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Site:	Dungeness B		
Title:	Agreement to the modification described in Safety Case NP/SC 7749 to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B (Excluding R21 SHO Headers B3 and B8)		
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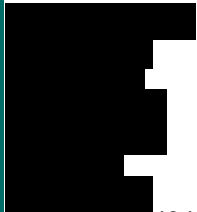
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Assessment of the optimisation of inspection requirements on superheater outlet and reheater inlet steam side header welds

Agreement to the modification described in Safety Case NP/SC 7749 to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B (Excluding R21 SHO Headers B3 and B8)

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EXECUTIVE SUMMARY

Title

Agreement to the modification described in Safety Case NP/SC 7749 to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B (Excluding R21 SHO Headers B3 and B8)

Permission Requested

EDF Energy Nuclear Generation Limited (NGL), the operator and Licensee of Dungeness B, has requested Agreement from the Office for Nuclear Regulation (ONR) under its Licence Condition 22 arrangements to modify inspections on the steam-side welds in each of Reactor 21 and 22's steam superheater outlet and reheat inlet headers.

Licence Condition 22 (1) requires the licensee to make and implement adequate arrangements to control any modification (or experiment) carried out on any part of the existing plant or processes which may affect safety. This permission is being performed under a derived powers Agreement.

Background

EDF NGL routinely performs surface and volumetric inspections of their superheater outlet and reheater inlet header steam side welds to provide a forewarning of failure as a requirement under its safety case to speculatively inspect for unexpected degradation. NGL initiated these inspections after the discovery during a routine task of a defect in one particular weld (known as weld "A") in 1999. NGL concluded this was due to rogue weld material and only one other weld A was found to be defective.

Since then, NGL has not detected any other significant defects in any of these steam side welds across the range of applicable headers.

NGL's key argument is that in order to gain access to inspect these welds internally, another nuclear safety significant weld must be cut and re-welded which is a potential detriment to nuclear safety. NGL also claims that it is unlikely that there are any present active degradation mechanisms and this regime is aimed at inspecting for unexpected degradation. The speculative inspection regime is set through the safety case guidelines and NGL proposes that it has reached a point, where the effort exhausted to inspect these welds internally is no longer proportionate to the benefit gained from the speculative inspection of these components. NGL have stated that the modification to the inspections is ALARP.

The purpose of the ONR assessment is to ensure that these claims are adequately supported by robust arguments and evidence.

Assessment and inspection work carried out by ONR in consideration of this request

This safety case's claims, arguments and evidence are structural integrity based so an ONR structural integrity specialist undertook the assessment of the case.

It was agreed with the ONR Operating Reactors sub-Division Head of Assessment, that this case would only require structural integrity assessment and therefore there was no involvement from other disciplines within ONR.

Matters arising from ONR's work

The case contains a number of outstanding commitments so ONR has raised a Regulatory Issue 5369 to monitor NGL's progress with these.

ONR also challenged NGL on the detail provided within its alternative inspection optioneering report and NGL have committed to provide a more detailed study of the most feasible options and ONR has raised a Regulatory Issue 5419 to monitor this commitment.

Conclusions

ONR's assessment report concluded that although there are several deficiencies within the safety case, the licensee identified these and has put actions and commitments in place for them to be resolved. ONR has raised Regulatory Issues to monitor NGL's progress on the most important commitments in its case.

It is ONR's judgement that NGL has provided sufficient evidence to support its view that the superheater outlet and reheater inlet headers are not subject to an active degradation mechanism and the material defect tolerance is high, with defect growth rate for any potential defects below the detectable defect size expected to be very low. This has been confirmed by the inspections performed since the header recovery programme in 1999.

ONR considers NGL's judgement that there is also a nuclear safety benefit by no longer performing these inspections, by not cutting a similar highest reliability weld to internally inspect the other welds is reasonable.

ONR is broadly satisfied with the claims, arguments and evidence laid down within the Licensee's safety case and is satisfied that the reduction of internal inspection is reasonable considering the strength of the other parts of the structural integrity case and the argument that the cutting and remaking of another highest reliability weld is a significant challenge to these components from a nuclear safety perspective.

Recommendation

It was recommended that a Licence Instrument was issued for Agreement to EDF Energy Nuclear Generation Limited removing the requirement to carry out the surface and volumetric inspections of Weld A on both the superheater outlet and reheat inlet headers on R21 and R22 at Dungeness B.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
DNB	Dungeness B
HOW2	(Office for Nuclear Regulation) Business Management System
IoF	Incredibility of Failure
IoGF	Incredibility of Guillotine Failure
NGL	EDF Energy Nuclear Generation Limited
ONR	Office for Nuclear Regulation
RHI	Reheater Inlet Header
SHO	Superheater Outlet Header

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1 PERMISSION REQUESTED

1. The Licensee requested (Ref. 1) the Office for Nuclear Regulation's (ONR) 'Agreement' under Licence Condition 22 (1) for the modification described in safety case NP/SC 7749 to optimise the inspection requirements of welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B (Excluding R21 SHO Headers B3 and B8) (Ref.2).

2 BACKGROUND

2. Dungeness B has two advanced gas reactors, designated Reactor 21 and Reactor 22. Each reactor has eight superheater outlet (SHO) header penetrations (Figure 1), which provide superheated steam from the boilers to the turbine. They are large welded cylindrical stainless steel vessels (Figure 2). In 1999, routine inspections undertaken by the licensee, EDF Energy Nuclear Generation Limited (NGL), identified a fully circumferential crack in a weld (designated Weld 'A' on Figure 2) on the inside surface of SHO header penetration labelled "B3" (Figure 1) on Reactor 21.
3. NGL attributed the cause of the deterioration to the use of an incorrect weld metal during manufacture. It undertook an extensive inspection and testing programme on welds in all similar components that it considered to be at risk from this form of deterioration. This programme identified one additional weld (Figure 1, B8) in another SHO that had suffered from cracking. NGL subsequently repaired both welds.
4. In parallel with the inspection work, NGL identified a shortfall in its classification of the SHO welds. It increased the classification of weld "A" to the highest category, Incredibility of Failure (IoF), where it deemed that the consequences of failure are unacceptable and protection against the consequences of failure cannot reasonably be provided. Included in its revised safety case was the requirement to undertake inspections (internal and external surface and volumetric non-destructive examination) of the SHO and reheater inlet header (RHI) welds on a 12 year frequency. This equated to 32 headers across the two reactors. The internal inspections required the end of the headers to be cut off in order to gain access to inside surfaces. The cut was through weld 3 in figure 2, which is a high nuclear safety significant weld. The weld was remade and inspected on completion of the header internal inspections.
5. NGL is now proposing to modify the inspection scopes for 30 out of the 32 SHO and RHI welds to remove the need to cut off the header end (Ref. 2). This is the modification for which NGL is requesting ONR Agreement. NGL is assessing the two repaired headers separately because of an error identified in the defect tolerance calculations on these specific repairs. Hence, ONR is not considering agreement to changes in inspection scope for R21 SHO Headers B3 and B8 at this time.
6. The proposal under consideration would remove internal volumetric inspections of the header welds. It would retain external inspection of welds 2, 3 and 5 and a proportion of weld E (as a portion of the weld is encased in the concrete and inaccessible externally). Weld E is an additional axial seam weld only featured on the RHI headers (see Figure 3). Also retained is internal surface inspection of all welds using remote visual inspection technology. NGL accept that this will not have the same capability as identified in the safety case but judge that the technique will detect any significant defects.
7. One weld in particular will have the greatest reduction in inspection and that is weld "A", which no longer needs be inspected volumetrically. NGL consider that it will retain forewarning of failure of all welds apart from weld A and the un-inspected areas of weld E through an external volumetric inspection. Under this proposal, NGL will modify

the weld inspection scope to internal remote visual inspection, which it considers is adequate.

8. NGL considers that the modification is safe and justified because:
 - Inspections undertaken since 1999 have not detected any significant defects.
 - The headers are not at risk from any reasonably foreseeable deterioration mechanisms and the extant inspection scope was produced to detect unexpected degradation.
 - There is a potential deterrent to nuclear safety associated with cutting and then repairing nuclear safety significant welds.
 - It has reviewed the SHO and RHI defect tolerance assessments and judges that the modified inspection scopes provide adequate margin
 - The revised remote visual internal inspection capable of detecting significant defects will be performed on all headers on a three year frequency.
9. NGL considers that it has reached a point where the effort exhausted to inspect the SHO and RHI welds internally is no longer proportionate to the benefit gained from the speculative inspection of these components. It considers, therefore, that the proposed modification to the inspection scope is ALARP.
10. NGL has categorised the modification at Category 1, which is its highest nuclear safety category. The proposal has completed NGL's due process, including consideration by its Nuclear Safety Committee (Ref. 3) and Internal Regulator (Ref. 4).

3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST

11. As explained above, this case is based on structural integrity claims, arguments and evidence. I am a structural integrity specialist inspector and I have assessed this case from NGL (Ref. 5). I obtained agreement from the ONR Operating Reactors sub-Division Head of Assessment, that this case would only require structural integrity assessment and therefore there was no involvement from other disciplines.
12. As part of my intervention plan, I attended several level 4 technical meetings with the licensee to discuss the case. At the meetings I obtained resolution for my challenges and commitments to address them, including resolving questions and comments I made during my assessment. Other ONR inspectors attended some of these meetings including the site inspector for Dungeness B.
13. I also undertook a site inspection during the assessment and this is reported within my assessment. I used the findings of the inspection to inform my assessment judgements. I viewed the area around the headers whilst considering the associated risks with cutting the weld and performing the inspection and in my opinion, they are significant enough to be supporting evidence within the case.

4 MATTERS ARISING FROM ONR'S WORK

14. My assessment report (Ref. 5) concluded that although there are several deficiencies within the safety case, the licensee identified these and has put actions and commitments in place for them to be resolved. I have raised Regulatory Issues (5369 and 5419) to monitor NGL's progress on the most important commitments in its case. I do not consider that these should prevent issue of ONR's agreement.
15. During the assessment, I challenged NGL (Ref. 6) on its decision not to pursue alternative inspection techniques, commenting that their review of these techniques was limited, in my opinion. NGL has now committed to re-consider these techniques in

more detail focusing on the techniques which are likely to be most feasible. I am satisfied that this addresses a shortfall in the case I identified and I have raised regulatory issue 5419 to monitor this work.

16. I judge that another shortfall of the case is the newly identified transients and the error in limiting defect sizes calculations for B3 and B8 (not part of this case). These are important and may be significant but in my opinion, NGL is taking reasonable measures to deal with these. I judge NGL has provided suitable arguments for why it is safe to continue to operate, including a commitment to continue to assess the implications of these transients. I have raised an ONR Regulatory Issue 5369 to monitor this situation through to a suitable conclusion.

5 CONCLUSIONS

17. My assessment report concluded that although there are several deficiencies within the safety case, the licensee identified these and has put actions and commitments in place for them to be resolved. I have raised Regulatory Issues (5369 and 5419) to monitor NGL's progress on the most important commitments in its case.
18. It is my judgement that NGL has provided sufficient evidence to support its view that the superheater outlet and reheater inlet headers are not subject to an active degradation mechanism and the material defect tolerance is high, with defect growth rate for any potential defects below the detectable defect size expected to be very low. This has been confirmed by the inspections performed since the header recovery programme in 1999.
19. I consider NGL's judgement that there is also a nuclear safety benefit by no longer performing these inspections, by not cutting a similar weld to internally inspect the other welds is reasonable.
20. I am broadly satisfied with the claims, arguments and evidence laid down within the Licensee's safety case. I am satisfied that the reduction of internal inspection is reasonable considering the strength of the other parts of the structural integrity case and the argument that the cutting and remaking weld 3 is a significant challenge to these components from a nuclear safety perspective.

6 RECOMMENDATIONS

21. The project assessment report recommends that:
- ONR provides a licence instrument with agreement to this activity.
 - The Superintending Inspector for Operating Reactors should sign this PAR.
 - The Superintending Inspector for Operating Reactors should sign Licence Instrument 553 to provide ONR's Agreement to this modification.

REFERENCES

1. NGL letter – Dungeness B – NSLDNB50938 R – Request for Agreement or Acknowledgement under arrangements made under Licence Condition LC22(1) for NP/SC 7749: Dungeness B Power Station: Safety Case to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B - 2017/146633
2. NGL – Dungeness B –NP/SC 7749 – Safety Case to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B (Excluding R21 SHO Headers B3 and B8) EC No. 357791 Revision 000 Proposal Version No. 06- 2017/146656
3. NGL – Dungeness B — Extract taken from NSC minutes (January 19th 2017) – 2017/146648
4. NGL – Dungeness B –INSA Approval Statement for NP/SC 7749 – Safety Case to Optimise the Inspection Requirements of Welds within the Superheater Outlet Headers and Reheat Inlet Headers on Reactor 21 and Reactor 22 at Dungeness B EC No. 357791 Revision 000 Proposal Version No. 06 – 2017/146646
5. ONR-OFD-AR-17-005 Assessment of NPSC 7749 - relaxation of inspection requirements on superheater outlet and reheat inlet steam side welds – TRIM 2017/170782
6. ONR-OFD-CR-17- 038- Level 4 meeting with DNB Safety case team to discuss header safety case questions and responses - 19th April 2017

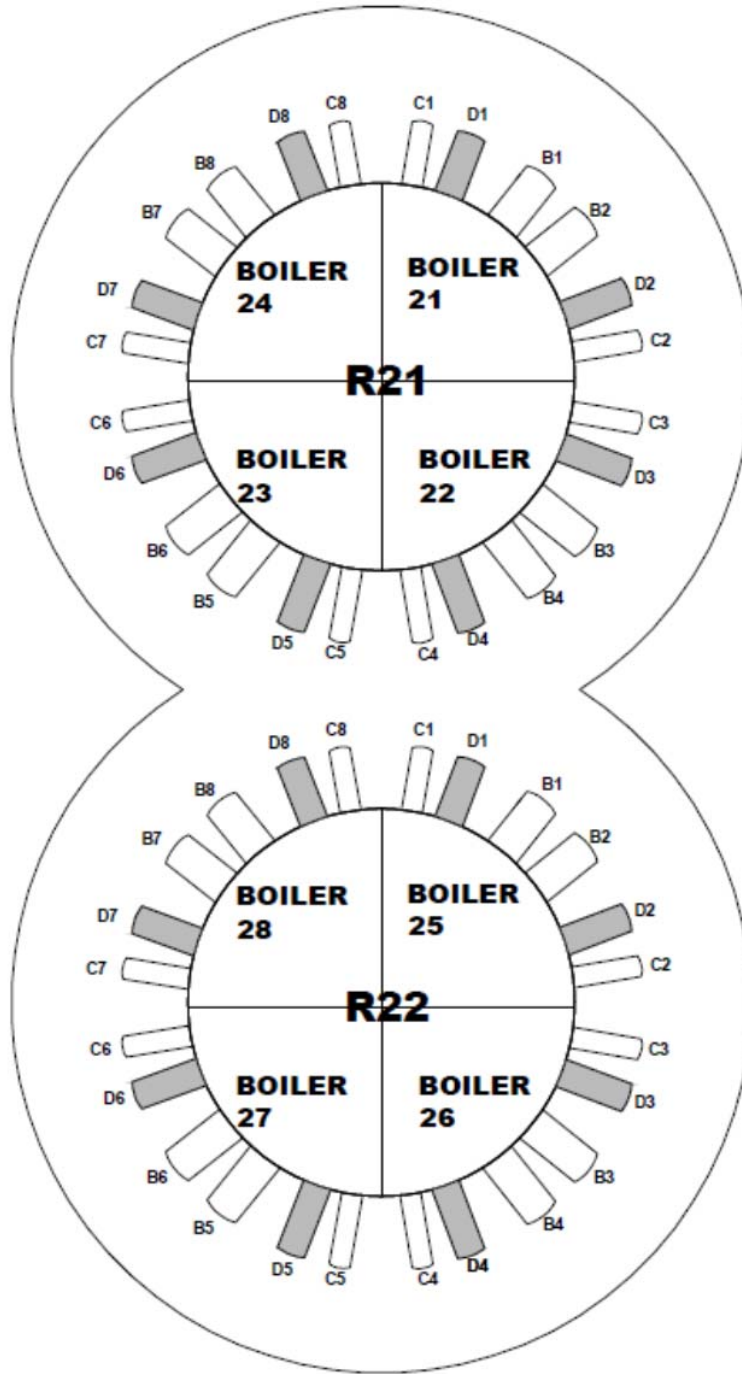


Figure 1 - Position of the headers

Location of the Steam Side Welds in the Superheater Outlet (Main Steam) Header

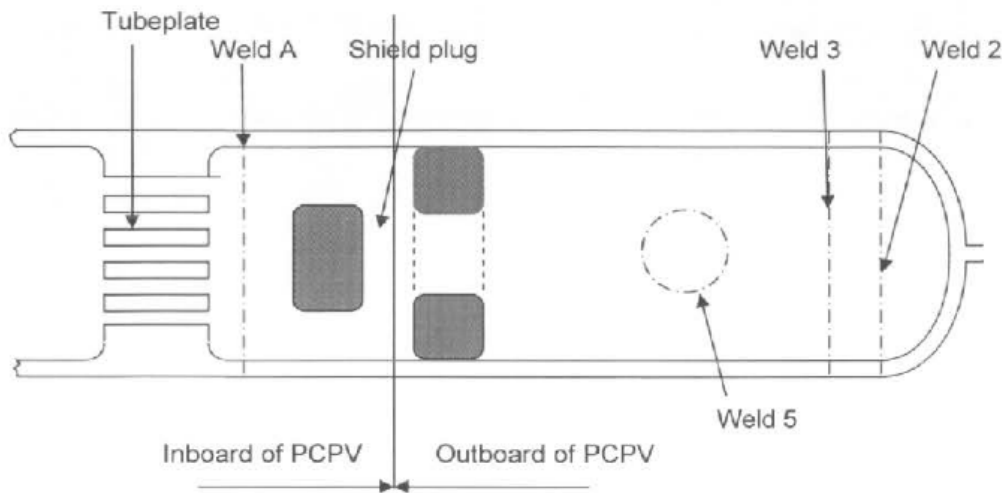


Figure 2 - Superheater outlet header

Location of the Steam Side Welds in the Reheater Inlet (Cold Reheat) Header

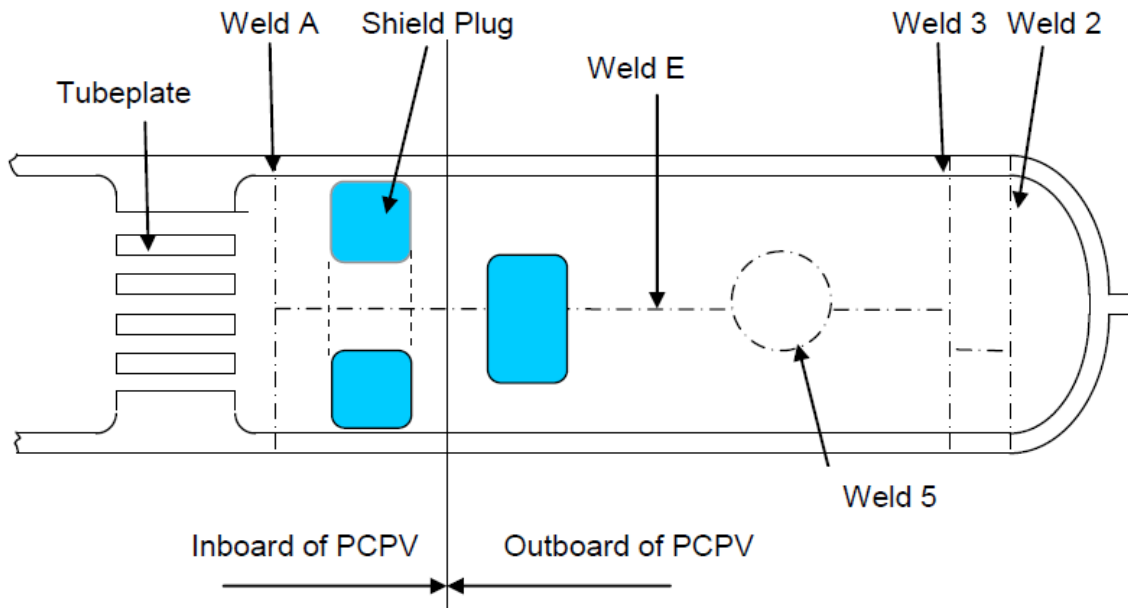


Figure 3 - Reheater inlet header