

In the Matter of: Entergy Nuclear Operations, Inc.  
(Indian Point Nuclear Generating Units 2 and 3)

**ASLBP #:** 07-858-03-LR-BD01  
**Docket #:** 05000247 | 05000286  
**Exhibit #:** ENT000600-00-BD01  
**Admitted:** 1/15/2013  
**Rejected:**  
**Other:**

**Identified:** 12/10/2012  
**Withdrawn:**  
**Stricken:**



**ENGINEERING  
STANDARD**

EN-EP-S-002-MULTI      Rev. 1      Effective Date: 11/30/2012

Underground Piping and Tanks General Visual Inspection

Applicable Sites	Effective Date Exception	Applicable Sites	Effective Date Exception
IP-1 <input type="checkbox"/>		ANO-1 <input checked="" type="checkbox"/>	
IP-2 <input checked="" type="checkbox"/>		ANO-2 <input checked="" type="checkbox"/>	
IP-3 <input checked="" type="checkbox"/>		GGNS <input checked="" type="checkbox"/>	
JAF <input checked="" type="checkbox"/>		RBS <input checked="" type="checkbox"/>	
PLP <input checked="" type="checkbox"/>		WF3 <input checked="" type="checkbox"/>	
PNPS <input checked="" type="checkbox"/>		NP <input type="checkbox"/>	
VY <input checked="" type="checkbox"/>		<input type="checkbox"/>	

Safety Related: \_\_\_\_\_ Yes

EC No(s) N/A      X No

Prepared by: Joe Abisamra *[Signature]*      Date: 11-14-2012

Approved by: Steve Woods *[Signature]*      Date: 11/26/2012  
Engineering Standard Owner

Process Applicability Exclusion (EN-LI-100) / Programmatic Exclusion

All Sites:  Specific Sites: ANO  GGNS  IPEC  JAF  PLP  PNPS  RBS  VY  W3

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REQUIREMENTS AND REVISION SUMMARY

Revision No.	Date	Changes
0		Original Issue
1	11/01/2012	General updates to entire body of procedure, Added Attachment 7.1, Attachment 7.2 and Attachment 7.3.

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## 1.0 PURPOSE

- 1.1 This engineering standard is written to document the requirements to perform underground piping and tanks general visual inspection. The visual inspection is performed to assess the general condition of the piping/tank surfaces to detect evidence of degradation that may affect structural integrity or leak tightness. This inspection satisfies the requirements of EN-DC-343 and CEP-UPT-0100.
- 1.2 This engineering standard applies to personnel inspecting components identified per CEP-UPT-0100, Underground Piping and Tanks Inspection and Monitoring.

## 2.0 REFERENCES

- 2.1 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report"
- 2.2 NUREG/CR-6876, "Risk-Informed Assessment of Degraded Buried Piping Systems in Nuclear Power Plants", June 2005
- 2.3 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants"
- 2.4 10 CFR 50 Appendix B "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"
- 2.5 ANSI N18.7-1976, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants"
- 2.6 NUMARC 93-01 (NEI 93-01), "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants", April 2011
- 2.7 NEI 95-10 (1996), "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule", Rev. 6, June 2005
- 2.8 NEI 07-07, "Industry Ground Water Protection Initiative, Final Guidance Document, August 2007"
- 2.9 EPRI Report 1011829, "Condition Assessment of Large-Diameter Buried Piping, Phase 2: Vehicle Design and Construction", December 2005
- 2.10 INPO Engineering Program Guide, "Underground Piping Reliability Management", dated June 2006

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- 2.11 INPO Operating Experience Digest OED 2007-09, "External Degradation of Buried Piping", April 2007
- 2.12 EPRI-1021561, "Inspection Methodologies for Buried Pipes and Tanks", August 2010
- 2.13 CEP-NDE-0100, Administration and Control of NDE
- 2.14 ANSI N45.2.6, "Standard Guide for Establishing Procedures to Qualify and Certify Personnel Performing Coating and Lining Work Inspection in Nuclear Facilities"
- 2.15 API Standard 570, "In-Service Inspection, Rating, Repair, and Alteration, of Piping Systems", Third edition, November 2009
- 2.16 EPRI 1021175, "Recommendations for an Effective Program to Control the Degradation of Buried and Underground Piping and Tanks (1016456 Rev 1)", December 2010
- 2.17 CEP-UPT-0100, "Underground Piping and Tanks Inspection and Monitoring"
- 2.18 EN-DC-167, "Classification of Structures, Systems, and Components"
- 2.19 EN-DC-343, "Underground Piping and Tanks Inspection and Monitoring Program"
- 2.20 EN-FAP-LR-025, "Selective Leaching Inspection"
- 2.21 ANI Nuclear Liability Insurance Guideline 07-01, "Potential for Unmonitored and Unplanned Off-Site Releases of Radioactive Material", March 2007
- 2.22 NEI 09-14, Guideline for the Management of Underground Piping and Tank Integrity", Rev 1, December 2010
- 2.23 EPRI/NEI "Industry Guidance for the Development of Inspection Plans for Buried Piping", Final Draft Approved for Use, April 2011
- 2.24 EN-DC-340, "Microbiologically Influenced Corrosion (MIC) Monitoring Program"

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### 3.0 DEFINITIONS

- 3.1 Baseline Inspection – The inspection of a new or replaced pipe or component that has not previously been involved in plant operations.
- 3.2 Buried Piping and Tanks - Piping and tanks that are below grade and in direct contact with the soil or concrete (e.g. a wall penetration or embedded in concrete).
- 3.3 Concrete Piping - Piping that is manufactured from concrete or cementitious material with or without metallic reinforcement. Concrete piping is generally used for large diameter lines such as the water intake piping from sources of cooling water (e.g., lakes, rivers, and reservoirs).
- 3.4 Corrosion - The chemical or electrochemical reaction between a material, usually a metal, and its environment that produces a deterioration of the material and its properties. A common example is the oxidation of an iron-based alloy exposed to water (rusting).
- 3.5 Crevice Corrosion - Localized corrosion that may occur in areas of stagnant solutions existing in crevices, joints, and contacts between metals or between metals and non-metals.
- 3.6 Erosion - Deterioration of materials by the abrasive action of moving fluids or gases, usually accelerated by the presence of solid particles or gases in suspension. When corrosion occurs simultaneously, the term Erosion/Corrosion is often used.
- 3.7 General Corrosion - This type of corrosion attacks the entire un-protected surface in a uniform manner. Of all types of corrosion, this is the least damaging and easiest to determine or quantify the corrosion rate. (Also referred to as uniform corrosion).
- 3.8 General Visual Inspection - The inspection of a component via direct observation by Inspectors or via the use of remote visual inspection devices if not accessible.
- 3.9 Holidays - Discontinuities in coatings, (e.g., pinholes, voids)
- 3.10 Initial Inspection - The inspection of a pipe or component that has been in-service but has not been previously inspected.

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- 3.11 Inspection Program – A systematic evaluation of in-scope underground components using various techniques [e.g., ultrasonic testing (UT), radiographic testing (RT), visual testing (VT), leak testing (LT), eddy current (ET)].
- 3.12 Inspector / Coating – An individual that is trained and experienced with coating condition assessment (See attachment 7.1).
- 3.13 Inspector (Visual) / Base Metal – An individual that is VT-1 qualified (See reference 2.13).
- 3.14 Microbiologically Influenced Corrosion (MIC) - Corrosion caused by the presence and/or activities of microorganisms in biofilms on the surface of the material. Microorganisms have been observed in a variety of environments that include seawater, natural freshwater (lakes, rivers, wells), soils, and sediment. Microbiological organisms include bacteria, fungi, and algae.
- 3.15 Pitting - A form of localized corrosion that results in the formation of small, sharp edged cavities in a metal.
- 3.16 Quality Assurance Classification – For the purpose of this procedure Safety Class or QA Category is used to designate safety classification. Refer to EN-DC-167 for a summary of the corresponding “legacy” classifications formerly used at each plant and how they are classified as safety related, augmented and non-safety related.
- 3.17 Redox - Of or relating to oxidation-reduction.
- 3.18 Selective Leaching - Corrosion in which one element is preferentially removed from an alloy, leaving a residue (often porous) of the elements that are more resistant to the particular environment. Also called de-alloying or parting.
- 3.19 Subsequent Re-inspection – The inspection of a component that has been previously subjected to a Baseline Inspection and/or an Initial Inspection.
- 3.20 UT (Ultrasonic Testing) - A nondestructive test method that employs high-frequency mechanical vibration energy to detect and locate structural discontinuities or differences and to measure thickness of a variety of materials.

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- 3.21 Underground Piping – All piping that is below grade, not accessible, and outside of buildings. Underground piping may or may not be in direct contact with soil or concrete. This includes piping that is directly buried and those that are embedded (or encased) in concrete or located in underground concrete vaults, tunnels, or guard pipes. Buried piping is considered to be a subset of underground piping
- 3.22 Underground Tank - All tanks that are outside of buildings and sufficiently below grade such that there is a reasonable possibility that leakage from inaccessible portions of the tank may not be detected. These tanks are below grade and may or may not be in direct contact with soil or concrete. This includes tanks that are directly buried and those that are embedded in concrete or located in underground concrete vaults or tunnels.

#### **4.0 RESPONSIBILITIES**

- 4.1 Program Owner – has the responsibility to develop, maintain, and implement the Underground Piping and Tanks Inspection and Monitoring Program. The Program Owner or qualified Responsible Engineer (RE), from Site Engineering has responsibility to review/evaluate the inspection results. The individual shall be experienced in reviewing / evaluating the condition of underground piping or tanks. The Program Owner and/or qualified individual shall also be responsible for:
- [a] Development of plans and procedures for inspection of underground components within the program.
  - [b] Instruction, training, and approval of visual inspection of personnel.
  - [c] Performance or direction of general and detailed visual inspections.
- 4.2 Inspector – has the responsibility to conduct underground piping and tank inspections in accordance with this standard.

#### **5.0 DETAILS**

##### **5.1 General Guidelines**

- [a] Typically, the inspection of underground segments requires the Safety Department to be involved with the inspection. The job supervisor ensures all safety requirements (i.e. confined space, excavation, safety harness, etc) are addressed and the site safety department has given approval for the inspection to proceed.

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- [b] It is important that either the Program Owner or Inspector document the excavation as outlined in Attachments 7.2 and 7.3. The type of backfill near the piping surface, excavation details, and the as-found condition of the pipe and/or coating is essential when assessing for degradation.
- [c] The general visual inspection shall be performed either directly or remotely with sufficient illumination and resolution to assess the general condition of the accessible surfaces. The inspection shall be documented and supplemented by photographic and/or video records.
- [d] Inaccessible areas are not required to be inspected unless specifically warranted by scope expansion.
- [e] Inspectors shall visually inspect non-coated and coated surface areas using Attachments 7.2 and 7.3 as a guide and future documentation.
- [f] Painted or coated areas shall be inspected for evidence of flaking, blistering, peeling, discoloration, and other signs of distress.
- [g] Coating should be checked for dis-bondment. This may include inspecting the coating for high and/or low spots and possible additional forensics of areas that sound hollow when lightly tapped.
- [h] If portions of the coating are believed to be dis-bonded, a CR shall be written. Those portions should be considered for removal for base metal surface visual inspection using non-destructive examination (NDE) to determine if base metal is adversely affected.
- [i] Non-coated areas shall be inspected for evidence of cracking, discoloration, wear, pitting, excessive corrosion, gouges, surface discontinuities, dents, and other signs of surface irregularities.
- [j] Pressure retaining bolting shall be inspected for defects which may cause the bolted connection to violate either leak tightness or structural integrity.
- [k] During the inspection, the detailed results should be documented using Attachments 7.2 and 7.3. Attachments 7.2 and 7.3 should be taken into the area, if possible and used as an inspection checklist as the inspection is being performed. This will ensure everything is addressed so a follow-up inspection is not required.
- [l] If the inspector notes indications which need further review, a condition report shall be written.
- [m] Analysis of soil samples should be performed when undertaking excavations for piping/tanks inspections.

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## 5.2 Inspection Guidelines

5.2.1 The inspection guidelines are intended for use as a checklist by qualified inspection personnel to determine when an existing condition is acceptable or requires acceptance review. The guidelines are not intended to be all-inclusive. When a questionable condition is encountered, the inspection personnel should always be conservative and initiate a condition report.

5.2.2 Indications identified as “Yes” on the inspection guidelines checklist (Attachments 7.2 and 7.3) must be evaluated through the CR and/or EC process.

- Proper characterization of the degradation is essential to allow future trending. A camera may be essential to provide proper characterization. The RE or designee shall initiate Work Orders to identify required repairs and/or further inspections (e.g. NDE).
- If the Program Owner or RE designee determines that additional information is needed for the acceptance review, actions shall be developed and documented in PCRS.

5.2.3 Inspection guidelines for uncoated surface areas:

If any of the relevant conditions listed below are present, further review is required. Initiate a CR.

- Cracking in base metal
- Discoloration resulting from age, heat, or corrosion
- Discernible wear
- Pits, dents, or gouges in the base metal.
- Excessive external corrosion.
- Corrosion which results in discernible base metal loss
- Discernible bulges
- Arc strikes
- Other conditions causing discernible degradation of the base metal

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#### 5.2.4 Coated Surface Areas:

If any of the relevant conditions listed below are present, further review is required. Initiate a CR.

- Any of the conditions listed for uncoated surfaces
- Missing or degraded coating
- Blisters in the coating
- Significant cracking in the coating
- Excessive flaking of the coating
- Dents or gouges in the coating

#### 5.2.5 Grey Cast Iron and Copper Alloys with >15% Zinc Content:

The Inspector should be aware of selective leaching in this type of piping components (ref. 2.20). Visual inspection of cast iron would indicate unexplained porosity or a honeycomb-like grain structure. A buildup of iron oxide on cast iron requires further evaluation. A confirmation test to validate the evidence of selective leaching should be performed by using a Brinell hardness tester or by mechanically scraping the sample with a sharp tool.

#### 5.2.6 Tank Bottom Inspections:

Inspection of the bottom of tanks that cannot be accessed from the OD and have a leak path of radioactive material to the ground should be considered for NDE inspection (ref. 2.21)

Use Attachments 7.2 and 7.3 as needed and this inspection shall also include UT since the under-side of the tank bottom cannot be accessed to determine integrity.

#### 5.2.7 Bolting Assemblies:

If any of the relevant conditions listed below are present, further review may be required. Initiate a CR as required.

- Bending, twisting, stretching or deforming of bolts or studs
- Missing or loose bolts, studs, nuts, or washers
- Fractured bolts, studs, or nuts
- Degradation of protective coatings on bolting surfaces
- Evidence of leakage near bolting
- Misalignment of connection or bolting

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### 5.3 Personnel Qualification:

- 5.3.1 Personnel conducting general visual inspections shall have an annual eye examination and meet visual acuity as specified in CEP-NDE-100 and/or ASME XI IWA-2321.
- 5.3.2 Personnel conducting general visual inspections shall be VT-1 qualified (see reference 2.13).
- 5.3.3 Personnel conducting coating inspections shall meet the qualification requirements identified in Attachment 7.1.
- 5.3.4 The Engineering Program Owner shall be qualified in accordance with FTK-ESPP-G00121 "Underground Piping/Tanks Program Owner".

## 6.0 RECORDS

- 6.1 No quality or controlled records are generated by this standard. It is recommended that a copy of the completed inspection checklist be attached to the related WO. However the completed inspection checklist as well as a summary of the findings shall be maintained in the program notebook.

## 7.0 ATTACHMENTS

- 7.1 Coating Personnel Qualification Matrix
- 7.2 Pipe/Tank Coating Visual Inspection Checklist
- 7.3 Pipe/Tank Base Material Visual Inspection Checklist

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**ATTACHMENT 7.1**

**COATING PERSONNEL QUALIFICATION MATRIX**

Sheet 1 of 1

<b>COATING PERSONNEL QUALIFICATION REQUIREMENTS</b>		
<b>Education</b>	<b>Professional Achievement</b>	<b>Coating Experience<sup>2</sup></b>
With a four-year engineering/science degree	Coating training <sup>1</sup>	One year
With a 2-year associate science degree	Coating training <sup>1</sup>	Two years
High School graduate	Coating training <sup>1</sup>	Three Years
<b>Qualification by Certification</b>		
NACE or other industry recognized coating specialist certification		Not Required
NBR for Safety-related Coating Engineers and Specialists Certification		Requirements are integral to obtaining qualification and therefore not listed here.
ANSI N45.2.6 Coatings Qualification		Not Required

**NOTES**

1. In general the minimum coating training shall consist of EPRI, NACE or other documented coating specialist training and other site-specific coating procedures and requirements. The EPRI Technical Seminar, "Comprehensive Coating Training Course" is recommended for the documented training. Other qualifications, professional achievement, experience and certification may be determined by the Program Owner to satisfy the qualification requirements (e.g. ANSI N45.2.6 Level III, Registered Professional Engineer, etc).
2. Coating Experience in this case is defined as extensive in-field experience as well as noteworthy technical and educational achievements. Technical and educational achievements could consist of one of the following: 1) as necessary to supplement education and professional achievements; 2) Publication of technical papers regarding industry coatings; 3) Participation in technical committees responsible for coatings standards; 4) Preparing and presenting training aimed at qualifying personnel to apply or inspect coatings.

NBR = National Board of Registration

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**ATTACHMENT 7.2 PIPE/TANK COATING VISUAL INSPECTION CHECKLIST**

Sheet 1 of \_\_

**NOTE: A photographic record of each indication should be retained with the inspection report.**

Line/Tank ID & Name: \_\_\_\_\_ Work Order: \_\_\_\_\_  
 System: \_\_\_\_\_ Inspection Date: \_\_\_\_\_  
 Location: \_\_\_\_\_ Inspector: \_\_\_\_\_  
 Coating Material: \_\_\_\_\_ Thickness: \_\_\_\_\_

Not Coated

**Backfill Makeup:**

Contains Rocks? Yes  No  Description: \_\_\_\_\_  
 Contains Other Foreign Objects? Yes  No  Description: \_\_\_\_\_

Note

- 1. Any Mechanical Damage? Yes  No  \_\_\_\_\_
- 2. Any Holiday/Hole? Yes  No  \_\_\_\_\_
- 3. Any Blistering? Yes  No  \_\_\_\_\_
- 4. Any Peeling? Yes  No  \_\_\_\_\_
- 5. Any Flaking? Yes  No  \_\_\_\_\_
- 6. Any Delamination? Yes  No  \_\_\_\_\_
- 7. Any Embrittlement? Yes  No  \_\_\_\_\_
- 8. Any Embedded Rocks (Coating and/or Base)? Yes  No  \_\_\_\_\_
- 9. Any Cracking? Yes  No  \_\_\_\_\_
- 10. Any Gouges? Yes  No  \_\_\_\_\_
- 11. Any Rusting? Yes  No  \_\_\_\_\_
- 12. Other? Yes  No  \_\_\_\_\_

**Any Yes answer requires a CR to be initiated**

General Appearance: \_\_\_\_\_

Degradation Found? Yes  No  Further Evaluation Required? Yes  No

Comments: \_\_\_\_\_

CR Required? Yes  No  CR No. \_\_\_\_\_

Performed By: \_\_\_\_\_ Date: \_\_\_\_\_

Program Owner or Qualified Designee: \_\_\_\_\_ Date: \_\_\_\_\_

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**ATTACHMENT 7.3 PIPE/TANK BASE MATERIAL VISUAL INSPECTION CHECKLIST**

Sheet 1 of \_\_

**Note: Any inspection photographs or videos should be included with the inspection report.**

Line/Tank ID & Name: \_\_\_\_\_ Work Order: \_\_\_\_\_

System: \_\_\_\_\_ Base Material: \_\_\_\_\_ Inspection Date: \_\_\_\_\_

Location: \_\_\_\_\_ Thickness: \_\_\_\_\_ Inspector: \_\_\_\_\_

Previously Coated? Yes [ ] No [ ]

Backfill Contains Rocks? Yes [ ] No [ ] Description: \_\_\_\_\_

Backfill Contains Other Objects? Yes [ ] No [ ] Description: \_\_\_\_\_

**(circle one, Internal /tank or External/pipe)**

**Note**

- |   |         |         |              |
|---|---------|---------|--------------|
| 1. Any Cracking?                              | Yes [ ] | No [ ]  | _____        |
| 2. Any Rust?                                  | Yes [ ] | No [ ]  | _____        |
| 3. Any Corrosion?                             | Yes [ ] | No [ ]  | _____        |
| 4. Any Flaking or Scaling?                    | Yes [ ] | No [ ]  | _____        |
| 5. Any Mechanical Damage?                     | Yes [ ] | No [ ]  | _____        |
| 6. Any Nicks, Gouges, Pitting or Arc Strikes? | Yes [ ] | No [ ]  | _____        |
| 7. Any Tubercles (if Internal Inspection)     | N/A [ ] | Yes [ ] | No [ ] _____ |
| 8. Any MIC (if Internal Inspection)           | N/A [ ] | Yes [ ] | No [ ] _____ |
| 9. Any Indication of Selective Leaching?      | Yes [ ] | No [ ]  | _____        |
| 10. Other?                                    | Yes [ ] | No [ ]  | _____        |

**Any yes answer requires a CR to be initiated**

General Appearance: \_\_\_\_\_

Degradation Found? Yes [ ] No [ ] Further Evaluation Required? Yes [ ] No [ ]

Comments: \_\_\_\_\_

Degradation Location: Straight Pipe [ ] Fitting [ ] Weld [ ]

Position of leak (i.e., 6 o'clock) \_\_\_\_\_

CR Required? Yes [ ] No [ ] CR No. \_\_\_\_\_

Performed By: \_\_\_\_\_ Date: \_\_\_\_\_

Program Owner or Qualified Designee: \_\_\_\_\_ Date: \_\_\_\_\_