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Radiation Monitoring System Design for ACP Hotcell Safety

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1. Introduction

Advanced spent fuel Conditioning Process (ACP) Project is under development for safe and efficient management of PWR spent fuel. The main process of this project is to recover oxide from UO_2 pellet in the LiCl molten salt. This process reduce heat generation and radiation intensity of spent fuel and, therefore minimize the required area of disposal.

The whole process shoud be performed in the hotcell which could control highly radioactive materials safely. For this purpose, ACP project built a new hotcell(ACPF) in IMEF (Irradiated Material Examination Facility) basement which already has a reserved hotcell area.

The operation of ACPF needs a safety guideline against radiation from hotcells in both operation area and service area where workers could reach, and consequently radiation monitoring system(RMS) is essential for ACPF.

2. System Units & Configuration

ACPF consists of two hotcell which are process cell(M8a) and maintenance cell(M8b), with 2 m width × 11 m length × 4 m height.

RMS consists of 7 category units which are Room air monitor, Area monitor, Hotcell monitor, Duct monitor, Iodine monitor, CCTV, and Management Server. The system units are listed in Table 1 and brief specifics for each units are described below.

Table 1. RMS units list

Item	Count	Position
Room Air	2	Op., Ser.
Area	3	Op., Ser., Int.
Hotcell	2	Op., Iso.
Duct	1	Ser.
Iodine	1	Ser.
CCTV	3	Op., Ser., Int.
Server	1	Hea.

※ Op. : Operating Area, Ser. : Service Area
Int. : Air bumper Area, Iso. : Isolation Room
Hea. : Health Physics Room

2.1 Room Air Monitor

Room air monitors are for detecting particulates & iodine simultaeneously in operating area and service area each. These monitors are expected to secure clean work area by surveying nuclides which could induce hazardous human's intake.

2.2 Area Monitor

Area monitors are installed in 3 positions; operating area, service area and air bumper zone(opposite side wall of M8b cell rear door). These positions represent most detectable point of each zone, therefore the efficiency of gamma ray detection is high.

2.3 Hotcell Monitor

When examination material (i.e. radioactive spent fuel) is carried to hotcell inside, the radiation intensity goes up rapidly. This means that hotcell monitoring detecter should cover very wide range of detection; normal condition and extremely high radiacive condition. Two hotcell monitor which could follow up previously described conditions are set up in each hotcells. As long as the radiation intensity of hot cell is over 2.5 mSv/h, the hotcell rear door must not open for safety of hotcell outside. For this reason, hotcell monitors send 'Interlock' signal to the rear door whenever radiation level is over it's limit.

2.4 Duct Monitor & Iodine Monitor

As RIPF(Radio Isotope Production Facility) & ACPF belong to IMEF and these two facilities also share all utilities of it, the radiation safety manager of IMEF needs to distinguish radioactive ventilation contamination from each facilities. Duct & Iodine monitors are installed in the middle of outline duct of ACPF to meet previously mentioned necessity.

2.5 Closed Circuit TeleVision

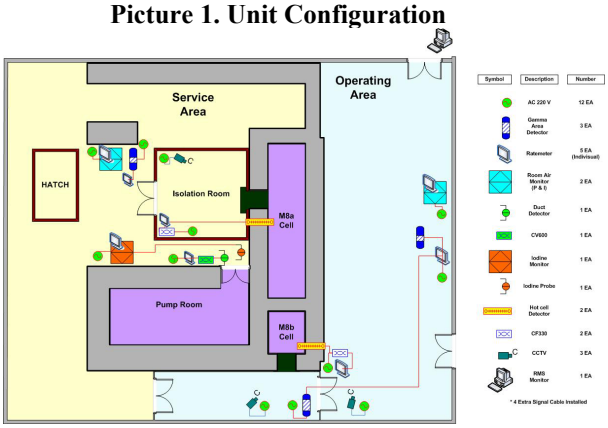
The facility manager regularly should watch the operating area where most working is performed and the rear door opening position where first level shieding is performed. In order to do this easily, one CCTV is installed in the operating area and two at the back of rear door.

2.6 Management Server

RMS management server receives system units's all signal remotely by network. It also shows the detecting trends of each units for various optional time step which user can tune and always record CCTV's screen.

Picture 1 shows RMS units's position in the ACPF. Blue area means 7000 zone, yellow 8000, and violet 9000. All units are positioned at the representative point for each own purpose.

Picture 1. Unit Configuration



3. Conclusion

Radiation monitoring system is essential to run the ACPF because the final goal of this facility is to demonstrate that oxided uranium from highly radioactive spent fuel could be converted into metal uranium in molten salt. Conservative and safe RMS design is expected to ensure safety of work place and finally freedom from radioactive danger.

REFERENCES

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