September 6, 2012

MEMORANDUM TO: Patrick Hiland, Director
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Michael J. Case, Director */RA/ S. Richards for*
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: RESPONSE TO RESEARCH ASSISTANCE REQUEST TO ASSESS THE IMPLICATIONS OF THE INDICATIONS DISCOVERED IN THE DOEL 3 REACTOR PRESSURE VESSEL IN BELGIUM (NRR-2012-005) (RAR)

On August 27th, 2012, the Division of Engineering in the Office of Nuclear Reactor Regulation (NRR) requested technical assistance from the Office of Nuclear Regulatory Research (RES) to provide assistance to assess the implications of the indications discovered in the Doel 3 reactor pressure vessel (RPV) ring forgings to domestic RPV forgings (see ADAMS ML12242A258). NRR requested technical assistance in the areas of nondestructive examination (NDE) and deterministic and probabilistic fracture mechanics. Specifically, the assistance requested provides support on three fronts:

1. **NON-DESTRUCTIVE EXAMINATION (NDE):**

   a. Tasks: RES will provide NRR with technical expertise to assess the procedures, techniques, equipment, standards, qualifications, inspections, acceptance criteria and other relevant NDE variables used to examine the Doel 3 RPV forgings. This assistance may include contact with the licensee at Doel, with the Belgian Nuclear Regulatory Authority, and possibly with contractors. Travel to Belgium may also be necessary.
   b. Schedule: The schedule will be determined based on the availability of information from Belgium and on Nuclear Regulatory Commission (NRC) prioritization. RES understands that this is a high priority matter and will work with NRR to expedite the needed work.
   c. Deliverables: Support via e-mail, telephone, and meetings are anticipated. Topical reports and/or memoranda can be prepared as needed.
   d. RES Point of Contact: Carol Nove, RES/DE/CIB, carol.nove@nrc.gov

CONTACT: Mark Kirk, RES/DE
301-251-7631

2. **Fracture Mechanics, Support of the Belgian Regulatory Authority, Federal Authority for Nuclear Control (FANC):**

   a. RES will provide NRR with technical assistance to support the Belgian regulator, FANC. The FANC has requested the participation of RES staff member Mark Kirk in an international working group of experts in the area of structural mechanics and fracture mechanics (see ADAMS ML12242A335). The working group will assist FANC in assessing the safety case being prepared by the licensee for Doel 3, which is likely to include both deterministic and probabilistic fracture mechanics analyses. It is anticipated that prior review of the licensee's presentation material, telephone, video conference, and in-person meetings in Belgium will be necessary to support this effort.
   b. Schedule: Schedule will be determined by FANC and based on NRC prioritization. The invitation letter from FANC stated that one or two meetings, each of 1-2 days duration, are planned for September-October 2012. These meetings will occur in Brussels, Belgium. RES understands that this is a high priority matter and will work with NRR to expedite the needed work.
   c. Deliverables: Attendance and participation in the international working group meetings and support of any work products arising from these meetings is anticipated. NRR management will be briefed on the outcome of the meetings following their completion, and a meeting summary will be prepared.
   d. RES Point of Contact: Mark Kirk, RES/DE/CIB, mark.kirk@nrc.gov

3. **Fracture Mechanics, Evaluation of Domestic RPVs:**

   a. RES will provide NRR with technical assistance to review and/or perform analyses to assess the implications of the NDE indications similar to Doel 3 if postulated to exist in similar domestic RPV ring forgings. It is anticipated that the U.S. nuclear industry may perform both structural and fracture mechanics analyses of RPV forgings postulated to contain indications similar to those discovered in Doel 3. If the industry performs these analyses, RES will perform confirmatory analyses in support of NRR's review. In the event that industry does not perform these analyses in a timeframe suitable to NRR, RES will support NRR by assessing the adequacy of current ASME Section III acceptance criteria for (b)(4) it is anticipated that this assessment will include structural analysis as well as deterministic and/or probabilistic fracture mechanics analyses.
   b. Schedule: The schedule will be determined based on the availability of information from Belgium, timeframe for completion of the assessment by the U.S. nuclear industry, and on NRC prioritization. RES understands that this is a high priority matter and will work with NRR to expedite the needed work.
   c. Deliverables: Support via e-mail, telephone, and meetings are anticipated. Topical reports and/or memoranda can be prepared as needed.
   d. RES Point of Contact: Gary Stevens, RES/DE/CIB, gary.stevens@nrc.gov

Due to lack of information, there is considerable uncertainty regarding the level of effort needed to support this work. Below is the initial estimate to complete this effort:

1. NDE: 80 staff hours
2. Fracture Mechanics, Support of FANC: 100 staff hours
3. Fracture Mechanics, Evaluation of Domestic RPVs: 120 staff hours will be needed for a review of an analysis performed by the industry. If the industry does not perform an analysis, 0.5 FTE will be needed to perform the requested evaluations. Overall, 300 staff hours (approximately 0.2 FTE) are needed to respond to tasks 1, 2, and 3.

Also, contractor support may be needed (e.g., Pacific Northwest National Laboratory, Oak Ridge National Laboratory, etc.) depending on the constraints imposed by the overall scope of work and schedule.

Enclosures:
1. NRR Request for Assistance, ADAMS ML12242A258
2. FANC Request for Assistance, ADAMS ML12242A335

Due to lack of information, there is considerable uncertainty regarding the level of effort needed to support this work. Below is the initial estimate to complete this effort:

4. NDE: 80 staff hours
5. Fracture Mechanics, Support of FANC: 100 staff hours
6. Fracture Mechanics, Evaluation of Domestic RPVs: 120 staff hours will be needed for a review of an analysis performed by the industry. If the industry does not perform an analysis, 0.5 FTE will be needed to perform the requested evaluations. Overall, 300 staff hours (approximately 0.2 FTE) are needed to respond to tasks 1, 2, and 3.

Also, contractor support may be needed (e.g., Pacific Northwest National Laboratory, Oak Ridge National Laboratory, etc.) depending on the constraints imposed by the overall scope of work and schedule.

Enclosures:
3. NRR Request for Assistance, ADAMS ML12242A258
1. FANC Request for Assistance, ADAMS ML12242A335

DISTRIBUTION:

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ADAMS Pkg. Accession No.: ML12242A333

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