

The Scheme of Certification of NDT Personnel in Greece

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Abstract. This paper introduces in the present situation of NDT in Greece and provides also the activities of the Hellenic Society of Non Destructive Testing (HSNT) as well as its contribution to the development of the National System of Nondestructive Testing.

HSNT is the national non-profit society for NDT in Greece, which was established in 1987. Today it enumerates more than 400 members who come from the universities, research centers and the industries of the country. It is member of EFNDT and ICNDT and has signed agreements of mutual cooperation with a lot of NDT societies. HSNT has organized 8 international and national conferences on NDT in Greece. The Hellenic Accreditation System (ESYD) accredited HSNT on 2005, according to EN-ISO/IEC 17024 standard. Furthermore HSNT was certified and was accepted for recognition and registration within the terms of the EFNDT Multilateral Recognition Agreement on 2005.

The training and certification of NDT personnel according to EN 473 and ISO 9712 standards is provided by an examination center, the Technology and Quality Control Center (KETEPE), located in the city of Volos, which has been certified by HSNT. On the other hand education and training in various NDT methods, was provided from 1970 in high schools and technical universities of the country.

1. Introduction to NDT in Greece

Formal training on NDT in Greece began about 35 years ago in 1970, when the first Greek radiographers had to be trained and certified mainly for safety reasons, by “Demokritos”, the National Center for Scientific Research that first offered this training and issued the relevant certificates in Greece.

Later about the 1980 the Krautkramer representative in Greece Mr. J. Kapoyiannis started to organize classes on ultrasound method and also to offer certification of NDT personnel according to SNT-TC-1A and EN473 using instructors and examiners from Germany.

Prassianakis in 1985^[2] introduced the NDT on National Technical University of Athens (NTUA), first in undergraduate courses and later in postgraduate and also in the form of seminars under the authority of the university Continuing Education Committee. These seminars occupied all NDT methods and were accompanied by examinations according to EN 473 and ISO 9712 standards, using experience staff of NTUA and Greeks holders of Level III coming from industry.

In 1980 a vocational training organization was established in Greece^[2] in order to offer continuing training of Greek industry personnel, the Companies Association for Industrial and Professional Training (IVEPE), including NDT. It developed three centers, in Athens, Thessaloniki and Volos and conducted training and examinations on NDT methods using Greek staff as trainers and foreign staff as examiners until 2004, when as accreted body,

according to EN45013, started to use Greek examiners for the certification of NDT personnel.

In 1987 was founded HSNT which from very early started to offer training and certification in various NDT methods using Greek ASNT's Level III holders as examiners.

In 1994 was founded the Hellenic Accreditation System (ESYD) and later in 2002 its certification committee for NDT was established. ESYD, from 2000 provides accreditation and certification services on various bodies, laboratories and personnel, according to the international standards. It has provided until today more than 230 accreditation certificates on various certification, accreditation and testing laboratories and bodies. ESYD has signed agreements of mutual recognition with many other relative European bodies and organizations and is full member of the European Collaboration for Accreditation (EA), of the International Accreditation Committee of Laboratories (ILAC) and of International Accreditation Forum (IAF).

In January 1999 a new training and examination center was founded in Volos, the KETEPE. Its primary purpose was to offer training, examination and certification services to Greek NDT personnel. KETEPE first was certified according to EN 45013 by BINDT/PCN in collaboration with Lavender International using Greek staff as trainers and Lavender's staff as examiners. On the beginning of 2005 it was also approved by HSNT according to ISO-EN/17024 standard and start to be used as HSNT examination center in compliance with the EN 473 and ISO 9712 standards, using Greek staff as trainers and HSNT staff as examiners.

The certification of NDT personnel in Greece until 2005 and in some cases in nowadays is also offered by various certified examination centers in collaboration with foreign accredited bodies. In all these cases foreign independent bodies approved the certification, because there was not in use until then an independent national non-profit accreted body.

On the other hand from 1980 the contemporary NDT methods had been introduced first from NTUA and later from the rest, mainly, technological universities and institutes of the country, in the education programs as well as in the research field.

2. The Hellenic Society of Nondestructive Testing (HSNT)

HSNT was founded in 1987^[3] by a small team of scientists and specialists on NDT in Greece by approval of the city court of Athens under Resolution No 2861/15-9-1987.

Today, HSNT encompasses more than 400 members^[4] who come from the universities, research centers and industries of the country. There are three categories of membership in the Society: Honorary, Full Members and Associate or Student Members.

Among them, are 70 professors at various Hellenic Universities, 20 corporate members and the rest are ordinary members. All ASNT level III certificate holders in Greece are members of HSNT. Many famous on NDT persons, members of other NDT sister societies around the world have been accepted also as honorary members of the society. More than 80 Greek industries, companies and organizations use NDT, with approximately more than 1000 NDT inspectors.

HSNT has been fortunate to have as founding and active members University Professors, experienced industry Engineers of all disciplines and experienced NDT inspectors of Hellenic Accreditation System (ESYD), Hellenic Organization for Standardization (ELOT), Olympic Airways (OA), Hellenic Aerospace Industry (HAI), State Factory of Weapons (EBO), Hellenic Air Force and Navy, Hellenic Railways (OSE), State Aircraft Factory (KEA), State Airforce Laboratory (KETA), Shipyards, Refineries, Hellenic Electricity Power Plant (HPPC), Hellenic Air force Research Centre (HARC), Hellas Lab Association, Civil and Military Aviation and Hellenic Petrol's and others.

According to HSNT statutes and articles, the purposes of the association are as follows:

- To promote the technology of NDT in Greece.
- To organize lectures and educational seminars in NDT.
- To promote theoretical and practical research in NDT and publish the results.
- To provide advice on NDT quality control.
- To continually keep members up-to-date in NDT matters.
- To make available and publish magazines, pamphlets and books on NDT.
- To promote the interests of its members.

The Society cooperates with similar sister societies worldwide, such as the British Institute of NDT, the American Society for NDT etc, in the interest of promoting NDT technology.

The society is governed by a seven-member Board of Directors, which is elected by the General Assembly in a secret balloting. The BoD is elected for a two-year period.

The BoD assembles regularly once per month. Its function is to govern the society based on the statutes and the law, to administer the personnel, to execute the decisions of the general assembly and to manage the society's resources. The president of the society heads the BoD.

2.1 The main activities of HSNT, from its establishment until today

From its establishment, HSNT^[4] was quickly recognized internationally as the national non-profit association for NDT in Greece.

HSNT was a member of ECNDT, from 1987 (London 15-9-1987) to 1998 and a founding and full member of the new EFNDT, from 1998 (Copenhagen 25-5-1998). Also, HSNT is a member of ICNDT, from 1989 (Amsterdam 22-4-1989).

The society has signed agreements of mutual cooperation, with other NDT societies, as: ASNT of America (1991), ABENDE of Brazil (1992), DGZfP of Germany (1998), BUSNDT of Bulgaria (2000) and SSNDT of Slovenia (2004). It has also signed the agreement of multilateral mutual recognition of NDT – Personnel certification schemes with other European countries (EU/EFTA), during a special meeting in Nice/France during 1994.

HSNT is a founding member of Balkan Peninsula Society of NDT (BP S NDT) and of the East European and East Mediterranean Society of NDT (SEEEM NDT).

Members of HSNT participate in various national NDT committees and councils including:

- The NDT Technical Committee of ELOT, TC 70 “Nondestructive testing of materials”. This Committee was established in 1992 and its main purpose is the elaboration of European NDT standards and their translation into Greek, as well as the cooperation with CEN/TC 138.
- The Hellenic National Accreditation System (ESYD), and
- The Hellenic Association of Laboratories (Hellas Lab), which is the national member of Euro Lab, since 1998.

The article written in the scientific magazine ‘Insight’^[5] in the June 1999 issue, (Vol. 41, No 6, pp. 350-371, June 1999) with the title “NDT in Greece” was important for the international recognition of HSNT.

HSNT co-organized with BANT, the 1st Hellenic-Belgian Conference on NDT in Patras, Greece, on May 22-23, 1995. The conference was well attended by participants from 15 countries. In addition to the proceedings of this conference, some further interesting papers were published in a special issue of the Journal NDT and E – International.

HSNT organized a one-day conference on NDT entitled: “NDT’s role in Quality Assurance”, on November 23, 1998. This conference took place at NTUA, on the Zographou University Campus. More than 160 specialists in NDT in GREECE attended the conference, and 25 papers were presented.

Furthermore, HSNT with BANT, AIPnD, University of Patras and the Vrije Universiteit Brussels, organized the 2nd International Conference, entitled: “Emerging Technologies in NDT” in Athens, on May 24-26, 1999.

The HSNT 2nd conference on NDT took place in University of Volos successfully on June 17, 2000, and the 3rd National Conference on NDT of HSNT took place in Thessaloniki with equal success, on June 9, 2001.

Also HSNT organized its 4th annual national conference on NDT, which was held, together with the 2nd NDT conference of the Balkan Peninsula Society of NDT (BPSNDT), on November 2, 2002 in the Zografou University Campus of the NTUA.

HSNT organized its 3rd International Conference on NDT, which took place in Chania Crete-Greece, on October 15-17, 2003.

HSNT organized also its 5th annual National Conference on NDT, which took place, on November 18-19, 2005 in the Zografou University Campus of NTUA.

Finally HSNT started the preparation of its 4th International Conference on NDT, which will take place in Chania Crete, on October 2007.

The society and some of its certificated members have organized training seminars on various NDT methods and have also certified (at level II) NDT personnel, according to ASNT and EN 473 standards.

The main purpose of HSNT^[4-6], that was its accreditation as an independent certifying body, in order to run examination centres for qualification and certification of NDT personnel in Greece, carefully and after strict procedure was succeeded according to ELOT-EN-ISO/IEC 17024 standard in March of 2005 by ESYD (certification No. 198/2005).

After its accreditation HSNT submitted all the necessary documents for the approval by EFNDT. So, HSNT was accepted (27-5-05) for recognition and registration within the terms of the Multilateral Recognition Agreement (MRA) and received the corresponding Registration Certificate on June 2005.

HSNT is the unique national non-profit body accreted by ESYD in Greece, internationally recognized, for the qualification and certification of NDT personnel.

Accreditation of HSNT includes five methods: Radiographic Testing (RT), Ultrasonic Testing (UT), Visual Testing (VT), Magnetic Particle Testing (MT) and Liquid Penetrant Testing (PT). Each method contains three levels (I-II-III).

The education, training and certification of NDT personnel is provided by the examination centre KETEPE, located in Volos Greece, certified by HSNT according to EN 473 and ISO 9712 standards. KETEPE was founded in January 1999 and its primary purpose is to offer proper training, examination and certification opportunities to Greek NDT personnel. HSNT assessed the centre from March 2005, so that EN 473 and ISO 9712 training and exams will be offered, the eventual certificates of successful examinees are edited by HSNT directly.

Today HSNT is preparing in order to extend, as soon as possible, its accreditation in all the rest NDT methods and industrial NDT fields.

On the other hand HSNT examines the expressed interest from other candidate examination centers and the procedure now is in progress in order that they will be soon certified, thus occupying all the rest NDT education and training NDT fields.

3. Education and Training on NDT Methods in Greek Universities

Simultaneously from 1980 the education and training in formal way on the contemporary NDT methods are introduced mainly in the technological universities and institutes of the country^[3], so in the undergraduate and postgraduate education programs as well as in the research field.

It started mainly from the first technological university of the country, the NTUA and from its department of Mechanics.

NTUA was founded in 1836, a few years after independence of country and the formation of the New Hellenic State (1821). The systematic development of NDT methods in Greece started after 1970 with the application of visual NDT examination (Holography, Moiré, Photoelasticity and Caustics) methods, in NTUA. In 1980 was established the NDT laboratory in the department of Mechanics. Thus, from 1980 all NDT methods were taught to the university students in undergraduate and postgraduate level. Later, NDT introduced in the rest schools of NTUA and other universities so that in nowadays almost all technical universities and institutes provide education, training and research in all NDT methods. From 1990 a lot of special seminars for all NDT methods have been organized in the Continuing Education Centre of NTUA, for post-graduate students, as well as considerable research also has been accomplished concerning mainly the ultrasonic method. From 1996 NDT are introduced officially in the postgraduate programs of NTUA.

4. NDT in Ancient Times

Although the currently way of testing using NDT methods was introduced in last decades for industrial applications and under the supervision of foreign accreted bodies and from 2005 by the accreditation of HSNT by Greek bodies, NDT was known and used for testing materials and constructions for far antiquity in Greece^[1,7] with the help of human senses.

All the marvellous technological achievements of the human spirit are based on the rapid evolution of the science, the technology and the quality control of materials. As start of the NDT can be considered the 19th century, which however was developed and was established as scientific method much later in the middle of the last century.

The humanity has to show many big and ultra structures from the distant antiquity. Although the science of Mechanics was not known were made tough structures many of which survive until today. It was happened because there was known the NDT, as many archeological findings confirm it. Ancient Greeks, e.g.^[7-9], used strict specifications in their orders and also a well-organized quality control system, based on NDT methods. It was applied to almost all products in those times for the protection of the consumer as well as the state from the illegitimacy and bad quality.

All these specifications belong to the same century, the 4th B.C. century, the time period in which in ancient Greece a high development of Greek civilization took place.

4.1 Non destructive testing in distant antiquity by ancient Greeks

The ancient Greeks were "technological" population. They considered, as it is reported in their Mythology, the Technology and the Energy as gifts of divine forces to the human gender, immediately afterwards the Creation.

For each marketable good, as for the technological products of ancient Greeks, the production followed the qualitative control.

Based on historical and scientific information that the archaeological spade and the scientific research have brought in the light, we are led to the conclusion that the ancient

Greeks, 25 centuries ago, knew and also applied the qualitative control in the materials that they used.

In the antiquity the destructive testing was not known. On the other hand, as it is also confirmed by many ancient Greek inscriptions^[7-9], the NDT must would be applied by subjective way, that is to say with the help of the five human senses (sight, hearing, touch, smell and taste).

These inscriptions are engraved, mainly, in marble plates and they have been found in excavations that have been carried out in regions where the ancient Greek culture was developed.

The most significant of them are the stele of Elefsis, the low of Athens and the plates of Thassos.

The first and most important of these is **the inscription of Elefsis**, inscribed on a white marble stele, around 360 B.C. Its text constitutes a standard with very strict technical specifications and concerns the manufacture of bronze fittings to be used in the erection of the columns of the Philonian Stoa, a portico placed in front of the much older temple of Elefsis, the well-known Telestirion.

It was given the contractor of the project specific instructions about the origin and the chemical composition of the copper-tin alloy, which was to be used and also the shape and exact sizes of the required fittings were specified. It reports that the bronze and the fittings should be produced in the Marion of Cyprus and that in the 12 parts of bronze must be contained 11 copper and 1 tin. At that time this inscription is considered as the oldest ancient European standard discovered so far.

The second of these is the inscription which regard **the Athenian law** on silver coinage, belongs to the beginning of the 4th century B.C. and constitutes a “directive” regarding the quality control of silver in general, and more specifically the Athenian silver currency.

Important are also the **three inscriptions of Thassos**, of the 5th century B.C. Their text mentions three very important directives, concerning the quality control of wine.

4.2 Possible quality control procedures of testing metals in ancient Greece

The quality control procedures of testing pure metals and metals alloys in antiquity should be based on the NDT methods, using reference specimens with different contents in the various metals. The tester with the help of NDT methods, that is to say the sight, touch, hearing and with engraving, comparing the unknown content of alloy with the standard reference blocks would realize easily the composition of the unknown alloy and consequently the existence of illegitimacy.

First, they observe the coin carefully, then they touch it with their very sensitive fingers, they feel the weight when keeping it in their first, and finally they let it drop on a hard surface and hear the sound of its ringing.

Regarding gold, it is well known that its purity or its composition was determined by the common test of the touchstone (Lydian stone). It is the oldest colorimetric non-destructive assaying in use since the antiquity. The test is based on the comparison of rubbing a gold object of unknown composition and those left by a series of gold standards of certified composition.

“Lydia Lithos”, was a black hard stone and constituted one from the objects with which ancient Greeks by engraving checked the cleanliness of the golden and silver currencies, jewels, alloys and other objects.

The conclusion is that the testers in ancient Greek must have used their senses sight, smell and taste for testing the wine.

The message from the distant antiquity is that the ancient Greeks used strict specifications in their orders and also strict control of quality, because, if there is not a

control, the specifications would not have any value and the danger for illegitimacy would be serious.

5. Conclusions

During the last years, the whole situation in the field of certification of NDT personnel in Greece has changed significantly. Industry is better organized, a lot of NDT training and certification centers have been established and the certification of NDT personnel can be offered by the Greek accredited body, the Hellenic Society of NDT.

On the other hand having gained enough experience HSNT can offer services and assist for certification of NDT personnel and also in developing training and certification centers in accordance with recognized schemes like ISO-EN/17024, ISO 9712 and EN 473. So, HSNT can contribute in the developing new certification centers in Greece as well as in other countries and especially in those members of BPS NDT and SEEEM NDT that have not been used till now the above recognized NDT schemes.

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