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Hellenic Gas Transmission System Operator

HELLENIC GAS TRANSMISSION SYSTEM OPERATOR

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HIGH PRESSURE (HP) TRANSMISSION SYSTEMS

PROTECTION AGAINST RADIATION

QUALITY ASSURANCE PAGE

CHANGES LOG

REVISIONS LOG

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REFERENCED DOCUMENTS

- EU Directive 96/29/EURATOM "laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation"

- HELLENIC REGULATION FOR PROTECTION AGAINST RADIATION «ΕΓΚΡΙΣΗ ΚΑΝΟΝΙΣΜΩΝ ΑΚΤΙΝΟΠΡΟΣΤΑΣΙΑΣ, Υ.Α. **1014** (ΦΟΡ) **94/2001**, ΦΕΚ 216/Β/01»

1.0 GENERAL INTRODUCTION AND PURPOSE

Ionizing radiation (electromagnetic or corpuscular) is harmful. NDT Radiographic procedures normally include x or γ-rays radiographic techniques for Inspection and Control of welds in Industrial Systems and Constructions (e.g. pipeline welding), and their users must primarily be concerned and full responsible to protect their personnel (radiographers e.t.c) and the general Public by establishing the appropriate safety measures and health regulations for personnel protection against x and γ-rays.

The radiographic equipment used (either x-rays tubes or γ-rays sources (Iridium sources) are hazardous to humans.

The hazardous equipment /material or operations shall not be used if the proper protection measures are not implemented.
Every effort shall be made in order to minimize all hazards and specially of the biological effects of ionizing radiations, as it is clear that tissues and cells experience changes or reactions when are exposed to a certain dose of radiation. These changes or reactions vary and are depended from the absorbed dose of the human organ exposed to each type of radiation and the time. There are non-stochastic and stochastic effects on the human tissues, organs and body in general, that have immediate reactions or changes and may appear later or after many years, without any previous indications. The long term somatic effects can be caused by the cumulative even low dosages of radiation received and occur independently of the actual dose rate. Genetic defects can be caused by extremely low radiation doses and occur at a rate related to the overall population exposure. So the personnel & the general Public must be protected against ionizing radiation.

2.0 SCOPE

The scope of this document is to provide the basic principles to be followed by Contractor for radiation protection study and application for the x or γ-rays for radiographic welding inspection of a Pipeline Project. For all practical purposes the harmful radiation emitted by x-ray equipment or γ-ray radioactive sources are to be considered the same and the Hellenic Legislation ΦΕΚ 216/Β/01 applies.

3.0 REFERENCES

- Hellenic Legislation "Regulation for protection against radiation":
  Greek Governmental Gazette ΦΕΚ 216/Β/01 with all referred Decrees,
- EU Directive 96/29/EURATOM and all EU directives and regulations referred therein.
- International Atomic Energy Agency (IAEA) and International Committee on Radiological protection (ICRP) regulations.

4.0 DEFINITIONS AND UNITS

The general definitions and units given in ΦΕΚ 216/Β/01 part. 1 para 1.9) applies.

5.0 MAXIMUM PERMISSIBLE RADIATION DOSES:

Since ionizing radiations produce undesirable effects on the body tissues, the user must observe the maximum permissible levels of radiation as are imposed and stipulated by the latest National or International Committee on Radiological Protection (ICRP), International Atomic Energy Agency (IAEA) and several Decree's, National Governmental Gazettes, i.e. ΦΕΚ 216/Β/01 and EU Directive 96/29/EURATOM etc.

The Permissible dose is a dose of ionizing radiation that in the light of present knowledge is not expected to cause appreciable bodily injury to a person at any time during his life time.

The maximum cumulative equivalent radiation dose Hmax for professional exposed personnel starting their work on 18th year of their life and working until age N is Hmax = 5 (N-18) (rem).

Although it is difficult to define thresholds or permissible levels for the maximum "dose" of radiation (or more precisely of "Equivalent Dose") absorbed, the values which are applying for external radiation (see also ΦΕΚ 539Β/19.7.91 paras 1.2, 1.3, 1.4) are :

Dose limits for the whole body, per calendar year

CATEGORY	DOSE LIMIT
Profess exposed Personnel at work aged 18 or over..	0.05 Sv (5rem)
Profess exposed trainees aged under 18.....	0.015 Sv(1.5rem)
Any other person	0.005 Sv(0.5rem)

Dose limits for Individual organs and tissues (other than the lens of the eye) or any other body extremity or area of Skin, per year:

CATEGORY	DOSE LIMIT
Profess exposed Personnel at work aged 18 or over..	0.5 Sv(50rem)
Profess exposed trainees aged under 18	0.15Sv(15rem)
Any other person	0.005 Sv(0.5 rem)

Dose limits for the lens of the eye per year:

CATEGORY	DOSE LIMIT
Profess exposed personnel aged 18 or over.....	0.15Sv(15rem)
Profess exposed trainees aged under 18	0.05 Sv(5rem)
Any other person	0.03 Sv (3rem)

Dose limits for abdomen of women of reproductive capacity,

TIME PERIOD	DOSE LIMIT
In any 3 months interval	0.013Sv(1.3rem)
During pregnancy..	0.01 Sv (1 rem)

Whilst the subject of permissible levels of radiation is a complex one, the dose per hour for the whole body can be derived by interpolation e.g. 0,005 Sv per year 0.1 m Sv per week, 2.5 μ SV per hour (= 0.25 mrem/h)

The above value is usually used in the calculations of safety barriers for x-ray and gamma-ray installations for the personnel protection.

6.0 CONTRACTOR'S RESPONSIBILITIES

The Contractor shall prepare and submit for Comments/ Approval by Owner's Representative following Engineer's recommendation a complete study for the radiation protection taken into consideration x or γ-rays equipment and the provisions of the Hellenic Atomic Energy Committee (EEAE) and ΦΕΚ 216/Β/01.

6.1 STUDY FOR THE RADIATON PROTECTION

The study shall include as minimum:

Radiation Calculations, taken into consideration all technical data such as equipment source radio-activity geometry and direction of it, radiation factors, exposure time and total exposure at minimum distance from source, use of direction equipment, safety barriers etc.

Protection Measures deriving from the above calculations.

Procedures describing how the above safety protection measures shall be implemented including all the relevant tests and measurements to be performed (according to ICRP and ICRU) in order to prove the adequacy of the applied protection measures. The a/m procedure shall include the relevant record forms for the measurements taken.

For safety reasons in residential areas the activity of Ir-192 shall not exceed 2 Ci.

6.2 REDUCTION OF RADIATION

Distance, time and shielding are the methods that shall be applied by Contractor for reducing radiation below the maximum permissible levels of doses in accordance with provisions of para. 5 (above) and the National Regulations (ΦΕΚ 216/Β/01).

6.2.1 DISTANCE

This is an effective method of protection because Gamma and X-radiation emitted by point sources obey the inverse square law, that is the radiation intensity decreases with the square of the distance. Conversely, dose rates at close distances can be extremely high,

even for small sources. It is essential, therefore, that sealed sources are never handled directly, but only by remote controls.

6.2.2 TIME

This is also an acceptable method of protection because high dose rates can be accepted over short periods of time, provided that the cumulative dose remains low. The maximum permissible doses as per para 1.2 of ΦΕΚ 216/Β/01 are determined by suitable weighted measurements, i.e. 2.5 μ Sv per hour (0.25 m rem/h) for the whole body dose for any person from all above methods.

6.2.3 SHIELDING

To lessen harmful radiation, shield materials of high density, such as lead, depleted uranium, or tungsten, shall be used.

A sealed source is constantly emitting radiation and cannot be switched off. To reduce radiation emitted and to facilitate handling of the unit, the sealed source is housed in a shield which is normally made of depleted uranium.

In the use of X-ray equipment, no precautions against emitted radiation are necessary until the electric power is turned on.

6.3 CLASSIFICATION OF PERSONNEL

For the classification of personnel the provisions of ΦΕΚ 216/Β/01 para 1.5 shall be applied for the personnel protection the provisions in para 1.5, 1.6, 1.7 and 1.8 shall be strictly followed. It must be understood that the classification of personnel does not grant immunity against radiation.

6.3.1 CLASSIFIED PERSONS

Any person who, in the course of his work, is expected to deal with ionizing radiation must be classified. This means that he will have undergone an annual medical examination and that his base line blood count is known. Competent Persons and Radiographers are Classified Persons.

A Classified Person must wear a film badge, which is changed at regular intervals, and a personal dosimeter at all times when using radioactive material.

6.3.2 COMPETENT PERSONS

Competent Persons are classified personnel who are not normally directly concerned with ionizing radiation but who are capable of dealing with emergency situations and of supervising the use of radioactive equipment.

6.3.3 NON-CLASSIFIED PERSONS

Non-classified Persons are members of the general public who are not exposed to ionizing radiation as part of their jobs.

6.4 RESPONSIBILITIES FOR SAFE HANDLING

The Contractor shall appoint Competent Persons to be responsible for the immediate supervision and the enforcement of instructions and standards.

6.4.1 COMPETENT PERSON

The Competent Person will make frequent checks at the beginning of each shift on the zeroing and recharging of dosimeters and on the condition of the equipment.

This person must familiarize himself with all new equipment so that the correct action can be taken in any emergency situation involving the equipment.

6.4.2 RADIOGRAPHER

The Industrial Radiographer should have a firm understanding and should follow strictly the Radiation Protection International and National Regulations, ΦΕΚ 216/Β/01, EU Directive, IAEA, ICRP instructions, codes and standards etc. imposed in order that may perform his duties without compromising the health and safety of personnel and general public.

At the start of each shift, the Radiographer must ensure that all equipment is in safe working order. All malfunctions must be reported to the Supervisor of Competent Person immediately. The Radiographer must also make sure that he is wearing a valid film badge and a dosimeter which has been charged and zeroed. One radiation monitor must be available for each source in use. Equipment must be transported to the work site with the safety locks in place.

Under no circumstances is equipment to be transported in an assembled or open condition.

Upon arrival at the job site and prior operating with any sealed source, the Radiographer must ensure than Non classified Persons will not be subjected to more than the permitted level of radiation in accordance with the requirements of ΦΕΚ 216/Β/01.

To keep Non classified Personnel out of the radiation area, radiation warning signs must be clearly displayed and a rope barrier and a flashing light erected.

The limits of the radiation area are determined in acc. with para 1.5 of ΦΕΚ 216/Β/01, by the experienced and qualified radiographer.

A weekly report on the condition of all equipment should be passed to the supervisor.

This report should cover loss, damage, and general wear and tear.

6.5 STORAGE AREAS

Upon completion of work or at the end of each work period, every sealed shall be returned to a safe storage area, in accordance with the requirements of ΦΕΚ 216/B/01 the most effective means of storage is within a properly constructed and fenced off compound.

In permanent storage areas a proper fence with a security gate must be installed. For temporary storage areas a rope barrier must be erected round the hazardous area.

In both permanent and temporary storage areas radiation signs must be fixed to the barriers.

Sources must never be left at any time in the back of a truck whether or not they are under lock and key.

6.6 PROCEDURE AND FORMS/REPORTS

Contractor shall prepare and submit for comments and/or approval by Owner's Representative following Engineer's recommendation a complete Procedure for Protection Against Radiation, according to this Specification which will be applied to all related works.

To a.m. procedure shall incorporate:

- All forms to be filled
- Sample Reports to be prepared and submitted.

6.7 NDT CONTRACTOR LICENCES, PERMITS etc.

All Contractors performing NDT radiographic Inspection in Greece must comply to the **Greek Ministerial Decree** «ΕΓΚΡΙΣΗ ΚΑΝΟΝΙΣΜΩΝ ΑΚΤΙΝΟΠΡΟΣΤΑΣΙΑΣ, Υ.Α. **1014** (ΦΟΡ) **94/2001**, ΦΕΚ 216/B/01» and the relevant Greek Law.

All Contractors must be in possession of:

- A current and valid Import Licence for each radiographic source.
- a current and valid Licence for the use of each radiographic source.
- a current and valid licence for the storage and transport of sources.
- a calibrated and certified radiation measurement device.

All personnel must be trained qualified and equipped with the correct licence, film badge, and registered with the Greek Committee of Nuclear Energy.

The Contractors must inform or warn all involved personnel, the general public and the Authorities for the program of their works (x- or γ-rays) and their consequences.