Overview

• Concept of controlling radioactive material (regulatory framework) in the BSS
  • exemption
  • clearance
• Approaches to derive exemption and clearance levels
• Practical application


Control of Contaminated Material

- What needs to be under control?
- What can be released from regulatory control?
- How to control the release process?
- How to prevent and handle incidents/accidents with uncontrolled material?
Material

• Naturally occurring radioactive materials, concentrations vary in nature and human activities can concentrate them deliberately or adventitiously

• Artificial radionuclides are produced
  • Deliberately for their use in industry, medicine and other purposes
  • As a by product of nuclear fission
Control of Contaminated Material (cont)

- High concentrations of radioactive material require safe management
- As concentrations become lower - need for control becomes less
- At a sufficiently low concentration controls are no longer necessary - for health and safety reasons
- Many types of objects and materials and circumstances of generation and use or radioactive material after release
Control of Contaminated Material (cont)

• Stylistics approach needed to establish basis for setting lower levels for which controls not required

• Sites and buildings need particular consideration
  • Bulk quantities
  • Fixed location
  • Possible re-use for regulated activity

• Basic Safety Standards:
  • “practice” is a planned deliberate activity which will introduce a source of radiation, an exposure pathway or an exposed group
  • an “intervention” is an existing exposure situation where actions are taken to reduce exposure
Control of Contaminated Material (cont)

- Material from normal operation of an authorised practice
  - Mining and mineral processing facilities
  - Fuel cycle facilities (NPP, etc.)
  - Enrichment facilities
  - Operation, maintenance
  - Decommissioning of facilities
  - Use of ionizing sources
- Contamination as a result of incidents or accidents
  - Operational/decommissioning radiological incidents or accidents
  - Handling and long-term management of disused sealed sources
  - Management of orphan sources
Control of Contaminated Material (cont)

• Define the scope of regulatory control
  • Exclusion
  • Exemption
  • Clearance

• Definition of release of material from regulatory control - criteria and conditions

• Methods to control
  • At the licensee site (on-site handling)
  • Off-site transport, processing storage or disposal
  • Transboundary movement
Options for Radioactive Material Control

- Source
- Application for authorization
- Exemption
- Regulatory control
- Exclusion
- Authorised Disposal
- Clearance
- Authorised Discharges
- Regulatory domain of planned exposure situations

IAEA
Exclusion

• An exposure that is essentially **unamenable** to control

• Examples are exposures from:
  • $^{40}$K in a (human) body
  • Cosmic radiation on the surface of the earth
  • Unmodified concentrations of radionuclides in most raw materials
  • Gaseous discharge, through a building ventilation system, of radon and associated daughters arising from the ground or construction materials

• **No more in the GSR Part 3, because the new BSS are for exposure amenable to control.**
Practices and sources within practices can be exempted from regulatory control (notification, registration or licensing) if the sources meet exemption criteria:

- Total activity of a given nuclide present on the premises at any one time
- The activity concentration used in the practice does not exceed the exemption levels

Examples: Smoke detectors, very limited use of radionuclides

Note: The practice must always be justified
Trivial Dose

• Choose a risk level and a corresponding dose which have no significant effect as regards to individuals

• Use the exposure to natural background, to the extent that it is normal and unavoidable, as a relevant reference level

• Relates to a level of individual dose of some tens of microSieverts in a year

• Because an individual may be exposed to radiation from several exempted practices, it must be ensured that the total dose does not exceed the trivial level

• Therefore, the IAEA recommends 10 µSv in a year
Exemption: Practices

Existing Annual Dose

Additional annual dose attributable to the practice, $+\Delta E$,

if $+\Delta E \leq 10 \text{ mSv}$
(exreme $+\Delta E < 1 \text{ mSv}$)

EXEMPTION from Regulatory System of Notification and Authorization

Registration or licensing?

Time
Requirement 8: Exemption and clearance

The government or the regulatory body shall determine which practices or sources within practices are to be exempted from some or all of the requirements of these Standards, and shall approve which sources, including materials and objects, within notified or authorized practices may be cleared from regulatory control.

**NEW.- No EXCLUSION**
Requirement 8: Exemption and clearance

Exemption

3.10 The government or the regulatory body shall determine which practices or sources within practices are to be exempted from some or all of the requirements of these Standards, including the requirements for notification, registration or licensing, using as the basis for such determination the criteria for exemption specified in Schedule I or any exemption levels defined by the regulatory body on the basis of the criteria.

3.11 Exemption shall not be granted for practices deemed not to be justified.
Clearance

3.12 The regulatory body shall approve which sources, including materials and objects, within notified or authorized practices may be cleared from further regulatory control using as the basis for such approval the criteria for clearance specified in Schedule I or any clearance levels defined by the regulatory body on the basis of such criteria. This approval shall ensure that sources that have been cleared do not again become subject to requirements for notification, registration and licensing, unless otherwise specified by the regulatory body.

New ....”and shall not be higher than the exemption levels specified in Schedule I.”.
Requirement 31: Radioactive waste and discharges

The relevant parties shall ensure that radioactive waste and discharges of radioactive material to the environment are managed in accordance with the authorization.

Note: and with the specific regulation in force
Options for Radioactive Material Control

- Source
- Application for authorization
- Regulatory domain of planned exposure situations
- Exemption
- Regulation control
- Exclusion
- Authorised Disposal
- Clearance
- Authorised Discharges

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waste, radioactive

1. For legal and regulatory purposes, waste that contains, or is contaminated with, radionuclides at concentrations or activities greater than clearance levels as established by the regulatory body.

2. [Radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party.] (From Ref. JC.)
Basic Safety Standards

waste, radioactive (BSS 1996)
Material, whatever its physical form, remaining from practices or Interventions and for which no further use is foreseen (i) that contains or is contaminated with radioactive substances and has an activity or activity concentration higher than the level for clearance from regulatory requirements, and (ii) exposure to which is not excluded from the [Basic Safety] Standards.

waste, radioactive (GSR Part 3, 2011)
For legal and regulatory purposes, material for which no further use is foreseen that contains, or is contaminated with, radionuclides at concentrations or activities greater than clearance levels as established by the regulatory body.
2.2. In accordance with the approach outlined in the appendix, six classes of waste are derived and used as the basis for the classification scheme:

   (1) **Exempt waste**\(^4\) (EW): Waste that meets the criteria for clearance, exemption or exclusion from regulatory control for radiation protection purposes as described in Ref. [RS-G-1.7, IAEA, Vienna (2004)].

\(^4\) The term ‘exempt waste’ has been retained from the previous classification scheme (see footnote 3) for consistency; however, once such waste has been cleared from regulatory control, it is not considered radioactive waste.
Schedule I
EXEMPTION AND CLEARANCE

CRITERIA FOR EXEMPTION

I-1 The general criteria for exemption are that:

a. The radiation risks to individuals arising from the practice or source within the practice are sufficiently low as to not warrant regulatory control and the exempted practice or source is inherently safe, with no appreciable likelihood of scenarios that could lead to a failure to meet this criterion; or

b. Regulation of the practice or source would provide no net benefit, in that no reasonable control measures would achieve a worthwhile return in reduction of individual doses or risks.

New - No collective radiological impact is considered
Choose a risk level and a corresponding dose which have no significant effect as regards to individuals.

- Annual risks of death of the order of $10^{-7}$ to $10^{-6}$ are of no concern in the society.
- Risk factor of fatal cancer $10^{-2} \text{ Sv}^{-1} \Rightarrow 10 - 100 \mu\text{Sv}$

Use the exposure to natural background, to the extent that it is normal and unavoidable, as a relevant reference level.

An individual may be exposed to radiation from several exempted practices; it must be ensured that the total dose does not exceed the trivial level.

Therefore, the IAEA recommends 10 mSv in a year.
CRITERIA FOR EXEMPTION

I.2 A practice or a source within a practice may be exempted under para. I-1(a) without further consideration provided that in all reasonably foreseeable situations, the effective dose expected to be incurred by any member of the public due to the exempted practice or source is of the order of 10 \( \mu \text{Sv} \) or less in a year\(^{[41]} \). To take account of low probability scenarios for which the above criterion fails, an additional criterion can be used, namely that the effective dose due to such low probability events does not exceed 1 mSv in a year.

New.- No collective effective dose committed is applied

\(^{[41]}\) A decision on whether or not to exempt a practice or a source within a practice is normally made on the basis of a safety assessment undertaken by, or on behalf of, the regulatory body.
CRITERIA FOR EXEMPTION

I-3. Under the criteria in paras I-1 and I-2, the following sources within justified practices are automatically exempted without further consideration from the requirements of these Standards, including those for notification, registration or licensing:

a. Radioactive material in a moderate amount [42] for which either the total activity of an individual radionuclide present on the premises at any one time or the activity concentration used in the practice, does not exceed the applicable exemption level given in Table I-I of Schedule I [43]; except that for radionuclides of natural origin these conditions for exemption apply only to their incorporation into consumer products, or for their use either as a radioactive source (e.g. $^{226}$Ra, $^{210}$Po) or for their properties as chemical elements (e.g. thorium, uranium);
CRITERIA FOR EXEMPTION

I-3. Under the criteria in paras I-1 and I-2, the following sources within justified practices are automatically exempted without further consideration from the requirements of these Standards, including those for notification, registration or licensing:

b. Radioactive material in a bulk amount [42] for which the activity concentration of a given radionuclide of artificial origin used in the practice does not exceed the relevant value given in Table I-2 of Schedule I [43];

c. Radiation generators, of a type approved by the regulatory body, or in the form of an electronic tube, such as a cathode ray tube for the display of visual images, provided that:

i. They do not cause in normal operating conditions an ambient dose equivalent rate or a directional dose equivalent rate, as appropriate, exceeding 1 mSv/h at a distance of 0.1 m from any accessible surface of the equipment; or

ii. The maximum energy of the radiation generated is no greater than 5 keV.
CRITERIA FOR EXEMPTION

1. The exemption values (activity concentrations) set forth in Table I-1 have been calculated on the basis of scenarios involving a moderate quantity of material: “The calculated values apply to practices involving small scale usage of activity where the quantities involved are at the most of the order of a tonne.” (see Ref. [20]). The regulatory body will need to establish for which quantities the concentration values in Table I-1 may be applied, bearing in mind that for many radionuclides, in particular those for which there is no corresponding value in Table I-2, a restriction on the quantity is not meaningful.  

2. The application of values in Table I-1 to the exemption of natural radionuclides is limited to their incorporation into consumer products or their use as a radioactive source (e.g. Ra-226, Po-210) or for their elemental properties (e.g. thorium, uranium); for ores or for residues from industries processing materials containing radionuclides in the uranium and thorium decay chains or containing K-40 the corresponding activity concentration values are given in I-9 (b).
CRITERIA FOR EXEMPTION

The exemption and clearance levels set out in Tables I-1 and I-2 of Schedule I are subject to the following considerations: (a) They were derived using a conservative model based on (i) the criteria of paras I-2 and I-8 respectively and (ii) a series of limiting (bounding) use and disposal scenarios (see Ref. [20] in the case of Table I-1 and Ref. [21] in the case of Table I-2). (b) In the case of more than one radionuclide, the derived exemption level or derived clearance level for the mixture is determined as specified in para. I-11.


CRITERIA FOR EXEMPTION

I-4. For radionuclides of natural origin, other than when incorporated into consumer products, or used either as a radioactive source or for their properties as chemical elements, exemption shall be considered on a case by case basis, by using a dose criterion commensurate with natural background levels. Doses to individuals as a consequence of these activity concentrations should be unlikely to exceed about 1 mSv in a year,
I-5. The Regulations for the Safe Transport of Radioactive Material [5] (the Transport Regulations) do not apply to exempt material or exempt consignments — that is, material in transport for which either the activity concentration of the material or the total activity of an individual radionuclide in the consignment, does not exceed the relevant ‘basic radionuclide value’ for exemption given in the Transport Regulations [44]. In general, such basic radionuclide values are numerically equal to the corresponding exempt activity concentrations or exempt activities given in Table I-1 of Schedule I.

[44] For purposes of material in transport, exemption means exemption from the requirements of the Transport Regulations.
CRITERIA FOR EXEMPTION

I-6. Exemptions may be granted subject to conditions specified by the regulatory body, such as conditions relating to the physical or chemical form and to the use or disposal of the radioactive material. In particular, such an exemption may be granted for an apparatus containing radioactive material not otherwise exempted under para. I-3(a) provided that:

a. The equipment is of a type approved by the regulatory body;

b. The radioactive material
   i. Is in the form of a sealed source that effectively prevents any contact with the radioactive material and prevents its leakage, or
   ii. Is an unsealed source of a small amount such as sources used for radioimmunoassay;
I-7. The general criteria for clearance are that:

a. The radiation risks to individuals arising from the cleared material are sufficiently low as to not warrant regulatory control, with no appreciable likelihood of scenarios that could lead to a failure to meet this criterion; or

b. The continued regulatory control of the material would provide no net benefit, in that no reasonable control measures would achieve a worthwhile return in reduction of individual doses or risks.
CRITERIA FOR CLEARANCE

I-8. Material may be cleared under para. I-7(a) without further consideration provided that, in all reasonably foreseeable situations, the effective dose expected to be incurred by any member of the public due to the cleared material is of the order of 10 µSv or less in a year. To take account of low probability scenarios for which the above criterion fails, an additional criterion can be used, namely that the effective dose due to such low probability scenarios does not exceed 1 mSv in a year.

New.- No collective effective dose committed is applied
I-9. Radioactive material within a notified or authorized practice may be cleared without further consideration provided that:

a. The activity concentration of an individual radionuclide of artificial origin does not exceed the relevant level given in Table I-2 of Schedule I; or

b. In the case of naturally occurring radionuclides, the activity concentration of each radionuclide in the uranium and thorium decay does not exceed 1 Bq/g and the activity concentration of $^{40}$K does not exceed 10 Bq/g.

The derivation of these activity concentration values does not take into account the possible use of these materials for construction of buildings. Control of construction materials is addressed in Section 5.
CRITERIA FOR CLEARANCE

I-10. Clearance may be granted to subject to conditions specified by the regulatory body, such as conditions relating to the physical or chemical form of the material, or to the use or disposal of the material\[46\].

\[46\] For example, specific clearance levels may be developed for metals, building rubble, and waste for landfill.
I-11. For exemption and clearance of radioactive material containing more than one radionuclide, using the levels given in Tables I-1 and I-2, the condition for exemption or clearance is that the sum of the individual radionuclide activities or activity concentrations, as appropriate, is less than the derived exemption or clearance level for the mixture ($X_m$), determined as follows:
Schedule I
EXEMPTION AND CLEARANCE

OTHER CONSIDERATIONS

\[ X_m = \frac{1}{\sum_{i=1}^{n} \frac{f(i)}{X(i)}} \]

Where:
- \( f(i) \) is the fraction of activity or activity concentration, as appropriate, of radionuclide \( i \) in the mixture,
- \( X(i) \) is the applicable level for radionuclide \( i \) as given in Table I-1 or Table I-2, and
- \( n \) is the number of radionuclides present.
I-12. For exemption and clearance of bulk quantities of material containing a mixture of radionuclides of both natural and artificial origin, both conditions presented in paras I-9(b) and I-11 are to be satisfied.

I-13. Residual radioactive material arising from authorized discharges is exempted from any future requirements for notification, registration or licensing unless otherwise specified by the regulatory body.
NOTE: During the revision of the BSS, the Agency received a number of requests for the inclusion of additional nuclides in Table I-1, primarily used in medical applications that were not routinely used when the current edition of the BSS was published in 1996. It was also pointed out that, during the lifetime of the revised BSS, it is more than likely that further applications will be developed that involve 'new' radionuclides. The Agency was also asked to ensure that a procedure is in place to allow the updating of Tables I-1 and I-2 without the need to review the BSS in its entirety.

Table I-1 has been amended to include an exhaustive list of approximately 800 radionuclides and their associated exemption values. These are taken from the NRPB report NRPB-R306 “Exempt Concentrations and Quantities for Radionuclides not included in the European Basic Safety Standards Directive” published in April 1999 and were calculated based on ICRP dose conversion factors existing at the time that the calculations were made. These dose conversion factors are currently under revision and, as soon as revised values have been published, Table I-1 will be reviewed.

After the revised BSS is published, Schedule I may need to be updated through an addendum.
TABLE I-1: LEVELS FOR EXEMPTION OF MODERATE AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION: EXEMPT ACTIVITY CONCENTRATIONS AND EXEMPT ACTIVITIES OF RADIONUCLIDES

<table>
<thead>
<tr>
<th>Radio nuclide</th>
<th>Activity concentration (Bq/g)</th>
<th>Activity (Bq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-60</td>
<td>$1 \times 10^1$</td>
<td>$1 \times 10^5$</td>
</tr>
<tr>
<td>Tc-99m</td>
<td>$1 \times 10^2$</td>
<td>$1 \times 10^7$</td>
</tr>
<tr>
<td>I-131</td>
<td>$1 \times 10^2$</td>
<td>$1 \times 10^6$</td>
</tr>
<tr>
<td>Cs-137a</td>
<td>$1 \times 10^1$</td>
<td>$1 \times 10^4$</td>
</tr>
<tr>
<td>Sm-153</td>
<td>$1 \times 10^2$</td>
<td>$1 \times 10^6$</td>
</tr>
<tr>
<td>Ti-201</td>
<td>$1 \times 10^2$</td>
<td>$1 \times 10^6$</td>
</tr>
</tbody>
</table>
TABLE I-2: LEVELS FOR CLEARANCE AND FOR EXEMPTION OF BULK AMOUNTS OF MATERIAL WITHOUT FURTHER CONSIDERATION: ACTIVITY CONCENTRATIONS OF RADIONUCLIDES OF ARTIFICIAL ORIGIN

<table>
<thead>
<tr>
<th>Radio nuclide</th>
<th>Activity concentration (Bq/g)</th>
<th>Activity concentration (Bq/g) Moderate amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-60</td>
<td>$1 \times 10^{-1}$</td>
<td>$1 \times 10^{1}$</td>
</tr>
<tr>
<td>Tc-99m</td>
<td>1</td>
<td>$1 \times 10^{2}$</td>
</tr>
<tr>
<td>I-131</td>
<td>10</td>
<td>$1 \times 10^{2}$</td>
</tr>
<tr>
<td>Cs-137</td>
<td>$1 \times 10^{-1}$</td>
<td>$1 \times 10^{1}$</td>
</tr>
<tr>
<td>Sm-153</td>
<td>$1 \times 10^{2}$</td>
<td>$1 \times 10^{2}$</td>
</tr>
<tr>
<td>Tl-201</td>
<td>$1 \times 10^{2}$</td>
<td>$1 \times 10^{2}$</td>
</tr>
</tbody>
</table>
Importance of Clearance Levels

• Reduce the amount of material disposed as waste, thereby reducing cost - consistent with fundamental principles. If criteria are not established - resources will be wasted

• In decommissioning, need criteria to determine when decommissioning is finished (decommissioning endpoint)
Impacts on National Policy

• Impacts on the amount of material to be disposed of have national repercussions as well as affecting operators

• Absence of clearance criteria can affect the ability to complete decommissioning & perform cleanups

• Inappropriate criteria can result in previously-cleared material becoming the focus for further remediation
Application of the Concepts

- Guidance to regulators and operators
- Bulk material - over the order of a 1 tonne
- Activity concentration values (Bq/g) (details in IAEA Safety Report 44)
- Food and drinking water out of the scope, radon in air and potassium in the body
Radionuclides of Natural Origin

- Levels are established for exclusion of naturally occurring radionuclides from regulatory control
- Basis linked to radiation levels in natural environment
- Amenityability to control
- Levels proposed from data on levels of naturally occurring radionuclides reported by UNSCEAR
- Based on median natural content in soil (not counting radon)
  - K-40 - 10 Bq/g
  - All other radionuclides of natural origin - 1 Bq/g
  - U-238, U-235, Th-232 - values for parent of decay chain
Application of the Concepts (cont)

Artificial Radionuclides

• Levels for considering exemption of artificial radionuclides

• Doses to individuals anticipated 10 μSv and unlikely to exceed 1 mSv

• Collective dose associated with exemption of bulk quantities not to exceed 1 man.Sv in a year

• Exemption for bulk quantities of material can be used for clearance

• Levels tabulated for individual radionuclides
## Typical Clearance Levels

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>Bq/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-3</td>
<td>100</td>
</tr>
<tr>
<td>C-14</td>
<td>1</td>
</tr>
<tr>
<td>Mn-54</td>
<td>0.1</td>
</tr>
<tr>
<td>Fe-59</td>
<td>1</td>
</tr>
<tr>
<td>Co-60</td>
<td>0.1</td>
</tr>
<tr>
<td>Ni-59</td>
<td>100</td>
</tr>
<tr>
<td>Sr-90</td>
<td>1</td>
</tr>
<tr>
<td>Tc-99</td>
<td>1</td>
</tr>
<tr>
<td>I-131</td>
<td>10</td>
</tr>
<tr>
<td>Cs-137</td>
<td>0.1</td>
</tr>
<tr>
<td>Eu-154</td>
<td>0.1</td>
</tr>
<tr>
<td>Pu-238</td>
<td>0.1</td>
</tr>
<tr>
<td>Am-241</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Application of the Concepts (cont)

(a) **Mixture of RNs of natural origin**
Concentration of each radionuclide should be less than the relevant value of the activity concentration.

(b) **Mixture of Artificial RNs**

\[ \sum_{i=1}^{n} \frac{C_i}{(\text{activity concentration})_i} \leq 1 \]

(c) **Mixture of RNs of natural and artificial origin**
Both conditions presented (a) and (b) should be satisfied.
Application of the Concepts (cont)

• Decisions needed on how the values will be incorporated into national regulations

• Decisions needed on how the values will be used to control clearance of materials

• These will depend on the legal framework and national regulatory practices (e.g. France, Ukraine)
Application of graded approach:

- Commensurate with the characteristics of the practice or source
- Commensurate with the magnitude and likelihood of the exposures
- Conforming to any requirements specified by the Regulatory Body
- When values are exceeded by several times (e.g. up to ten times)
Trade

International trade in materials and objects with radioactivity levels below derived levels should not be restricted.

Authorities should ensure compliance at the source of origin of object or material (Exporting Country).

Monitoring at borders (Importing Countries) and important locations such as metal recyclers should be established.

Regulatory Bodies should coordinate monitoring strategies and programmes.
Verification

• Values derived for large quantities and homogeneous material

• Consideration should also be given to areas of concentrated activity on or near the surfaces of materials

• Verification of values should be based on procedures

Dilution

Deliberate dilution in order to meet the values is should not be permitted
Application of the Concepts (cont)

Monitoring for Compliance

• Draft IAEA Safety Report (DS 740)

a. Selection of a monitoring strategy
   ▪ Scope of work (material)
   ▪ Clearance criteria (e.g. generic, site-specific, averaging)
   ▪ Material characteristics
   ▪ Management approach
   ▪ Decision of optimum strategy
   ▪ Stakeholders involvement
Nuclide-Specific Clearance Levels

- Dose criteria are the same as for exemption but for derivation of clearance levels different scenarios are used: often greater amounts of material (up to 100,000 tonnes)
- Regulatory body either directly gives or approves clearance levels
- Clearance levels can be generic or defined case-by-case
Establishing Radionuclide-Specific Clearance Levels

1. Decide on situations of interest
2. Establish exposure scenario and calculate doses
3. Radionuclide-specific exemption or clearance values
4. Dose criteria for exemption or clearance
Calculating Clearance Levels for Scrap Metal

Scrap from nuclear facilities

Scrap Processing: Handling
Segregating
Transportation

Smelting: Dust in the workplace
Discharges to environment
Product manufacture

Use of Products: At workplace At home

Use / Disposal of Byproducts: Slag Dust
Derivation of Generic Clearance Levels (RS-G-1.7)

- For artificial radionuclides: use scenarios representing typical exposure situations
  - Using realistic parameter values and a dose criteria of 10 μSv/a
  - Using low probability parameter values and a dose criteria of 1 mSv/a
  - Dose criteria to the skin of 50 mSv in a year
- Values developed for naturally occurring radionuclides based on worldwide distribution of activity concentrations by UNSCEAR (2000)
- Not applicable to food and drinking water (use Codex Alimentarius / WHO recommendations)
Clearance Procedures

• Clearance using general clearance levels derived / approved by the regulatory body.
• Competent operator: activity measurements reliable, records kept, quality assurance in place, clearance plans given to the regulatory body.
• Reporting (e.g. annual information of amount and activity of cleared materials to the regulatory body)
• Case by case clearance:
  • No general clearance levels in place or
  • The general clearance levels are exceeded
A case/site specific assessment has to be carried out
Practical Application of Clearance

- Locate clearance instruments in low-background area
- Have process knowledge of the material (where did it come from, and its chain of custody)
- Non-porous materials are much easier to clear
- Clearance levels are set on a volumetric and surface contamination basis
- Material that is suspected to be alpha-contaminated is difficult to clear
Examples for Clearance

- Release of steel from nuclear installation to general scrap metal pool
- Release of waste oil from nuclear power plant
  - Separation of water and oil
  - Filtering
  - Send for recycling
- Release solid hospital waste contaminated by $^{131}$I
  - Allowing the $^{131}$I decay
  - Disposal with other hospital wastes
Implementation of Monitoring Strategy

- Selection of monitoring techniques and instruments
- Background
- Dealing with mixture of RNs (Fingerprint)
- Converting clearance criteria to field levels (units)
- Measurement sensitivities
- Use of multiple monitoring techniques
- Uncertainties
- Physical sorting techniques
Monitoring for Compliance with Clearance Criteria (cont)

**Measurements**
- Surface contamination
- Bulk material

**Collection and Analysis of Samples**
- Sampling methods
- Representative samples

**Management System**
- Documentation
- Responsibilities and supervision, etc.
### Summary clearance report

<table>
<thead>
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<th>Results</th>
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<td>Background</td>
<td>Lessons learned</td>
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<td>Material description</td>
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<td>Clearance objectives</td>
<td>References</td>
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<tr>
<td>Clearance criteria</td>
<td>Contributors to the report</td>
</tr>
<tr>
<td>Clearance strategy and techniques</td>
<td></td>
</tr>
</tbody>
</table>

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### Contributions

- **Executive summary**
- **Background**
- **Material description**
- **Clearance objectives**
- **Clearance criteria**
- **Clearance strategy and techniques**
- **Results**
- **Lessons learned**
- **Next step(s)**
- **References**
- **Contributors to the report**
Class Discussion

• Discuss the importance of clearance (or authorized release) levels for a typical facility (e.g. a research reactor being decommissioned)

• Discuss some of the difficulties that might be encountered in setting clearance levels and getting them accepted.
Summary

- Exclusion is removal of entire types of materials from regulatory control (based on unamenability to control)
- Exemption / clearance of specific quantities of materials based on trivial risk (de-minimis)
- Exemption levels (BSS) apply to small volumes
- Clearance levels for release of large volumes from regulatory control (generic or specific)
- Exclusion, exemption and clearance provide a fundamental basis for waste segregation strategies
Summary

• At national level it is important to define:
  - concepts application
  - criteria
  - methods of demonstration of compliance
  - control mechanisms
  - coordination with neighbouring countries

• IAEA assistance:
  • Development of safety reports on derivation and monitoring for compliance with clearance levels
  • Technical support to MSs in establishing their regulatory framework
Thank you!