

Radioactivity Leak Accident at the Hadron Experimental Facility in J-PARC

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A brief overview is given on the radioactivity leak accident at the Hadron Experimental Facility in J-PARC, on May 23, 2013 and the measures against similar accidents.

At the HD Facility, experiments were carried out utilizing secondary particles produced by bombarding a gold target, 6 mm square and 60 mm long, with a 30 GeV proton beam extracted from 50 GeV synchrotron. In this mode, $\sim 3 \times 10^{13}$ protons were extracted over two second using a slow extraction system. At 11:55, however, $\sim 2 \times 10^{13}$ protons were extracted and delivered to the target within 5 milli-second because of malfunction of the power supply for slow extraction magnet. Then the gold target melted partially by the injection of a beam with very short duration despite of contact with a water-cooled copper disk. [1]

Then, radioactive materials accumulated within the target were released to atmosphere within a primary beam line room surrounded by concrete blocks for radiation shielding. The primary beam line room was designed to be air-tight but not tight enough, and consequently the radioactive materials leaked to the hadron hall through the wall and caused internal exposure of 103 workers in the hall. However, this fact was not recognized correctly, despite of various symptoms of the event like an increase of radiation dose. Furthermore, radioactive materials were released to outside the Hadron hall because of the operation of ventilation fan in the Hadron hall.

The exposure of workers and the influence to the environment proved to be respectively, 1.7 mSv in committed effective dose and 1.7 micro Sv in total dose at the site boundary closest to the Hadron hall.

The preventive measures against similar accident were proposed by J-PARC and reviewed by the External Expert Panel [2] together with the cause of the accident and the emergency responses. It was pointed out the direct cause of the accident was the malfunction of hard wares, but the problems in safety management system (soft wares) should also be revised entirely. Therefore, in addition to the improvement of hard wares, such as fixing and improvement of slow extraction system, air-tightness of targets, primary beam line room, Hadron hall etc., the safety management system of J-PARC was entirely reorganized to reinforce the risk evaluation capability and emergency responses.

References

[1] http://j-parc.jp/en/topics/20130812Accident_Report.html

[2] http://j-parc.jp/en/topics/HDAccident20130827_01.pdf