

From: Collins, Jay *mark*
Sent: Friday, August 03, 2012 2:11 PM
To: Lupold, Timothy
Subject: FW: URGENT Message on Nuclear Safety: Flaw indications in Doel 3 Reactor Pressure Vessel
Attachments: FANC_LOGO.gif; Doel 3 - RPV preliminary IRS report_final.docx; Potential problem on the reactor pressure vessel (RPV) of the Belgian Doel 3 NPP

fyi, if you did not see this already

From: VAN WONTERGHEM Frederik [Frederik.VANWONTERGHEM@FANC.FGOV.BE]
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Subject: URGENT Message on Nuclear Safety: Flaw indications in Doel 3 Reactor Pressure Vessel

Dear all,

This week, a preliminary IRS Incident Report was published by Belgium related to the detection of a large number of flaw indications in the reactor pressure vessel of Doel 3 (PWR - Framatome Design). (Reference IRS Number 8244: "FLAWS INDICATIONS IN THE REACTOR PRESSURE VESSEL"). In attachment you can find a copy of this IRS report.

As indicated in the IRS report, the Doel 3 NPP outage has been extended to allow further inspections and to perform additional studies by the licensee to analyze and, if possible, to validate and confirm the structural integrity of the vessel. At the moment, the licensee supposes that the flaw indications were already present at the moment of forging of the vessel, which was done by Rotterdam Droogdok Maatschappij (also referred to as Rotterdam Dockyards or RDM). Both a deterministic approach (in accordance with ASME XI Appendix A) and a probabilistic approach (in accordance with 10CFR50.61a) are being considered by the licensee to justify the structural integrity of the reactor vessel.

Some additional information on the types of flaw indications and other possible reactor vessels forged by this company can be found below.

Considering the potential consequences of this event, the Belgian regulatory body would like to organise on short notice a technical working meeting in Brussels on this issue for those regulatory bodies which could be interested by these findings, specifically those regulatory bodies of countries where RPVs forged by RDM can be present. During this technical working meeting, additional information on the results found at Doel 3 NPP and the on-going licensee investigations and calculations will be made available by the Belgian regulatory body (FANC, its technical support organisation Bel V and the Authorized Inspection Authority AIB Vincotte International). In addition, a roundtable discussion between regulatory bodies will be held to discuss relevant experiences with this kind of

inspections and flaw indications. Specific topics/questions to be discussed during this roundtable discussion are mentioned in an email by Bel V which was sent last week (see attachment). We are especially interested to know if this type of ISI was already performed in your countries on the reactor vessels forged by this company, and if so, what the results have been. May we kindly invite every country to present additional available input and thoughts to our working meeting .

This technical working meeting shall take place in Brussels (FANC offices, Ravensteinstraat 36, 1000 Brussels) on Thursday 16 August between 10h00 and 16h00. We would be very grateful if one or more technical experts of your organisation could be present during this working meeting.

To confirm your participation, please send me a reply by email to frederik.vanwonderghem@fanc.fgov.be<mailto:frederik.vanwonderghem@fanc.fgov.be> (tel. ++32 2 289 2082) before Friday 10 August.

If you have further technical questions on this event, you can contact pierre.briegleb@belv.be<mailto:pierre.briegleb@belv.be> (tel ++32 2 528 0245).

A second technical working meeting could be held in the near future (presumably early September) to discuss the available results of the additional inspections at Tihange 2 and the results of the licensee investigations and calculations aiming to confirm the structural integrity of the reactor vessel. Further actions in your countries can also be discussed during this second meeting. We will inform you as soon as possible of the timing of this second working meeting.

Best regards,

Frederik Van Wonderghem

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Additional information on the types of flaw indications and other possible reactor vessels

- Preliminary results from additional inspections

o As described in the IRS message, considering the limitations of the inspection method which revealed the presence of those defects, an inspection of the whole height of the RPV with the UT-qualified method used to control the beltline welds has subsequently been performed. This inspection covers the whole thickness and the whole height of the RPV of Doel 3.

o The preliminary results from those additional inspections confirm the presence of several thousand (up to 10000) flaw indications in the reactor vessel base material. These flaw indications seem to be laminar in shape and have average diameters of 25 mm.

- Reactor Pressel Vessels forged by Rotterdam Droogdok Maatschappij (also referred to as Rotterdam Dockyards or RDM)

o The Doel 3 and Tihange 2 RPVs were forged by RDM, which according to the Licensee Electrabel provided some 20+ vessels in Europe and the US.

o The table below gives an overview of these RPVs (this list has been established by the licensee and could contain errors or omissions).

COUNTRY

PLANT

TYPE

LOOPS

Mwe (net-1)

START (cr-1)

DESIGN

ARGENTINA

Atucha 1

PHWR

335

1980

Siemens

BELGIUM

Doel 3

PWR

3

1000

1982

Framatome

Tihange 2

PWR

3

1000

1982

Framatome

GERMANY

Brünsbittel

BWR

-

770

1977

KWU

Philippsburg 1

BWR

890

1980

KWU

NETHERLANDS

Dodewaard

BWR

-

52

1968

RDM

Borssele

PWR

2

515

1973

KWU

SPAIN

Sta Maria de Garona

BWR

450

1971

General Electric

Cofrentes

BWR

-

1064

1984

General Electric

SWEDEN

Ringhals 2

PWR

3

813

1974

Westinghouse

SWITZERLAND

Leibstadt

BWR

-

1165

1984

General Electric

Mühleberg

BWR

373

1971

General Electric

USA

Catawba 1

PWR

4

1129

1985

Westinghouse

McGuire 2

PWR

4

1100

1983

Westinghouse

North Anna 1

PWR

3

903

1978

Westinghouse

North Anna 2

PWR

3

973

1980

Westinghouse

Quad Cities 1

BWR

-

882

1972

General Electric

Sequoyah 1

PWR

4

1162

1980

Westinghouse

Sequoyah 2

PWR

4

1126

1981

Westinghouse

Surry 1

PWR

3

839

1972

Westinghouse

Surry 2

PWR

3

800

1973

Westinghouse

Watts Bar 1

PWR

4

1123

1996

Westinghouse

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Flaws indications in the reactor pressure vessel

Background

Belgian reactor pressure vessels (RPV) are inspected according to ASME XI. Volumetric inspections of the beltline area are normally limited to the circumferential welds (there are no axial welds in the Belgian RPVs) and surrounding heat affected zone and base material, within the limits set by the code.

Additionally, as a result of the experience at Tricastin, inspections aiming at detecting possible underclad defects in the pressure vessel beltline region are planned for all Belgian plants. The first inspection of this kind took place at Doel 3 this summer.

These inspections are performed with a qualified UT-method for detection of underclad defects, and encompass the height of the vessel beltline region. This means that clad base material was inspected where no volumetric in-service inspection was performed up to now.

Results of the inspection performed

At Doel 3, no underclad defects were detected.

Nevertheless, defect indications of an apparently different type were detected by this UT-inspection, especially in one of the three forged rings (SA-508-cl.3). These indications appear to be of a laminar type of flaw, more or less parallel to the inner/outer surface of the pressure vessel, located in and outside the inspected zone where underclad defects were looked at. Obviously, it is not possible to justify those indications on a one-by-one basis by means of an analytical evaluation according to the App. A of ASME XI code requirements.

Current investigations

In the absence of any other explanation at this stage, the Owner supposes the presence of fabrication defects.

Considering the limitations of the inspection method which revealed the presence of those defects, an inspection of the whole height of the RPV with the UT-qualified method used to control the beltline welds has subsequently been performed. This inspection covers the whole thickness and the whole height of the RPV. Results will not be available before beginning of august.

The Owner is currently investigating the inspection results.

In parallel additional studies are being performed to analyze and, if possible, to validate and confirm the structural integrity of the vessel.

Similar inspections will be performed at another Belgian reactor vessel (unit 2Tihange NPP) during the upcoming outage within a few weeks (see hereunder).

Further information

Upper and lower vessel rings of the Doel 3 and Tihange 2 RPVs were forged by the Rotterdam Droogdok Maatschappij (also referred to as Rotterdam Dockyards or RDM), at the same time and under the same contract.