PHYSICAL PROTECTION OF RADIOACTIVE MATERIALS IN A UNIVERSITY RESEARCH INSTITUTE

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ABSTRACT

Although nuclear research centers attached to universities usually do not keep large inventories of radioactive or special nuclear material, the mentioned material has still to be under strict surveillance and safeguards if applicable. One problem in such research centers is the large and frequent fluctuation of persons - mainly students, scientists or visiting guest scientists - using such materials for basic or applied research.
In the present paper an overview of protective actions in such a research institute will be given and experience of more than 36 years will be presented.

1. INTRODUCTION

The Atominstitute of the Austrian Universities is an interuniversity institute founded in 1959 and officially inaugurated in March 1962. Its main research facility is a 250 kW TRIGA Mark-II reactor with pulsing capability up to 250 MW. The institute is devoted to the education of students in the Master and PhD level in fields such as

- neutron and solid state physics
- nuclear technology
- radiation protection and dosimetry
- radiochemistry
- low temperature physics
- x-ray physics.

About 35 professional staff and 30 technicians train about 50 students per year in the above fields. In addition, more than 100 specialized lectures and 10 practical courses are offered during the educational program.

In addition, due to the fact of the proximity of the IAEA many fellows and visiting guest scientists are hosted at the institute and training courses are carried out in cooperation with the IAEA.

In view of the educational program the institute not only stores more than 90 TRIGA fuel elements, most of them in the reactor core, some of them in a fuel storage facility, but also small samples of Special Nuclear Material (SNM) and other radioactive sources for calibration and standardization of instruments. A part of these sources do not even belong to the institute but is stored for and under contract with the IAEA to be used as calibration sources for IAEA-safeguard instruments (Table 1).

Table 1: Special nuclear material and radioactive sources stored at the Atominstitut (approx. values only)

1. Radioactive Sources (activity as of December 1997)

Co-60	1	2.12 MBq
Co-60	2	114 MBq
Co-60	3	437 MBq
Co-60	4	34.7 MBq
Co-60	5	7.6 MBq
Co-60	6	8.7 MBq
Co-60	7	0.9 MBq
Cs-137	1	101 MBq
Cs-137	2	673 MBq
Am-241	1	3700 MBq
Pu-239	1	377 Bq
Sr-90/Y-90		740 kBq
Tl-204		185 kBq
Am-Be		111 GBq
Pu-Be		111 GBq
Pu-Be		11.1 GBq

2. Special Nuclear Material

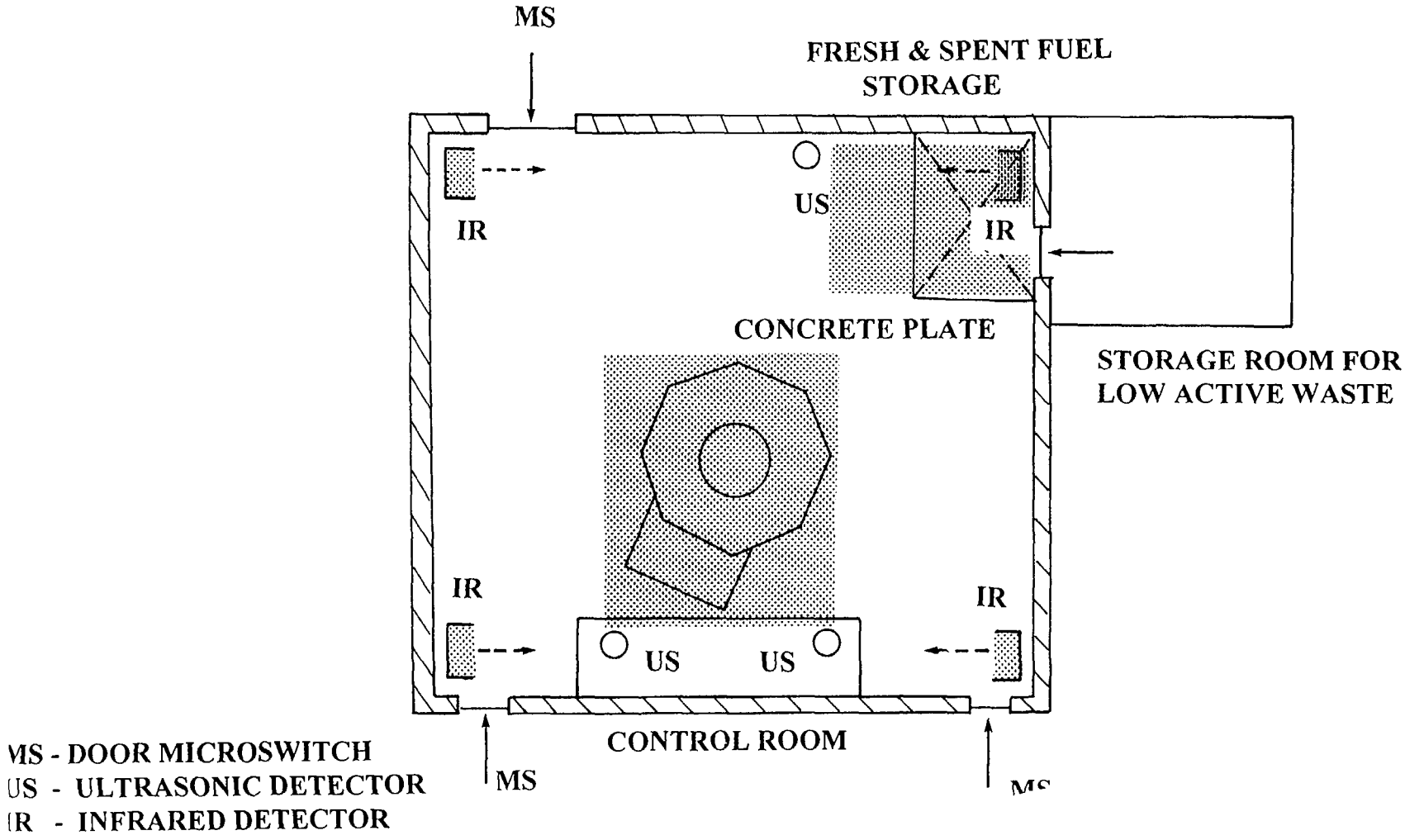
HEU	total	~ 1 900 g
HEU	U-235	~ 1 300 g
LEU	total	~ 155 000 g
LEU	U-235	~ 6 700 g
Depl. U		~ 23 kg
Pu		~ 60 g

2. PHYSICAL PROTECTION

According to the National Law for Radiation Protection radioactive material and Special Nuclear Material must be protected accordingly, unauthorized access must be prohibited and special security measurements must be enforced.

The first barrier is a round-the-clock entrance guard at the institute's main entrance. The public area of the institute with auditorium, library, director's office etc. are physically separated from the laboratory areas by locked doors and only staff members and enrolled students are entitled to access these rooms.

The reactor hall is again separated by self-closing doors from the laboratory area with another type of access key which is only issued to students actively working at the reactor facility. The keys both for the laboratories and the reactor hall are individually numbered and registered at the reactor management (Figure 1).



SCHEME OF PHYSICAL PROTECTION INSTALLATION AT
THE TRIGA MARK II REACTOR VIENNA

Entitled students are allowed into the reactor hall at weekdays between 7 a.m. and 9 p.m. Outside this period an automatic surveillance system consisting of a combination of key-lock microswitches, ultrasonic and infrared detectors is activated with a direct connection to the nearest police station. Any unauthorized access will trigger an immediate alarm.
The alarm panel is mounted in the entrance guard room staffed round the clock.

Inside the reactor hall there are four main areas to be specially protected, all of them contain Special Nuclear Material or radioactive sources.

a) The reactor with the fuel elements,
b) the fresh and spent fuel storage facility,
c) the safe containing various samples of Special Nuclear Material to be used for experiments, and
d) the reactor storage room containing several neutron sources.

All four areas are additionally controlled by remote sensors which are connected to the central alarm system. The storing places for the above mentioned materials and sources are internally controlled by the reactor staff every month, and externally controlled by EURATOM and IAEA.

The main entrance of the institute is controlled by a very sensitive fast-response scintillation detector to prevent any unintentional transport of radioactive materials outside of the institute. It triggers an alarm when the normal background level is exceeded by 100%, and it is connected to a data logging system.

3. SAFEGUARDS

Austria as an NPT country and a member country of the European Community is subjected to the EURATOM control system for Special Nuclear Material. Therefore, the facility has to report any inventory change (ICR), carry out an annual physical inventory listing (PIL), and report annually the material balance (MBR). This has been done up to 1998 by filling out the appropriate lists and transfer them to EURATOM through the official national channels which is the Federal Chancellery in Austria. Since 1998 all data are now in a computerized form and transferred through e-mail parallel to EURATOM and to the Federal Chancellery. This increases information speed and reduces possible data entry errors.

4. PRACTICAL EXPERIENCE WITH SAFETY AND SECURITY OF RADIOACTIVE MATERIAL

The Atominstitut has been officially inaugurated in March 1962 and has accumulated, therefore, more than 36 years of practical experience with radioactive sources and Special Nuclear Materials. The safeguard program became really operational in the early seventies while the complete security surveillance system started its operation in the early eighties. Before these dates the sources and SNM were controlled by good housekeeping and according to the standards under application at these times.

The security measures installed in the eighties consisted of multiple barrier access doors, visitors' badges, door and room surveillance systems and exit control. As there is a large in- and outflow of students attending lectures and courses at the Atominstitut, the institute is separated into a non-controlled area (auditorium, seminar room, library) and into a controlled area where the laboratories and the reactor are located.

During the past 36 years we only had one case where a student tried to take out a low activated gold foil used for flux mapping. This was immediately detected by the sensitive Na(J) scintillator at the entrance guard and appropriate measures were taken. The gold foil was appearantly diverted during a practical course where the students had to perform neutron flux mapping at the TRIGA reactor.

No other incidents were observed and the entrance/exit control station is usually triggered when small radioactive samples are delivered to or shipped from the institute.

5. SUMMARY AND CONCLUSION

University institutes are usually low budget, easy going facilities where strict industrial rules cannot be applied. Therefore, a compromise has to be established between appropriate security measurements and open access to academic facilities. Strict security measures would ultimately reflect the students away from all possibilities offered by a university institute for academic education. The Atominstitut has demonstrated in the past 36 years that such a compromise is possible and the number of graduate students (more than 1000) from our facility is the best reference that this compromise had been a success.