WHAT WASTE IS "RADIOACTIVE"?
DEFINING THE SCOPE OF THE REGULATORY SYSTEM

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All substances -- whether regarded as waste or not -- hold some amount of radioactivity. They contain either naturally occurring radioactive materials, or traces of radioactive substances produced from human activities.

This fact has complicated what at first glance seems like a rather easy question -- namely, what is radioactive waste? Of course, instruments detect even the smallest levels of radiation around us. But radiation detectors alone cannot answer the question, since there is is no threshold below which radioactivity cannot be identifed as one property of waste -- whatever its origin.

So the question is actually far more complicated, and raises issues about how societies define and regulate all kinds of wastes.

Over the past decade, the issue of defining radioactive wastes for regulatory purposes has been hotly debated among experts in the field. So far, agreement has been elusive on two distinct concepts -- namely, the *exclusion* and/or *exemption* of radioactive wastes from regulatory requirements. Both of these concepts speak to the scope of the system regulating radioactive materials. Basically, such a system should establish what wastes are within the system, and therefore should be treated as radioactive waste, and what wastes should be outside the system and therefore *excluded* from the regulations for treatment as "normal" wastes. The system should also establish what radioactive wastes are in principle within the system but, because their radioactivity is trivial, they can be *exempted* from regulatory action.

The lack of international agreement on these concepts is important because it breeds ambiguity and inconsistency in regulatory approaches, and by extension affects the costs of regulation. For example, some national regulatory standards regulate wastes containing trivial amounts of radioactive materials arising from nuclear activities, but the requirements usually do not apply to wastes from industries handling naturally occurring radioactive materials (NORMs), which may contain substantial amounts of radioactivity. *(See box, pages 38 & 39.)*

Through its work, the IAEA has been instrumental in trying to stimulate some kind of global harmony in the characterization of radioactive waste. This article describes the state of international consensus that has been reached so far.

SCOPE OF THE REGULATORY SYSTEM

The "scoping" of the regulatory system used to control radioactive waste is an important matter. Considerable resources could be spent unnecessarily if the regulatory "scope" is not properly defined and waste that does not need to be regulated as radioactive is subjected to strict controls. Lately, the issue has received closer attention, not least because of the question of whether to regulate waste from industrial activities involving NORMs.

As all substances are radioactive and able to cause radiation exposure, radiation protection regulations in principle can be applied to everything, to every human activity and every environmental situation, to every waste. However, regulatory systems are presumed to have limited resources. Consequently, in order to achieve appropriate use of resources, and also to avoid legal ambiguity, the scope of application of regulatory systems needs to be clearly defined, particularly in the case of waste.

The International Commission on Radiological Protection (ICRP) -- whose recommendations guide the

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INTERNATIONAL RADIATION SAFETY STANDARDS

The International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources -- often called the BSS -- were issued by the IAEA in 1996 as Safety Series No. 115. The BSS are co-sponsored by all the international organizations with interests in radiation safety. They set down requirements for protection against the risks associated with exposure to ionizing radiation (or radiation in short). These requirements are based on the estimates of the health effects attributable to radiation exposure, which are periodically submitted to the United Nations General Assembly by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), and on radiation protection recommendations of the International Commission on Radiological Protection (ICRP).

For more information and technical references, see the *IAEA Bulletin*, Vol. 36, No. 2 (1994), and visit the "RasaNet" Web pages of the IAEA's *WorldAtom* site at www.iaea.org, and the Web site of the ICRP at www.icrp.org.

formation of international radiation safety standards --has recognized the importance of limiting the scope of its System of Radiological Protection. In its latest recommendations, the ICRP indicated that: *"[as] everyone in the world is exposed to radiation from natural and artificial sources..., any realistic system of radiological protection must therefore have a clearly defined scope if it is not to apply to the whole of mankind's activities."*

In many countries, regulations governing radioactive waste management and disposal are guided by international standards of radiation protection and safety. These were last issued in 1996 as the *International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). (See box this page.)*

The BSS establish requirements for controlling the additional radiation exposure caused by ***practices***. This is the term used to characterize human activities (such as the medical and industrial uses of radiation and radioactive materials and the generation of electricity by nuclear power) including their wastes, which are expected to add some radiation exposure to the background radiation exposure that people normally incur. The BSS also establish requirements for averting existing radiation exposures, including high background exposures, through ***interventions***. This is the term used to describe the protective activities seeking to reduce radiation exposure that is not part of a controlled practice. After the termination of intervention, some residual waste may remain.

Thus, practices may generate radioactive waste; intervention may leave residual radioactive waste. Some of these wastes may not need to be regulated. In order to facilitate these types of decisions, the BSS include the concepts of ***exclusion*** and ***exemption***. Both of these concepts are modern parallels to the ancient criteria of *de minimis non curat lex* and *de minimis non curat praetor*, which governed similar problems in Roman law two millennia ago.

Exclusion simply determines what waste shall -- and what shall not -- be subject to regulatory instruments related to radiation safety. *Exemption* determines what waste may -- and what may not -- be freed *a priori* from some or all regulatory controls. The BSS further introduced another term -- *clearance* -- to denote exemption from within the system of control, i.e., exemption *a posteriori*.

These three terms are not "waste safety" concepts per se; rather they should be viewed as mechanisms intended to protect the regulatory authorities from unnecessary burdens. Indirectly they strengthen the regulatory system by allowing the regulators to concentrate on exposures or radioactive substances that they can control effectively and whose control is essential for public health, safety, and protection of the environment.

Thus, the BSS incorporates the concepts of ***exclusion*** and ***exemption*** to describe situations where regulatory controls are either not feasible or not warranted.

THE CONCEPT OF EXCLUSION FROM REGULATION

Exclusion is described in the BSS as follows: *"Any exposure whose magnitude or likelihood is essentially unamenable to control through the requirements of the BSS is deemed to be excluded from the BSS."*

The ICRP recommended that: *"Sources that are essentially uncontrollable, such as cosmic radiation at ground level and potassium-40 in the body, can best be dealt with by the process of exclusion from the scope of the regulatory instruments,..."*

In BSS parlance, exposures which are excluded include uncontrollable exposures and exposures that are *essentially unamenable to control*, regardless of their magnitude. Uncontrollable exposures are those that cannot be restricted under any conceivable

circumstance. A typical example is the exposure caused by radioactive elements -- like potassium -- that are constituents of our body and essential for our normal living. An example of an exposure that is essentially unamenable to control (i.e. where control is theoretically feasible but obviously impractical) is that due to cosmic rays at ground level.

Exposures of this kind are to be excluded from regulations -- even though they may be important for public health -- because it would not be feasible to regulate them. It is to be noted that the exclusion applies to the exposure itself, rather than the source of the exposure. This is because a radiation source can produce various types of exposure in a variety of situations, some of which may be amenable to restrictions while others may not.

Equally important is that the determination of what is essentially unamenable to control requires a judgement on the part of the legislator, which may be influenced by cultural perceptions. For instance, exposure to cosmic rays at ground level is universally considered unamenable to control. Cities have been sited at high altitudes (e.g. La Paz, the capital of Bolivia is located at more than 4000 meters). The inhabitants of these cities incur a substantively higher exposure than those living at sea level. However, it has not been considered reasonable to move these cities to lower altitudes just to avoid the exposure.

In relation to the controllability of exposures from other natural sources, including waste from industries processing NORMs, the international practice is vague. For instance, the BSS refer to exposure from "unmodified concentrations of radionuclides in most raw materials" as an example of an excluded exposure. The national attitudes to these materials are extremely variable. People in many countries enjoy beaches with monazite sands, which are rich in naturally radioactive materials. But the authorities in these countries do not restrict radiation exposure to these materials in spite of the fact that control would be rather simple (e.g., by limiting access to the beaches). In other countries, even the transport of relatively small amounts of these types of sands is under regulatory control.

The reference to "most raw materials" in the BSS indicates that there may well be a few industries using NORMs where radioactivity concentrations are high enough to warrant consideration and control. An extreme, but generally accepted, case is the production of uranium or thorium ores, but some other raw materials may also need to be considered. The BSS reference to "unmodified concentrations" points to the fact that processing some raw materials, which may have relatively normal concentrations of radioactivity, may lead to products or wastes that have much higher levels.

The approach that should be adopted with respect to waste from industries processing NORMs is currently the subject of a lively international debate. Further work is required to reach an international consensus on what exposures from natural wastes should be excluded from (or perhaps, more appropriately, included within) the scope of regulations.

THE CONCEPT OF EXEMPTION FROM REGULATORY REQUIREMENTS

The BSS use the concept of exemption only within the context of practices; therefore, the concept is applicable to waste generated by practices. The BSS provide the following description of exemption: "*Practices and sources within practices* [and their waste] *may be exempted from the requirements of the BSS, including those for notification, registration or licensing ... Exemption should not be granted to permit practices that would otherwise not be justified*".

The ICRP also had provided guidance on the exemption of sources from regulatory control as follows: "*In order to avoid excessive regulatory procedures, most regulatory systems include provisions for granting exemptions ... The Commission believes that the exemption of sources is an important component of the regulatory functions... There are two grounds for exempting a source or an environmental situation from regulatory control. One is that the source gives rise to small individual doses and small collective doses in both normal and accident conditions. The other is that no reasonable control procedures can achieve significant reductions in individual and collective doses. The basis for exemption on the grounds of trivial dose is much*

THE CASE OF "NORM"

Radioactive waste regulations have focused largely, if not exclusively, on practices making use of "artificial" sources of radioactivity, that is, those arising from human activities. However, there is another area where arguments could be made for and against the need for regulatory involvement on radiological protection grounds: waste from industries involving bulk quantities of naturally occurring radioactive materials (NORMs) but where the presence of radioactivity is often incidental to the use to which the material is being put. Examples include the production of mineral sand products, of phosphoric acid from phosphate rock, of some metals (e.g., tin), and the use of natural building materials containing elevated levels of natural radionuclides. ICRP recommendations strengthened the idea that, in principle, such industries may be candidates for regulation; in some cases, doses to workers and the public were at least as high as those from nuclear installations, and in many cases they were significantly higher. These industries may produce radioactive waste containing much higher levels of radioactivity than the exemption levels. *(See table, which shows a particular example on the mining and processing of mineral sand in Australia.)*

These situations are different from those involving artificial radionuclides where the concept of triviality has been used to decide on the extent of regulatory involvement. The differences are: (i) the industries and processes have often been operating for many years and may predate systems of radiological protection that were introduced, at least initially, for protection against artificial radionuclides; and, (ii) the possibility of significant changes in exposure rates, in particular, an increase, may be automatically limited by a number of factors including plant throughput, the natural upper bound on the activity concentration of the raw material, and workplace legislation controlling concentrations of airborne dusts.

One approach would be to exclude these industries from regulations unless the activity levels in the materials used were such that the doses being received were sufficiently high to cause concern. Another approach follows from a decision that specified industries should be subject to regulation, i.e. that they constitute a *practice* in the context of the BSS. In such cases, a provision for exemption from regulatory requirements may be useful, but the conditions for such exemption would need to be defined. The concept of triviality of additional dose could no longer be applied -- the condition could, for example, be established on the basis that exemption is the optimum option for radiation protection. However reasonable this might be from a theoretical perspective, it could be seen as applying different "standards" for situations involving artificial radionuclides as compared with NORM. For this reason some have proposed that NORM industries should be regulated in the same way as nuclear-related industries. This would mean that for most wastes from NORM industries, exemption would not be appropriate because radiation exposures due to NORM are not trivial. The level of regulation would vary depending upon the potential risks to the workers and the public (a graded approach), and for industries where the risks due to radiation are low and where the source or practice is inherently safe, a notification by the operator or owner to the regulatory body that the practice and its waste exist may be sufficient.

sought after, but very difficult to establish. Apart from the difficulty of deciding when an individual or a collective dose is small enough to be disregarded for regulatory purposes, there is a considerable difficulty in defining the source... The underlying problem is that exemption is necessarily a source-related process, while the triviality of the dose is primarily individual-related."

The ICRP had also indicated that: "*The second basis for exemption calls for a study similar to that needed in the optimization of protection. It provides a logical basis for exemption of sources that cannot be exempted solely on the grounds of trivial doses, but for which regulation on any reasonable scale will produce little or no improvement.*"

In ICRP *Publication 64*, the Commission summarized the current criteria for exemption levels for practices as follows: *"In the case of normal exposure, most regulatory systems include provisions for granting exemptions from the regulatory system where it is clear that a practice is justified but regulatory provisions are unnecessary. The grounds for exemption are that the source gives rise to small individual doses (of the order of 10 microsievert per year, or about one hundreth of the average*

TYPICAL THORIUM & URANIUM CONCENTRATIONS IN MINERAL SANDS PRODUCTS AND PROCESS WASTE

Material	*Thorium (Becquerel/gram)*	*Uranium (Becquerel/gram)*	*Material*	*Thorium (Becquerel/gram)*	*Uranium (Becquerel/gram)*
MINING					
Ore	0.04-0.6	0.07-0.25			
PRIMARY SEPARATION					
Product			→ **Waste**		
Heavy mineral	0.6-6.6	<0.25-1.7	Sand tailings	<0.1-<0.4	<0.25
			Oversize	<0.1-<0.4	<0.25
			Slimes	<0.25	<0.25
SECONDARY SEPARATION					
Products			→ **Waste**		
Ilmonite	*0.04-4.1*	<0.25-0.75	*Monazite tailings*	*1.5-5.0*	*0.25-25*
Leucoxene	*0.6-5.7*	*0.5-1.2*	*Slimes*	*~5*	*~0.75*
Rutile	*<0.4-2.9*	<0.25-0.5	*Oversize*	*0.7-5.3*	*1.2-3.7*
Zircon	*1.2-2.5*	*3.7-7.4*	*Mill dust*	*~2-21*	*~0.25-6.2*
Monazite	*410-575*	*25-75*	*Stack particulates*	*~4.41*	*~0.25-12.5*
Monazite concentrate	*80-450*	*12-60*			
Xenotime	*~120*	*~100*			
SYNTHETIC RUTILE PRODUCTION					
Product			→ **Waste**		
Synthetic rutile	*<0.4-2.9*	<0.25	*Iron oxide solids*	*<0.4-2.8*	*<0.25*
			Inert solids	~0.4	~0.1
			Neutralized acid solids	*~0.7-4.4*	*~0.25-1.5*
			Non-magnetic fines	*0.4-5*	*0.25-1.5*
			Kiln scrubber solids	*~0.2-2.2*	*<0.1-0.75*
			Kiln discharge oversize	*~1.1*	~0.4
TITANIUM DIOXIDE PIGMENT PRODUCTION					
Product			→ **Waste**		
Titanium dioxide pigment		Nil	*Residue slurry (wet)*	*2.5*	0.75
			Filter cake (dry)	*1.9-2.9*	*0.75-1*

The table shows typical amounts of radioactivity from thorium and uranium per unit mass of mineral sands products and process waste. The BSS exemption level for thorium and uranium is 1 Bq/g; therefore, part of the products and waste (show in italic in the table) should be regarded as "radioactive".

Source: The Chamber of Minerals and Energy of Western Australia.

background dose) and the protection is optimized, i.e. regulatory provisions will produce little or no improvement in dose reduction. (If the collective dose is small, e.g. on the order of one man-sievert per year, protection is often assumed to be optimized)."

Thus, historically, *exemption* is the concept on which wider international consensus has been achieved. There was an early agreement that some practices do not warrant full imposition of the regulatory system because the additional exposure that they are expected to deliver is trivial. Over 10 years ago, the IAEA, jointly with the OECD's Nuclear Energy Agency (NEA), had set out the following general principles for exempting a practice: (i) individual risks must be sufficiently low as not to warrant regulatory concern; (ii) radiation protection, including the cost of regulatory control, must be optimized; and, (iii) the practice should be inherently safe. *(IAEA Safety Series 89.)*

These principles were further developed. The first principle was interpreted as meaning that situations involving trivial risks would not warrant regulatory control (the other conditions being satisfied of course). By comparison with society's response to, and perception of risks from, other activities, this

principle was converted to an annual dose of around 10 microsievert (or 0.01 millisievert), which is equivalent to less than 1% of the average natural background and less than one tenth of a percent of typically elevated background radiation levels in many parts of the world. These considerations supported the idea that doses in this range could be regarded as trivial.

Turning to the optimization principle, IAEA/NEA made the point that a practice could be considered as a candidate for granting exemption if the result of the assessment of optimization showed that exemption is the optimum radiological protection option. Furthermore, the resources required for regulation were a factor that needed to be considered in the optimization of protection. The IAEA/NEA suggested on cost-benefit grounds, that if the collective dose committed by one year of the unregulated practice were less than around 1 man-sievert, or 1000 man-millisievert, the expected detriment would be low enough to permit exemption without more detailed consideration of other options. This does not mean that a practice giving rise to a larger collective dose could not be exempted; rather it would have to be shown in such cases that exemption is the optimum solution in radiological protection terms. In should be noted, however, that the collective dose criterion has, in general, not been a determining factor in the exemption of practices.

These dose criteria, together with the requirement for inherent safety, have been accepted internationally as a basis for the exemption of practices from regulatory control, and were introduced in the BSS. They were turned into radionuclide-specific levels which can be applied directly. In doing so, the concept of exemption was further refined as follows: (i) a practice is taken to be a use of radionuclides for a specific purpose (industries where large quantities of naturally radioactive ores or materials were being processed for other than their radioactive properties were not considered); (ii) candidate practices involving small-scale usage of radionuclides, eg, medical research, etc (practices involving large quantities of radionuclides, eg, nuclear installations, may not be "inherently safe"); and, (iii) the dose criteria apply to individuals working in the practice as well as to members of the public exposed incidentally to discharges. On the basis of these assumptions, a set of exposure scenarios was constructed and used to derive concentrations and total quantities of radionuclides that corresponded to the dose criteria. These derived radionuclide-specific levels are included in Schedule I of the BSS (the same values were also incorporated in the Euratom Basic Safety Standards). Their use allows automatic exemption from the requirements of the BSS, except that the practice should be justified; i.e., exemption should not be invoked to allow frivolous or unwarranted usage of radionuclides.

Thus, a practice that is so exempted is not outside the system of radiological protection nor is it outside the scope of a regulatory system. Rather the exemption is from the administrative aspects of a regulatory system. Regulatory involvement should not be required at any stage of the practice, and this includes the disposal of any resulting wastes.

It should be noted, however, that the exposure scenarios used in calculating the radionuclide-specific levels all assumed small-scale usage of radionuclides, and therefore waste with small amounts of radioactivity. Situations involving large volumes of wastes with very low activity concentrations, such as can arise during decommissioning of nuclear installations, were not explicitly considered. If the radionuclide-specific exemption levels are used in these types of situations, doses in excess of trivial levels could theoretically be received (although probably not in excess of the dose limit for members of the public).

Schedule 1 of the BSS also provides for conditional exemption of radioactive materials which are not covered by the radionuclide-specific levels mentioned above (such exemptions might well be used for disposing of devices such as smoke detectors containing small amounts of americium-241). It also recognizes that in establishing conditional exemptions, the regulatory authority may set conditions, for example, on the physical or chemical form and on the use or disposal of the radioactive material, so that the general principles for exempting a practice are complied with. It is to be

noted that, generally, in using *exemption* it is important to state from "what" the practice is being exempted. In general, unless otherwise stated, the term exemption refers to exemption from all of BSS requirements except the requirement of justification of the practice.

THE CONCEPT OF CLEARANCE

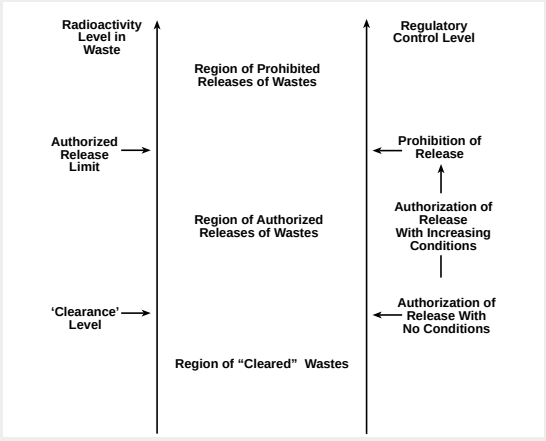
The BSS also uses the concept of *clearance*. While *exemption* is used as part of a process to determine *a priori* the nature and extent of application of the system of registration or licensing of a practice, *clearance* -- in BSS parlance -- is intended to mean exemption *a posteriori*, i.e., *exemption*, from within the system, of sources which for one reason or another are under regulatory control and should not continue to be so. Thus, clearance is defined in the glossary to the BSS as: "*Removal of radioactive materials or radioactive objects within authorised practices from any further control by the Regulatory Authority*". Furthermore, the BSS state that clearance is subject to clearance levels that are "*Values, established by the Regulatory Authority and expressed in terms of activity concentrations and/or total activity, at or below which sources of radiation may be released from regulatory control*".

Although the intention of the BSS was to limit the concept of clearance to an administrative exemption from within the system, the word itself did not help to convey the anticipated idea. The word "clearance" has different meanings in English with no direct translation into other languages. In language editions of the BSS, for example, it was translated as "liberation" in French and as "dispense" in Spanish. Not surprisingly, this led to different interpretations of the concept and resulted in some confusion.

One distinct use of the term clearance relates to the release of radioactive materials into the environment. While some of the wastes generated by practices will require isolation in an appropriate facility, others may be candidates for release to the environment.

Generally, controlled releases of radioactive materials from approved practices are governed by an authorization. Such authorizations may have conditions attached to them including, for example in the case of effluent discharges, requirements for environmental monitoring, retrospective assessment of critical group doses, etc. The lower the assessed dose to members of the public, the less stringent the requirements are likely to be. It makes sense to define some point in this spectrum where there are no such requirements. This point defines a subtly different "clearance" concept: it is the release of materials whose activity level is sufficiently low that any form of post-release regulatory involvement is not required in order to verify that the public is being sufficiently protected. *(See graph this page.)* This regulatory involvement could be a requirement for monitoring of the environment or, in the case of solid material, specification of the destination for the released material or of the use to which it should be put. The dose criteria developed for exemption/clearance could equally be applied to this analogous "clearance" concept.

A GRADED APPROACH TO THE AUTHORIZED RELEASE OF WASTE



The term "clearance" has also been used in legal terms as equivalent to the lower boundary for the definition of radioactive waste. Materials, for which no future use is foreseen with activity levels above clearance levels, would be regarded as radioactive waste; whereas, if their activity levels are at or below clearance levels, they would not be regarded as being radioactive for regulatory purposes.

Within this conundrum of concepts, which seem equivalent but are subtly different, *clearance levels* have been, and continue to be, developed for a number of materials. Within the European Union, the Article 31 Group made recommendations on clearance levels for a number of important radionuclides in metals from the dismantling of nuclear installations. The IAEA has developed clearance levels for release of radioactive materials from medicine, industry and research and is also developing clearance levels for general application to any solid material. Thus, clearance levels for the most important radionuclides are available for a range of

different materials. When compared with the values derived for *exemption*, the *clearance* values tend to be the lower. One reason is that much larger quantities of materials are generally taken into account in calculating *clearance* levels than in deriving *exemption* levels.

There have been some discussions as to whether one set of radionuclide-specific values should be used to allow both *exemption* of practices and *clearance* of materials from regulated practices. Such an approach has the advantage of simplicity; one set of values would be easy to apply and could be interpreted as a definition of a radioactive material, including radioactive waste, for regulatory purposes.

There are, however, counter arguments. The values for clearance are being derived on the basis of different assumptions and sometimes for a different purpose than those derived for exemption. A consequence of choosing one set of values is likely to be selection of the lowest of those available. Nevertheless, there may be a case for choosing one set of values for *clearance* levels: a plethora of levels, each specific to a material or industry, will lead to confusion. Another tempting possibility is to use a specified fraction of the published *exemption* levels as a generic clearance level.

At the IAEA International Conference on the Safety of Radioactive Waste Mangement, convened in March 2000 in Cordoba, Spain, the Chairman of the ICRP, Prof. Roger H. Clarke, stated that "*...if, at the outset, we had realized what a complex system we were going to end up with and had thought of the various possible scenarios, we would probably not have had to make a distinction between exemption and clearance...exclusion and exemption are reasonably straightforward; we have criteria for them. However, there are*

EXCLUSION & EXEMPTION FROM INTERVENTION: THE ICRP RECOMMENDATIONS

The ICRP has provided some specific recommendations in relation to *interventions.* While these recommendations are not particular to waste, they may influence international agreements on how to deal with residual waste remaining from interventions. In its *Publication 60*, the ICRP stated that: "*To avoid unnecessary restrictions in international trade, especially in foodstuffs, it may be necessary, in this context, to apply derived intervention levels [that] indicate a line of demarcation between freely permitted exports or imports and those that should be the subject of special decisions. Any restrictions applied to goods below the intervention levels, better called intervention exemption levels for this purpose, should be regarded as artificial barriers to trade. Trade in materials above an intervention exemption level should not automatically be prohibited, but such materials might be subject to temporary controls. Intervention exemption levels used in this way in international trade should not necessarily have the same quantitative values as the intervention levels used for initiating action in other circumstances*". This important recommendation, which is applicable to exposure situations involving commodities for public use, could be applied to existing waste.

The presence of long-lived radionuclides in commodities for public use, such as building materials, has caused lively discussion on the scope of radiation protection. When the radionuclides are attributable to a practice, their levels in the commodities are controlled through the ICRP System of Radiological Protection for practices. In other cases, they should conceptually be subject to intervention. Mainly due to the globalization of markets, intervention exemption levels of radionuclides in commodities cannot be established on a case-by-case basis; rather, they need to be standardized. A similar problem exists with the residual waste from interventions. On the basis of the presumption that it is not likely that several types of commodities would be simultaneous sources of high prolonged exposure to any given individual, the ICRP has recently recommended a *generic intervention exemption level* of around 1 millisievert for the individual annual dose expected from a dominant type of commodity, such as some building materials which may in some circumstances be a significant cause of prolonged exposure. Since some of these commodities will end as waste, it could be expected that the recommendations will be applicable to these wastes as well. Following this recommendation, national authorities and, as appropriate, relevant international organizations are expected to derive radionuclide-specific *intervention exemption levels* for individual commodities, in particular for specific building materials. The ICRP noted that intervention exemption levels should not be used for implicitly

problems with clearance, and perhaps a better term would be 'authorized release'....[and]*...the maximum dose does not have to be 10 micro-sievert per year. One authorizes discharges of radionuclides in such a manner that, in accordance with the ICRP's latest relevant recommendation, the dose to the most exposed members of the public does not exceed the dose constraint of 300 micro-sievert per year."* He emphasized, however, that we should not be "*looking for a single 'magic number' [as] there is a whole spectrum of authorized release, and it is the situations which regulators approve."*

OUTLOOK FOR THE WORK AHEAD

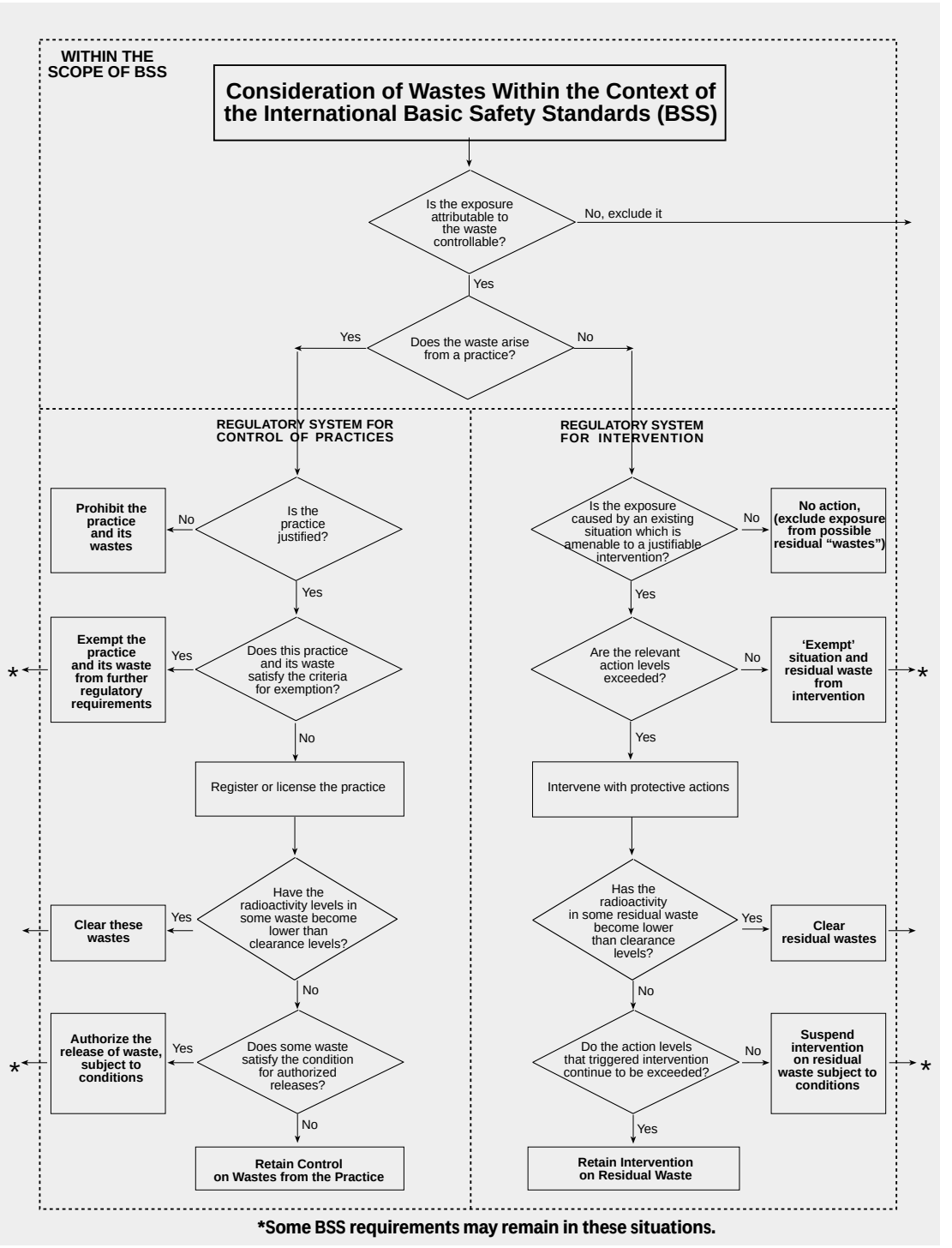
Surprisingly for many, work still is needed to reach full international agreement on what constitutes "radioactive wastes" for regulatory purposes. While there is general agreement on the meaning and application of the concepts of exemption, clearance, and authorized release (as defined in the BSS) to waste arising from practices, problems remain with the full interpretation of the concept of exclusion, and especially with the application of the concepts of exclusion and exemption to waste from NORMs. Some indications have been given here of the possible ways forward, but more discussion is needed to reach international consensus.

Substantial amounts of residual radioactive waste can remain after the undertaking of interventions. The application of concepts which are analogous to exclusions and exemption from practices to these situations has been proposed as a means of avoiding the needless control of such residual waste and also as a means of establishing acceptable levels of contamination in commodities moving in trade from countries affected by intervention actions. The ICRP has made a number of recommendations in this regard. *(See box on this & facing page.)*

relaxing radionuclide release limits for practices; in particular, they should not be used for the recycling of materials resulting from the decommissioning of practices, which should be regulated by the criteria of exemption for practices.

An exceptionally difficult situation is presented by commodities produced in an area affected by radioactive releases from an accident and containing radioactive substances attributable to the releases. If the corresponding activity levels are higher than those in products from neighbouring areas, issues of market acceptance could arise -- particularly if there are transboundary movements of the commodities. The WHO/FAO Codex Alimentarius Commission adopted generic intervention exemption levels for radionuclides in foodstuffs following an accident. These levels have been incorporated into the BSS. They would lead to individual doses of up to a few millisieverts per annum to those who consume the foodstuffs.

Moreover, recently, in its *Publication 82,* the ICRP has also recommended the use of generic reference levels for action (or no action) in intervention situations. These levels can conveniently be expressed in terms of the existing annual dose in a particular situation. They are particularly useful when intervention is being considered in situations of exposures to radioactive residues that are a legacy from the distant past. The ICRP, however, prudently recommended that generic reference levels should be used with extreme caution. If some controllable components of the existing annual dose are clearly dominant, the use of the generic reference levels should not prevent that protective actions are taken to reduce these dominant components. These actions can be triggered by either specific reference levels or case-by-case decisions following the requirements of the System of Radiological Protection for interventions. Nor should the use of the generic reference levels encourage a "trade-off" of protective actions among the various component of the existing annual dose. A low level of existing annual dose does not necessarily imply that protective actions should not be applied to any of its components; conversely, a high level of existing annual dose does not necessarily require intervention. With these provisos, the ICRP considers that an existing annual dose approaching about 10 millisievert may be used as a generic reference level below which intervention is not likely to be justifiable, making it a generic case for exemption from intervention. However, below this level, protective actions to reduce a dominant component of the existing annual dose are still optional and might be justifiable. In such cases, action levels specific to particular components can be established on the basis of appropriate fractions of the recommended generic reference level. Above the level below which intervention is not likely to be justifiable, intervention may possibly be necessary and should be justified on a case-by-case basis.



While these recommendations generally are intended for interventions *per se*, they are a useful framework for future developments. However, the application of exclusion and exemption criteria to residual waste from intervention needs further analysis and discussion. In particular, it is necessary to address the potential confusion that might be expected if commodities are released by exemption from intervention to a region where materials also are being released from practices by the clearance mechanism.

Within these provisos, the diagram on this page provides a simplified summary of the current situation. ❐