Controlled platform for the radiation dose data measured in Radiation controlled area of KOMAC

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1. Introduction

Korea multi-purpose accelerator complex (KOMAC), the branch institute of Korea atomic energy research institute (KAERI), is a multi-user facility to provide a high-intensity proton beam with the energy from 20 MeV to the 100 MeV. This proton beam is accelerated via the proton linear accelerator that is comprised of a 50-keV injector, 3-MeV radio frequency quadrupole (RFQ), and 100-MeV drift tube linac (DTL). The KOMAC site is classified into General public area and Radiation controlled area, according to the dose rate of 0.25 μSv/h. This radiation controlled area also divided into two areas: High-level radiation area and Radiation worker area. If the dose rate of this controlled area can be more than 12.5 μSv/h [1], this area is called as High-level radiation area, described as the red part of Fig. 1. When the dose rate in this area has between 12.5 and 0.25 μSv/h, this area is defined as Radiation worker area, expressed as the yellow part of Fig. 1. High-level radiation area includes the acceleration tunnel with the proton linear accelerator, beam lines and target rooms.

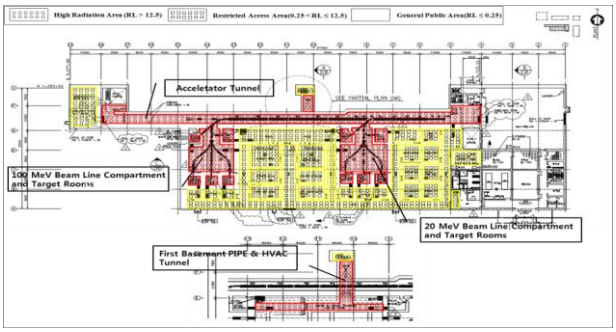

Fig. 1 Classification of Radiation controlled area in the first floor of the accelerator building. The red area means High-level radiation area and Radiation worker area is expressed as the yellow space.

Actually, the boundary parts between High-level radiation area and Radiation worker area are exposed to greater risks to have a radioactive contamination or radiation leak. Thus, the radiation safety team of KOMAC measures the radiation dose values and has the contamination test at various points in Radiation worker area every week and values measured are documented in the form of the report. In this research, the controlled platform for the data collected in Radiation controlled area of KOMAC is described to organize the data and comprehend their condition very well.

2. Qt-based controlled platform

The system for the data made in Radiation controlled area should have the database to save and the data in the database could be expressed on the monitor in the any form which user wants. The control platform to satisfy these conditions will be made on the basis of the Qt program [2] and MYSQL program.

2.1 Platform structure

The Qt program is a cross-platform application framework with graphical user interfaces (GUIs). That is, the graphical interface of the Qt can make the parameter input window to enter the measured data into the form understood very well by the user, shown as Fig. 2. The software like C++ built in the Qt can also have any kinds of calculations that user wants. The Qt program can be connected with the MYSQL program. Thus, the data entered by the Qt can be stored into the MYSQL database and these data can be retrieved by the Qt. The data about the radiation dose and radioactivity are entered via the input windows of Qt5 into the MYSQL database, shown as Fig. 2.

Fig. 2 Parameter input window to enter the radiation dose values measured in Radiation controlled area is made by Qt-based controlled platform. There are the measurement date, the person to measure, the record of the equipment used, and values of the radiation dose on the input window.

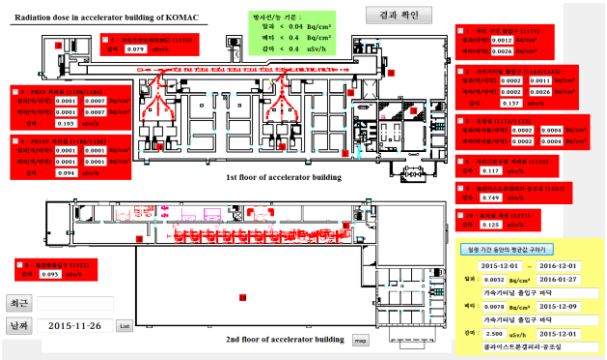

Fig. 3 Parameter output window to describe the trend of the data about the radiation dose and radioactivity in Radiation controlled area of the accelerator building.

The data saved in the MYSQL database are retrieved via the parameter output window of the Qt, shown as Fig. 3. In this output window, measurement points with the values of the alpha, beta, and gamma detected are expressed on the map of the accelerator building. The data is searched from MYSQL databases using the date entered and recent date. This output window has the function to calculate the average data included in some date range and the results are expressed on measurement points. Then, the maximum values of the alpha, beta, and gamma detected during this some date range can be expressed with the place and date.

2.2 The numbers of measurement points

The numbers of measurement points to measure the radiation dose values or have the contamination test are 10 points as described in Fig. 3. Measurement points are classified into three categories according to the measurement method. In the first category, the entrance of Radiation controlled area is included and the contamination test to check the detection of the alpha and beta is done. The boundary areas between High-level radiation area and Radiation worker area such as the entrance of the acceleration tunnel, PR23 processing room, and PR103 processing room are included into the second category and the measurement of the radiation dose value and the contamination test are done together. In the rest points, the radiation dose values are measured. Especially, since the klystron gallery located in the second floor of the accelerator building has the nine klystrons to supply the power into the proton linear accelerator and generate the radiation, the radiation dose values are measured in the 13 points of the gallery and the maximum dose values of values measured are recorded here.

3. Conclusions

The real data measured in measured points of Radiation control area between 2015-11-26 and 2016-03-02 are entered into MYSQL database using Qt-based controlled system. Table I shows the average values of the radiation dose and the result of the contamination test during the date period used. The place with the maximum average values about the alpha and beta detected is the entrance of Radiation controlled area. However, their values are very small in comparison to the criteria to decide the contamination area in KOMAC. That is, KOMAC is safe from the radioactive contamination. The reason why the radiation dose value is twice the background value in Klystron gallery is the klystron to generate the radiation. However, actually the klystron gallery is controlled by the control room when the proton beam is accelerated. The several areas in Radiation controlled area are managed very well in the points of a radiation leak or radioactive contamination now. Qt-based platform system is still developed to optimize the data made in Radiation controlled area.

Table I: The average values of the data detected in several measurement points of Radiation controlled area between 2015-11-26 and 2015-03-02 are shown. There are ratio between measured values and its criteria in the bracket of each blank

Measurement points	α-detection (Bq/cm^2)	β-detection (Bq/cm^2)	γ-detection (μSv/h)
Entrance of Radiation controlled area	0.0012 (3.0 %)	0.0026 (0.65 %)	·
Entrance of accelerator tunnel (floor)	0.0011 (2.75 %)	0.0026 (0.65 %)	0.137 (34.3 %)
Entrance of accelerator tunnel (wall)	0.0002 (0.5 %)	0.0002 (0.05 %)	·
PR23 processing room (floor)	0.0007 (1.75 %)	0.0007 (0.18 %)	
PR23 processing room (wall)	0.0001 (0.25 %)	0.0001 (0.03 %)	·
PR103 processing room (floor)	0.0001 (0.25 %)	0.0001 (0.03 %)	
PR103 processing room (wall)	0.0001 (0.25 %)	0.0001 (0.03 %)	·
Control room (floor)	0.0004 (1.0 %)	0.0004 (0.1 %)	·
Control room (table)	0.0002 (0.5 %)	0.0002 (0.05 %)	·
Shielding door	·	·	0.117 (29.3 %)
Spare room	·	·	0.079 (19.8 %)
Equipment hatch	·	·	0.093 (23.3 %)
Klystron gallery	·	·	0.749 (187.3 %)
Rooftop of target room	·	·	0.125 (31.3 %)

REFERENCES

[1] Yong-Sub Cho, The KOMAC Accelerator Facility, IPAC2013, May13-17, China (2013).
[2] J. Blanchette, M. Summerfield, C++ GUI Programming with Qt 4, Second Edition (2008)