

Course Modules in Non-Destructive Evaluation of Reactor Systems

Executive Summary

The University of Maryland (UMD) initiated its unique on-line Masters Program in Nuclear Engineering during academic year 2009-2010. The program is based on graduate-level courses in advanced nuclear engineering and nuclear science. The proposed online course modules will further expand our course offerings to include the critical area of non-destructive evaluation instrumentation and techniques of reactor structures and systems.

The proposal is based on the development of two separate course modules for direct insertion into existing courses. The course modules can exist as separate short courses, or packaged together into a new course on *Techniques and Engineering Science of Non-Destructive Evaluation Techniques for Nuclear Reactor Systems*.

Instruction material will be developed and aimed at understanding the non-destructive analysis necessary for assessing multiple-layer safety systems for deep repository for high-level nuclear waste, as well as pressure vessels within reactor systems. The teaching tool will be the copper canister, which consists of the iron cast insert for withstanding mechanical loads and the copper shell for preventing the contact of the radioactive waste with the environment. This then becomes an ideal tool for understanding non-destructive techniques (NDT) test parameters. We will cover detectability through an on-line test experiment using our proposed web-assisted virtual laboratory. For this part of the course we will test a series of actual copper EB welds using four different methods: 1) visual (optical) testing, 2) eddy current testing, 3) ultrasonic testing, and 4) radiographic testing. The integrity of this canister post welding will be determined using traditional destructive as well as NDT methods to build an experiment set to help students understand and learn how to use NDT analysis.

UMD's well-established web-based delivery system will be streamlined to offer the proposed courses to a broad audience of nuclear industry professionals, including web-based access for interested NRC and DOE staff. As part of this proposal, the new online MS degree program will now include the new courses and will be fully online during academic year 2010-2011. The courses developed online will also be integrated within the new online MS degree program in Sustainable Energy.

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