

**A NONDESTRUCTIVE TESTING (NDT) TECHNICIAN** is an individual who examines engineering structures, materials or components, using one or more testing methods that do not result in the destruction of the object being tested. The technician's duties may range from the carrying out of tests in accordance with a simple, well established procedure, to the exploratory evaluation of a complex component. A certification procedure of technicians is well established in Canada and involves both written and practical examinations; formal training is usually gained as part of a program in some related field, such as welding or metallurgy, or through short specialized courses offered by technical societies or commercial organizations.

### **Nature of Work**

Nondestructive testing technicians usually find themselves applying one or more of the common NDT techniques to an inspection problem. They may, for example, be handed a casting to check for soundness or they may be inspecting the welds of a new bridge or looking for fatigue cracks in a crankshaft.

The NDT method they use may already be specified or, they may have to choose the most economical method of inspecting one item or many similar items. They must be aware of the capabilities and limitations of each NDT method, and they must not ignore the relative cost of each per inspection.

The equipment used in NDT varies considerably. Large tanks are used for production-line penetrant inspection. Highly portable x-ray tubes and ultrasonic instruments are used for field inspection of aircraft. Small aerosol cans of liquid penetrants provide an easily carried and economical basic inspection kit.

Technicians specializing in nondestructive testing can find work dull and repetitive or as interesting and challenging as they like. The true NDT technician will need to become skilled in more than one NDT method; as experience is gained, the technician will find that responsibilities increase and that there is no end to the technical challenge presented by nondestructive examination. Each new material, product or application will require a new approach or modification of an old technique.



Magnetic Particle inspection using an electromagnetic yoke

### **Working Conditions**

The working conditions encountered by NDT technicians will depend on the industry in which they are employed. One who works for example, for an inspection company may be required to travel extensively, to work long hours or to work outdoors on construction. On the other hand, one who works in the quality assurance branch of a manufacturing firm will work normal shifts in a laboratory. In maintenance inspection, technicians will find themselves in every part of the plant of operation and their working conditions will be similar to those of any other worker in a steel plant, mine or pulp mill.

There is a radiation hazard associated with x-ray work. Awareness of the danger of exposure to radiation and a knowledge of the principles of radiation safety are required of every radiographer. Good safety habits will protect the technician from this potential danger.

Other working conditions are the same as for that part of the industry in which the technician is employed. NDT personnel will normally belong to the union which represents other employees in their own environment.

Many of those working in nondestructive testing are members of the Canadian Institute for NDE. A non-profit corporation, the Institute was formed to promote education in NDT and the dissemination of technical information. It does this through monthly chapter meetings, training courses, seminars and conferences. The Institute also publishes a technical magazine, the CINDE Journal, which contains current information and news of the industry and which can be used by members as a means of contacting potential employers or employees.

## **Qualifications Necessary for Entry and Success**

Obviously the required physical qualities for a technician who is x-raying pipeline welds in the far north will be different from those for one who is doing ultrasonic testing in a laboratory. The one characteristic that is required of every NDT technician is good eyesight. Their decisions about the quality of the product they are inspecting will depend on their ability to see a defect on a radiograph, or to pick out the line penetrant or magnetic particles that indicate a discontinuity. Certification in any one of the NDT methods will require that the technician pass an annual eye examination for both visual acuity and colour vision.

Because there is a wide range of possible employment situations, there is room in the field of nondestructive examination for persons of any age, sex and personality. As in many other fields, the individual who has the personal qualities of initiative, persistence, and leadership will advance more rapidly than the person who lacks these qualities. The demand for people who have a knowledge of all NDT methods and a feeling for manufacturing processes ensures that individuals with the initiative and drive to broaden their qualifications will be rewarded

The best NDT technician is one who has the technical qualifications plus the ability to make sound decisions and the willingness to take responsibility for his or her decisions. In some situations, an assessment of a part as containing a flaw will not be a popular one, particularly to the producer.

## **Preparation Needed**

Personnel employed in nondestructive testing are certified by the Department of Natural Resources Canada (NRCan), which acts as the examining authority for the Canadian General Standards Board (CGSB). A CGSB standard CAN/CGSB 48.9712 now exists for training and certification in industrial radiography, ultrasonics, magnetic particle, liquid penetrant and eddy current inspection; it includes levels of qualification which depend upon experience and the ability to pass written and practical examinations.

The oldest, and perhaps the best known program is the industrial radiographer certification. This system has served as a model for the other four specifications and is described in detail as an example of the certification process.

Trainees require three months of experience and 40 hours of training to become eligible for the Level 1 CAN/CGSB examination. The examination consists of three written papers which test for knowledge in the general principles of radiography, x-ray safety and darkroom procedures. Trainees must also complete a practical examination which demonstrates their ability to follow written instructions and radiation safety procedures. Trainees using gamma radiation must also complete forty hours of radiation safety training and successfully pass the Canadian Nuclear Safety Commission (CNSC) examination for the Certified Exposure Device Operator (CEDO). Once certified to Level 1, technicians may carry out inspections independently, using established procedures.

After nine months of experience at Level 1 and an additional 80 hours of training, a Level 1 radiographer may undertake the Level 2 examination. This consists of a written examination in general radiography, plus a written and practical examination in each of the specialized categories of aircraft structures, welds and weldments, castings and forgings. Success in this examination qualifies the individual as a Level 2 radiographer, ready to assume the responsibility for the supervision of a radiographic laboratory, the establishment of inspection procedures and the interpretation of radiographs.

A certified Level 2 radiographer will require a further four years of experience to become eligible for Level 3 examination. A Level 3 radiographer is a senior technician, usually in a supervisory position and familiar with other NDT methods, the codes and specifications pertaining to NDT and associated technical fields such as metallurgy, welding, foundry practices, etc.

The eligibility requirements for examination and certification vary with the method and the applicants level of formal education. The CAN/CGSB standard for certification provides detailed information on the requirements for each method.

Other systems of certification exist and are used by industry. Certification in all methods is available from the American Society for Nondestructive Testing (ASNT). Companies sometimes use the American Military Standard (MIL-STD-410) to certify their NDT personnel; some aircraft companies have their own certification systems.

To enter the NDT field, the would-be technician should have at least a high school background in mathematics and physics. A fundamental knowledge of the principles of optics would be valuable. Familiarity with materials and their properties, fabrication processes, and mechanical or electronic skills each add to the value of the technician as an inspector.

In some industries, it is preferable to have a basic skill as an aircraft mechanic, welder or foundryman before specializing in nondestructive examination. The more the inspector knows about the object or material being inspected, the more valuable he or she will be as an employee.

Personnel currently employed in nondestructive testing have come from many different types of backgrounds. Because of this variety, training courses have tended to be short and intensive. A company may send an employee on a two-week course on the ultrasonic inspection of welds, for example. Courses of this nature are offered by equipment suppliers, some community colleges across the country, and private training organizations, usually with the objective of preparing the student for

the CGSB examinations. The Canadian Institute for NDE promotes educational courses in all methods and offers a full selection of training courses and workshops of various lengths and formats. These courses are available in most of the larger cities from coast to coast.

Courses offered through community colleges in welding technology, mechanical engineering technology and metallurgy sometimes include instruction in nondestructive examination.

## **Employment, Advancement Outlook**

The man or woman who starts a career in the field of NDT is entering a specialty which offers a wide variety of working conditions and the potential for unending challenge and interest. There are four major areas of employment, each which includes organizations ranging from one person operations to the civil service and the industrial giants. There are many people in the industry who started as helpers and now own their own companies.

Inspection services offer laboratory and on-site inspection to customers on a contract basis. While the pay is relatively high, inspection company employees may find themselves working at heights on storage tanks, buildings or towers, or in an isolated part of the far north. Such conditions, however, are reflected in special allowances, and there is plenty of opportunity for overtime work. Since the variety of work provides an opportunity to accumulate a wide range of experience, the inspection service is one of the best places that the young NDT technician can start.

In the maintenance of trains, aircraft and truck fleets, public utilities and industrial plants, NDT technicians may encounter

shift work; usually they operate within the plant or maintenance area. The workload is usually programmed and thus relatively steady.

With the current trend to product liability, the manufacturer must be especially conscious of the benefits of NDT and one hundred percent inspection, and thus employs the NDT specialist in the quality control department or metallurgical laboratory to improve the product.

Opportunities for people who have an aptitude for sales exist with most NDT equipment distributors. In addition to a head for sales and commerce, the individual must have experience in the NDT field as he or she is frequently called upon to advise clients on the solution of inspection problems. In general, the sales persons will have responsibility for their areas and each will be supplied with a car and an expense account.

A typical progression in industry will be from original employment as a helper to Level 1, eventually Level 2 and possibly Level 3 in any one of the methods, each advancement dependent on CGSB certification. In many instances, the employer will require certification in more than one method. The next step may be to NDT foreman, then to Chief of Nondestructive Testing or Chief Inspector. Since the inspection department offers a good opportunity to see the plant from many angles, it is also a good starting place as a step into management.

## **Remuneration**

While pay and progression vary with different industries, different locations and different employers, and will in most cases depend to some extent on personal qualities, it is possible to discuss general levels for the industry as a whole.

The base hourly rate for union personnel in the service industry is \$13.50/hour for helpers, \$18.50/hour for Level 1 technicians and \$23.50/hour for Level 2 technicians. In addition, supervisors and management generally are chosen from Level 2 technicians.

The situation for sales personnel is roughly similar to that of a person qualified as a Level 2 technician. Related experience in such areas as welding, heat treating or materials testing usually will be reflected in the pay level. A graduate from a technician or technologist program that included a substantial quantity of NDT training would enter the NDT field at a salary in the same range as a junior technician.

## **How to Get Started Toward the Occupation**

The student who is seeking to gain some practical experience during the summer holidays would be well advised to approach one of the inspection companies. These companies usually experience a peak workload during the summer months, when new construction is at its highest, and provide the best opportunity to learn the NDT skills. If formal courses in NDT are not available in the local area, the student should take courses in related subjects, such as welding metallurgy. The NDT sections of local industries will always welcome visitors who are interested in learning about nondestructive examination.

## **Related Occupations**

The nondestructive testing technician has much in common with colleagues in welding, in maintenance and on the production line and is related professionally to the metallurgist, the mechanical engineer or the corrosion engineer.

## **For Further Information**

### **Canadian Institute for NDE**

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Fax: (905) 574-6080  
email: [info@cinde.ca](mailto:info@cinde.ca)  
website: [www.cinde.ca](http://www.cinde.ca)

### **Canadian General Standards Board**

c/o Cdn Government Publishing Centre  
Supply & Services Canada  
Ottawa, Ontario, K1A 0S9  
Tel: (819) 997-2560

### **Certifying Agency**

CANMET Materials Technology Laboratory,  
Minerals and Metals Sector - Natural  
Resources Canada  
183 Longwood Road South  
Hamilton, ON L8P 0A5  
Tel: 1-866-858-0473  
website: <http://www.nrcan-rncan.gc.ca/mms-smm/ndt-end/index-eng.htm>

### **American Society for Nondestructive Testing**

1711 Arlington Lane  
P.O. Box 28518  
Columbus, Ohio, 43228-0518  
Tel: (614) 274-6003  
website: <http://www.asnt.org>

### **Publications**

CINDE Journal  
ASNT - Materials Evaluation