

Nondestructive Testing

What are the Specific Formal
Training Requirement?



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Nondestructive Testing

Nondestructive Testing (NDT): the development and application of technical methods to examine materials or components in ways that do not impair future usefulness and serviceability in order to detect, locate, measure and evaluate flaws; to assess integrity, properties and composition; and to measure geometrical characteristics.

The terms **nondestructive examination (NDE)**, **nondestructive inspection (NDI)**, and **nondestructive evaluation (NDE)** are also commonly used to describe this technology.

Overview

- **This presentation is designed to compare certain specification requirements regarding *formal training* for NDT Certification, and:**
 - Understand the definitions for formal training as applied to specific standards. (e.g., NAS-410 & SNT-TC-1A)
 - Review the specific requirements per the standards that may be used by the employer to qualify and certify NDT personnel.
 - Have an understanding of the types of training application: instructor led; self-study; computer base; web based or virtual instructor led.
 - Input, for comparison, from other educational settings as to the definition of Formal Training/Formal Learning.

Specifications/Sources of Reference Material

- **Recommended Practice No. SNT-TC-1A (2016)**
 - Personnel Qualification and Certification in Nondestructive Testing
 - Normally used by general industry in the United States
- **Federal Aviation Administration (FAA)**
 - Memorandums
 - Advisory Circulars
- **NAS 410 (December 19, 2014)**
 - National Aerospace Standard - Normally used by the aerospace industry
 - Used by Nadcap (Audit Criteria for Nondestructive Testing {NDT} Suppliers Accreditation Program)

SNT-TC-1A

- **Definition: Training**

- An organized program developed to impart the knowledge and skills necessary for qualification.

SNT-TC-1A (Continued)

■ Training Programs:

- Personnel being considered for initial certification should complete sufficient organized training. The organized training may include instructor-led training, personalized instruction, virtual instructor led training, computer based training or web based training. Computer based training and web based training should track hours and content of training with student examinations in accordance with para. 7.2. The sufficiently organized training shall be such as to ensure the student is thoroughly familiar with the principles and practices of the specified NDT method related to the level of certification desired and applicable to the processes to be used and products to be tested. All training programs should be approved by the NDT Level III responsible for the applicable method.
- The training program should include sufficient examinations to ensure understanding of the necessary information.
- Recommended training course outlines and references for NDT Levels I, II and III personnel, which may be used as technical source material, are contained in *ANSI/ASNT CP-105 – Topical Outlines for Qualification of Nondestructive Testing Personnel*.
- The employer who purchases outside training services is responsible for assuring that such services meet the requirements of the employer's written practice.

Summary of minimum training hours for Level I & II status:

- The following is an example of some of the examination methods listed in this document.
 - Eddy Current (ET): Level I is 40 hours; Level II an additional 40 hours (80 total hours)
 - Liquid Penetrant (PT): Level I is 4 hours; Level II an additional 8 hours (12 total hours)
 - Magnetic Particle (MT): Level I is 12 hours; Level II an additional 8 hours (20 total hours)
 - Ultrasonic (UT): Level I is 40 hours; Level II an additional 40 hours (80 total hours)

Federal Aviation Administration (FAA)

- Memorandum (June 15, 2007)
- Subject: Information – Qualification Standards for Nondestructive Testing
 - This memo contains information only and as such is not national policy.
 - **Training:** NDT personnel should receive documented initial and recurrent training in the standards, methods, and levels they utilize. This should be a mix of classroom, practical, and on-the-job training. The frequency and content of recurrent training will be specified by the standard under which the NDT personnel have been qualified.

Federal Aviation Administration (FAA)

- **Advisory Circular (AC No: 65-31B): Training, Qualification, and Certification of Nondestructive Inspection Personnel. Dated 2/24/14**
 - Definition: **Training** – An organized and documented program of activities designed to impart the knowledge and skills necessary for qualification. This program may be a mix of classroom, laboratory, programmed self-teaching, and OJT.
 - **Organized Training**: Qualified personnel should have completed sufficient organized training to become familiar with the principles and practices of the applicable test method. The training program should include OJT instructions in basic principles, products, equipment, operating procedures, test techniques, and review and analysis of inspection/test data that the individual will encounter in his/her work assignment. Upon becoming qualified, personnel are entitled to notification within a reasonable amount to time.

Federal Aviation Administration (FAA)

- **The FAA recognizes several national and international standards that organizations may implement to qualify and certify NDT personnel.**
 - AIA-NAS-410
 - ATA Specification 105*
 - ISO 9712*
 - MIL-STD-410E*
 - Recommended Practice SNT-TC-1A
 - Canadian National Regulations contained in CAN/CGSB-48.9712-95*

* These documents are not address in this presentation

Federal Aviation Administration (FAA)

- **FAA (AC 65-31B) minimum **classroom** training requirements and SNT-TC-1A requirements.**
 - FAA **Classroom** Instruction hours (examples)
 - ✓ Penetrant (PT): Level I is 16 hours and Level II is an additional 16 hours (total of 32 hours)
 - ✓ Magnetic Particle (MT): Level I is 16 hours and Level II is an additional 16 hours (total of 32 hours)
 - SNT-TC-1A (examples – *note the difference!*)
 - ✓ Penetrant (PT): Level I is 4 hours and Level II is an additional 8 hours (total of 12 hours)
 - ✓ Magnetic Particle (MT): Level I is 12 hours and Level II is an additional 8 hours (total of 20 hours)

NAS410 Revision 4 (Dec 2014)

■ **Definitions:**

- **Formal Training:** An organized and documented program of learning activities designed to impart the knowledge and skills necessary to be qualified to this standard. Formal training may be a mix of classroom, practical and programmed self-instruction as approved by the *responsible* Level 3 or Examiner.
- **On-The-Job-Training:** Training in the work environment to gain experience in learning instrument set-up, equipment operation, applying the process, and recognition, interpretation and evaluation of indications under appropriate technical guidance.

NAS410 Revision 4 (Dec 2014)

- **Training:** Candidates for certification to all levels shall complete sufficient formal training to become proficient with the principles and practices of the applicable test method and technique(s) and be capable of carrying out the duties specified in Section 5. Formal training shall be conducted prior to, or in conjunction with, on-the-job-training. All completed NDT training shall be documented.
- **Training Outlines:** All training shall be conducted in accordance with a detailed course outline approved by the Responsible Level 3. The outline shall include a list of references from which the training material is derived.

NAS410 Revision 4 (Dec 2014)

■ Training Facilities:

- Training facilities and classrooms shall provide an environment conducive to learning and shall be sufficiently well equipped with equipment and training aids, models, samples, etc., to ensure that all aspects of the training course requirements are met. In addition, a sufficient number of representative test samples containing natural or artificial features and/or flaws shall be available to cover the range of testing to be conducted by the candidate. Test samples used for practical examinations shall not be used for training purposes. To ensure the candidate fully benefits from the practical exercises, equipment used for training shall be sufficiently comparable to that which the candidate will use in the performance of their job. Production parts and NDT equipment may be used for training.

Nadcap AC7114 Rev. K (Check List)

- **NDT Qualification/Certification – NAS410 / EN4179**
 - **Note:** Reference NAS410 / EN4179 for detailed requirements.
- **5.1.6:** Does the written practice address the required training requirements?
- **5.2.9:** Do the records include the NDT training history that identifies the source, type of training, dates of training and course hours?

Training Outlines

If your NDT program requires compliance to NAS410 or other global documents such as EN 4179 your program must include a detailed course outline for all training conducted.

- These documents list numerous subject areas that must be included in the course outlines.
- When using ANSI/ASNT CP-105 training outlines you still need to insure all required subjects are addressed.

The outlines shall also include a list of references from which the training material is derived.

Summary of Training Applications

- **Instructor Led:** (*General Definition*)

- This type of training is facilitated by an instructor either online or in a classroom setting. Instructor-led training allows for learners and instructors or facilitators to interact and discuss the training material, either individually or in a group setting.

Summary of Training Applications

(Continued)

■ **Virtual Instructor-Led Training (VILT):**

- **Virtual Instructor-Led Training (VILT)** refers to training that is delivered in a virtual or simulated environment, or when instructor and learner are in separate locations. Virtual instruction environments are designed to simulate the traditional classroom or learning experience. VILT can be conducted synchronously or asynchronously. The term is also referred to as Virtual Classroom Training (VCT).
- **Content:** The design of VILT programs requires a different approach than classroom or online asynchronous programs. The instructional designer must provide the instructor and student with mechanisms to communicate frequently, and must keep the content engaging and collaborative. Learning content must be developed with maximum student engagement in mind. To capture learners' interest and promote retention, VILT must be designed around a comprehensive learning strategy. Visuals and interaction are paramount to promoting engagement and increasing training effectiveness.

Summary of Training Applications

(Continued)

■ Self-Study:

- The study of something by oneself, as through books, records, etc., without direct supervision or attendance in a class.
 - ✓ *The disadvantage here is that self-study books provide little guidance – if something is not clear, the book doesn't come with a teacher or instructor to explain it. Books may not have auto-correct exercises to show you whether you really understood the subject matter.*

Summary of Training Applications

(Continued)

■ **Web Base Training:**

- **Web-based training (WBT)** is an innovative approach to distance learning in which computer-based training (CBT) is transformed by the technologies and methodologies of the World Wide Web, the Internet, a Web-based training presents live content, as fresh as the moment and modified at will, in a structure allowing self-directed, self-paced instruction in any topic. WBT is media-rich training fully capable of evaluation, adaptation, and remediation, all independent of computer platform.
- Disadvantages include one's access to a computer, and if one has access to a computer the bandwidth/browser limitations may restrict instructional methodologies.

Summary of Training Applications

(Continued)

■ Computer Base Training:

- **Computer-based training (CBT)** is any course of instruction whose primary means of delivery is a **computer**. A **CBT** course (sometimes called courseware) may be delivered via a software product installed on a single **computer**, through a corporate or educational intranet, or over the Internet as **Web-based training** .
- Off-the shelf and “customizable” programs can be cost effective.
- Self-paced, flexible, and individualized are some benefits.
- *Computer-based training is not, however, the answer to every training need. It is more appropriate -- effective and cost efficient -- in some situations than others.*

Formal Learning

- **Formal learning: (*Wikipedia*)**
 - Normally delivered by trained teachers in a systematic intentional way within a school, academy/college/institute or university, is one of three forms of learning as defined by the OECD (Organization for Economic Co-operation and Development), the others being informal learning, which typically takes place naturally as part of some other activity, and non-formal learning, which includes everything else, such as sports instruction provided by non-trained educators without a formal curriculum.

Formal Training

- **Formal Training (*Training Magazine*)**
 - Typically, formal training is any learning experience that is planned and organized as a classroom-based lectures and structured e-learning courses. Certain times and instances call for formal learning. These include teaching tough subjects such as company policies or emergency response procedures; the things you need to ensure will translate and be fully comprehended by all involved.

General Statement

- This presentation does not address all the different definitions of terms used and the numerous interpretations of said definitions.
- This presentation does not address all specific requirements of the standards indicated, which are used for the qualification and certification of NDT personnel.
Focus is on the subject of formal training.
- The intent of this presentation is to stimulate discussion to help clarify the requirements for formal training.

Summary

(Minimum Number of Training Hours)

The SNT-TC-1A, NAS410 and FAA's AC65-31B documents are clear as to the requirements for the **MINIMUM** number of formal training hours required for Level I or Level II certification status for each method sought.

- SNT-TC-1A (Table 6.3.1A) states "Training Hours"
- NAS410 (Table I) states "Formal Training Hours"
- AC 65-31B (Table 1) states "Classroom Instruction Hours"

It is noted that NAS410 and AC65-31B requires more hours for the Penetrant and Magnetic Particle methods than SNT-TC-1A.

Summary

(How are formal training hours accomplished)

■ SNT-TC-1A:

- This document states that for initial certification personnel *should* complete sufficient organized training that *may* include instructor led training, self-study, virtual instructor led training, computer based training or web based training. The training program *should* include sufficient examinations to ensure understanding of the necessary information and recommended training. Recommended course outline are contained in ANSI/ASNT CP-105.
- *Basically this document leaves the detail specifics of how training is accomplished to the employer's written practice. Based on how this document is interpreted an employer could specify that all training be self-study only and any examinations/quizzes (covering course material) or course outlines could be very generic or non-existent.*

Summary

(How are formal training hours accomplished - Continued)

■ FAA's AC No. 65-31B:

- This document defines a training program that may be a mix of classroom, laboratory, programmed self-teaching, and OJT (On-The-Job-Training). Table 1 clearly indicates **Classroom Instruction Hours**, which could include:
 - ✓ *laboratory time as part of the curriculum and programmed self-teaching could be considered "Home Work" where the results could be graded and measured for comprehension. OJT is normally considered training to meet the **experience** need of the certification formula and is not normally considered formal training or classroom training.*
- *There is no specific guidance as to how much time would be dedicated to each specified element of a training program. Is 75% of the training dedicated to self-teaching and 25% to classroom? Does one element have more precedence than another?*

Summary

(How are formal training hours accomplished - Continued)

■ **NAS410:**

- This document states that formal training may be a mix of classroom, practical and programmed self-instruction as approved by the responsible Level 3 or Examiner.
 - ✓ The formal training program must be approved by Level 3 or Examiner.
 - ✓ Not clear as to what practical is? Is this considered laboratory type training?
 - ✓ Programmed self-instruction is not clearly defined.
 - ✓ When using a mix application there is no precedence, as to the minimum percentage (weight) required, for each identified training element.
- OJT is identified as training to gain experience, and therefore would meet the experience requirement for certification.
- All NDT training shall be documented.
- All Training shall be conducted in accordance with a detailed approved course outline.

Summary

(How are formal training hours accomplished - Continued)

■ **NAS410:**

- This document provides detail requirement for what is required for training facilities and classroom.
- *The assumption is that classroom training is the core of the formal training program for those that use NAS410 and that a mix of practical (laboratory?), and programmed self-study (home work?) could be included into the training program curriculum. Then the question arises – What is the minimum time (percentage) that is dedicated to classroom or the other identified training elements?*
- *Another assumption is that the Employer's Written Practice would clarify and provide specific guidance regarding this subject. But do they?*

Conclusion

- None of the reference documents addresses the subject of follow-up: The process of validating that training given was mastered, comprehended, or understood.
 - This normally accomplished at a pre-determine time period after training is accomplished (3 – 6 months, as an example).
 - This process is also a tool to validate if past students need or require additional training.
- The assumption is that quizzes or exams given during the training are sufficient to validate retention of subject matter.

Conclusion (Continued)

- Although documents such as NAS410 have a requirement identified as “Annual Maintenance” this approach is focused on technical proficiency (ability to follow a work instruction?) and does not require a comprehensive approach to validate a students retention/comprehension of subject matter that was presented during the formal training phase of their certification process.
- Documents used to develop a written practice needs to be specific in regard to the subject of “formal training”.
 - How are a mix of instructional processes used and what weight does each carry? Classroom, a minimum of 50% - as an example.

Conclusion (Continued)

- There are numerous private organizations/companies that advertise NDT training using or applying web base, self-study, correspondence, etc., applications.
 - Based on how these companies advertise their services would a employer assume that their program would meet **all** the training requirements for certification of their personnel?

Summation

Become educated about your NDT program and insure your training program is well defined and meets customer and regulatory requirements.

The End

It is our desire that this presentation provided the reader with insight regarding the formal training requirements outlined in the document references provided, with the understanding that other industry standards may vary in their requirements - know your NDT program's requirements!



A realistic NDT program includes (1) Formal Training – {X number of hours}; (2) On-The-Job Training – {X number of hours}; and written & practical exams.

