

NPP KRŠKO
TO.VZISI

TECHNICAL SPECIFICATION

For
NPP-Krško Steam Generators
Eddy Current Inspection in Outage 2027

No. TS ISI-10/26

Safety Related

(Rev. 0)

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1.0 ACTIVITY

Technical Specification defines requirements related to performance and scope of the Steam Generator (SG) Eddy Current (ET) inspection during refueling outage 2027, under terms and conditions specified in this document. Potential supplier (bidder) shall submit proposal for service mentioned above.

2.0 BASIC SCOPE

Scope of services, inspection frequencies and tube sampling are given in procedure: ADP-1.4.322 Inservice Inspection of Steam Generator Tubes, Rev.2, par. 5.2 (Ref. 5.07). In the event of C-2 and C-3 results, scope of inspection shall be increased in accordance with the requirements from SR 3.4.5.2 and SR 3.4.5.3 (Ref. 5.06). Scope is also based on previous ECT inspections and results from 2024 and SG Assessment Study for SG ECT in the outage '27 (status: in progress). All conclusions and additional requirements from SG Assessments Final Report shall be considered and implementation in ECT SG, if necessary.

- 1) Scope of bobbin probe inspection, when Steam Generators exhibits C-1 condition, is 50 % of the tubes in each SG. Inspection scope contains tubes not inspected in previous ECT outage 2024; ref. 5.18.
- 2) Bobbin inspection of all DNT indications on tubes within the scope of 50% defined in 1). and additional tubes with the previous reported DNT indications; ref. 5.18.
- 3) MRPC, + point probe, x-probe or Array probe inspection of (up to) 160 indications or positions per SG: - 20 biggest DNT indications
 - Low row U-bends (Row 1: 59 tubes, Row 2: 65 tubes).
 - MBM, confirmation of indication, ...
- 4) Install software for viewing/analyzing of collected ET data on one NEK's PC.
- 5) Plug Position verification & VT2 / VT1 inspection of 36 plugged positions with documented VT-video records. Each plug position shall be video-recorded and evaluated for Boron residuals – if any. This requirement is based on Event Analysis Report EAR PAR 08-065. Eventual traces of foreign object – damage like scratches, dents, cracks on the Tube Sheet cladding surface shall also be reported if detected during normal ET acquisition process as required by 5.03 (ASME XI, Edition 2017) and due to requirements from NEK TD-2S, Program nadzora Inconela 600/82/182.
- 6) Radiation protection doors installation during SG platform ECT equipment Set-up.
- 7) Plugging of SG tubes – if necessary, based on the ET inspection results. Contractor shall ensure that the required plugging equipment and plugs (sufficient for up to 5 tubes) are available at the NEK site during ET inspection. Plugging activities, if performed, shall be carried out under an annex to this contract. Contractor shall specify price for plugging services in the bid as an option.

Supplier shall provide all necessary personnel, equipment and consumables required for performance of Scope described above.

3.0 SAFETY CLASSIFICATION

ECT Inspection of Steam Generators is classified as Safety Related (SR) activity.

4.0 TYPE OF SERVICE

SG ET Inspection is considered as type of service with fixed price for defined activity and scope according to supplier's procedures which will be reviewed and accepted by NEK and includes supplier's QA/QC.

5.0 APPLICABLE CODES, STANDARDS AND PROCEDURES

- 5.01 TD-OH Program uparjalnikov; Rev.6
- 5.02 ASME B&PV Code Section V, Edition 2017
- 5.03 ASME B&PV Code Section XI, Edition 2017
- 5.04 ANSI/ASNT CP-189 (2006)
- 5.05 EPRI TR 3002007572; SG Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines; Rev. 8
- 5.06 NEK Technical Specification SR 3.4.5.0
- 5.07 ADP-1.4.322 Inservice Inspection of Steam Generator Tubes; Rev.2
- 5.08 ISI-4.301 General Procedure for Eddy Current Inspection of SG tubes; Rev 4
- 5.09 EPRI TR 1014981; Steam Generator Foreign Object Handbook
- 5.10 PERFORMANCE DEMONSTRATION DATABASE: ETSS # 27904.1 Appendix A Technique Specification Sheet (Rev. 0 June 2007)
- 5.11 NRC INFORMATION NOTICE 2004-10, Loose Parts in Steam Generators
- 5.12 Generic Letter 97-06: DEGRADATION OF STEAM GENERATOR INTERNALS
- 5.13 EPRI - TR 1020989; Foreign Object Prioritization Strategy for Triangular Pitch SG
- 5.14 NEER-G/2008/en/0100 Rev. A: Operational and Maintenance Manual of Replacement SG Krško Model SG 72W/D4-2.
- 5.15 NEK's CAP 2018-1670; Technical Specification for procurement of ECT SG shall require Radiation protection doors.
- 5.16 NEK SG Operational Assessment based on ECT 2018 results
- 5.17 Reevaluation of SG ET data from 2024, 2021, 2018, 2015, 2009 & 2003 at DNT locations detected in outage 2024 during ET inspection.
- 5.18 IFR-SG-01/24-E, Rev.1 ET inspection of SG tubes in NPP Krsko 2024
- 5.19 SG Assessment as mandatory preparation for SG ECT in the outage '27.
- 5.20 ADP-1.1.128 General FME requirements for NPP Krško (slo); Rev. 5

6.0 IDENTIFICATION OF EQUIPMENT AND COMPONENTS

NPP – Krško Replacement Steam Generators model 72W-D4/2 with I - 690 TT ¾" tubes, triangular pitch and grid supports design. MECL: RCPCSGN1, RCPCSGN2

7.0 TECHNICAL REQUIREMENTS

ECT Steam Generators inspection (data acquisition, data analysis, Computerized-Automated Data Screening, inspection planning and data management) as well as overall System Performance for EC Steam Generator examination including technique, analysis and human performance, process controls and field analysis feedback, shall be performed in accordance with requirements of EPRI TR-3002007572 ref. 5.05.

7.1 ECT TECHNIQUES, INSPECTION PLANS & PROBES

Bobbin probe inspection:

- 1) R1 through R10, C1 through C131 HL straight length using 0.630" diameter bobbin probe from 11-HL to TE-HL;
- 2) R1 through R10, C1 through C131 CL straight length and U-bend (except Row 1 & 2 U-bends) using 0.610" and/or 0.590" bobbin probe from 11-HL to TE-CL;
- 3) R11 through R107, C1 through C131 full length test using 0.630" or 0.610" diameter bobbin probe from TE-CL to TE-HL.
- 4) "3-frequency bobbin coil mix" ET technique shall be implemented based on the reference 5.11.
- 5) Tubes with DNT indications from 2024 inspection partial length using bobbin probe from Tube end to 1st support (Ref. 5.17).

MRPC, + point probe, X-probe or array probe inspection:

- 6) Row 1 & 2 from C1 to C131 U-bend (59+65 tubes) using 1 coil MRPC or + point probe from 11-CL to 11-HL.
- 7) Confirmation of bobbin probe indications by 3 coil MRPC or + point probe
- 8) MRPC (up to 160 locations per SG):
 - Hot leg dents/dings with bobbin voltages ≥ 2.00 volts; ~40 dents/dings.
 - PLP (Possible Loose Part) locations identified during the previous inspection. cca 20 TTS locations (Att.3: PLP locations to be inspected).
 - 20% MBM which changed characteristics since the PSI; < 10 MBMs expected.

7.2 ECT EQUIPMENT, SYSTEM AND SOFTWARE

Equipment (manipulators with dual and/or multiple probe pusher system), ET - Instrument, System and appropriate software for data acquisition, analysis & management shall be qualified as required by SGMP PWR Steam Generator Examination Guidelines Ref. 5.05.

8.0 QUALIFICATION REQUIREMENTS

Inspection personnel shall be trained, qualified, and certified in accordance with:

- 1) ASME B&PV Code Section XI, Edition 2017

- 2) ASME B&PV Code Section V, Edition 2017
- 3) ANSI/ASNT CP-189, ASNT Standard for Qualification and Certification of Non-Destructive Testing Personnel, 2006 Edition
- 4) EPRI TR 3002007572; SG Management Program: Pressurized Water Reactor Steam Generator Examination Guidelines; Rev. 8.
- 5) EPRI - Steam Generator Eddy Current Data Analysis – Performance Demonstration Review Material (PDD), Research Project S-530, (including latest updates).

Data acquisition personnel shall be qualified & certified for at least level I or II. Data analysis personnel shall be qualified & certified as Level II / QDA. Leading analyst (s) performing data resolution shall have ASNT NDT Level III certificate (Ref. 5.04) and valid QDA certificate. Supplier shall submit Company Written Practice (Procedure for Qualification & Certification of NDT Personnel) as required by Ref. 5.04. In Company – Corporate ET Level III shall have ASNT NDT Level III certificate. If training, qualification & certification of NDT personnel has been organized and performed in-house Bidders Company (without Outside Organization), then all activities shall be administrated by ASNT NDT ET Level III also.

Supplier's ET personnel shall pass Site Specific written and practical ET exam (as per ref. 5.05) on NPP Krško site administrated by independent IQDA contracted by NEK before start of inspection activities (see section 12.0). TO.VZISI (NEK) will perform technical and regulations evaluation of potential suppliers bidding - proposals based on the requirements prescribed in paragraph 5.0, 7.0, 8.0 and 12.0. (Remark: TO.VZISI: Leading ISI Engineer / NEK Principal Level III).

9.0 DETAIL SCHEDULE

Steam Generator Eddy Current inspection activities shall be performed on around o'clock basis, 24 hours / per day. Supplier shall propose a detailed schedule of the inspection, which shall not exceed 100 hours for inspection of both Steam Generators working in parallel. 100 hours period refers to SG platform equipment set-up, inspection and completed tear down (i.e. critical path of EC data acquisition activities). EC Inspection is scheduled as follows: System windows RC62-SG#1 and RC64-SG#2; From 15th of April 11:00 to 19th of April 15:00 for both SG#1 & SG#2, see Att. 1: Outage Plan for ECT SG 2027. Eventual changes of Outage plan are possible and will be handed over to supplier.

10.0 SUPPLIER RESPONSIBILITIES

Potential Contractor (Supplier) shall provide bidding - technical proposal including the following documents:

1. Site Inspection Organization Chart / scheme with names and responsibilities will be evaluated as technical criterion of proposal. For ECT acquisition equipment & crew NPP Krško recommends one of the following options:

Option a):

- 5 data acquisition manipulators on site
- to work with 4 set of equipment in parallel
- 5 manipulator drivers per 12 hours shift
- 6 platform workers per 12 hours shift or ...

- Option b):
- 4 data acquisition manipulators on site
 - to work with 3 set of equipment in parallel
 - 4 manipulator drivers per shift
 - 5 platform workers per 12 hours shift
2. Trained, qualified and certified inspection personnel as required in paragraph 8.0 with a List of valid ET certificates in accordance with requirements from paragraphs 5.0 and 8.0.
 3. All Inspection Plans in accordance with 2.0 SCOPE. Each Inspection Plan with numbered LIST of tubes containing Row Col shall be handed over in digital format (Excel or similar) and associated TTS Lay-out print-out. This shall be part of the technical proposal. This is necessary to be sure that potential supplier understands Scope of inspection.
 4. Suppliers Company Written Practice as required in paragraph 8.0 QUALIFICATION REQUIREMENTS.
 5. Applicable procedures i.e. for equipment installation, data collection, data analysis etc. All working procedures shall be prepared in accordance with applicable regulations (Sections 5.0, 7.0, 8.0 & 12.0) for the review.
 6. Supplier's ET acquisition procedures shall address FME (Foreign Material Exclusion) responsibilities of acquisition personnel Ref.5.19 and (Att. 2).
 7. Site Inspection Organization Chart including at least 1 individual per shift with NEK Work-Leader status.
 8. Supplier's Company Reference list of ET data acquisition & analysis on vertical PWR Steam Generators same or similar to model 72W-D4/2 having I-690 TT ¾" tubing, triangular pitch, lattice bars support, baffle plate and Siemens design tube bend supports (AVB), see Att.2. Only Company References from the NPP's with data acquisition & analysis - together in the time interval 2015-2026 will be considered
 9. Supplier shall specify electric power and compressed air needs for its inspection system
 10. Plugging equipment shall be capable of performing the plugging of NEK SG tubes. Plugs shall be made from I-690 alloy. Contractor shall submit in the bid as an annex plugging procedure, design of the plug and a list of plugging references since 2015.

Other supplier responsibilities / documents to be provided **after awarding** a contract:

1. Program Plan for preparation, training & inspection activities to be carried out.
2. All applicable ETSS (Examination Technique Specification Sheet) for ET techniques which will be used based on the paragraph 2.0 Scope
3. Performance of field activities in accordance with ALARA principles.
4. List of Calibrated equipment as specified by Section 7.0 and consumables required for performance of Eddy Current Steam Generator Inspection.
5. Completion of required scope within available time frame (Section 9.0)
6. Turnover of SG primary channel head, platform, and all working areas clean and in the same condition as at the start of activities
7. Two copies (master & copy) of ECT data
11. Reports of inspection performed (Daily, Preliminary and Final reports). All reports shall be handed over to NPP Krško representative for review and comments.
12. All ECT equipment shall be prepared for hand-carry (manual) transportation.
13. Containers for data acquisition, analysis, and management crew (for supplier's personnel)

14. Provide computer station for IQDA individual.

11.0 NEK RESPONSIBILITIES

NPP Krško shall provide the following:

1. All necessary applicable as-built drawings (Att. 1), technical details and previous ET reports of Replacement Steam Generators (for History management purpose) and ET data.
2. Latest revisions of applicable NPP-Krško ET and field service procedures
3. NPP Krško Eddy Current Data Analysis Guidelines document
4. Site specific field service training courses for supplier personnel (GET, HP, work leader exam, etc.)
5. Applicable ET calibration blocks
6. Clean SG mock-up for training purpose and on-site transportation & lifting
7. One office (2 tables & 6 chairs) outside the technological area.
8. Access to SG platform and primary channel head manways
9. Power supply, compressed air, and demineralized water
10. HP coverage and decontamination assistance of supplier's equipment
11. Support of mechanical and electrical shop if necessary
12. NPP Krško will designate Independent IQDA oversight (Ref. 5.05).
13. Site Specific written and practical ET exam on site will be administrated by an independent IQDA
14. ISI representative (ISI engineer) will take care of explanation, field application and necessary instruction to site specific requirements from applicable NPP-Krško procedures as referred to. Supplier's personnel are obliged to follow ISI representative instructions.

12.0 SPECIAL REQUIREMENTS

Data analysis shall be performed in accordance with organization plan from reference 5.05 SGMP PWR SG Examination Guidelines rev. 8; Figure 6-1, Typical Data Flow (page 6-12). Three-(3) frequency mixer-channel shall be integrated in applicable-bobbin ETSS to fulfill requirements from ref. **5.11 NRC INFORMATION NOTICE 2004-10, Loose Parts in Steam Generators** to assure detection of potential loose parts.

Applicable block diagram (yes/no) within analyses flow chart shall also be integrated into ETSS to provide detection of tube lattice grids support ET signal anomalies as required by **ref.: 5.12 Generic Letter 97-06: Degradation of Steam Generators Internals.**

Separate ETSS for DNT detection and evaluation shall be prepared using the same set-up as used in 2018 for trending purposes.

Site Specific written and practical Exam will be administrated by an independent IQDA individual contracted by NEK. Suppliers ET personnel will receive all necessary documents (NEK Specific Analyze Guidelines, applicable NEK ET procedures, acceptance criteria, ...) and ET data for training purpose on site. Scope of Written exam will include questions from documents mentioned above (SG design, degradation

mechanisms, NEK specific characteristics) and suppliers ET procedures. The practical exam will contain NEK ET data. Both exams will be conducted on the PC stations with software grading similar to QDA exam. Scope and criteria for written and practical Site-Specific exam is defined in ref. 5.05.

13.0 QA REQUIREMENTS

For Safety Related (SR) classification activities, the Contractor must have an established quality assurance system within their organization in accordance with the requirements of 10CFR50, Appendix B, *Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants*, and 10CFR21 *Reporting of Defects and Noncompliance*, and in compliance with the requirements of specification QS-610, Rev. 2, *Generic Quality Assurance Program Requirements*, which is attached to the purchase order.

The Contractor must submit, together with the offer, a valid Quality Assurance System Manual under which the work will be performed. The adequacy and effectiveness of the Contractor's quality assurance system must be verified and approved by NEK prior to contract award.

The work is carried out in accordance with the Contractor's quality assurance system and a previously agreed QC plan, technological and inspection procedures as defined in section 5.0 of this specification, as well as applicable legislation and standards related to the scope of work. The work is performed under the supervision of the responsible coordinator of the TO.VZISI discipline, the contractor's work supervisor, and the Contractor's QA/QC personnel. The Contractor assumes responsibility for meeting quality requirements, commercial-technical requirements, and schedule commitments for all of their potential subcontractors as well. The Contractor ensures that their subcontractors perform the work in accordance with the requirements of this specification.

Nonconformance and deviation reporting must be carried out in accordance with the requirements of 10CFR21.

Applicable regulations and standards:

- 10 CFR 50 Appendix B – Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants
- 10 CFR 21 – Reporting of Defects and Noncompliance
- ASME NQA-1-2008, Addenda 2009/2011 – Quality Assurance Requirements for Nuclear Facility Applications
- QS-610, Rev. 2 – Generic Quality Assurance Program Requirements
- QS-600, Rev. 1 – Quality Assurance Program Specification for Software

14.0 APPENDICES

Att. 1: Outage Plan for ECT SG 2027

Att. 2: FME Material accountability Log

Att. 3-1: PLP locations to be inspected on TTS SG#1 CL

Att. 3-2: PLP locations to be inspected on TTS SG#2 CL

Att. 1: Outage Plan for ECT SG 2027:

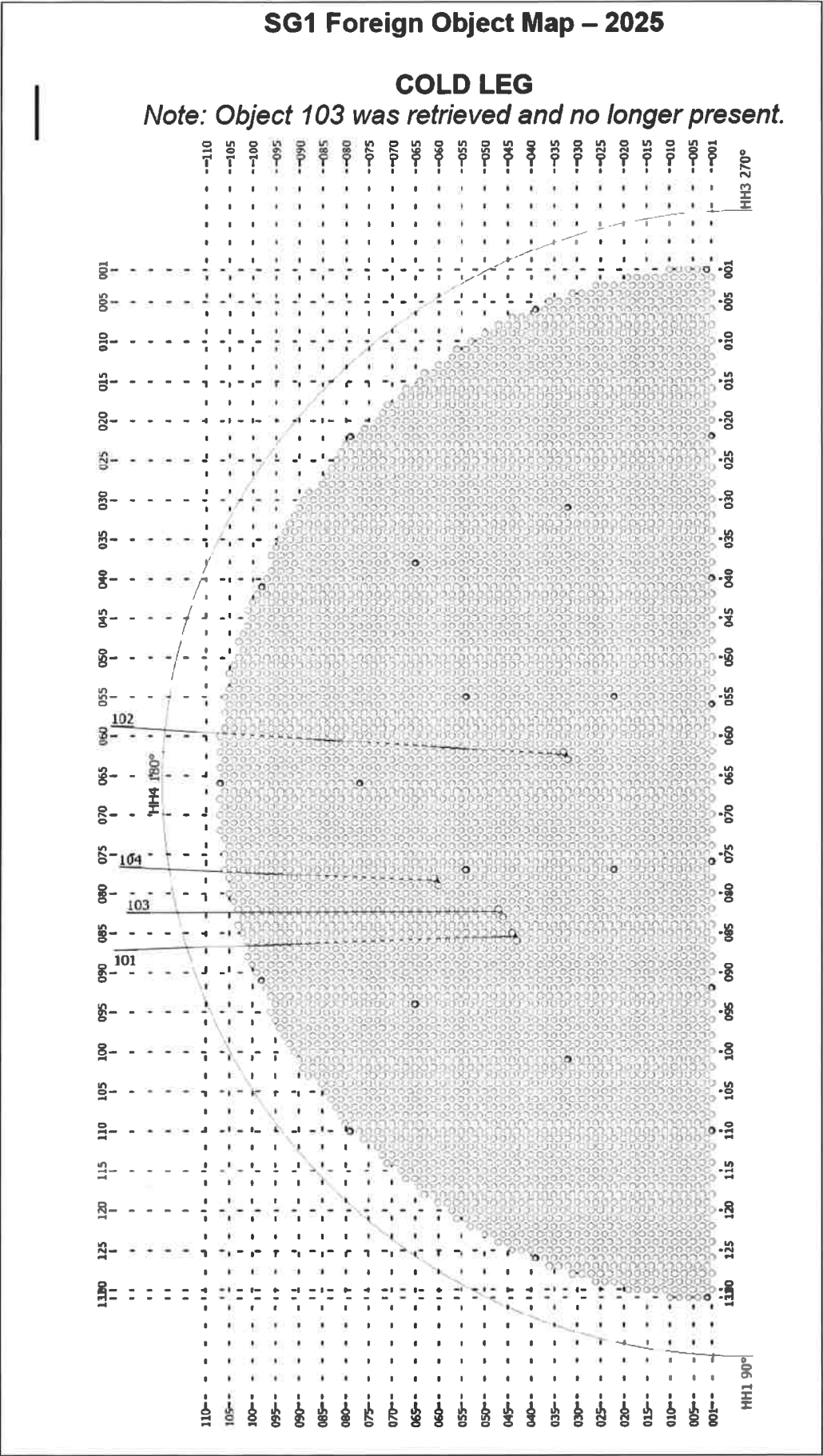
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Activity ID	Activity Type	Sistém / Oblasť	Activity Name	Description	Dvigslo	Avrtočvigali	Original Duration	Tehnolog	Start	Finish	Apr 12							
											Mon	Tue	Wed	Thr	Fri	Sat	Sun	Mon
Project: RE27 - projekt v izdelavi																		
OARG0300Y	Task Dependent	RC62	RC62 - ECT na SG1				100	VUČA JUNK ALEŠ	15-Apr-27 11:00	19-Apr-27 15:00								
OARG0400Y	Task Dependent	RC64	RC64 - ECT na SG2				100	VUČA JUNK ALEŠ	15-Apr-27 11:00	19-Apr-27 15:00								
											RC62 - ECT na SG1							
											RC64 - ECT na SG2							

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W.O. First line supervisor / FME supervisor

Date: _____

Signature: _____



Att. 3-2: PLP locations to be inspected on TTS SG#2 CL:

