ABSTRACT – In the last two years we trained two new operators for the SLOWPOKE reactor at École Polytechnique. In this paper we describe how the training program for these operators was designed. We also discuss the shortcomings that were identified in the program and the modifications it required when being put in use.

1. Introduction

The SLOWPOKE reactor at École Polytechnique de Montréal was installed in 1976. It is a low power (20 KW) inherently safe pool type reactor operating with a maximum excess reactivity of 4 mk. Access to the reactor core is limited to CNSC approved nuclear engineers and the operator cannot modify the core configuration at any time. The reactor is typically operated 5 days a week during normal working hours and it can also be operated during the night under indirect surveillance.

Over the last 34 years the number of licensed operators for the reactor has varied between two and five. The license holder designates one of the operators as the “Responsable du Réacteur” to ensure reactor safety and compliance with the operating license issued by the CNSC. In 2008 the two operators were nearing retirement age; it was therefore urgent to train new operators. Two important problems were then encountered: 1) the program that was set up when the current operators were trained was now obsolete and 2) the tasks that were required from an operator had evolved considerably over the years. We therefore undertook in early 2008 the process of writing a new training program for reactor operators. This was completed in late 2008, and put into use immediately leading to two new operators being approved by the CNSC in early 2010. In this paper we will describe our approach to designing the new training procedures for the operators as well as the lessons we learned during the implementation of the training program.

2. Tasks expected from a SLOWPOKE operator

A first observation is that this reactor can be operated both manually and in automatic mode. Over the last 20 years the reactor has operated less than 1% of the time in the manual mode. Accordingly, we will concentrate our discussion here on the automatic mode of operation of the reactor.

One would expect that the main role of a SLOWPOKE reactor operator (automatic mode) would be to operate the reactor. However, because of the characteristics of the reactor and the small size of the installation, the tasks that were assigned to the operator were much more extensive. They initially included:
1. Starting, operating and shutting down the reactor in automatic mode in normal operating conditions.
2. Shutting down the reactor in abnormal conditions.
3. Performing the weekly maintenance of the reactor.
4. Performing the occasional maintenance of the reactor.
5. Responding to reactor alarms.

No formal training program for the early operators was available since it was deemed that this reactor was safe enough that “it could be operated by non-highly trained personnel”. Since all of the early operators already had a graduate level degree, it was also felt that hands-on training provided by the approved nuclear engineer would prove sufficient.

Since then, the safety and security requirements from the CCNS have evolved considerably and the tasks assigned to the operator have increased to the level they are now. Accordingly, in addition to the five tasks defined above, the following have been added:

6. Approve substances for irradiation in the reactor
7. Irradiate substances in the reactor
8. Manipulate radioactive materials
9. Manage and dispose of radioactive materials
10. Supervise users of the laboratory
11. Prepare the reactor for the nuclear engineer
12. Apply the radioprotection program
13. Ensure the security of the reactor
14. Keep up to date with the changes in the reactor documentation

Note that most of these tasks refer to the “laboratory” rather than the reactor since the CNSC now considers that the responsibilities of the operator extend to the entire laboratory.

In the main paper we will describe these tasks in more detail and justify the need for specific training in each case.

3. Designing the training program for a SLOWPOKE operator

The approach we took in designing the training program of an operator of the SLOWPOKE reactor in automatic mode is the systematic approach to training combined with a graded approach in the application of training requirements for the SLOWPOKE research reactor.[1-5] Thus, each of the specific tasks that was identified was first characterized according to: 1) the level of difficulty; 2) the importance for the safety of the reactor and 3) the frequency. Based on these characteristics, we defined the specific objectives that our training should achieve for a specific task. The next step consisted in identifying the general knowledge and competency required to perform these tasks. From this analysis we could then infer the training requirements and the specific form this training would take.

For the knowledge requirements, we concluded that operating the reactor requires minimal knowledge in nuclear physics, reactor physics and thermalhydraulics. On the other hand the approval of substances for irradiation in the reactor mainly requires knowledge in nuclear physics. Managing and disposing of radioactive material requires some knowledge in
radioprotection. Once such information was collected for all the tasks, formal course descriptions were proposed to fill these requirements.

For the training requirements to achieve a certain level of competency, the problem was slightly more difficult. First each task was subdivided into a number of subtasks each representing a specific action (pushing a button, reading a temperature gauge, changing the paper in the flux recorder). Then the subtasks were classified according to the level of difficulty: from simple (turning a key), to delicate and difficult to learn (changing the paper in the temperature recorder). Finally, based on this global analysis, we designed a specific hands-on training program that included a procedure for the evaluation of the competency acquired.

In the full paper we will describe in more details how we use the systematic approach to training to design our own operator-training program. We will also discuss the implementation of this program for the training of two new operators. Finally we will comment on the lessons learned from this training exercise and the remaining work that is required to train an operator in manual mode.

4. References


