AUTORIDAD REGULATORIA NUCLEAR

Ana María Rojo

Gerencia de Apoyo Científico y Técnico
Autoridad Regulatoria Nuclear
Argentina

Autoridad Regulatoria Nuclear
Presidencia de la Nación Argentina

Individual Monitoring of Internal Exposures for Nuclear Medicine Workers in Argentina

[1] Rojo A, [1]Puerta N, [1]Villella A, [2]Acosta N, [2]Arenas G, [1]Gossio S, [1]Gomez Parada

[1]Nuclear Regulatory Authority.
Av. del Libertador 8250. Buenos Aires, Argentina

[2]Fundación Escuela de Medicina Nuclear (FUESMEN), National Atomic Energy Commission. Garibaldi 405, Mendoza, Argentina

INTRODUCTION

Situation of occupational exposure in nuclear medicine

External individual monitoring: is required

Internal individual monitoring: is NOT required

BUT

IAEA Safety Standards Series - Safety Guide Nº RS-G-1.2

"Assessment of occupacional exposure due to intakes of radionuclides"

"The internal monitoring should be carried out whenever the potential internal exposure leads to a value of annual committed effective dose equal or higher than 1 mSv"

OBJECTIVE

To propose an individual monitoring procedure feasible to implement routinely with the instrumentation available in the FUESMEN nuclear medicine center for the control of ^{131}I internal exposures in normal and accidental scenarios

- Radionuclide of interest: ^{131}I
- Detector System available: **Gamma cameras**

Advantage:

Gamma cameras have enough sensitivity to detect ^{131}I thyroid burden corresponding to effective doses below 1 mSv [IAEA-ARCAL Project RLA/9/049]

Disadvantage:

Gamma cameras are used to scan patients for medical purposes with a very high demand

- Radionuclide of interest: ^{131}I
- Detector System available: **surface monitors**

Advantage:

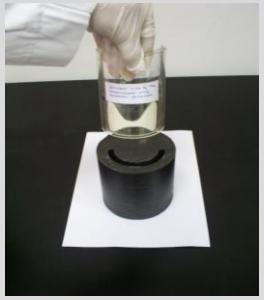
Surface monitors are available
Exclusively for radiation protection purpose

Calibration procedure → *(MDA) Minimum Detectable Activity*

MDA → *Minimum ^{131}I intakes* → *Minimum E(50)*

DETECTORS CALIBRATION

A calibration procedure, feasible to implement, is performed and the Minimum Detectable Activity (MDA) is calculated



The neck phantom: polyethylene cylinder (11.4 cm diameter and 11.3 cm high), developed by Institute of Radiation Protection and Dosimetry of Brazil (IRD) in the frame of Project IAEA/ARCAL RLA 9/049.

Detector	Characteristics	MDA (kBq)
Geiger-Mueller Halogen-quenched	Ø = 45mm, 1.5-2.0 mg/cm^2 Mica window	9.1
Geiger-Mueller	Ø = 45mm, 2 mg/cm^2 Mica window	9.2
Plastic scintillator	3”×3” plastic scintillator	2.1

DETECTORS RESPONSE

$$E(50) = e_{inh}(50) \times \frac{MDA}{m(t)}$$

m (t): theoretical retention fraction in thyroid

Conservative hypothesis:

- ^{131}I vapour

e(50)= 2×10^{-8} Sv/Bq
(ICRP68)

- Time after exposure= 1 day

m(t)= 0.23
(ICRP 78)

Detector	MDA (kBq)	$E(50)_{min}$ (mSv)
Geiger-Mueller halogen-quenched	9.1	0.8
Geiger-Mueller	9.2	0.8
Plastic scintillator	2.1	0.2

MONITORING PROCEDURE

1 **Screening monitoring**

M ≥ MDA
Surf. Monitor

NO

Register Measurement (Bq)

YES

2 **Confirmatory monitoring**

M ≥ MDA
Gamma Camera

NO

Register: ^{131}I Measurement Datum (Bq)

YES

3 **Internal dose assessment**

Guías IDEAS. FZKA 7243 2006

IDEAS guidelines criteria

Register: ^{131}I E(50) (mSv)

CONCLUSIONS

The surface detectors available in FUESMEN Nuclear Medicine Center for radiation protection purpose have an adequate response for a first screening to detect potential workers intakes

In case that a positive result is obtained, the use of a gamma camera and the application of IDEAS Guidelines criteria allows to complete the process of internal dose assessment

The proposed procedure is easy to implement and it could contribute to control the workers ^{131}I internal exposures in nuclear medicine

Ana María Rojo
Autoridad Regulatoria Nuclear

Av. del Libertador 8250 (C1429BNP)
Ciudad Autónoma de Buenos Aires, ARGENTINA
Tel.: (+54) (011) 6779 8482
Fax: (+54) (011) 6779 8460

Mail: arojo@arn.gob.ar
http:// www.arn.gob.ar