapping and analysis, it uses the most advanced 3-D modeling and CFD methodologies. Using a physical 3-D model of the facility it can help define zones and potential leaking points, establish weather scenarios, and calculate dispersion to determine the most effective detector arrangement configuration.

For More Information

Learn more about Honeywell's solutions, visit www.honeywellprocess.com or contact your Honeywell Account Manager.

Honeywell Process Solutions

1250 West Sam Houston Parkway South
Houston, TX 77042

Honeywell House, Skimped Hill Lane
Bracknell, Berkshire, England RG12 1EB UK

Building #1, 555 Huanke Road,
Zhangjiang Hi-Tech Industrial Park,
Pudong New Area, Shanghai 201203

www.honeywellprocess.com

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