



The World Organisation for NDT

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Volume 8 Issue No 16

August 2015

CHAIRMAN'S MESSAGE

New Working Group on Condition Monitoring and Diagnostic Technologies

First meeting of the joint ICNDT/ISCM Working Group

It was a real pleasure to find myself in Oxford in June, along with Terry Clausing, President of the American Society for Nondestructive Testing (ASNT), and Professor Len Gelman, Chairman of the International Society of Condition Monitoring (ISCM). We were there to hold the first meeting of the joint ICNDT/ISCM Working Group on Condition Monitoring and Diagnostic Technologies, in conjunction with CM 2015/MFPT 2015 – the Twelfth International Conference on Condition Monitoring and Machinery Failure Prevention Technologies. Terry and Len have kindly agreed to act as Co-Chairs for the Working Group.

ICNDT members of the Working Group are as follows: Paul Rand – AINDT (Alternate: Peter Milligan); Dr Gábor Pór – MAROVISZ; Florian Raddatz – DGZfP (Alternate: Lars Schubert/Jens Prager); Dr Peter Tscheliesnig – OGZfP; Professor Wontae Kim – KSNT (Alternate: Professor Younho Cho); and Professor Mehdi Behzad – IRNDT (to be confirmed).

During the meeting, the group agreed its priorities and the outline of an action plan, which will be published in time for the Policy and General Purposes Committee (PGPC) meeting to be held in Cartagena, Colombia, in August this year.

After the meeting, it was a great pleasure to hear Terry Clausing deliver his plenary keynote lecture to CM 2015/MFPT 2015 attendees and in the evening we enjoyed a guided walking tour of Oxford with Terry and his wife, Devon. We were bowled over by the history of the place.

COTEQ 2015

The Conference on Equipment Technology, COTEQ 2015, was held in Brazil in June and was a great success. More than 700 people attended and participated in ten parallel streams encompassing NDT, equipment inspection, corrosion, welding, asset integrity and life extension.

COTEQ brings together technical presentations, an exhibition of new technologies, products and services directed to areas of non-destructive testing and inspection, corrosion, oil, gas and biofuels in a number of simultaneous events:

- XXXIII CONAEND – National Conference on Non-Destructive Testing and Inspection
- 35° CONBRASCORR – Brazilian Congress of Corrosion
- 35° SEMINSP – Seminar of Equipments Inspection
- 19th IEV – International Conference on Assessing Integrity and Life Extension of Industrial Equipment
- 9th EXPOEQUIP – Exhibition of Technology Equipments of Corrosion & Painting, NDT and Inspection of Equipments.

I am very enthusiastic about this grouping of events as NDT is relevant to corrosion, equipment inspection, assessing integrity and life extension.

This was the third time the conference had been held in the Pernambuco region in the north-east of Brazil. The region is the focus of heavy investment in infrastructure, including two car factories (Jeep and Fiat), two shipyards and petrochemical plants, but has suffered in recent times due to the economic problems in Brazil.



Continued on page two

New research register

ICNDT is establishing on its website (www.icndt.org) a new register of institutions and other organisations that carry out research into NDT and associated disciplines.

The register may be found under the 'Resources' tab on the home page.

Authorised representatives of organisations involved in research activities are invited to add their details free-of-charge, at: www.icndt.org/resources/registerentry.aspx

The register is compiled from information supplied by research organisations. Whilst every effort is made to ensure that the details are correct and as up-to-date as possible, ICNDT cannot accept any responsibility for errors or omissions.

World Conference on Non-Destructive Testing

19th WCNDT 2016

13-17 June 2016

The International Conference Centre (ICM), Munich, Germany

Topics include:

- Structural engineering
- Materials characterisation
- Modelling and data processing
- Medical products
- Energy generation

Contact: German Society for Non-Destructive Testing (DGZfP), Max-Planck-Strasse 6, 12489, Berlin, Germany.

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ICNDT Journal



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Material for the next ICNDT Journal should be sent to Sharon Bond, email: s.bond@cinde.ca

Chairman's message continued from front page

The approach of cooperating with related disciplines in a single regional conference organised every two years was started by the Brazilian Association for NDT and Inspection (ABENDI) and is an excellent example for other NDT societies to follow. I was very pleased to attend and represent ICNDT at the opening ceremony, as well as delivering an invited paper, entitled: 'A world panorama of certification of NDT personnel'.

Another novelty to be applauded was the involvement of youth. On the final day of the conference, ABENDI invited student groups from six local universities. They were given a half-day of training, covering NDT, welding and corrosion, and shown around the exhibition. To conclude, ABENDI had organised an inter-University quiz. This was conducted with great aplomb and razzmatazz by a very skilled compere. The young people participated with great enthusiasm and cheered on their representatives. The winners were presented with a palm-top PC, a complimentary training course in NDT, a t-shirt and a substantial cash prize. As a result of this initiative, 145 young people (both male and female) gained an insight into engineering disciplines related to NDT and saw the possibility of interesting and rewarding careers.

The next COTEQ will be held in Rio de Janeiro in 2017.

New President for EFNDT

Congratulations to Dr Peter Trampus (MAROVISZ, Hungary) on his election

as the new President of the European Federation for NDT (EFNDT), and also to the new Vice-President, Roger Lyon (BINDT, UK). Peter succeeds Dr Matthias Purschke (DGZfP, Germany), who is also President of the 19th WCNDT and serves on the ICNDT Executive Committee in that capacity.

World Conference – 19th WCNDT

With the 19th World Conference on Non-Destructive Testing (WCNDT) now less than a year away, it is time for people and companies to budget and plan for participation in what is likely to be the world's biggest NDT conference this century. It is the first time the conference is being held in Europe since 2000 and Munich, Germany, promises to be an excellent location.

During the conference, a decision will be made on the venue for the 21st WCNDT, which will follow the 20th WCNDT being held in Korea in 2020.

ICNDT Awards

A call for proposals for the ICNDT Awards, to be presented at the 19th WCNDT in June 2016, is being issued to member societies. The Awards are as follows:

- **Roentgen Award** – for major contribution to the science and technology of NDT
- **Pawlowski Award** – for major contribution to the promotion of NDT internationally
- **Havercroft Award** – for major contribution to NDT education, training or certification
- **Sokolov Award** – for major contribution to NDT research

Obituary

Professor H J Kopineck

1924 – 2015

It is with the deepest sympathy that ICNDT reports the passing of Professor H J Kopineck, who died on his 91st birthday, on 15 June 2015.

President of the International Committee for Non-Destructive Testing (ICNDT) from 1992 to 1996, Professor Kopineck made many valuable contributions to ICNDT. The starting documents for the ICNDT project 'Harmonisation of Certification for NDT Personnel' were created and issued under his leadership, and for those involved in the project it was an honour to work alongside him.

As the oldest surviving Honorary Member of ICNDT, Professor Kopineck will be remembered fondly by many in the industry for his great contributions to the NDT profession.

- **ICNDT Young Achiever Award** – for the achievements of young people in NDT (<35 years).

Full instructions on how to prepare a proposal are given in ICNDT Operating Procedure OP4, available on the ICNDT website, where previous years' winners are also recorded in the Roll of Honour (home page tab). The ICNDT Awards provide an excellent opportunity to recognise the contributions of individuals and organisations at the highest level in the industry.

6th Pan-American NDT Conference

The 6th Pan-American NDT Conference will be held in Cartagena, Colombia, from 12-14 August 2015. I am delighted to be attending this conference at the invitation of President Eduardo Pulido, and pleased that the next ICNDT Policy and General Purposes Committee meeting will be held here. The committee will discuss and make decisions (subject to ratification by the General Assembly) on the future structure of ICNDT and its constituent regions. I briefed representatives from ABENDI, AAEND and CONEND on the proposals whilst at COTEQ. There will also be a meeting of the Pan-American Committee, which will decide how to transform itself into a legally-established Federation.

Dr J M Farley
Chairman, ICNDT

EUROPE

New President elected for the European Federation for Non-Destructive Testing (EFNDT)

During the General Assembly held in Budapest at the end of April 2015, members of the European Federation for Non-Destructive Testing (EFNDT) elected its new President, Vice-President, Board of Directors and Secretary for the next three years. Professor Peter Trampus, former EFNDT Vice-President and President of the Hungarian Association for Non-Destructive Testing (MAROVISZ), became the new EFNDT President. He took this opportunity to deliver the following message...

Firstly, I would like to sincerely thank the representatives of EFNDT national member societies for their trust. Presidency of EFNDT is a great honour for me and, at the same time, it presents a big challenge as well. I also have to express my gratitude to Dr Matthias Purschke, former EFNDT President, Ms Jutta Koehn, former Secretary, the whole Board of Directors and everyone who contributed to the past successful period. On behalf of the newly-elected Board of Directors, I would like to reassure our predecessors that we shall do our best to continue EFNDT activities at the same level.

I have taken over the Federation while it is in excellent condition; it has been well organised, all administrative, managerial and financial means are available, it has a sound strategic plan, European-wide partnerships have been established and it has good partners within the other regional groups and the European national NDT societies. Also, it has good relations with ICNDT management, representing an important player in the NDT scene. Equally important, the new Board of Directors comprises both experienced people and enthusiastic young people looking for new tasks and challenges.

Among the tasks EFNDT is facing, the most complicated is to successfully complete dialogue with ICNDT and the regional federations on creating a new organisational and fee structure for the entire NDT community. The objective of this action, which was initiated by EFNDT, is a reorganisation of ICNDT/regional federations on a more hierarchical basis, with clearer definitions as to what is to be done at each level and stronger coordination. This will lead to an improvement in efficiency and a reduction in duplication at both ICNDT and EFNDT level.

Another challenging task is the subject of NDT personnel training, qualification and certification. With EN ISO 9712, a worldwide Standard for qualification and certification of NDT personnel has been achieved. The Standard offers a common basis for building NDT personnel competence all over the world. ICNDT has set up a worldwide mutual recognition agreement based on a similar agreement that has existed in Europe for some time. EFNDT, as one of the regional groups of ICNDT, will support those activities with all its strength – international unity in national diversity is also beneficial for European industry. In this area, EFNDT will strengthen the cooperation with its national member societies and will further push the idea of defining the best practice in NDT by high-level qualification and independent third-party certification for NDT personnel. Based on experience it seems that, within the quality system of NDT, the weakest link must be the competence of personnel.

The strength of EFNDT is in its national NDT societies. I would like to put a stronger emphasis on them, to hear their voices and, therefore, I would like to better involve the societies in the daily work. The national societies in Europe are very different and that means we can, and should, learn a lot of things from each other. The regular exchange of information and experience between our societies must be a strong common focus of our activities.

Remarkable actions have been carried out within the working groups and forums of EFNDT. Our goal is to strengthen this

activity, primarily by activating the less active groups or forums. The role of these is becoming increasingly important because they can provide forums for exchanging information, in particular industrial segments and/or specific application areas of NDT.

EFNDT has to not only keep but also improve its European visibility. This means the maintenance of its existing cooperation with various partners and the identification of new partners with which its goals can more easily be achieved. One of the target areas is its deeper involvement in laboratory accreditation. EFNDT has already started to collaborate with the relevant European organisation but still has a long way to go.

Last year, the European Conference on NDT (ECNDT) was successfully organised by the Czech Society for NDT in Prague, Czech Republic. The next European regional event, the 12th ECNDT, will take place in Gothenburg in 2018, organised by the NDT societies of Sweden, Finland, Denmark and Norway. ECNDT 2018 will offer a fantastic opportunity for the national societies and all our colleagues in NDT to meet, to discuss common issues, to become familiar with the new developments and trends in the field of NDT, and to deepen friendships among members of the whole NDT community.

In closing, I refer to EFNDT's Mission Statement:

The overall mission of EFNDT is to bring together the resources of the individual national societies and organisations in the field of NDT in Europe to create a more effective and more valuable voice for the NDT industry, the NDT profession, the users of NDT and thus the wider community.



Organised by the German Society for
Non-Destructive Testing

7th International Symposium on NDT in Aerospace

16-18 November 2015

Atlantic Hotel Universum, Bremen, Germany

www.ndt-aerospace.com

NDT Laboratory and Knowledge Centre inaugurated with assistance from MAROVISZ

Bay Zoltán Applied Research Coordination Agency, Hungary, is supporting Hungarian research and development in the field of non-destructive testing and evaluation by providing qualified and skilled experts as well as infrastructure. Its activities include the introduction of new methods, the development of specific procedures, inspection validation and training.



The NDT Laboratory and Knowledge Centre opened in June 2015

On 3 June 2015, some 50 attendees were present in Miskolc, Hungary, the headquarters of Bay Zoltán Applied Research Coordination Agency, Engineering Division, for the official opening of a new NDT laboratory, which took place in the form of a conference.

The NDT Laboratory and Knowledge Centre was established with sponsorship from MVM Paks Nuclear Power Plant Ltd and in

collaboration with the Hungarian Association for Non-Destructive Testing (MAROVISZ). In Hungary, there are four nuclear units in operation and the decision was made to build two more units.

MAROVISZ and Bay Zoltán Applied Research Coordination Agency would like to cooperate closely in the development of the Hungarian NDT profession. Symbolising this, Dr Gyöngyvér B Lenkey, Director of the Engineering Division at Bay Zoltán Applied Research Coordination Agency, and Professor Peter Trampus, President of MAROVISZ, have signed a cooperation agreement. The tasks under the agreement will focus on the dissemination and industrial implementation of new NDT methods, offering joint training, launching joint projects for MAROVISZ members and the organisation of workshops and conferences.

The conference presentations were followed by an equipment and software demonstration.



Professor Peter Trampus (left) and Dr Gyöngyvér B Lenkey (centre) sign the cooperation agreement

The 54th Annual British Conference on Non-Destructive Testing is taking place this autumn at The International Centre, Telford, UK.

There will be three parallel technical sessions covering a broad range of NDT technologies and applications. The 2015 Materials Testing Exhibition will run alongside the conference.

Topics include:

Applications • Data processing & validation
 NDT – Putting theory into practice • Simulation
 Human elements of NDT • Phased arrays
 Pipeline inspection • Composites
 From theory to application • Modelling

Register now online at:
www.bindt.org

The British Institute of Non-Destructive Testing

 **NDT2015**

54th Annual Conference

8-10 September 2015
 The International Centre,
 Telford, UK

Contact: Conference Services,
 The British Institute of Non-Destructive Testing,
 Newton Building, St George's Avenue,
 Northampton NN2 6JB, UK. Tel: +44 (0)1604 89 3811;
 Fax: +44 (0)1604 89 3861; Email: conf@bindt.org



REVISED

Visit <http://www.icndt.org>

The World Organisation for NDT

Highlights

- Recommendations on qualification and certification
- Responsibilities of the employer
- Requirements for NDT personnel certification bodies
- Qualification and certification of NDT personnel in accordance with ISO 9712: 2012
- ICNDT membership directory
- ASME position on recognition and acceptance of central certification programmes
- Non-destructive testing under the European Pressure Equipment Directive (97/23/EC)
- Certification Schemes compliant with ISO 9712
- ICNDT Multilateral Recognition Agreement, PCB assessment scheme and Examination Question Bank
- Qualification of NDT personnel in accordance with ISO 20807 and ISO TS 11774
- Guidance for developing countries seeking to establish national certification schemes
- Code of practice for personnel certification bodies
- ICNDT tabulation of PCB's implementation of ISO 9712:201237

Qualification and Certification of Personnel for NDT

ASIA-PACIFIC

Success for inaugural NDT exhibition and conference in Kazakhstan

The 1st Kazakhstan International Non-Destructive Testing and Technical Diagnostics Exhibition and Conference, NDT Kazakhstan, took place 7-9 April 2015 in Astana, Kazakhstan, and was a huge success.

NDT Kazakhstan presented a full range of equipment, devices and services from the fields of non-destructive testing (NDT), technical diagnostics, laboratory monitoring, measurement and testing.

Exhibition sections included the following:

- Non-destructive testing
- Training of personnel in the field of non-destructive testing
- Equipment and instruments for non-destructive testing
- Services in the field of non-destructive testing
- Technical diagnostics
- Monitoring systems
- Energy audit
- Laboratory control
- Environmental diagnostics
- Destructive testing
- Measuring and testing
- Services in the field of industrial safety
- Mechanical testing
- Metrology and standardisation
- Nanometrology and nanodiagnostics
- Laboratory control
- Computer vision
- Production control
- Climate testing.

Alongside the exhibition, the event also included a business programme featuring a one-day conference on 7 April and

seminars over the last two days.

The only core exhibition within the Central Asian countries, NDT Kazakhstan aimed to provide a business platform for both foreign experts and those in Kazakhstan who are responsible for technical diagnostics in enterprise. It was hoped the event would allow for a detailed study of the latest equipment and innovations in the field of non-destructive testing and become an event for business communication for the main suppliers of equipment and services in NDT.

NDT Kazakhstan received both support and active participation from the Non-Destructive Testing and Technical Diagnostic Association of Kazakhstan and was also held in conjunction with the following large industrial exhibitions:

- **Power Astana** – Kazakhstan International Energy, Electrical Equipment and Machine Building Exhibition
- **Kazatomexpo** – Kazakhstan International Nuclear Power Engineering and Industry Exhibition
- **MachExpo Kazakhstan** – Kazakhstan International Industrial Exhibition Machine Building, Machine-Tool Building and Automation.

As expected, the joint conduction of these industrial events attracted the maximum number of specialists working in the energy, machine building, oil & gas, mining, nuclear, aerospace and related industries.

The success of NDT Kazakhstan has put the event in line with other international exhibitions within the area of NDT, such as NDT Russia (Moscow and St Petersburg) and Aerospace Testing & Industrial Control (Moscow), organised by the British Group of Companies ITE.

Asia-Pacific Conference on Non-Destructive Testing

15th APCNDT 2017

13-17 November 2017

Marina Bay Sands Convention Centre, Singapore

Theme:

NDE for Enhanced Safety, Quality and Productivity.

Important dates:

- *Call for papers*: open from 1 January 2016
- *Submission of abstracts*: 1 January 2016 to 31 March 2017
- *Submission of full papers*: 1 April to 30 May 2017
- *Author registration*: 1 June to 31 July 2017
- *Early bird registration*: 1 June to 30 September 2017.

The location:

Well known for being a little red dot on the world map, Singapore is not to be underestimated as it is one of the leading vibrant cities in the heart of Asia. Within this multicultural city-state, the integrated resort of Marina Bay Sands has surpassed most tourist attractions to emerge as Singapore's newest landmark. This large, iconic structure overlooks 'Gardens by the Bay', a new feature that evolved from Singapore's reputation as a garden city.

www.apcndt2017.com

MINDTCE15

**MALAYSIA INTERNATIONAL
NDT CONFERENCE and EXHIBITION**

“NDT for Safer Life and Cleaner Environment”

22-24 NOVEMBER 2015

SUNWAY PUTRA HOTEL, KUALA LUMPUR, MALAYSIA

CALL FOR PAPERS

Increasingly complex engineering systems and plants pose greater challenges for members of NDT community. New NDT methods and equipment are continuously developed. More funds are injected into research with the objectives among others to diversify the already existing NDT methods, develop new methods, to increase degree of reliability of NDT data, automation of NDT methods and advancing the existing method such as digital radiography, phased array and time-of-flight diffraction. In addition, worldwide efforts are also made to improve NDT education, training and certification to ensure that the technology provides the most accurate presentation for level of integrity of tested items. MINDTCE15 provides a platform for members of NDT community throughout the world to share their new NDT technologies, knowledge, experiences and research findings for betterment of mankind dwelling in this world as well as protecting our environment and preventing industrial disasters.

TOPIC OF INTEREST INCLUDE BUT NOT LIMITED TO:

- Radiation safety and security
- The need of NDT end users
- Automation and robotic NDT

- New and advanced NDT methods
- Computed radiography and tomography
- Power generation application

- NDT education, training and certification
- NDT for nuclear power application
- NDT for aerospace application
- NDT for non-metallic material
- Ultrasonic phased array, TOFD and other advanced techniques
- Other areas related to NDT

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Program and Proceedings will be published in a Conference & Proceedings Web App for on-site usage. All participants will get USB-sticks at the conference with the handouts. Full papers of the contributions will be published Open Access after the symposium in NDT.net's renowned Open Access e-journal of Nondestructive Testing - ISSN 1435-4934

IMPORTANT DATES

**EXTENDED ABSTRACT
SUBMISSION DATELINE**
30th August 2015

**NOTIFICATION OF
ACCEPTANCE**
15th September 2015

FULL PAPER SUBMISSION
Contributions (Paper, Slides, Poster and Movie) submission until 8th Nov for USB and 22th Nov 2015 for MINDTCE15 Conference & Proceedings Web App

**Paper submissions and
author information at**
www.ndt.net/MINDTCE-15

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Malaysian Society for NDT (MSNT)

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International
Committee for NDT
(ICNDT)



Asia Pacific Federation
for NDT (APFNDT)

PAN-AMERICA

News from the Brazilian Association for NDT and Inspection

NDT Student Guide

One of the objectives included in the 2014-2016 Strategic Plan of the Brazilian Association for NDT and Inspection (ABENDI) is that of disseminating NDT in Brazilian universities and technical schools.

Part of ABENDI's mission is to inform and increase awareness among the newer generations of the importance of NDT inspection as a profession and its use in industry in general. To this end, the Association has published the NDT Student Guide, among other activities, containing a description of all NDT methods, their respective fields of application, career opportunities and statements by professionals already working in this area. 10,000 copies of the handbook will be distributed throughout the main educational institutions in the country.

ABENDI joins Instagram

Included within the goals of ABENDI's Strategic Plan is to use all different types of media vehicles available to further increase NDT awareness.

Activities on Facebook, Twitter and electronic newsletters have already been implemented and last April ABENDI's page on Instagram was released revealing the invisible world of NDT. It can be accessed at: <https://instagram.com/a.b.e.n.d.i/>

New certifications

Vibration Analysis is an essential factor in the early detection of anomalies such as mechanical, electrical and hydraulic errors in machines and equipment. ABENDI recently began a process in which to certify N1 Vibration Analysis. ABENDI's norm covering the method (NA-004) was drafted based on ISO 18.436-2 and encompasses four certification categories.

Considered as a non-intrusive and non-destructive technique,

thermography reveals the distribution of surface temperatures through the use of a thermal image produced by cameras able to detect electromagnetic and infrared radiations.

ABENDI introduced this certificate for the N1 category in June 2015.

Online simulation

Always aimed at creating benefits able to effectively contribute towards the development of its associates, ABENDI has made online simulations available to its candidates to aid preparation for the Level 3 theoretic exam.

Associates can access seven simulations: basic knowledge, dimension control, radiography research, penetrating liquids, magnetic particles and ultrasound.

The new CD, EV and ER tests are all comprised of 50 multiple choice questions drafted, compiled and reviewed by N3 methodology specialists.

ABENDI numbers

The following are ABENDI's numbers in reference to 2014:

- 25 recognised organs
- 4080 people trained
- 530 training sessions held
- 223 meetings held with commissions and committees with 2014 participants
- 11 norms published in 62 meetings with 645 participants
- 12,583 tests given (theoretical and practical)
- 10 events realised with 1610 participants.

Total numbers:

- 20,154 professionals certified
- 33,459 certifications
- 5042 Associates.

Organised by the Asociación Argentina Ensayos No Destructivos y Estructurales (AAENDE)

COMADEM 2015 & X CORENDE

1-4 December 2015

CNEA – Constituent Atomic Center (CAC), Buenos Aires, Argentina

COMADEM 2015

The 28th International Conference on Management of Engineering Monitoring and Diagnostic Terms/International Congress of Condition Monitoring and Diagnostic Engineering Management (COMADEM 2015) provides the opportunity to contact/approach technologies that continuously improve and enhance the quality, reliability, safety, maintainability and performance of assets (both physical and human) as broadly as possible and achieve the maximum benefits with minimal risk.

X CORENDE

The 10th Regional Congress of Structural and Non-Destructive Testing (X CORENDE) is intended as a discussion forum where ideas are exchanged and discussed regarding improvements in the use of technology in the evaluation of components, systems and structures, from research to production and marketing. Topics include: non-destructive testing, personnel certification, standards, welding inspection, and maintenance and structural testing.

www.aaende.org.ar/Comadem2015Corende/



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19th WCNDT 2016



World Conference on Non-Destructive Testing

June 13 – 17 in **Munich** Germany

- ▶ Abstract Submissions accepted until 30 June 2015
- ▶ Final Programme in December 2015

CALL FOR PAPERS You are invited to submit abstracts on various topics of NDT. Present your latest developments, applications and research results – reach experts from all over the world and make NDT history! Find the best way to present your work – oral, poster or interactive presentation – everything is possible!

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Welding quality in Kenya: application of radiography

M M Gatari, J K Birir, D M Maina, S M Mutuli and W M Kairu

In Kenya, welding services are extensively employed in both the formal and informal sectors. The needs continue to increase with increasing population, infrastructure, vehicle fleet and economic development. Welding need is currently very important in support of 'Kenya Vision 2030'. This study reports some examples on the role of radiography in assessing the quality of welds in Kenya in accordance with Articles 2 and 22 of ASME V. Samples were acquired from both informal and formal sectors and tested for volumetric flaws using a radiographic method. During the sample acquisition, visual inspection was carried out before and after welding, and professional non-destructive testing investigators witnessed the welding process on-site. The study observed a wide variation in welding competency, especially in the informal sector, and this has provoked efforts to widen the study with the aim of developing a comprehensive advisory report for Kenyan policy makers.

Keywords: radiographic film, visual inspection, informal sector, welders, Kenya Vision 2030.

1. Introduction

Radiography is a non-destructive testing method that has been used for many decades in inspecting the welding joints of structures and vessels, such as boilers, pipelines, nuclear reactors, ships and so on^[1]. This method makes use of ionising radiation to detect volumetric discontinuities such as voids and inclusions in a material. Its main application is in the inspection of structures and vessels. However, it can also be used as a means of random quality assessment of industrial welds and deterioration, and in certifying the skills and competency of welders.

In Kenya, welding services are extensively employed in both the formal and informal sectors. While in the formal sector the services are regulated, this is not the case in the informal sector. The formal sector employers are bound by law to be responsible for their products' safety and employees competency in service delivery. The employees are also annually assessed through welders retesting and license renewal. Their licenses specify the range of material thickness and type, welding positions and applicable welding procedure. However, independent monitoring of product safety is not carried out. On the other hand, the informal sector is highly unregulated despite being the largest employer in Kenya. It employs over 80% of the working population, of which 20% are engaged in manufacturing^[2]. The services of the welders in the sector are extensively utilised in the construction industry, fabrication of domestic products, repair of machinery and in the transport industry^[3]. The sector is also a major source of welding manpower in Kenya and it is expanding very fast with the population growth, the demand for cheap domestic and farming products and the high increase of reconditioned vehicles in a fast-growing transport industry. The current economic development

trend in Kenya and the long-term strategic plan under Kenya Vision 2030^[4] will demand enhanced skills and competency as well as independent monitoring for purposes of sustainable safety policies. In this study, the first independent monitoring of the welding services in Kenya are reported, which is aimed to support the Government efforts towards achieving sustainable development.

2. Methodology

2.1 Test sample acquisition

Test samples were randomly acquired from selected towns in Kenya, which were representative of major industrial, transport and farming activities. The towns were Mlolongo (12 samples), City Stadium (12), Mombasa (10), Kisumu (10), Kitale (10) and Meru (10). The samples were selected on accounts of thickness range and welding orientation, from both the informal and formal sectors. For all of the acquired samples, the field investigators witnessed the welding processes on-site and performed visual inspection before and after the process. Inspection and process observations were recorded and from the formal sector copies of the welding procedures were taken. 64 samples of 3 mm thickness were acquired from the informal sector, while a total of 92 plates and 18 pipes of 10 mm and 8 mm thickness, respectively, were acquired from the formal sector. The samples were preserved and securely transported to radiography laboratories for testing and further examination.

2.2 Examination and testing

Visual inspection involves not only inspecting the samples visually but also studying the radiographic films. This helps in identifying and sizing any obvious discontinuities open to the surface and film interpretation of images. The main items required to perform the inspections include a measuring tape, vernier caliper, magnifying lens, film viewer and weld gauge. Visual testing was carried out in accordance with Article 9 of ASME V^[5], taking into account the minimum luminance requirements. Each of the samples was subjected to radiographic inspection to determine volumetric flaws. The source of radiation was a 300 KV, 6 mA X-ray tube and Kenya radiation protection regulations and procedures were followed in taking the sample radiographs. The obtained radiographic films were processed and viewed in accordance with Articles 2 and 22 of ASME V^[5] and interpretation was in accordance

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Table 1. Results of defects in percentages of tested samples from both informal and formal sectors

Welds	Type of discontinuity					Total discontinuities
	Undercut	Porosity	Cracks (C)	Lack of fusion (LOF)	Incomplete penetration (IP)	
Informal sector plate welds	16%	6%	3%	34%	33%	92%
Formal sector plate welds	5%	15%	0%	8%	10%	38%
Formal sector pipe welds	0%	0%	0%	0%	6%	6%

Note: The % indicated represents the percentage of total samples tested having the given defect.

with ASME VIII^[6] and ASME IX^[7]. The standards give codes that specify the acceptance levels of imperfections detected in welds. The films were first evaluated for artefacts and false indications that are formed prior to film processing, during film processing and after processing. The radiograph was then evaluated for true discontinuities and to assess the quality level, and the sizes of imperfections permitted by the standard were compared with the dimensions of indications revealed by radiographs. These tests were repeated for all specimens and joints of interest.

3. Results and discussion

Defects present in plates from both the informal and formal sectors, and formal sector pipes are shown in percentages of the tested samples (Table 1). The defects in the formal sector welds were significantly lower than in the informal sector, by approximately a factor of three. However, the percentage of defects, although different between the sectors, portrayed unacceptable percentage of failure as reflected in the figures of total discontinuities. This difference was attributed to the fact that welders in the formal sector are subjected to annual assessment through testing and subsequent licensing. We observed that defects that were recorded in the formal sector welds were mostly from welders taking the test for the first time. The welding in the formal sector was also carried out following written welding procedures and specifications, but this was not the case in the informal sector. The welders in the informal sector were also not annually assessed and licensed, thus causing the high failure of the tested welds. We further observed that the welders who were subjected to retraining,

mainly in the informal sector, provided a better service than those who were not retrained.

4. Conclusion

This study investigated the application of radiography in inspecting the quality of welding services in Kenya. It revealed the wide deficiencies in the quality of weld services given by both the formal and informal sectors. Retraining of welders and annual assessment through testing and licensing was found to be an important aspect in the two sectors and governmental policy to that effect is required. The study also affirmed the importance of radiography as an important tool in industrial services/product inspection and support for

Kenya in the realisation of its long-term strategic plan towards Kenya Vision 2030. However, expanded studies were seen to be necessary to strengthen what has been achieved in the current work.

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Month	Date	Venue	Event	Contact
August 2015	12-14	Cartagena Colombia	VI Pan-American Conference on Non-Destructive Testing	desiderio.rodriguez@aviatur.com www.vicopaend.org / www.viiiicongresoacosend.org
September 2015	1-3	Edinburgh UK	10th International Congress on Advances in Experimental Mechanics	amandaboaler@bssm.org www.bssm.org/conf2015
	8-10	Telford UK	54th Annual British Conference and Materials Testing Exhibition (NDT 2015)	conferences@bindt.org www.bindt.org
	13-16	Bahrain	7th Middle East NDT Conference and Exhibition	bseng@batelco.com.bh www.mendt.net
	15-17	Berlin Germany	International Symposium on Non-Destructive Testing in Civil Engineering (NDT-CE 2015)	herbert.wiggenhauser@bam.de www.ndt-ce2015.net
	21-23	Sendai Japan	20th International Workshop on Electromagnetic NDE (ENDE 2015)	noritaka.yusa@qse.tohoku.ac.jp http://afre.qse.tohoku.ac.jp/ende2015/ index.html
October 2015	12-14	Prague Czech Republic	VIIIth International Workshop NDT in Progress	cndt@cndt.cz http://cndt.cz/ndt_in_progress2015/
	26-29	Salt Lake City, Utah USA	ASNT 2015 Annual Conference and Quality Testing Show	conferences@asnt.org www.asnt.org
November 2015	16-18	Bremen Germany	7th International Symposium on NDT in Aerospace	tagungen@dgzfp.de www.ndt-aerospace.com
	22-24	Kuala Lumpur Malaysia	Malaysia International NDT Conference and Exhibition (MINDTCE15)	abd Nassir54@yahoo.co.my www.msnt.org.my
	26-28	Hyderabad India	25th Indian National Seminar and International Exhibition on Non-Destructive Evaluation	isntheadoffice@gmail.com
December 2015	1-4	Buenos Aires Argentina	Regional Conference on Non-Destructive and Structural Evaluation (X CORENDE) and COMADEM 2015 (Condition Monitoring and Diagnostic Engineering Management)	comunicacion@aaende.org.ar www.aaende.org.ar/Comadem-2015Corende/
June 2016	13-17	Munich Germany	19th World Conference on NDT (19th WCNDT)	tagungen@dgzfp.de www.wcndt2016.com
October 2016	24-27	Long Beach, California USA	75th ASNT Annual Conference	conferences@asnt.org www.asnt.org