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DISCLAIMER

Department of Energy
Energy Facilities Contractors Group
Best Practices Submittal for Digital Radiography
WSRC-EM-2005-01306

Facility:

Savannah River Site

Best Practice Title:

Digital Radiography

Point of Contact:

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Brief Description of Best Practice:

The practice employs a non-destructive examination technique using a radioactive source generating either X or gamma rays to map the subject's features and density changes to a re-usable phosphorus coated plate.

Why the Best Practice was Used:

Digital radiography was selected over conventional radiography for the following:

1. Lower energy gamma sources may be used which reduces the personnel exclusion area;
2. The digital images could be manipulated and enhanced using standard digital imaging software;
3. Processing the phosphorus coated plates was faster than conventional film processing and does not involve chemical wastes;
4. Storage, retrieval, and distribution of images is much easier;
5. Existing NDE technicians are able to perform the examination with minimum training as the techniques are similar to conventional film radiography.

Digital radiography was selected over pulsed eddy current for the following:

1. Pulsed eddy current examination requires specially trained technicians;
2. The are few companies offering pulsed eddy current examination;
3. The cost to perform pulsed eddy current is higher than digital radiography.

Digital radiography was selected over contact ultrasonic examination for the following:

1. Contact ultrasonic examination requires insulation removal this becomes costly when dealing with asbestos;
2. Contact ultrasonic examination is difficult to perform if the system is on-line;
3. Contact ultrasonic examination does not readily lend itself to high temperature examination.

What are the Benefits of the Best Practice:

1. The condition of the subject area may be assessed without insulation removal;
2. The condition of the subject area may be assessed without system shutdown;
3. There are no hazardous materials to dispose of after processing;
4. Phosphorus plates are re-usable;
5. Digital images may be manipulated and enhanced using standard digital imaging software;
6. The technique has been accepted by ASME;
7. Storage, retrieval, and distribution of images is not complicated;
8. The software package included allows wall thickness measurement;
9. System cost (approximately $200,000) was quickly paid for by the savings in not having to remove insulation or shutdown operating systems.

Problems/Issues Associated with the Best Practice:

As with most new techniques there is always a learning curve associated with software use and establishing the limitations of the technique (e.g. pipe diameters that need additional source strength, etc) . Other than these issues there were no other issues.

How was the Success of the Best Practice Measured:

The success was measured by:

1. Cost avoidance in asbestos insulation removal and system shutdown;
2. Decreased operational impact because of smaller radiation exclusion areas;
3. Reduced image processing time;
4. Use of technique in other Site applications;
5. Completion of the initial project within budget limitations

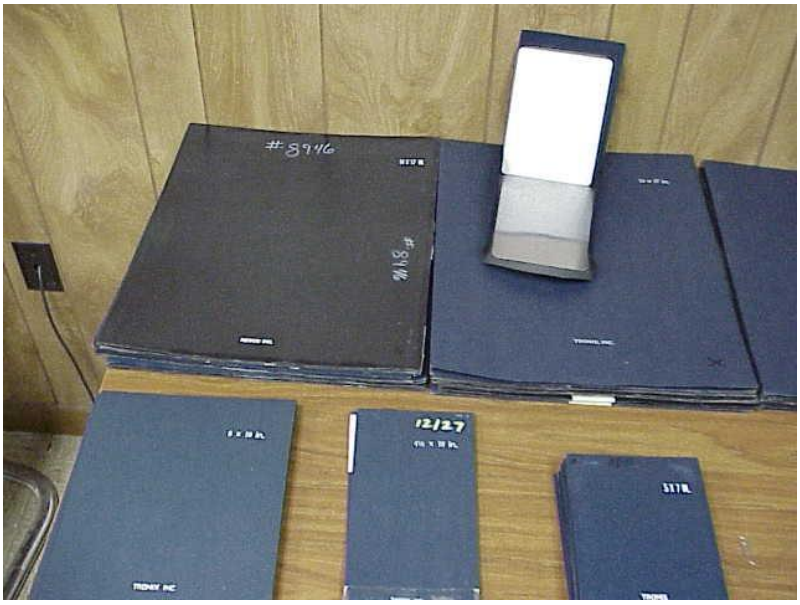
Description of the Process Experience:

Review of the attached images will provide the best explanation of the process experience.

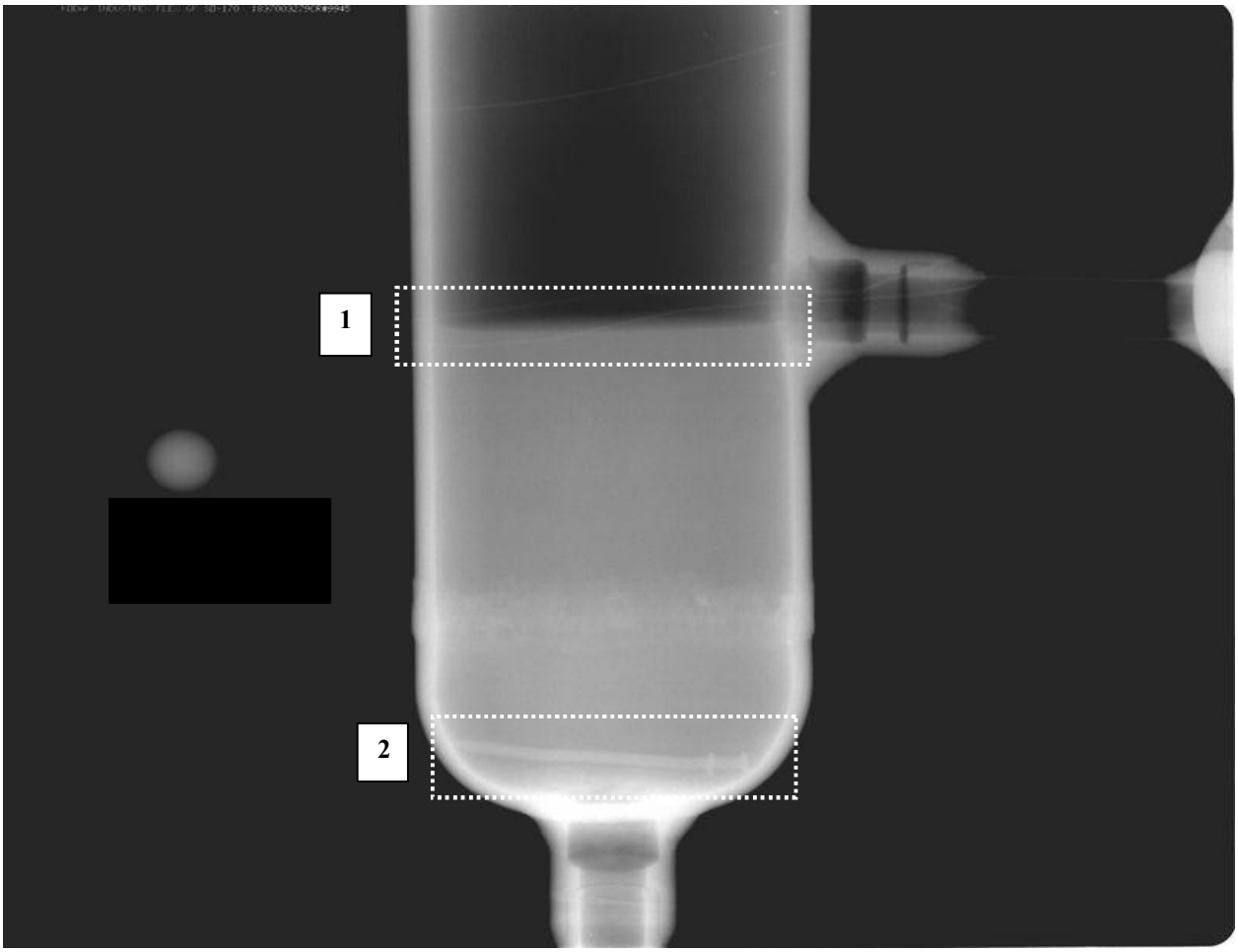
Applicable ISM Core Functions

Core Function 1: Define Scope of Work
Core Function 2: Analysis of Hazards
Core Function 3: Develop and Implement Hazard Controls

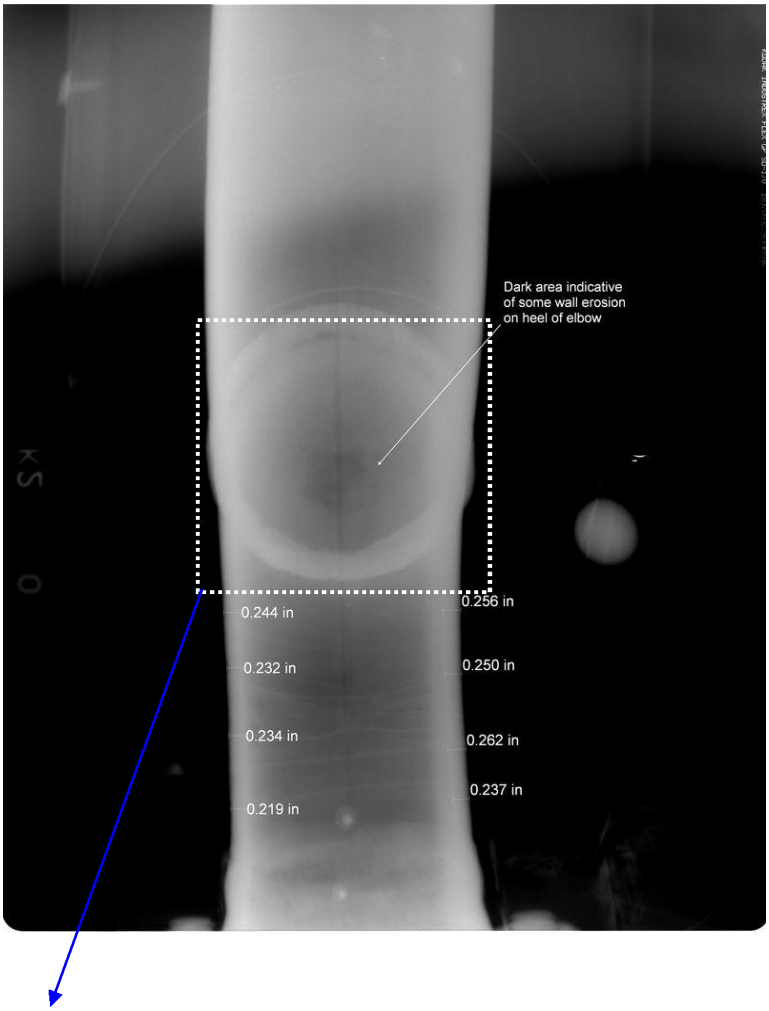
The image above illustrates a typical digital radiographic processing station. The right side of the image shows the scanner. The exposed phosphorus plates are fed into scanner and the images are processed by the CPU (middle image) and viewed on the high resolution monitor (left image).

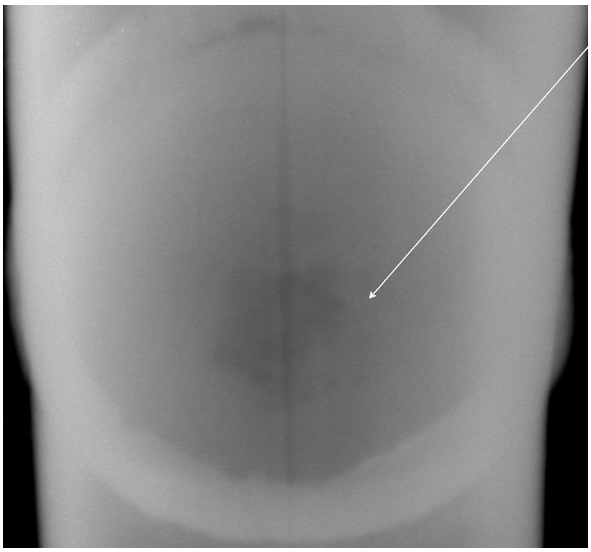


The phosphorus plates are available in standard sizes and may be “erased” and re-used. The plates may also be cut to accommodate unique geometries. Plate placement on the subject is the same as for conventional film.

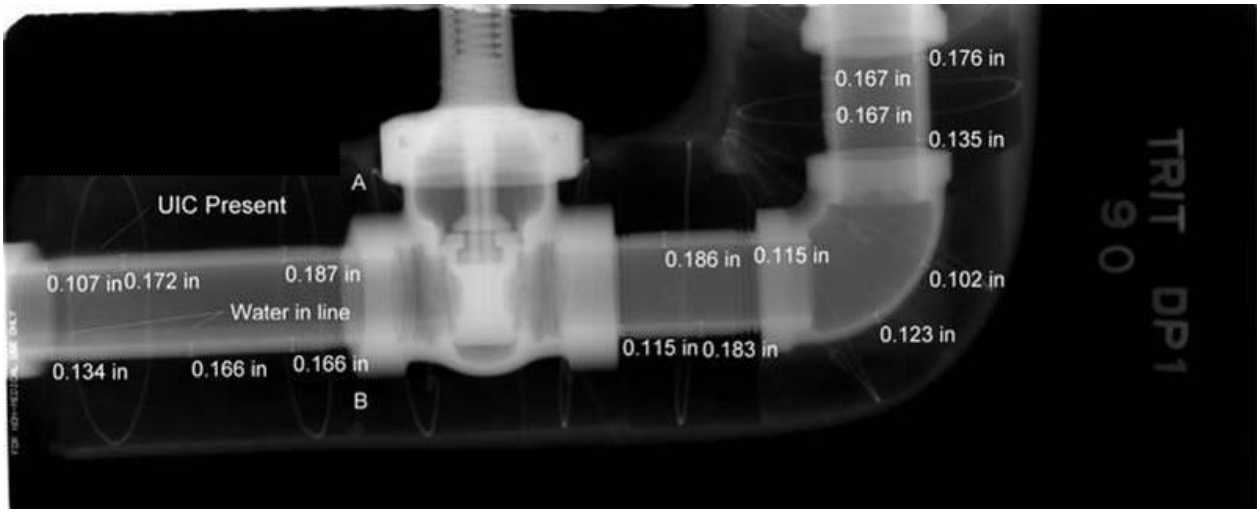


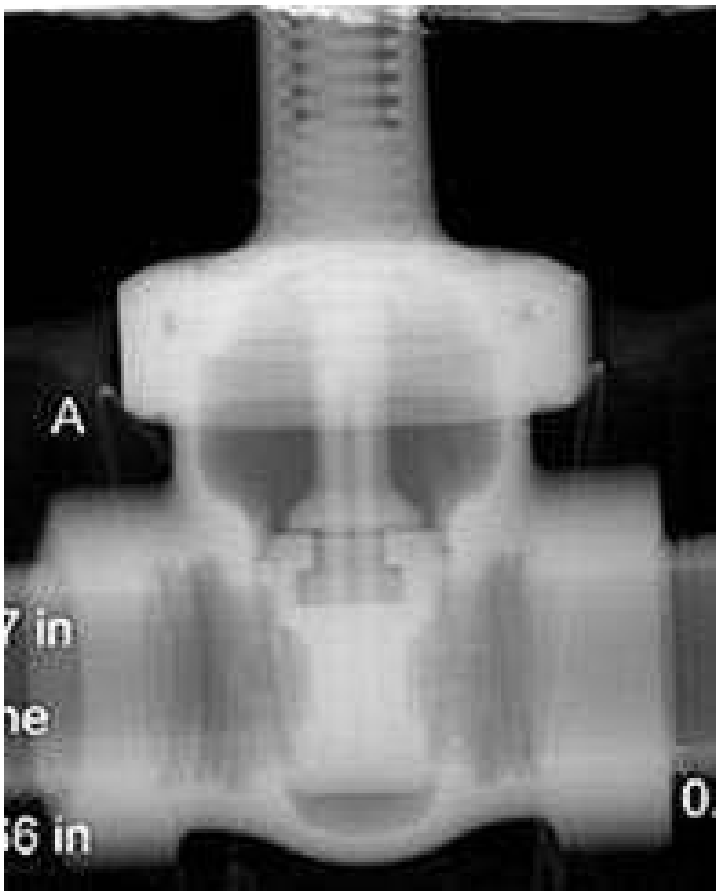
1. Condensate accumulation level;
2. Carpenter's nail


Dark area indicative
of some wall erosion
on heel of elbow
0.244 in
0.256 in
0.232 in
0.250 in
0.234 in
0.262 in
0.219 in
0.237 in

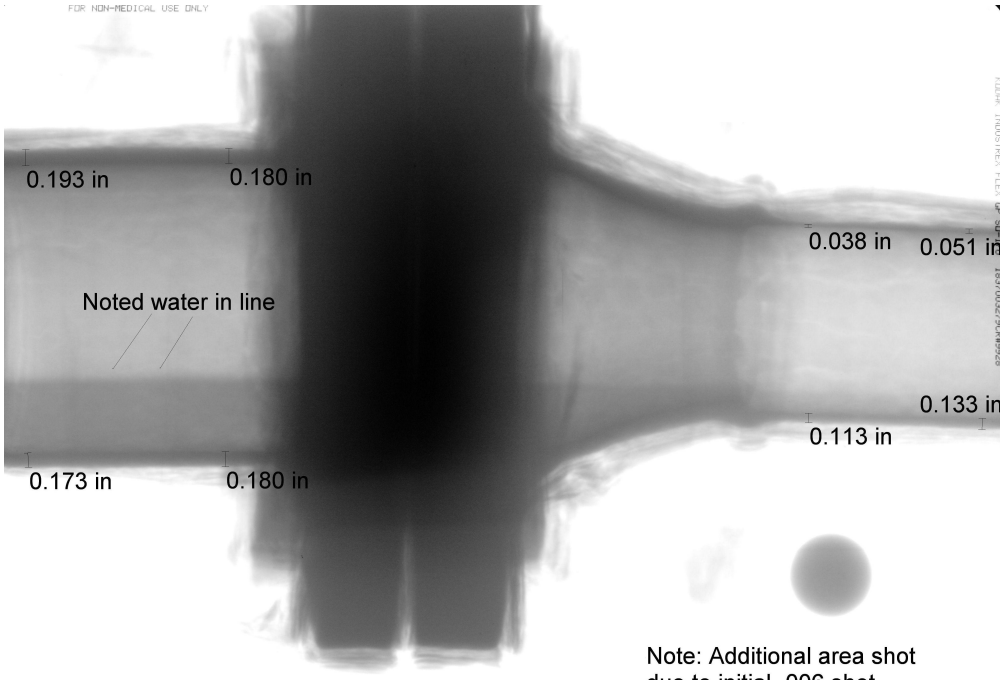


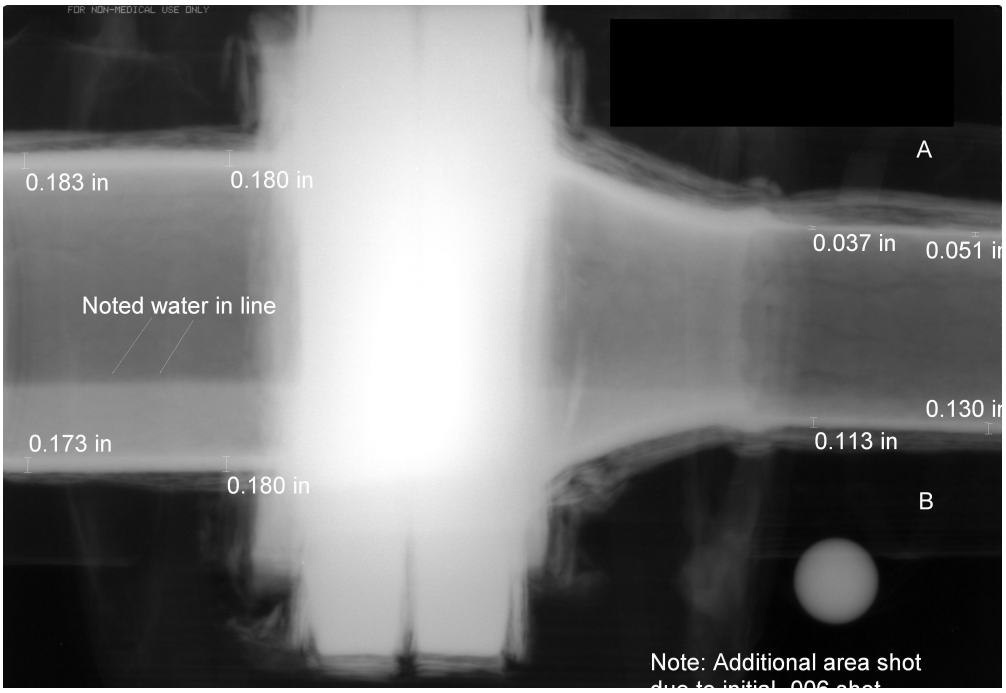
Using standard images software the area of interest may be enlarged to show greater detail.





Another example of digital radiography's flexibility to manipulate the digital image.





The images above show the positive image above and a negative version below, two different ways of viewing the accumulated condensate and under insulation corrosion. Also note annotations may be made on the images to aid in defining the areas of interest.