Pioneering SafeRad Close Proximity Radiography Technology in India

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Abstract: India’s Jamnagar complex represents the largest industrial project ever implemented by anyone from the Indian corporate sector.

Many process plants and hydrocarbon units in the oil and gas sector including Petrochemical plants regularly have requirements to carry out radiography inspections of butt-welds during plant shut-downs and new construction programmes. It is recognised that the highest cost in radiography is downtime because non-radiation workers not able to work in the radiation area. Evacuation of construction personnel causes significant disruption to construction and shutdown activities often resulting in programme over-runs.

SafeRad Ltd.,(UK) is a company that has developed and pioneered a radiography process that does not require evacuations of personnel and the resultant disruption that this causes. In order to overcome the usual problems and disadvantages of traditional radiography many Indian companies in the corporate sector including Reliance Industries Ltd has contracted with SafeRad to introduce their radiographic inspection technique in a progressive way across their production units. This has enabled major Indian companies in the PSU oil and gas sector like HPCL, IOCL, MRPL and in the private sector companies like Reliance Industries, Essar Oil Ltd. and Cairn India Ltd., to carry out major works without the usual negative impact of radiographic inspections.

This paper describes the forward thinking and the radical change brought about in the work culture of the corporate sector companies like Reliance Industries Ltd., and the steps taken to progressively change the work culture in the Indian oil and gas industry to embrace the new technology available from SafeRad.

The paper also outlines the forward plans to introduce computed radiography, digital radiography and ‘real time’ radiography to make SafeRad radiography services a permanent feature of Indian Industry, in sectors like oil and gas, petrochemical, power generation etc...

Keywords: SafeRad, SAFER, Close Proximity Radiography, Controlled Area Radiography
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It has long been recognised that the highest cost in industrial radiography testing is downtime because non-radiation workers are not able to work in the radiation area. Evacuation of construction and other personnel causes significant disruption to construction and other shutdown activities often resulting in programme over-runs and significant negative cost impacts. The use of radiography as an inspection technique has been on the decline for some time mainly due to its disruptive effects on other activities in the area.

SafeRad has developed and pioneered an unique industrial radiography process that does not require evacuations of personnel and the resultant disruption that this causes. SafeRad is now firmly established in India where a number of high profile prestigious projects have used the SafeRad Radiography service.

As a result of the complete elimination of the disruption normally associated with radiography by SafeRad a number of Clients have re-visited radiography as their inspection method of choice. SafeRad Radiography has rekindled an interest in radiography as a preferred method of non-destructive testing.

Chronology

SafeRad Radiography system was first demonstrated in India to Scientific Officers of AERB in their office on September 22 2008, where there was a group of radiation specialists present as witnesses. The demonstration took place on the fifth floor B-wing Niyamak Bhavan, Mumbai, in a conference room where a 63 Curie Se-75 source was exposed over a sample pipe simulating stand-off radiography technique. Two days later we carried out the same demonstration of the equipment in an ndt laboratory at Jamnagar Refinery.

SafeRad Radiography represented a significant shift away from conventional radiography and at that time no-one wanted to be the “first” to use it on a major project. Every part of it was new – the Selenium-75 isotope, the SafeRad Exposure Container and the GammaBlok shielding.

In order to satisfy technical curiosity and interest of many companies there followed a long period of demonstrations to many potential Clients across the Indian subcontinent.

The use of Selenium-75 as the gamma radiation source has significant benefits. SafeRad has produced numerous comparison radiographs for Clients and specifiers to allow them to judge for themselves the improvements that are achieved. The radiographs produced are comparable to x-ray quality when compared with Iridium192. The ‘soft’ radiation spectrum emitted by Se-75 gives improved contrast and sensitivity. Typically two more IQI wires are visible on thinner materials and one more on thicker materials. The limits for producing acceptable radiographs are form 2mm penetrated thickness up to 75mm penetrated thickness. For example radiographs of 34mm thick 10” diameter duplex stainless steel have been produced for a major Certifying Authority.
It was not until 2010 that HPCL (Hindustan Petroleum Corporation Ltd) decided to contract with SafeRad for one of their major shutdown project.

The result has been astonishing – the published and verbal feedback to other government owned oil and gas refineries such as Indian Oil Corporation Ltd., caused a huge interest in SAFER radiography and other orders soon followed from IOCL.

To date SafeRad has been involved in over 35 shutdowns revamps and construction projects with a number of public and private sector facilities.

There has been a major interest from the private sector companies such as Reliance Industries Ltd, and Jamnagar Refinery complex has been at the forefront of technologies in the Indian oil and gas sector and was keen to take on board SafeRad radiography technology.

SafeRad was contracted to carry out major radiography inspection on a number of shutdown projects at Jamnagar Refinery, Reliance Patalganga Manufacturing Division, Reliance Hazira Manufacturing Division, Reliance Nagothane Manufacturing Division and very recently at Reliance KGD6 On-shore Terminal project at Kakinada.

Over the course of a number of shutdown projects SafeRad radiographers were responsible for delivering approximately 70,000 radiographs overall and almost 15,000 of these were butt welds and profiles for Reliance Industries alone.

All of these radiographs were completed without the need to evacuate any other trades away from their places of work. This non-disruption has had significant cost and schedule benefits to the company. If these had been done by conventional radiographers producing say 10 radiographs per hour, then this would have required 7000 hours of evacuation. Assuming that if only one person had been evacuated then that would have meant a loss of 7000 manhours. However, it is not unusual for hundreds of workmen to be evacuated meaning losses to the projects of millions of manhours just to carry out traditional radiography.

Over the last few years there has been remarkable progress made in the use of radiographic images produced by computed radiography, the latest technology being ‘real-time’ radiography. These technologies are very different to each other.

Computed radiography uses flexible phosphor imaging plates and a scanner to produce the images on a computer screen while ‘real-time’ radiography – known as DR (direct radiography) uses amorphous silicon panels to produce the image directly onto a computer screen.

Digital radiography was seen by SafeRad as a way to further enhance site radiography as there are many benefits to be leveraged from these technologies. SafeRad has been at the forefront of trials of phosphor plate imaging (CR) and is now using DR equipment to produce extremely high quality radiographs in seconds.

**Culture Changes**
Change causes stress – even when it is perceived that the final outcome will be better. For the last forty years traditional radiography has required people to be evacuated to take them away from the random radiation it causes over a widespread area.
With the introduction of SafeRad Radiography ‘SAFER’ it is now not a requirement to evacuate personnel away from their workplace. However, our experience has been that there remains a suspicion that radiography is a dangerous activity and should be avoided. In addition, there are now no evacuations of the workforce that was seen as a ‘perk’ whenever radiography was taking place. SafeRad Radiography is a 24/7 activity that does not require personnel evacuations.

Breaking down the barriers of the long standing culture of evacuation is probably the biggest challenge faced by management when introducing SAFER radiography. In order to overcome these long held beliefs major companies such as Reliance Industries Ltd, HPCL, IOCL and others have introduced SafeRad Radiography to their respective workforces in a progressive way.

Demonstrations to the workforces have been carried out to show them the safety features of the SafeRad Radiography system and the negligible levels of radiation that are present during source exposures.

There is now a growing awareness in the Indian industries that radiography has significantly changed for the better. The SafeRad Radiography technique is now a transparent activity that can be seen by the workforce.

Radiation doses to radiographers using traditional radiography equipment remain fairly constant. At every exposure and retraction of the radiation source they will receive a small dose of radiation. This radiation accumulates in their body and over a long period of time can have detrimental effects on their health.

SafeRad radiographers receive ‘ZERO’ dose rate even though they are standing close to the radioactive source when it is exposed to produce the radiograph. It is hardly surprising to note that radiographers prefer working with SafeRad Radiography because it is much safer than traditional radiographic equipment.

The next steps discussed with major private sector companies like Reliance is the deployment of SafeRad Radiography system coupled with ‘real-time’ imaging. It is considered that this will provide unprecedented radiation safety and higher productivity than has previously been possible with traditional radiography methods.

Overall the Indian oil and gas industry and other construction sectors have embraced the new technology and SafeRad Radiography is becoming the ‘standard’ method across public and private sectors in India.