

Overview of the organisation and the measurement procedures used for the radioactive contamination controls during the refurbishment of the PSI Hot Laboratory

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Abstract

The PSI Hot-Laboratory (HL) is undergoing a large refurbishment of its ventilation system in order to bring it to the modern fire-safety requirement and earthquake safety requirement.

During the realization of the work, a large amount of materials had to be removed from the laboratories. In order to reduce the amount of radioactive waste, a large part has been thorough fully checked for possible radioactive contamination and if necessary cleaned. This procedure has allowed the disposing of a large part of the materials as normal waste, reducing greatly the costs.

In addition, the mounting of the new installation had to be realised by workers who are not declared as radiation-exposed personnel and therefore not checked for radiation absorption or incorporation. Therefore, the laboratories had to be out-zoned. It means that all free surfaces in the laboratory had to be cleaned, checked and declared as radioactive contamination free. Also, in order to insure a total safety, all material and tools used in the refurbishment is checked for possible radioactive contamination.

The PSI health physic team has clearly not the manpower capacity to realise such a work. A team of well skilled and experienced HL-staff was organised for the practical realisation of this crucial task.

The presentation will give an overview of the amount of work it involved, the organisation plan, the measurement procedures as well as the criteria's used for the realisation of the task in the tight schedule defined by the project manager. A summary of the experience gained during the HL refurbishment process will also be shared.

Keywords: contamination refurbishment smear waste

1. Goal

During almost two years the PSI hot laboratory has been refurbished. It was necessary to renew the whole ventilation system including all channels and tubing's in order to bring it to the modern fire safety

requirement. It was known that some of these channels were contaminated. It was also important to remove as much as possible of the burnable (mostly wooden) furniture and other constructions built from burnable material. The Laboratory has also been updated to new earthquake safety requirement.

The refurbishment had to be realised by workers who were not declared as radiation-exposed personnel. Therefore, they were not checked for radiation absorption or incorporation. That means, that the whole Laboratory, including all not removable furniture and machines, had to be cleaned and checked for possible contamination. Contaminated parts had to be removed or decontaminated in order to insure no risk of radioactive incorporation or contamination for the uncontrolled personnel.

2. Laboratories and other rooms

Furniture, glove boxes, large and not removable machines and tools had been encapsulated in non-burnable boxes and sealed to forbid any exchange of air and dust. After cleaning of the rooms, 100% of the free surface had to be checked for possible contamination.

For this purpose a net of coordinates in x, y and z direction was drawn in the rooms. Smear tests (round, 4.5 cm in diameter) were taken on surfaces not reachable with standard counters (small area, curved area, tubing etc.). All smear tests had got a single number all information related as the place where it was taken (coordinates) were recorded in a protocol book. The smear test were then analysed for α - and β/γ -contamination with an AB 14 (Harwell Instruments) counter. It is considered that 10% of a contamination of a mean area of 100 cm² is removed by a smear test and that the efficiency of the detector is 32 % for α and 25% for β/γ . One CS (CS = contamination surface (French) = value for contamination) for the AB 14 (Harwell Instruments) counter is for α 3 Bq (netto) and 30 Bq (netto) for β/γ . Surfaces where considered as contaminated when smear tests had more than 10 counts (netto) of α and / or more than 225 counts β/γ (netto). "Netto" means numbers of counts after Rn-compensation (α), included the rate of decontamination (α and β/γ) and the safety factor for self-shielding (α). The cleaning was repeated until no contamination could be found out. Whenever it wasn't possible to clean, the contaminated parts had been removed, declared as radioactive waste and disposed. After taking smear tests, all reachable places and flat areas had been checked by direct measuring with contamination detectors.

3. Furniture

For the period of the refurbishment, some furniture's (shelves, racks etc.) had to be stored outside PSI Hot laboratory and some even outside PSI. Therefore all items had to be checked for α and β/γ contamination by direct measuring with counters and indirectly by smear tests.

4. Waste

During the preparation work for the refurbishment as well as during the refurbishment itself, a huge amount of waste was produced. There had been old or damaged machines and tools, old or wooden (fire safety problem) furniture's, old installations that had to be replaced (ventilation channels, tubes, electricity cables, ceiling covering plates, walls etc.) and material used during the refurbishment. All this materials had to be checked for possible α and β/γ contamination. Every single item that was checked was recorded in a protocol containing the item number and description, the count rate, the background count rate, the type and number of the monitor used as well as the name of the controller. By working this way a large amount of material could be disposed as inactive waste at a much lower cost or be recycled. The contaminated pieces were declared as radioactive waste in accordance with the PSI standard procedure and were given to the PSI waste management group.

5. Summary

The refurbishment of the PSI hot laboratory has clearly shown that the amount of work needed for the decontamination, cleaning and mostly control of the laboratory had been massively underestimated. Such a work needs a detailed planning, a lot of time and also resources and very flexible management for the process optimisation. The personnel involved in this type of work must be well educated and also well motivated. Finally, in order to reduce the risk of mistake mostly coming from tiredness and lack of concentration during the measurement process, the working time for each collaborator must be kept reasonable and therefore the amount of personnel needed must not be underestimate.

The refurbishment of the PSI hot laboratory is in its final phase and, thanks to the motivation and hard work of the control team, it was realised without personnel contamination and spilling of radioactivity outside the hot laboratory.