SAFETY MANAGEMENT AT PUSPATI TRIGA REACTOR (RTP)

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Abstract

Adequate safety measures and precautions, which follow relevant safety standards and procedures, should be in place so that personnel safety is assured. Nevertheless, the public, visitor, contractor or anyone who wishes to enter or be in the reactor building should be well informed with the safety measures applied. Furthermore, these same elements of safety are also applied to other irradiation facilities within the premises of Nuclear Malaysia. This paper will describes and explains current safety management system being enforced especially in the TRIGA PUSPATI Reactor (RTP) namely radiation monitoring system, safety equipment, safe work instruction, and interconnected internal and external health, safety and security related departments.

Keyword: Safety management, PUSPATI TRIGA Reactor

Abstrak

Persediaan awal dan kawalan keselamatan yang memuaskan, dilengkapi dengan piawaian dan prosedur keselamatan yang berkaitan, hendaklah disediakan untuk menjamin keselamatan pekerja. Walau bagaimanapun, orang awam, pelawat, kontraktor atau sesiapa sahaja yang berniat untuk memasuki atau berada dalam bangunan reaktor hendaklah dimaklumkan sepenuhnya dengan kawalan keselamatan yang digunakan dan diaplikasikan. Disamping itu, elemen-elemen keselamatan ini juga digunapakai oleh kemudahan sinaran yang lain di dalam premis Nuklear Malaysia. Kertas kerja ini akan menerangkan sistem dan pengurusan keselamatan sediaada yang dikuatkuasakan dan digunapakai khususnya di Reaktor TRIGA PUSPATI (RTP) seperti sistem pemantauan sinaran, peralatan keselamatan, arahan keselamatan kerja, dan hubungan jabatan-jabatan kesihatan dan keselamatan dalaman dan juga luaran.

Keyword: Pengurusan keselamatan, Reaktor TRIGA PUSPATI

INTRODUCTION

The safety of the reactor can be assured through the continuous and vigilant monitoring of its operational parameters with the implementation of the systematic safety management. One of the purpose safety management system implementation at the PUSPATI TRIGA Reactor (RTP) is to meet the requirement of reactor licensing by Atomic Energy Licensing Board (AELB) as well as Basic Safety Standard (BSS) Radiation Protection Regulation 2010 (Act 304), the Occupational Safety and Health Act 1994 (Act 514) and other national safety department such as Department of Occupational Safety and Health (DOSH) in order to continuously operate the reactor safely to personnel, properties and the environment. Hence the discussion will be focus on major aspects that emphasized at the RTP such as listed below;

i. Radiation monitoring system
ii. Safety equipment
iii. Safe work instruction
iv. Interconnected internal and external health, safety and security related departments

PROCEDURES, RESULT AND DISCUSSION

Radiation Monitoring System

Most integral part of the safety working at the irradiation facilities is radiation monitoring system itself since precaution comes ahead of mitigation. Heterogeneous radiation monitoring system has been applied at the RTP, with the attention to limit the dose exposed to the personnel to the lowest level (referring to the concept of ALARA – As Low As Reasonably Achievable), especially, to control health and safety of personnel. Basic Safety Standard (BSS) Radiation Protection Regulation 2010 (Act 304) is a baseline to control employee and public radiation protection program and guideline, as well as to meet the requirement of the Occupational Safety and Health 1994 (ACT 514) respectively.

Type of radiation monitoring system applied at the RTP;

a) Personnel monitoring system
b) Area radiation monitoring

a) Personnel monitoring system

Every personnel working directly with the activities at the RTP is equipped with Termoluminiscent Dosimetry bagde (TLD). Meanwhile for those involve with the analyses of the irradiated sample, the additional of the TLD ring is required. The monitoring device or equipment does not only apply to the reactor personnel or those involve with the related activities, it is also supplied to visitor including outsiders called pen dosimeter. The difference between these devices is that the pen dosimeter, the doses exposed to the user can be read in an instant where the feature is akin to the thermometer, using the mercury to raise the level of detection.

Table 1: Difference categories of Annual Dose Limit (ADL) [5]

Categories	Radiation Worker	Pregnant Worker	Members of the Public	Trainees in Radiation Area
Dose limits	20 mSv	1 mSv	1 mSv	6 mSv

Hand and Foot Radiation Monitor are provided at two entrances and exits of the reactor. These radiation monitoring devices will trigger the alarm if contamination detected on the spot.

b) Area radiation monitoring

The instrument used for measuring radiation levels are referred to as area survey meters or also known as area radiation monitoring (ARM). Mainly it is designed for workplace monitoring. It is also can be described as a precaution device since it will give an alarm or notification that reactor shut down is necessary if the surrounding area radiation level goes beyond safety limits. Area radiation monitoring instruments can be either fixed/wall-installed or hand carry (portable). To ensure radiation all around the reactor building is monitored, ARM's are installed in five strategic locations in the reactor hall and other controlled area such as Pneumatic Transfer System (PTS) control room and basement (where reactor cooling system is located) as shown in Figure 1. The ARM system consists of alarm that will be triggered if the radiation exceeds safety limit levels in specific areas are shown in Table 2. The testing and calibration of ARM system is done annually by the Secondary Standard Dosimetry Laboratory (SSDL) with the assistance of Health Physics Group (KFK), Nuclear Malaysia Agency.

Table 2: ARM's alarm settings

Location	Pre-Alarm (Roentgen)	Alarm (Roentgen)
Reactor Beam Ports	0.500 mR/hour	1.000 mR/hour
Reactor Pool Top	500.000 mR/hour	1000 mR/hour
Reactor Control Room	0.500 mR/hour	1.000 mR/hour
Pneumatic Room	0.500 mR/hour	1.000 mR/hour
Basement (Cooling System)	10.000 mR/hour	20.000 mR/hour

1R= 0.11933Sv

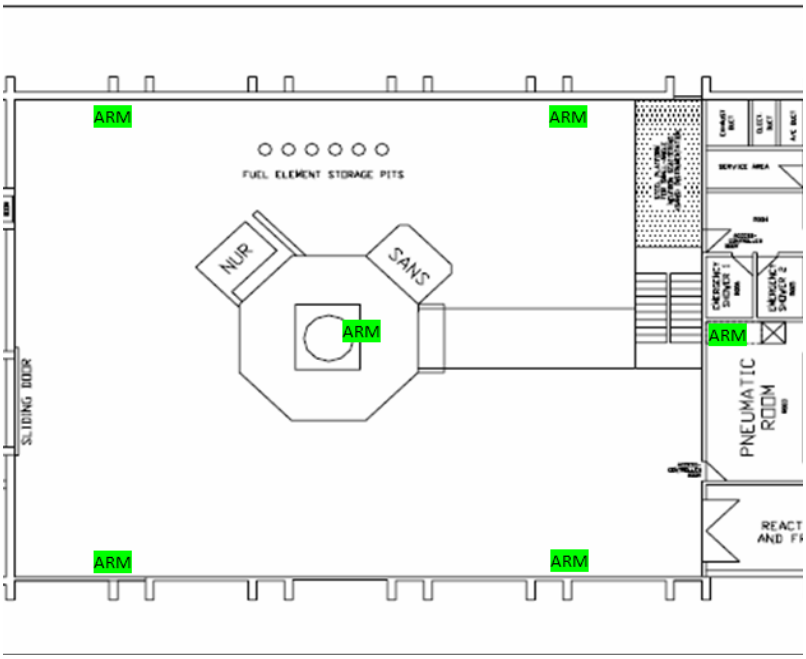

Figure 1: ARM's location at RTP reactor hall [1]

Safety Equipment

Fire prevention and protection system

a) Heat /Smoke Detector

Each room in reactor building and reactor hall is equipped with heat detector. These detectors will trigger the alarm if any smoke or high temperature is detected. This could help early detection of fire if such case occurs. Signal cables from all detectors are connected to an alarm device installed at Block 20, just near the security post at the facility entrance. This fire detection system is powered by UPS and emergency power supply in case of electric network loss.

b) Watering System

Reactor building is also equipped with hose reel system on each floor. The hose is long enough to reach any location on the floor. The hose reel system consists of water storage pressed steel tanks complete with accessories using existing system. Two units water pump available for the hose reel system. The entire pump set on electric motor driven. The duty and standby pump set on the normal power supply. The standby pump set on emergency power supply. Nevertheless, sprinkler also installed at certain potential area which is operated based on the signal sent by alarm detection system.

c) Fire Extinguisher

Each floor in the reactor building is equipped with fire extinguisher. All reactor-operating personnel are trained on fire fighting instructions. The extinguishers are checked, and refilled if necessary, every year. All extinguishers will be replaced every ten years. All this is managed by Engineering Division.

Surveillance system

a) There are many CCTVs available in the reactor building mainly for physical protection monitoring. These CCTVs can be monitored from Emergency Control Center (ECC) and Reactor Control Room. This is one of the methods to detect any indication of security breach, site defection, including fire at early stage by the person in-charge or operator at the reactor control room during operating hours or at the ECC during non working hours.

b) The Access Control System (ACS) is applied to allow authorized personnel or Nuclear Malaysia's employee to pass integrated doors or gates especially reactor entrance. The application is enable to restrict access to a selected, designated premise or area. The system will auto generate a list to the card controller to allow authorized users to pass.

Personnel protection equipment (PPE)

In order to ensure personnel or outsider wearing proper personnel protection equipment in the reactor building especially within the Controlled Area and Supervised Area compound, quality assurance program adopting OHSAS licensing program to insert the detailed procedure into Safe Work Instruction manual. Therefore proper guideline is provided when safety measures required. Furthermore, it makes the job safer. The procedure can be found in RTP-QAP19.

Safe Work Instruction (SWI)

Apparently, any activities that require skills must be carried out properly with the safety controls are in place. The introduction of the Occupational Health and Safety Analyses Series (OHSAS) significantly has been lots improving safety management at the RTP. By adding more concrete safety features, undoubtfully it is a step forward by means safer to personnel, including environmental and the facility itself. Hence, reflect to the OHSAS program, SWI has been added to the existing work procedures (Standard Operation Procedure – SOP). It is applied to any activities, processes, tool, machineries or equipment wherever there is any possibility of risk or hazard, which may causes the incident or accident. These instructions are very useful to improve the safety effectiveness and efficiency while conducting any activities with the safety concerns especially for new personnel that does not familiar with the situation as well as reduce the risk of the activities to be performed and providing them with the rules and procedures that need to comply to ensure the whole process in a safe manner.

The structures of the RTP SWI which can be found in the RTP quality assurance programme documentations including related personnel with their responsibilities, safety monitoring preparation (the follow up acts from hazards and risks analyses), and personnel protection equipment or called PPE constructed with the plan matrix considering the activities procedures. In the reactor safety management system, SWI comes ahead of work procedures in the programme documentations, to make sure all the necessary safety elements are well informed and delivered to the responsible personnel especially reactor operator and maintenance team.

Occupational Safety and Health Management System (OSHMS)

OSHMS is a management system with the combination of MS1722 (Malaysian Standard) and OHSAS 18001 (Occupational Health, Safety Assessment Series). The MS 1722 and OHSAS 18001 are the certification and/or management system that emphasizing health, safety and security that subsequently will improve many areas such as;

- Occupational safety and health management system highly capable to eliminate or at least minimize the risks to employee and other interested parties who may be exposed to occupational safety and health risks associated with the activities conducted within the RTP building.
- Assure itself of its conformance with its stated occupational safety and health policy in line with the national regulatory and authority such as Department of Occupational Safety and Health (DOSH), Atomic Energy Licensing Board (AELB) and International Atomic Energy Agency (IAEA).
- Demonstrate such conformance to others that will put more confidence with the safety measures exercised within the RTP building.

Hazard Identification, Risk Assessment and Risk Control (HIRARC)

HIRARC is one of the most notable methods or approach to ensure safety and health in place at the RTP especially to maintain and improve OHSAS development, implementation and control. HIRARC is the system that will ease the task to eliminate and/or reduce any risk that may potentially harmful to reactor personnel. A basic guideline is provided by Department of Occupational Safety and Health (DOSH) and adopting with the occupational safety, security and health situation and working environment at the RTP [6]. The objectives in implementing HIRARC are;

- To identify types of hazard in work area
- To make risk assessments
- To suggest risk controls to organization
- To implementing risk controls
- To review risk controls

Interconnected Internal and External Health, Safety and Security Related Departments

In order to enforce the health and safety particularly Nuclear Malaysia personnel, adequate organization to perform required task has been identified and well established. These organizations or safety related department can be classified into two groups, internal and external.

Internal or Nuclear Malaysia safety and health related organization or department is lead by Safety, Health and Environment Committee or well known as SHE Committee. Under SHE Committee, five subcommittees divided to perform specific task to enhance the effectiveness of the outlined program. SHE Committee organizations structure chart is shown below.

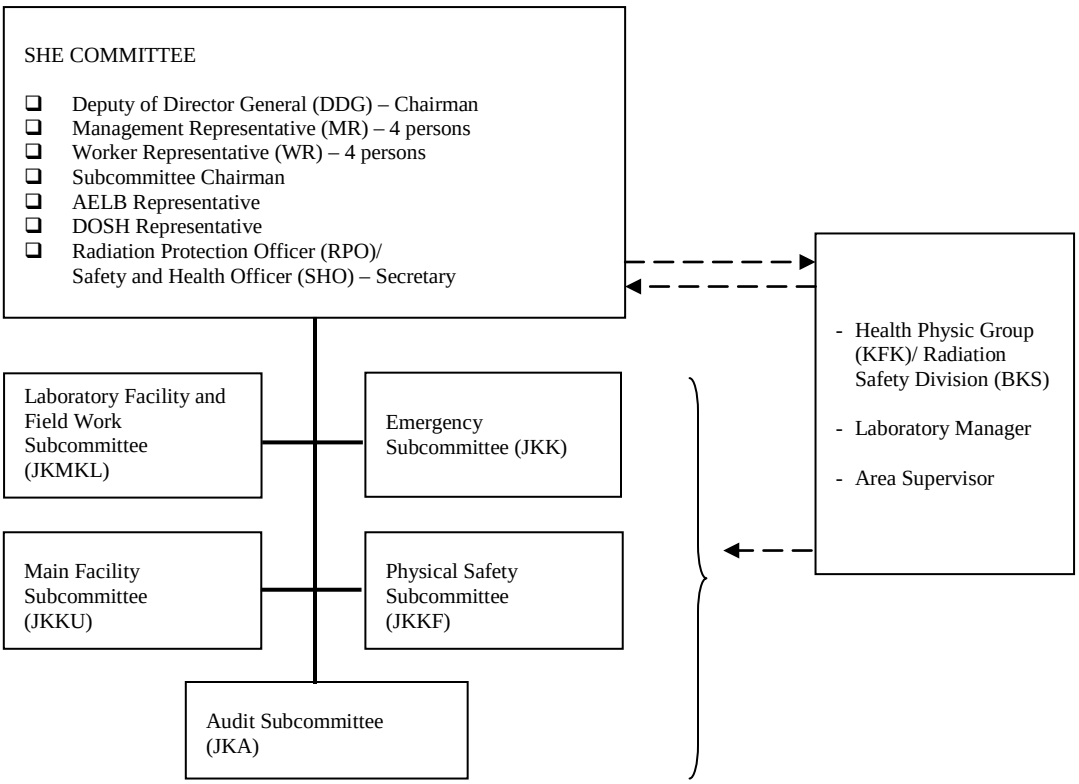

Figure 2: Nuclear Malaysia Organizational Structure [4]

Meanwhile for the external safety and health related organizations (Outside Response Team), Nuclear Malaysia systematically under the SHE Committee management, will react accordingly if any urgency or any necessary actions required. Outside Response Team those handling the emergency to be contact namely Fire and Rescue Department, Hospital, AELB, Royal Malaysian Police (PDRM). Outside Response Team will take charge the emergency operation as if the task urgency is falls below Nuclear Malaysia's emergency response team capability and ability.

CONCLUSION

The excellent safety management, reliability, and maintainability of RTP reactor structures, coupled with personnel numerous lessons and experiences learned, means Reactor TRIGA PUSPATI research reactor providing Nuclear Malaysia personnel and visitor the very safe working and visiting environment.

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