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Submitter Information

Name: Julie Keys
Address:
1776 I St. N.W.
Washington, DC, 20006
Organization: NEI

General Comment

NEI has reviewed the proposed changes to the Generic Aging Lessons Learned (GALL) report Aging Management Program (AMP) M41 on Buried Components and our comments are attached. Our comments reflect changes which were discussed with you in public meetings which were held May 26-28th.

We appreciated the opportunity to discuss AMP M41 and the GALL with NRC staff prior to submitting these comments. If further discussion is desired, please contact Julie Keys at (202) 739-8128; jyk@nei.org.

Julie Keys
Sr. Project Manager
NEI

Attachments

NRC-2010-0180-DRAFT-0003.1: Comment on FR Doc # 2010-11841

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = R. Framm (Rag)

XI.M41 BURIED, ~~UNDERGROUND, AND LIMITED-ACCESS~~ PIPING AND TANKS

Comment/Basis:

XI.M41 – 1 Program Description & applicable elements:
Recommend deleting "underground" and "limited access" environments. "Underground" and "limited access" environments are defined as components exposed to air and located where access is limited. Detection of aging effects for limited access components exposed to air environments is managed by AMP XI.M36 External Surfaces Monitoring of Mechanical Components (see element 4). Clarification has been added to M36. Also, the definition of change in material properties needs to be added to GALL Chapter IX.

XI.M41-2 Element 1
Recommend deleting the sentence identifying typical systems. The buried piping and tanks program manages aging of components in a soil environment. Identification of systems for this type of AMP is not consistent with other GALL AMPs.

XI.M41 – 3 Element 1 – the last sentence states that aging of bolting associated with piping systems within the scope of this program are also managed by this program. However there are no line items for bolting that credit this AMP. Recommend adding steel bolting line items for loss of material (managed by Buried Piping and Tanks) and loss of preload (managed by Bolting Integrity AMP)in a soil environment in GALL Chapter VIII.H and VII.I, External Surfaces of Miscellaneous Components and Bolting.

XI.M41 – 4 Element 2 item 2a –Need to define or give examples of materials that are considered super austenitic stainless steels.

XI.M41 – 5 Element 2 item 2b – Recommend limiting the use of coatings to susceptible metallic piping consistent within the scope of NACE Standard Practice SP0169-2007 (submerged or underground metallic piping). Plants not consistent with the requirement of Table 1 of NACE Standard Practice SP0169-2007 must provide a plant specific justification for an alternative coating.
The size of particles in structural backfill and the potential coating impact varies and depends on the type of coating used and backfill placement/compaction. Recommend deleting 49 CFR 195.252 and revising to allow structural backfill consistent with plant specific specifications. Structural backfill for opportunistic and directed inspections should have 30% or less of its particles retained on a ¾ inch sieve or demonstrate that the backfill material and placement/compaction methods will not result in exposure of piping metallic surfaces. Also see addition backfill considerations in comment 19.

XI.M41 – 6 Element 2 item 2c – If the environment is limited to a soil environment, this item is not required (see comment XI.M41 – 1 and XI.M41 - 5). Delete the requirement to maintain justification for lack of coating on materials on site – this is required by NEI 95-10 for license renewal documentation.

XI.M41 – 7 Element 2 item 2d – This section appears to require cathodic protection of all buried steel, copper, and aluminum components consistent with the referenced

NACE standards with no exceptions. The 2007 and 2002 editions of the referenced NACE standards were not available when cathodic protection systems for existing operating plants were built. As written, this would require an applicant to backfit existing cathodic protection system designs to be consistent with NACE Standard Practice SP0169-2007 or Recommended Practice RP0285-2002 or take exception to the requirement. Recommend revising this section to focus on installed cathodic protection systems. Steel, copper, and aluminum components not cathodically protected are inspected by paragraph 4.c.

XI.M41 – 8 Element 3 – For metallic components, loss of material due to all forms of corrosion and potentially, cracking due to stress corrosion cracking are addressed by this AMP. However, other MEAE line items such as polymeric and cementitious materials also credit this AMP. Examples: VII.C1.AP-175 & 176 credit this AMP for cracking, blistering, change in color due to water absorption and VII.C1.AP-177 & 178 credit this AMP for cracking, spalling, corrosion of rebar due to exposure of rebar.

XI.M41 – 9 Element 3 – Clarify this element to indicate that the measurement of pipe-to-soil potential and the cathodic protection current are applicable to steel, copper, and aluminum components that are cathodically protected.

XI.M41 – 10 Element 4 item c(i) – The requirement for a minimum of 5% of the length of all piping can require extensive excavation for some plants creating a condition that would damage more piping than it would provide evidence of the piping condition. Recommend replacing the 5% length requirement with locations that consider the NEI 09-14 industry initiative. Six locations are proposed as follows:

- At least three high risk locations determined by the NEI 09-14 methods for piping within the scope of license renewal
- At least three additional locations where the potential for pipe degradation is highest based on considerations noted in item c.iv.

Also in the introduction to item c. delete reference to paragraphs 2b and 2c to clarify applicability of this element to piping that is inherently resistant to corrosion and is not cathodically protected.

XI.M41 – 11 Element 4 item c(v) and item e(iii) – Delete the requirement for not allowing individual inspections of shared piping to be credited for more than one unit. This is inconsistent with portions of the ASME Section XI code that allow credit for similar or shared components. Selection of excavations is driven by where the risk of degradation is greatest and is not based on shared systems.

XI.M41 – 12 Element 4 item vi – Revise to identify volumetric examination of wall thickness and identify ultrasonic examination as an example of a volumetric examination. Field eddy current techniques are being developed that can also be used for thickness measurements.

XI.M41 – 13 Element 4 item e. - The introduction of this item requires two inspections of cathodically protected piping. Item e(v) also requires two inspections of cathodically protected pipe and is redundant to the introduction. Recommend deleting item e(v). Consistent with NACE Standard Practice SP0169-2007, pipe to soil potentials should be used where possible. Piping system congestion or other considerations may result in unreliable data.

XI.M41 – 14 Element 4 Item g - Clarify applicability of this element to tanks that are not coated (coating and backfill characterized by paragraph 2b) and not cathodically protected.

XI.M41 - 15 Element 4 item i – Revise the introduction to this item to be consistent with element 4 item c, item e, and item g.

XI.M41 – 16 Element 4 Items g thru j – If this environment applicable to this program is limited to buried components (soil environment), item i should be combined with item g due to identical inspection requirements for "each tank". Item h should also be combined with item j due to identical inspection requirements for "each tank". The Buried Pipes and Tanks AMP should only apply to the buried portion of tanks for those tanks that are only partially buried in a soil environment. Portions of partially buried tanks exposed to an air environment and not in contact with a soil environment should be managed by AMP XI.M36 External Surfaces Monitoring of Mechanical Components.

XI.M41 – 17 Element 4 Items k & l (new) – Recommend adding inspection requirements for polymeric and cementitious buried components.

XI.M41 – 18 Element 4 item m (revised from k). – Doubling of the sample size seems excessive when conditions found and cause evaluations could determine that there is no need to expand the sample this significantly. Recommend increasing the sample (up to doubling) in accordance with root cause evaluations. Similarly, if significant indication are found in the expanded sample, cause evaluations may provide justification for not performing a 100% inspection of all buried piping.

XI.M41 – 19 Element 4 item m (revised from k) – Considering the presence of any coarse material within 6 inches of the pipe or tank as significant and requiring additional inspections should be replaced with consideration of conditions that would damage the coating. Demonstration that backfill will not damage the pipe was previously provided in element 2.b and is based on site specific considerations and specifications. Damage due to backfill and its impact on the condition of the coating is considered as one of the risk factors in element 4.c.iv. that is used to select inspection locations. Typical site specifications for structural backfill require backfill to be well graded, dense, and consisting of sound durable material capable of achieving the required degree of compaction. Typical compaction characteristics such as those in ASTM D1557 apply to soils that have 30% or less by mass of their particles retained on a 3/4inch sieve.

XI.M41 – 20 Element 6 – Revised coating damage acceptance criteria consistent with element 4 item m (revised from k) to require repair of any coating damage that directly exposes the piping or tank to the soil environment. Requiring repair of any coating degradation is overly restrictive. Minor coating degradation can occur that does not cause aging effects that result in loss of intended function of the piping or tank.

Program Description

This ~~is a comprehensive~~ program ~~designed to manage~~ manages the aging of the external surfaces of ~~buried, underground, and limited access~~ piping and tanks exposed to a soil environment. It addresses piping and tanks composed of any material, including metallic, polymeric and cementitious materials. This program manages aging through preventive, mitigative and inspection activities. It manages ~~all applicable aging effects such as~~ loss of material, cracking, and changes in material properties. The term buried will be used to identify components in direct contact with a soil environment.

Depending on the material, preventive and mitigative techniques include: the material itself, corrosion resistant coatings, and the application of cathodic protection. Also, depending on the material, inspection activities include ~~electrochemical verification of the effectiveness of cathodic protection,~~ non-destructive evaluation of wall thicknesses from either the inside or the outside of the pipe or tank, and visual inspections of the pipe or tank from the exterior as permitted by opportunistic or directed excavations.

Although this program considers the material inside the pipe or tank, and certain aspects of the program may be carried out from the inside of the pipe or tank, this program is designed to address only the degradation occurring on the outside of the pipe or tank. Aging of the inside of the pipe or tank is managed by another program. Additionally, this program does not address selective leaching. The Selective Leaching Program (Chapter XI.M33) is applied in addition to this program for applicable materials and environments. Limited access piping or tanks in above, or below grade vaults or tunnels is managed by the external surfaces monitoring of mechanical components program (Chapter XI. M36).

~~The terms "buried, underground, and limited-access" are fully defined in Chapter IX of the GALL Report. Briefly, buried piping and tanks are in direct contact with soil or concrete (e.g., a wall penetration). Underground piping and tanks are below grade, but are contained within a tunnel or vault such that they are in contact with air and are located where access for inspection is restricted. Limited-access piping and tanks are boveground, are exposed to air where condensation is possible and are located where access for inspection is restricted. The presence of insulation alone does not classify a pipe or tank as limited access.~~

Evaluation and Technical Basis

1. ***Scope of Program***: This program is used to manage the effects of aging of buried~~, underground, and limited-access~~ piping and tanks constructed of any material including metallic, polymeric and cementitious materials. The program addresses aging effects such as loss of material, cracking, and changes in material properties. ~~Typical systems within the scope of license renewal that may contain buried, underground, or limited-access piping include service water piping and components, condensate storage transfer lines, fuel oil and lubricating oil lines, fire protection piping and piping components (fire hydrants), and storage tanks.~~ The aging of bolting associated with piping systems within the scope of this program is also managed by this program.

2. ***Preventive Actions:*** Preventive actions utilized by this program vary with the material of the tank or pipe and the soil environment ~~(air, soil, or concrete)~~ to which it is exposed.

a. Some materials are inherently resistant to all the ~~applicable~~ aging ~~effects in the environment to which exposed~~ identified above due to exposure to a soil environment. These materials typically

include titanium and super austenitic stainless steels (e.g. AL-6X). For buried~~, underground, and limited access~~ piping and tanks made from these materials, additional preventive actions beyond the use of these corrosion-resistant materials are not necessary.

b. Steel, copper, and aluminum ~~Some materials~~ are not resistant to all the applicable aging effects in a soil environment. ~~any of the environments addressed by this program. These materials and include steel, as defined in Chapter IX of this report), including carbon steel, low-alloy steel, all types of cast iron, and galvanized steel~~. These materials should be coated consistent with ~~a corrosion-resistant material appropriate for the environment. In some instances this may be paint. For buried piping, the coating must~~ should ~~conform to~~ one or more of the standards listed in Table 1 of NACE Standard Practice SP0169-2007. Exceptions to Table 1 of NACE Standard Practice SP0169-2007 warrant a plant specific justification for the installed coating. ~~Backfill for buried piping should be consistent with 49 CFR 195.252. If the size of aggregate or other material within 6 inches of the buried piping is unknown or exceeds ½ inch in diameter, the applicant should provide information in the license renewal application sufficient to demonstrate that the backfill material will not damage the pipeline coating.~~ Structural backfill for opportunistic and directed inspections should have 30% or less of its particles retained on a ¾ inch sieve or demonstrate that the backfill material will not result in exposure of piping metallic surfaces.

~~c. Some materials are inherently resistant to the applicable aging effects in some but not all the environments applicable to this program. These materials include all materials not previously listed (including stainless steels). No preventive actions for these materials are required in environments to which the materials are immune to all applicable aging effects. Protective coatings are required in other environments. If protective coatings are not used for these materials, the applicant must provide sufficient information in the license renewal application and, thereafter update said information as necessary and maintain it on site, to justify why the use of protective coatings is not required.~~

c~~d~~. Installed cathodic protection systems are used to mitigate corrosion where pinholes in the coating allow ~~For~~ buried piping and tanks composed of steel, ~~low-alloy steel, all types of cast iron,~~ copper, or aluminum to be in contact with an aggressive soil environment. ~~corrosion-resistant coatings and cathodic protection as described in~~ Installed cathodic protection systems shall be consistent with NACE Standard Practice SP0169-2007 or Recommended Practice RP0285-2002.~~are provided. (Attempts to demonstrate that cathodic protection is not required as discussed in Sections 1.2 and 3 of SP0169 will not be considered.)~~ Cathodic protection systems that are not consistent with NACE Standard Practice SP0169-2007 or Recommended Practice RP0285-2002 will require a plant specific justification of the installed system. Steel, copper, and aluminum components not cathodically protected are inspected by element 4.c.

3. ***Parameters Monitored/Inspected:*** The aging effects addressed by this AMP based on component materials are:
a. Metallic materials: loss of material ~~due to all forms of corrosion~~ and, potentially, cracking due to stress corrosion cracking,
b. Cemititious materials: cracking, change in material properties, spalling, and/or corrosion of rebar,
c. Polymeric: cracking, blistering, or change in material properties

~~Two parameters are monitored to detect and manage these aging effects:~~ Visual appearance of the exterior of the piping or tank is monitored to detect and manage aging effects. ~~and wall thickness of piping or tanks, generally as determined by a non-destructive examination technique such as ultrasonic testing (UT).~~ For Metallic components, visual inspections are supplemented with

surface and/or volumetric non-destructive testing (NDT) if significant indications are observed. For steel, copper, and aluminum components that are cathodically protected, two additional parameters, the pipe-to-soil potential and the cathodic protection current, are monitored to determine the effectiveness of cathodic protection systems and, thereby, the effectiveness of corrosion mitigation. Change in material properties for polymeric materials is determined by visual inspection of conditions such as surface cracking, discoloration, dimensional changes, or exposure of internal reinforcement for reinforced polymers. Change in material properties for cementitious materials are determined by visual inspection of conditions such as surface cracking, loss of material, exposure of internal reinforcement, or spalling.

4. Detection of Aging Effects: Methods and frequencies used for the detection of aging effects vary with the material and environment of the buried, ~~underground, or limited-access~~ pipe or tank. These methods and frequencies are outlined below.

a. Buried~~, underground, and limited-access~~ piping and tanks are opportunistically inspected by visual means whenever they become accessible for any reason.

b. Direct or focused inspections of buried~~, underground, or limited-access~~ piping or tanks constructed from materials that are inherently resistant to all forms of expected degradation (paragraph 2a above) are not necessary.

c. During the 10 years ~~preceeding~~ preceding the period of extended operation, buried metallic ~~, underground, and limited-access~~ piping not inherently resistant to corrosion ~~characterized by paragraphs 2b and 2c above (i.e., materials not inherently resistant to corrosion~~ and that is not cathodically protected~~)~~ are visually inspected. Visual inspections are supplemented with surface and/or volumetric non-destructive testing (NDT) if significant indications are observed. Opportunistic examinations may be credited toward these direct examinations if all of the following criteria are met. Piping inspection will be conducted as follows:

~~i. Not less than 5% of the linear length of all buried, underground, and limited-access piping is inspected~~

i. Provide reasonable assurance of the integrity of 100% of the high risk buried piping (where risk is determined by methods consistent with NEI 09-14) shall be inspected by direct or indirect methods. At least 3 direct inspections are conducted on accessible high risk locations.

ii. At least one inspection is conducted for each type of buried material present. ~~as buried, underground, or limited-access piping~~

iii. Each visual inspection examines at least 10 feet of piping where practical. In each inspection all surfaces, including the bottom of the pipe will be inspected if practical.

iv. In addition to the three high risk locations noted in item i, at least three additional inspections are conducted at other accessible locations. The additional locations are selected where the potential for ~~risk of~~ pipe degradation is highest. Environment (including soil conductivity and backfill characteristics for buried piping), piping material, coating type, and expected condition of coatings are considered. Contents of the pipe may be considered

~~v. At multi-unit sites, individual inspections of shared piping may not be credited for more than one unit.~~

vi. Direct, volumetric, (e.g. ultrasonic) ~~thickness~~ examination of the wall thickness of piping conducted from the inside of the pipe may be substituted for the excavations and visual examinations described above.

vii. The use of guided wave ultrasonics or other advanced inspection techniques is encouraged for the purpose of determining those piping locations that should be inspected; ~~but~~ however, these techniques may not be substituted for those inspections until such time that these techniques are improved and accepted as being as effective as current NDE techniques.

d. The inspections described in (c) above are repeated during the 10 years following entry into the period of extended operation

e. During the 10 years preceding the period of extended operation, the degree of corrosion protection afforded to buried metallic piping by cathodic protection systems (paragraph ~~2d~~ 2c above) is examined by measuring cathodic protection currents and pipe-to-soil potentials (where possible), ~~as directed by~~ consistent with NACE Standard SP-0169-2007. Additionally, during the timeframe, not less than two directed excavations of at least 10 linear feet ~~of piping,~~ and visual examinations of cathodically-protected buried piping are conducted. Piping inspection is conducted as follows:

i. Directed piping examinations are conducted at accessible locations where the pipe-to-soil potential measurements indicate the greatest possibility of corrosion. Advanced evaluation tools such as guided wave ultrasonics may be used to assist in the determination of inspection locations.

ii. Direct, ultrasonic thickness examination of the wall thickness of piping conducted from inside the pipe may be substituted for the excavations and visual examinations described above.

~~iii. At multi-unit sites, two inspections per unit are necessary. Individual inspections of shared piping may not be credited for more than one unit.~~

iv. Opportunistic inspections may be substituted for these examinations if the location of these inspections would have been chosen for direct inspection.

~~v. Additionally, not less than two directed excavations of at least 10 linear feet of piping, and visual examinations of cathodically-protected piping are conducted.~~

f. The measurements and inspections described in (e) above will continue or be repeated during the 10 years following entry into the period of extended operation.

g. During the 10 years ~~preceeding~~ preceding the period of extended operation, buried ~~underground, and limited-access~~ metallic tanks not inherently resistant to corrosion ~~characterized by paragraphs 2b and 2c above (i.e., materials that are not inherently resistant to corrosion and~~ that are not coated (coating characterized by paragraph 2b) and not cathodically protected~~)~~ are inspected. Opportunistic examinations or examinations conducted under another aging management program may be substituted for these examinations if all of the following criteria are met. Tank inspection will be conducted as follows:

i. Each buried~~, underground, or limited access~~ metallic tank is examined

ii. Examination may be visual, conducted from the outside of the tank, or volumetric (preferably ultrasonic), conducted from inside the tank

iii. Visual inspections may be direct examinations or may be conducted using cameras and remotely-operated vehicles

iv. When tank examinations are conducted using ultrasonic thickness measurements, one measurement is made per square foot of tank surface for the portion of the tank in contact with a soil environment

v. When tank examinations are conducted using another form of non-destructive testing, the testing is conducted so as to measure the thickness of at least 90% of the surface of the tank in contact with a soil environment

vi. Tanks that cannot be examined using volumetric examination techniques are examined visually from the outside

h. The inspections described in (g) above are repeated during the 10 years following entry into the period of extended operation

i. ~~Beginning not less than~~ During the 10 years ~~preceeding~~ preceding the period of extended operation, the degree of corrosion protection afforded to buried metallic tanks by cathodic protection systems (paragraph ~~3d~~ 2c above) is examined by measuring cathodic protection currents and pipe-to-soil potentials, ~~as directed by~~ consistent with ~~NACE Standard RP-0285-2002~~ NACE Standard SP-0169-2007. Additionally, cathodically-protected metallic buried tanks are inspected as follows:

i. Each buried tank is examined

ii. Examination is volumetric, preferably ultrasonic, conducted from the inside of the tank

iii. When tank examinations are conducted using ultrasonic thickness measurements, one measurement is made per square foot of tank surface for the portion of the tank in contact with a soil environment.

iv. When tank examinations are conducted using another form of non-destructive testing, the testing is conducted ~~so as~~ to measure the thickness of at least 90% of the surface of the tank in contact with a soil environment

j. The measurements and inspections described in (i) above continue or be repeated during the 10 years following entry into the period of extended operation

k. During the 10 years preceding the period of extended operation, at least one directed excavation for each type of polymeric and cementitious material shall be inspected. At least 10 linear feet of piping shall be visually inspected. Polymeric tanks shall be tested for leak tightness.

l. The measurements and inspections described in (k) above continue or be repeated during the 10 years following entry into the period of extended operation

~~mk~~. Adverse indications observed during monitoring of cathodic protection systems or during inspections are entered into the plant corrective action program. Sample sizes will be increased (up to doubling) in accordance with corrective action evaluations ~~are doubled~~ if significant indications are detected. Although the significance of indications is generally determined by the corrective action program, any coating damage that directly exposes the piping or tank to the environment or conditions that could lead to damaged coatings are ~~or the presence of any coarse material in backfill within 6 inches of the pipe or tank is~~ considered significant. If significant indications are found in the expanded sample, the sample sized will be increased consistent with the corrective action evaluations. ~~a 100% inspection is appropriate.~~

5. ***Monitoring and Trending:*** For piping and tanks protected by cathodic protection systems, potential difference and current measurements are trended to identify changes in the effectiveness of the systems and/or coatings. Numerical measurements obtained from any inspections are trended to monitor corrosion rates and estimate the remaining life of piping and tanks.

6. ***Acceptance Criteria:*** The acceptance criteria for soil-to-pipe potential are listed in NACE Standards RP-0285-02 and SP-0169-07. ~~For coated piping or tanks, there should be no evidence of coating degradation.~~ If coating degradation is observed that directly exposes the piping or tank to the environment, the coating shall be repaired. An evaluation is conducted to determine the cause of coating degradation and whether additional inspections are needed. If coated or uncoated metallic piping or tanks show evidence of corrosion, the remaining wall thickness in the affected area is determined to ensure that the minimum wall thickness is maintained. This may include different values for large area minimum wall thickness, and local area wall thickness. The potential for through-wall pitting is evaluated. An evaluation is conducted to determine the cause of corrosion or cracking and whether additional inspections are needed. Cracking or blistering of nonmetallic piping is evaluated. Concrete piping may exhibit minor cracking and spalling provided there is no evidence of leakage or exposed rebar or reinforcing "hoop" bands.