What is nondestructive testing (NDT) performance-based demonstration qualification testing, and why is it needed? NDT performance-based qualification testing is a hands-on practical application of specific NDT examination skills to demonstrate competency, and not a stand-alone certification to perform NDT examinations. As defined in ASNT Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing (2016), “qualification is demonstrated skill, demonstrated knowledge, documented training, and documented experience required for personnel to properly perform the duties of a specific job” (section 2.1.13). Performance-based demonstration qualification testing is a verification of the competency skills of an NDT technician that shows they can follow an NDT procedure to perform an examination for a specific application and deliver acceptable results within the capability of the NDT method or technique utilized.

NDT certification schemes are built upon knowledge and skills required to perform an NDT method, and while there are certain components to these certifications that are often considered specific, they generally do not include industry-specific hands-on training with real-world samples. In the case of employer-based certification schemes, it is left to the employer to decide the level of detail needed for industry-specific training, including training on real-world samples. In this reference, “real-world samples” are defined as samples of the material type(s), shape(s), size(s), and product form(s) that contain damage types and morphologies that will be encountered during application of the NDT method in a specific industry. Performance-based demonstration qualification testing spans this gap between the minimal skill requirements of certification and the industry-specific competency requirements of operating equipment owners (OEOs).

For the OEOs (the clients of the NDT service providers), establishing minimum acceptable NDT performance quality levels is paramount for several critical reasons, including improved process safety, increased organizational capability, and strong capital stewardship. These principles are detailed in Figure 1 (Seiwald 2014). Historical statistics show that when performance-based demonstration testing is required by OEOs, the capability of the NDT technicians providing

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**FYI**

Driving Standardization in NDT Competency Testing to Reduce Risk and Manage Costs: the ASNT Oil & Gas Industry Sector Qualification Program

by Michael Sens

Improved process safety  ● Quality data is provided and the potential for missing injurious defects goes down dramatically.

Increased organizational capability  ● Reliable information is provided for proper risk-based inspection and fitness-for-service calculations.

Strong capital stewardship  ● Supply of accurate information on assets results in high decision quality.

Figure 1. Reasons behind establishing minimum acceptable NDT performance quality levels (Seiwald 2014; © Chevron, used with permission).
services is driven up. This is shown in Figure 2, which shows two examples of three-year trends of exam pass rates climbing in considerable steps. This highlights the improved capabilities of NDT technicians in being able to deliver industry-specific competency over time as they are held to a minimum quality level standard.

For all these reasons, oil, gas, and petrochemical companies have long understood the need for performance-based NDT qualification testing. As such, many of the larger oil and gas (O&G) companies allocated resources and developed their own NDT qualification programs as early as the 1980s and 1990s. In the early 2000s, at the request of numerous O&G companies, the American Petroleum Institute (API) created an NDT qualification program for ultrasonic angle beam examination for weld quality. There were similar programs developed in other industries outside of O&G as well, such as the performance demonstration initiative for the power generation industry created by the Electric Power Research Institute.

In its current state, the O&G industry is somewhat fragmented with numerous NDT qualification programs that service providers and technicians must consider if they are to provide NDT services to multiple clients. The current programs in O&G have a multitude of inconsistencies, and none provides a solution for the entire industry. Many NDT technicians must participate in multiple qualification programs on a regular basis, which creates redundancy in the form of time, costs, and expected performance associated with qualification testing. There is a substantial need for a unified and standardized NDT qualification testing program in the O&G industry sector.

Several factors, including the dynamics required to provide a global performance-based NDT qualification program, the resources that ASNT has to offer, and their commitment to support the O&G industry, it was determined that the optimal solution was to utilize ASNT for this effort. ASNT is a recognized leader in NDT, and its global network includes authorized examination centers (AECs), which have gone through a rigorous qualification process. The ability to deliver the examinations on a global scale is paramount to O&G OEOs across the world. ASNT also has a proven track record with administering NDT exams, with its first qualification exam guidance delivered in SNT-TC-1A in 1968; the ASNT NDT Level III program established in 1976; and the ACCP program developed in 1999, which includes both written and practical exams under the International Standards Organization (ISO) scheme.

A steering committee was formed under the ASNT Certification Management Council (CMC) with the goal of developing a performance-based NDT competency testing program for the O&G industry that would be all-inclusive and consider the input of all OEOs, with open membership to anyone interested in participating. The ASNT Industry Sector Qualification (ISQ) program was created with the collaboration of the following O&G companies: Chevron, BP, Shell, ExxonMobil, Phillips66, Valero, DuPont, Saudi Aramco, Sinclair, Flint Hills, Marathon, and

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**Figure 2. Example of three-year trend of NDT qualification testing results in two regions from the Chevron NDT qualification program (Seiwald 2014). The Y-axis shows exam pass rates, while the X-axis shows locations and number of exams given over three consecutive years (© Chevron, used with permission).**
Colonial Pipeline. All aspects of the ISQ program are managed through a consensus committee process to ensure that each company’s requirements are met. With the support of ASNT staff, the O&G ISQ steering committee has laid the foundation for future ISQ programs. When other industry sectors, such as the utility, aerospace, or automotive industries, require performance-based NDT competency programs, the base structure is already in place. In addition, this ISQ program has been organized in a manner that allows NDT employers to use these practical examinations to satisfy the practical component of their employer-based SNT-TC-1A certification program.

Benefits of the O&G ISQ
This qualification program closes the gap between basic NDT method certification and O&G-specific application competency with the exams built around samples that represent the real-world conditions facing NDT technicians in the field. As much as possible and practical, exams are built with samples from retired or abandoned equipment from O&G facilities. Exams are being developed to accommodate all the various subsectors within the O&G industry, including upstream production facilities, midstream pipeline and gathering facilities, and downstream refining and chemical facilities.

The intent of the O&G ISQ is to provide a fully comprehensive NDT qualification program that will meet the needs of all and be deployed with equivalency around the globe. With full adoption by the O&G industry, this standardized program will remove the need for other programs, including internal OEO programs, removing the burden of overtesting NDT technicians. This, in effect, will reduce costs from the full procurement chain, from clients requiring NDT services to the NDT service providers (who cover the costs of redundant exams and labor for their employees) to technicians (who often cover the exam costs themselves). The ISQ program will build a library of data from the exams that will be utilized to identify gaps in technician capabilities. ASNT will then create focused training materials for the O&G industry to close those identified gaps and drive the quality of training up.

ISQ Exams
As previously mentioned, all aspects of the ASNT ISQ program are developed by the consensus committee process with voting membership for all companies who wish to participate. Every effort is made to meet or exceed the requirements of all O&G OEOs. Selection and development of exam samples, including those from retired equipment, is managed by the ISQ committee with support from ASNT International Service Center (ISC) staff. Exam sample truth data/fingerprinting for exam grading key development is also performed directly by the ISQ committee and CMC member subject matter experts (SMEs). Exam sample sets are built based on exam content requirements set by the committee with a focus on the inclusion of all established essential parameters; for example, damage types included, specific skills for individual methods, characterization of damage types, and sizing requirements of defects. During the sample truth data/fingerprinting process, the SMEs set sample or defect difficulty rating values based on criteria. These difficulty rating values are then used to establish comparable exam difficulty across all exams administered in any given method or technique.

Exams are provided through ASNT AECs; however, all exam sample truth data and exam grading are confidential to ISC staff only. The AECs do not have access to this information. This is part of the detailed exam security protocols that were set into place to help safeguard the credibility of the program. In order to facilitate this and other aspects of the exams, ASNT has built a series of computerized systems specifically for practical exam management. These systems include an online application process, an exam sample management tool, an online exam form submission and grading process, and a searchable database of qualified technicians. The exam sample management tool tracks the location of all exam samples, the number of exam exposures for each sample per location, provides notifications for routine sample maintenance, and flags samples that are not currently available for exams. This system also randomly generates the exam sets with the exam criteria established for each method utilizing the pool of samples at a given AEC location. The system notifies ASNT when samples have reached their maximum number of exam exposures at an AEC so they can be shipped to a new region or placed back into the exam sample pool at the ISC to mitigate the overexposure of samples in any given region. The computerized grading system utilizes an online exam form submission at the completion of each exam, which is automatically uploaded into the ASNT system for immediate grading and results notification by email. This allows technicians to get their results the same day that they test. This automatic computerized grading system will also add the technician to the online searchable database of qualified technicians on ASNT’s website.

The full ASNT ISQ program overview, along with specific individual exam information, can be found on the ASNT website at asnt.org (click on Certification, and then ISQ). Links are provided to all the supporting documents candidates need for each exam, including exam overview protocols, exam instructions, sample exam forms, and exam technique-specific NDT procedures.

And, finally, in order to close the loop on NDT qualification testing, there needs to be a mechanism for organizing lessons learned and creation of materials to improve the quality of NDT. There is a need for a feedback loop in the O&G industry communicating identified areas of required improvement from the
ISQ exam results. The ISQ program will do this by regular review of the exam pass/fail statistics and specifically the areas that generate the greatest number of incorrect answers. The ASNT Technical & Education Council, a separate group from the CMC who builds the exams, will then work with industry SMEs to create training materials specifically focused on closing these gaps. These training materials will be publicly available to NDT training companies, universities with NDT programs, Level IIIs, and whomever else may be interested, to improve the quality of O&G application-specific NDT training.

First ISQ Exam
The first exam developed was the Ultrasonic Thickness and Corrosion Scanning qualification, designated as O&G ISQ-UTT. The UTT exam includes ultrasonic straight beam examination of 10 samples. The samples are a combination of flat and curved samples, including both coated and noncoated carbon steel pieces from previously in-service equipment. Figure 3 shows some UTT exam samples. The exam covers a technician’s ability to differentiate between samples with no wall loss, samples with significant wall loss in various morphologies from corrosion and erosion, and samples with midwall laminations. The exam also tests the technician’s ability to accurately measure these various damage types within set tolerances, all within a range of thickness from 0.25 in. (6.35 mm) to 2.5 in. (63.5 mm). Readers should refer to the two-part series by Kervan Govender on reducing false calls published last year in TNT (Govender 2019a, 2019b). These articles provide good reference materials for technicians interested in taking the UTT exam.

Beta testing for the UTT exam was conducted from August to November 2019 at an AEC in Houston, Texas. Through this process, the newly developed systems were brought online, trialed, and finalized. The UTT exam was cleared for full deployment starting in December 2019. An additional AEC in Marietta, Georgia began providing ISQ exams in March 2020. Exam deployment in Anaheim, California, and in the Columbus/Toledo, Ohio, area was temporarily put on hold due to the current COVID-19 pandemic travel restrictions but will be resumed soon. The ISQ program has identified these additional strategic domestic regions where exam availability is required: Salt Lake City, Utah; San Francisco Bay area, California; and the New Orleans/Baton Rouge, Louisiana, area. ASNT is currently seeking interested partners in these areas to become AECs.

O&G ISQ Program Plan
In addition to the regions identified for new AECs in the United States, ASNT is also working on a global deployment plan. The plan includes working with existing AECs in Saudi Arabia, Bahrain, and Egypt for deployment in 2020. There are also several other international parties that may potentially become AECs, including the Welding Institute in the United Kingdom, the Dutch Society...
for Quality Surveillance Inspection and Non-Destructive Testing in the Netherlands, the Brazilian Association of Non-Destructive Testing and Inspection, and the Canadian Welding Bureau.

The next ISQ exam currently under development is the Ultrasonic Shear Wave (UTSW) examination of pressure equipment welds governed by the American Society of Mechanical Engineers (and other equivalent international standards). The timeline for beta testing of the UTSW exam is third quarter of 2020. Once beta testing starts for the UTSW exam, development of the ISQ Ultrasonic Phased Array (PAUT) exam for pressure equipment welds will begin, with beta testing to start by the end of the year. Following the PAUT exam, an ultrasonic examination of pipeline long-seam welds exam will be developed. The ISQ O&G steering committee is presently developing a long-term program plan and has a list of more than 10 potential additional exams, which will be prioritized by the committee members.

Conclusion

In developing the ISQ program, ASNT is meeting the needs of industry and its members, and in doing so, is creating a safer world.

For O&G owner/operator companies who are not currently represented on the ISQ steering committee and are interested in joining, please contact the committee chairs, Michael Sens (msens@chevron.com) or Danny Keck (keckdl@yahoo.com).

For NDT SMEs outside of owner/operator companies who wish to assist the ISQ program with either exam development or training material development, please also contact the committee chair or co-chair. All other information regarding the ASNT O&G ISQ program can be found on the ASNT website.

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