

March 13, 2009

MEMORANDUM TO: Donald G. Harrison, Acting Chief
Safety Issues Resolution Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation

FROM: John Lehning, Reactor Systems Engineer /RA/
Safety Issues Resolution Branch
Division of Safety Systems
Office of Nuclear Reactor Regulation

SUBJECT: NRC STAFF TRIP TO WUHAN, CHINA, TO PARTICIPATE IN AN
INTERNATIONAL ATOMIC ENERGY AGENCY WORKSHOP ON
EMERGENCY CORE COOLING SYSTEM STRAINER BLOCKAGE

A Nuclear Regulatory Commission (NRC) staff member traveled to Wuhan, China, to participate in an International Atomic Energy Agency (IAEA) workshop on emergency core cooling system (ECCS) strainer blockage that was held from October 14–16, 2008. The workshop was held under the auspices of the IAEA extrabudgetary program on the safety of nuclear installations located in countries in Southeast Asia, the Pacific, and the Far East. The primary purposes of the workshop were to provide (1) an overview of operating experience concerning strainer blockage events that have occurred throughout the world, (2) an overview of the technical issues associated with strainer blockage, and (3) a description of the regulatory efforts undertaken in other IAEA member countries to resolve ECCS strainer blockage issues.

In addition to the NRC staff participant, attendees of the workshop included representatives from the IAEA, from Transco Products, Incorporated (an American thermal insulation and strainer vendor), from two organizations in Japan, and from a number of nuclear installations and research organizations in China, including the sponsoring organization, the Research Institute of Nuclear Power Operation, which is located in Wuhan.

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Exemptions 4 outside scope
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A formal 30-day foreign trip report dated October 31, 2008 (ML083020208), has already been completed for this trip, which was intended to provide the office of Nuclear Reactor Regulation (NRR) management a high-level summary of the workshop proceedings. The enclosed detailed trip report is intended to provide NRR technical staff a more detailed description of the information discussed at the workshop.

Enclosure:

Detailed Trip Report for October 14–16, 2008, Trip to Wuhan, China

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DETAILED TRIP REPORT

Workshop Dates: October 14–16, 2008

Traveler: John Lehning, Reactor Systems Engineer, NRR/DSS/SSIB

Location: Wuhan, China

Organization/Committee: International Atomic Energy Agency (IAEA)

Sensitivity: Non-Public

Trip Purposes:

This trip was proposed for staff to attend an IAEA workshop on emergency core cooling system (ECCS) strainer blockage issues held from October 14–16, 2008, in Wuhan, China. The primary purposes of the workshop were to provide (1) an overview of operating experience concerning strainer blockage events that have occurred throughout the world, (2) an overview of the technical issues associated with strainer blockage, and (3) a description of the regulatory efforts undertaken in other IAEA member countries to resolve ECCS strainer blockage issues.

Desired Outcomes:

1. Provide technical and regulatory perspectives on ECCS strainer blockage to attendees of the workshop from Southeast Asia, Pacific, and Far East countries.
2. Understand the current status of ECCS strainer blockage issues among other workshop participants
3. Gain insights on ECCS strainer blockage issues from the technical approaches used by other workshop participants

Results Achieved:

The staff fulfilled the desired trip outcomes, as follows:

1. The staff made two presentations at the workshop that summarized the activities conducted by the NRC and the U.S. nuclear industry to address strainer blockage issues. The first presentation provided an overview of strainer performance issues in the United States from the mid-1970s to the present time, and the second presentation focused on the current status of the NRC staff's reviews of pressurized-water reactor (PWR) licensees' responses to Generic Letter 2004-02.
2. Based on the presentations made by attendees of the workshop from China and Japan, the staff obtained an improved understanding of the current status of strainer blockage issues in these countries. Details concerning the status of these countries in addressing strainer blockage are provided below.
3. Based on the presentations made by attendees from China and Japan, the staff observed that many of the technical approaches implemented by these countries are based on technical approaches developed in the United States by either the

NRC or U.S. nuclear industry. However, unique aspects of their approaches were also noted, some of which are described in further detail below.

Summary of Trip:

The strainer performance workshop consisted of two days of presentations and a half-day tour of the facilities of the Research Institute of Nuclear Power Operation (RINPO) in Wuhan, China.

Workshop Day 1

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Following the IAEA representative's presentation, the NRC staff made a presentation that summarized the activities of the NRC and U.S. nuclear industry starting with the issuance of Regulatory Guide 1.82, Revision 0, in June 1974, and continuing through the present time. The presentation described the objectives, major activities, and conclusions associated with the NRC's efforts on Unresolved Safety Issue A-43 from 1979-1985, the BWR ECCS strainer issue in the 1990s, and Generic Safety Issue 191 (GSI-191), from 1996 through the present. The presentation also noted the effort to re-examine aspects of BWR strainer performance based on the improved level of knowledge gained from addressing GSI-191, as well as the NRC staff's efforts to address strainer performance for new reactor applications. The staff's presentation slides are included as Appendix I to this report.

Finally, Chinese presenters from various organizations presented their perspective on ECCS strainer blockage issues. Currently, China has a variety of operating reactor designs that include the following types:

- Russian-designed VVER-type PWRs
- Canadian-designed pressurized-heavy-water reactors (PHWRs)
- French-designed PWRs
- Domestically designed CNP-type PWRs

In addition, China is also planning to construct new reactor designs, such as Westinghouse's Advanced Passive 1000 (AP1000) and Areva's Evolutionary Power Reactor (EPR). Notably, none of the operating or planned reactors are BWRs. Most of the discussion from the Chinese presenters focused on safety reviews performed for the strainer designs for planned new reactors. Both the Chinese industry representatives and regulators appeared to be aware of the progress of the NRC's review of new reactor designs (i.e., AP1000 and EPR) that are also being planned for construction in China.

(b)(4)

Exemption 4
10 CFR 2.390(d)(2)

(b)(4)

(b)(4)

Exemption 4
10 CFR 2.390(d)(2)

The NRC staff suggested that Chinese regulators and plant operators consider evaluating strainer performance and associated risks for operating plants before making a final determination that near-term actions are not required to have reasonable assurance of adequate strainer performance for these plants. The NRC staff referred to analogous studies that had been performed for U.S. PWRs during the GSI-191 technical assessment (NUREG/CR-6762, NUREG/CR-6771). These studies led to the issuance of Bulletin 2003-01, which requested the implementation of interim compensatory actions from PWR licensees that could not confirm compliance with regulatory requirements pertaining to sump strainer performance on a mechanistic basis. The staff noted that evolving concerns associated with chemical effects and downstream effects had not been included in the studies performed during the GSI-191 technical assessment.

Workshop Day 2

The NRC staff made a presentation concerning the current status of the reviews of the Generic Letter (GL) 2004-02 supplemental responses and the staff's planned approach for closure of the GL 2004-02 reviews. This presentation also discussed examples of outstanding technical issues still being resolved for some U.S. PWRs, the staff's intended timeline for resolving GSI-191, and a summary of the corrective actions taken by U.S. PWR licensees to address the concerns documented in GL 2004-02. The staff's presentation slides are included as Appendix II to this report.

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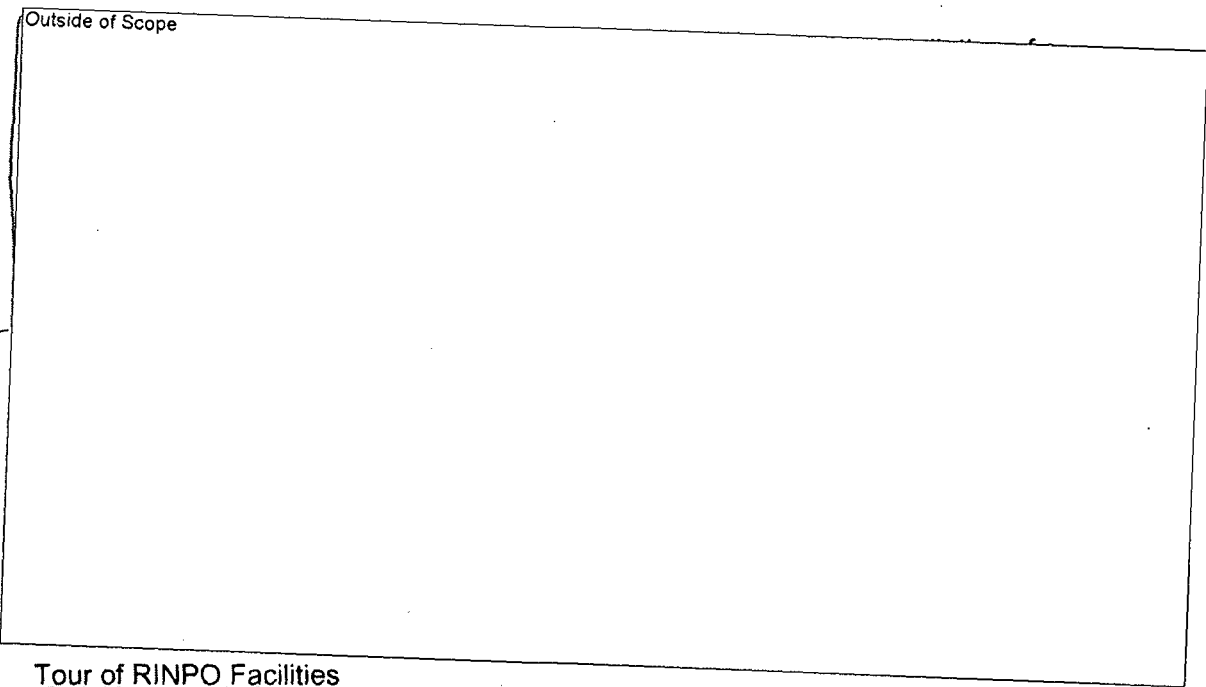
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Tour of RINPO Facilities

The third day of the ECCS sump performance workshop concluded with a tour of the facilities of RINPO. The RINPO facilities had recently been built and were located in a technology park on the outskirts of Wuhan.

At the beginning, the tour group was shown several buildings that housed equipment for performing non-destructive examination of piping and components such as steam generators, pressurizers, and reactor vessels. Non-destructive examination methods being developed at RINPO included ultrasonic testing, eddy current testing, and closed circuit television. Mock-ups of various components were set up to examine the capability of test equipment and operators to identify material flaws. Equipment and mock-ups for performing diagnostic testing for air-operated valves, motor-operated valves, and other types of valves were also included in this segment of the tour.

The tour group also observed the simulator-development computer laboratory. RINPO technicians created a computer program that can be used to develop nuclear reactor plant simulators. The program was being used to design simulators for Chinese nuclear power reactors. The staff observed the simulator interfaces created for several Chinese nuclear power plants.

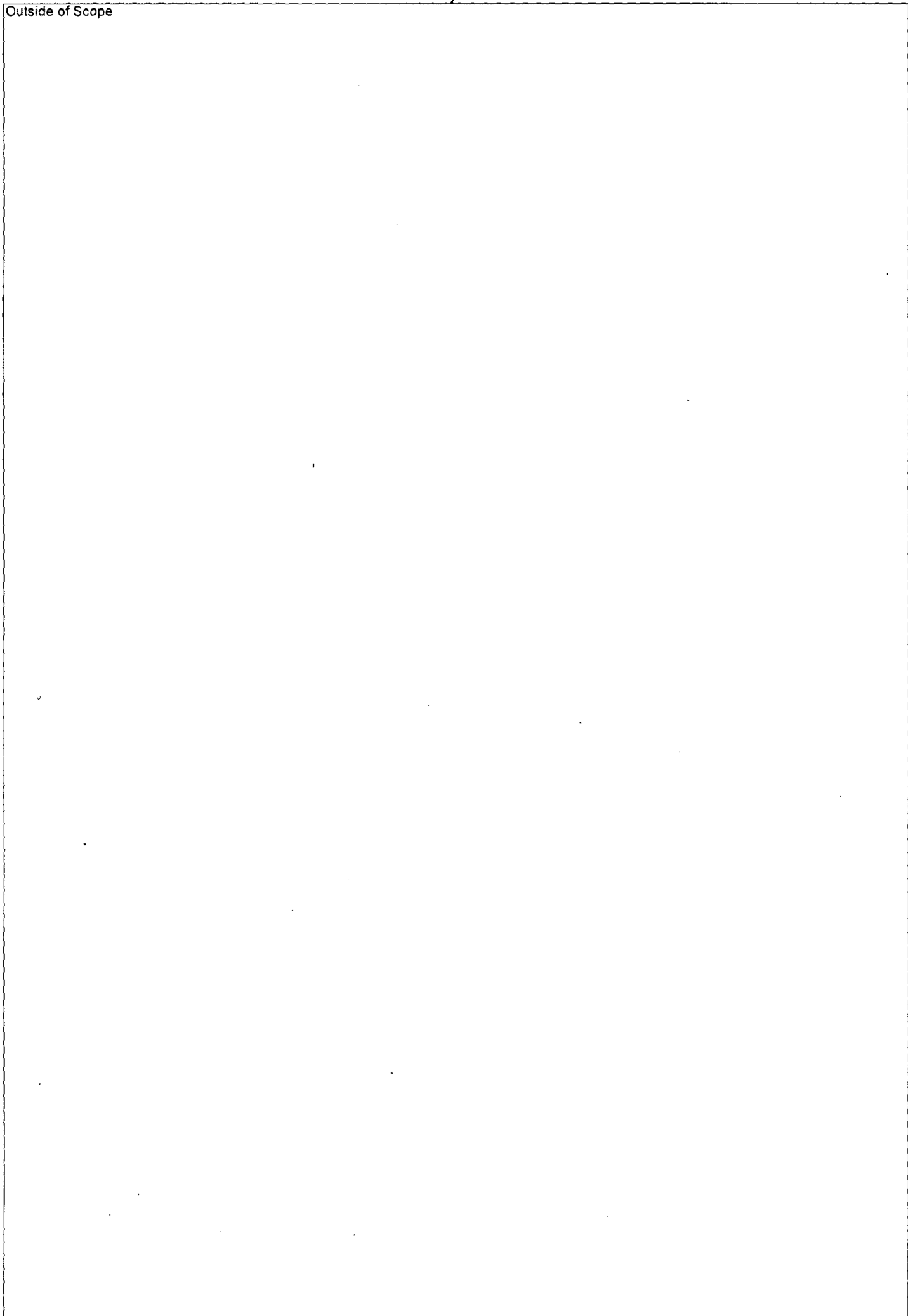
Finally, the tour group was shown the internal website developed and maintained by RINPO to serve as an information clearinghouse for the Chinese nuclear power industry. The website included information from operating experience, event reports in China and throughout the world, performance indicators, regulations, and other information and news from the nuclear power industry.

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