SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATED TO THE USE OF SAAB BRAND MILES LASER SYSTEMS DURING FORCE ON FORCE EXERCISES AT NUCLEAR POWER PLANTS

1.0 INTRODUCTION

By memorandum dated July 6, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML101800035), the Office of Nuclear Security and Incident Response (NSIR) asked the Office of Nuclear Reactor Regulation (NRR) to determine whether the use of Saab Brand Multiple Integrated Laser Engagement System (MILES) within nuclear power plants could adversely affect the proper operation of plant instrumentation and control (I&C) systems.

Precedent is found in memorandum dated April 2, 2003 (ADAMS Accession No. ML030920677) regarding the use of MILES equipment in nuclear power plants where the staff concluded MILES equipment supplied by Cubic Defense Applications will not affect the safety related instrumentation in nuclear power plants. The staff also reviewed the potential impact of smoke from blank firearm cartridges and the laser light source in this earlier safety evaluation.

The Saab Brand MILES equipment is developed to the same MILES compatible standard as the previously reviewed product from Cubic Defense Applications. The MILES standard is maintained by the U.S. Army Program Executive Office for Simulation, Training & Instrumentation. The Saab equipment is notably different regarding its inter-component wireless communications. It employs 916 Megahertz (MHz) wireless local area network (WLAN) technology.

2.0 REGULATORY EVALUATION

In order to ensure the electromagnetic compatibility of electronic equipment installed in nuclear power plants, Regulatory Guide (RG) 1.180 Revision 1, “Guidelines For Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems, “ was issued in October, 2003. The RG 1.180 Revision 1 endorses MIL-STD 461E to evaluate electromagnetic and radio frequency interference (EMI/RFI) for safety I&C systems.

Mil-Std 461E provides criteria to evaluate a variety of equipment and not all tests apply to the MILES equipment. The MILES equipment is hand-held, not wired into the plant. Therefore, no determination of conducted EMI is necessary. In addition, since MILES equipment is not a safety-related system and is only used for guard force exercises, there is no requirement that MILES equipment have immunity from EMI emissions of other plant equipment. The susceptibility of the MILES equipment will therefore not be addressed. The only relevant requirement is that the EMI emissions from the MILES system not interfere with the operation of plant systems, and for this reason, only the EMI from radiated emissions will be considered.

The light from a laser source has the potential for being a hazard to humans; however, there is no NRC regulation concerning the use of laser light within a nuclear power plant. The safety aspect of laser light are regulated by 21 *Code of Federal Regulations* (CFR) 1040, and those aspects were reviewed.

The smoke produced by the blank cartridges used in the MILES weapons has the potential to interfere with smoke detectors within the power plant. Again, there is no specific NRC regulation concerning the smoke emissions from gunfire; however, there have been several Nuclear Regulatory Guidance Reports (NUREG's) concerning the effects of smoke on electronic equipment.

3.0 TECHNICAL EVALUATION

3.1 Electronic Emissions

The MILES equipment was tested for conformance with the requirements of MIL-STD 461E using the Army ground criteria, Radiated Emissions, Electric Field, RE102. However, the MIL-STD 461 criteria do not apply to intentional emitters. The WLAN transceiver, operated between 902MHz-928MHz, was tested separately to FCC Class B requirements. Therefore, plant safety I&C equipment qualified to MIL-STD 461E RS103 radiated susceptibility, should not be impacted.

However, it is beyond the scope of this evaluation to determine the qualification status of all safety related I&C equipment in nuclear power plants. It is also beyond the scope of this evaluation to determine other potential areas susceptible to radiated emissions (e.g. turbine controls). Given the highly portable nature of the MILES components, plant specific analysis should be performed to determine exclusion zones based on MIL-STD 461E and FCC Class B emissions in order to ensure safe operations during the training exercise. Exclusion zones shall include, regardless of analysis, the plant control room, safety I&C equipment rooms and cable spreading room(s).

Based on the testing performed and considerations discussed above, there is reasonable assurance that EMI/RFI emissions from the MILES equipment will not affect the safety related instrumentation in nuclear power plants. Further, it is common practice to not hold force-on-force training exercises in the nuclear power plant control rooms.

3.2 Laser Light Emissions

There is no specific NRC regulation concerning the use of laser light within a nuclear power plant. Saab Training Systems AB, the manufacturer of the MILES equipment, has stated that the BT47 small arms transmitter (SAT) is certified to IEC 60825-1 Class I, similar to an ANSI Class 1 laser device. 21 CFR 1040.10(b)(5) defines Class 1 laser products as not hazardous to people. This provides reasonable assurance that the MILES equipment will not present a personnel hazard.

3.3 Smoke Emissions

The smoke produced by blank cartridges has the potential for damaging electronic circuit boards within the electronic equipment within the power plant; but again, there are no specific NRC regulations concerning the smoke emissions from gunfire. There have been five NUREGs that address the effect of smoke on electronic equipment, NUREG/CR-6476, NUREG/CR-6406, NUREG/CR-6543, NUREG/CR-6579, and NUREG/CR-6597. The determination of these studies was that since there is no practical repeatable testing methodology, it was not feasible to assess smoke susceptibility of electronic equipment. However, these NRC studies did determine that the electronic equipment is less susceptible to smoke damage than personnel.

Therefore, unless the smoke is sufficiently dense that the location must be evacuated for personnel safety, the probability of smoke damage to electronic plant equipment is negligible.

The second possibility of smoke problems concerns the possibility of smoke interfering with or activating smoke detectors within the power plant. The amount of smoke and the potential hazard would depend on the amount of blank shells fired, the location, and ventilation in the affected areas. In addition, smoke detector sensitivity and location are plant specific. These make it impossible to determine, on a generic basis, that the smoke will not trigger the smoke detectors. This must be a plant specific determination.

4.0 CONCLUSION

The NRR staff has concluded, based on the considerations discussed above, as long as plant specific analyses are performed to establish exclusion zones to restrict use of this equipment, that there is reasonable assurance that the MILES equipment will not affect safety related instrumentation in nuclear power plants. In addition, there is reasonable assurance that the use of MILES equipment will not present a personnel hazard. The effect of smoke on the smoke detectors within nuclear power plants is undetermined, and will require plant specific analysis. This determination is based the following plant specific action items being addressed at each location where the MILES equipment will be used:

Plant Specific Action Items:

(1) Plant personnel shall review the EMI radiated susceptibility qualifications of plant safety systems and any other systems considered important to safety to ensure they are compliant with FCC Class B emitters.
(2) Perform analyses to define exclusion zones where the MILES equipment may not be operated.
(3) Clearly mark the exclusion zones in the plant prior to the start of the training exercise and maintain the markings for the duration of the exercise.
(4) Prior to the start of force-on-force exercises, provide list of exclusion zones to NRC personnel coordinating the exercise.
(5) Identify areas in the plant where smoke detector sensitivity may be a concern.

Principal Contributor: Stephen M. Wyman
Date: October 7, 2010