Selenium 75 Computed Radiography
Offers Advantages

Computed radiography technology combined with the lower-energy Selenium 75 radiation source proves to be a cost-effective alternative to the Iridium 192 source method

BY KEVIN WIELAND AND ERIC SJERVE

A Tulsa, Okla., petroleum company that produces 900,000 barrels of gasoline a day faced a plant-wide shutdown that would involve emptying storage vessels to allow personnel to enter and inspect for degradation, corrosion, and cracking. Of the three firms asked to submit proposals for the project, IRISNDT, in business since 1953, met the shutdown requirements best. Its Houston, Tex., office offered what the customer wanted: a computed radiography technology using the highly refined Selenium 75 detection method.

IRISNDT was not only knowledgeable about the mechanical and corrosion damage mechanisms that impact petroleum equipment reliability, they could also offer the specialized tools and procedures specified by the customer. “These are the best customers to work with,” said Kevin Wieland, general manager, IRISNDT Corp. in Houston. “They had some familiarity with computed radiography (CR) and appreciated what it could do. They were also clear about what they needed.” IRISNDT currently utilizes three CR systems from FUJIFILM NDT, Roselle, Ill., and has a fourth on order.

Costs of Selenium vs. Iridium Technologies

Even if there would be an increase in direct costs vs. conventional radiography with Iridium 192, plant management had decided it was worthwhile. The combination of CR and Selenium 75 would prove to reduce the costs associated with maintenance downtime, eliminate processing chemicals on site, and would provide added safety benefits from lower radiation levels (that meant smaller, more manageable boundaries).

The combination of computed radiography with the lower-energy Selenium 75 radiography source allowed the inspectors to get the weld quality images the customer needed. Typically, weld images can be magnified up to 400× and can measure a defect as small as 0.001 in. — Fig. 1. Because Selenium 75 is a lower-energy radiation source, the lower wavelength provides higher contrast. And while the exposure times are a little longer, it provides what Wieland believes to be a higher-sensitivity image.

The choice of Selenium 75 as the energy source had additional advantages. When used with a tungsten collimator, it was possible to confine the boundary to a much smaller area than using Iridium. This allowed personnel to continue working in adjacent areas without disruption — another tradeoff worth its higher costs.

Making the Inspections More Efficient

In all, it took the company five weeks to finish the project, using a wide range of nondestructive testing technologies,
including automatic ultrasonics, tube inspections, ultrasonic thickness testing, penetrant testing, magnetic particle, conventional radiography, and alternating current field measurement. Computed radiography crews worked day and night shifts.

Often in these types of projects, images taken overnight are burned to CD for the customer to view the next morning. According to Eric Sjerve, “Our crews work from 3:30 PM until 2:00 AM when it is easier to perform the radiography work without as much disruption to plant operations. When the customer arrives at 7 or 8 in the morning, he can review the previous night’s work using software called ImageShare®, from Fuji. Since IRISNDT personnel will have interpreted and annotated the images, the customer has the choice of accepting the readings or performing their own interpretation with the software.”

Using the CR System

Measurements are taken using what Wieland calls an electronic ruler, which, like ImageShare® software, is another tool in the CR system the company uses. It is able to point, click, and take a measurement of wall thickness or length of defect, for example. Typically, a known-diameter ball is included in the shot, which allows the software to electronically compensate for all geometric magnification over the image. Also, annotation of electronic images is much easier compared to working with conventional film. Operators are able to input location information, scanning parameters, exposure criteria, and other data at the keyboard rather than using conventional means.

For IRISNDT, the most common use for CR is for corrosion wall shots on piping systems, which includes shots on straight runs of piping, elbows, T-joints, and flanges. Most of the work is done using 14- × 17-in. imaging plates (IPs) shot in the same way as conventional film would be with a single exposure. A tremendous advantage for IPs is that they can be erased after exposure then reused, which provides a significant cost savings compared with film over the long term.

See More with CR

“With the considerable dynamic range of CR compared to conventional film,” said Wieland, “you can gather a lot of information over a multitude of thicknesses and configurations in a single shot.” Sjerve agrees. “If you do it with standard radiography, you’ll likely end up taking two images when shooting parts with varying thicknesses. You can see a lot more with CR vs. conventional, simply because you are covering such a large dynamic range. By enhancing the image with the software, you can see the thin and thick areas all on one shot.” Wieland also believes that profile measurements are more accurate and repeatable with CR than with conventional tools, which facilitates more accurate trend analyses.

Storing all of this information is also a consideration for plant management. “I can hand you a CD or a 3-in. stack of film,” Sjerve said. He noted that this can be an important marketing feature, along with production speed, and electronic analysis of the shot by the customer.

For companies marketing new technologies against incumbent methods, you often don’t get a second chance to prove its value. “When you commercialize a technology, you want to make sure that everything goes right,” explained Sjerve. “Customers go through stages in the process of accepting a new technology — initially they are not sold on the technology; they then agree to try it, usually for a specific application; if it works they’ll usually try it again; and at some point it becomes another tool that they use for the applications that are appropriate.”

CR Applications in Harsh Environments

In addition to its benefits over film, CR can also provide benefits when compared to other image-capture technologies. In Canada, with its cold environments, CR can edge out ultrasound for examining insulated pipes, which is a significant proportion of the work there.

“There are certain piping systems that are critical to inspect because they may contain an explosive product, a highly toxic product, or a product under high pressure. In some of these cases, it is cost-prohibitive to remove the insulation for inspection. In these cases, CR is often used to inspect the piping systems through the insulation. If you were to use ultrasound, the cost to remove and then reinstall insulation is very high.”

But as Sjerve and Wieland are quick to point out, CR and ultrasound are more often complementary to one another rather than replacements for each other. As Sjerve puts it, “They’re simply different. With radiography you can measure a bigger area more quickly, even through all that insulation, but you don’t get the depth information over the entire area the way you do with ultrasound. With radiography — if you’re talking welds — it’s very good at detecting porosity and volumetric defects, but it can miss tight linear angled defects. Ultrasound is the opposite — it’s good at detecting angled fusion line defects, but it’s not as good at quantifying volumetric flaws.”

Sjerve, who also does technology assessment for the company, believes that CR will dominate radiography in the future. “This technology has some compelling advantages over conventional radiography that I think eventually will lead it to replace conventional radiography in many areas.”

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