Some Suggestions to Adequate the IAEA Safety Standards Series No. 49 According to the General Safety Requirements Part 3 from IAEA

Adelia Sahyun[a,d*], Carlos N. Ghobril[b], Clarice F. Perez[c], Gian Maria Sordi[a]

[a]Instituto de Pesquisas Energéticas e Nucleares/ ATOMO Radioproteção e Segurança Nuclear, São Paulo, Brazil

[b]Instituto de Economia Agrícola - São Paulo / ATOMO Radioproteção e Segurança Nuclear, São Paulo, Brazil

[c]Centro Tecnológico da Marinha em São Paulo - CTMSP, São Paulo, Brazil

[d]Associação Brasileira de Ensaios Não Destrutivos e Inspeção, ABENDI, São Paulo, Brazil

Abstract. At that time of publication SSR49 two exposure situations were considered, namely: practices and interventions, with Naturally Occuring Radioactive Material (NORM) being considered as intervention exposures but acknowledging that some natural sources can have exposures resulting from practices. In the Ba sic Safety Standards (BSS) the exposure situations have been categorised as planned, emergency and existing. These three situations necessitate an update of SSR No.49 since NORM fits in the existing situation, i.e one in which the doses already exist and should be reduced. To reduce the doses will create radioactive waste that must be either treated or stored. This scenario raises a problem of defining the dividing line between existing and planned situations. The point of transistion from one situation to the other needs to be clarified in order to establish the necessary controls for an existing situation whilst providing the necessary controls needed for the planned situation. For the latter planned situation several questions arise as to whether certain requirements can be exempted and under what circumstances. This paper will examine what the authors consider most important in more detail with some suggestions made for further consideration.

KEYWORDS*: *NORM; mining.

1 INTRODUCTION

The aim of this paper, is to present some suggestions that envolve in a revision of the IAEA Safety Series Report (SSR) N°49, 2006 [1], entitled: "Assessing the Need for Radiation Protection Measures in Work Involving Minerals and Raw Materials due to the recent publication of the IAEA[2]" according to the Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards Edition, General Safety Requirements Part 3, GSR Part 3, Vienna (2014) . Our suggestions are cover two important aspects namely:

a) Update recommendation of the Safety Series Report (SSR) N°49, 2006 [1]
b) Important issues that should now be introduced to meet the demands of General Safety Requirements Part 3, GSR Part 3 they made necessary due to the radiation levels presented by the materials and their by-product.

2 DISCUSSION

We will show some arguments that illustrate the need to revise SSR49 and also some issues that could be addressed in the new publication.

*Presenting author: asahyun@ipen.br or adelia@atomo.com.br

2.1 SSR49, Section 2.3.2 (a)

"… with regard to the activity concentration levels in materials below which it is usually unnecessary to regulate 1 Bq/g for uranium and thorium series radionuclides and 10 Bq/g for ^{40}K … ".
It is not clear that the exemption levels stated in paragraph (a) refer to values in which the radioactive materials are considered unnecessary to regulate from a radiological protection point of view. These values consider the scenarios of more restrictive dose which provide individuals with a dose equal to or less than 10 μSv/y. With this and the public limits from 1 mSv/y for the whole body, the exemption levels derived from the application of radiological protection regulations would increase by a factor of one hundred (100) or more.

In addition, if we consider the derived air concentration, it can be concluded with reasonable confidence that the exemption limits would also be allowed to increase by a factor of around 100 (one hundred).

In the case of ingestion, this level of intake will never be achieved since the body can only accept a limited mass of material.

Finally, if we consider the external dose exposure, the effects of self-absorption in the material will increase the quantity of the material required to produce the measured external dose.
In view of the above it becomes problematic to make a direct relationship of dose rate in mSv/h per Bq/g from Tables 10, 11, and 12 from SSR49 which would then result in an exemption level of 1 mSv/y.

2.2

It is proposed that the radiological protection regulations are revised to identify for Naturally Occurring Radioactive Material (NORM) the activity concentration (Bq/g) as a function of volume to determine a volume of the material above which the mass or volume of the material can be disregarded, with regards an external dose, due to self-absorption effects.

2.3

SSR49 was published in 2006 with two exposure situations defined as practices and interventions. Some 5 years later the IAEA published the Basic Safety Standards Interim Edition, General Safety Requirements Part 3 [Ref2] in which three exposure situations, planned, emergency and existing were defined.

SSR49 is based on the existence of two exposure situations,namely practices and interventions, and currently section 2.3.2(a) is considered to be an intervention. In the BSS published in 2011 the exposure situations were categorised as planned, emergency and existing. As a result SSR49 needs to be revised to align with the three exposure situations defined in the BSS.

2.4

The situations include those in which the radiation doses already exist and should be reduced. To reduce existing doses will generate radioactive waste and / or raw material and in this case the situation will change from existing to planned. The first problem to resolve is to establish when a situation becomes planned situation. We recall that in the existing situation the first steps to be made relate to the principles of justification and optimization of protection to verify whether it is feasible to undertake the action of decreasing doses. If the action of decreasing the dose is chosen and justified and the principle of optimization indicates implementation should begin, this raises

the question at what stage of implementation of the existing situation does it become a planned situation and the requirements therefore change?

2.5

Once the dividing line is established between the two situations under consideration the next step is to check what the conditions of the material under examination that satisfies the record level, since any dose lower than this value is considered as zero or not registered. As the radiation levels are higher than 1 mSv/y personnel involved in processing the material is regarded as a worker. Internationally, both UNSCEAR and the ICRP recommend a recording level of 5 mSv/y whilst in contrast the IAEA Safety Standards recommend its member states that they determine their own levels of registration according to their own national policies, with a caveat that they could not be less than the limits of the public.

We consider in this paper the value of 5 mSv/y has a valid technical-scientific basis and therefore the materials that will not reach this dose value should not be subjected to international recommendations and national regulations for radiological protection.

2.6

For materials that produce doses than 5 mSv/y which are subjeceted to international recommendations and national higher regulations there are several problems that need to be addressed depending on the expected doses in normal situations.

For example, suppose the expected doses do not exceed the average annual limit of 20 mSv/y. In this case we need to indicate in when individual monitoring is necessary since both the international recommendations of ICRP and SSR49 stipulate that is only needed if there are large variations in doses during the development of tasks and thus can not be predicted beforehand. But in practice it is necessary to monitor the workplace and it must be defined which of external radiation, contamination of surfaces and air contamination are required.

Dose in this region should be, undoubtedly required be subjected to the principle of optimization and other aspects of the international recommendations.

We will also need to discuss the possibility of potential exposures.

2.7

The next step is for materials which under normal working conditions have a higher than average but below the annual dose limit of 50 mSv. In this case, in addition to the principle of optimization the use of individual dosimeters and international recommendations should be implemented almost entirely dependant upon the predicted potential exposures.

Consideration of potential incidents and accidents should also be included to inform the requirement for a Radiological Emergency Plan (REP). In this case, in addition to the three types of monitoring of the workplace, individual monitoring for external radiation, contamination of skin, clothing and the potential intake of contamination should also be required.

It is understood that, as result of an incident, the potential situation is considered to be confined within the premises of the nuclear facility and are therefore only workers are affected.

2.8

Unacceptable higher than annual dose limits for both the public and workers when they are subjected to a possible potential situation can be can be considered in the context of their maximum doses and the probabilities of occurrence. In this case one can introduce two situations, the first in which the expected doses are in the region of stochastic biological effects and the second those in which the tissue reactions result in somatic effects that manifest themselves in all subjects who received higher doses above the thresholds.

In these two cases we believe that international recommendations apply fully. Regarding the radiological emergency plan, there is a need to discuss what topics should be covered and to what extent situations in which individuals need referal to specialized medical services should be included.

3 CONCLUSIONS

It is important to assess NORM to establish which materials can exceed the average annual limit for workers in normal work situations.

It is very unlikely that the doses in abnormal situations can reach the levels defined as an incident or accident nonetheless this matter should be included in a revised SSR49 report.

A revision of SSR49 is necessary to align it with the BSS. The aspects discussed in this paper are important for workers involved in processing NORM and we propose that the arguments presented in this paper raise anomalies that should be addressed clearly in a revised SSR49 to provide the correct level radiological protection under all conditions of working.

4 ACKNOWLEDGMENTS

Acknowledgement to Brazilian Association of Non Destructive Assays and Inspection - ABENDI that allowed me to participate in this congress.

5 REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Assessing the need for radiation protection measures in work involving mineral and raw material, IAEA Safety Standards Series No. 49, IAEA, Vienna (2006).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety os Radiation Sources: International Basic Safety Standards Edition, General Safety Requirements Part 3, GSR Part 3, Vienna (2014).