Trends in NDT Certification and Training in Canada

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Abstract

Changes in nondestructive testing (NDT) technologies and workforce demographics are affecting people in the business of NDT inspection. Changes in economic factors are affecting the NDT business community, with many companies now competing in a world-wide marketplace. What hasn't changed is the requirement for people to be certified as competent to work in the specialty occupation of NDT.

Many of the people who helped develop and shape the NDT business for the last 40 years are preparing to retire, if in fact they have not already. They leave behind a much different playing field that includes new technologies and new international standards for NDT personnel. The companies that rely on the competency of their NDT inspectors are impacted by the standards, and by the fact that people entering the NDT occupations today are often different from those who entered the NDT workforce 30 to 40 years ago.

Given the above, two key aspects of NDT training and certification in Canada should be reviewed and understood by industry stakeholders and interested parties:

1) Occupational turnover and the rate at which new people are certified to generate NDT data, interpret it, report it, or act on the results, and
2) The training, certification and qualification programs needed for existing and new NDT technologies.

Introduction

In the 1940's, 50's and 60's, Canada and the rest of the world was busy learning how to use newly emergent NDT technologies. The inspection, testing and quality assurance techniques taken for granted today were driving research and shaping the NDT industry. The pioneers of the NDT industry realized that to have a skilled workforce, they needed specialized training, qualification and certification programs to keep pace with the rate of technical and business development.

The quick pace of technological development and parallel interest in training and certification continued throughout the 70's, 80's, 90's and into the new millennium because of additional requirements to improve safety, productivity and quality while protecting the environment. These, coupled with continuous technology advances, constantly redefined the needs of the NDT community and its' customers. The good news for Canada is that the academic, supplier and employer base were sensitive to these forces and responded in an appropriate manner to devise systems to assure a competent workforce.

A brief historical overview of NDT standard developments affecting Canada is:

1960: First CGSB NDT standards published (48-GP-4)
1962: First industrial radiographer certified in Canada
1966: SNT publishes SNT-TC-1A, with assistance from Canadian W. Havercroft.
1967: ICNDT recognizes the need for a Personnel Qualification system, hears from UK, USA, Canada and Japan who have one, and initiates the creation of ISO committees TC135 and SC7.
1972: First Canadian certification in Ultrasonics
1983: TC135 SC7 meets in Canada and agrees to develop an international standard for three levels of certification with qualification by examination, based on requirements for education, formal training, and practical experience.
1984: The Canadian certification system using CGSB 48-GP standards moves from a two level to a three level system and adds more methods to the original RT and UT methods.
1992: ISO publishes ISO Standard 9712 with significant Canadian input.
1995: Canada CGSB 48/2 Committee adopts the ISO 9712:1992 standard without modification as the national standard for implementation by the Natural Resources Canada (NRCan) CANMET-Materials Technology Laboratory, National NDT Certifying Agency.

Forty years of standard changes, technological advances and workforce aging have created an interesting prospect: *How to cope with them with an eye to the future?*

The Economy and Workforce Demographics

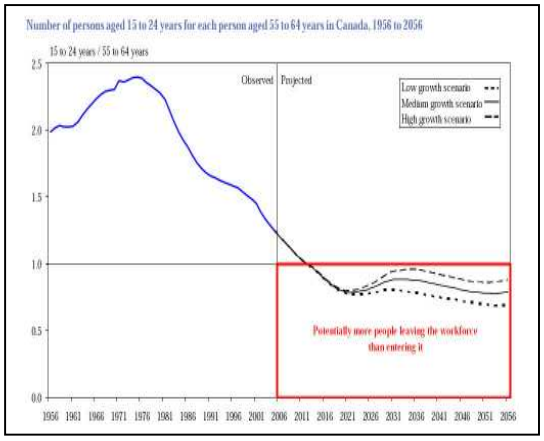
Over the past 50 years Canada has enjoyed good economic growth as shown by the trend in national GDP in Figure 1.

Figure One – Canada GDP Growth: 1960 – 2009

Source: World Bank Indicator database [1]

A healthy advance in employment opportunities for NDT occupations accompanied this growth. Hidden within it though was the demographic time bomb of "boomer" [2] generation retirements. Now that it is upon us, the topic of workforce retirement is receiving extensive study so as to avoid the problem whereby more people leave the workforce than are entering it, as shown in Figure 2.

Figure Two – Number of Persons Aged 15 to 24 years versus Persons aged 55 to 64 in Canada



Source: Statistics Canada [3]

Further underscoring the impact of workforce retirements, in June 2010 the Globe and Mail published an article about retirements in Canadian oil and gas firms that will require the hiring of 100,00 skilled workers, many of whom are not available today. It stated: *"At least one third of our work force is eligible for retirement today," said Kim McCaig, chief operating officer of the Canadian Energy Pipeline Association. "Over the next few years, likely the next five, you'll see that that moves up even farther: two-thirds of that work force becomes eligible."* [4]

To put this into an NDT perspective, think about the fact that oil and gas is not the only industry sector that is highly dependent on NDT; NDT technicians are present in practically every manufacturing and industrial sector. Will the retirement numbers be any different for automotive, nuclear power, aviation, construction and general manufacturing?

Trends in NDT Certification

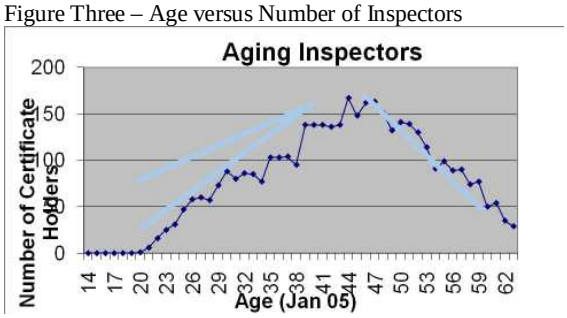
The national standard and certification agencies, certainly Canada's, must help deal with the demographic and technical challenges that lie ahead. Anticipating this, the NRCan Certification Agency studied the demographics of their certified NDT inspector clients. Not surprisingly, as shown in Figure 3, it approximates the national population demographic.

Figure 3 shows that the CGSB certified NDT inspectors in Canada have an average age around 50 years old. Industry feedback is that hundreds of new inspectors will be needed in the next 10 years to sustain the existing workforce, and potentially more will be needed to deal with new work from an expanding economy. Which begs the question, *"Where will they come from?"*

Figure 4 shows the number of new CGSB certification certificates issued by NRCan over the past 10 years, which increased on average by 4.5% each year.

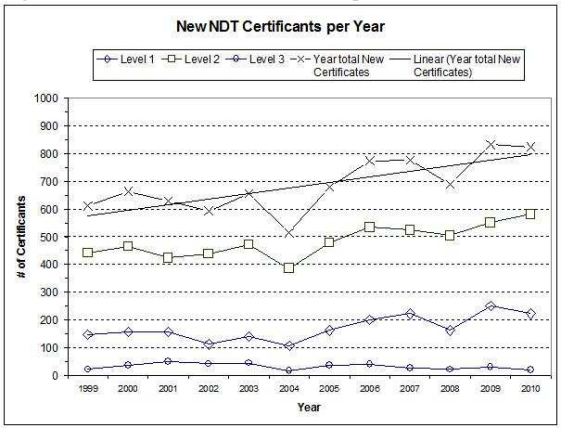
Figure 5 shows an average 3.4% increase in individuals holding one or more CGSB NDT certifications, boosting the total number of certified people from approximately 4000 to slightly over 5000 people over the past 5 to 10 years. This includes the renewal of CGSB certifications which averaged approximately 85% over the past 5 years.

Figure Three – Age versus Number of Inspectors



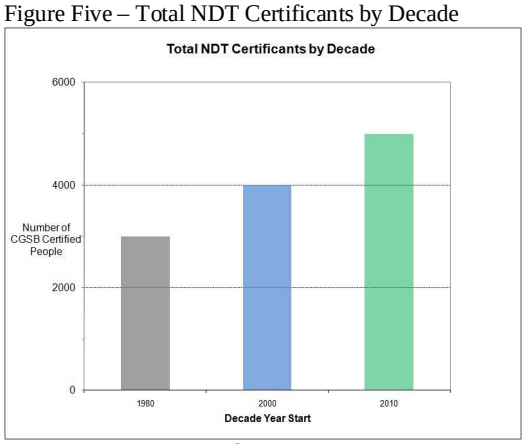
Source: Natural Resources Canada Certification Agency

Figure Four – New NDT Certificants per Year



Source: NRCan reports to CGSB 48/2 Committee

Figure Five – Total NDT Certificants by Decade



Sources: CSNDT Journal & NRCan reports

Of the trends exhibited in Figure Four, the trend for certified Level 3 inspectors is intriguing, as it does not follow the increasing trends demonstrated by Levels 1 and 2. These trends raise more questions: *"Will there be enough qualified people to adequately support NDT in Canada in the next 10 years?"* And: *"Will they really know how to properly perform NDT inspections when they are deployed?"*

Trends in NDT Training

A report jointly issued in 2009 by Human Resources and Skills Development Canada and Statistics Canada states: *"Education and training are complementary. While initial education plays a key role in strengthening Canada's human capital and developing people's potential, however, it is also necessary for individuals to continually develop new skills and competencies and upgrade existing ones. Thus, it is important for Canadians not only to acquire higher education but also to participate in learning throughout life in order to manage external pressures and changes in the workforce and society at large."* [5]

With this encouragement in mind, the education of quality NDT personnel takes on new importance. Traditional sources of NDT technicians in Canada are field recruits, skilled trades, military retirees, and college and university graduates. Wherever they come from, they require certain technical, physical and interpersonal skills.

Technical Skills

- Level 2 manual technical skills related to the NDT method(s), of which more than one is usually required.
- Ability to handle fragile electronic instrumentation with care and expertise.
- An understanding of how the technician impacts the overall measuring system in terms of precision, accuracy, reproducibility, repeatability and probability of detection (POD).
- Significant computer skills to interface with the instrument for data acquisition, analysis, reporting and archiving.
- An understanding of the industry sector and the materials, components and machinery that are used within it.

Physical Skills

- Meet vision requirements per the national standard.
- Ability to work in constrained or confined spaces, at heights in sometimes extreme environments.

Interpersonal Skills

- Ability to articulate results verbally and in writing
- Excellent decision making capability, understanding that decisions are not always straightforward, and that judgement must be exercised to provide sound interpretations.
- Good customer service attitude.

Education and training programs are more important than ever to ensure NDT personnel acquire these technical and soft skills. However, the educational and training programs devised over the past forty years are encountering students who are not entirely the same as those of 30 to 40 years ago. For example, a Statistics Canada report issued in 2005 stated that *"In 2003, roughly 45% of Canadians aged 16 years and older attained numeracy scores at or above Level 3. This means that over half of adult Canadians did not demonstrate levels of mathematical skills and knowledge associated with functioning well in Canadian society."* [4] Other studies and reports have documented the differences between students entering post-secondary schools and training organizations today and their peers of three or four decades ago. [5, 6, 7, 8, 9, 10, 11] The minimum training hours stipulated by the national standard remain at levels decided decades ago; very often course feedback received today by a training organization is: *"Great course, but could have used more time."*

Some new student characteristics encountered today are:

- Highly variable numeracy and literacy skills.
- Older second career students apprehensive about a modern educational environment. [12]
- Absorbed with computers and digital devices. [13]
- Impatient with classroom lectures.
- Expectations misaligned with effort.
- Attitude of entitlement. [14]
- Quicker to challenge institutional rules and structures.

This creates new challenges and requirements for academic and training organizations. They must accommodate a broader spectrum of students that include - rapid learners, the easily bored, and those unwilling, unprepared or unable to do the work necessary to achieve the academic success and hands-on training needed for a career in NDT.

Advances in curriculum design now acknowledge that education cannot be treated like a templated or formulaic approach because:

- People learn at different speeds.
- People learn different things different ways through different learning channels, i.e. visual, auditory, or hands-on, with the best approach often being a blend of each.
- More types of delivery methods are available.

Advances in the delivery of training programs now include self-guided computer-based training (CBT) or interactive voice-over-internet (VOIP) on-line delivery. "The new technologies are unlike previous learning technologies, digital media has the potential to be highly disruptive of classroom-based education and training because they are personal, portable and bi-directional." [15] While they have the benefit of enabling more flexible access to suit the specific needs and timetable of the student, they also have a potential downside of creating an overall educational and training experience that is fragmented in a non-traditional manner, and may not be fully optimal to best prepare the specialized personnel.

Additionally, less experienced computer users become aggravated when the CBT or VOIP technology crashes, times-out or freezes while they are trying to learn. When used for testing, test candidates using on-line systems may try to deflect their poor performance on problems with server-side or client-side firewalls, security programs, or

the internet service provider which is susceptible to bandwidth changes and all other manner of technical hiccups that will inevitably occur.

It is as relevant today as it was 40 years ago that academic education or technical training gained in a classroom and laboratory / workshop setting can only provide a strong and structured lattice upon which experience-based knowledge and competency can grow. Put another way, classroom training is no substitute for on-the-job experience, which is how deep knowledge becomes embedded, rehearsed, mastered and refined into top performance.

Regrettably, unlike some other trade occupations with apprenticeship programs, the NDT occupation in Canada seems to have a lack of entry level positions, with many employers insisting on some level of CGSB certification before job applicants will even be considered for hiring. This creates the merry chase of *"You need experience to get the job … if I don't get any experience, how can I get a job?"* Furthermore, this has promoted a trend in Canada for more candidates to attempt their CGSB NDT certification exams before fully accumulating the requisite practical experience. During 1999 to 2000, allowing people to attempt practical exams without experience was discussed by the national CGSB 48/2 NDT committee and also subsequently at the CEN/ISO committee meetings, resulting in the implementation of this allowance by the NRCan NDT Certifying Agency. The overriding rationale was that it would provide more options, i.e., with and without experience, to achieve certification in an accelerated and expeditious manner for some candidates, and thus support the needs of the industry better. But this may have also adversely contributed to the changes in the pass / fail demographics, and the overall quality and competency of the candidates attempting the practical certification examinations. This accommodation, along with the realities of the industrial landscape and increasing cost consciousness, may have also translated into fewer opportunities for candidates to acquire valuable hands-on practice and on-the-job experience that would in all likelihood better prepare them to pass their certification examinations and excel in their NDT careers.

Discussion is also ongoing in Canada about the options to recertify knowledge and competency, such as written tests, practical performance demonstration, etc. One of the authors has heard it described as *"The impossible challenge - how to quantify human factors in terms of performance demonstration"*. The science of knowledge and competency testing has improved vastly in the last 40 years. The discussion about when to test and how best to test ongoing competency is polarizing many people, and the debate has somewhat constrained the Canadian NDT arena, possibly affecting the development of training and certification program for new technologies. Other highly technical occupations routinely measure and recertify peoples' competency on an ongoing basis, why should NDT be any different? Applied intelligently and diligently, other well known best practices[16] for personnel training and certification programs should work to the advantage of students and NDT technicians, their employers and customers, and the public at large.

Summary

This paper provides some history and trends for NDT training and certification in Canada. It is obvious to those in the business today that:

1. Given the global marketplace, international equivalency and reciprocity is needed to align NDT training and certification systems around the world.
2. Areas of improvements should be discussed regarding how much education, theoretical training and practical experience is needed before applying for professional certification and qualification.
3. Programs should be developed and implemented that reflect the realities of today and the needs of the industry.
4. Schools and training organizations need to respond with outcome based curricula and delivery systems.
5. An urgent demand for qualified NDT personnel will continue into the next two decades.
6. More entry level opportunities are needed while the current NDT workforce retires.
7. Many of the fundamental factors need to be addressed by the industry as a whole. Key stakeholders must engage and work together to achieve significant progress. Therefore the national membership society, certifying agency, national standards organization, training organizations, unions, employers, and NDT personnel must collaborate effectively and efficiently to make the sought after improvements.

After 50 years of development and successful endeavor, now is a good time to examine and continually improve all aspects of the NDT training and certification programs in Canada.

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APPENDIX

Figures Provided in the Paper

Figure One

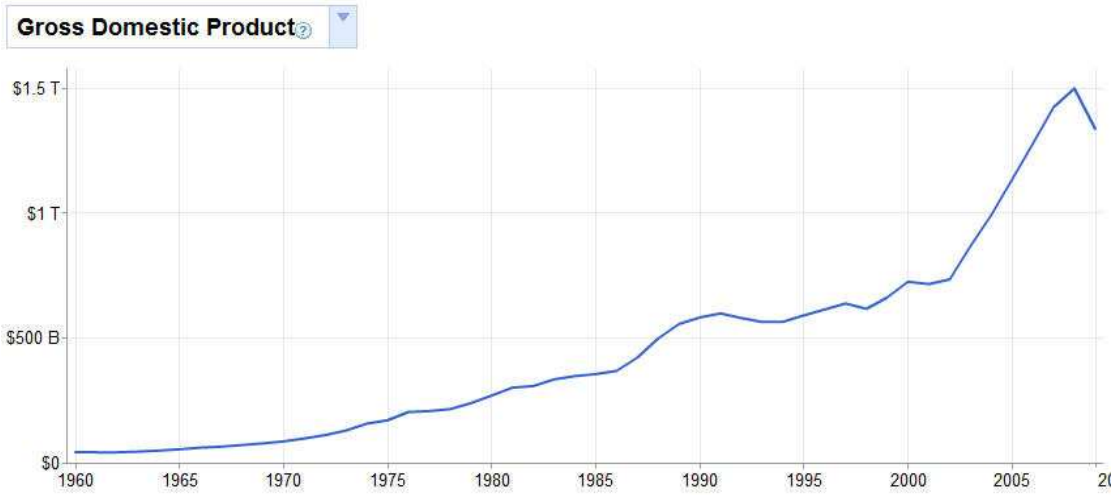


Figure Two

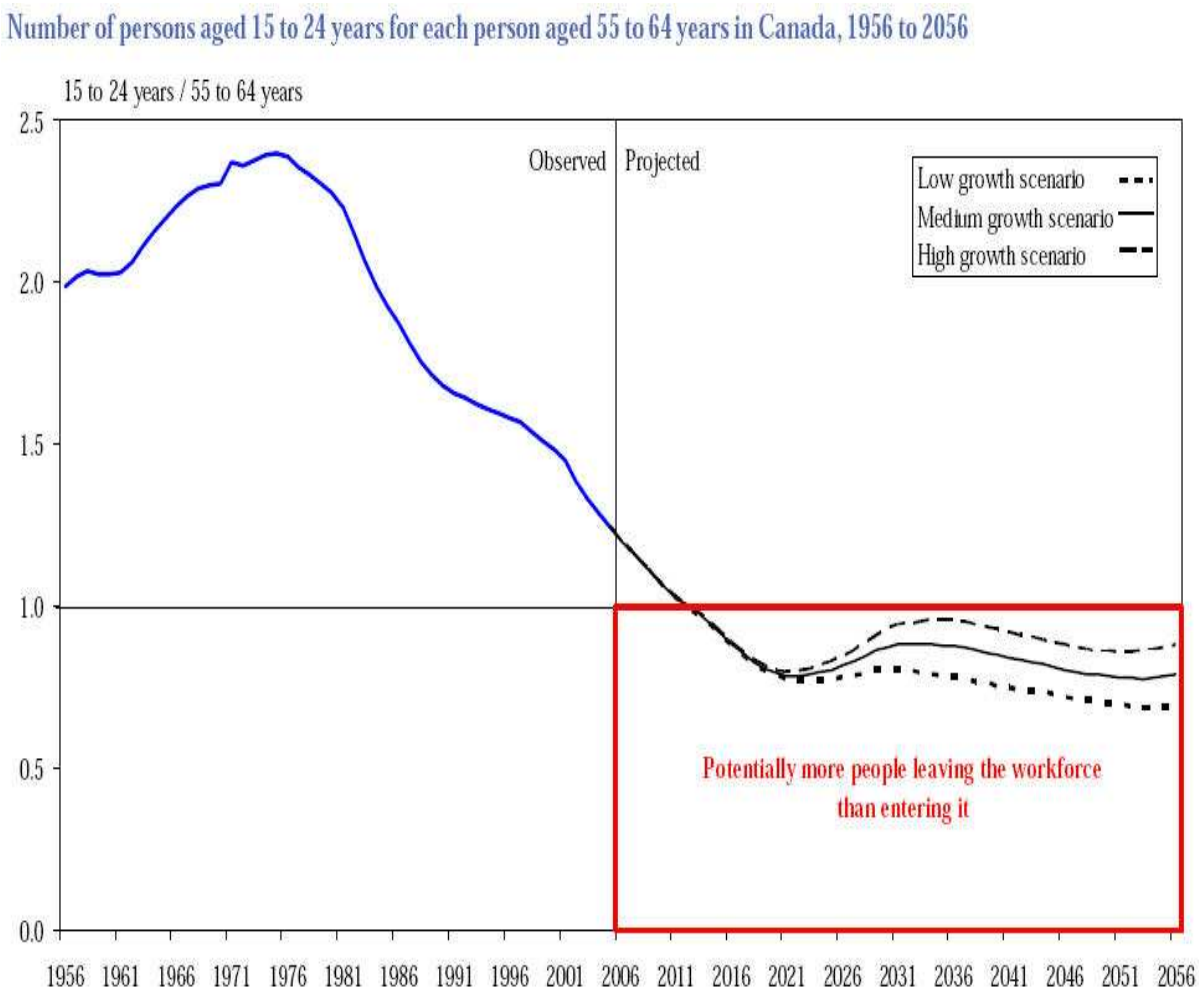


Figure Three

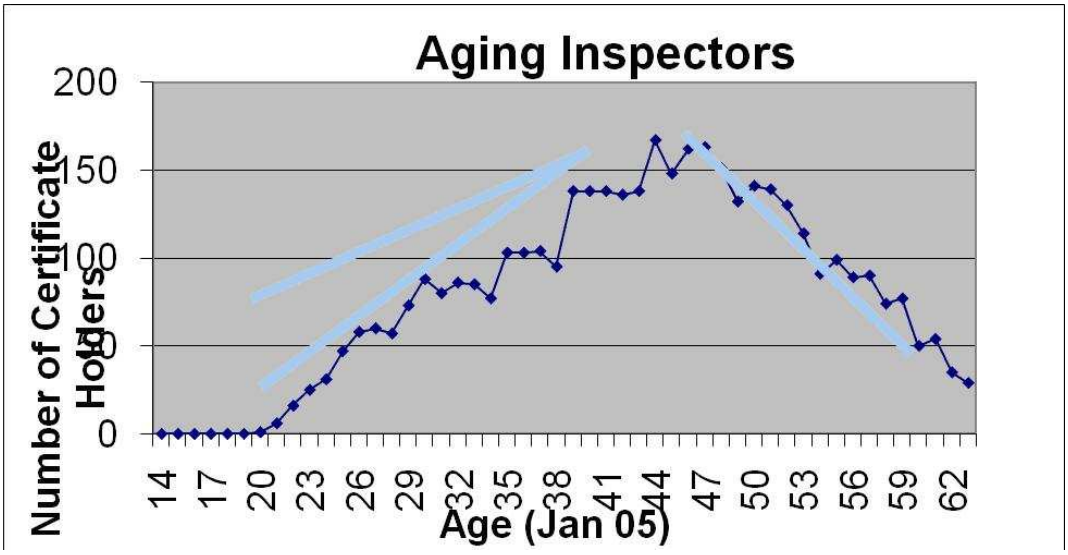


Figure Four

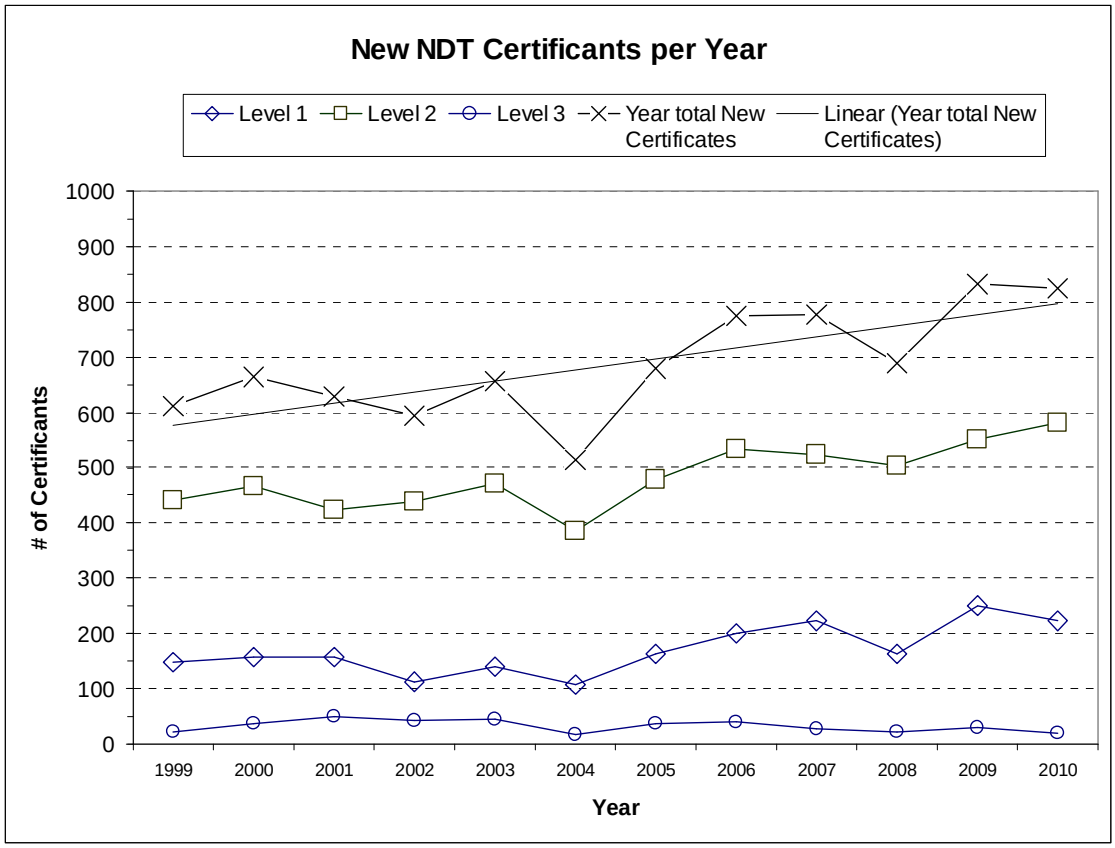
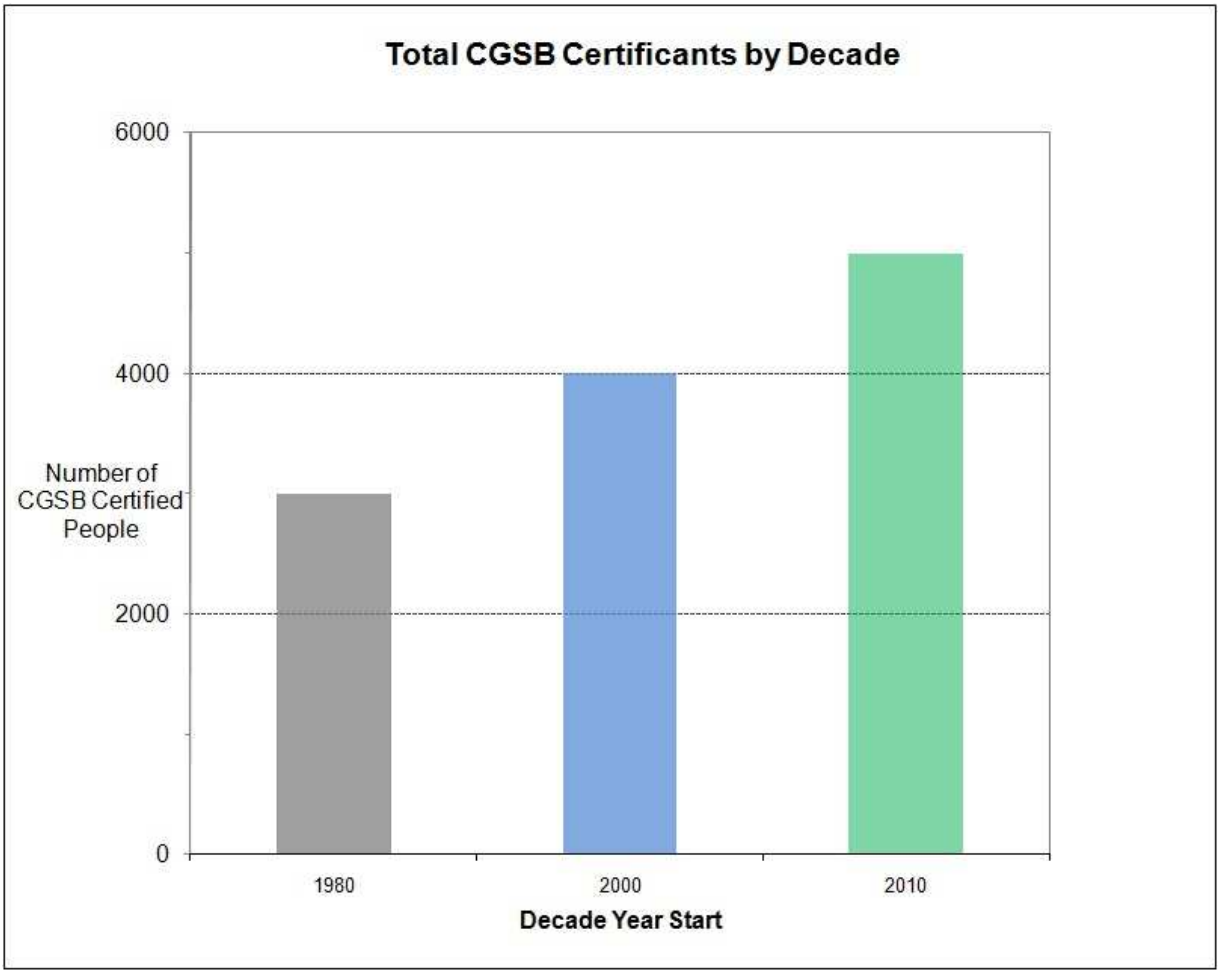


Figure Five


Total CGSB Certificants by Decade
6000
4000
2000
0
Number of CGSB Certified People
1980
2000
2010
Decade Year Start