Radiography: Conventional vs. Computed

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Bringing Volumetric Pipe Inspection into the Digital Age with Computed Radiography (CR)

For over two decades, Chemex has worked on capital projects of varying sizes and scopes. One of the main common denominators we see is Welding. With pipe or vessel welding comes the need for Radiography. Radiography is a way to take a volumetric image (or picture) of the weld to determine its quality. Although Conventional Industrial Radiography is the least cost-effective way to determine weld quality, it is the most used NDE method in our industry today.

Conventional vs. Computed

Radiography is one of the oldest, nondestructive inspection methods used throughout pipe fabrication and maintenance projects for initial discontinuity and defect detection, corrosion monitoring, and product conformity. Industrial Radiography consisting of conventional or standardized film methods is continuously being challenged by Computed Radiography (CR). This is partly due to how labor-intensive traditional or standardized Radiography can be.

Figure 1 shows a standard Industrial Radiography setup. Industrial Radiography film is much like the X-Ray film your doctor shows during an exam. Profile work on a pipe that was performed by conventional RT (Radiography Testing) can now be performed by CR.

Figure 1

Non-Destructive Testing (NDT)

"A picture is worth a thousand words" refers to a concept that a complicated idea can be conveyed with a single still image, made possible by taking in large amounts of information quickly. In Non-Destructive Testing (NDT), we have historically used a standard image (film/radiograph) to be worth a thousand words but NDT companies can now use digitized radiographs created by Computed Radiography.

This method of inspection has many inherent challenges that the seasoned film radiographer must be aware of. If not addressed properly, these conditions can be detrimental to the overall inspection results. The characterization and evaluation of this image require additional training, over and above current requirements found in ASME Sec. V Article 2, SNT-TC-1A, and CP-189 for the typical industrial radiographer.

Implementing Computed Radiography

Computed Radiography (CR), as defined by ASME and ASTM (photostimulated luminescence method), is a two-step radiographic imaging process. First, a storage phosphor imaging plate, which replaces standard radiography film, is exposed to ionizing radiation. Second, the luminescence from the plate's photostimulable luminescent phosphor is detected, digitized and presented on a high-resolution computer screen. See Figure 2.

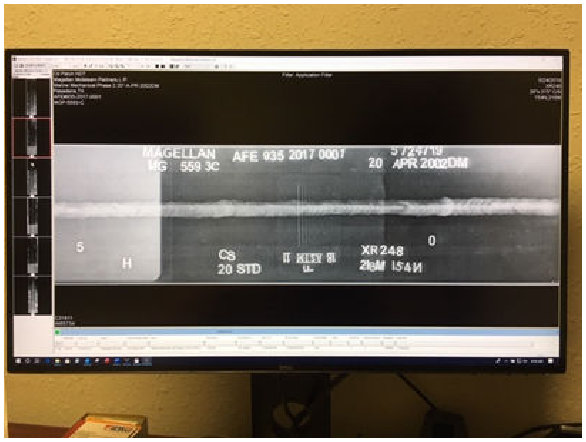

Figure 2

Managing this process while working to achieve the optimum digital image is the challenge faced by radiographic practitioners. The overall success is based on the digital image acquisition system utilized and variables that are consistent with typical radiographic conditions.

Implementing CR begins with a fundamental understanding of the radiographic principles that have been practiced for decades with film radiography and used by the aerospace, automotive, construction, energy, oil and gas, and shipping industries. Certified Level II radiographers are required to understand these principles, along with specific knowledge in the manufacturing and fabrication process to correctly interpret the acquired digital image. Geometric principles attributed to the setup are essential in the evaluation of mechanical or fatigue defects and for the assessment of repair work.

The utilization of the proper IQIs (Image Quality Indicators) to ensure technique, contrast sensitivity, and resolution, is essential to meet industry specifications and code compliance. The development of an operator and company-defined QC program is crucial to monitor equipment performance and maintain records of data collected which ensures a stable continuous process. In addition, having a detailed QA auditing program shows compliance to COC and specifications. System and scanner performance tests vary from manufacturer to manufacturer but must include quality control checks specified by the manufacturer and be modeled to meet the technician's requirements. If at the time of inspection, significant equipment malfunctions are found, the technician may be required to perform more frequent testing to ensure good image quality.

Final acceptance of the image is the same as film radiography and is the responsibility of the certified Level II technician, and Manufacturer. Most industries are updating reference radiographs for defect severity and comparisons are being updated to digital formats for ease of interpretation. Preserving the raw image is critical and maintaining its origin is a requirement by most industry codes, specifications, and end-users. It is the operator's responsibility to maintain this data set to ensure recall in the native format as needed. The main benefit of having digital images is that the shelf life is forever. This enhances our ability to turn over information digitally instead of hard copy. The hard film takes up space, can be lost, and deteriorates over time and that deterioration can be accelerated by improper storage.

CR takes all the disadvantages of conventional radiography out of the equation. Shot times are essentially cut in half, there are no chemicals needed to process film, and interpretation can be done on a computer screen instead of having to review a conventional film on a film viewer as seen in Figure1. As an example, a 20" Sch. 40 weld has 6 views or pieces of film.

To review properly, it would take a Radiographer around 20 minutes to review that film using conventional tools, such as a viewer, and densitometer. Using CR and reviewing the film on a computer screen (see Figure 2) you can see all 6 images on the computer screen. Then, by just clicking on each image you can see the image, the IQI, (which takes out the need for a densitometer), and all other information, such as line number, weld number, welder I.D, and client information. The time of review now takes about 7 to 10 minutes.

As we all know too well, time is money, and using CR (Computed Radiography) can save a lot of time and, in the long run, a lot of money. We work hard to inform clients that there are other, more effective, methods of determining volumetric weld quality, such as CR, and that it is a way to drive down costs.

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Jim has 27 years of experience working in the Power Market, OGC, LNG, and Midstream, acting as Sr. Quality Manager and Welding SME, on projects ranging from $30 million to $850 million. His last assignment before joining Chemex Global was the Corporate Welding Technical Services Manager. His current responsibilities are as Director of QA/QC and overseeing Welding Technology.

References, ASME Sec. V Article 2, SNT-TC-1A, ASNT CP189.