EU GUIDANCE ON THE IMPLEMENTATION OF THE BASIC SAFETY STANDARDS WITH REGARD TO NATURAL RADIATION SOURCES

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1 ABSTRACT

The Group of Experts established under Article 31 of the Euratom Treaty has provided guidance on the implementation of Title VII of the Basic Safety Standards (Council Directive 96/29/EURATOM). General guidance for all types of work activities (radon in workplaces, NORM industries, aircrew) was given in 1997 (Radiation Protection 88), followed by specific guidance as reference levels for workplaces processing NORM materials (RP 95 and 107) and on building materials (RP 96 and 112).

Guidance on the definition of exemption-clearance levels for NORM materials was recently adopted for publication as RP 122 (part II).

The different documents will briefly be discussed and the coherence of the overall approach will be explained, also in relationship with other legislation (Drinking Water Directive, draft Recommendation on radon in drinking water).

2 INTRODUCTION

Since the signature of the EURATOM Treaty (1957) and the subsequent Directives on the protection of the health of workers and members of the public against ionizing radiation natural radiation sources were never excluded, but in reality Member States paid little attention to sources outside the nuclear fuel cycle or industrial or medical applications. It took until 1990 for legislation on indoor exposure to radon to be adopted, not as a Directive but merely as a Commission Recommendation[1]. With the adoption of Council Directive 96/29/EURATOM revising the Basic Safety Standards natural radiation sources are brought explicitly within the regulatory framework, both for the protection of workers and members of the public, albeit in a flexible form which allows Member States to adjust progressively their regulatory framework, on the basis of the specificities of the countries geological features and characteristics of process industries.

While the Directive offers this flexibility there was need for Community guidance on this matter, to help Member States embarking on a very new area of radiation protection, and if possible to maintain a certain degree of harmonisation. The Group of Experts established under Article 31 of the Euratom Treaty has offered such guidance over a period of many years, both before the deadline for implementation in national legislation (May 2000) and later. As discussed earlier (J.L. Daroussin and F. Brillanceau, this conference)

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[1] OJ L 80, 27.03.90, p. 26-28

the extent to which the provisions of the Directive with regard to natural radiation sources have been transposed in legislation or rather in terms of ongoing operational regulatory practice varies a lot among Member States, and in many cases the guidance will remain of interest from an operational perspective.

The new Basic Safety Standards deal with natural radiation sources also in intervention situations and guidance to a common regulatory approach has been offered.

Meanwhile legislation outside the EURATOM Treaty has started dealing with natural radiation sources, in particular in the context of the construction products Directive[2] and of the Drinking Water Directive[3]. Even though these were adopted with the EC Treaty as the legal basis, guidance has been given by the Article 31 Experts under the EURATOM Treaty on the requirements relating to radioactive substances. This guidance is briefly discussed here as well, for the sake of completeness but also because this legislation needs to be taken into account in the context of the Basic Safety Standards.

3 REGULATORY CONTROL OF NATURAL RADIATION SOURCES

3.1 Work activities

Within the scope of the Basic Safety Standards Directive (Article 2) with regard to natural radiation sources a distinction is made between:

1. Utilisation of natural radionuclides *which are or have been processed in view of their radioactive, fissile or fertile properties*. Such cases are considered practices and all the provisions of the Directive on practices apply.

A distinction on the basis of the intended use of a radionuclide may in fact not always be practicable, in particular when the practice is terminated. Upon receipt of metal for recycling, for instance, it will often not be possible to determine whether the origin of the material is a work activity rather than e.g. uranium mining. Uranium mining is a practice, and in the past criteria has been defined to establish whether an ore is uranium-grade.

2. Work activities where the presence of natural radiation sources leads to *a significant increase* in the exposure of workers or members of the public (and the material is not used because of its radioactive, fissile and fertile properties). The Directive applies to these work activities in accordance with Title VII.

The Directive does not apply to exposure to radon in dwellings or to natural levels of radiation which are deemed to be essentially unamenable to control, i.e. to naturally occurring radionuclides contained in the human body (e.g. K-

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[2] Council Directive (89/106/EEC, OJ L 40, 11.02.1998, p. 12-26) on the approximation of laws, regulations and administrative provisions of Member States related to construction products

[3] OJ L 330, 05.12.98, p. 32-54.

40), to cosmic radiation prevailing at ground level or to above ground exposure to radionuclides present in the earth's crust.

3.2 Intervention situations

While clean-up of the contaminated site of an ongoing practice and decommissioning are subject to the requirements for practices, old sites, in particular with residues of NORM industries not previously regulated, would normally be dealt with as intervention situations (Title IX of the Basic Safety Standards). Guidance on intervention in case of lasting exposure situations has been given in CARE, a study towards a Common Approach for the REstoration of contaminated areas, part of which was taken up as Community guidance[4].
While industries processing large amounts of NORM are brought within the scope of the Directive, it is important to account for the fact that possible restrictions on the discharge of effluents for such industries have implications on the amount of residues stored on-site.

3.3 Building materials

In the same way as radon in dwellings is excluded it is understood that external exposure from traditional building materials (stones, bricks, …) is in general excluded. However, residues from work activities such as fly-ash from coal-fired power stations, by-product gypsum and certain slags which are produced in large volumes may be recycled in or used as building materials, and one could argue that such recycling or reuse is cause of an enhanced exposure pathway. It is important to have a coherent policy with regard to natural and by-product materials. Specific guidance[5] has been given by the Group of Experts established under Article 31 – Euratom Treaty. An activity index is proposed corresponding to the excess gamma exposure (compared to that received outdoors):

$$I = \frac{C_{Ra}}{300\ Bq\ kg^{-1}} + \frac{C_{Th}}{200\ Bq\ kg^{-1}} + \frac{C_{K}}{3000\ Bq\ kg^{-1}}$$

where C_{Ra}, C_{Th}, C_K are the radium, thorium and potassium activity concentrations (Bq kg^{-1}) in the building material.

Below an index I=0.5, for materials used in bulk amounts (e.g. concrete), or an exposure increment of 300 μSv per year, it is recommended that building materials would be exempted from any restrictions.

This guidance has been offered in view of the possible adoption of product specifications with regard to radioactivity content under the terms of the construction products Directive(2).

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[4] Radiological considerations with regard to the remediation of areas affected by lasting exposure as a result of a past or old practice or work activity (Radiation Protection 124, 2001, http://europa.eu.int/comm/environment/radprot/124/124.htm)

[5] Radiological protection principles concerning the natural radioactivity of building materials (Radiation Protection 112, 1999).

3.4 Radon in dwellings

While radon in dwellings is excluded from the Basic Safety Standards Directive, there is a Commission Recommendation on the protection of the public against indoor exposure to radon (90/143/EURATOM)[6]. It was recommended that where a reference level of 400 Bq m^{-3} is exceeded, simple but effective remedial action should be considered. For constructions after 1990 a design level of 200 Bq m^{-3} was recommended.
In the guidance on building materials, it is proposed that radon exhalation can be ignored if it does not cause this design level to be exceeded (which is the case if gamma exposure is controlled on the basis of the index).

3.5 Drinking water

Council Directive 98/83/EC[7], on the quality of water intended for human consumption, includes radioactivity in the list of indicator parameters (Part C to Annex 1). The parameter is expressed in terms of "total indicative dose" (parametric value 0.1 mSv) including exposure to naturally occurring radioactive substances (except K-40, radon and radon decay products). The indicative dose will be translated into monitoring frequencies, methods and locations in a modified Annex II (not yet published) to this Directive. Guidance to this effect has been given by the Article 31 Experts (November 1999) on the basis of monitoring for α-β activity or for reference nuclides such as Uranium or Ra-226.
The requirements of the Directive need to be taken into account in addition to the specific assessment under the Basic Safety Standards of pathways of exposure to members of the public by ingestion, e.g. by infiltration in the water table, from work activities. It should be noted that the Directive does not apply to private wells, and hence exposure pathways via such wells may need to be taken into account, unless excluded on the basis of other (national) legislation.

Radon and decay products being excluded from the Directive, the Article 31 Experts have proposed a Commission Recommendation (not yet adopted) on radon in domestic water supplies, similar to the one on radon in dwellings.

4 TITLE VII OF THE BASIC SAFETY STANDARDS

4.1 Introduction

The provisions on work activities involving exposures to natural radiation sources are given in Title VII of the Basic Safety Standards Directive. Articles 40 and 41 establish a stepwise system in which the Member States are required 1) to identify, by means of surveys or by any other appropriate means, work activities which may be of concern, 2) to set up appropriate means for monitoring exposure in the identified work activities and as necessary 3) to implement corrective measures to reduce exposure pursuant to Title IX (Intervention), and 4) to apply all or part of the system of radiological protection for practices, as prescribed elsewhere in the Directive.

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[6] OJ L 80, 27.03.90, p. 26-28.
[7] OJ L 330, 05.12.98, p. 32-54.

The structure of the Directive is such that a priori all work activities are within the scope of the Directive. It is up to Member States to identify which work activities are of concern and require an appropriate form of regulatory control. In the case of radon exposure nation-wide radon surveys in dwellings and workplaces in addition to geological information are means of identification. Surveys will also relate to the characteristics of industries processing materials with (enhanced levels of) naturally occurring radionuclides (NORM).

The approach of Title VII is thus rather general offering flexibility for the Member States to take into account national circumstances. Such flexibility is necessary in view of the fact that in most Member States there is little experience with the regulation of natural radiation sources and in addition a new legal framework must be set up for this purpose. It would nevertheless be advantageous if Member States in the EU would adopt similar approaches in identifying the relevant work activities, in taking corrective measures and in applying the system of radiological protection in occupational and in public exposure.

The economic implications of controls imposed on industries processing raw materials may be such as to require a harmonised policy. The Article 31 Experts have recognised this need and have provided technical guidance[8] on the implementation of a system of protection for workers (not only in NORM industries but also for radon in workplaces and for exposure of aircrew to cosmic radiation).

4.2 Implementation of a system of protection

Article 41(b) of Title VII of the Basic Safety Standards states that it shall be required, as necessary, to apply all or part of the system of radiation protection for practices (Titles III, IV, V, Title VI for workers, and Title VIII for members of the public). “All or part” means that the extent of regulatory control can be defined as appropriate, commensurate to the nature of the work activity and taking into account the monitoring results. In the guidance of the Article 31 Experts, boundaries are proposed expressed in terms of radon concentration (Action Level) in places of work and in terms of annual effective dose to workers.

Radon in workplaces

It is recommended that the Action Level for places of work should be set in the range 500-1000 Bq m^{-3} time averaged radon gas concentration, equivalent to an annual effective dose range of 3 to 6 mSv. Occupational exposures to radon above the Action Level will be subject to regulatory control. However, it is expected that the normal response to finding that radon levels in a workplace are above the Action Level will be to undertake remedial measures so that the regulations need no longer be applied.

The term “Action Level” has received the connotation of an intervention level in case of prolonged intervention situations (IAEA, ICRP). In the EU guidance, it is

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[8] Recommendations for the implementation of Title VII of the European Basic Safety Standards Directive concerning significant increase of exposure due to natural radiation sources (Radiation Protection 88, 1997, http://europa.eu.int/comm/environment/radprot/88/88.htm).

at the same time a reference level for the identification of places of work and for remedial action. In addition, the part of the exposure to radon below the action level is de facto excluded from the overall exposure, in the same way as “background radiation” is excluded from external exposure.

Control of Exposure of Workers

The important routes of exposure of workers from the processes involving naturally occurring radionuclides are normally external gamma radiation and inhalation of dust. The appropriate control measures may include limitation of exposure time, special arrangements for the storage of bulk materials and dust control. In some cases radon or thoron may present a problem and surface contamination may also need to be considered.

Normal common-sense precautions should be taken to avoid all unnecessary exposures to radiation. Beyond this, assessments should be made to estimate the doses to workers from such natural radionuclides. If actual doses are less than 1 mSv per year then no special precautions are required. If annual doses exceed 1 mSv then the normal scheme for controlling exposures can usually be applied. If doses exceed 6 mSv then it may be appropriate to define a controlled area.

If actual doses exceed 1 mSv but are less than 6 mSv it would be appropriate to consider, for example, whether doses could effectively be reduced and whether there is a possibility that doses increase either over time or as the result of an accident. If doses are low and cannot effectively be reduced and if there is no realistic potential for accidents then few radiation protection measures are likely to be required beyond whatever is necessary to ensure that doses do not increase.

Guidance on the exposure of aircrew is broadly consistent with the annual effective doses referred to above for terrestrial natural radiation sources.

Control of Exposure of the Public

Exposures of the public may arise from the product of a process or from atmospheric or liquid discharges, from re-use of by-product material or from disposal of solid waste. The important routes of radiation exposure of the public are external gamma radiation, inhalation and ingestion.

The requirements for members of the public are laid down in Title VIII of the Basic Safety Standards. Article 47 stipulates that the undertaking shall be responsible for achieving and maintaining an optimal level of protection for the environment and the population.

There is currently no guidance as to which dose constraints should apply to the exposure of members of the public as a result of work activities. A study on current national approaches and operational practice has recently been launched for tendering. It may lead to later recommendations of the Group of Experts.

5 INDUSTRIES PROCESSING NORM

5.1 Introduction

It should be noted that the degree of exposure depends not only on the activity concentration of the material involved but also on any chemical or physical processing which may increase the availability of the material. For example, grinding up raw materials may generate respirable dusts and may also make it easier for radon to escape into the air of the workplace. Processing materials rich in uranium or thorium families at high temperatures (e.g. coal combustion, about 800° C) could enrich airborne dust in some radionuclides of the uranium and thorium series, e.g. Po-210 and Pb-210. At very high temperatures (about 3000° C or above) other nuclides of the uranium or thorium families may also gasify, e.g. Ac-228 may gasify from welding rods doped with Th-232 during welding. Dust and volatile radionuclides may be discharged through the stack or accumulate on filters and need to be disposed of.

Solid residues of some industries may also contain enhanced levels of radionuclides. Disposal or reuse of such materials may be significant especially with regard to public exposure. Scales deposited on steel pipes (oil and gas industry) are a possible source of exposure upon recycling of the metal. Certain types of work activities generate large amounts of slurries which are discharged in a river or in the sea.

5.2 Approaches to the identification of industries

The regulatory control of practices starts with the responsibility of the undertaking to notify the planned practice to the authorities. Work activities in most cases already operate under specific (non-nuclear) licences and thus the work activity is in principle known to the authorities, as well as its general characteristics. The Basic Safety Standards lay the responsibility for identifying which industries are of concern on the national authorities.

The identification will in general proceed first on the basis of types of industries, secondly on the basis of the origin of the ores or the activity of the feed material, or the enhanced concentration in parts of the process.

In cases where all the information is available, the authorities may identify industries immediately. In many cases however, the authorities need information to be provided by the undertaking. For that purpose the authorities may introduce a reporting requirement similar to that for practices (Title III), or make specific requests on a case-by-case basis.

A reporting requirement would relate to decisions whether a work activity would enter a control regime. For identified work activities, the disposal of radioactive substances, or the recycling or reuse of materials containing radioactive substances, may be subject to prior authorisation. In general, the regulatory approach will be that the authorities identify work activities simultaneously taking into account the disposal of residues, and authorise or immediately exempt both the operation of the industry and the disposal of residues.

Criteria for reporting or for the identification of work activities on the basis of the activity concentration would in general make reference to defined concentration levels. Where in the case of practices (exemption and clearance levels) the uncertainty on the derivation of such levels is in general small compared to the broad range of activity concentrations which may occur in the practice, this may not be the case for NORM materials in work activities, since the natural variability in ore concentrations is limited and concentration factors cannot be extremely high. Hence an approach based on levels may be very sensitive to the choice of the level and a certain degree of judgement and pragmatism will need to be applied.

This fact determines the choice among different options available for the identification of the industries on the basis of activity concentrations. The two main options are on the one hand the identification by the authority on the basis of *reference levels*, on the other hand the reporting by industries to the authorities on the basis of the activity in the feed material or in later stages of the process *(exemption)* or in the residues *(clearance)*.

The distinction is made for the sake of clarity, but the authorities may consider a scheme which incorporates features of the two options.

5.3 Reference levels of activity concentration

The Commission launched a study on the "Establishment of reference levels for regulatory control of workplaces where materials are processed which contain enhanced levels of naturally occurring radionuclides" (Radiation Protection 107, 1999). The Article 31 Group of Experts adopted a Guide on the basis of this work (Radiation Protection 95, 1999). It provides reference levels for identifying those industries for which workers exposure should require regulatory control. The reference levels are specified in terms of activity concentrations of the input material. The exposure scenarios are based on a review of relevant industries within the EU and consider both prudently realistic and unlikely, or extreme, situations.
The *reference levels* for nuclides and parts of the decay chain have been defined in relation to marker points in terms of annual effective dose, the key points being those discussed earlier (1 mSv and 6 mSv per year).

In addition, for screening purposes, a fixed radionuclide composition is assumed and the activity of the input material is characterised on the basis of its single most significant nuclide.

The Guide provides assistance to Member States in identifying the processes where the potential exists for significant radiation exposure of workers.

5.4 Principles for the Application of the Concepts of Exemption and Clearance

The schedule of administrative requirements of reporting and prior authorisation, part of Title III, may in certain cases be found useful.
Where clearance levels are applied the material may enter other premises which potentially could be identified as a work activity. If the latter is subject to exemption values, these should logically not differ from the clearance levels, at

least if the same criteria are used and if the different work activities can be covered by a single set of enveloping scenarios. Moreover, in the case of work activities, the amounts of material to be considered are in general very large both for exemption and for clearance, contrary to practices for which clearance often relates to much larger volumes than exemption. Thus for work activities the concepts of exemption and clearance converge and where appropriate the same levels should be used.

Dose criterion

In addition to the above conceptual difference between exemption-clearance for natural radiation sources and for artificial sources, the definition of values for natural sources cannot proceed on the basis of the trivial risk criteria established in Annex I of the Basic Safety Standards. For work activities, individual annual exposures may be much higher than 10 μSv and collective doses can be very important. If one would impose a restriction of 10 μSv it would in general not be practicable to implement a control scheme for such a small increment to the natural radiation background, in fact below the natural variability.

The Article 31 Experts propose to set the criteria for exemption-clearance for work activities at an annual effective dose increment of 300 μSv. The choice of this criterion is justified on the following grounds:

It is comparable to or smaller than regional variations in total effective dose from natural radiation background (external exposure only)[9].

It is coherent with the exemption level proposed for building materials (in RP 112).

It is coherent with any dose constraint which may usefully be considered for the control of effluents (300 μSv recommended by ICRP for practices).

It is below the lower marker point for workers exposure proposed for the control of workers exposure in work activities, for the definition of reference levels.

The dose criterion of 300 μSv should be regarded as an increment to the exposure which would prevail in the absence of the work activity. In some cases the materials resulting from the practice shield exposure to the existing background radiation. In other cases the exempted materials replace natural materials also containing background levels of radioactivity. This has been allowed for when calculating doses per unit activity, using UNSCEAR values as default for the background.

Implications of other legislation and guidance

Radon

As stated in chapter 3.2, radon concentrations in workplaces below 500 Bq m^{-3} are de facto excluded from the overall exposure. In line with the guidance on building materials, radon in dwellings is taken into account only if the reference

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[9] Natural Sources of Ionizing Radiation in Europe, 1993, EUR 14470.

level for future concentrations (200 Bq m^{-3}) would be exceeded. Thus general clearance/exemption levels have been calculated on the basis of exposure scenarios without radon, and it has been checked subsequently whether the corresponding radon concentrations are below 200 Bq m^{-3} in dwellings and 500 Bq m^{-3} in workplaces.

Reference levels of activity concentration

Reference levels calculated for the marker points corresponding to 1 mSv or to 1 mSv (normal assumptions) and 6 mSv (unlikely assumptions) would be higher than exemption/clearance levels for comparable scenarios given that in the latter case the calculation is based on the 300 µSv criterion. This is desirable since otherwise the authorities would have the task of identifying industries which are not subject to the requirement of reporting. For Ra-226 this is not always the case however, since the possible presence of radon in workplaces up to 500 Bq m^{-3} could add a dose of up to 3 mSv, hence above the 1 mSv marker point. The above approach for dealing with radon concentrations arising from NORM materials has not been applied when calculating reference levels for the identification of industries by the regulatory authority.

Such inconsistencies are not dramatic since the reference levels are merely a tool for the authorities, not a regulatory constraint.

Building materials

NORM materials from regulatory control may be reused as building materials. Except for phosphogypsum it has been assumed that there would be a certain dilution in order to meet the technical specifications of the building material. It may seem incoherent that materials are cleared in excess of the index value for exemption of building materials from trade restrictions. There is in that case a certain responsibility of the manufacturers to ensure compliance with the index through an appropriate mix of materials.

Drinking water

Since all public drinking water supplies are regularly checked for the presence of natural radionuclides, this precludes exposures relating to this pathway beyond 100 µSv (Council Directive 98/83/EC). For the sake of simplicity it has been decided not to include this pathway for compliance with 300 µSv.

The Directive does not apply to private wells however. In most Member States it would not be permitted to drill wells for drinking water in proximity to a landfill. Hence this pathway has been ignored, but it must be highlighted that in regions where this situation does arise, or is liable to arise, that Member States monitor either the radioactivity in landfills or in well water.

In such cases where a public water supply might be contaminated, even if this would not result in exposure of members of the public, this may constitute a detriment to the water supplies and hence the question of liability for the resulting cost should be addressed.

In a number of situations the possibility of drinking water contamination would thus require a case-by-case analysis, which may seem contrary to the idea of general clearance.

General clearance and exemption levels

In table 1 the recommended rounded *general* clearance and exemption levels are given[10]. General exemption/clearance levels for NORM are for any type of material. Considerably higher values have been calculated for wet sludges from the oil and gas industry.

It should be noted that the higher *specific* values apply only as long as the material is in the configuration envisaged in the related scenarios. If the material dries out the lower general values should apply. This implies some form of engineering or regulatory control which is not strictly compatible with the idea of clearance. It should be noted that the specific values do not apply either to sludges from other industries in particular where these are discharged with liquid effluent.

Table 1: Rounded General Clearance Levels in kBq/kg

Nuclides	All materials
U-235sec	1
U-235+	5
Pa-231	5
Ac-227+	1
U-238sec	0.5
U-238+	5
Th-230	10
Ra-226+	0.5
Pb-210+	5
Po-210	5
Th-232sec	0.5
Th-232	5
Ra-228+	1
Th-228+	0.5
K-40	5

6 CONCLUSIONS

The more relaxed regulatory approach for work activities has been said to be unfair compared to the strict control of practices. The difference in the approaches reflects the higher potential risk from practices on the one hand, and the high variability of the normal range of exposure to natural radiation sources on the other hand. This different approach is most strikingly apparent from the introduction of a dose criterion for exemption of 300 µSv for work activities rather than 10 µSv for practices. The release from regulatory control of artificial sources is meant to yield nothing but *negligible* exposures. In the case of work activities, a negligible exposure to natural radiation sources is not quite meaningful and levels of radioactivity should correspond to *acceptable* levels of

[10] Guidance adopted by the Article 31 Experts in June 2001, to be published as part II of Radiation Protection 122: Practical use of the concepts of clearance and exemption, part I giving guidance on general clearance levels for practices. (http://europa.eu.int/comm/environment/radprot/122/122.htm)

exposure below which there is little scope for a reduction of exposure through regulatory control.

So far members of the public have expressed very little concern about natural radiation sources, and the more relaxed regulatory approach also reflects this public perception. The NORM industries are worried that this perception may change as a result of the Basic Safety Standards Directive. Their fears are possibly amplified by the fact that some (including regulators) confound reference levels or exemption-clearance levels with a boundary between radioactive and non-radioactive materials and waste. It should be emphasised that there is no such boundary and that it is at all times the responsibility of the competent authority to define the most appropriate management of NORM materials and waste. This of course puts a high burden on regulatory resources.

The essential requirement of the Basic Safety Standards on Member States is to put in place a mechanism for the identification of NORM industries which are of concern. To help Member States with this task guidance has been offered in terms of reference levels and screening levels of activity concentrations in feed material for the identification of industries where part of the radiation protection system for workers may need to be applied.

The alternative approach introducing exemption-clearance levels put the burden of proof on the industry rather than on the regulatory authority. While these levels are in general lower than the corresponding reference levels and in some cases there might be no benefit from regulatory control, it should again be emphasised that the regulatory authority should assess the situation for each type of industry on the basis of the more detailed information provided by the industry, and only then decide on appropriate regulatory control measures..

Whereas for practices a clear boundary between those materials which are subject to regulatory control and those exempted or cleared form the requirements is possible, this is not the case for NORM materials. The ubiquitous nature of NORM materials precludes such a clear distinction.

7 REFERENCES

1. OJ L 80, 27.03.90, p. 26-28
2. Council Directive (89/106/EEC, OJ L 40, 11.02.1998, p. 12-26) on the approximation of laws, regulations and administrative provisions of Member States related to construction products
3. OJ L 330, 05.12.98, p. 32-54.
4. Radiological considerations with regard to the remediation of areas affected by lasting exposure as a result of a past or old practice or work activity (Radiation Protection124,2001, http://europa.eu.int/comm/environment/radprot/124/124.htm)

5. Radiological protection principles concerning the natural radioactivity of building materials (Radiation Protection 112, 1999).

6. OJ L 80, 27.03.90, p. 26-28.

7. OJ L 330, 05.12.98, p. 32-54.

8. Recommendations for the implementation of Title VII of the European Basic Safety Standards Directive concerning significant increase of exposure due to natural radiation sources (Radiation Protection 88, 1997, http://europa.eu.int/comm/environment/radprot/88/88.htm).

9. Natural Sources of Ionizing Radiation in Europe, 1993, EUR 14470.

10. Guidance adopted by the Article 31 Experts in June 2001, to be published as part II of Radiation Protection 122: Practical use of the concepts of clearance and exemption, part I giving guidance on general clearance levels for practices. (http://europa.eu.int/comm/environment/radprot/122/122.htm)