

# To Audit or Not to Audit?

*The importance of properly auditing the performance of nondestructive examination activities during pipeline projects cannot be overemphasized*

BY DAVID L. CULBERTSON

It is important that the welding inspector pay close attention to daily monitoring of nondestructive examination (NDE) activities being performed during pipeline projects to keep NDE activities on track and within code requirements. The information presented in this article is based on actual field results obtained during recent audits of several large and small pipeline projects. The results of these audits were alarming. Following are some examples and tips on what you should look for when conducting your audits.

## NDE Requirements — API Standard 1104

In accordance with API Standard 1104, *Welding of Pipelines and Related Facilities* (Fig. 1), NDE personnel shall be certified in accordance with the American Society for Nondestructive Testing's Recommended Practice Document No. SNT-TC-1A, ACCP, or any other recognized national certification program acceptable to the pipeline operator. Only NDT Level II or Level III personnel shall evaluate and interpret the results. A record of the NDE personnel's certification (Fig. 2) shall be maintained on file by the pipeline operator. The record shall include results of NDE certification test(s), the agency and person granting certification, and the date of certification. NDT Level I and II personnel shall be recertified at least once every three years, and NDT Level III personnel shall be recertified at least once every five years.

## Review of NDE Personnel Certifications

Now that we understand the requirements concerning certifications of NDE personnel, let's look at some examples of typical situations that have occurred during pipeline projects.

Many NDE technicians have shown up on the job site without any documentation or certification paperwork. They, of course, always have the convenient excuse that their employer didn't inform them about having to bring any paperwork out to the job, or that their employer failed to supply them with the appropriate documentation.

## Examples of Audit Findings

**Incorrect, inadequate, or no certifications.** On a recent pipeline project, an NDE technician had been performing magnetic particle inspection on some small welds when a pipeline company's certified NDE inspector received a telephone call asking that he come out to audit the project. The caller indicated that, in his opinion, the NDE technician performing the work was not using the proper NDE inspection techniques. A review

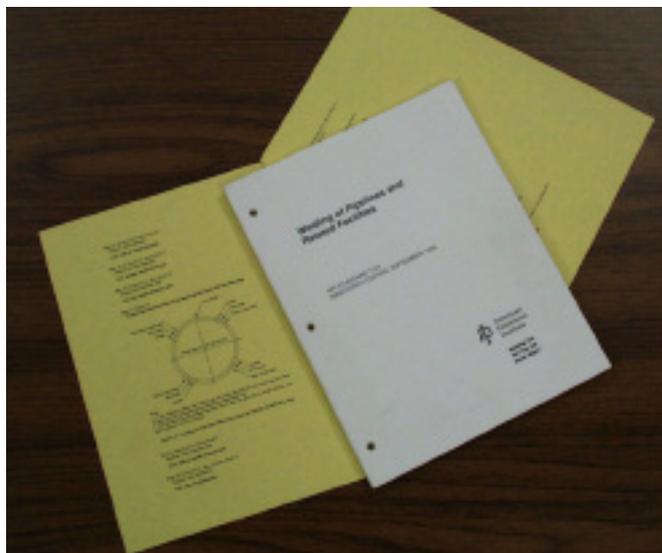


Fig. 1 — API Standard 1104.

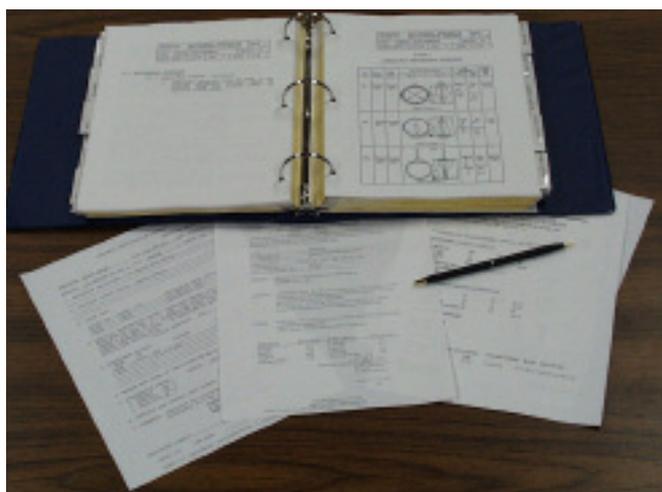


Fig. 2 — NDE procedures and certification credentials.

of the technician's documentation indicated he was certified as an NDT Level II in both the radiography and magnetic particle testing methods. However, after observing his magnetic particle technique (i.e., applying excessive amounts of powder, only

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Fig. 3 — Radiation safety equipment (radiation warning sign, film badge, pocket dosimeter, rate alarm meter, and survey meter).

examining the weld in one direction, etc.) it became apparent the technician did not know how to properly apply the inspection method. When he was asked “What types of weld flaws can you detect with this method?” He replied, “Burnthroughs, inadequate penetration, undercut, and porosity.” When quizzed further, the technician finally admitted that the inspector seemed to know much more about magnetic particle than he, and that he really was not trained nor was he actually certified in the magnetic particle testing method. His employer had told him that if anybody asked him any questions, he should just make up things “because no one will really know the difference.” Needless to say, neither the NDE technician nor his employer will ever be allowed to provide NDE services on any of that company’s projects in the future.

**Expired certifications.** When auditing NDE paperwork, make sure to pay close attention to the expiration dates on the NDE technician’s certification documentation. Check to see if the technician’s expiration dates are valid at the start of the job and make sure that if they will expire during the project that the technician is either recertified or replaced with an NDE technician with valid certifications.

## Radiation Safety Equipment

Industrial regulatory requirements stipulate that whenever radiography is being performed using gamma radiation such as Iridium 192, the radiographer technician must be certified by an industry-recognized radiation safety agency and that he or she must utilize a radiation survey instrument during all radiographic exposures. The radiographer shall use this survey instrument not only to check the perimeter of the radiation area, but to check the exterior of the exposure device and the full extent of the source guide tube after each exposure. Additionally, the survey meter shall be calibrated at least once every six months. The inspector should perform checks on the radiation safety credentials of the radiographer(s) as well as perform a verification check on the calibration of the survey instrument(s).

Each radiographer and assistant who work within the restricted radiation area are required to wear a film badge, pocket dosimeter, and rate alarm meter — Fig. 3. If they do not follow these requirements, they are in violation of state or federal radiation safety regulatory requirements as well as in violation of their own employer’s radiation safety requirements. Additionally, the pocket dosimeter must be zeroed at the beginning of each shift, and the rate alarm meters must be calibrated once every 12 months.

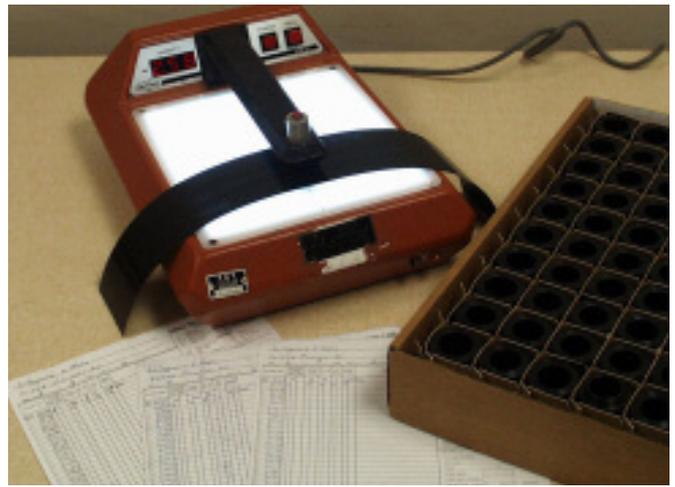


Fig. 4 — Densitometer used to measure film densities.

During all radiographic operations, the radiographer is required to post sufficient numbers of radiation warning signs. This includes posting both “Radiation Area” as well as “High Radiation Area” warning signs. Failure to do so is in violation of regulatory radiation safety requirements.

## Verify that NDE Methods Are Being Properly Applied

The inspector should make sure that the NDE procedure being used fits the scope of the work to be performed. For example, the NDE procedures may specify requirements of the ASME *Boiler and Pressure Vessel Code* or AWS D1.1, *Structural Welding Code — Steel*, which of course do not meet the requirements for pipelines under API Standard 1104, or the procedures may specify incorrect NDE inspection parameters not applicable to pipelines. Review all NDE procedures to be used and make sure they have been properly qualified prior to their use.

Additionally, the inspector should verify that the NDE equipment to be used is what has been specified within the approved NDE procedures. Verification checks should be made to determine that the equipment functions properly and is within the specified calibrated frequency requirements.

During all NDE applications, a periodic check should be performed to verify that the NDE technician is following the requirements that have been specified within the approved procedure(s). Don’t be surprised to find that technicians will sometimes take shortcuts because they think the inspector doesn’t know that much about what actually is in the NDE procedures.

## Review of Radiographic Film

When reviewing radiographic film, one item the inspector should check for is that the proper penetrameter has been selected and is being used. During one pipeline project audit, the inspector discovered that more than ten miles of pipeline had been radiographed, but no penetrameter images appeared on any of the films. Needless to say, a lot of rework was required in an effort to get the pipeline back within code-accepted limits. On another project offshore, after all construction had been completed, the pipeline failed during a hydro test. Once the failed ends of the pipe were brought up to be examined, it was discovered the weld had failed due to internal undercut. Yet when all the radiographs for the project were reviewed, no signs of undercut were visible on any of the films. After closer examination of the film, it was discovered the wrong size penetrameter (a larger

size penny) had been selected and used. The various penetrameter tables within the codes can be confusing if you do not fully understand the different types of penetrameters or image quality indicators (IQI) allowed. Within API Standard 1104, there are three types of IQIs that are allowed: ASTM E 1025 (hole type), API 1104 (hole type), and ASTM E 747 (wire type).

The inspector should check the radiographic film to ensure that the proper film densities are being maintained. Today, most of the contract radiographic service companies are utilizing actual densitometers (Fig. 4), rather than film strips, to make these measurements. As a good rule of thumb, the darker the density on the film the more detail that will be shown within the radiograph. A suggested range of good film densities to maintain is 2.3 to 2.5 (in the weld metal) on the H&D density measuring scale. Additionally, the overall quality of the film should be good. This means that the images of the IQI and weld image should all appear clearly on the film. When image quality is lacking, it may be because of problems associated with geometric unsharpness. Most codes will refer to a formula that the inspector can use to evaluate for geometric unsharpness.

Just like fingerprints, no two weld images will be identical. When reviewing radiographic film, if you believe you have seen the same identical imperfection or weld profile on a previous radiograph, go back and study the two films and the indications more closely. During an audit of two tie-in welds on a recent pipeline project, it was discovered the same weld had been radiographed twice, yet the weld identification numbers indicated they were different welds. This meant the two tie-in welds in question had to be reradiographed in an effort to determine the exact extent of the acceptability of these welds.

Therefore, it is highly recommended that the inspector should perform periodic cursory audits on at least 10% of the total film radiographed per day on each project. From a cursory

audit the inspector should be able to determine whether or not everything is going well. If not, then a more detailed audit is warranted. Not only will the audit of the film indicate whether the radiography is being performed properly but it will also indicate how well the welding on the project is progressing.

## **Review of Daily NDE Inspection Reports**

The daily NDE inspection reports should indicate the number of welds examined and whether the welds were found to be acceptable or rejectable to the code requirements. Each weld should be identified by its own unique weld ID number. The inspection report should equally apply to radiography, ultrasonic, magnetic particle, and liquid penetrant examinations, as well as visual examination of the welds that require only visual examination. When radiographic inspection reports are reviewed, check to verify that the correct number of radiographic film is available for each of the weld ID numbers used. Check the daily NDE inspection reports for completeness and that the report is properly signed by the NDT Level II or III as appropriate.

## **Conclusion**

Inspectors on pipeline and similar types of projects need to be prepared to closely audit the NDE operations being performed. Verify the certification credentials of NDE personnel. Check to make sure that the correct NDE procedures are being utilized and that the procedures were properly qualified. If film radiography is being performed, periodically review the film to determine that proper image quality and appropriate sensitivity are being maintained and that correct interpretations are being made. Lastly, verify that the appropriate paperwork has been completed to document the results of the NDE inspections performed. ❖