June 23, 2016

MEMORANDUM TO: John W. Lubinski, Director
Division of Engineering
Office of Nuclear Reactor Regulation

FROM: Robert O. Hardies, Senior Level Advisor ***/RA/***
Division of Engineering
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF RESULTS FROM NRC TEMPORARY INSTRUCTION 2515/182, REVIEW OF THE IMPLEMENTATION OF THE INDUSTRY INITIATIVE TO CONTROL DEGRADATION OF UNDERGROUND PIPING AND TANKS

The objective of this temporary instruction (TI) was to determine whether licensees were implementing the industry initiative on underground piping and tank integrity and to gather information to enable the staff of the U.S. Nuclear Regulatory Commission (NRC) to assess whether the initiative provides reasonable assurance of the structural and leakage integrity of buried piping and underground piping and tanks. The information collected using this TI was to be used to determine the extent of the industry's implementation of the voluntary initiative and to aid in evaluating whether additional NRC regulatory actions are warranted.

This assessment was conducted in two phases. In the first phase the NRC inspection staff evaluated whether the organization of the licensee's program and due dates contained in the program match the organization and due dates contained in NEI 09-14 Rev. 3. Also in this phase the NRC inspection staff determined whether the licensee met applicable due dates. In the second phase NRC inspection staff reviewed the implementation of the licensee's program in sufficient detail to provide responses to a specific set of questions. In the first phase the NRC evaluated whether licensees were participating in the initiative. In the second phase the NRC qualitatively assessed whether the implementation of the initiative improved reliability of buried assets.

Both phases of TI 2515/182 inspections have been completed at all sites.

The results of the first phase indicate that all licensees implemented the initiative and met the due dates established in the initiatives.

The results of the phase 2 inspections indicate all sites perform effective risk ranking, all sites have programs and all sites have or are developing associated performance indicators and system health reports for buried

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assets. All sites are performing inspections of high risk buried assets. Many sites are making improvements to cathodic protections systems. These changes have enabled utilities to identify assets at risk for significant deterioration and implement inspection, maintenance, repair and replacement strategies to ensure long term reliability of safety related underground and buried piping and tanks that are safety related or that contain hazardous material. A summary of the Phase 2 inspection results is attached.

Attachment: Temporary Instruction 2515/182, Review of the Implementation of the Industry Initiative to Control Degradation of Underground Piping and Tanks Data Conclusions

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Temporary Instruction 2515/182, Review of the Implementation of the Industry Initiative to Control Degradation of Underground Piping and Tanks Data Conclusions

Phase 2 of the temporary instruction (TI) involved inspectors reviewing licensee buried piping program activities. Inspectors sought answers to a list of questions provided by the TI. The objective of the questions was to acquire a consistent subset of information that could be used to qualitatively assess buried and underground piping and tanks program performance. The questions and a summary of responses is provided in the following paragraphs:

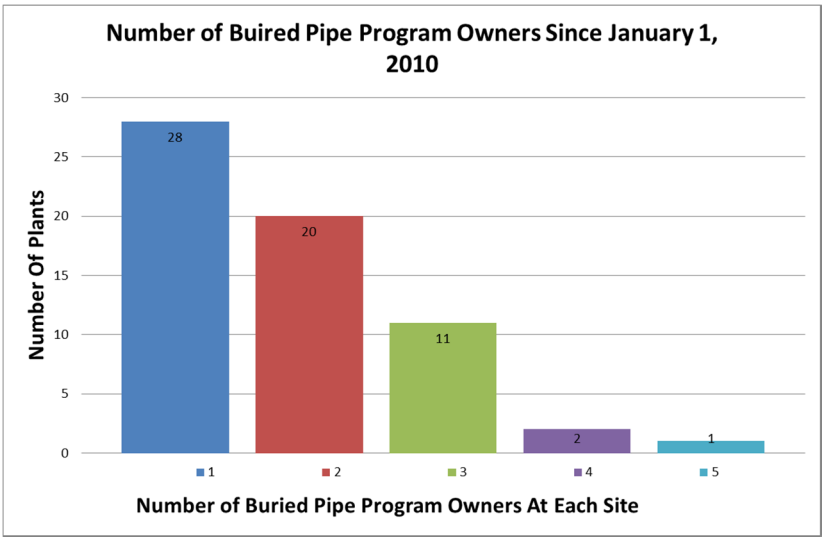
Initiative Consistency

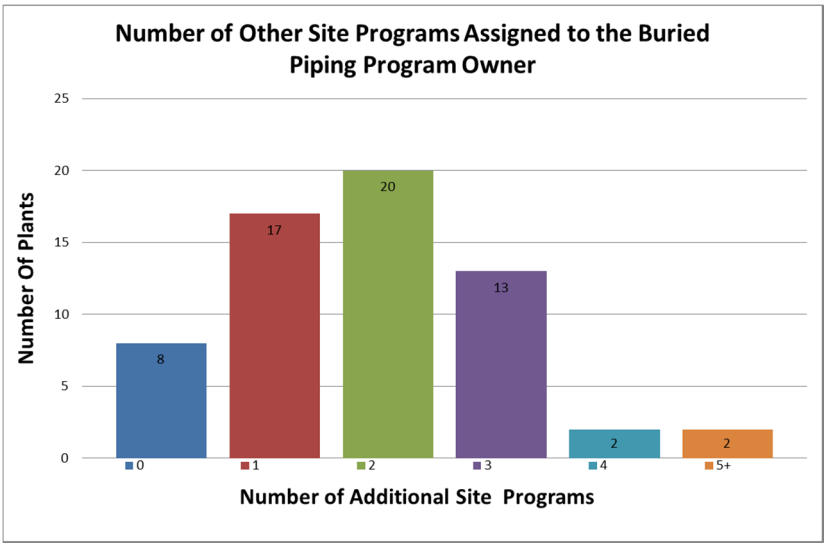
Questions 1a and 1b: Has the licensee taken any deviations to either of the initiatives? If so, what deviations have been taken and what is (are) the basis for these deviations?

Summary of responses to questions 1a and 1b: All but one plant met all of the initiative milestones. The one plant that may have deviated closed an action item associated with one milestone by its due date, but subsequently determined the item needed to be reopened to address additional scope. The item was subsequently completed. The licensee reported the deviation in accordance with the processes described in the initiative and entered the event into the corrective action program.

Questions 2a, 2b, and 2c: Does the licensee have an onsite buried piping program manager (owner) and, potentially, a staff? How many buried piping program owners have there been since January 1, 2010? How many other site programs are assigned to the buried piping program owner?

Summary of responses to questions 2a, 2b, and 2c: All sites had program owners, although not all sites used the term “buried piping program manager.” Most sites have a single owner with a designated backup. Some sites have corporate support that could augment site program owner performance.





No plants are in the category of both having a large number of owners and the owner having responsibility for a large number of programs, therefore plants seem to be placing an adequate focus on the buried and underground piping and tanks programs.

Questions 3a, 3b, and 3c: Does the licensee have requirements to capture program performance, such as system health reports and performance indicators? Are these requirements periodic or event driven? Are there examples where these requirements have been successfully used to upgrade piping systems or to avert piping or tank leaks?

Summary of responses to questions 3a, 3b, and 3c: In general plants have system health reports. System health reports address cathodic protection health, failure history, program owner qualification, groundwater protection issues, etc., related to underground and buried piping and tanks. Performance indicators are developed from these metrics for the program. All but one plant site are currently using system health reports and/or performance indicators to drive activities. The one plant that does not currently have system health reports is developing them, but has a mature program.

The System health reports and performance indicators are reviewed periodically, which for most plants is on a quarterly bases.

System health reports and performance indicators have driven changes in inspection, maintenance and modifications, including in some cases cathodic protection system installations or upgrades. In some cases increased budgets were attributed to implementation of health reports.

Overall conclusion for question 3: Licensees are using buried piping system health reports and it is having a large positive effect. The health reports have been successful in improving the leak tight reliability of buried pipe, in most cases.

Questions 4a, 4b, and 4c: Does the licensee have a program or procedure to confirm the as-built location of buried and underground piping and tanks at the plant? Has the licensee used this program? Was the program effective in identifying the location of buried pipe?

Summary of responses to questions 4a, 4b, and 4c: Most plants do not have a procedure to confirm the as-built location of buried and underground piping and tanks at the plant. Inspections indicated that the sites were able to locate all underground and buried piping, as necessary. No sites were unable to find buried and underground piping. For excavations, most sites use plant construction drawings in conjunction with ground penetrating radar to locate buried pipes. Generally field locations have been found to be in good agreement with plant drawings. This process has effectively identified all metal structures, pipes, etc. prior to excavation.

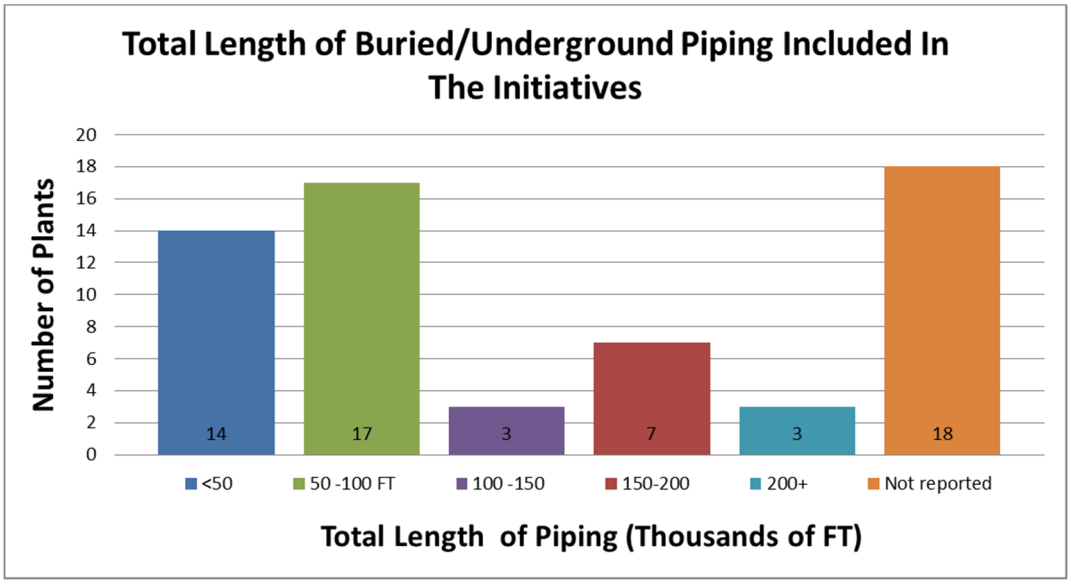
Question 5: For a sample of buried pipe and underground piping and tanks (sample size at least 1 high and 1 low risk/priority pipe or tank), did the risk ranking and/or prioritization process utilized by the licensee produce results in accordance with the initiative guidelines, i.e., which emphasize the importance of components which have a high likelihood and consequence of failure and deemphasize the importance of components which have a low likelihood and consequence of failure?

Summary of responses to Question 5: Samples of risk ranking were inspected at every site. In all cases inspectors concluded risk ranking was being performed in a manner consistent with the initiative objectives. The number of plants that did not have high risk piping was higher than anticipated, but each plant's explanation verified the reasoning for this.

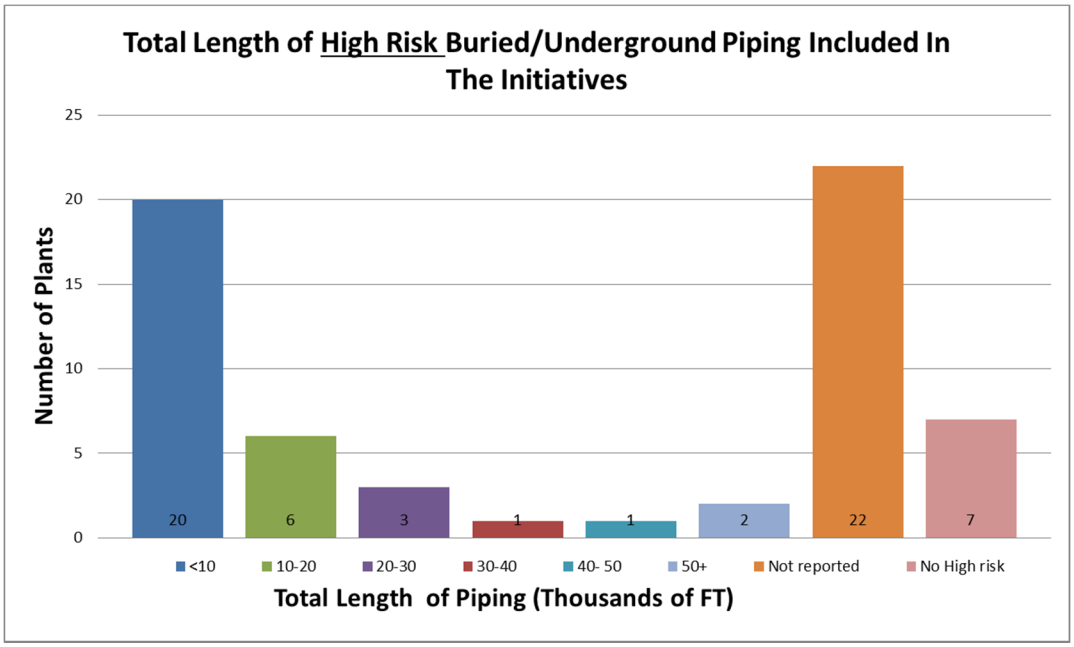
Question 6a and 6b: As part of its risk ranking process did the licensee estimate/determine the total length of buried/ underground piping included in the initiatives? As part of its risk ranking process did the licensee estimate/determine the total length of high risk buried/underground piping included in the initiatives?

Summary of responses to question 6:

Approximately 30% of the plants/sites did not estimate or report the amount of buried and underground piping. The estimated amount of buried pipe at nuclear plants in the United States is approximately 6,823,320 Feet or 1,292 Miles.



The total amount of high risk buried pipe in the country is approximately 784,615 Feet or 149 miles.



Preventive Actions/ System Maintenance

Question 1: For uncoated steel piping, has the licensee developed a technical basis for concluding that structural (e.g. ASME Code minimum wall, if applicable) and leak tight integrity of buried piping can be maintained? Is the technical basis provided as justification by the licensee consistent with the initiative (including its reference documents) or industry standards (e.g. NACE SP0169)?

Summary of responses for Question 1: Most plants indicated that there was no uncoated buried steel piping on site. Of the plants that indicated there was uncoated steel piping most responded that the only uncoated steel pipe was stainless steel, galvanized steel or piping not exposed to soil. These categories were not targets of the question. Therefore the inspection results indicated only a few plants have buried uncoated steel, and the ones that do have either developed a technical basis or have very low corrosivity soils.

Questions 2a and 2b: For buried steel, copper, or aluminum piping or tanks which are not cathodically protected, has the licensee developed a technical basis for concluding that structural (e.g. ASME Code minimum wall, if applicable) and leak tight integrity of buried piping can be maintained? Is the technical basis provided as justification by the licensee consistent with the initiative (including its reference documents) or industry standards (e.g. NACE SP0169)

Summary of responses to question 2a and 2b: There are 6 plants/sites do not have cathodic protection (CP) and have no technical basis. There are 17 plants that do not have CP and have

a technical basis consistent with industry standards or initiative expectations. There are 38 plants that have CP and thus answered N/A to the question. The technical justifications are consistent with the initiatives. At the time of the inspections some plants were still in the initial phase of developing a technical basis.

Questions 3a, 3b, and 3c: For licensees with cathodic protection systems, does the licensee have procedures for the maintenance, monitoring and surveys of this equipment? Are the licensee procedures consistent with the initiative (including its reference documents) or industry standards (e.g. NACE SP0169)? Is the cathodic protection system, including the evaluation of test data, being operated and maintained by personnel knowledgeable of, or trained in, such activities

Summary of responses to question 3a, 3b, and 3c: Most plants/sites that have cathodic protection have procedures for the maintenance, monitoring and surveys of equipment. Three sites do not have licensee procedures but instead rely on vendors for these procedures. At these sites vendors have performed inspections and have provided guidance for system operation and monitoring but in most cases the information has not been incorporated into licensee procedures.

All licensee procedures inspected were consistent with the initiative or industry standards

Most sites do not have on-site staff NACE certified personnel operating and maintaining the cathodic protection system. However, they use a NACE certified contractor to periodically monitor the systems. Typically outside NACE certified contractors do yearly CP surveys. Plant technicians operate CP system under procedures consistent with NACE guidance.

Question 4: Is there a program to ensure chase and vault areas which contain piping or tanks subject to the underground piping and tanks initiative are monitored for, or protected against, accumulation of leakage from these pipes or tanks?

Summary of responses to question 4: A few plants have specific programs for periodically inspecting chases and vaults for accumulation of liquid. A majority of plants do not have any piping within the scope of the initiative in vaults or chases, so do not need inspection programs. Several plants have requirements for inspection chases or vaults, but the requirements are contained in buried piping or groundwater monitoring programs, scheduled periodic preventive maintenance orders, operator walk downs or other periodic inspection processes. Several plants are developing specific programs. Some sites have sump pumps and control room alarms alert if there is leakage in the vaults and periodic walk down and monitoring is done to verify no leakage. There were no plants that have in scope piping in trenches or vaults that do not inspect the locations in some manner at some periodicity.

Inspection Activities/Corrective Actions

Questions 1a, 1b, and 1c: Has the licensee prepared an inspection plan for its buried piping and underground piping and tanks? Does the plan specify dates and locations where inspections are planned? Have inspections, for which the planned dates have passed, occurred as scheduled or have a substantial number of inspections been deferred?

Summary of responses for questions 1a, 1b, and 1c: Almost all of the plants completed inspection plans. At the time of the TI inspection some still had to enter dates and locations but were nearly complete. In general the plans specify dates and locations. In general plant/sites performed the inspections as scheduled. At the time of the TI Phase 2 inspections, some buried piping inspections were still pending but were on track for the December 31, 2014 due date. In a few cases, various examinations had been deferred due to modifications that affected the accessibility of the piping. In one case new information brought to the attention of the buried piping program owner (potential licensed material in piping system) caused inspections to be deferred until further information was obtained. A total of three inspections for this specific case were deferred.

Questions 2a, 2b, 2c, and 2d: Has the licensee experienced leaks and/or significant degradation in safety related piping or piping carrying licensed material since January 1, 2009? If leakage or significant degradation did occur, did the licensee determine the cause of the leakage or degradation? Based on a review of a sample of root cause analyses for leaks from buried piping or underground piping and tanks which are safety related or contain licensed material, did the licensee's corrective action taken as a result of the incident include addressing the cause of the degradation? Did the corrective action include an evaluation of extent of condition of the piping or tanks and possible expansion of scope of inspections? (Preference should be given to high risk piping and “significant” leaks where more information is likely to be available).

Summary of responses for questions 2a, 2b, 2c, and 2d: Of 62 plant sites, 33 reported that they had experienced leaks and or degradation of piping systems. In general, all plants sites were able to determine the cause of the leak. For some leaks that were minor in nature a risk analysis was performed and it was determined that the risk of excavating the pipe to determine the precise failure mode outweighed the benefits of discovering the failure mode. In general leaks and degradation did not rise to the level of risk or operational significance to warrant a root case analysis. In some cases, the licensee identified substantial degradation in other buried pipes and developed corrective actions to mitigate this piping. Of all of the apparent causes and root causes performed, approximately half of the plant sites performed an extent of condition analysis.

Questions 3a, 3b, 3c, and 3d: Based on a review of a sample of NDE activities which were either directly observed or for which records were reviewed, were the inspections conducted using a predetermined set of licensee/contractor procedures? Were these procedures sufficiently described and recorded such that the inspection could be reproduced at a later date? Were the procedures appropriate to detect the targeted degradation mechanism? For quantitative inspections, were the procedures used adequate to collect quantitative information?

Summary of responses for questions 3a, 3b, 3c, and 3d: Inspectors concluded that NDE was performed in accordance with procedures. The procedures were described in sufficient detail and recorded such that the inspection could be reproduced at a later date in all cases but one guided wave examination at one site. In that one instance the purchase order for the inspection by a third party did not require retention of some of the information that would be needed to reproduce the examination, but the examination did identify areas that required additional examinations using other techniques and procedures. The additional examination procedures were described in sufficient detail and recorded such that the inspection could be reproduced at a later date.

Question 4: Did the licensee disposition direct or indirect NDE results in accordance with their procedural requirements?

Summary of responses to question 4: The plants dispositioned direct or indirect NDE results in accordance with their procedural requirements.

Question 5: Based on a sample of piping segments, is there evidence that licensees are substantially meeting the pressure testing requirements of ASME Section XI IWA-5244?

Summary of responses to question 5: There is evidence that all licensees meet the pressure testing requirements of ASME Sections XI IWA-5244.