PRESENT STATUS OF NDT APPLICATIONS AND QUALIFICATION & CERTIFICATION OF NDT PERSONNEL IN BANGLADESH

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Abstract

Bangladesh has many old and new industries, which need NDT technology to improve their productivity, quality and safety. Due to increasing awareness for quality, safety and environmental protection globally, the industrial sector of Bangladesh utilizes different NDT techniques for testing, inspection and quality control & quality assurance.
In order to buildup a strong and effective infrastructure of local NDT practitioners at international standards and to attain self reliance in the field of NDT technology, NDT training program has been taken up within the framework of UNDP/IAEA/RCA plan for Regional NDT Training and Certification for RCA countries. The infrastructure of the above program has been developed in order to increase the acceptability of its activities internationally through the adaptation of ISO-9712 "Non destructive testing- Qualification and Certification of Personnel". A National Certifying Body in the name of "NDT Personnel Certification Committee (NDTPCC)" has been constituted with the representatives from different organizations having the approval of the Govt. of Bangladesh. The NDTPCC is the only recognized body responsible for NDT Certification in Bangladesh. Recently, a program has been taken for accreditation of Qualification & Certification activities of NDTPCC as per ISO-17024-"Conformity assessment-General requirements for bodies operating certification of persons" and a program for harmonization of NDT training & certification has also been taken. NDT Personnel Certification Committee has been organizing the National NDT training courses and qualification examinations and certification since 1986.
Necessary NDT services are being provided by the local NDT Companies.
Research & Development program on NDT is being carried out and is mainly focused towards the current industrial needs of the country and also for promotion of technology transfer of new or advanced NDT technology.
Bangladesh Society for NDT (BSNDT) was formed in 1990. Since its formation BSNDT made bilateral cooperation agreement with NDT Societies of 11 countries and became member of ICNDT in 1996. BSNDT also organizes NDT training courses, seminars, conferences and workshops.
Potentiality of NDT technology in the fields of R&D, service and training is great in Bangladesh and its requirement is increasing with industrial growth. Bangladesh has attained self-reliance in the field of NDT technology.

Introduction

Development and Application of Non-Destructive Testing (NDT) Technology is not quite old in Bangladesh. Its application was first initiated in seventies and since then its requirement has been increasing rapidly with the industrial growth.
Bangladesh is mainly concerned with the development and implementation of NDT technology in her industrial sector with the following objectives (1):

- to fulfill the demand of NDT services in the industrial sector for quality control and quality assurance
- to build up a strong and effective infrastructure of local NDT practitioners at international standard through NDT training, qualification and certification scheme
- to initiate Research & Development works on NDT technology and to promote technology transfer of new or advanced NDT techniques

- to harmonize the national NDT training and certification scheme with regional scheme for mutual recognition

The present paper deals with the NDT activities on training, qualification, certification of NDT personnel, NDT service and research & development works in Bangladesh.

Industries in Bangladesh

Bangladesh is basically an agricultural country, the Government is making strenuous effort to develop industries to create employment and reduce dependence on imports in many sectors.
There are many old and new industries like oil refinery, power stations, oil and gas pipelines, paper mills, steel mills, aircrafts, railways, ship buildings, fertilizer factories, pharmaceutical industries. manufacturing plants and other industries which need NDT technology to improve their productivity, quality and safety. Due to increasing awareness for quality, safety and environmental protection globally, the industrial sectors of the country are becoming more and more interested to utilize different NDT techniques for inspection, testing and quality control.

NDT Facilities in Bangladesh

Bangladesh Atomic Energy Commission (BAEC) among its many other objectives has been also playing a pioneer role for the development and implementation of NDT technology in the industrial sector. IAEA having in its regular technical cooperation program is also working for the continuous and effective transfer of NDT technology to the developing countries. These efforts have led to a stage of maturity and self-sufficiency in many countries including Bangladesh, especially in the field of training and certification of NDT personnel and in the provision of service rendering activities to industries. This obviously has brought a positive impact on the improvement of the quality of life and the environment.
Bangladesh joined the UNDP /IAEA/RCA industrial project for Asia and the Pacific on Application of Isotope and Radiation Technology in early 80s with the aim of increasing regional cooperation for socio-economic development of the country through industrialization. Bangladesh has been actively participating in different industrial projects including NDT since her joining this program.
BAEC in collaboration with industries, universities, Bangladesh Society for NDT and NDT Personnel Certification Committee is implementing the NDT program.
Although there are many NDT techniques available to suit the particular industrial needs. The six NDT methods- Radiographic Testing (RT), Ultrasonic Testing (UT), Magnetic Particle Testing (MT), Liquid Penetrant Testing (PT),Eddy Current Testing (ET), Visual Inspection Testing (VT) are commonly used in Bangladesh.

NDT Programs in Bangladesh

i) Research & Development Works

The applied research & development activities on NDT have been initiated in BAEC in the NDT Laboratory of Atomic Energy Centre, Dhaka and are mainly focused towards the current industrial needs of the country, Research is usually conducted in the following fields:

- Development of conventional & advanced Radiographic inspection techniques
- Development of Ultrasonic inspection technique for metallic and non-metallic materials
- Development of Magnetic Particle testing and Penetrant testing techniques for detecting the surface and subsurface discontinuities
- Development of Eddy Current Testing technique for plane and tubular products
- Development of NDT of concrete structures

University teachers and students are also associated with this R&D programs. BAEC works closely with the Universities for providing research support and guidance to the students of undergraduate & postgraduate levels in order to carry out their research works.

NDT Services to Industries

Due to lack of trained & certified manpower, equipment and other facilities, NDT services were usually provided by foreign NDT companies in early days. Now-a-days the scenario has been totally changed. BAEC, 5-6 local NDT private companies and some industries are rendering quality and readily available total NDT services to the industries. The range and capacity of NDT services are expected to expand further in future with the industrial demand.
Industrial sector wise potentiality and status of NDT applications are summarized in Table-1. BAEC alone has so far rendered NDT services to more than 70 leading industries in the country Table-2. Tables 3 & 4 show the Gas Pipeline Project Costs of Inspection Activity in some countries and Thermal Power Station Projects Costs of NDT Inspection by BAEC respectively.

Human Resource Development through NDT National Training Program

1). Administration of NDT Training & Certification Scheme

Bangladesh has been conducting the training & certification scheme since 1986 through NDT Personnel Certification Committee (NDTPCC) and NDT Academic Committee (NDTAC) first constituted in 1986 and then reconstituted in 1993 with representatives from different organizations and approval of the Government of Bangladesh. At present, to meet the requirements as stipulated in the third edition of ISO-9712 (ISO-9712: 2005) and to harmonize the national certification scheme with the regional /international scheme for mutual recognition, reconstitution of the above two committees are essential. Hence a new certification body namely the "Charter of Non-Destructive Testing Personnel Certification Committee (NDTPCC) of Bangladesh" has been approved by the competent authority in 2009. The newly constituted NDTPCC will be the only body to administer the NDT certification scheme in the country and shall have the authorities and responsibilities as described in this Charter (2).

The following Documents, Standards and Guidelines are to be followed for Administration of NDT Training & Certification:

i) NDT Personnel Certification Committee Charter (January 2009)
ii) BAEC Circular for NDT Personnel Certification Committee (April 2009)
iii) BAEC Circular for NDT Technical Committee (May 2009)
iv) Standard ISO 9712:2005
v) Standard ISO/IEC 17024:2003
vi) IAF Guidance on the Application of ISO/IEC 17024:2003
vii) IAEA/RCA Draft Guidelines for Harmonization of Qualification & Certification of Personnel for NDT in Asia and the Pacific
viii) Draft Agreement for Mutual Recognition for NDT Personnel Certification Schemes in the RCA Member States According to ISO 9712:2005 and ISO/IEC 17024:2003
ix) IAEA-TECDOC-628/Rev.2- Training Guidelines in Non-Destructive Testing Techniques: 2008 Edition
x) ICNDT Guidelines and Recommendations for Qualification and Certification of NDT Personnel according to ISO 9712 and Aligned Standards

2). General Purpose

According to Charter the general purpose of the "**Non-Destructive Testing Personnel Certification Committee**" (NDTPCC) is to develop & administer national certification scheme for NDT personnel. NDTPCC will control, monitor and hence implement the entire operation of national certification scheme for the persons involved in NDT at different industrial sectors. NDTPCC will qualify competent NDT professionals as per relevant national /international standard through evolving appropriate procedures for conducting courses to impart knowledge and to examine candidates, so that the certified personnel are accepted at the national and international levels.

3). Authorities

NDTPCC shall have the following authorities:

- To operate as the only recognized "National Certification Body" for NDT Qualification and Certification in Bangladesh
- To award/cancel/renew/review Certification to individuals
- To appoint the members and approve the charter of the "NDT Technical Committee"
- To give/cancel/renew/review accreditation to a training center
- To give/ cancel/renew/ review accreditation to an examination center
- May delegate, under its direct responsibility, the detailed administration of qualification to authorized qualifying bodies to which NDTPCC will issue specifications for facilities, personnel, equipment, examination materials, records etc.
- To determine the acceptability and equivalence of the NDT Certification received by a person from overseas, if he/she desires to work in Bangladesh

4). Jurisdiction

The jurisdiction of the **NDTPCC** shall include all activities related to the certification of NDT personnel and others, which directly or indirectly affect the quality and competency of NDT professionals within Bangladesh.

5). Responsibilities

The Committee shall take the following responsibilities:

a. To initiate, maintain and promote the national certification scheme according to the standard ISO-9712 "Non-destructive testing- Qualification and Certification of Personnel"
b. To administer operations and to take overall responsibility for certification in accordance with the documented procedures conforming to all the requirements of ISO 9712.
c. To keep all appropriate records and issue the certificates and other testimonials.
d. To arrange specimens with documented discontinuities for practical examinations
e. To update the training and certification scheme as per the requirement of national/international standards.
f. To take necessary steps for mutual recognition of certification, regionally and internationally
g. To provide NDT Advisory Services to Government and Non-Government Organization.

6). Organogram of NDTPC

The organizational structure and interrelationships are shown in Figure 1.

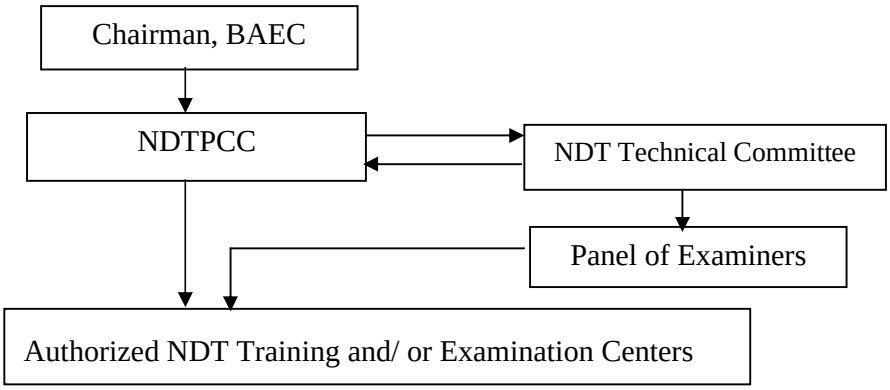

Figure 1. Organizational Structure and Interrelationship

6.1). Formation of NDT Technical Committee

An ad hoc NDT Technical Committee has recently been formed to provide technical support to the NDTPCC for conducting its certification program.

Authorized NDT Training Centre

NDT Laboratory of Atomic Energy Centre, Dhaka is the only authorized NDT Training and Examination Centre

Methods

The following methods of Non-Destructive Testing have been included in the training program:

i) Radiographic Testing, ii) Ultrasonic Testing, iii) Eddy Current Testing, iv) Magnetic Particle Testing, v) Liquid Penetrant Testing, vi) Visual Inspection

Syllabi for the NDT training courses

The syllabi of the courses and teaching hours are in accordance with IAEA TECDOC-628 /Rev.2 “Training Guidelines in Non-Destructive Testing”

Standard

The NDT certification scheme is being implemented in accordance with the guidelines and requirements stipulated in the third edition of ISO 9712 (ISO-9712: 2005) “Non-Destructive Testing- Qualification Certification of Personnel”.

Level of Competence

A person is certified in accordance with the ISO-9712(ISO-9712-2005) standard into one of the three levels of competence: Level-1, Level-2 and Level-3

Industrial Sectors

At present industrial sector is welding. In future when sufficient test pieces, experience, and demand exists, more specific industries will be included.

Accreditation

Necessary steps for mutual recognition of certification regionally and internationally are to be taken. All requirements of ISO 9712:2005 are to be followed and NDTPCC certification scheme shall be accredited in accordance with ISO 17024:2003 by the national accreditation body.

Formation of BSNDT

BSNDT was formally formed in 1990. Since then the Society has also been organizing NDT training courses, seminars, workshops and publishing Newsletter. BSNDT made bilateral cooperation agreement with NDT Societies of 11 countries and became member of ICNDT in 1996.

Harmonization of NDT Training & Certification

The use of ISO 9712 as the foundation for a national certification program does not automatically guarantee international recognition of certificates issued by the National Certifying Body. To gain recognition it is important that the certification body and the examination centre should strictly follow the requirements given in ISO/IEC 17024 and that this is checked and stated by an international accepted organization like an accreditation body or an international NDT organization. ISO/IEC 17024:2003 is an International Standard which sets out criteria for bodies operating certification of persons. To comply with the requirements of this document by the certification body and the examination centre is an important step towards the worldwide harmonization and mutual recognition of Certification Scheme.

Bangladesh is maintaining close cooperation with IAEA and actively participating in harmonization program. First meeting on “IAEA/ RCA Regional Consultant Meeting to Draft an Agreement for Mutual Recognition of various Certification Schemes” was held in Dhaka, Bangladesh from 27-29 August, 2001. Subsequent meeting was held in Colombo, Sri Lanka from 15-19 August, 2005 on “IAEA/RCA Technical Meeting on Harmonization of Regional NDT applying ISO/IEC 17024” and the draft Dhaka Agreement on “ Mutual Recognition for Non-Destructive Testing Personnel Certification Schemes in the RCA Member States according to ISO 9712:2005 & ISO/IEC 17024:2003” was amended and the Mutual Recognition Agreement (MRA) finalized. To meet the requirements of this MRA Bangladesh has to achieve the followings by the year 2012:

- Establishment of Certification Schemes in accordance with ISO 9712:2005
- Establishment of Quality Management System in compliance with ISO/IEC 17024:2003
- Accreditation of National Certification Body by national or international accreditation body recognized by International Accreditation Forum (IAF)

Regulatory Aspects of using Ionizing Radiation

In Bangladesh, the legal framework is well defined in Nuclear Safety and Radiation Control (NSRC) Act-1993 and Nuclear Safety and Radiation Rules-1997.The regulatory activities are assigned to the Nuclear Safety and Radiation Control Division (NSRCD) of Bangladesh Atomic Energy Commission (BAEC). In exercise of powers conferred by section 16 of the NSRC Act

(ACT No.21 of 1993), BAEC is the competent authority in the country to formulate necessary regulations & policies, to issue orders & instructions for the control of radiation activities and to take appropriate steps to implement them. The laws and rules can only guarantee the desired safety if all concerned persons respect the rules and practice them to achieve the desired safety of the occupational workers, populations and the environment (3)..

National Activities on NDT Training Program

The national training program was initiated in 1986. Table 5 shows the number of NDT personnel trained & certified under different NDT programs (4).

Collaboration with Bangladesh Air Force

A 17 hours training program on NDT is included as a part of the **"Flight Safety Officers' (FSO) Training Course"** of Bangladesh Air Force, organized by Bangladesh Air Force Flight Safety Institute, Dhaka. Since 1989 BAEC has been extending its cooperation to conduct more than 40 FSO courses through sending resource persons and arranging laboratory demonstration in BAEC's NDT laboratory. More than 600 Pilots and Engineers from home and abroad have taken part in these training courses.

Conclusion

Potentiality of NDT technology in the fields of R&D, service and training is great in Bangladesh and its requirement is increasing with industrial growth. BAEC and other related organizations are working with right earnest for development and applications of NDT technology in Bangladesh. As a result Bangladesh has attained self-reliance in the field of NDT technology.

References

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2. Ministry of Science and Information & Communication Technology, Government of Bangladesh, "Charter of Non-Destructive Testing Personnel Certification Committee (NDTPCC) of Bangladesh", 2009.
3. Nuclear Safety and Radiation Control (NSRC) Act No. 21 0f 1993, Bangladesh Gazette Nuclear Safety and Radiation Control (NSRC) Rules, 1997 (SRO No.205-Law/97), Bangladesh Gazette
4. J. Sadique, Seminar on Present Status and Future Prospects of NDT Application in Bangladesh, 2009.

Table 1 : Sector wise Potentiality and Actual Application of NDT in Bangladesh

S/N	Industrial Sector	Potentiality of NDT Application	Actual Application	Remarks
1.	**Petrochemical Industries** Oil Refinery Fertilizer Factory Natural Gas T & D Lines Gas Process Plant Paper Mills Other Chemical Industries	 High High High High Low Moderate	 Moderate Moderates High Moderate Low Low	A few of these organizations have proper NDT facilities, trained manpower and annual plan of preventive maintenance using the benefits of NDT application.
2.	**Power Sectors** Thermal Power Plants Hydro Power Plants	 High Moderate	 High Low	Almost no facility available in this sector.
3.	**Shipbuilding**	High	Moderate	Few industries have their limited facilities and trained manpower
4.	**Aviation** Civil Aviation Army Aviation Air Forces	 High Moderate High	 Moderate Low Moderate	Commercial air lines are moderately utilizing NDT and have limited facilities and manpower. There is great potentiality of Biman and BAF to develop appropriate NDT facilities to cater entire aviation sector.
5.	**Railway** Coach Track	 High High	 Very Low Very Low	Although some equipment is procured but due to lack of trained personnel those are not utilized.
6.	**Steel Fabrication**	Moderate	Low	Most of the industries have no facilities and NDT is being used in few industries.
7.	**Civil Engineering** Bridges Buildings	 High Moderate	 Very Low Very Low	Local facilities are yet to develop for proper application in the field.

Table2: List of Some Major Industries that Received NDT services from Bangladesh Atomic Energy Commission (BAEC)

Power Plants
Ghorasal Thermal Power Station
Shiddhirgonj Power Station
Kaptai Hydro Power Station
AES Horipur Pvt.Ltd.
Khulna Power Station
Shahjibazar Power Station
Ashuganj Power Station Complex
Rural Power Company Ltd.Mymenshing

Gas & Oil Industries
Titas Gas T& D co.Ltd
Bangladesh Petriolium Institute
Galalabad Gas T&D Co.Ltd
Eastern Refinery Limited
PSN Bangladesh Ltd.Sangu Operation
Bangladesh Gas Fields Ltd.
Sylhet Gas Fields Ltd.
Bakrabad Gas System Ltd.
Desh Petrolium Services Ltd.
Techno Gas Services

Fertilizer, Cement & Chemical Industries
Ghorasal Urea Fertilizer Factory
Jamuna Fertilizer Company Ltd
Khulna Newsprint Mills
Ltarge Surma Cement
Chatok Cement Co.Ltd
Karnaphuli Rayon & Chemicals Ltd.

Bangladesh Water Development Board
Teesta Barrage and Associated Canal

Shipbuilding and Engineering
Narayanganj Dockyard Ltd.
Highspeed Shipbuilding and Heavy Engineering
Modern Steel Engineering
National Tubes Ltd.
BITAC
Bangladesh Shipping Corporation
BOC Bangladesh Ltd.
Beximco Engineering
Eastern Metal
Mcdonald Steel Building Products Ltd.
Khulna Shipyard Ltd.
Islam steel Mills Ltd.

Sugar Mills
Setabgonj Suger Mills Ltd.
Shampur Sugar Mills Ltd.
Rajshahi Sugar Mills Ltd.
Rangpur Sugar Mulls Ltd.
Renwick, Jagneswar and Co.(BD) Ltd.
Kushtia Sugar Mills
North Bengal Sugar Mills Ltd.

Armed Forces
Bangladesh Army
Bangladesh Air Force

Bangladesh Railway
Phartali Worshop
Sylhet to Srimongal Rail Track

Biman Bangladesh Air lines

Other Organizations
ABB-Shajibazar Rehabilitation Project
Ahmed & Co.Ltd.
Asiana Trading Corporation
Bangladesh Industrial X-ray(BIX)
Bangladesh Technological Corporation Ltd.
Concept Engineers Limited
Corolla Corporation
Covanta Bangladesh Operating Ltd.
Directorate of Agricultural (Plant Protection)
ELPIJI,Malaysia-Bangladesh Ltd.
Engineering and Consultants Bangladesh Ltd.
Engineering Inspection Services of Bangladesh
Fantasy Kingdom
Jonny Corporation
Kepple-Setsco Training & Testing Centre
M/S Trade Linkers
Majestic International
Material Testing & Engineering Services Ltd.
Max Automobile Products Limited
Project Builders Ltd.
Qualitec Engineering & NDT Services
R.K. Engineering & Construction
Saj Engineering & Trading Company
Seafs Bangladesh Ltd.
SGS Ltd.
Sorrento Electronics Ltd.USA
The Bengal Electric, Dhaka
Unimech Ltd.
United Fiber Industries Ltd.
Universal Technological Services
Zaker Engineering Associates Ltd.
Zenith Test & Inspection Services

Table 3: Gas Pipeline Project Costs of Inspection Activity in some countries

Country	Argentina	India	Malaysia	Bangladesh	Bangladesh
Project Name	Gasoducto Centro	HBJ Project	PGUP Stage-II	Tangail Elenga Project	BBGas T&D Project
Client	Gas del Estado	GA.II/Spie	MMC Gas Entrep	Titas Gas T&D	Titas Gas T&D
Length	21,00Km	1800Km	780Km	12.37Km	223Km
Dia of Pipe	30",28",18",8"	36",30",24",18"	36",30",20",18", 16",6"	12"	24",16",12", 10",8",6"
Total Proj.Cost	US$500M	US$600M	US$160M	TK.32.24M	TK.52.37M
Total NDT	US$15M	US$14.75M	US$3.68M	TK.0.410M	TK.1.02M
%NDT Cost	3%	2.5%	2.3%	1.3%	1.94%

Table 4: Thermal Power Station Projects Costs of NDT Inspection by BAEC

Country	Bangladesh	Bangladesh
Project Name	210MW GTPSE (Unit-3)	210MW GTPSE (Unit-4)
Client	BPDB	BPDB
Total Project Cost	TK.3500M	TK.4150M
Total NDT Cost	TK.2.8M	TK3.4M
%NDT Cost	0.08%	0.082%

Table 5: Personnel Trained to NDT Level-1, Level-2, Level-3 through National Training Courses (NTC) and Regional Training Courses (RTC)

Methods	Level-1	Level-2	Level-3	Total
RT	62	60	07	129
UT	106	42	04	152
MT	10	38	02	50
PT	10	30	02	42
ET	19	08	01	28
Total	207	178	16	401

In addition to the above formal training courses BSNDT and BAEC organized training courses, seminars, conferences, workshops like National Executive Management Seminars, NDT Course for Bangladesh Railways, General NDT Practices, NDT of Concrete Structure, NDT Foundation Course, Basic Welding Technology, Radiation Safety for Industrial Radiographers, Seminar on QA & QC through NDT, Selection and Management of Non-Destructive Testing for Senior Level Executives, NDT Appreciation Course for Industrial Users, NDT Application during In -Service Inspection (ISI) for Mid level Executives and Engineers, QA & QC through NDT for Top Level Executives, Radiation Safety and Protection, NDT Appreciation Course for Senior Level Executives, BSNDT-OLYMPUS workshop on Advanced NDT.
About 830 participants from 50 industrial organizations attended these programs.