Management of radiological and non radiological risks in a decommissioning project

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Introduction

As already shown by Oudiz et al (1), the assessment of carcinogenic risk and the management of asbestos and ionising radiation needs to focus on three levels namely, the legal obligation level, the organisation and companies level and the work situation level. The main purpose of a paper is to provide a practical example of such management. Based on a set of four operations related to the removal of asbestos from working areas, we want to illustrate the general conclusions as presented in (1). After a short description of the SCK•CEN institution and of the BR3 decommissioning pilot project, we will present the general approach of the Health Physics and Safety at the SCK•CEN. Than, four sets of operations will be proposed. One should then stress on the driving forces and compare with the conclusions presented in (1). Lessons which have been learned will serve as conclusion, together with the remaining questions which are the questions the 4th European ALARA Network Workshop has to deal with.

Setting the scene

The Belgian Nuclear Research Centre (SCK•CEN)

The mission of the Belgian Nuclear Research Centre of Mol is mainly dealing with the peaceful uses of nuclear energy. As a federal institution, the SCK•CEN has 600 employees who are performing their function in the departments as shown in figure 1 . The SCK•CEN installations are mainly the four research reactors, the underground laboratory, the laboratories for the studies of the irradiated materials and for the measurements of very low activities. There is also a department dealing with the radiological protection and laboratories working with uranium and plutonium. The SCK•CEN is working in many programmes,for some of them as partner in European projects,for some other to provide support to the belgian authority.

The Belgian Reactor 3

As already mentioned, four research reactors belong to the SCK•CEN installation. One of these, the BR3, is now under decommissioning. This reactor has been the first PWR build outside the USA. The BR3 reactor has been used for many purposes (training, research, and production of electricity) and has been definitely stopped in June 1986. Chosen as a pilot project on decommissioning of nuclear power plants by the European Union, the BR3 reactor has also been chosen by the SCK•CEN as a pilot project as far as the optimisation in concerned.
After a first decontamination of the primary loop, the dismantling has been performed. A few months ago, the pressure vessel has been extracted and has been cut for final storage.
Actually, the operators are busy with the cutting operation of the remaining primary circuit components (primary pipes, steam generator, pressurizer, etc….).
The examples we want to stress out in this paper have taken place at the BR3 installation.

The Health Physics and Safety Department at the SCK•CEN

Figure 2 shows the organisation of the Health Physics and Safety Department at the SCK•CEN. This organisation has recently been slightly modified to be in accordance with the last Belgian Royal Decree (3), which requires a better interdisciplinary approach of the health and safety on the workplaces. Almost fifty persons are working within the Health Physics and Safety Department. The missions of this department are described in the Belgian regulations. The head of this has to report to the General Manager, to the "Health Physics and Safety Committee" (representatives from the management line and from the trade unions) and also to the Competent Authority. As far as the nuclear topics are concerned, an independent Control Body that reports to the Belgian Competent Authority, namely to the Federal Agency for Nuclear Control, controls the Health Physics and Safety Department of our centre.

Figure 2: Organisationchart of the SCK•CEN

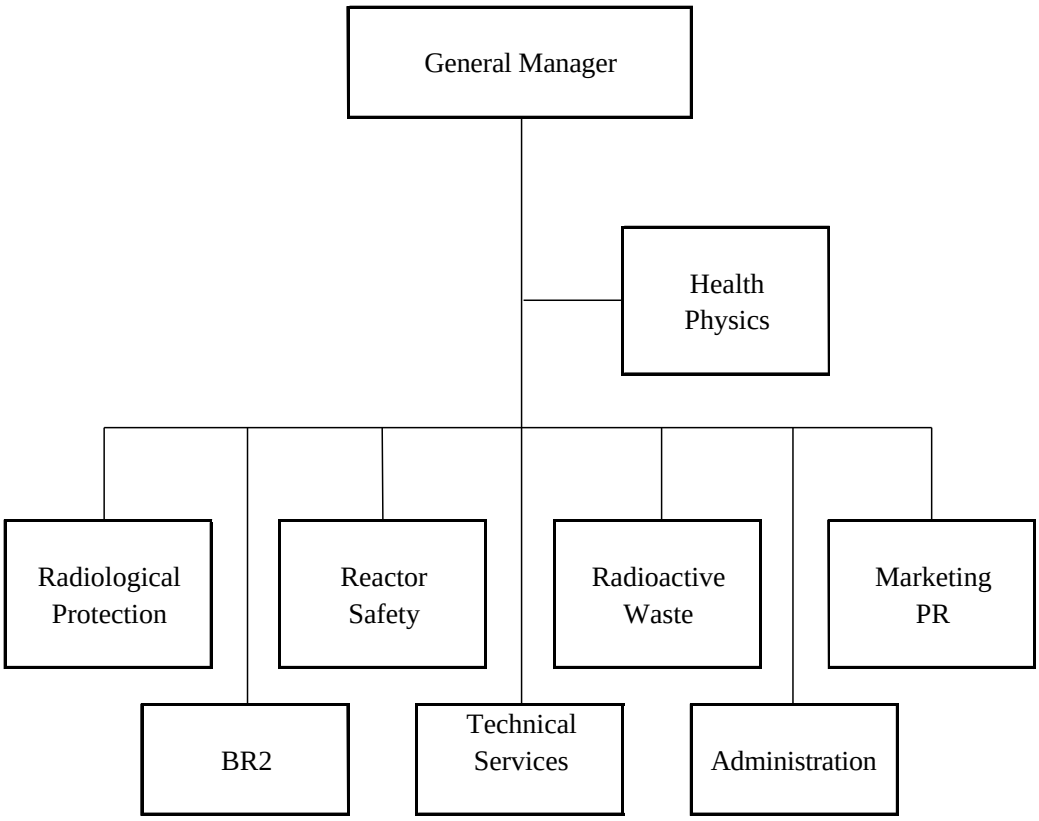
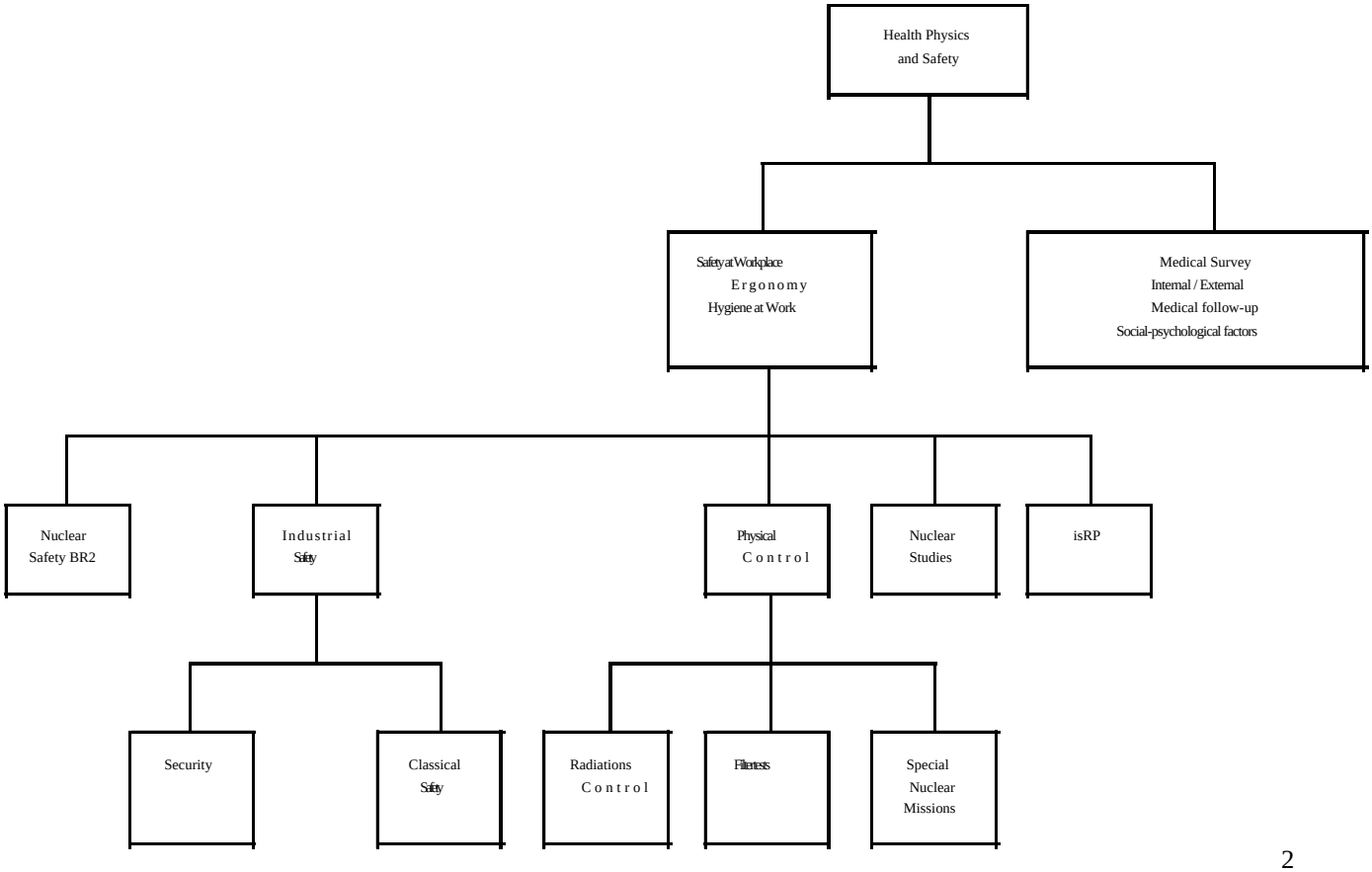


Figure 2: Organisationchart of the Health Physics Department



The ALARA approach

As already described, by the end of the eighties, the management line of the SCK•CEN has decided to put into practice the ALARA principle. Very shortly speaking, this decision has led to the designation of the local ALARA co-ordinators (one for each installation), of an "ALARA and Safety Committee" and, in 1993, to the implementation of an "ALARA procedure". One of the main characteristics of this procedure is that the conventional safety aspects were also dealt with. It is worthwhile to note that the first steps to launch this procedure were based on the pilot-project covering the decommissioning of the BR3 reactor. Since 1993, all the technical procedures have to be completed by an ALARA procedure. Outside the BR3 reactor, let us mention the whole optimisation of the refurbishment of the BR2 reactor which duration was almost eighteen months! The main conclusions of ten years ALARA practice at the SCK•CEN can be found in (2) and (3).

Elimination of asbestos at BR3

The problem

As many buildings built before the publication of the more restrictive regulations dealing with asbestos, use of asbestos bas been relatively important in the BR3 installations. As required by the Belgian regulations, an asbestos inventories needs to be established and one of the missions of the Health Physics and Safety Department is to control the level of asbestos contamination and to insure the completeness of such inventories. In 1997, it appeared clearly to some workplaces in the BR3 building were, if not really contaminated, very close to the limiting value (10 fibre/litre). Furthermore, it also appeared that this level of asbestos concentration were almost reached, not only in some "cold areas", but also in "controlled areas".
The management of the BR3 and the Health Physics Department decided together to perform all the operations required for the removal of asbestos. Indeed, the planning of the following operations related to the dismantling showed without any doubt that the workers could be exposed to such risk in the next months.
Due to simultaneous presence of both risks, radiological and non radiological, it has been decided to take time enough to define an adapted approach involving all the partners. This approach is presented now.

The approach

The first step for the definition of the approach was to identify the partners who had to be involved, the location of the risks and the legal requirement. Contact has then been taken with the administration of the Technical Work Inspection. A first meeting has been organised. A draft of the technical procedure has been proposed as well as the radiological topics. The representants of this administration were then invited to visit the workplaces. It has to be noted that this was their first experience in a nuclear area and that they were really interested persons!
Based on this first contact, the technical procedure and the ALARA procedure have been established. Together with the contract sent to the licensed firm that was chosen to perform the works, copies of the technical as well as the ALARA procedures have been distributed. For example, it was already mentioned that the contractor should take care of the training of his workers. For instance,it was decided to make use of the first day of the works to provide a short information about the radiological and the non radiological risks. Furthermore, a visit to the controlled area has given the opportunity to the workers of this external firm to become aware of their "environment". It also has to be noted that some modifications in the planning as proposed by the contractor have been imposed.

The works

These were performed as foreseen but some modifications were brought and some requirements were added too. For example, instead of working "top-down" as far as the removal of asbestos was concerned, the contractor accepted to begin in the middle of the steam generator. This decision was taken as a result of the pre-job ALARA study performed with the software VISIPLAN. Another example is related to the use of the full-face masks. After a few days, due to our additional check-up for internal contamination, it seemed that the masks in use in nuclear areas were more efficient and that they were more guaranteed for the safety of the workers. The use of cameras is certainly useful in such circumstances. A third example copes with "at random" check-up in the Whole Body Counter for potential internal contamination. This has led to the evidence of disfunctionments (or misuses) of the personal protection equipment and brought to more severe requirements. On the other side, this supplementary measurement was very well accepted by the workers. Their fear, as far as nuclear risks were concerned, has really decreased! Finally, the dose for each worker was daily recorded and transmitted to the partners (contractor, BR3, Health Physics and Safety Department).

The results

The main technical results need to be presented in two ways:

- the positive ones :
  - duration of the works: 35 days (instead of 50 days)
  - quantity evacuated: 6 567 kg (instead of 3 123 kg)
  - received collective dose: 19,2 man.mSv (instead of 88,9 man.mSv)
  - 7 working hours/day (instead of 6 working hours/day)
  - manual cleaning: most important source for the doses (time, distance)
  - depressurisation: 3 mm water (1 mm legal)
- the negative ones:
  - cost of the works:
    - 78 % → waste
    - 18 % → manpower
    - 4 % → varia
  - difficulty to realise the legal rate of ventilation

One may add to these results some other considerations; for instance, the role of the ventilation system is very important ("free release" measurement as far as asbestos is concerned). On the other side, the absolute filters (99,95 %) have been contaminated by asbestos, which will lead to problem when they will be replaced. Some changes in the behaviour of the external work force needed to be required. But the commitment of the project leader in this firm was really positive. Finally, after a few weeks, the owner of the BR3 installation has made another "clearance" measurement. This wasn't required by the regulators but… has been really appreciated by them! For more details, see also (4).

Other asbestos removal!

Since the first elimination of asbestos in 1997, three other operations, with the same goal, have taken place. Their duration, their localisation and their characteristics are quite different from those which we just have mentioned. Let us shortly resume these operations.

- Elimination of the thermal insulation from the legs of the reactor pressure vessel at BR3. This set of operations took place during the month February 1999. Workers belonging to the staff of BR3 performed the related tasks. This was the result of preliminary discussions with the administration of the Technical Inspection on the Workplaces. Indeed, due to the limited quantities of asbestos which had to be taken away and to the very well defined tasks to be performed, she concludes that the nuclear know-how and the safety features usually applied were adequate and that the managers of the BR3 didn't have to work with a licensed external firm. The estimated collective dose was 3,3 man.mSv and the received collective dose was 2,8 man.mSv (9 days and 10 workers).
- Elimination of the thermal insulation from the turbine and from the Machine Hall at BR3. In this case, all the operations happened in the "cold" area of BR3 during the month August of 1999. The only particular topics we want to indicate is that the waste was very slightly contaminated but the values were low enough to proceed to the free release of this material. An external licensed firm has performed all the tasks. A mobile ventilation system, totally independent of the main ventilation circuit of BR3 has been used.
- Elimination of the remaining asbestos from the controlled area of BR3 (September 2000). In this case, an external firm has performed the works, which wasn't the same as in the first elimination. The operations were located into the controlled area and the same procedure as in the first case has been put into practice (technical procedure, ALARA study, training, follow-up). The estimated collective dose was 6,5 man.mSv and the received collective dose was equal to 2,5 man.mSv. It is worthwhile to note that the first technical procedure has been seriously amended by the ALARA and Safety Committee. Indeed, a first estimation of the collective dose gave 13 man.mSv. Furthermore the location where the job had to be done was really "confined" with as a consequence a more potential exposure of the fingers and arms. Finger dosimeters were imposed. Full-face masks were accepted under the condition that these were SCK•CEN masks. The same daily control in the Whole Body Counter was applied. The administration of the Technical Inspection at the Workplaces was aware of our willingness to increase the safety of the workers and she really appreciated as well as our procedure as the final results!

Driving forces and lessons learned

Referring to what has been written up to now and taking advantage of diagram 1 as presented by Oudiz et al, we can observe that :

- each institution as identified by Mr. André Oudiz has effectively been involved in the BR3 operations for removal of asbestos; indeed, at the beginning of the operations, the so-called "Design phase", contacts have established between the authorities, the experts (radiological and non radiological risks) and the licensee. These "kick-off" meetings provided to each partner the most significant factors that have to be taken into account during this first step (Design). It also has to be noted that the main result as far as the legal authority is concerned is that it become clear for her that "If asbestos had to be removed, the removal had to be performed taking into account another risk which for some operations seemed to be considered as the priority"!
- on the other hand, in accordance with the conclusion of Mr. André Oudiz, such works with "combined sources of risks" give the opportunity to the authority to learn something about such workplaces and work conditions. This has clearly lead to a more flexible interpretation of the existing legal requirements, under the condition that transparency can be guaranteed by the exploitant and the local Health Physics and Safety Department representants.
- as a third point, we want to emphasise the importance of such dialogue with the contractors. Also here, like the legal requirements, flexibility appears as a major need during the various steps of the removal's operations. The Health Physics and Safety Department have imposed some changes but this doesn't mean that the contractor will take care of these new requirements. In such case, the obligation to spent one day (for which there was no financial retribution!) for training is a sign of the level of confidence between both partners. To reach such level, the approach of safety by the SCK•CEN is of prior importance. The contractor acceptance in certainly increased if there is sufficient evidence of a high level of the general safety approach in the "host institution".
- as a fourth remark, at the work situation level, we also have been able to observe the necessary interactive and mutual support given to both partners. From our experience, based on the cases we presented here above, it appears clearly that the radiological approach has brought some fundamental changes in the safety approach of the "conventional" firm. For example, the modification of the chronology of the works, the use of the masks, the permanent control by use of cameras are of great significance.

Generally speaking, the driving forces, which seem to be working as guidelines in such work's circumstances, can be summarised as follows:

- willingness to comply with the legal requirements
- wish to work not on a short term basis
- wish to guarantee an efficient level of prevention
- will to optimise the whole approach but extended to new areas
- willingness to preserve the "brand image" of both partners

Let us examine much deeper each of these "forces". For what compliance with legal requirements concerns, we have shown that both risks have been treated in such a way to satisfy both kinds of regulations. This means that no special effort has been done to give more importance to the radiological or to the non radiological risks.
Furthermore, the fact that the decision for removing asbestos before the legal value was reached may be considered as the sign of a long term approach. Strictly speaking, this approach has nothing to do with the precautionary principle which is more a static than a dynamic principle.
As also shown here above, all the partners involved in the operations were aware of the need for an effective prevention and that care had to be taken mostly for the health and the safety of the workers. Indeed, some modifications or improvements brought during the operations were mainly focusing on prevention more than protection.
It's really difficult to say that a real optimisation has been performed. Nevertheless, some parts of the operations have really been optimised. The modifications of the technical procedure in the first case (priority to the removal of asbestos from the central region of the steam generator instead of the lower regions) is a good example and don't have to be considered as only "good practice". On the other side, the "asbestos contamination" of the filtration units of the BR3 didn't have been considered in the ALARA pre-job study.
Last but not least, the "brand image" of all the partners was certainly of great importance. For the authority, this was the first workplace where they had to combine such radiological and non-radiological risks. For the external firm , the know how gained during such works was of prior importance. And of course for the owner of the BR3

installations and the H&S Department, these operations were also a very way to check their ability to manage on the field such risks.

Conclusions

The examples which have presented here are certainly too limited for deriving general conclusions. But, let us try to pay attention to some topics which can appear as the lessons which have been learnt but which also can lead to further discussion.

The first remark we want to bring here deals with the importance of the communication at the different levels and at the different steps of the operations. Faced with unusual work circumstances, one certainly need to develop adapted tools as far as communication is concerned. In this way, the level of the safety culture in the installations can act as a very efficient tool.

A second topic which has to be pointed out is the commitment of all management levels. All the partners have been faced in their past to circumstances where they have to take decision. So they have built their know how and also their usual way of thinking and/or working. As a consequence of this, some resistance can exist and it is not only a question of good communication. Here, it has to do with the behaviour of people. One's has to cope with these resistances by use of ... an other behaviour ! This requires a real commitment of each partner.
We think that the ALARA approach is a very good way to provide an adapted language as well as such commitment. Without any doubt, this approach is mainly responsible for the good results we got !

Thirdly, as far as the removal of asbestos at BR3 is concerned, it is obvious that the "radiological approach" has brought some technical improvements to the "non radiological" approach. Examples can be found in the use of the masks, of in the daily control for potential contamination. But, on the other end, the workers of the BR3 installation are now more aware of the potential existence of other sources of risks and of the rules which have to be followed in such cases. Working into the nuclear field leads sometimes to a lack of awareness regarding "industrial risks".

Some questions are still remaining as "open questions". Some of these have still be pointed out (5). How do we have to optimise such operations where more than one "recognized" risk is involved ? How did we cope up to now with such "interactive" situations ?
How far do we have to optimise ? What's the meaning of "optimisation" in such cases?
These are examples of questions we hope to deal with during the discussions with partners from the radiological and non radiological fields.

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