
Radiation Protection and Nuclear Safety Regulatory Inspection: A Happy Marriage?

Alain GEENS, Pierre BARRAS

Bel V (subsidiary of the Belgian Federal Agency for Nuclear Control)
Rue Walcourt 148
B-1070 Bruxelles
Belgium

Abstract:

As the subsidiary of the Belgian Federal Agency for Nuclear Control (FANC), Bel V performs the regulatory inspections and safety assessments in nuclear installations, according to the Belgian Royal Decree of July 20th 2001. This Royal Decree is not meant to give a recipe on how to perform inspections and therefore requires interpretation. This paper presents the inspection techniques and practices applied by the Bel V inspectors in order to comply with the spirit of the Royal Decree, using the available resources.

1 INTRODUCTION

As the subsidiary of the Belgian Federal Agency for Nuclear Control (FANC), Bel V performs the regulatory inspections and safety assessments in nuclear installations, according to the Belgian Royal Decree of July 20th 2001. This paper presents an overview of the philosophy and practical applications of these nuclear inspections.

2 LEGAL ASPECTS

According to article 23.1 of the Royal Decree of July 20th 2001 (entitled “Royal decree on the general regulation of the protection of the population, the workers and the environment against the danger of ionizing radiation”), the licensee of class I installations (e.g. Electrabel, the owner of the Belgian nuclear power plants), has to establish a health physics department, that is responsible for the organization and the surveillance of all the necessary measures in order to comply with the Royal Decree.

Since it is the responsibility of the licensee of the nuclear power plants (not of Bel V) to take the necessary measures in order to protect the population, the workers and the environment against the danger of ionizing radiation, a radiation protection office makes part of this health physics department, also in charge of nuclear safety aspects.

One of the major tasks of Bel V is the regulatory control of the nuclear power plants in Belgium, concerning nuclear safety and radiation protection.

The role of the nuclear inspectors of Bel V is “to permanently supervise the good execution of the licensee’s radiation protection office’s tasks” (article 23.8 of the Royal Decree). Note that despite of these inspections, the licensee remains the responsible for the nuclear safety of his installations.

3 CONTRADICTIONS CAUSED BY LEGAL ASPECTS

In order to literally comply with the Royal Decree, Bel V should inspect both the documentary and the practical aspect of the task of the radiation protection office. This means that every single document (with an impact on radiation protection or nuclear safety) has to be examined, every room in the controlled zone has to be inspected, every worker has to be monitored, i.e. the dose the person receives, as well as the compliance of this person to the rules and behavioral codes applicable in the controlled zone. All these inspections have to be carried out 24 hours a day, 7 days a week. This would require nearly infinite resources of manpower of Bel V. On top of that, the Bel V inspectors also have to permanently evaluate all other aspects concerning the nuclear safety of the licensee.

Even in the hypothetical case that Bel V would have these resources at its disposal, executing these inspection tasks would still create a serious problem: the cumulated dose of the Bel V inspectors would be tremendously high, hence violating the ALARA principle (also described in the Royal Decree):

- Is it really justified to expose all inspectors to ionizing radiation during their 24 hours/7 days inspections in all rooms of the controlled zone? One easily sees that the advantages of such a permanent stay do not counterbalance the disadvantages of the huge cumulated dose.
- Is this really an optimized approach of the eventual goal (i.e. supervising the compliance of the licensee with the regulations described in the Royal Decree)?
- In order to respect the individual dose limits of the inspectors, even more inspectors are required.

Conclusion: Literally executing the inspections permanently as may seem to be requested by the Royal Decree, is a violation of the ALARA principle described in that same Royal Decree.

4 SOLUTION

At this point, one can either take two actions

- complain that it's impossible to perform radiation protection inspections, quit and become a shoe salesman
- try to find a solution

As mentioned before, a 24hours/7days inspection program on radiation protection is unrealistic and incompatible with the ALARA principle. On the other hand, doing no radiation protection inspection is also unacceptable. What we need is an inspection program that covers all areas without needing a 24hours/7days presence of the inspector in all rooms.

Remember that the basic goal of Bel V is to verify that the licensee does a good job in order to protect the population, the workers and the environment against the danger of ionizing radiation. At Bel V, our inspections are based on the sampling principle in combination with the experience feedback (REX) process.

4.1 Inspection by sampling

The Bel V inspectors have access to all rooms at the nuclear power plant (inside as well as outside of the controlled zone) and this at any moment, taking into account the radiation risks of course. It is however obvious that in order to access rooms with a very high dose rate (i.e. more than 1 mSv/h, which are locked, according to the article 31.3 of the Royal Decree) they must contact the health physics department of the licensee. Discussions can be engaged concerning the necessity to access these rooms, but in fine, the access must be granted if the inspector deems his access necessary. In this case the justification of the exposure (as defined in the radiation protection principles) is the need to perform inspections in order to

increase the overall nuclear safety level of the power plant. The exposure itself should be submitted to the optimization (ALARA) principle. E.g. if the inspector makes an observation in a room with a high dose rate, s/he will rather exit this room to write down the observation instead of staying in the room and calmly taking written notes, sitting down on a primary reactor coolant conduit.

The Bel V inspectors have access to all the files and documents of the licensee as long as this access is necessary for the accomplishment of Bel V's task (see article 23.11 of the Royal Decree). The inspections can furthermore cover any domain.

Hence, with a limited amount of resources and time, Bel V's inspections comply with the 24/7 inspection spirit of the Royal Decree.

Indeed, since these inspections can occur in any domain, at any time, in any place, the licensee has to make sure that everything is OK in all domains at all times.

This inspection principle can be compared to an academic examination: when the professor questions his/her students, s/he cannot ask the student to explain every detail of the course. The professor rather selects a few topics and questions the students about these topics in order to form an idea of the student's comprehension of the course and rates the student based on this exam. The student can of course have some luck if the professor only questions the student about the topics s/he understood. The probability that this "lucky" scenario occurs in the case of our inspections becomes extremely small, since the inspections performed by the Bel V inspections are not a "one shot", but occur frequently (typically once a week). New topics can be raised during the next inspection.

The fact that the inspections occur by "sampling" has yet another advantage: the inspector can no longer be used as a "reviewer" as would be the case for the hypothetical 24hours/7days inspections. Indeed, in the 24 hours/7 days inspections scenario, the inspector takes a look at every document. In this case, the licensee could consider the inspector as a "reviewer", since s/he checks every document. The overall quality of the documents and processes could decrease due to a kind of laziness. If there are small mistakes in the documents or processes, it will not have too much effect on the nuclear safety, since the inspector will see it and ask to correct it.

But if the inspector only looks at a sample of documents, this "safety net" does no longer exist and the licensee knows he has to produce quality documents that have to be correct. Therefore the licensee has to provide for internal independent review. This is in line with the IAEA recommendations.

4.2 Experience Feedback process

In order to optimize the inspections, the inspection reports circulate among all the members of Bel V (inspectors and experts). Everyone is invited to comment these reports if s/he deems that the inspector should be made aware of an important issue, that the inspector should take a closer look at a certain aspect, etc... In parallel, inter-site coordination meetings are held weekly during which the inspectors inform each other about important observations that were made. These meetings hence inform the inspectors about the potential shortcomings of the licensee concerning the mastering of his processes and/or nuclear safety culture.

Using the REX of the colleagues helps the inspector to:

- determine the points of attention (what elements were discovered in the other units and what about the situation in his unit?)
- determine the radiation measurements to be performed (where did the colleagues measure abnormal dose rates?)
- determine the important issues in the verification of documents.

All this information allows the inspector to perform his duty using a biased sampling principle.

5 PRACTICAL APPLICATION

5.1 How to treat an observation?

In a nuclear power plant, a lot of observations can be made, going from a small deviation (e.g. an indicated dose rate of 20 $\mu\text{Sv/h}$ while the inspector measures 15 $\mu\text{Sv/h}$) to a major one (e.g. people smoking and playing cards next to a primary coolant pump). The first reaction might be to say that only the important issues have to be treated. This is true and not true, in the sense that each observation has to be weighted with its recurrence in order to have a global appreciation of the importance of an observation.

A major issue will always be discussed with the licensee in order to determine why the event occurred and what measures must be taken to avoid a recurrence of the event in the future.

Concerning the example above (people playing cards in the controlled zone), the inspector will discuss the problem with the Health Physics department and analyze documents in order to verify:

- if there exist clear instructions about what is allowed and forbidden in the controlled zone;
- if the people that have access to the controlled zone are well informed about the rules applicable in that zone and about the impact of ionizing radiation;
- if there are enough Health Physics department officers present in the controlled zone;
- if those officers verify the compliance of the people present in the zone with the zone rules, just like police officers do;
- if those officers are aware that they have the authority to remove someone from the zone;
- etc...

Discussions about these topics lead to changes in procedures / management / instructions / courses etc... and increases the level of the nuclear safety culture.

In case of a measurement inconsistency, the inspector can discuss the observation with the licensee and ask to re-check the measurement, or the inspector can simply search for other examples or similar problems in order to discover if this problem is an isolated case or a more generic concern.

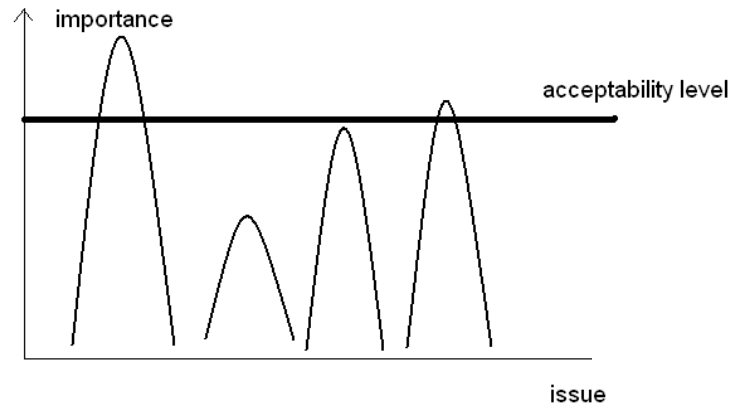
In case of a one-time appearance, the observation is not important and can be simply mentioned to the licensee.

On the other hand, if more discrepancies between the measurements of the licensee and the inspector appear, discussions can be engaged in order to determine the reason of the discrepancies (Human errors? Errors of the measurement device? How come, since the measurement devices should be periodically calibrated? Is there a generic calibration error? etc...)

When using a metaphor, the inspection can be seen as the analysis of a knitted sweater. The observations of the inspector are hence comparable to the observations of loose fibres on this sweater. If a small fibre is loose on the sweater, a potential customer will search for other loose fibres and pull on them. If only the tread comes loose, there is no problem. The loose fibre was an isolated case or was of no significant importance. If however, all the knitting starts to come loose when pulling on the fibre, there is a more serious problem.

5.2 Overall philosophy

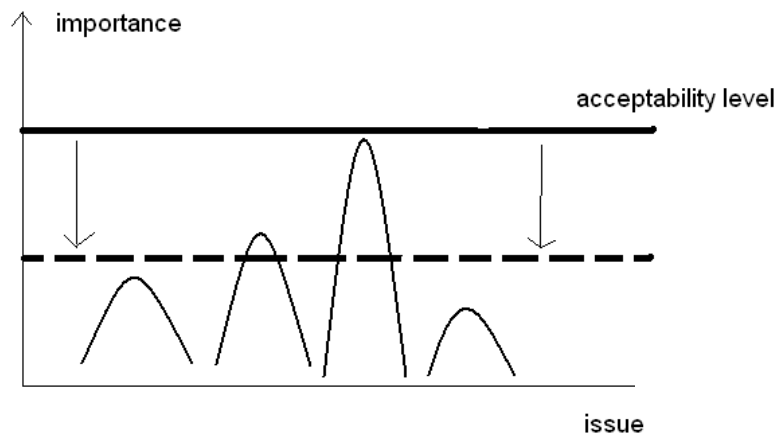
The importance of the problems linked to the observations can be represented as follows:



The overall goal is to first tackle the most important issues, which are mostly also perceived by the licensee as unacceptable.

The tackling of these issues is performed at all levels (documentary, practically, habitudes, culture, etc...) in order to decrease the potential impact of the issue.

During his next visits, the inspector keeps the topic in mind and observes if the problem persists or if it evolves towards a solution. If not, the inspector rediscusses about the problem. Once the inspector is convinced that the licensee has the problem under control, the inspector focuses at the next most important issue.



Due to the thrive towards Excellence, the acceptability level very often also changes, and hence the level of nuclear safety is continuously increasing.

It is indeed so that some 20 years ago, when Bel V observed people playing cards next to a primary coolant pump, the licensee told that this issue was not that important. Nowadays, a similar observation will be considered as unacceptable since the safety reference levels are quite a lot higher. Hence nowadays, the inspector looks at details that were considered as ridiculous 20 years ago.

6 CONCLUSION

At first glance, the fact of performing radiation protection inspections seems contradictory with the spirit of the Royal Decree itself.

This paper presented the solution used by Bel V in order to perform efficient nuclear inspections with a reduced number of people, using inspection by sampling combined with the experience feedback process. In this way, a happy marriage between radiation protection principles and the need to perform regulatory inspections is ensured.