

Emergency mode of Personal Safety Interlock System (PSIS)

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1. Introduction

Personal Safety Interlock System(PSIS) is directly linked to the accelerator interlock and shielding doors to prevent an abnormal situation and radiation accident to protect radiation workers as one of the major radiation safety systems in KOMAC [2].

This study deals with the emergency mode of PSIS that affects the accelerator interlock and the actions after situation (except newly built facility, TR102 and Neutron irradiation lab since these were constructed different logic).

2. Methods and Results

In this section normal operation modes of PSIS and emergency mode are described. Then introduces the conditions of the emergency and interlock system either actions against interlock occurrence.

2.1 Normal operation on PSIS

The operation mode of PSIS is divided in two types, the one is normal mode and the other is emergency mode. The normal mode consists of (1) Free Access mode, (2) Controlled Access mode, (3) Search mode, (4) No Access mode. And summary of each normal modes are above Table 1.

Table I: Normal operation mode of PSIS

Mode	Meaning	Characteristic
Controlled Access Mode	Radiation worker can access	<ul style="list-style-type: none"> ▪ Accelerator ready ▪ Beam line Off ▪ Shielding door open ▪ Yellow lamp/display
Search Mode	Check worker in high radiation area	<ul style="list-style-type: none"> ▪ Accelerator ready ▪ Beam line off ▪ Air conditioner Off ▪ Blue lamp/display
No access Mode	Possible to run Accelerator	<ul style="list-style-type: none"> ▪ Accelerator ready ▪ Beam line On ▪ Shielding door close ▪ Air conditioner On ▪ Interlock ready ▪ Red lamp/display

In order to enhance understanding of the operation procedure of PSIS, the configuration diagram is shown in the figure 1 below. [4]

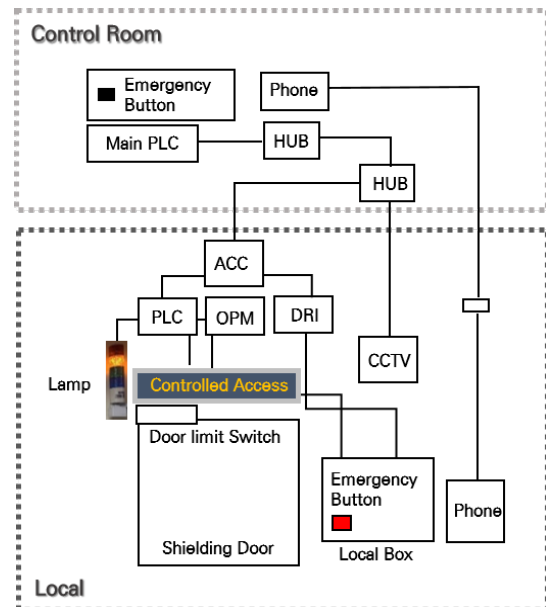


Fig. 1. Schematic diagram of PSIS

2.2 Emergency mode

The emergency mode is triggered in abnormal or accidental situations while the accelerator is ready. Namely, the emergency situation is not appeared according to a simple process, but complex logic by considering PSIS mode, radiation dose rate, accelerator operating status, and emergency devices action (mainly emergency button).

2.3 Conditions of the emergency mode

The emergency mode is activated in some conditions which determine to be in an emergency situation by PLC program. [1], [3]

There are conditions of the emergency mode :

- (1) PSIS main PLC power Off

If the power of main PLC is lost, or if the PLC is interrupted or broken, the emergency mode is activated.

(2) Push Local Emergency Button

When the mode of PSIS is 'No access mode', if any emergency buttons at local is pushed, the emergency mode is activated with opening door automatic and alarming siren.

(3) Push Control room Emergency stop Button

This case, emergency mode is operated by control room worker, but the sequence and result of occurrence of emergency mode are the same as in part (2).

(4) Door limit Switch

When the mode of PSIS is 'No access mode', and PLC receives a 'door open' signal by door limit switch from the local shielding door, the door is recognized as open and the emergency mode is activated.

2.4 Interlock occurrence

As described in 2.3 *Conditions of the emergency mode*, if a situation occurs under the condition that the emergency mode is activated, an interlock of the PSIS is applied. When the PSIS interlock is operated, the accelerator interlock (beam interlock) is also operated according to the schematic diagram below figure 2, and as the accelerator power is turned off, workers can be guaranteed safety from radiation. [1]

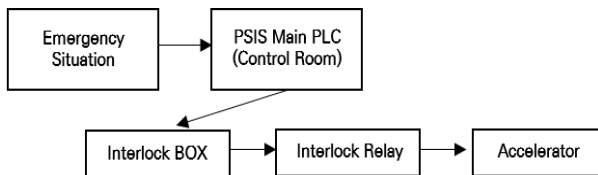


Fig. 2. Schematic diagram of interlock occurrence

After the emergency mode is operated, control room workers should ensure that accelerator is stopped and the point where the emergency mode is operated. Then, they check whether a person is present at the high radiation area where the emergency has sounded, and make them evacuate to the emergency. After action of safety, they apprehend the cause by emergency log program linked to PSIS.

When the cause is identified, the air conditioning power of the emergency occurrence area is turned off, and the operation mode is switched to the general operation mode according to the PSIS operation procedure.

3. Conclusions

In this study investigates the emergency mode of PSIS, one of KOMAC's radiation safety systems. It interworks hardware equipment and software program

with complex, and study deals with the operation of emergency mode in depth.

There are four conditions for emergency mode to be activated. (There is an another condition called RMS, but this only deals with PSIS.)

If even one of these conditions is satisfied, the emergency mode sounds. When the emergency mode works, the door of the high-level radiation area is opened and the accelerator stop interlock is automatically performed to protect workers. Also the alarm system with emergency mode is activated to inform the workers remaining in the facility of the danger and induce evacuation.

The study of PSIS emergency mode and operating logic can be used as a reference for a proton accelerator extension or other similar accelerator facility which will be established in the future.

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