Ultrasound: Protecting the Environment

The attached paper, "Ultrasound: Protecting the Environment" is a publication of BP SNS Environmental. It describes their use of Ultrasonic Gas Leak Detection in their Southern Northern Sea (SNS) installations, including a description of how ultrasonic detection works in such applications, and detailing its benefits.

ID 07-8306-MC/November 2011

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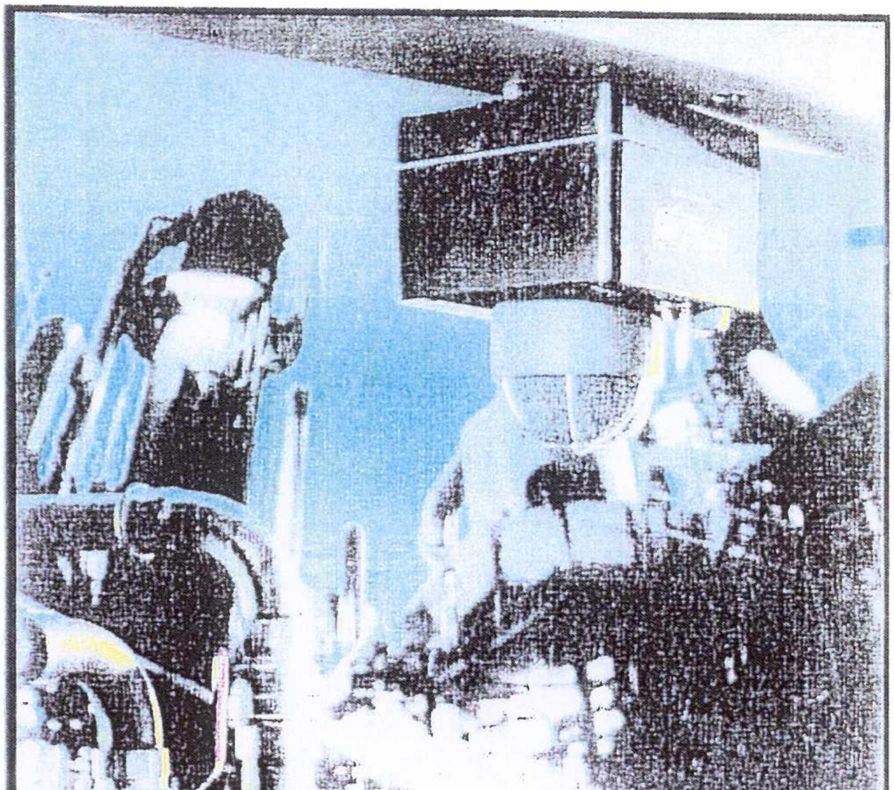
The Safety Company

ULTRASOUND

PROTECTING THE ENVIRONMENT



BP SNS ENVIRONMENTAL PUBLICATION

BH300102 BP report 2

Ultrasound Leak Detection in SNS

Introduction.

Loss of hydrocarbon containment within the process is undesirable from both safety and environmental points of view. The BP recommended code of practice RP14c to some extent provided guidance on the appropriate methods of detecting the loss of containment. In general it is recommended that for small leaks the platforms conventional gas detection system will provide the protection, For major leaks pressure switches at strategic locations are deemed as the best devices available. These pressure switches are set to trip the plant when the pressure at that location falls to a predetermined low pressure setting or PSLL (Pressure Switch Lo Lo) value. It must therefore be noted that before such device can begin to operate a large inventory of the process gas must be allowed to escape. On many occasions the size of the leak is either insufficient to cause a trip or is being diverted away from the location of the gas detector by the prevailing wind direction. Whichever method of detection is being used there has always to be a significant quantity of hydrocarbon to air release. Introduction of ultra sound leak detection is intended to provide the earliest possible warning of leaks from even the smallest pin hole size leak. The benefits of this are obvious, in complying with BP's commitment to preserving the environment is paramount. The sentiments of Sir John Browne's BP charter clearly state our position with respect to these important environmental issues.

Sources of leaks.

On occasions leaks have occurred and have been successfully detected by our gas detection system, ironically the source of many of such leaks have been attributed to failures of compression fittings which are used to connect the PSLL's. Therefore it is important that in order to minimise leaks we must take every opportunity to minimise the number of connections to the main process envelope. Other leaks which will become more prevalent as time goes on will be those associated by the particle erosion of the process pipe work and intrusive instrumentation, valves, thermowells etc. Although we operate a rigorous non-intrusive inspection programme there always exists the remote possibility a hole could appear undetected. The advantage of ultrasound detection is that it detects very small leaks as small as 0.1mm dia. At this point the other more conventional methods would not have even begun to operate.

Ultrasound.

Ultrasound has been a well proven technology for many years and is used in many areas of medicine and engineering. Ultrasound is the band of frequencies beyond the audible range, normally 30khz to 80khz. Ultrasound is readily emitted from any pressurised jet release from any size of hole. The amplitude of the ultrasound is directly proportional to the pressure at the point of leak, the frequency will vary depending on the density of the gas escape; for our gas the frequency is generally around 40Khz.

How the Ultrasound Detector works.

The unit consists of three main components, microphone, amplifier and power supply relay box. The microphone and amplifier are strategically located in the area of the process to be protected, the power supply and relay box is located at the control centre. There is a sensitivity adjustment which is set to ensure that spurious background ultrasound noise is eliminated, there is a timer set in the relay box which ensures that the source of the leak is sustained and it not the result of a control valve venting nearby. The setting up of these devices only takes a few minutes and once set up is very easy to test, one shot from a small hand held aerosol is generally sufficient to test the unit is working satisfactorily.

Field Trials.

During our early involvement with the ultrasound leak detection technology, it was necessary to carry out satisfactory field trials to identify any limitations in the system before final installation on site. The trial detector was set up on the Cleeton platforms well bay. This is the area at the reception point of all the Cleeton gas. The well bays on Cleeton are protected by an infrared open path gas beam detector. Prior to the test being carried out the platform control room operator was notified as it was my intention to release .gas from one of the Cleeton flow lines. This IR detector was put on override to prevent the plant shutting down by the release of gas. A gas release was carried out at two separate locations of the well bay, instantly the ultrasound detector was activated. Satisfied that the test were successful I returned to the control room to advise the control room operator, I explained the tests were now complete and any trips resulting from the release could now be cleared and the overrides could be removed, to my astonishment none of the gas beam detectors had detected an escape. These tests and many others which followed convinced me that this method of leak detection would operate at a much earlier point and therefore minimise any future emissions to air.

Their current use on NUI (Normally Unattended installation) platforms.

These are now installed on the West Sole Bravo and Charlie gas production platforms. Part of the NUI project was to simplify the instrumentation on the platform including the fire and gas protection. Many conventional gas detectors were removed and were replaced by the latest infrared gas beam detectors. One of these devices takes the place of many conventional point gas detectors, however despite the tremendous advantages offered by these new detectors these is a down side. There is an in built feature termed as "Beam Block", the purpose of this is to advise the control room there is something obscuring the line of the infrared beam. During this time the detector is unable to detect for gas escapes and would therefore be considered blind from detection. Ultrasound now fills this gap by becoming the ears of the detection system. If during these periods of beam block ultrasound is detected then the platform will shut down. Without ultrasound technology it would have been difficult to have selected this method of IR gas detection on its own and would have had compromising effect during the beam block periods.

Recommendations and conclusion.

As a result of the trials carried out we have been able to implement this new item of instrumentation which will undoubtedly detect leaks at a much earlier stage. Leaks from passing valve stem packings have already been identified using a similar hand held version of the ultrasound detector.

I am convinced that there will be many other opportunities where ultrasound technology can be used, not only offshore platforms but onshore terminals. Ultrasound will soon become our primary source of gas leak detection over conventional gas detectors.

I am sure that in the future ultrasound detection will become more refined and will not only have the ability to locate the source and size but the ability to differentiate the nature of any leak i.e. air or gas. This reduces the risk and consequence to the environment of unnecessary hydrocarbon emissions to the atmosphere.

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