NORM VIII

NORM Industrial Activities most likely to require regulatory considerations

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CNEN Comissão Nacional de Energia Nuclear
Ministério da Ciência e Tecnologia
BRASIL UM PAÍS DE TODOS GOVERNO FEDERAL

MAIN PRINCIPLES

- Justification
- Optimization;
- Dose Limitations

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MAIN PRINCIPLES

Justification:

Any decision that alters the radiation exposure situation should do more good than harm"

The justification should also include the analysis if other techniques that do not require exposure to ionizing radiation are more appropriate.

Justification thus goes far beyond the scope of radiological protection. It is for this reasons that the Commission limits its use of the term justification to require that the net benefit (NB) be positive." (related to the optimization concept)

It also apply to the clearance concept

MAIN PRINCIPLES

Optimization:

COST BENEFIT ANALYSIS
NB = GB - P- (X+Y)>0

GB=(Gross) Benefit
NB= (Net) Benefit>0
P =Cost of Production P
X=Cost of Radioprotection
Y=Detriment=αS
S=Collective Dose

As (P) do not vary with the dose to maximize the liquid benefit you have to minimize (X+Y)

Brief historical about optimization

ICRP-22, 1973:
- All doses should be kept as low as reasonably practicable.
- Collective **dose must be expressed in monetary units. (α)**

ICRP-26, 1977:
Risk of fatal cancer = 165 X 10-4 / Sv. (~ 0.02 / Sv)
1-Justification of the Principle
2- Optimization Principle
3-Single Dose limitation principle

. **ICRP-37, 1983:**
- Proposes as a tool for Optimization "Cost-Benefit Analysis".
- The Standard CNEN-NE-3.01- (1988), Basic Guidelines of Radiation Protection, recommends the use of this technique

ICRP-55, 1989:
Describes in detail and exemplifies the principle of optimization and its main mathematical tools.

ICRP-60, 1991:
Increases the value of Risk Likelihood of deadly cancer to: 460 x 10-4 / Sv (~ 0.05 / Sv).

ICRP 103 (§ 203)-2007
§ 31: "The principle of optimization of protection: the likelihood of incurring exposures, the number of people exposed, and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors. This means that the level of protection should be the best under the prevailing circumstances, maximizing the margin of benefit over harm."

Main Principles

Dose Limit:

Effective Dose	Worker	Public
Dose Limit	20 mSv/ano	1 mSv/ano
Dose Constraint	Fraction of the dose limit	Fraction of the dose limit

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Dose Constraint-IAEA

A.1. In setting a dose constraint, the following factors should be taken into account:

(a) Dose contributions from other sources and practices, including realistically assessed possible future sources and practices on a regional and global scale;

(b) Reasonably foreseeable changes in any condition that could affect public exposure, such as changes in the characteristics and operation of the source, changes in exposure pathways, changes in the habits or distribution of the population, modification of critical groups, or changes in environmental dispersion conditions; and

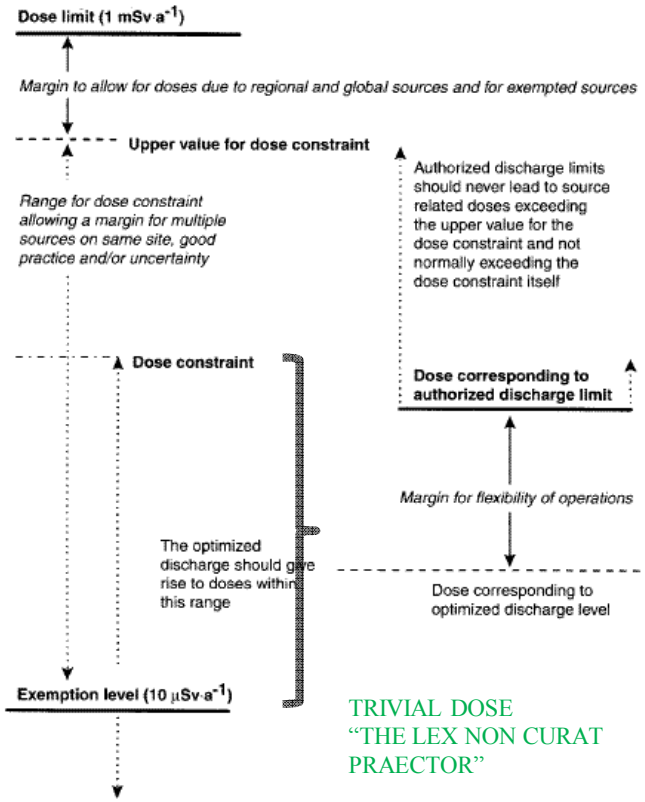
(c) Any uncertainties including conservatisms associated with the assessment of exposures, especially in potential contributions to the exposures if the source and the critical group are separated in distance or time.

Additionally, consideration should be given to:

(d) The result of any generic optimization of protection for the source, practice or task being considered; and/or

(e) The experience of well managed operation of practices or sources of the same kind.

RELATION BETWEEN DOSE LIMIT ->DOSE CONSTRAINT AND OPTIMIZATION



TRIVIAL DOSE
"THE LEX NON CURAT PRAECTOR"

▪Dose Constraint (IAEA)

A prospective restriction on the individual *dose* delivered by a *source*, which serves as a **bound on the *optimization*** *of protection and safety* for the *source*. For *occupational exposures*, the *dose constraint* is a *source* related value of individual *dose* used to limit the range of options considered **in the process of optimization**. For *public exposure*, the *dose constraint* is an upper bound on the annual *doses* that *members of the public* should receive from the planned operation of any controlled *source*. For *medical exposure* the *dose constraint* levels should be interpreted as *guidance levels*, **except when used in optimizing** the protection of persons exposed for medical research purposes or of persons, other than *workers*, who assist in the care, support or comfort of exposed patients.

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RELATION BETWEEN DOSE LIMIT ->DOSE CONSTRAINT AND OPTIMIZATION

What are usually the upper bound dose constraint values adopted in the world?

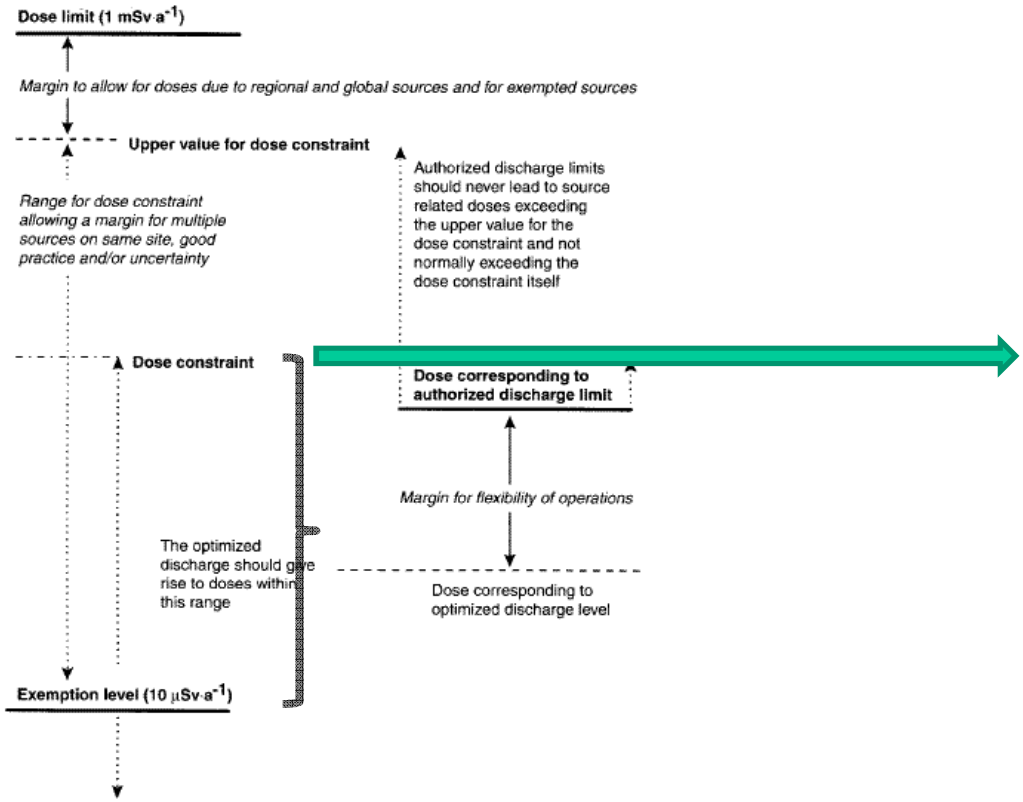

TABLE II. DOSE CONSTRAINTS AND THE SOURCES TO WHICH THEY APPLY FOR SEVERAL MEMBER STATES

Country	Dose constraint (mSv·a^{-1})	Source
Argentina	0.3	Nuclear fuel cycle facilities
Belgium	0.25	Nuclear reactors
China	0.25	Nuclear power plants
Italy	0.1	Pressurized water reactors
Luxembourg	0.3	Nuclear fuel cycle facilities
Netherlands	0.3	Nuclear fuel cycle facilities
Spain	0.3	Nuclear fuel cycle facilities
Sweden	0.1	Nuclear power reactors
Ukraine	0.08	Nuclear power reactors
	0.2	Nuclear fuel cycle facilities
United Kingdom	0.3	Nuclear fuel cycle facilities
United States of America	0.25	Nuclear fuel cycle facilities

A.4. Because it is not easy to arrive at generally applicable constraints for individual sources or practices, establishing a single generic dose constraint is not reasonable. However, it may be possible to estimate a generic upper value for a dose constraint by a procedure that takes into account maximum per capita estimates of global and regional annual doses, the buildup of radionuclides in the environment over a specified period of time and the dose contributions from possible exempt sources. Subtracting these contributions from the annual dose limit of 1 mSv results in dose values that are in a range in which the generic upper value of dose constraint can be chosen. This procedure is illustrated in Fig. 3.

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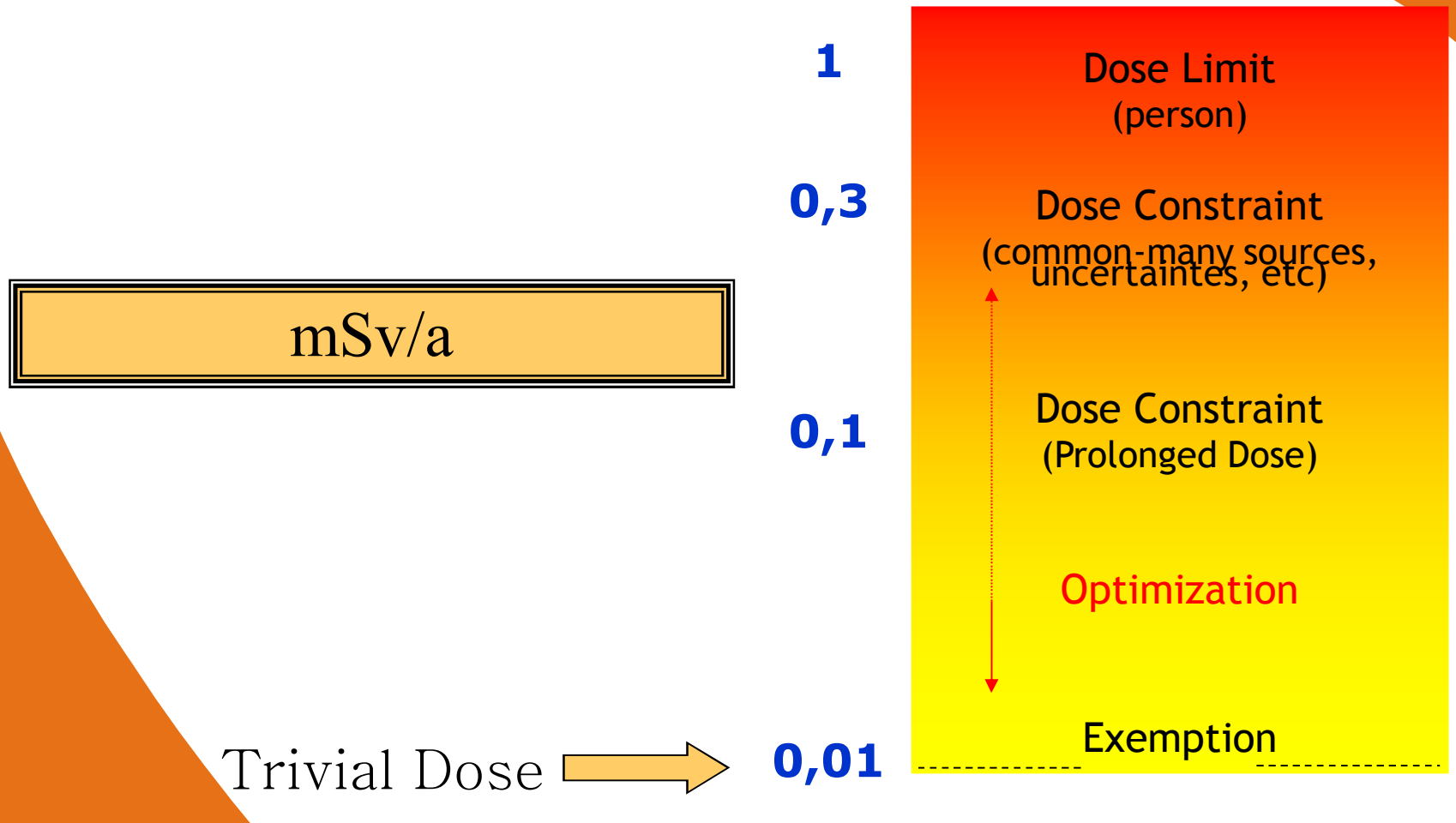
Dose System Public: Practices



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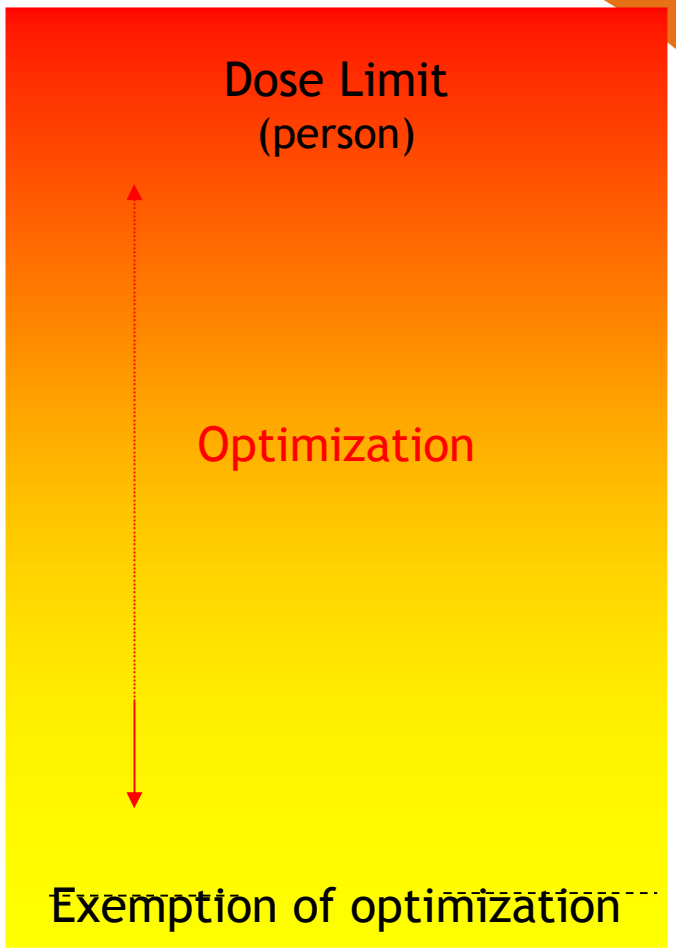
Dose System Worker: Practices

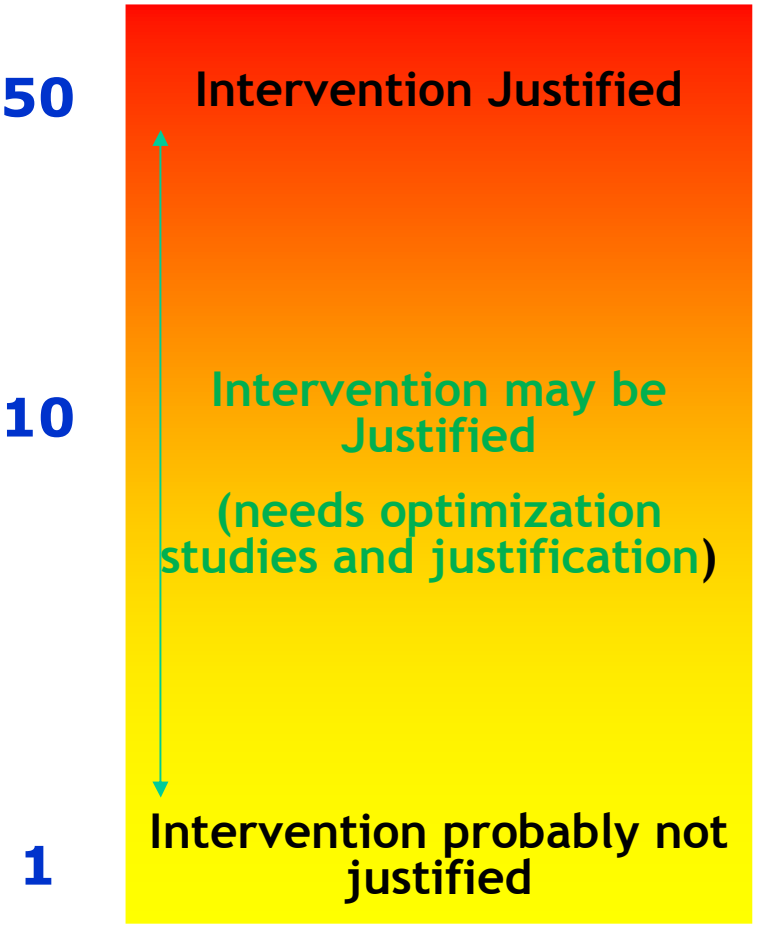
mSv/a



And Collective dose <1 human.Sv

General Levels for Intervention

(mSv/a)



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Others Important Concepts

- Exclusion;
- Exemption;
- Clearance

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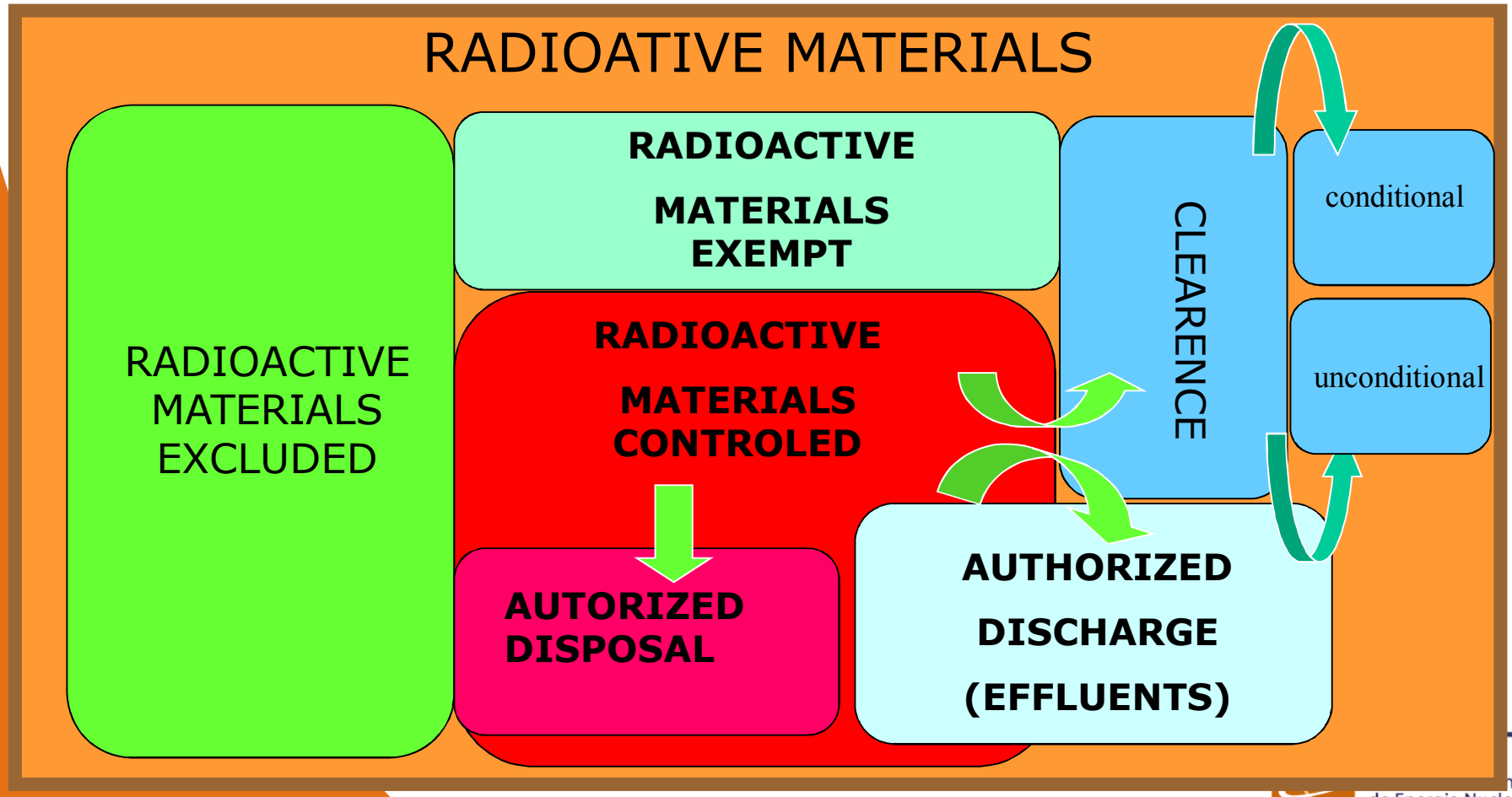
Radioactive Material Control System-Diagrame



Exclusão-Excluded

- An exposure impossible to control (not because the dose is trivial or low)

Examples :

  - Levels of K-40 on human body;
  - Cosmic Radiation on Earth Surface (**And what about crew on Flights??**);
  - Unmodified concentrations of naturally ocurring radioactive material (Some NORM situations);
  - Radon Gaseous Discharges- Building Ventilation System, soil emanations, construction materials, water, etc.

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Exempt- Isenção

- Low enough individual radiological risks
- Collective radiological impact low enough not to require regulatory control - Trivial radiological risk
- The practice or the situation is inherently safe, with no likelihood of scenarios that could lead to a failure to exceed the previous principles
- Applies to moderate amounts of material (of the order of one ton). Difficult to apply to NORM facilities and use of residues for example.

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Trivial Doses

- Corresponds to a level of risk and therefore a dose that does not cause significant effects to individuals
- Anual Death Probabilities of 10^{-7} to 10^{-6} - They are not of interest to society
  - Remember fatal risk câncer is in the order of 4×10^{-2} /Sv (linear dose response in lower doses)
- An individual may be exposed to radiation for several practices; It must ensure that the total dose due to one practice does not exceed the trivial dose level.
- For this reason, the IAEA recommended the adoption of 10 μSv in a year as the trivial dose. (This level is difficult to apply to NORM)

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Derivation of Exemption Levels

- The dose criterion applies both to workers and to the public (different values of course)
- Exemption levels given in BSS and CNEN-NE-standard 3:01
- Scenarios are based on using limited amounts of material (less than 1 ton)- Difficult to apply to NORM
- They are expressed in activity concentration (Bq / g) and the total activity (Bq) (Based on trivial doses)
- Usually exempt practices involve small users of radioactive material.

Exemption of What?

Exempt practices to comply with the requirements of:

- Notification, registration or license control;
- Records in general;
- Evaluation discharges - effluents;
- Intervention actions.

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Clearence - Dispensa

- Practices and sources within practices may be exempted from regulatory control (the control requirements) if the sources meet the criteria for trivial doses and are inherently safe.
- Examples: smoke detectors, some waste from mining and industrial plants (only if very small concentrations in the case of NORM), waste arising from nuclear medicine, etc.
- Note: The practice must always be justified

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Desregulação / Dispensa (Clearance)

- Implies radioactive material removal of any subsequent regulatory control.
- BSS: Sources, including substances, materials and objects within authorized practices may be released from any subsequent requirement provided they comply with the clearance criteria approved by the Regulatory Body
- These levels can be set both in terms of doses and in terms of concentration and may differ from exemption limits. (Unconditional Clearence x Conditional Clearence.)
- Unconditional Clearence- It doesn't matter the use of the radioactive material (Trivial dose 10 microsievert/y- **Difficult to apply to NORM)**
- Conditional Clearence - For certain use of the radioactive material (dose between the trivial and a fraction of the dose constraint) - **Have to justify and optimize!!. Can apply to NORM**

INTERNACIONAL REGULATIONS

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BSS-IAEA

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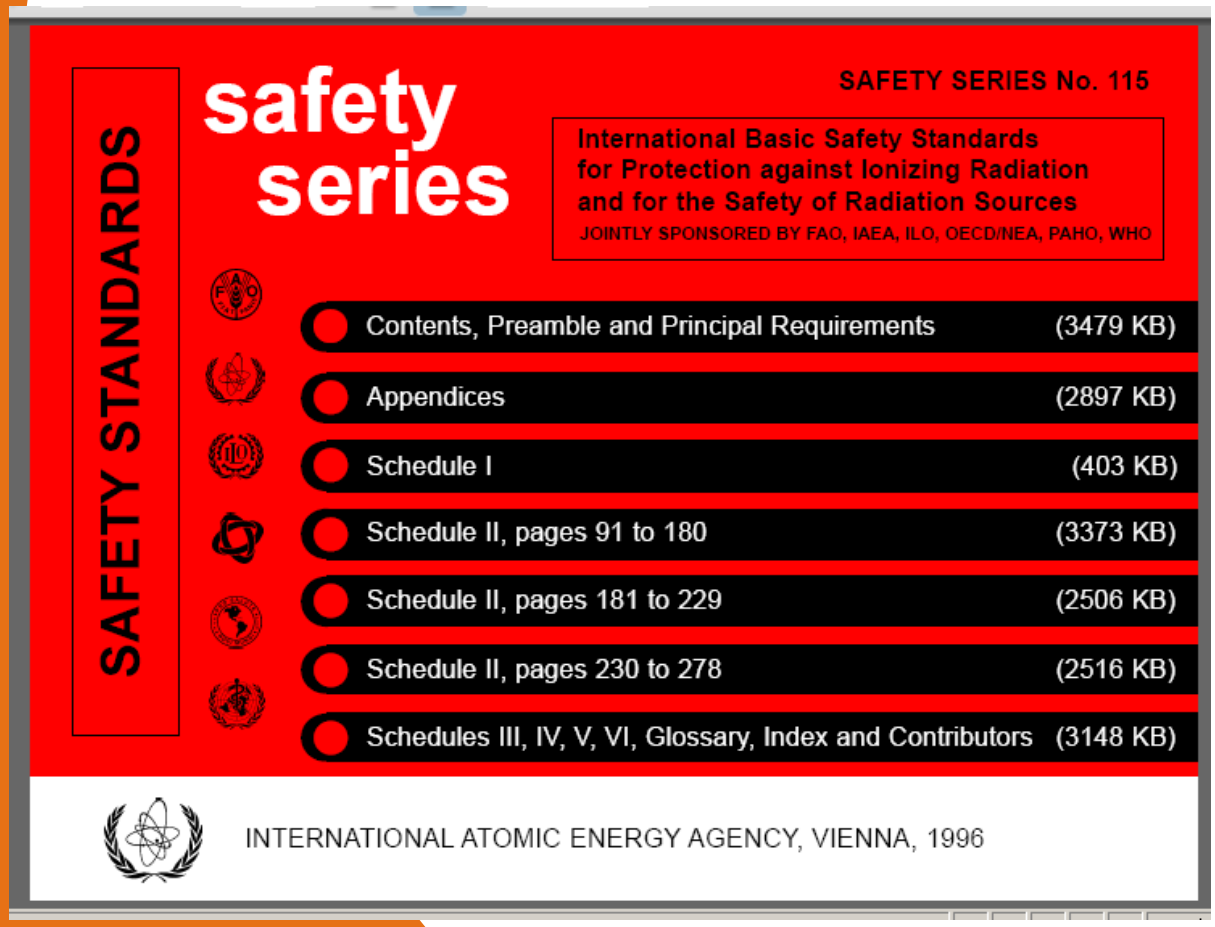
DOCUMENTO DE REFERÊNCIA ISENÇÃO



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Limites de Dose- IAEA-ICRP 60 BSS-115

Anual Dose Limits			
	Órgão	Workers	*Public*
Effective Dose		20 mSv [a]	1 mSv [b]
Equivalent Dose	Lens of the eyes	150 mSv	15 mSv
	Skin	500 mSv	50 mSv
	Hands,	500 mSv	50 mSv

b-average in 5 years
50 mSv/y maximum (workers) and 5 mSv/y maximum (Public)

0,3 mSv/y restrição de dose para público

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TABELA 1. Níveis de Isenção: Atividades e Concentrações de Atividade Isentas (continuação)

Nuclídeo	Concentração de Atividade (Bq/g)	Atividade (Bq)
U-236	1E+01	1E+04
U-237	1E+02	1E+06
U-238*	1E+01	1E+04
U-nat	1E+00	1E+03
U-239	1E+02	1E+06
U-240	1E+03	1E+07
U-240*	1E+01	1E+06
Np-237*	1E+00	1E+03
Np-239	1E+02	1E+07
Np-240	1E+01	1E+06
Pu-234	1E+02	1E+07
Pu-235	1E+02	1E+07
Pu-236	1E+01	1E+04
Pu-237	1E+03	1E+07
Pu-238	1E+00	1E+04
Pu-239	1E+00	1E+04
Pu-240	1E+00	1E+03
Pu-241	1E+02	1E+05
Pu-242	1E+00	1E+04
Pu-243	1E+03	1E+07
Pu-244	1E+00	1E+04
Am-241	1E+00	1E+04
Am-242	1E+03	1E+06
Am-242m*	1E+00	1E+04
Am243*	1E+00	1E+03
Cm-242	1E+02	1E+05
Cm-243	1E+00	1E+04
Cm-244	1E+01	1E+04

TABELA 2. Radionuclídeos e seus filhos em equilíbrio secular, conforme deve ser considerado na utilização dos valores da TABELA 1.

Sr-90	Y-90
Zr-93	Nb-93m
Zr-97	Nb-97
Ru-106	Rh-106
Cs-137	Ba-137m
Ba-140	La-140
Ce-134	La-134
Ce-144	Pr-144
Pb-210	Bi-210, Po-210
Pb-212	Bi-212, Tl-208 (0,36), Po-212 (0,64)
Bi-212	Tl-208 (0,36), Po-212 (0,64)
Rn-220	Po-216
Rn-222	Po-218, Pb-214, Bi-214, Po-214
Ra-223	Rn-219, Po-215, Pb-211, Bi-211, Tl-207
Ra-224	Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Ra-226	Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
Ra-228	Ac-228
Th-226	Ra-222, Rn-218, Po-214
Th-228	Ra-224, Rn-220, Po-216, Pb-212, Bi-212,Tl-208 (0,36), Po-212 (0,64)
Th-229	Ra-225, Ac-225, Fr-221, At-217, Bi-213, Po-213, Pb-209
Th-nat	Ra-228, Ac-228, Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
Th-234	Pa-234m
U-230	Th-226, Ra-222, Rn-218, Po-214
U-232	Th-228, Ra-224, Rn-220, Po-216, Pb-212, Bi-212, Tl-208 (0,36), Po-212 (0,64)
U-235	Th-231
U-238	Th-234, Pa-234m
U-nat	Th-234, Pa-234m, U-234, Th-230, Ra-226, Rn-222, Po-218, Pb-214, Bi-214, Po-214, Pb-210, Bi-210, Po-210
U-240	Np-240m
Np-237	Pa-233
Am-242m	Am-242
Am-243	Np-239

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CLEARENCE TECDOC855

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TECDOC 855:

205. The two basic criteria for determining, from a radiation protection standpoint, whether or not a source can be exempted [2] from regulatory control are contained in Refs [1, 3]; they are as follows:

— **Individual risks must be sufficiently low not to warrant regulatory concern; and**
— **Radiation protection must be optimized, taking the cost of regulatory control into account.**

2 Although the general principles were established for exemption, it is clear that the same principles apply to clearance.

208. Because an individual may be exposed to radiation from several exempted practices, it is necessary to ensure that the total dose does not rise above the trivial dose level. It is therefore recommended that each exempt practice should contribute only a part of the identified trivial dose [3]. The apportionment suggested could lead to individual doses to average members of the critical group of the order of 10 μSv/a from each exempt practice [3]. The value of 10 μSv/a is used in this report as the basis for evaluating unconditional clearance levels.

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TECDOC 855:
Clearence is Related to Optimization

"Release from regulatory control may, of course, be allowed under other conditions; regulatory authorities may decide, **on the basis of a generic or site specific optimization subject to dose constraints, to select other, less restrictive, release levels**.

This optimization process includes consideration of factors other than those associated with radiation protection, for example, those concerned with the health, social, environmental and economic benefits and risks of implementing the practice. ….**The most likely uses and destinations for material being released from regulatory control are recycling, reuse and near surface disposal."**

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TECDOC 855:

215. The full and complete clearance of a material requires that all reasonably possible exposure routes are examined and taken into account in the derivation of the clearance levels, irrespective of how that material is used and to where it may be directed. Such clearances are here called 'unconditional clearances'.

216. Alternatively, **the clearances may be constrained in some way**, usually because the fate of the material being considered in the clearance is known, so that only a limited number of reasonably possible exposure routes have to be considered in deriving the clearance levels. The clearance may then be granted with certain conditions, for example, it may prescribe a definite fate for the material being considered. Such clearances are here called 'conditional clearances'.

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TECDO 855-RECYCLING-NORM

Article 219 When the **practice which is a candidate for clearance** is well defined, such as disposal to a landfill or the recycling of steel scrap by melting, it will usually be possible to take account of the known features of the practice. **The likelihood of critical group exposure due to overlapping practices should be taken into account.**

If it is clear that the likelihood of accumulating doses from more than one cleared practice is small, then a more liberal apportionment of the trivial dose (**a few tens of microsieverts)** may be considered. (**which is probably not the case, for example, houses builted with NORM radioactive material)**

On the other hand Article 220 also makes it very clear that if there is no guarantee of compliance with these low sum doses (of the order of tens µSv and not 1 mSv / year) the regulatory body should adopt the criterion for unconditional clearance (trivial dose = 10 µSv) .

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CLEARENCE
ICRP

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NEW ICRP- JUSTIFICATION AND OPTIMIZATION FOR CLEARENCE

Justification principle

Any decision that alters the radiation exposure situation should do more good than harm. This means that by introducing a new radiation source or by reducing existing exposure, one should achieve an individual or societal benefit that is higher than the detriment it causes."

The justification should also include the analysis if other techniques that do not require exposure to ionizing radiation are more appropriate.

Optimization principle

"The Commission recommends that, when activities involving an increased or decreased level of radiation exposure, or a risk of potential exposure, are being considered, **the expected change in radiation detriment should be explicity included in the decision-making process**

If you want to recycle NORM you have to apply the 3 radioprotection principles (justification, optimization and dose constraint)

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NEW ICRP-JUSTIFICATION AND OPTIMIZATION FOR CLEARENCE

Constraint principle (Dose limit principle)

"The likelihood of incurring exposures, **the number of people exposed and the magnitude of their individual doses should all be kept as low as reasonably achievable, taking into account economic and societal factors.** This means, that **the level of protection should be best under the prevailing circumstances, maximizing the margin of benefit over harm**. In order to avoid severely inequitable outcomes of this optimisation, procedure, **there should be restrictions on the doses or risks to individuals from a particular source (dose or risk reference levels and constraints)**

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NEW ICRP-JUSTIFICATION AND OPTIMIZATION FOR CLEARENCE

"The Commission considers that **certain procedures could deemed to be unjustified without further analysis**, unless there are exceptional circunstances supporting the use of those procedures. These include: **Increasing, by deliberate addition of radioactive substances** or activitation, **the activity of commodities or consumer products**, such as food, beverages, cosmetics, toys, and personal jewellery or adornments."

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OTHER INTERNACIONAL REGULATIONS RELATED TO NORM RG-1.7 PARA COMODITIE

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SAFETY GUIDE
No. RS-G-1.7

Aplication of the concepts of Exclusion, Exemption and clearence for comodities (international trade)

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4.3. The values have been determined on the basis of consideration of the worldwide distribution of activity concentrations for these radionuclides. Consequently, they are valid for the natural decay chains in secular equilibrium; that is, those decay chains headed by ^{238}U, ^{235}U or ^{232}Th, with the value given to be applied to the parent of the decay chain. The values can also

10 daughters Th

14 daughters U

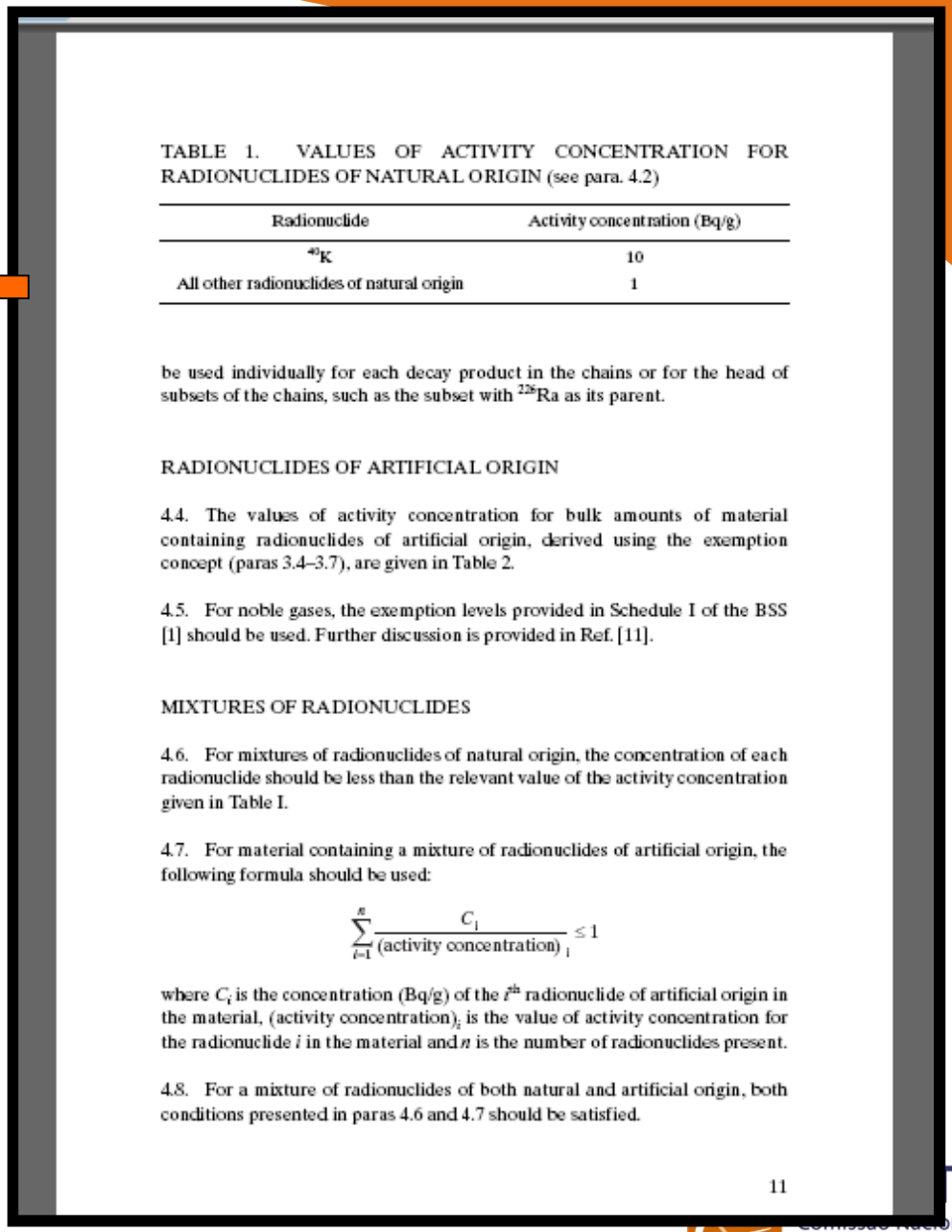


TABLE 1. VALUES OF ACTIVITY CONCENTRATION FOR RADIONUCLIDES OF NATURAL ORIGIN (see para. 4.2)

Radionuclide	Activity concentration (Bq/g)
^{40}K	10
All other radionuclides of natural origin	1

be used individually for each decay product in the chains or for the head of subsets of the chains, such as the subset with ^{226}Ra as its parent.

RADIONUCLIDES OF ARTIFICIAL ORIGIN

4.4. The values of activity concentration for bulk amounts of material containing radionuclides of artificial origin, derived using the exemption concept (paras 3.4–3.7), are given in Table 2.

4.5. For noble gases, the exemption levels provided in Schedule I of the BSS [1] should be used. Further discussion is provided in Ref. [11].

MIXTURES OF RADIONUCLIDES

4.6. For mixtures of radionuclides of natural origin, the concentration of each radionuclide should be less than the relevant value of the activity concentration given in Table I.

4.7. For material containing a mixture of radionuclides of artificial origin, the following formula should be used:

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

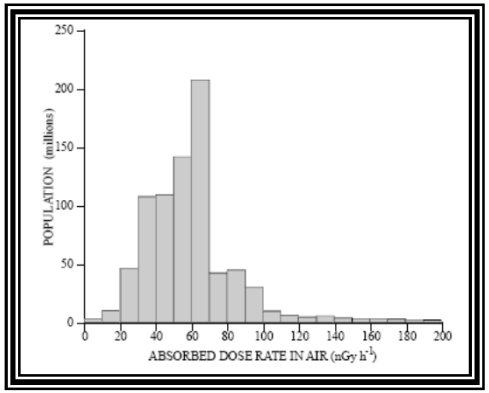
where C_i is the concentration (Bq/g) of the i^{th} radionuclide of artificial origin in the material, $(\text{activity concentration})_i$ is the value of activity concentration for the radionuclide i in the material and n is the number of radionuclides present.

4.8. For a mixture of radionuclides of both natural and artificial origin, both conditions presented in paras 4.6 and 4.7 should be satisfied.

11

UNSCEAR

NATURAL RADIATION IN SOIL



Radio-nuclide	*Concentration in soil (Bq kg^{-1})*		*Dose coefficient [I20, S49] (nGy h^{-1} per Bq kg^{-1})*	*Absorbed dose rate in air (nGy h^{-1})*	
	Median value [a]	*Population-weighted value* [a]		*Median value*	*Population-weighted value*
^{40}K	400	420	0.0417	17	18
^{238}U series	35	33	0.462	16	15
^{232}Th series	30	45	0.604	18	27
Total				51	60

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2.14. In summary, the BSS provide radiological criteria to serve as a basis for the derivation of clearance levels but provide no definitive quantitative guidance on clearance levels. **The activity concentration values developed in the following section for use in making decisions on the exemption of bulk materials may find use by regulatory bodies as a basis for the clearance of such materials**

3.3. **The values of activity concentration for radionuclides of natural origin set out in Table I have been selected on the basis of consideration of the upper end of the worldwide distribution of activity concentrations in soil provided by UNSCEAR [2].**

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RG-1.7 x BSS

1.9. **The values of activity concentration provided in this Safety Guide are not intended to be applied** to the control of radioactive discharges of liquid and airborne effluents from authorized practices, or to **radioactive residues in the environment**. Guidance on the authorization of discharges of liquid and airborne effluents and the reuse of contaminated land is provided in Refs [9, 10]

2.13. Clearance is defined as the removal of radioactive materials or radioactive objects within authorized practices from any further regulatory control by the regulatory body. Furthermore, the BSS state that clearance levels "shall take account of the exemption criteria specified in Schedule I and shall not be higher than the exemption levels specified in Schedule I or defined by the regulatory body" (Ref. [1], para. 2.19**).**

A footnote indicates that "Clearance of bulk amounts of materials with activity concentrations lower than the guidance exemption levels specified in Table I-I of Schedule I may require further consideration by the regulatory body" (Ref. [1], footnote 8).

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RG-1.7

3.4. The primary radiological basis for establishing values of activity concentration for the exemption of bulk amounts of material and for clearance is that the effective doses to individuals should be of the order of 10 μSv or less in a year.

To take account of the occurrence of low probability events leading to higher radiation exposures, an additional criterion was used, namely, the effective doses due to such low probability events should not exceed 1 mSv in a year. In this case, consideration was also given to doses to the skin

This approach is consistent with that used in establishing the values for exemption provided in Schedule I of the BSS (see Ref. [1]).

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RG-1.7

5.19. Deliberate dilution of material, as opposed to the dilution that takes place in normal operations when radioactivity is not a consideration, to meet the values of activity concentration given in Section 4 should not be permitted without the prior approval of the regulatory body.

RG-1.7

5.13. Where the regulatory body has determined that regulatory controls do apply, the stringency of the regulatory measures should be commensurate with the level of risk associated with the material**. When the human activities involving the material are considered to constitute a practice, the regulatory measures that are applied should be consistent with the requirements for practices established in the BSS (Ref. [1], Section 2).** The minimum requirement is that such practices be notified to the regulatory body. For some practices involving low or moderate risks, registration as defined in the BSS may be sufficient. Other practices may need to be licensed, with the stringency of the licence conditions reflecting the level of risk.

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RG-1.7 –IAEA-NORM

1.3. Radionuclides of natural origin are ubiquitous in the environment, although their activity concentrations vary considerably. Uranium and thorium may be extracted from ores containing relatively high concentrations and the BSS clearly consider such extraction as falling under the requirements for practices. However, exposure that is essentially unamenable to control through the requirements of the BSS, such as exposure due to "unmodified concentrations of radionuclides in most raw materials" (Ref. [1], footnote 2), "is deemed to be excluded from the Standards" (Ref. [1], para. 1.4).

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RG-1.7 -IAEA

1.5. The BSS define the terms and explain the use of the concepts of exclusion, exemption and clearance for establishing the scope of regulatory control. In the case of exclusion, they provide a qualitative description of the concept, leaving much of the interpretation to national regulators. In the case of exemption, the BSS set out the radiological basis for exemption and provide generic exemption levels, which may be used by national regulators for determining which sources or practices may be exempted from regulatory control**. However, it is acknowledged in the BSS that the exemption levels apply only to 'moderate' amounts of material and that for larger amounts additional consideration is necessary. In the case of clearance, the BSS define the concept and the radiological criteria to be used as a basis for determining clearance levels but leave the establishment of clearance levels to national authorities.**

The term moderate quantities means quantities that "are at most of the order of a tonne" of material [5]. Anything greater than this amount is considered bulk quantities

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RG-1.7 -IAEA

1.6. The objective of this Safety Guide is to provide guidance to national authorities, including regulatory bodies, and operating organizations on the application of the concepts of exclusion, exemption and clearance as established in the BSS [1]. **The Safety Guide includes specific values of activity concentration for both radionuclides of natural origin and those of artificial origin that may be used for bulk amounts of material for the purpose of applying exclusion or exemption. It also elaborates on the possible application of these values to clearance**

1.7 ……Bulk amounts of material may be involved in clearance and for this reason regulatory bodies may wish to adopt more stringent values of activity concentration than those given in Schedule I of the BSS, which apply only for the exemption of moderate quantities of material.

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Esquema de Licenciamento

NOTIFICAÇÃO DE UMA PRÁTICA

AS DOSES RESULTANTES DESTA PRÁTICA PODEM SER CONTROLADAS ?

N

PRÁTICA FORA DE CONTROLE REGULATÓRIO

EXEMPLOS:
(a) controle das doses devido à radiação cósmica
(b) nível de potássio – 40 no corpo humano

CONCEITO DE EXCLUIDO-

S

CONCEITO DE ISENÇÃO-

A PRÁTICA ESTARIA ISENTA DE CONTROLE REGULATÓRIO ?
≤LIMITES ESTABELECIDOS NO BSS (PEQUENAS QUANTIDADES= 1-3 TON)
ATVIDADE ESPECIFICA OU ATIVIDADE TOTAL
PARA GRANDES QUANTIDADES AVALIAR IMPACTO NO GRUPO CRITICO

S

REQUISITOS DA NORMA NÃO SE APLICAM PORQUE AS DOSES SERIAM TRIVIAIS E A FONTE É INERENTEMENTE SEGURA

DOSES TRIVIAIS RISCO ENTRE 10^{-6} E 10^{-7} FATOR DE RISCO (0,02/Sv)

10 a 100 μSv/ano

ICRP-60 (0,05/Sv)

A PRÁTICA É JUSTIFICADA ?

N

USO FRÍVOLO DA RADIAÇÃO

OS LIMITES DE DOSE SÃO RESPEITADOS ?

N

AS DOSES DO PÚBLICO OU TRABALHADOR IRIAM EXCEDER OS LIMITES PERMISSÍVEIS

A PRÁTICA ESTÁ OTIMIZADA ?

N

PRINCÍPIO ALARA NÃO RESPEITADO

A FONTE ESTÁ SEGURA ?

N

PRÁTICA REJEITADA

REGISTRAR E LICENCIAR

CONCEITO DE CLEARENCE

1-INCONDICIONAL
2-CONDICIONAL

PODE-SE LIBERAR O CONTROLE REGULATÓRIO?

S

ABAIXO DOS VALORES DE LIBERAÇÃO – DISCHARGE CLEARENCE

VALORES EM

CONCENTRAÇÃO

ATIVIDADE TOTAL ANUAL

ETC

CONTINUAR CONTROLE REGULATÓRIO

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SOME BASIC INFORMATION ABOUT NORM

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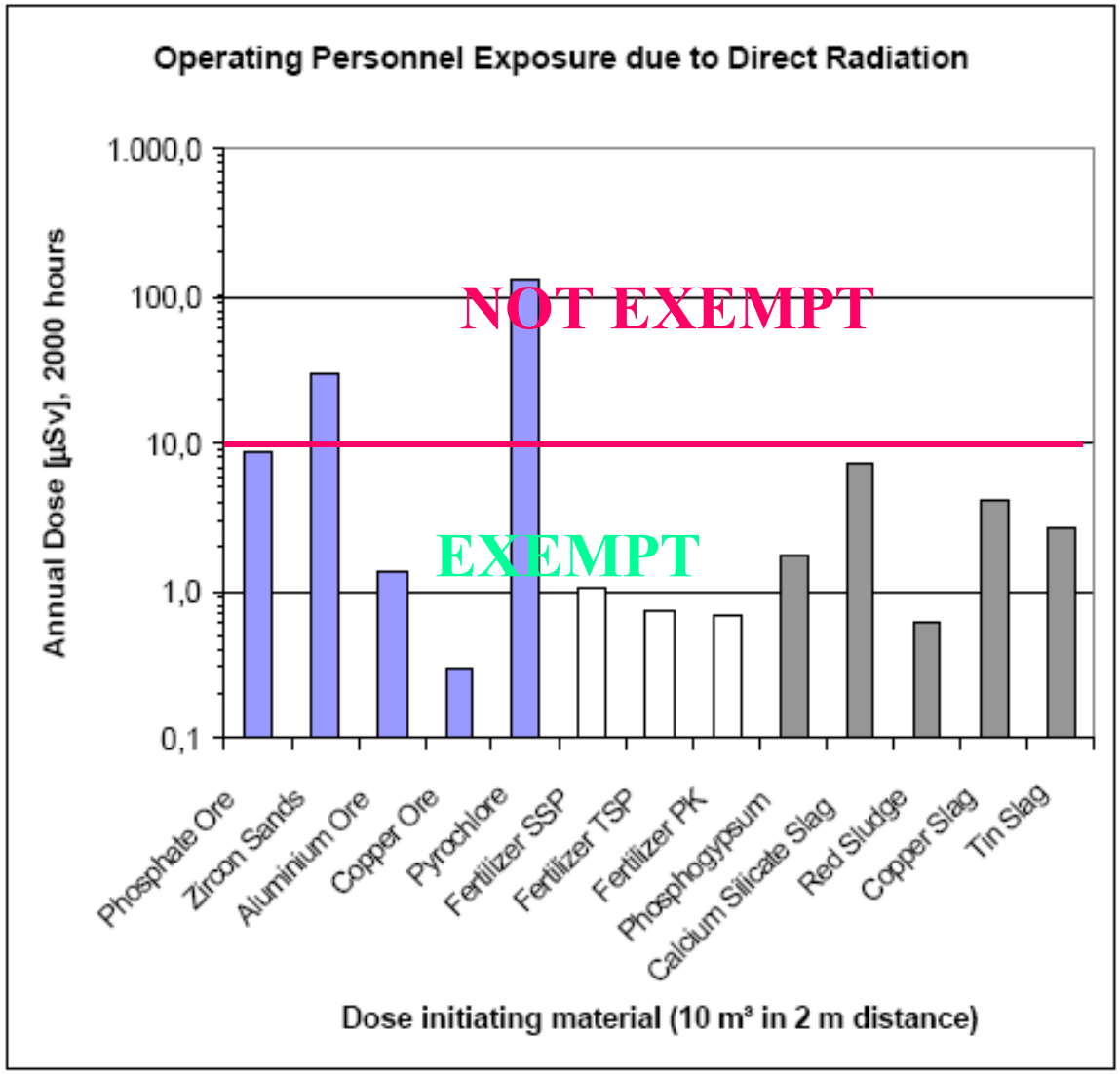
Typical NORM concentrations

Dose initiating material	Appr. density [Mg/m³]	Nuclide	Mean specific activity [Bq/kg]	Maximum specific activity [Bq/kg]
Raw materials				
Phosphate ore	3	Th-232→Tl-208	50	100
		U-238→Po-210	2.000	5.000
		K-40	100	250
Zircon sands	5	Th-232→Tl-208	700	4.000
		U-238→Po-210	4.000	30.000
Aluminium ore	3	U-238→Po-210	300	500
		Th-232→Tl-208	100	400
Copper ore	4,6	U-238→Po-210	40	80
		Th-232→Tl-208	30	100
Pyrochlore (Ferro-niobium)	5,3	U-238→Po-210	17.000	
Products				
Fertilizer, SSP	2,4	Th-232	20	40
		Ra-228→Ac-228	10	
		Th-228→Tl-208	10	
		U-238	500	1.100
		Th-230	670	800
		Ra-226	300	850
		Pb-210→Po-210	300	500
		K-40	140	170
Fertilizer, TSP	2,4	Th-232	45	50
		U-238	800	2.000
		Th-230	500	
		Ra-226	200	230
		K-40	30	50
PK-fertilizer	2,4	Th-232	10	20
		Ra-228→Ac-228	10	20
		Th-228→Tl-208	8	10
		Ra-226→Po-210	200	350
		K-40	5000	6200
By-products				
Phosphogypsum	2	U-238→Th-230	200	500 (Spain: 900)
(Ra-enrichment)		Ra-226→Po-210	600	2.000 (Spain: 2.700)
		Th-232	20	60
		Ra-228→Ac-228	70	100
		Th-228→Tl-208	20	60
Calcium silicate slag (Phosphate thermal process-Pb-volatilization	2,5	U-238→Po-214	2.000	4.000
		Pb-210→Po-210	200	400
		Th-232→Tl-208	400	1.000
Red sludge (Iron-sludge from aluminium refining)	1,5	U-238→Po-210	250	500
		Th-232→Tl-208	300	500
Copper slag	3,5	U-238→Po-210	800	1.500
		Th-232→Tl-208	80	200
Tin slag	3,5	U-238→Po-210	500	4.000
		Th-232→Tl-208	250	5.000

TYPICAL EXPOSURES (NOT A RULE)



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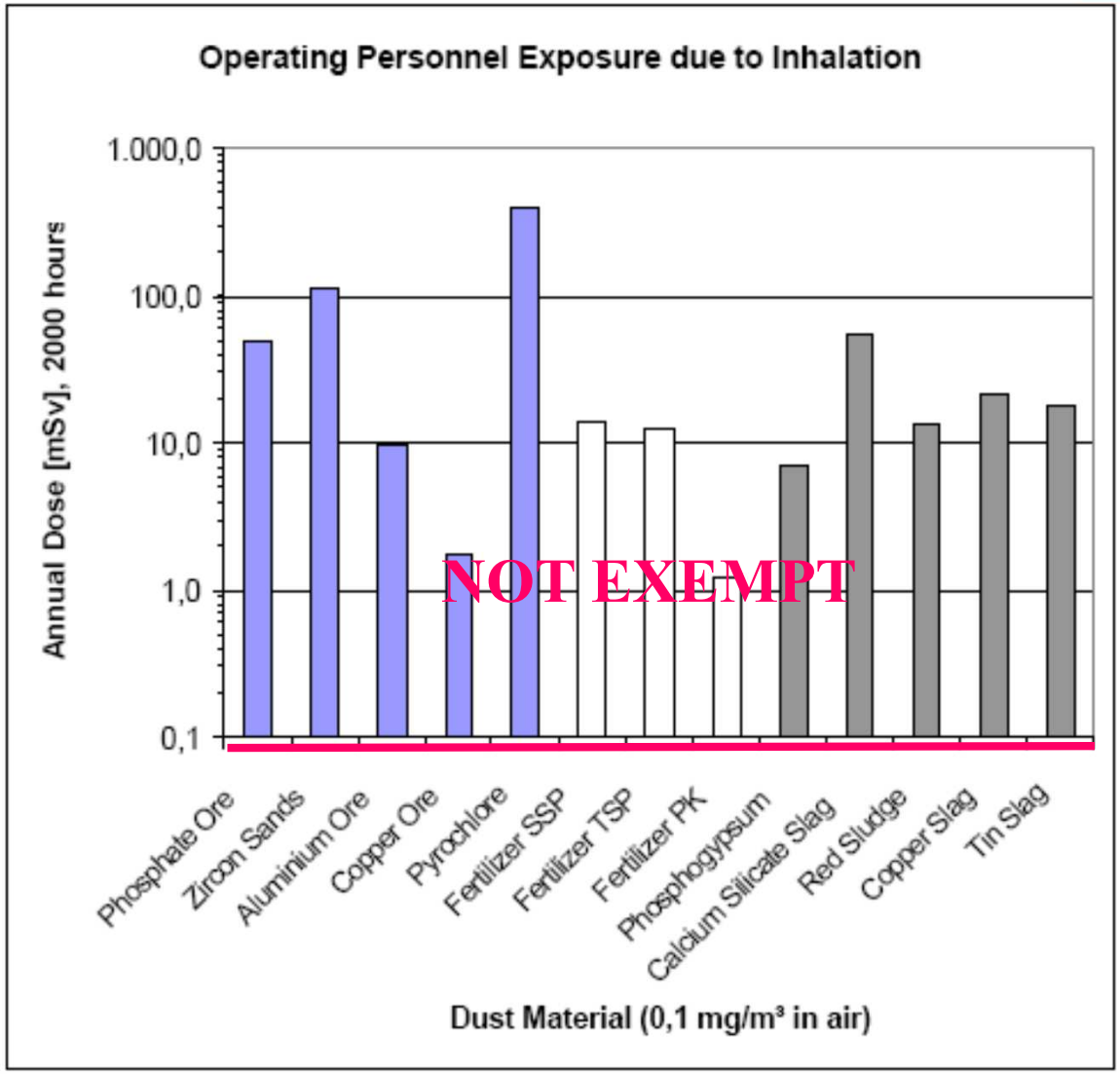
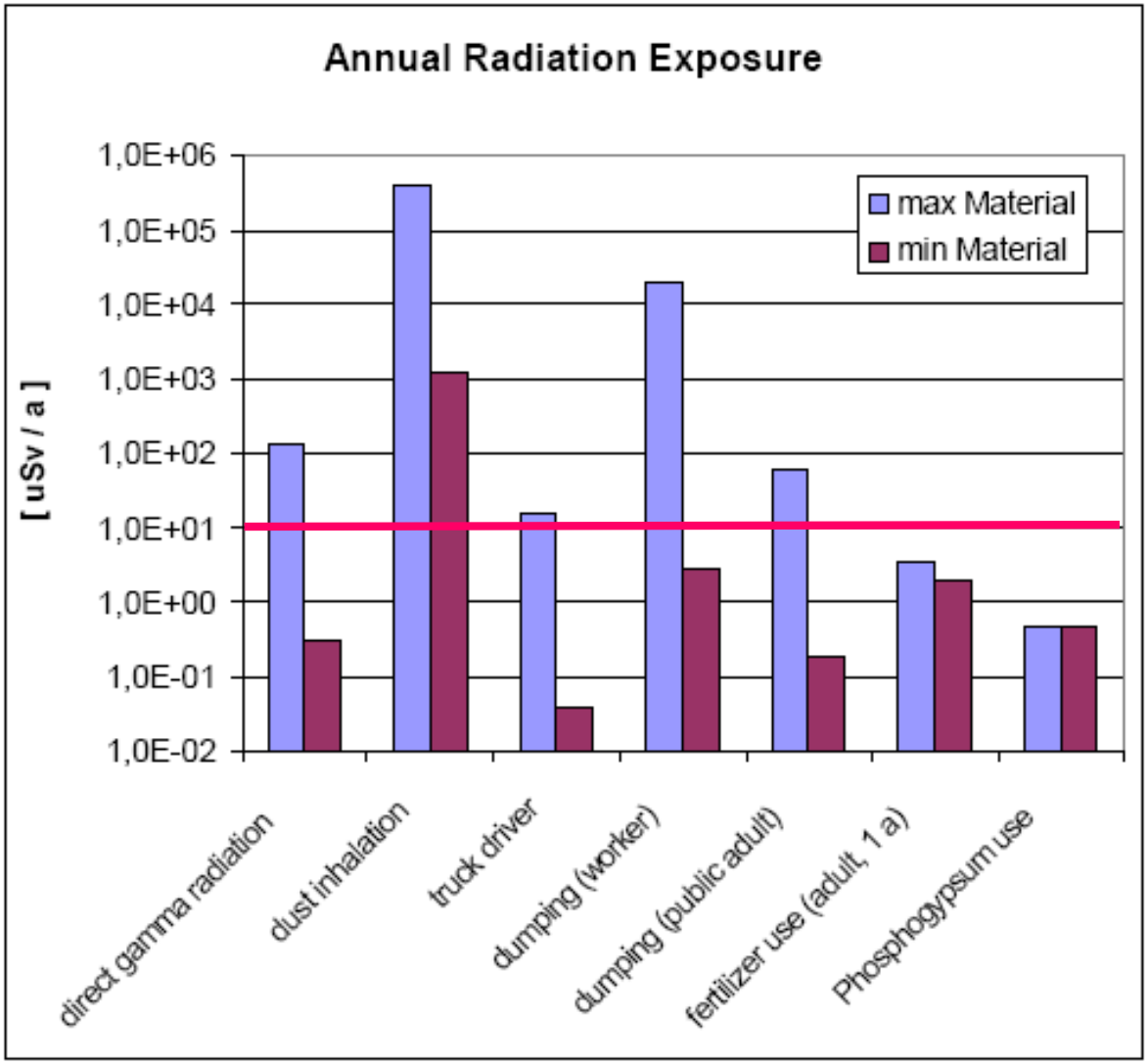
TYPICAL EXPOSURES (NOT A RULE)



Vários Cenários



MAIN BRAZILIAN REGULATIONS FOCUS ON NORM

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CNEN-NN-3.01
BASED ON BSS

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CNEN-NN-4.01
NORMA MÍNERO INDUSTRIAL

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BREVE HISTÓRICO

Até junho de 2003 (Antes da CNEN-NE-4.01 Norma Minero Industrial) as instalações minero industriais estavam isentas de controle regulatório porque não se controlava instalações relacionadas com radiação natural (isenção até 500 Bq/g)

Em janeiro de 2005 foi publicada a norma básica da CNEN (CNEN-NE-3.01) que no seu item 1.2.2 disse que a CNEN deveria dizer quais exposições relacionadas com a radiação natural (instalações minero industriais) deverão ser controladas (Veja texto abaixo)

As práticas para as quais esta Norma se aplica incluem:

a) o manuseio, a produção, a posse e a utilização de fontes, bem como o transporte, o armazenamento e a deposição de materiais radioativos, abrangendo todas as atividades relacionadas que envolvam ou possam envolver exposição à radiação;

b) aquelas que envolvam exposição a fontes naturais cujo controle seja considerado necessário pela CNEN.

A BASE DE ISENÇÃO DE UMA INSTALAÇÃO É NÃO EXPOR NENHUM INDIVIDUO DO PUBLICO A DOSE SUPERIORES A 1 mSv/ano (Que é uma dose baixa)

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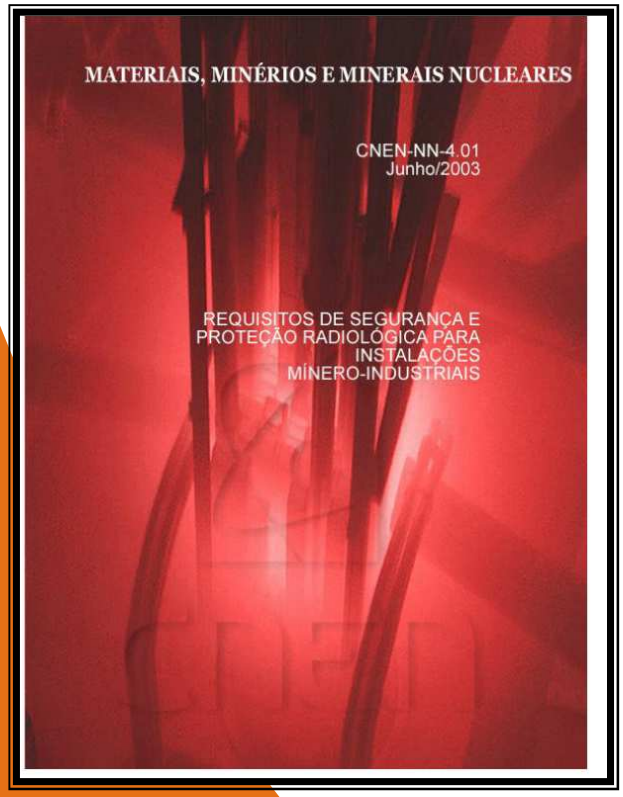

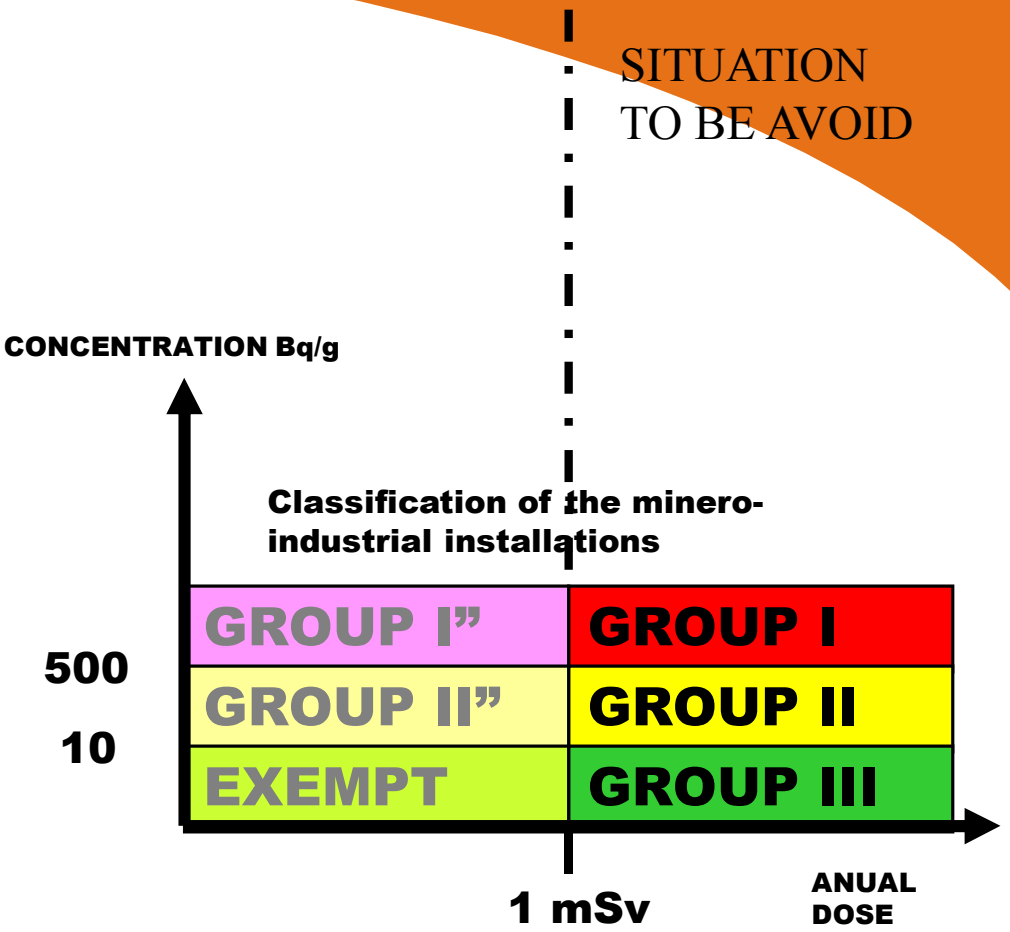

Group III- Little information should be submitted to CNEN for analysis (mass balance, concentrations of U and Th, solubility, waste, etc.). They are not generally necessary safety and radiation protection measures to prevent exposure of the public of the individual above 1 mSv / year)

GROUP II - A simplified report safety analysis should be submitted to CNEN for evaluation-content set forth in item 6.2 of the standard. (Safety and radiation protection measures may be needed to avoid exposure of the public of the individual above 1 mSv / year)

GROUP I - A detailed safety analysis report should be submitted to CNEN for evaluation-content set forth in item 6.3 of the standard. (General safety and radiation protection measures are necessary to avoid exposure of the public of the individual above 1 mSv / year)

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NORM-TENORM

LOCALIZAÇÃO DAS INSTALAÇÕES MÍNERO-INDUSTRIAIS

- Borborema (RN/PB) - pegmatitos
- Bunge Fertilizantes - Araxá (MG)
- Cambuí (carvão) - Figueira (PR)
- Cia. Ind. Fluminense - CIF - S.J.Rey (MG)
- CBL - Araçuai (MG)
- CBMM - Araxá (MG)
- Extrativa Manganês - S.J.Rey (MG)
- Fosfértil - Tapira (MG)
- MIBRA - Nazareno (MG)
- Millennium - Mataraca (PB)
- Min. Catalão - Catalão (GO)
- Min. Mamoré - P. do Bom Jesus (SP) e S. Tiago (MG)
- Min. Taboca - Pitinga (AM)
- Min. Serra do Sossego (PA) - CVRD
- Projeto 118 (PA) - CVRD
- Ultrafértil - Cubatão (SP)

+

PETRÓLEO, ETC

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IBAMA
(OUR EPA)

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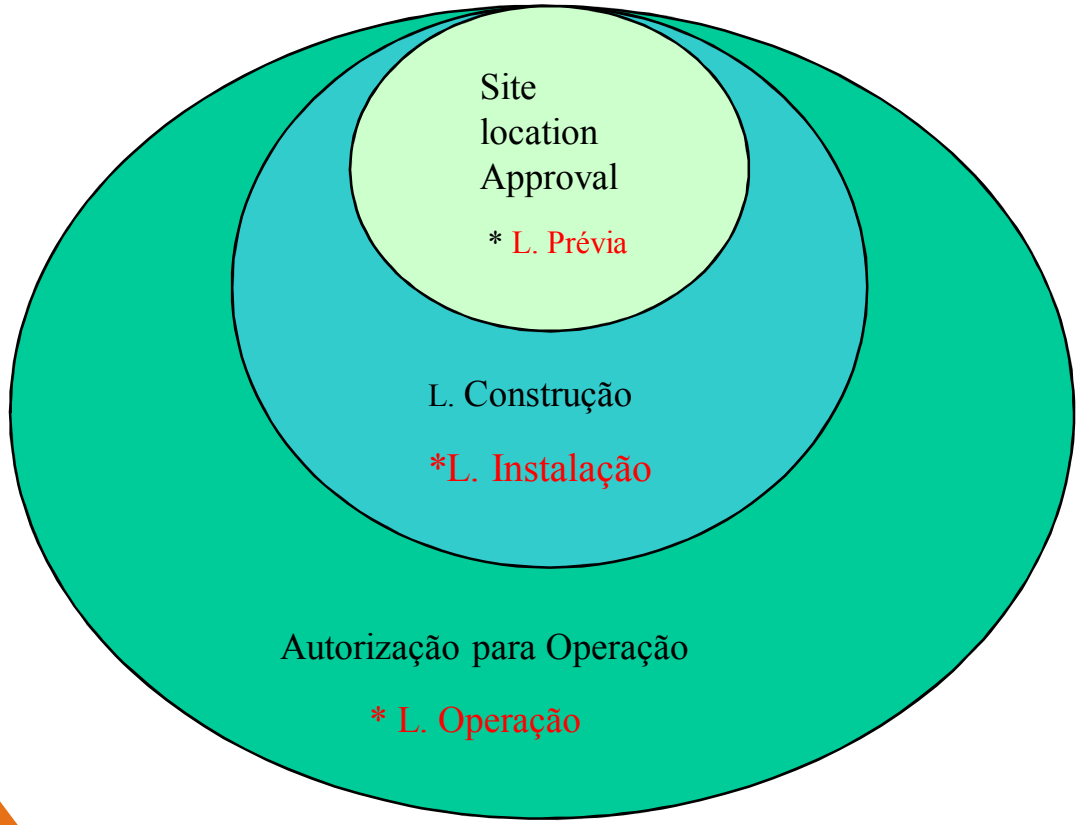
de Energia Nuclear

Licensee Procedures for the nuclear installations

CNEN

*IBAMA



Term of Reference is signed

CNEN-FSAR

IBAMA-EIR-EIA

There are no procedures established so far between CNEN and IBAMA for the minero-industrial activities – a meeting was held on july to initiate the discussions

Comissão Nacional de Energia Nuclear

Thank you very much!!!!

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