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NUCLEAR ENERGY AGENCY
RADIOACTIVE WASTE MANAGEMENT COMMITTEE

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RWMC Regulators' Forum (RWMC-RF)

REMOVAL OF REGULATORY CONTROLS FOR MATERIALS AND SITES

National Regulatory Positions

Issues with the removal of regulatory controls are very important on the agenda of the regulatory authorities dealing with radioactve waste managemnt (RWM). These issues arise prominently in decommissioning and in site remediation, and decisions can be very wide ranging having potentiallly important economic impacts and reaching outside the RWM area. The RWMC Regulators Forum started to address these issues by holding a topical discussion at its meeting in March 2003. Ths present document collates the national regulatory positions in the area of removal of regulatory controls. A summary of the national positions is also provided. The document is up to date to April 2004.

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FOREWORD

Issues with the removal of regulatory controls are very important on the agenda of the regulatory authorities dealing with radioactive waste management (RWM). These issues arise prominently in decommissioning and in site remediation, and decisions can be very wide ranging having potentially important economic impacts and reaching outside the RWM area. The relevant issues must be addressed and clearly understood by all stakeholders. There is a large interest in these issues outside the regulatory arena. The Working Party on Decommissioning and Dismantling and Co-ordinated Programme on Decommissioning Projects are attentive to these issues and are also interested in an in-depth dialogue with the regulatory authorities.

The RWMC Regulators Forum started to address these issues by holding a topical discussion at its meeting in March 2003. As a basis of the discussion, individual regulatory agencies provided answers to a questionnaire on the national situation.

The present document collates the national regulatory positions in the area of removal of regulatory controls and includes a summary of the national positions. The national positions are up to date to April 2004.

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SUMMARY OF REGULATORY CONTROLS FOR MATERIALS AND SITES

Descriptive Summary

In at least one country (France), there is no release of nuclear materials.

Most of the other countries that responded permit release of materials. Of these, the majority use criteria based on activity concentrations (typically in the range of 1 Bq/g or less, usually lower for alpha emitters), while the others are based on doses (ranging from 10 μSv/a to a few 10's of μSv/a). Dose criteria require a further case-by-case determination for application to specific cases, and some of the countries which use a dose-based release process are investigating the development of activity-based criteria (e.g. USA, Canada).

A few countries cited IAEA documents such as TECDOC-855 and TECDOC-1000, either directly as criteria or more indirectly as guidance. However, the majority of countries using formal criteria publish those criteria in national regulatory documents.

In general, criteria for release of sites are less well-advanced than criteria for release of materials. Several countries have not yet dealt with release of sites at all. Release of sites is most likely to be done on a case-by-case basis, rather than by referring to standards, and the criteria applied are sometimes higher than the criteria applied to release of materials (some dose figures in the range 100 μSv/a to 300 μSv/a were quoted in the responses; the USA unrestricted release limit is 250 μSv/a). This probably reflects the higher degree of control that can continue to exist over subsequent use of sites, even after formal regulatory control ceases, as well as the greater difficulty of verifying that a site has been decontaminated to extremely low levels as compared with verifying the same for materials.

Replies Regarding Criteria for Termination of Controls on Radioactive Materials and Contaminated Sites

It is rather difficult to fully compare the 13 replies as various levels of details have been given and some information is missing.

The French system does not involve any site or waste liberation; products and sites stay within the "nuclear industry".

Japan has no clearance or site release system yet. The NRC made proposals and a working group of the NISA is studying clearance verification procedures.

The other countries have a clearance system. The legal frameworks are different: the procedures related to termination of controls may be clearly described in a legal text and/or indicated in particular licences on a case-by-case basis.

Reference documents mentioned:

Belgium: Royal Decree of 20th July 2001 "General Radioprotection Regulation for the protection of the workers, the population and the environment"

Canada: regulatory standard on clearance / exclusion levels is in preparation. Current "modus operandi" is based on TECDOC-1000 or TECDOC-855 type levels ("10s of μSv/y")

Finland: STUK has issued a Guide (YVL 8.2) on clearance of radioactive materials from nuclear facilities. There is no relevant legal text about decommissioning (not currently needed).

Germany: Clearance is regulated in the Radiation Protection Ordinance: *Verordnung über den Schutz vor Schäden durch ionisierende Strahlen (Strahlenschutzverordnung - StrlSchV*); Federal Gazette part 1, No. 38, 26. July 2001 (amended). Sect. 29 contains the regulations on clearance, Annex III Table I contains the clearance levels, Annex IV contains additional provisions for the implementation of clearance.

Italy: the National Standard Organization has approved (May 2002) a Standard on "Solid materials from nuclear plants – Radiological methods and Procedures for the Clearance"; There are two relevant Legislative Decree (n° 230 and 241) transposing the various EURATOM Directives. Regarding sites, the "general criteria for unrestricted release" is adapted on a case-by-case basis.

Hungary: exemption levels are regulated by the Decree 23/1997 and clearance is regulated by the Decree 16/2000 from the Health Minister. There is no special regulation for the release of sites.

Norway: no legal limits; NRPA follow international recommendations: TECDOC-1000, EC Radiation Protection 122, IAEA SS 111-P-1.1, EU standards

Slovak Republic: new set of rules issued in 2000; derived limits issued in 2001 (in accordance with IAEA guidance)

Spain: no generic clearance levels but administrative framework in Spanish Royal Decree 1836/1999 on Nuclear and Radioactive Facilities.

Sweden: clearance of material and oil is regulated by SSI FS 1996:2. Clearance of buildings needs case-by-case study.

Switzerland: regulatory control of clearance of materials and sites is defined in Regulatory Guide HSK-R-13 (Feb 2002)

United Kingdom: "Exemption Orders" (exemption from the requirements of RSA 93), e.g. "Substances of Low Activity Exemption Order". The UK nuclear industry is developing a Code of Practice. HSE is planning to issue up-to-date delicensing policy guidelines.

United States: USNRC regulations in 10 CFR Part 20, Subpart E; USDOE Order 5400.5, "Radiation Protection of the Public and the Environment"; "Health Physics Position Data Base," NUREG/CR-5569; Regulatory Guide 1.86, entitled "Termination of Operating Licenses for Nuclear Reactors"; Fuel Cycle Policy and Guidance Directive FC 83-23, entitled "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Byproduct, Source or Special Nuclear Materials Licenses".

The following specific cases were described:

Italy: decommissioning plan for the Caorso NPP; authorization by Ministerial Decree 4/8/2000 from Ministry of Industry (table of activity by radionuclide)

Hungary: uranium mine (dose constraint of 300 μSv/y and derived limits given in a table

Norway: two examples - retrieval of a near surface LILW repository (IFE Kjeller site) and environmental cleanup in the Nitelva River

Spain: two examples - Andujar mill factory decommissioning project and Vandellòs 1 NPP.

Sweden: two examples - Agesta PHWR waste treatment facility and large laboratory in Studsvik (ACL)

Switzerland: underground prototype nuclear power plant (Lucens); two research reactors at the research institute PSA (Würenlingen)

Table. **Summary of replies regarding criteria for termination of controls on radioactive materials and contaminated sites**

Member State	Materials	Sites	Remarks
Belgium	Liquids may never be released to the ground; they may be released in water streams if the concentration in radionuclides is lower than 0,1 % of the AIL (limits in Bq/l given in Royal Decree). Concentration of radionuclides in gases must be lower then limits (Bq/m³) given in Royal Decree. Clearance of solids is based on the following values: Individual dose < 10 µSv/y. Collective dose < 1 manSv/y. Activities in Bq/g are given in Royal Decree However, if half-life is less than 6 months, a nearly complete decay (at least 10 half-lifes) is required. FANC may also allow clearances "case-by-case".	Decommissioning must be approved by FANC. ONDRAF-NIRAS is notified and give advices. An Environmental Impact Study is required in some cases (Class 1 installations).	Decommissioning of some sites is being studied.
Canada	Public dose 1 mSv/y. Modus operandi for releases: Effluents: small users and facilities:10s of µSv/y Solids: see licences (may be site-specific).	Public dose 1 mSv/y. Modus operandi for releases: Other than mines: 10s of µSv/y. Tailings , sites (U, Ra): site-specific levels, must be below dose limits.	NORM not within CNSC's mandate.
Finland	Effluents : Individual dose < 10 µSv/y Collective dose < 1 manSv/y. Solids may be unconditional or conditional.	In mid 1990's: remediation of pilot uranium mining and milling plant, based on sound engineering.	

	Unconditional: max. surface contamination (see transport regulation) plus activities below: 0,1 Bq/g for alpha 1 Bq/g for beta-gamma 10 Bq/g for weak beta-gamma. Conditional: case-by-case, up to 10 times higher.		
Germany	Public dose 10 µSv/a Collective dose 1 manSv/a Various clearance options exist for • unconditional clearance; • clearance of materials or buildings for a specific purpose. Each clearance option associated with a set of clearance levels for ~ 300 nuclides. Clearance also applies to liquids (such as oil) while effluents (authorized discharges) are licensed separately.	Public dose 10 µSv/a. Collective dose 1 manSv/a. This clearance option associated with a set of clearance levels for ~ 300 nuclides. Background (such as fallout – Cs 137, natural U, Th, K 40) can be subtracted.	1. The clearance procedure requires a written permit from the authorities. The licensee is responsible for implementation and checking for compliance with clearance values. 2. Compliance of clearance with the collective dose criterion (sum of doses from all clearance options) has been explicitly investigated and approved. 3. NORM is regulated in a separate part of the Radiation Protection Ordinance.
Hungary	Effective dose 30 µSv/y and clearance is the optimum solution.	A dose constraint of 300 µSv/y has been applied for a closed uranium mine. Derived limits: Rn emission: 0,74 Bq/m²/s Activity: < 0,18 Bq/g (top 15 cm) and < 0,55 Bq/g (15 cm below).	(note : inside mine buildings, radon concentration, activities and doses are also limited – see table).
Italy	Activity < 1 Bq/g Half-life < 75 days If not: case-by-case study to demonstrate Effective dose < 10 µSv/y Collective dose < 1 manSv/y (and exemption is the optimum option).	Activity < 1 Bq/g Half-life < 75 days If not: case-by-case study to demonstrate Effective dose < 10 µSv/y Collective dose < 1 manSv/y (and exemption is the optimum option).	For Caorso NPP, a table of activities has been given.
Japan			No system in place (being studied).

Norway	TE-NORM / Scale: 10 Bq/g Ra-226.	In the examples: Clay and sediments: Am-241 < 10 Bq dw of clay (Kjeller and Nitelva River) Cs-137 < 100 Bq/g dw of clay (Kjeller).	
Slovak Rep.	Individual dose < 10 µSv/y Collective dose < 1 manSv/y.		Derived clearance limits based on 5 radiotoxicity classes : from 0,3 to 3000 Bq/g for volume and 0,3 to 3000 Bq/cm² for surface contamination.
Spain	For Vandellos 1: Unconditional: 10^{th} of µSv/y leading to various clearance levels (see tables). Conditional: in general based on EC documents.	Andujar: Effective dose to individual in the critical group < 100 µSv/y. Residual Ra-226 concentration < 0,2 Bq/g (top 15 cm) or < 0,6 Bq/g (15 cm below). (under review for Vandellos 1).	For Vandellos 1: derived clearance limits divided in 5 radiotoxicity classes: from 0,3 to 3000 Bq/g for volume contamination. Surface contamination: Alpha: 0,1 Bq/cm² Beta-gamma: 0,4 Bq/cm² Weak beta-gamma: 4 Bq/cm².
Sweden	General activity < 0,5 Bq/g For alpha: 0,1 Bq/g.	Case-by-case Agesta PHWR: 5000 Bq/m² (beta-gamma) and 500 Bq/m² (alpha).	
Switzerland			Values not provided / Reference is made to Regulatory Guide HSK-R-13. Clearance of "zone" criteria seems based on a dose constraint of 10 µSv/y.
United Kingdom	Solids are exempt if substantially insoluble and activity < 0,4 Bq/g.	Sites may be released when the HSE is satisfied that there is "no danger" from ionising radiation. Procedure may include lengthy period of institutional control. Up-to-date delicensing policy guideline to be issued.	Materials and site may be exempted from the obligations of RSA 93 by ad hoc "Exemption Orders".

United States	NRC has requirements in 10 CFR Part 20 for conducting surveys of solid materials. Solid materials can be released for any unrestricted use if the survey does not detect radioactivity from licensed operations on the material or, if it does detect radioactivity, the amount is below a level that is considered to be protective of public health and safety and the environment. Part 20 does not specify these levels. In the absence of a regulation, disposition decisions rely on existing guidance, which is based primarily on the ability of survey meters to measure the radioactivity level on, or in, the solid material. The guidelines include Regulatory Guide 1.86, Fuel Cycle Policy and Guidance Directive FC 83-23 for materials licensees and, for reactor facilities, Office of Inspection and Enforcement Circular 81-07 and Information Notices 85-92 and 88-22. Also, solid materials can be released on a case-by-case basis if approved by the NRC staff..	U.S. EPA risk range for sites is 10^{-4} to 10^{-6} lifetime cancer risk. U.S. NRC public dose limit for cleanups is 0.25 mSv/yr plus ALARA. EPA and NRC have an MOU for sites with dual jurisdiction. U.S. Department of Energy regulations are similar to those of NRC and EPA.	TENORM and NORM regulated by States.

NATIONAL POSITIONS AND EXAMPLES

CONTROLS FOR MATERIAL AND SITES – CANADA

1. Regulatory requirements

a) Public dose limit (1 mSv)

b) Limit for public hearings on contaminated lands (1 mSv)

c) Exemption levels in regulations are based on absolute quantity, not concentration

d) Case-by-case exemptions possible where risk is shown to be low

e) Regulatory standard on clearance/exclusion levels is in preparation

f) NORM (not associated with use for radioactive properties) is not within the CNSC's mandate

2. Current modus operandi - Materials

a) Effluents (liquids and gases)

   i. Small users: Licence conditions, often based on TECDOC-1000 type levels (10s of μSv, generic pathways) or may be site-specific

   ii. Facilities: Derived Emission Limits in licenses are based on site-specific pathways analyses, 1 mSv dose limit, but regulatory action levels are 10s of μSv

b) Solids

   i. Small users: Typically TECDOC-855 type levels (10s of μSv, generic pathways), but may also be site-specific

   ii. Facilities: Internal procedures (referenced in licences), may use either generic or site-specific analyses

   iii. Landfills receiving such materials: CNSC-sponsored studies (past and present) undertaken to verify that hazard is low

3. Current modus operandi – Sites

a) Nuclear facilities (practices) other than mines: site-specific limits for unconditional release set in decommissioning licences, 10s of μSv

b) Mine tailings, sites contaminated with long-lived nuclides (U, Ra) where unconditional release is impossible: site-specific levels for release to institutional control

4. Institutional control

c) The only long-term institutional control currently accepted is continued licensing for possession (e.g. government agency controlling use of the site holds a CNSC license).

a) Other forms of institutional control are possible in theory, but none has been proposed or accepted.

b) Contaminated sites (other than non-nuclear-cycle NORM sites) owned or controlled by competent organizations (mining companies, governments) are being brought under license.

c) Some small contaminated sites are under temporary institutional controls which ensure that demolition or renovations can only be done under license, although current occupation is exempted from licensing.

REMOVAL OF CONTROL FOR MATERIALS AND SITES: STATUS IN FINLAND

In Finland no decommissioning projects of major facilities subject to nuclear or radiation legislation are underway or even foreseen in near future. Remedial actions at a pilot uranium mining and milling site were terminated in mid 1990's and a couple of years ago the site was relaxed from regulatory controls, apart from some land use restrictions recorded in the pertinent register. That remedial action was based rather on sound engineering approach than on rigorous application of removal-of-control criteria and related assessments.

Currently, there are no regulations or guidance documents concerning removal of controls in the context of decommissioning. STUK has issued a Guide (YVL 8.2) on clearance of radioactive materials arising from nuclear facilities. That Guide, however, applies only to the limited quantities of materials arising from the operation of the facilities. The Guide is based on the following radiation protection criteria:

- Highest individual doses < 0,01 mSv/a
- Collective dose commitment from one year's practice < 1 manSv or ALARA

There are two options: unconditional or conditional clearance. The former is based on surface contamination upper bounds equal those in transport regulations. Besides that, the following activity concentration upper bounds are given:

- 0,1 Bq/g for alpha emitters
- 1 Bq/g for significant beta-gamma emitters (Co-60, Sr-90, Cs-137…)
- 10 Bq/g for weak beta-gamma emitters (H-3, C-14, Cr-51, Fe-55, Ni-63…).

Conditional clearance is based on a case-by-case analysis and judgement and no fixed upper bounds are given. Then, some information of the further fate of the cleared material need to be known. In practice, the activity concentrations in conditionally cleared materials may be approximately ten times higher than the upper bounds for unconditional clearance.

In Finland, clearance of materials from NPPs works in practice pretty well; there has been no problems with public acceptance. Unconditional clearance is convenient for clearing materials which accumulate continuously while conditional clearance is a flexible way to take care of e.g. scrap metal from major repair works.

Currently, the quantities of cleared materials in Finland annually amount to a few hundreds of tonnes at the maximum. Decommissioning of NPPs would imply at least tenfold material streams to be cleared annually. Additionally, removal of control for buildings and sites would be an issue to be resolved. Thus, we welcome international discussion on these subjects in view of future development of our regulations.

REMOVAL OF CONTROLS FOR MATERIAL AND SITES: THE SITUATION IN FRANCE

First experience in decommissioning in France has shown that a national system has to be put in place to deal with waste elimination and site cleaning up activities in order to allow a consistent, safe, transparent and industrially applicable management of these matters. A system founded on successive lines of defence has been put into enforcement, which does not involve any site nor waste release ("liberation" in French), as it is considered that the criteria associated are always prone to discussion and contradiction.

This choice stems from the following findings:

- Experience has shown that systems relying only on measurements to determine whether materials are contaminated or not are susceptible to fail when applied to large quantities and kinds of objects, like the objects encountered when decommissioning a nuclear facility.
- The definition of general clearance levels based on scenarios of recycling of materials, like metals or concrete, taking into account current national industrial practice, materials flows ("fluxes" in French), and technologies is prone to discussion and special uses of these materials can lead in some cases to higher level of exposures of individuals. There have been some cases in France where non-proper use of low-level radioactive materials has been put into evidence and has led to social rejection.
- As it is usual in the safety field, a good mean to improve the overall safety of a system is to provide several successive and independent lines of defence. Hence, the line of defence consisting of radioactive measurement should be supplemented by another line of defence entirely independent from any measurement process.

The French national system for waste elimination and site remediation is based on the following concepts:

- "nuclear waste", waste prone to have been contaminated or activated, is segregated from "conventional waste" using a system involving successive lines of defence, and hence, building a very high level of confidence that no "nuclear waste" will be eliminated without control in conventional waste eliminators or recycling facilities. The first line of defence is provided by the "zoning" of the facility based on a functional analysis and history of the facility; the second line of defence is provided by implementation of measurement procedures, which are defined and justified. The definition of these lines of defence is under the responsibility of the operator;
- "nuclear waste" is eliminated in dedicated facilities or repositories (a VLLW repository will begin operation in 2003), or in conventional facilities under the condition of a special authorisation based on a radiological impact study and a public inquiry; recycling of "nuclear waste" is only permitted within the nuclear industry;

- a global safety evaluation of the nuclear site is conducted after decommissioning in order to define possible use restrictions as well as surveillance schemes to preclude future unwanted practices on the site. In all cases, minimum restrictions will be put into enforcement in urbanisation plans in order to ensure sufficient precaution when planning future uses of the ground or the building.

REMOVAL OF CONTROL FOR MATERIALS AND SITES: THE SITUATION IN GERMANY

Legislation

The main parts of the nuclear regulatory framework in Germany with respect to clearance are the Atomic Energy Act [1] which contains the definition of "radioactive material" and the legal basis for clearance and the Radiation Protection Ordinance (RPO) of July 2001 0 which contains specific regulations for clearance and a list of clearance levels. These regulations apply to clearance of materials and of sites originating from (the operation or decommissioning of) nuclear installations as well as from other authorised use of radioactivity. The RPO has transformed the EURATOM Basic Safety Standards (BSS) [3] into national legislation.

The sets of clearance levels listed below are each based on radiological models which are compatible to international principles using a dose criterion of 10 μSv/a individual dose and of 1 manSv/a collective dose. The clearance levels have been derived in a number of studies some of which adapt recommendations of the European Commission ([4], [5], [6]) to the situation in Germany.

Beside the Atomic Energy Act and the Radiation Protection Ordinance, a number of technical standards and guidelines are relevant for clearance, in particular DIN 25457 [7]. These technical standards and guidelines cannot be treated here in detail.

Clearance Options and Clearance Levels

Sets of clearance levels exist for a number of clearance options. Each set contains clearance levels for about 300 radionuclides (those for which exemption levels exist in the BSS). The following clearance options are distinguished in section 29 para. 2 of the RPO 0:

1. unconditional clearance
   a. of all solid materials for reuse, recycling or disposal including building rubble of less than 1000 Mg per year,
   b. of liquids,
   c. of building rubble and soil of more than 1000 Mg per year,
   d. of buildings for reuse (this includes eventual demolition),
   e. of sites;
2. clearance
   a. of solid materials for disposal (on landfills or by incineration),
   b. of liquids for disposal by incineration,
   c. of buildings for demolition only,
   d. of metal scrap for melting only.

There is one set of mass specific clearance levels for each clearance option 1.a, 1.c, 1.e, 2.a, and 2.d. Clearance options 1.b and 2.b refer to liquids for clearance only (i.e. not to authorized discharges) and use the same clearance levels as options 1.a and 2.a, respectively. In addition, a set of

surface specific clearance levels has to be applied in cases where the material has a measurable surface (e.g. metal scrap). The clearance levels for options 1.d and 2.c are expressed as surface specific values (measurements at building surfaces, e.g. with in situ gamma spectroscopy). Table 1 below provides an overview of clearance levels for a selection of relevant radionuclides for all clearance options listed above. The full table is contained in Annex III Table 1 of the RPO 0.

Table 1. **Clearance levels of Annex III Table 1 of the German RPO 0 for all clearance options for a choice of relevant radionuclides (the column numbers in line 3 refer to the numbering of the table in the RPO; the full list in the RPO contains clearance levels for approximately 300 radionuclides)**

		Unconditional clearance of				Clearance of		
Radio nuclide	Surface contam-ination	solid materials* and liquids	building rubble and soil > 1000 Mg/a	sites	buildings for reuse	solid mater-ials or liquids for disposal	buildings for demol-ition only	metal scrap for melting
	[Bq/cm²]	[Bq/g]	[Bq/g]	[Bq/g]	[Bq/cm²]	[Bq/g]	[Bq/cm²]	[Bq/g]
1	4	5	6	7	8	9	10	10a
H-3	100	1000	60	3	1,000	1,000	4,000	1,000
C-14	100	80	10	0.04	1,000	2,000	6,000	80
Fe-55	100	200	200	6	1,000	10,000	20,000	10,000
Co-60	1	**0.1**	0.09	0.03	0.4	4	3	0.6
Sr-90+	1	**2**	2	0.002	30	2	30	9
Cs-137+	**1**	0.5	0.4	0.05	2	10	10	0.6
Eu-154	1	0.2	0.2	0.06	*0.7*	7	6	0.5
U-234	1	0.5	0.4	--	1	9	10	2
Pu-242	0.1	0.04	0.04	0.04	0.1	1	2	0.3
Am-241	0.1	0.05	0.05	0.06	0.1	1	3	0.3
+: the suffix "+" or "sec" refers to progeny which is already contained in the clearance level of the parent nuclide. The full list of progeny is provided in Annex III Table 2 RPO *) with exception of building rubble > 1000 Mg/a								

Requirements for the Application of the Clearance Levels

Additional requirements for the application of the sets of clearance levels listed above are listed in Annex IV of the German RPO 0 of which the following list is only a subset.

- The use of surface specific clearance levels (column #4) is limited to cases where a measurable surface exists (this is the case e.g. for metal scrap, but not for building rubble, soil or other bulk goods).
- Distinction has been made between solid materials (building rubble and soil) below and above 1000 Mg/a (columns #5 and 6 in Table 1). The reason is that large quantities require more restrictive scenarios leading to lower clearance levels.
- Any of the options for unconditional clearance (columns #5 to 8) do not require any (radiological) conditions on the further use, recycling, disposal or final destination of the materials.
- Any clearance for disposal (column #9) requires that the material is definitely disposed of on a landfill or in a waste incineration plant and will not be recycled.

- Clearance of buildings (columns #8 and 10) is recommended to be performed prior to demolition of the building. Any building rubble originating from a building which has been cleared prior to demolition does not require additional clearance measurements.
- Clearance of sites (column #7) refers to that part of the activity only which has been introduced by the practice going on on that site. Background activity (natural, fallout etc.) can be deducted. Mass specific clearance levels can be converted into surface specific levels using the penetration depth.
- Any clearance of metal scrap (column #10a) for recycling requires that the material is definitely melted in a (conventional) melting plant and will not be directly re-used.
- The use of the clearance levels listed above can be replaced by a site-specific radiological analysis on the basis of the dose criterion of 10 μSv/a.

It needs to be emphasized that after clearance all requirements of the German (and international) regulatory framework for conventional waste still apply. Annex IV of the German RPO 0 also contains requirements on averaging criteria and the treatment of cases where more than one radionuclide is present which are listed below.

Averaging Criteria for Clearance Measurements

A detailed system of averaging criteria has been developed for each clearance option which accompany the sets of clearance levels described above. Averaging masses and surfaces are provided in Annex IV of the German RPO 0. These averaging criteria match the predominant measurement techniques which are used in clearance measurements (see below). These averaging criteria are summarised in Table 2.

Table 2. **Averaging criteria for clearance measurements according to Annex IV of the RPO**

Clearance option	Averaging area or mass	Matching measure-ment technique
averaging mass for measurements in a release measurement facility for any kind of material	in the range of up to 300 kg	release measurement facility
averaging mass for measurements of building rubble	1000 kg or more	release measurement facility
averaging surface area for measurements of metal and other items except building surfaces and land (sites)	1000 cm²	contamination monitor
averaging surface area for measurements of building surfaces when the building shall be reused	1 m²	in situ gamma spectrometer with collimator
averaging surface area for measurements of building surfaces when the building is to be dismantled without prior reuse	more than 1 m²	in situ gamma spectrometer with / without collimator
averaging surface area for measurements of land (sites)	100 m²	in situ gamma spectrometer with / without collimator

It can be seen from Table 2 that the most restrictive averaging criteria are applicable for metal and items where the possibility of direct reuse cannot be ruled out. Larger averaging masses apply for building rubble where no direct reuse but only recycling is possible. The averaging area for buildings is smaller when reuse of the building may be possible than when the building will be dismantled without prior reuse. The largest averaging area is applied for clearance of land (sites).

Nuclide Vectors, the Summation Formula and the "10 % Rule"

In the usual case where more than one radionuclide is present it is necessary to establish a procedure how to combine these nuclides to form a so-called nuclide vector, i.e. the list of activity percentages for each nuclide normalised to 100 % total activity contribution. Section 29 in combination with Annex IV of the RPO 0 contains a provision how to apply the clearance levels in such cases. The summation rules

$$\sum_i \frac{C_i}{R_i} \leq 1 \qquad \sum_i \frac{A_i}{O_i} \leq 1$$

apply where i is the index over all nuclides present, C_i and A_i are the actual mass and surface contamination of radionuclide i, R_i and O_i are the mass and surface specific clearance levels for nuclide i.

Apart from the averaging criteria and this regulation for nuclide vectors, the RPO also contains a useful provision how to deal with those radionuclides in nuclide mixtures which contribute to the total potential dose from clearance only in a negligible way. According to the so-called "10 %-rule", those nuclides may be neglected (i.e. discarded from the nuclide vector) which contribute to the normalised summation formulae above by not more than 0.1 (10 %) in total. The rationale is that if the summation formulae reach 1 (100 %) then the resulting dose will not exceed the trivial value of 10 µSv/a. Therefore, a tenth of that dose or 1 µSv/a can totally be ignored and is used as a cut-off criterion. Only the most relevant nuclides whose share in the summation adds up to at least 90 % need to be kept.

Granting and Implementation of Clearance

The licensee is responsible for his material management, including the choice of clearance options listed above, the distribution of his material into these options as well as the implementation of suitable measurement procedures and quality assurance schemes.

According to Section 29 para. 2 of the RPO 0, the clearance procedure requires a written permit which may be issued by the competent authorities upon request. The authorities have flexibility how to regulate the clearance procedure in each particular case (Section 29 para. 4 RPO), i.e. the use of the clearance levels described above or of site-specific clearance levels may be prescribed, the conditions for the techniques used for clearance measurements may be stipulated etc.

The actual clearance measurement, i.e. checking the compliance of the residual activity in or on a particular material, building or site with the clearance levels, is performed under the responsibility of the licensee's appointed radiation protection officer. The results of these measurements may or may not be additionally checked by the authority or an independent expert acting on its behalf. After compliance has been verified, the material will be reused, recycled or disposed of according to the clearance option.

References

[1] Atomic Energy Act – Gesetz über die friedliche Verwendung der Kernenergie und den Schutz gegen ihre Gefahren (Atomgesetz), 23. December 1959, amended by Art. 1 G v. 22. 4.2002, Federal Gazette part 1, 1351.

[2] Radiation Protection Ordinance (RPO) – Strahlenschutzverordnung (StrlSchV); Federal Gazette part 1, No. 38, 26. July 2001 (amended).

[3] Council 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 ionizing radiation; Official Journal of the European Communities, ISSN 0378-6978, L 159, Vol. 39, 29.06.96.

[4] European Commission: Recommended radiological protection criteria for the recycling of metals from the dismantling of nuclear installations; Radiation Protection No. 89, Luxemburg, 1998, ISBN 92-828-3284-8.

[5] European Commission: Recommended radiological protection criteria for the clearance of buildings and building rubble from the dismantling of nuclear installations; Radiation Protection No. 113, Luxemburg, 2000, ISBN 92-828-9172-0.

[6] European Commission: Practical Use of the Concepts of Clearance and Exemption – Part I: Guidance on General Clearance Levels for Practices; Recommendations of the Group of Experts established under the terms of Article 31 of the Euratom Treaty; Radiation Protection No. 122, Luxemburg, 2000.

[7] German Institute on Standardization (Deutsches Institut für Normung – DIN): "Activity Measurement Methods for the Release of Radioactive Waste Materials and Nuclear Facility Components", DIN 25457 parts 1, 2, 4, 5, 6, 7, Beuth-Verlag, Berlin.

REMOVAL OF CONTROL FOR MATERIALS AND SITES – HUNGARIAN SITUATION

The Act on Atomic Energy CXVI of 1996 authorises the Minister of Health, Social and Family Affairs to determine in a decree the **dose limits** for employees engaged in the field of atomic energy applications and those of the population's radiation dose. The executive order of the Act is in this field the Ministerial Decree 16/2000 (VI. 8.). The Decree requires that regulatory rules must be applied to all activities involving the use of atomic energy and ionising radiation.

Exemption levels are regulated in accordance with the regulations of the European Union by the Decree 23/1997. (VII. 18.) issued by the Minister of Health.

The procedure of **clearance** from regulatory control is regulated by the Decree 16/2000. (VI. 8.) of the Minister of Health. According to this Decree substances containing radionuclides can be released from regulatory control if

- the projected annual individual dose originating from its re-use, re-utilisation or its handling as non-radioactive waste does not exceed 30 μSv effective dose, and
- the analysis proves that the clearance is the optimum solution.

There is no special regulation for the release of sites from regulatory control. In the case of the recultivation of the closed uranium mine the competent authority defined a dose constraint of 300 μSv/year, and the derived limits were the following:

Surface facilities	Rn exhalation	0.74 Bq/m^2/s
	Activity concentration in soil: in the upper 15 cm thick layer	background + 180 Bq/kg
	Activity concentration in soil: below 15 cm in depth	background + 550 Bq/kg
Inside buildings	Rn concentration	background + 30 Bq/m^3
	Gamma-dose rate average of workplace:	background + 200 nGy/h
	1 m from wall, floor:	background + 200 nGy/h
	Fixed alpha contamination (on floor and wall):	0.5 Bq/cm^2

Radiation protection requirements of the remediation of surface facilities, buildings and their immediate surroundings

REMOVAL OF REGULATORY CONTROL OF SITE AND MATERIALS IN ITALY

Legislation

Legislative Decree no. 230 of 17 March 1995 published in the Supplement to Italian Republic's Official Journal no. 136 of 13 June 1995, implementing six EURATOM Directives on radiation protection (EURATOM 80/836, 84/467, 84/466, 89/618, 90/641 and 92/3). The Decree replaced the previous DPR n°185 issued in 1964 and establishes radiation protection requirements for workers, public and environment.

Legislative Decree no. 241 of 26th May 2000 has transposed EU (European Union) directive 96/29/Euratom laying down basic safety standards for the radiation protection of workers and the public; the standards laid down in the directive incorporate the 1990 Recommendations of the International Commission on Radiation Protection (ICRP) into EU radiation protection legislation. Decree no. 241 has modified and integrated Legislative Decree no. 230 of 1995.

Site and material release

A general criterion is in force in Italy for unrestricted release. Radioactive materials can be unconditionally released from regulatory control if the radionuclides concerned comply with both a concentration and a radioactive half life threshold:

- Activity concentration ≤ 1 Bq/g, and
- half-life < 75 days.

If both conditions above are not complied with, a specific authorisation is required for releases, reuse and recycle of the materials concerned. The authorisation is given on the basis of a case-by-case analysis which has to demonstrate compliance with the basic 'below regulatory concern' criterion below, both conditions of which must be met:

a) Effective dose ≤ 10 μSv/year, and

b) either Effective collective dose ≤ 1 man·Sv/year or the analysis demonstrates that exemption is the optimum option.

An instance of application of the above criteria for solid materials is the recent authorisation, the Ministerial Decree 4/8/2000 from Ministry of Industry, now Ministry of Production, for some preliminary activities in the framework of the decommissioning plan for the Caorso NPP, thresholds are shown in the following table.

No specific criteria are provided for in Italian legislation for the release of radiologically regulated facilities and/or sites, although the general criteria stated above obviously applies; thus, a case by case analysis is employed.

Release criteria stated above (pre-estabished dose criteria) are applied making use of pathway analyses with a conservative approach, although unrealistic scenarios are excluded; time frame considerations are also taken into account.

Furthermore, it is worthwhile mentioning that, on May 2002, the National Standard Organization (UNI) approved a new Standard on"Solid materials from nuclear plants - Radiological methods and procedures for the clearance". To the drafting of this standard all the interested parts were involved, including the regulatory body. The main objectives of this standard is to give reference procedures for the verification of the clearance level in site and material release.

Nuclide	**Metal material**		**Building rubble**		**Other materials**
	Bq/g	Bq/cm^2	Bq/g	Bq/cm^2	Bq/g
H3	1	10000	1	10000	0.1
C14	1	1000	1	1000	0.1
Mn54	1	10	0.1	1	0.1
Fe55	1	1000	1	10000	0.1
Co60	1	1	0.1	1	0.1
Ni59	1	1000	1	10000	0.1
Ni63	1	1000	1	10000	0.1
Sr90	1	1	1	100	0.1
Sb125	1	10	1	1	0.1
Cs134	0.1	1	0.1	1	0.1
Cs137	1	10	1	1	0.1
Eu152	1	1	0.1	1	0.1
Eu154	1	1	0.1	1	0.1
α emitters	0.1	0.1	0.1	0.1	0.01
Pu241	1	1	1	10	0.1

A SUMMARY OF JAPAN'S SITUATION OF THE REMOVAL OF CONTROL FOR MATERIALS AND SITES

(1) Clearance (Removal of control for materials)

- A clearance system has not been introduced into Japan's regulations.
- The Nuclear Safety Commission, an advisory body for nuclear safety issues, made proposals for clearance levels in 1999, based on own calculation referring IAEA TECDOC-855. The Commission also made recommendation for principles of verification procedures for clearance practices in 2001.
- The Nuclear and Industrial Safety Agency, a regulatory body, established a special working group of academics and experts in order to study verification procedures for clearance practices in detail in March 2002. The special working group is expected to report within two years.

(2) Site release (Removal of control for sites)

- No site of nuclear facilities has been released in Japan.
- Site release criteria have not been established. The Nuclear Safety Commission has not yet started a study for the criteria.

(3) Decommissioning of nuclear power plants

- According to the Law of the Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors, licencees of nuclear power plants are required to submit a prior notification to the regulatory body for review in order to start decommissioning. In the notification, name of the facility to be dismantled, decommissioning schedule and dismantling method, etc. should be mentioned.
- The Japan Atomic Power Co. started decommissioning of the Tokai Power Plant as the first commercial nuclear power plant to be dismantled in Japan. The decommissioning of The Tokai Power Plant started in December 2001 and will finish in March 2018.
- In the decommissioning plan of Tokai Power Plant, the amount of radioactive waste arising from decommissioning is estimated at approximately 63,600 tons. If a clearance system is introduced, approximately 45,400 tons from among them will be cleared (treated as non radioactive wastes). Until a clearance system is introduced, those wastes will be stored as radioactive wastes.
- According to the decommissioning plan in Tokai Power Plant, site release is not envisaged. The site will stay under control after decommissioning as the environmental monitoring area for the neighbouring Tokai Power Plant No.2 of the same licencee.

REMOVAL OF CONTROL FOR MATERIALS AND SITES RECENT LEGAL BASIS FOR CLEARANCE AND REMEDIATION IN SLOVAK REPUBLIC

In 2000[1] a new set of rules were issued for clearance and remediation in Slovakia. The basic clearance principle (based on limit of effective dose for individual 10 micro Sv/y and collective effective dose 1manSv/y from each exempt/ clearance act) became the general principle i..e. the alternative for release of such materials where the derived limits were also issued. It enables to release the material with contamination higher then derived limits if it is used the way resulting to dose lower then dose limit.

New supporting Slovak derived limits were issued in 2001[2] in accordance with IAEA guidance [3,4] on exemption/clearance principles based on individual nuclides activities (see Table I).

Table I. **Clearance levels for all types of cleared material**[2]

Type of radioactive contamination	**Radiotoxicity class**				
	1	2	3	4	5
Materials, solid substances and items contaminated/activated through the whole volume	Clearance levels for specific activity [Bq.g^{-1}]				
	0.3	3	30	300	3 000
Materials and items contaminated on the surface	Clearance levels for surface activity [Bq.cm^{-2}]				
	0.3	3	30	3 00	3 000

Nuclides are grouped to 5 classes regarding their radiotoxicity (Table II). A permission of Regulatory Authority under Ministry of Health (Radiation protection) for each type of release act is necessary (with exemption of individual small tools /items with surface less then 150 cm^2 and mass less then 10 kg). Measurement system including instrumentation and calculation of some nuclides activities based on nuclides vector must be justified and approved.

Table II. **Radiotoxicity classes**[2]

Class	Radionuclides
1	Na-22, Na-24, Mn-54, Co-60, Zn-65, Nb-94, Ag-110m, Sb-124, Cs-134, Cs-137, Eu-152, Pb-210, Ra-226, Ra-228, Th-228, Th-230, Th-232, U-234, U-235, U-238, Np-237, Pu-239, Pu-240, Am-241, Cm-244
2	Co-58, Fe-59, Sr-90, Ru-106, In-111, I-131, Ir-192, Au-198, Po-210
3	Cr-51, Co-57, Tc-99m, I-123, I-125, I-129, Ce-144, Tl-201, Pu-241
4	C-14, P-32, Cl-36, Fe-55, Sr-89, Y-90, Tc-99, Cd-109
5	H-3, S-35, Ca-45, Ni-63, Pm-147

Activity is averaged over 1 t or 1m^2 for homogenous volume/surface activity and over 0.3 t or 0.1 m^2 for non-homogenous one. Non homogenous activity can accede the levels given in table three times, general activity limit averaged over 1t or 1m^2 must be kept.

If material/items are contaminated in both volume and surface ways, the evidence that both limits are kept has to be done. If material/items are contaminated by more nuclides, sum of their aliquot portions cannot accede one.

In 2001, the legal basis for remediation of contaminated sites was established first time. Any remediation activity needs a permission of the Regulatory Authority. The operator has to provide the evidence, that the way of remediation is the optimal from the point of the view of radiation protection.

References

1. The Act No. 272/1994 Coll. on Public Health Protection (as amended 2000), Slovak Republic
2. Regulation of Slovak Ministry of Health on Requirements for Radiation Protection No. 12/2001Coll.
3. Clearance levels for radionuclides in solid materials, IAEA-TECDOC-855, 1996
4. Principles for the Exemption of Radiation Sources and Practices from Regulatory Control, Safety Series No. 89, IAEA 1988

REMOVAL FROM REGULATORY CONTROL OF MATERIALS AND SITES IN DECOMMISSIONING AND SITE REMEDIATION SITUATIONS IN SPAIN

Introduction

In Spain, there are not generic clearance levels for residual materials or clean up criteria for lands or sites to be applied in a general way. All clearance or release criteria applied up to now have been issued on a basis of an "ad hoc" case by case decision, linked to the authorisation of the main decommissioning projects:

- The dismantling and site restoration of Andujar uranium mill factory, during 1999 and 2004.
- Vandellós 1 NPP decommissioning project till the IAEA level 2, now at the end, which will be followed by a 25 year latent period under regulatory control.

Specific administrative framework for the decommissioning process for nuclear facilities was addressed for the first time in the Spanish Royal Decree 1836/1999 on Nuclear and Radioactive Facilities. This regulation establishes the following provisions:

- Release or clearance from regulatory control of residual materials and sites will be subject to authorisation by the Directorate General for Energy and Mining Policy of the Ministry of Economy once received the perceptive and legally binding safety report of the Nuclear Safety Council (CSN).
- Documentation required for this authorisation include the "Radioactive Waste Management Plan", and the "Site Restoration Plan", which should contain the proposed criteria for material clearance and clean up criteria to release the site once the project is finished, respectively.

Site Release

- The release criteria set up for the Andujar mill factory decommissioning project were derived from the US EPA standard 40 CFR 192 for UMTRA program and from the Spanish groundwater protection regulation and defined as: an effective dose to individual in the critical group below 100 μSv, and a reduction of Ra-226 residual concentration on land, so the background level is not exceed by more than 0,2 Bq/g (in the upper 15 cm of soil) and 0,6 Bq/g (in the 15 cm of soil more than 15 cm below the surface).
- In the case of the Vandellos 1, the radiological criteria for the partial release of this site proposed in the "Site Restoration Plan" submitted by ENRESA according to the above mentioned licensing procedure are being reviewed by the CSN. The main features of the proposal can be summarised as follows:

- Relevant radionuclides considered in the analysis are ^{3}H, ^{14}C, ^{59}Ni, ^{63}Ni, ^{60}Co, ^{90}Sr, ^{94}Nb, ^{125}Sb, ^{137}Cs, ^{152}Eu, ^{154}Eu, ^{239}Pu and ^{241}Am.
- Two scenarios considered: a industrial scenario in the next 30 years (external exposure, inhalation and soil ingestion pathways) and a residential scenario after 30 years (external exposure, inhalation and limited ingestion of vegetables and water including inadvertent soil ingestion).

Dose release criteria (100 μSv/year) has been translated into corresponding derived concentration guideline levels using the RESRAD code. The radiological surveys to be conducted to demonstrate compliance with the derived concentration limits are based on the MARSSIM approach (NUREG-1700 and NUREG-1727).

Material Release

The Vandellós 1 Decommissioning Project has three authorised basic possibilities for the application of clearance of residual materials (Table 1):

- Unconditional clearance: A first set of unconditional clearance levels N_1 expressed in terms of gross activity concentration and surface contamination has been issued (Table 2). A second set of radionuclide specific clearance levels taken from the IAEA TECDOC–855 may also be used (Table 3). Compliance wit these criteria will ensure that the dose criteria of 10μSv/year will be not exceeded
- Generic conditional Clearance: derived conditional clearance levels N_2, based on "ad hoc" internationally published guidance, has been established for particular waste streams managed in well defined routes (metallic scrap recycling and concrete demolition debris).
  - Generic conditional clearance levels (N_2) for metal scrap recycling and direct reuse of equipment, components and tools are the figures in the EC document RP 89.
  - Generic conditional clearance levels (N2) for building reuse, or building demolition are the figures in the document RP 113.
- Specific conditional clearance: Higher specific conditional clearance levels (N_3) can also be issued by CSN in consideration to some future management route to be proposed by licensee.

Table 1: **Management options for residual materials in the Vandellós 1 NPP decommissioning program**

CLASSIFICATION	MANAGEMENT
Radioactive Waste	Radioactive Waste Management
N_3	***SPECIFIC CONDITIONAL CLEARANCE***
Specific Material or Waste Stream (To be proposed)	*Specific Management Route (To be proposed)*
N_2	***GENERIC CONDITIONAL CLEARANCE***
Defined Material or Waste Stream	Defined Management Route
N_1	***UNCONDITIONAL CLEARANCE***
No Contaminated Material	*Conventional Management*

Table 2: **First set of unconditional clearance levels (N1) for Vandellós 1 decommissioning Project**

ACTIVITY CONCENTRATION	N_1*
Total β/γ	0,2 Bq/g
Total α	0,1 Bq/g
Surface contamination total β/γ	0,4 Bq/cm^2
Surface contamination total α	0,1 Bq/cm^2
Surface contamination weak β/γ	4 Bq/cm^2

* These figures are not supported by any specific radiological study but are issued in order to avoid inconsistencies with other generic licensing documents, such as transport regulations or radiological protection manuals in different facilities within the country.

Table 3: **Second set of unconditional clearance levels for radionuclides in solid materials**

RANGE OF ACTIVITY (Bq/g)	**RADIONUCLIDES**					**REPRESENTATIVE SINGLE VALUE** (Bq/g)
0,1						
	Na-22	Nb-94	Eu-152	Th-230	Np-237	0,3
	Na-24	Ag-11m	Pb-210	Th-232	Pu-239	
	Mn-54	Sb-124	Ra-226	U-234	Pu-240	
	Co-60	Cs-134	Ra-228	U-235	Am-241	
	Zn-65	Cs-137	Th-228	U-238	Cm-224	
1						
	Co-58	Sr-90	In-111	Ir-192	Po-210	3
	Fe-59	Ru-106	I-131	Au-198		
10						
	Cr-51	Tc-99m	I-125	I-129	Tl-210	30
	Co-57	I-123	Tc-99	Ce-144	Pu-241	
100						
	C-14	Cl-36	Sr-89	Cd-109		300
	P-32	Fe-55	Y-90			
1.000						
	H-3	S-35	Ca-45	Ni-63	Pm-147	3.000
10.000						

REGULATORY RELEASE – SOME EXAMPLES FROM SWEDEN

- Clearance of material and oil (not intended for large amounts of material) regulated by general SSI Regulations (SSI FS 1996:2) and by specific approvals (for example recycling of metals and PVC). General activity limit: 500 Bq/kg, 100 Bq/kg alpha activity.

- Clearance of buildings treated on a case-by-case basis.

- Recent example: Ågesta PHWR waste treatment facility: 5 kBq/m2 (beta/gamma), 0.5 kBq/m2 (alpha).

- Current example: RP 113 (Table 2) applied for decommissioning of large laboratory in Studsvik (ACL). Clearance of the whole building for demolition anticipated in 2004-2005.

- New regulations from SSI (concerning planning of decommissioning put requirements on the licence holder to continuously document results of measurements and calculations together with considerations made and actions taken to provide background information for radiation protection assessments for future release of the site.

- No recent experience of release of nuclear sites (underground site released in 1985 after decommissioning of Research reactor R1 at the Technical University of Stockholm).

- Ongoing evaluation of applicability of RP 89 and RP 113 in Sweden (clearance for recycling of metals and clearance of buildings and building rubble, respectively).

- Procedures established to deal with stakeholders interests by requirement on EIA before dismantling.

REMOVAL OF CONTROLS FOR MATERIALS AND SITES: THE SWISS SITUATION

Legislation

Material or waste are considered to be radioactive, if they fall within the scope of application of the legislation on radiological protection as it is set in the Radiological Protection Ordinance. The activity level for unconditional clearance is identical to the exemption level. Three parameters are taken into account for declaring material as radioactive:

- The specific (Bq/kg) or absolute (Bq) activity of the material exceeds the nuclide specific clearance level tabulated in the ordinance.
- The surface contamination (Bq/cm^2) of the material exceeds the nuclide specific value tabulated in the ordinance.
- The dose rate at 10 cm distance from the surface of the material, after deduction of the underground, exceeds 0.1 microSv per hour.

The clearance level for the activity is derived from the nuclide specific dose factor for ingestion; the intake by ingestion of an activity corresponding to the clearance level would lead to a dose of 10 microSv. The surface contamination has to be averaged on a surface of 100 cm^2. The limiting value is derived from consideration of skin exposure and of intake by ingestion and inhalation.

The legislation also requires minimization of radioactive waste. Thus the operators of nuclear installations and other practices are required to decontaminate materials and to separate radioactive from non-radioactive materials.

A new Nuclear Energy Act has been submitted to the Parliament; it will supersede the old atomic legislation and contain specific requirements regarding the decommissioning of nuclear installations. The new legislation will require that the procedures for the decontamination and for the clearance of the large amounts of inactive materials arising from the dismantling be described in detail in the licence application for decommissioning. After the decommissioning and dismantling will be completed, the licensing authority will ascertain that the former nuclear installation represents no further radiological hazard and relieve the site from nuclear regulatory control.

Regulation

The regulatory control of clearance of materials and sites is defined in the Regulatory Guide HSK-R-13 from February 2002. This regulatory control applies as well to nuclear installations (supervision by HSK) as to non-nuclear practices in medicine, industry and research (supervision by Federal Office of Public Health).

HSK-R-13 fixes requirements on the procedures to be applied for the removal of materials considered to be non-radioactive from controlled zones. The aim is to ensure that no such material will be removed without a confirmation that it is in fact non-radioactive. The clearance procedures lie in the responsibility of the operators. The procedures put in place by the operators are checked by the

supervision authorities. The clearance of larger amounts of material (more than 1 m^3 or 1 t) has to be announced in advance in order to give the supervision authority the opportunity to do independent measurements. Records of such clearances have to be made and kept.

HSK-R-13 also fixes the requirements for the clearance of former radiologically controlled zones:

- surface contamination less than the nuclide specific limit of the ordinance,
- airborne activity concentration less than 1/300 of the nuclide specific clearance level,
- dose rate from direct exposure less than 1 mSv per year.

The clearance of controlled zones in which open radioactive sources have been handled must always be ascertained by the supervision authority.

Current Situation

Inactive materials arising from maintenance and renovation of nuclear installations (nuclear power plants and the research institute PSI) are routinely cleared from regulatory control. In recent years the amount of yearly cleared materials ranged between 200 t and 1000 t.

One former underground prototype nuclear power plant (at Lucens) has been dismantled. The site has been removed from regulatory control; a radiation monitoring programme is however continued by the Federal Office of Public Health in the frame of the general radiological surveillance of the environment. Two research reactors are in the stage of decommissioning at the research institute PSI in Würenlingen.

Many former controlled zones, mainly in the non-nuclear field, have been removed from regulatory control after cessation of the radiological practice.

UK SITUATION ON REMOVAL OF CONTROLS FOR MATERIALS AND SITES

Environment Agency

Materials

- In the UK the "keeping and use" of radioactive material, and the "accumulation and disposal" of radioactive waste are regulated by the Environment Agencies through the Radioactive Substances Act 1993 (RSA 93). RSA 93 requires prior regulatory approval for these activities, which are controlled through certificates (although for nuclear sites, only the requirement for prior approval of disposal applies – other aspects of on-site management of radioactive material and radioactive waste are regulated by the Health and Safety Executive (HSE) under other legislation).

- The primary regulatory instruments allowing controls to be removed from radioactive material or waste are a series of "Exemption Orders". These permit exemption from RSA 93 requirements, particularly from regulatory approval for the keeping and use of radioactive material or for the accumulation and disposal of radioactive waste, provided that certain conditions are met (such as solubility criteria). Exemption Orders may apply to quantities of radioactivity, particular applications or premises, or some combination of these.

- The UK Government has reviewed the conformance of these Exemption Orders with the requirements of the EU Basic Safety Standards Directive and has confirmed that they are broadly in line.

- The Exemption Order finding most common application for the clearance of radioactive material from nuclear sites in the UK is the "Substances of Low Activity Exemption Order". This provides exemption from the requirements of RSA 93 for solids, organic liquids and short half-life gases. Solids are exempt if they are substantially insoluble and their activity due to man-made radionuclides does not exceed 0.4 Bq/g.

- The UK nuclear industry is developing a Code of Practice for clearance and exemption, which will provide a practical guide on general principles. This should be issued in early 2003.

Sites

- Nuclear sites in the UK are licensed under the Nuclear Installations Act 1965 (NIA 65) by HSE. After decommissioning and any other site clean-up activities on the site have been completed, the licensee's period of responsibility for the site continues until such time as he seeks to delicense all or part of it.

- NIA 65 requires that HSE satisfies itself that the operator has adequately demonstrated that there is "no danger" from ionising radiation from that part of the site which the licensee wishes to delicense. Once HSE has decided that there is no longer a danger from radiation on

the site, the licensee's responsibility for it has ended. At some sites it is expected that the licensee's period of responsibility will last for many decades after decommissioning operations have ended.

- In anticipation of an increase in delicensing requests, HSE is planning to issue up-to-date delicensing policy guidelines for consultation during autumn 2003.

- The UK has issued guidance on the authorisation of repositories for the disposal of low and intermediate level radioactive wastes. This guidance envisages a period of institutional control extending beyond the operational period. The guidance sets a dose constraint for the period before control is withdrawn and a risk target for the period after control is withdrawn

USA SITUATION ON CONTROL FOR MATERIALS AND SITES

Sites

- The U.S. Congress designated the U.S. Environmental Protection Agency (USEPA) as the primary federal agency for establishing environmental standards for the protection from harmful and avoidable exposures to radiation. Nuclear facilities can be subject to clean-up under the Comprehensive Environmental Response, Compensation, and Liabilities Act, which utilizes a risk range of 10^{-4} to 10^{-6} to determine appropriate levels of cleanups for radioactive and hazardous materials at those sites *under sole USEPA authority.*

- The U.S. Nuclear Regulatory Commission implements standards by promulgating safety regulations for source, special nuclear, and byproduct material that are expressed in annual total effective dose equivalents, as well as air and liquid effluent concentrations for restricted and unrestricted areas. In general, NORM and TENORM are not within USNRC's jurisdiction.

- Under USNRC regulations for protection of individual members of the public, in general, the total effective dose equivalent from all licensed sources and practices is not to exceed 1mSv/yr (0.1 rem/yr). This dose is exclusive of background radiation, any medical therapy contributions, a licensee's disposal of radioactive material into sanitary sewerage, or other contributions not attributable to licensed operations.

- USEPA regulates some specific TENORM wastes, and has regulatory standards and guidance which are applicable to limiting public and environmental exposures, site cleanup, and waste disposal for other forms of NORM and TENORM. These regulations and guidance are utilized in most States to limit exposures to these wastes.

- Upon its decommissioning and license termination, a USNRC licensee is held to a fraction of the 1 mSv/yr (100 mrem/yr) public dose limit. USNRC regulations in 10 CFR Part 20, Subpart E specify a dose constraint for decommissioning and license termination of 0.25 mSv/yr (25 mrem/yr) and demonstration that the residual contamination levels are ALARA. This dose constraint is considered protective of public health and safety and the environment, and the appropriate allocation of the public dose limit for license termination, which is assumed to occur once for a NRC-licensed facility.

- Currently, a Memorandum of Understanding applies to the cleanup for those sites having overlapping jurisdiction under USNRC and USEPA.

- Under the authority of the Atomic Energy Act, the USNRC has relinquished regulatory authority for non-nuclear power plant licenses to many States through written agreement, and this includes site cleanup. Many States have comprehensive radiation control programs that are considered adequate to protect public health and safety.

- Sources of NORM and TENORM may be covered in States by either specific regulations for those materials, or general radiation protection standards.

- The U.S. Department of Energy has radiation protection regulations that are similar to those of the USNRC and USEPA, such as USDOE Order 5400.5, "Radiation Protection of the Public and the Environment." USDOE regulations are applicable to facilities and sites which they own.

Materials

- For reactors, liquids effluents are limited to 30 μSv/yr (3 mrem/yr) whole body and 0.1 mSv/yr (10 mrem/yr) for any organ. Gaseous effluents are limited to 10 mrad/yr from noble gases, 20 mrad/yr for beta radiation, and 15 mrem/yr to any organ from iodine, tritium and particulates. For non-reactor "materials" sites, air emissions of radioactive material to the environment, excluding radon-222 and its daughters, are constrained to 0.1 mSv/yr (10 mrem/yr).

- There are no generally applicable regulations for the control of the majority of solid materials containing small or no amounts of radioactivity.

- Absent a National standard, solid materials are controlled on a case-by-case basis, using license conditions, existing regulatory guidance, or other case-specific criteria.

- At reactor sites, solid material is controlled by using a "no-detectable" policy outlined in the "Health Physics Position Data Base," NUREG/CR-5569. Solid material does not have to be treated as waste if a reactor licensee conducts appropriate surveys and does not detect licensable material above natural background levels.

- At non-reactor "materials" sites, solid material releases with surface contamination is generally authorized on a case-by-case basis by incorporating existing regulatory guidance or other case-specific criteria into specific license conditions. Surface contamination criteria are contained in Regulatory Guide 1.86, entitled "Termination of Operating Licenses for Nuclear Reactors," and Fuel Cycle Policy and Guidance Directive FC 83-23, entitled "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Byproduct, Source or Special Nuclear Materials Licenses."

- For solid materials that contain slight levels of volumetric contamination, industry practice over the years has been to request approval on a case-by-case basis to release materials to offsite locations prior to license termination. Both reactor and materials licensees have used regulations In 10 CFR Part 20 to seek approval for the limited release of material, which typically involve the burial of solid materials on the licensee's site or disposal at a nearby landfill. Proposed offsite releases of solid material with volumetric sources of contamination are evaluated by applying the guideline that maximum annual doses should not exceed a very small fraction of the annual public dose limit of 1 mSv/yr (100 mrem/yr).

- USNRC is currently considering options for rulemaking on alternatives for controlling the disposition of solid materials that originate in restricted or impacted areas of NRC-licensed

facilities, and that have no, or very small amounts of, radioactivity resulting from licensed operations[1].

- USDOE is developing a Programmatic Environmental Impact Statement on disposition of scrap metal.

- The existing risk-informed/performance-based graded approach for controlling solid materials, as well as for managing the release of materials at the time of site license termination, addresses the need for adequate protection without undue burden on operator and regulatory resources.

1. Information on the status on these considerations, e.g., latest papers and schedule, is available at the web site address for solid materials (www.nrc.gov/materials.html) and go to "key topics," which contains the link to "Controlling the Disposition of Solid Materials."