ATTACHMENT 3

PNP 2020-034

Framatome Document No. ANP-3876 Revision 1Q1NP,

Response to NRC Request for Additional Information of

Palisades Relief Request Number RR 5-8,

Repair of Reactor Pressure Vessel Head Penetration,

Inservice Inspection Program, Fifth Ten-Year Interval

(Non-Proprietary)

13 pages follow

framatome

Response to NRC Request for Additional Information of Palisades Relief Request Number RR 5-8, Repair of Reactor Pressure Vessel Head Penetration, Inservice Inspection Program, Fifth Ten-Year Interval

ANP-3876
Revision 1Q1NP
Revision 0

Technical Report

September 2020

Nature of Changes

Item	Section(s) or Page(s)	Description and Justification
1	All	Initial Issue

Contents

List of Figures

Nomenclature

Acronym	Definition
ADAMS	Agencywide Documents Access and Management System
EFPY	Effective Full Power Years
ID	Inside Diameter
IDTB	Inside Diameter Temper Bead
NRC	Nuclear Regulatory Commission
OD	Outside Diameter

ABSTRACT

Framatome document ANP-3876, "Palisades Relief Request Number 5-8, Repair of Reactor Pressure Vessel Head Penetration, Inservice Inspection Program, Fifth Ten-Year Interval", was prepared by Framatome for Entergy and subsequently submitted to the Nuclear Regulatory Commission (NRC) by Entergy. The NRC has issued a Request for Additional Information (RAI) on this submittal, and this report provides the answers for RAIs 1 and 2.

1.0 INTRODUCTION AND SUMMARY

Framatome document ANP-3876, "Palisades Relief Request Number 5-8, Repair of Reactor Pressure Vessel Head Penetration, Inservice Inspection Program, Fifth Ten-Year Interval", was prepared by Framatome [1] for Entergy and subsequently submitted to the NRC by Entergy [2]. The NRC has issued a Request for Additional Information (RAI) on this submittal [3], and this report provides the answers for RAIs 1 and 2.

2.0 REQUESTS FOR ADDITIONAL INFORMATION AND RESPONSES

The NRC RAIs are reproduced from Reference [3] in Sections 2.1.1 and 2.2.1. The Framatome/Entergy responses are in Sections 2.1.2 and 2.2.2.

2.1 *RAI-1*

2.1.1 RAI-1

Provide following information associated with the flaw analysis of two limiting conditions of the repaired Alloy 600 nozzle in the reactor coolant pressure boundary;

a. The highest weld residual plus operating stress through-wall profile of the Alloy 600 nozzle adjacent to the Alloy 52 weld.

b. The highest weld residual plus operating stress through-wall profile of the roll-expanded region of the repaired Alloy 600 nozzle.

c. The estimated crack growth rate for the roll-expanded region of the repaired Alloy 600 nozzle.

2.1.2 Response to RAI-1

a. The highest weld residual plus operating stress through-wall profile of the Alloy 600 nozzle adjacent to the Alloy 52 Inside Diameter Temper Bead (IDTB) weld repair is shown in Figure 1.

b. The highest weld residual plus operating stress through-wall profile of the roll-expanded region of the repaired Alloy 600 nozzle is shown in Figure 2. Note that the maximum hoop stresses in the roll-expanded region occurs in the roll transition.

c. Crack growth rates for the repaired Alloy 600 nozzles are calculated per [ ] of MRP-420, Revision 1 [4]. These crack growth rates are non-linear, stress intensity factor dependent crack growth rates, and therefore cannot be reported as a constant value. Given this, the predicted life of the Alloy 600 nozzles in the roll-expanded region obtained through application of [ ] is [ ] EFPY. [

] This predicted life is determined using the same methodology and acceptance criteria used in determining the predicted life obtained for the repaired Alloy 600 nozzles just above the IDTB weld (i.e., the bounding location) which is 1.82 EFPY. Therefore, the growth rate is a factor of nearly [ ] times lower at the roll-expanded region relative to the bounding location adjacent to the Alloy 52 weld repair. The potential effects of cold work in the roll expansion region were also considered. It was determined that the cold work imparted by roll expansion is approximately [ ]. As noted in MRP-420, Revision 1 [4], the equation used to calculate the crack growth [

].

2.2 *RAI-2*

2.2.1 RAI-2

Provide the hydrogen concentration expected during the next cycle of operation at Palisades in the upper head region next to the repaired remaining Alloy 600 nozzle.

2.2.2 Response to RAI-2

The below response to this RAI was provided by Entergy in Reference [5].

Based on plant operating experience, Palisades expects the repaired remaining Alloy 600 reactor vessel upper head penetration nozzles to be exposed to a hydrogen concentration in the range of 34 – 44 cc/kg.

The primary coolant system hydrogen concentration range is controlled by Palisades' Chemistry Operating Procedure COP-1 Rev. 100, "Primary Coolant System Chemistry." Attachment 8, "PCS Chemistry Limits Mode 1 (Reactor Power > 5%)," of COP-1, limits the normal value of hydrogen concentration during Mode 1 operation to 30 – 45 cc/kg.

3.0 REFERENCES

1. Framatome Document ANP-3876 Revision 001, "Palisades Relief Request Number 5-8, Repair of Reactor Pressure Vessel Head Penetration, Inservice Inspection Program, Fifth Ten-Year Interval"
2. Entergy Nuclear Operations letter dated September 23, 2020 Inc., Relief Request RR 5-8, a proposed alternative to certain requirements of American Society of Mechanical Engineers Code for repair of reactor pressure vessel (RPV) head penetrations for Palisades Nuclear Plant (ADAMS Accession No. ML20267A386)
3. Request for Additional Information, Proposed Alternative to ASME Section XI Code Requirements, Reactor Pressure Vessel Head Penetration Repairs, Entergy Nuclear Operations, Inc., Palisades Nuclear Plant, Docket Nos. 50-255, dated September 26, 2020. EPID: L-2020-LLR-0128
4. Materials Reliability Program Report MRP-420, Revision 1, "Crack Growth Rates for Evaluating PWSCC of Alloy 600 Materials and Alloy 82, 182, and 132 Welds", EPRI, Palo Alto, California
5. Entergy Nuclear Operations Design Input Record DIR-EC87981-02, Response to RAI #2

Figure 1
Weld Residual Plus Operating Stress Through-wall Profile of the Alloy 600 Nozzle Adjacent to the Alloy 52 Weld

Figure 2
Weld Residual Plus Operating Stress Through-wall Profile of the Roll-expanded Region of the Repaired Alloy 600 Nozzle