European ALARA Network

European ALARA Newsletter
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Contents

A survey of the use of dose constraints across Europe

Stephen Fennell - Radiological Protection Institute of Ireland - Chairperson, ERPAN

Introduction

The concept of a dose constraint was established by ICRP in Publication 60 [1] and included in the 1996 European Basic Safety Standards Directive [2] (1996 BSS) which defined it as "*a restriction on the prospective doses to individuals which may result from a defined source, for use at the planning stage in radiation protection whenever optimization is involved*". The Directive also stated that "*it should be used, where appropriate, within the context of optimization of radiological protection*". As all member states of the European Union were required to implement this Directive in national legislation, the use of dose constraints should now be well established throughout Europe.

In 2010 the European Radiation Protection Authorities Network (ERPAN) undertook a survey to review how the concept of dose constraints had been implemented across Europe. In particular, the survey focused on its use in the context of the optimisation of occupational exposure in the non-nuclear sector. A total of 13 countries participated in the survey, eleven of which are member states of the European Union. The complete results of this survey have been included in the report "*Dose constraints - Dose constraints in optimisation of Occupational Radiation Protection and implementation of the Dose constraint concept into Radiation Protection regulations and its use in operators' practices*" published by the Nuclear Energy Agency (NEA) in September 2011 [3]. An overview of some of the results of the survey will be present in this article.

Survey results

Of the thirteen countries that responded to the questionnaire, nine stated that there is an explicit reference to the term "dose constraint" in their national legislation, with another two reporting that the reference to this concept in their regulations is implicit (table 1). When asked whether dose constraints are routinely used as an optimisation tool for occupational exposure in non-nuclear applications only eight of the 13 countries stated that it was.

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Table 1. Summary of the application of dose constraints across Europe.

Country	Referenced in National Legislation	Name	Used in Occupational exposure (non-nuclear)
Belgium	Yes	Dose constraint	No
Czech Republic	Yes	Dose constraint	No
France	Not explicitly	Dose objective	Yes
Germany	No	n/a	No
Greece	Yes	Dose constraint	Yes
Ireland	Yes	Dose constraint	Yes
Luxemburg	Yes	Dose constraint	No
Norway	No	n/a	No
Slovenia	Yes	Dose constraint	Yes
Spain	Yes	Dose constraint/ reference value	Yes
Sweden	Yes	Dose constraint/ dose restriction	Yes
Switzerland	Not explicitly	Source related dose value	Yes
United Kingdom	Yes	Dose constraint	Yes

Setting dose constraints

While the 1996 BSS did not suggest who is responsible for setting numerical values for occupational dose constraints, it is interesting to note that in the non-nuclear sector there are different approaches as to whether the regulator or facility/employer sets them, or whether it is a joint decision making process. For the majority of countries that use dose constraints, the Regulatory Authority has a role in setting their value, albeit at different levels (Table 2). In the current draft new European BSS, it is proposed that the dose constraint used for occupational exposure will be set by the undertaking under the general supervision of the competent authorities [2].

Table 2. Responsibility for setting numerical values for occupational dose constraints

Country	Organisation responsible for setting Dose Constraint values
Belgium	Regulatory Authority
Czech Republic	Regulatory Authority
France	Employer
Germany	n/a
Greece	Regulatory Authority (general), Employer (specific sources)
Ireland	Regulatory Authority
Luxemburg	Regulatory Authority (but not used in practice)
Norway	n/a
Slovenia	Regulatory Authority (specific task), Employer (specific source)
Spain	Employer (and approved by Regulatory Authority)
Sweden	Regulations, Regulatory Authority
Switzerland	Regulatory Authority
United Kingdom	Employer

The use of dose constraints

Dose constraints by definition should be used at the planning stage in radiation protection. They can be used at the design and planning stage of a new facility where the size and nature of the specific sources are taken into account. In these cases these are sometimes referred to as source-related or design dose constraints and are used to determine levels of shielding material required in order that calculated doses to workers should not exceed the annual dose constraint value. They can also be used when planning a specific task, rather than a facility, to take account of the actual working procedures that will be used - in such instances they are often referred to as task-related or operational dose constraints. Table 3 summaries the typical uses of dose constraints for the countries surveyed.

Table 3. The use of dose constraints in occupational exposure

Country	When are dose constraints used?
Belgium	Operational (if introduced)
Czech Republic	n/a
France	Operational
Germany	n/a
Greece	Facility design
Ireland	Facility design
Luxemburg	n/a
Norway	n/a
Slovenia	Operational (& facility design)
Spain	Operational

Country	When are dose constraints used?
Sweden	Facility design & operational
Switzerland	Facility design & operational
United Kingdom	Facility design & operational

A potential difference between the intention of the 1996 BSS and how dose constraints are used in practice was noted in the survey by the fact that some regulatory authorities use dose constraints, or similar concepts, as a tool that enables retrospective evaluation of working practices when workers receive doses greater the expected values. While this can often result in beneficial changes to working practices, which is to be encouraged, the use of the term dose constraint for this purpose may be seen to be inconsistent with the intention of the 1996 BSS which explicitly stated that they should be used for prospective (rather than retrospective purposes).

Further information on results of this survey, and the use of occupational dose constraints in the nuclear sector in other regions, is available in the NEA report [3].

Summary

The results of the ERPAN survey show that the majority of European countries have adopted the concept of dose constraints or similar instruments as an optimisation tool for occupational exposure in the non-nuclear energy sector in their national legislation. In analysing the results of the survey, it can be seen that there is an inconsistency in the use of terminology – while the majority countries use the term dose constraint, others use source related dose values, dose objective or other terms. Similarly, there can be observed inconsistencies in approaches as to how they are applied.

The revision of the 1996 BSS presents an opportunity to harmonise the application of dose constraints across Europe. To assist with this task, the European Commission's Article 31 Group of Experts has recently established a Working Party on Dose Constraints in order to clarify the concept of the dose constraint and to clarify its applications in different areas in order to achieve this harmonisation. The working party intends to produce guidelines on the use of dose constraints covering occupational, public and medical exposure, in the context of the nuclear industry, non-nuclear industries, medical installations, NORM industries and other natural radiation sources.

References

[1] 1990 Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. Ann ICRP 21 (1-3).

[2] Proposal for a Council Directive laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation.

http://ec.europa.eu/energy/nuclear/radiation_protection/doc/com_2011_0593.pdf, accessed on 16th February 2012.

[3] Nuclear Energy Agency (NEA) (2011), "Dose constraints - Dose constraints in optimisation of Occupational Radiation Protection and implementation of the Dose constraint concept into Radiation Protection regulations and its use in operators' practices", NEA/CRPPH/R(2011)1, OECD, Paris 2011.

www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=NEA/CRPPH/R(2011)1&docLanguage=En, accessed on 16th February 2012.

FAQ ALARA

On the ORPNET webpage, IAEA proposes a list of frequently asked questions (FAQs) which intends to provide information to radiation protection specialists so that they can answer quickly and correctly the most frequently asked questions. The ALARA Newsletter proposes in each issue a selection of these FAQs

Does setting dose constraints achieve the implementation of the ALARA approach?

Not necessarily. For example, applying a dose constraint of 0.5 mSv/day does not mean that optimization has been implemented.
This type of dose constraint is often estimated on the basis of the regulatory limits or of "managerial policy" objectives applied by the licensee. It is related to a system of limiting and managing individual exposure, not to optimization, although it must be factored into optimization. Optimization must not result in non-compliance with these constraints

Reference: http://www-ns.iaea.org/tech-areas/communication-networks/norp/faq.asp?fq=35

Experience feedback from the report of an interventional radiology event at the Strasbourg Academic Hospitals (France)

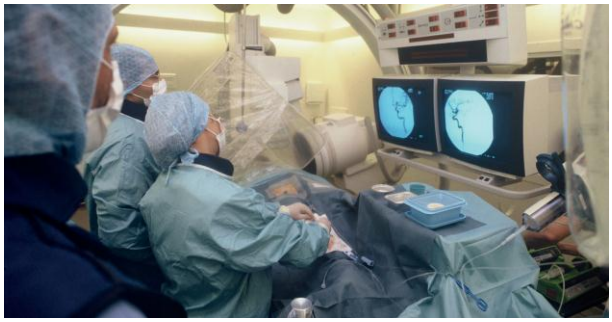
Carole Rousse - Deputy Head ASN Ionising Radiation and Health Department, France

Introduction

On March 20, 2009, the French Nuclear Safety Authority (ASN) was informed by the Strasbourg Academic Hospitals (HUS) of reports of patients presenting adverse reactions, of unusual intensity, consisting of hair loss over a large surface area and/or cutaneous erythema. These patients received treatment at the Hautepierre Hospital site by means of the same X-ray device used to guide practitioners during treatment of cerebrovascular disease.

ASN carried out a number of inspections on March 23, May 7, and September 29, 2009, so as to analyse the circumstances and causes of the occurrence of these adverse reactions, and to examine the corrective action implemented.

At the same time, the ASN and the French General Directorate for Health [Direction générale de la santé] jointly referred to the French Institute of Radioprotection and Nuclear Safety (IRSN) in order to reconstitute the doses received by the patients and to analyse any potential complications in exposed patients. Follow-up of patients carried out by HUS to date does not reveal any neurological, meningeal or subcutaneous abnormalities, and the cases of alopecia observed have fully regressed. Today, all the cases of alopecia have disappeared.



Results of the investigations

The different investigations and expert appraisals carried out revealed that the device in question did not present any technical faults and that insufficient attention had been given to optimising and monitoring the doses received by the patients. The effects observed are due to the use of a new device and the fact that the conditions relating to use and settings were not optimised, contributed to by inadequate training and organisational failings.

A number of failings were observed, at establishment level, in medical and paramedical personnel training in the knowledge of the devices and in the implementation of a dose-optimisation procedure, and also in the mastery of the maintenance and adjustment process for the device, together with the organisation of medical physics. Furthermore, the investigations evidenced a number of failings in the traceability of the maintenance operations carried out by the manufacturer, in the training provided by the latter for users of the device, and, lastly, in the optimisation of settings carried out during commissioning and maintenance operations. A number of contributing factors related to the device were identified, such as the absence of standardisation of measurable dosimetric quantities, the difficulty in monitoring doses based on the DAP[1], the absence of automatic dosimetric data export from the devices to the databases enabling them to be processed.

Moreover, the DAP levels during treatment of cerebrovascular diseases at the HUS as a whole (Hôpital Civil and Hautepierre) generally appear to be higher than those reported in the majority of the French and international literature reviewed. However, although the literature states that a dose-optimisation margin exists, it seems hard to determine whether these levels and the incidence of effects differ considerably from other French sites, in the absence of available reference systems and reliable local data. It appears likely that the findings observed locally during the investigations are not specific to the HUS.

Action plan implemented by the establishment, and the results obtained

The lessons drawn from analysis of this event enabled the HUS to define and implement a logical

[1] DAP: In order to monitor the doses delivered, the X-ray tubes are fitted with a sensor which is able to measure the dose*area product (DAP). By determining the exposed area and the DAP, it is thus possible to calculate the dose.

and innovative action plan, the aim of which is to identify and reduce the dose levels for all interventional procedures. Owing to this action plan, the HUS is now among those French establishments which follow the most advanced practices in terms of patient radioprotection in the field of interventional radiology.
The corrective action implemented by the HUS involved:

- implementing an optimisation procedure with regard to settings, in connection with the manufacturers,
- modifying the conditions of use of the devices (reduction in the number of images, selection of an image type requiring less radiation),
- modifying the organisation of the interventions (dedicated operators, intervention of an experienced practitioner from the start of complex procedures),
- automatically collecting the DAP for each procedure,
- systematically consolidating and processing the DAP,
- defining in-house dose reference levels,
- implementing self-assessment of practices, through processing dosimetric data,
- identifying and monitoring patients liable to present iatrogenic effects.

Lastly, the HUS initiated an innovative in vivo dosimetry process. Furthermore, work has begun with the manufacturer to improve the coordination and traceability of maintenance operations together with the possibility of developing a system able to monitor, in real time, skin dose mapping for doses delivered to patients.

The results obtained are significant and demonstrate the relevance of the action plan. This has led to a considerable reduction in the doses delivered to patients, in the region of 40% related to changes in the settings, and in the region of 30 to 50% related to the changes in practices relating to the use of the devices. Owing to these results, the occurrence of adverse reactions is now very rare.

Action relating to the monitoring of dosimetric data, and, in particular, the implementation of in vivo dosimetry, will moreover make it possible to determine more accurately the doses received by patients, which are still poorly evaluated and insufficiently documented.

Experience feedback

In addition to the teaching and corrective action implemented locally by the HUS, this event has given rise to considerable experience feedback for all professionals, and also for manufacturers and personnel responsible for device maintenance.

This event has reiterated the importance of the challenges in terms of dosimetry facing this type of activity, and has shown that the effects it can generate are largely unknown. The current regulatory system is not sufficiently applied or adapted. In particular, the concept of an optimisation procedure, which is a fundamental principle of radioprotection, is not sufficiently known or assimilated in the different departments. Likewise, technical mastery of equipment, radiovigilance and follow-up of complications, which should be at the centre of all procedures aiming for an improvement in practices, are inadequately defined and organised. This event also has demonstrated the existence of considerable margins for progress in terms of dose reduction, without compromising therapeutic efficacy.

Based on this experience feedback, ASN reiterated the regulatory requirements, in a memorandum dated December 11, 2009, and sent a number of recommendations to the heads of interventional vascular neuroradiology departments, together with the general managers of regional and academic hospitals with a view to improving interventional radiology practices.

Furthermore, ASN informed the French Health Products Safety Agency (AFSSAPS) of the lessons drawn from this feedback and the improvements which needed to be made both in terms of relations between the supplier of the device and the user during commissioning, maintenance, and the training provided, together with the ergonomic aspects and settings for devices used in radiology.

Although failings were evidenced locally, this event made it possible to identify a number of weaknesses and courses of action which need to be taken into account at national level. These were brought to the knowledge of the permanent medical radioprotection expert group (GPMED), convened by the ASN in January 2009, so as to draw up recommendations to improve radioprotection among patients and personnel in interventional radiology. The conclusions of this

expert group have been taken into account in the ASN Deliberation issue on 5 July 2011 on the improvement of radiation protection in interventional radiology available on the following link: http://www.asn.fr/index.php/Les-actions-de-l-ASN/La-reglementation/Bulletin-Officiel-de-l-ASN/Deliberations-de-l-ASN/Deliberation-n-2011-DL-0018-de-l-ASN-du-14-juin-2011.
The medical physicist appears as a key actor of the optimization of doses delivered to the patient.

Mining-related radiation exposure of members of the public and of workers: New Calculation Guide Mining in Germany

M. Kümmel and K. Wichterey (BfS, Germany)

The new "Calculation Guide Mining" is intended to determine the mining-related radiation exposure of members of the public and of workers. It is applicable for the use, decommissioning, remediation, and reuse of mining facilities and installations as well as for the use, remediation, and reuse of land contaminated as a result of mining facilities and installations.

The "Calculation Guide Mining" describes procedures and parameters to determine effective dose indoors, at underground workplaces, and outdoors, as well as exposures caused by consumption of breast milk and locally produced foodstuff. The following exposure pathways are considered: external exposure due to gamma-radiation from the soil, exposure due to inhalation of dust, exposure due to inhalation of radon and its short-lived decay products, exposure from ingestion of breast milk and locally produced foodstuff (drinking water, fish, milk and milk products, meat and meat products, leafy vegetables, other vegetable products), and exposure due to soil ingestion.

In order to account for the background levels of environmental radionuclides, the "Calculation Guide Mining" includes levels of natural background for all relevant environmental media.

The new "Calculation Guide Mining" is the result of a revision and summarization of the "Calculation Guide for the Determination of Radiation Exposure due to Mining-caused Environmental Radioactivity" and the "Calculation Guide for the Determination of Radiation Exposure due to Inhalation of Radon and its Short-lived Decay Products as a Result of Mining-caused Environmental Radioactivity", prepared in the mid-nineties by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in cooperation with the Federal Office for Radiation Protection (BfS).

The experience gained during the last ten years of application of the Calculation Guides, as well as more recent research results necessitated a revision. This was done with particular consideration of indications made by the above Federal Laender and the Wismut GmbH as well as by experts. The summarized and modified Calculation Guide Mining has been discussed at length in the Commission on Radiological Protection (SSK). The Calculation Guide Mining is confined to specifying procedures to calculate radiation exposure due to mining. It does not contain material for radiation protection requirements such as regulations concerning remediation objectives or information as to the prerequisites for the justification of remediation operations nor transport models, e.g. for outdoor radon or the water pathway.

BfS Report no. BfS-SW-09/11 (in English), downloadable from BfS homepage: http://doris.bfs.de/jspui/handle/urn:nbn:de:0221-201109056212

4th EAN$_{NORM}$ Round Table Workshop on "Transportation of NORM, NORM Measurements and Strategies, Building Materials"

Hartmut Schulz (IAF - Radioökologie GmbH, Germany), Astrid Schellenberger (IAF - Radioökologie GmbH, Germany), Sonja Schreurs (NuTeC - XIOS Hogeschool Limburg, Belgium), Wouter Schroyers (NuTeC - XIOS Hogeschool Limburg, Belgium)

The 4th EAN$_{NORM}$ - Workshop, organised and hosted by NuTeC - XIOS Hogeschool Limburg in cooperation with IAF - Radioökologie GmbH, was held from 29th November to 1st December 2011 in Hasselt (Belgium). This workshop was dedicated to "Transportation of NORM, NORM Measurements and Strategies, Building Materials". 84 participants from 18 different European countries took part in the discussions and shared their experiences.

The scientific program included three main sessions with 30 presentations of about 30 minutes

including ample time for discussion. In addition, an exhibition of companies offering radiation protection measurement devices and a demonstration of the intervention vehicle of SCK-CEN completed the scientific program.

Each daily session was finished with a round table discussion, initiated by a panel discussion on key questions. Participants belonged to international organisations, universities, research institutes, consulting companies, laboratories and NORM industries, and the discussions reflected the different points of view and the different approaches to dealing with NORM.

The main conclusions of the 4th EAN_{NORM} Round Table Workshop on "Transportation of NORM, NORM Measurements and Strategies, Building Materials" were:

- There is a need for harmonisation of the BSS and ADR.
- There is a need for new specific technical documents regarding the transport of NORM. The publication "Vervoer van radioactieve stiffen over de weg in Nederland en België" of the Nederlandse Vereniging voor Stralingshygiëne could be a basis for such a document.
- The implementation of information on the radiological characterisation of residues/waste within the European waste catalogue (codes) would be desirable.
- The dose assessment depends on the regulations of each country and the responsibility of the Radiation Protection officers.
- There are diverse approaches concerning the evaluation of data: E.g. the comparison with reference levels, taking into account the background level, and criteria for the representativity of measurements.
- The long and diverse discussions on Radon in building materials with respect to the BSS showed that there is a need for more practical/technical support and data for this topic.

The scientific program, presentations and some reflections on the round table discussions of the 4th EAN_{NORM} Round Table Workshop on "Transportation of NORM, NORM Measurements and Strategies, Building Materials" are available for download at the EAN_{NORM} web-page www.ean-norm.net.

The organisation of this workshop was financially supported by the European Regional Development Fund (ERDF-EFRO) and the Flemish government.

The present state and the future of the EAN_{NORM} have been a subject of lively discussions. The participants agreed on the advantage of having a well-working network and yearly workshops. Therefore, the **5th EAN_{NORM} workshop will be held from December 4th to 6th 2012 in Dresden.** The main topic will be "**Measurement strategies in NORM**". The respective first announcement will be released end of February at EAN_{NORM} website.

ALARA NEWS

For more news, please visit regularly EAN Website: www.eu-alara.net

❒ 2nd European course on ALARA from theory to practice in nuclear installations - 16 to 21 September 2012, Barsebäck, Sweden

The optimisation of radiological protection principle (also known as 'ALARA'), has been implemented since more than 30 years by nuclear professionals. The key role of optimisation has been reemphasized in the '2007 ICRP Recommendations for a System of Radiological Protection' (ICRP 103), to be transposed in the new European Basic Safety Standards.

Since a few years, the intention to build new nuclear power plants at the international level, together with the ageing of existing installations requires a new focus on maintaining and expanding skills, through radiation protection education and training and dissemination of ALARA culture. This is also reinforced by a large-scale retirement of nuclear workers.

Course objectives

This European Course on 'ALARA from Theory to Practice in Nuclear Installation' is organised by KSU (Sweden) and CEPN (France) with the objectives of providing up-to-date knowledge on the ALARA principle and its practical implementation through dedicated lectures, practical exercises as well as syndicate exercises.

The Course will be held in the KSU Barsebäck Training Centre, located on the site of the decommissioned Barsebäck Swedish nuclear power plant. The latter will be the place for the practical exercises.

Target audience

The Course is intended for experienced professionals having responsibilities in radiological protection in nuclear installations, such as Radiation Protection Managers, RP Qualified Experts and Officers, HP Engineers and Technicians, RP Inspectors, Maintenance Managers, etc.
Newcomers in the field of radiation protection are also very welcomed, as a core objective of this course is the transmission of knowledge and know-how in ALARA implementation to new generation

❒ 14th European ALARA Network Workshop (September 2012, Irland)

The 14th EAN Workshop will be held from 4th to 6th of September at the Dublin Castle in Irland. It will deal with "ALARA in existing exposure situations".

The programme is available on the EAN website: www.eu-alara.net

More information on the Workshop website: www.rpii.ie/ALARA2012.aspx

The 20 EUROPEAN ALARA NETWORK Contact Persons

AUSTRIA

Mr Alfred HEFNER
Seibersdorf Labor GmbH
2444 SEIBERSDORF
Tel: +43 50550 2509; Fax: +43 50550 3033
E-mail: alfred.hefner@seibersdorf-laboratories.at

BELGIUM

Mr Fernand VERMEERSCH
SCK/CEN, Boeretang 200, 2400 MOL
Tel: +32 14 33 28 53; Fax: +32 14 32 16 24
E-mail: fvermeer@sckcen.be

CROATIA

Mr Mladen NOVAKOVIC
Radiation Protection, EKOTEH Dosimetry,
Vladimira Ruzdjaka 21, 10000 ZAGREB
Tel: +385 1 604 3882; Fax: +385 1 604 3866
E-mail: mlnovako@inet.hr

CZECH REPUBLIC

Mr Jan KROPACEK
SUJB - State Office for Nuclear Safety,
Syllabova 21, 730 00 OSTRAVA
Tel: +420 596 782 935; Fax: +420 596 782 934
E-mail: jan.kropacek@sujb.cz

DENMARK

Mr Kresten BREDDAM
National Institute for Radiation Protection
Knapholm 7, 2730 HERLEV
Tel: +45 44 54 34 63
E-mail: krb@sis.dk

FINLAND

Mrs Maaret LEHTINEN
STUK – Radiation Practices Regulation
Laippatie 4, 00880 HELSINKI
Tel: +358 9 75988244 Fax: +358 9 75988248
E-mail:mamm

FRANCE

Mrs Olvido GUZMÁN
ASN, 6 place du Colonel Bourgoin
75572 PARIS Cedex 12
Tel: +33 1 40 19 87 64 ; Fax: +33 1 40 19 88 36
E-mail: olvido.guzman@asn.fr

GERMANY

Mrs Annemarie SCHMITT-HANNIG
BfS, Ingolstädter Landstrasse 1,
85764 OBERSCHLEISSHEIM
Tel: +49 3018 333 2110; Fax: +49 3018 10 333 2115
E-mail: aschmitt-hannig@bfs.de

GREECE

Mr Sotirios ECONOMIDES
Greek Atomic Energy Commission (GAEC)
P.O. Box 60228, 15310 AG-PARASKEVI
Tel: +30 210 6506767; Fax: +30 210 6506748
E-mail: sikonom@eeae.gr

ICELAND

Mr Guðlaugur EINARSSON
Geislavarnir Ríkisins, Rauðararstigur 10
150 REYKJAVIK
Tel: +354 552 8200; Fax: +345 552 8202
E-mail: ge@gr.is

IRELAND

Mr Stephen FENNELL
Radiological Protection Institute of Ireland,
3 Clonskeagh Square, Clonskeagh Road, DUBLIN 14
Tel: +353 1 206 69 46; Fax: +353 1 260 57 97
E-mail: sfennell@rpii.ie

ITALY

Mrs Serena RISICA
ISS – Technology and Health Department
Viale Regina Elena 299, 00161 ROME
Tel: + 39 06 4990 2203; Fax: +39 06 4990 2137
E-mail: serena.risica@iss.it

THE NETHERLANDS

Mr Cor TIMMERMANS
NRG Radiation & Environment, P.O. Box 9034,
6800 ES ARNHEM
Tel: +31 26 3568525; Fax: +31 26 3568538
E-mail: timmermans@nrg.eu

NORWAY

Mr Gunnar SAXEBØL
Norwegian Radiation Protection Authority, Grini
Naeringspark 13, Postal Box 55, 1345 ØSTERÅS
Tel: +47 67 16 25 62; Fax: +47 67 14 74 07
E-mail: gunnar.saxebol@nrpa.no

PORTUGAL

Mr Fernando P. CARVALHO
Instituto Tecnologico e Nuclear
Estrada Nacional 10, 2686-953 SACAVEM
Tel: +351 21 994 62 32; Fax: +351 21 994 19 95
E-mail: carvalho@itn.mces.pt

SLOVENIA

Mr Dejan ŽONTAR
Slovenian Radiation Protection Administration
Langusova 4, 1000 LJUBLJANA
Tel: +386 1 478 8710; Fax: +386 1 478 8715
E-mail: dejan.zontar@gov.si

SPAIN

Mr Arturo MULAS PEREZ
CSN, Justo Dorado 11, 28040 MADRID
Tel: +34 91 346 01 98; Fax: +34 91 346 05 88
E-mail: apm@csn.es

SWEDEN

Mrs Birgitta EKSTRÖM
SSM - Department of Nuclear Power Plant Safety
Solna strandväg 96, 171 16 STOCKHOLM
Tel: +46 8 799 42 45; Fax: +46 8 799 40 10
E-mail: birgitta.ekstrom@ssm.se

SWITZERLAND

Mr Nicolas STRITT
Swiss Federal Office of Public Health, Radiation Protection
Division, 3003 BERN
Tel: +41 31 324 05 88; Fax: +41 31 322 83 83
E-mail: nicolas.stritt@bag.admin.ch

UNITED KINGDOM

Mr Peter SHAW
HPA (Health Protection Agency) - Centre for Radiation,
Chemicals and Environmental Hazards
Hospital Lane, LEEDS - LS16 6RW
Tel: +44 113 267 9629; Sec: +44 113 267 9041 Fax: +44 113 261 3190
E-mail: peter.shaw@hpa.org.uk