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LESSONS LEARNED IN TESTING OF SAFEGUARDS EQUIPMENT

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During the 1990s, the IAEA Department of Safeguards began a transition from analog to digital equipment. This included surveillance equipment, seals, NDA measurement systems, and other instruments. The transition to digital equipment was intended to facilitate compatibility between and integration of instruments, remote communication of data, improved data storage, and modernization. Many of the instruments are designed to operate on battery power during loss of facility power, and therefore, are designed to consume minimal power.

In 2000, the IAEA experienced a number of failures in digital image surveillance (DIS) equipment. A study of the performance data revealed that the failures occurred in "high risk" environments where the systems were exposed to neutrons. As a supporter of IAEA equipment development and implementation, the U.S. Support Program worked with the IAEA, the equipment designer, and the equipment manufacturer in special meetings on DIS to determine the cause of the failures. It was as a result of these meetings that single event upset (SEU) was determined to be the root cause of the failures. The meeting participants also identified a list of actions to improve the reliability of DIS systems.

As a result of the DIS meetings and the identified actions, the U.S. Support Program approved a request from the IAEA and established Task E.125, "Remote Monitoring and Unattended Digital Surveillance Systems." This task is an umbrella task intended to provide a mechanism for response to IAEA needs related to improving the reliability of unattended, remote monitoring and DIS equipment. Subtasks approved under this task include:

- E.125.1, "SDIS Software Consolidation and DCM-14 Audit" - This subtask involves the consolidation of a number of individual upgrades to the SDIS and review of the DCM-14 software. As the sponsor of the design of the DCM-14 by Dr. Neumann, the German Support Program is also a participant in this subtask.
- E.125.2, "DIS Upgrade Travel Funding" - This subtask provides funding for the upgrade of DIS equipment installed in the field.
- E.125.3, "DIS Radiation Field Characterization" - This subtask provides for the procurement by the IAEA of radiation measurement equipment and technical assistance for the characterization of radiation conditions in the locations where DIS will be installed. This will help the IAEA ensure that the design specifications for the equipment are consistent with the location where the instrument will be used.
- E.125.4, "DIS Design Limit Testing and Advise to Strengthen IAEA's Current Equipment Qualification Criteria" - Under this subtask, Wyle Laboratories and Quanterion Solutions will conduct SDIS design limit testing, including harsh environmental testing and accelerated aging, to determine the expected lifetime and produce a design limit report to include maximum operating environment vs. design limit analysis. Additionally, this task will include the development of a strengthened environmental qualification test plan and reliability and maintainability definition methodology for all safeguards equipment.

The implementation of new equipment by the Department of Safeguards is costly. Expected costs associated with the implementation of equipment include capital costs, training and in some cases travel. The cost is dramatically increased when operational issues arise due to the costs of studying the issues, modifying and upgrading the equipment and additional travel. The U.S. Support Program believes that the IAEA's Division of Safeguards Technical Support (SGTS) must strengthen its equipment-testing program to ensure that the equipment it approves for inspection use is reliable and will not place additional burden on the Department of Safeguards' maintenance and inspection staff.

The U.S. Support Program recognizes that SGTS already requires a series of fundamentally important and revealing tests, but we believe that additional tests should be added to the testing regime to ensure that all aspects of the equipment are fully functional. If problems exist it is better to know about them prior to implementation.

This paper will discuss the results of the subtasks completed under Task E.125 and the progress of active subtasks. The cost/benefit of these subtasks will be addressed. Lessons learned by the U.S. Support Program in undertaking these tasks will be identified.