TEMPORARY INSTRUCTION 2515/177, REVISION 1

MANAGING GAS[1] ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS (NRC GENERIC LETTER 2008-01)

CORNERSTONE: MITIGATING SYSTEMS

APPLICABILITY: This Temporary Instruction (TI) applies to all holders of operating licenses for nuclear power reactors, except those who have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

2515/177-01 OBJECTIVE

The objective of this TI is to provide background information and guidance for inspectors to verify that the onsite documentation, system hardware, and licensee actions are consistent with the information provided in the licensee's response to United States Nuclear Regulatory Commission (NRC) Generic Letter (GL) 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems" (Reference 1). The Office of Nuclear Reactor Regulation (NRR) will review the licensee GL responses and proposed actions with respect to technical content and meeting the requirements of the GL. This TI requires NRC inspectors to selectively verify that the licensee has implemented or is in the process of acceptably implementing the commitments, modifications, and programmatically controlled actions described in the licensee's response to GL 2008-01. However, if in the course of reviewing the licensee's response to GL 2008-01, the inspectors identify an existing operability concern, then the operability concern should be assessed for appropriate regulatory significance using the same process that the inspectors would follow for any other operability concern.

2515/177-02 BACKGROUND

02.01 Technical Considerations. The NRC issued GL 2008-01 because of the continuance of gas accumulation events with significant safety implications. Examination of the problem established that previous corrective actions failed because they did not provide an overall, in-depth solution. Therefore, GL 2008-01 was issued to require licensees to submit information that covers all recognized technical and regulatory issues associated with gas accumulation in the subject systems. In addition, GL 2008-01 was issued to establish that the subject systems are operable when

[1] Use of "gas" in this Temporary Instruction includes any conditions where the subject system components are voided and are not water-solid. Note "gas" and "void" are often used interchangeably.

necessary and in compliance with the regulations, to address issues where confirmatory action is needed to assure operability and compliance, and to determine if additional regulatory action is required.

The root causes of gas accumulation include poor designs that allow gas introduction and accumulation, licensees failing to properly fill and vent the system following drain-down or maintenance, ineffective gas accumulation controls during operation, inappropriate technical specifications (TSs) regarding the scope and frequency of inspections for gas accumulation, and unanticipated problems with keep-full systems.

The objective of gas control measures is to limit the volume of gas accumulation to a quantity that does not jeopardize system operability. An acceptable volume depends on a variety of factors including, but not necessarily limited to, the location of the gas, the type and orientation of pumps, the net positive suction head (NPSH) margin, the gas volume fraction at the pump impeller, the potential for intact gas volume movement (slug flow), the flow rate, and the system backpressure effect on the pumps ability to clear the void.

The amount and location of gas are important in addressing system operability. This includes consideration of the following:

a. Sources and rate of generation of gases in systems, including ingestion of gas from tanks, air from system maintenance which may not be easily vented post maintenance, pipes such as pressurized water reactor (PWR) hot legs during shutdown operation, and recirculation sumps (vortexing).

b. Gas transport behavior as a function of location and system flow requirements.

c. Allowable limits on ingested gas volume in pump suction piping to reasonably ensure pump operability, as well as for the pump discharge piping to alleviate significant water hammer concerns such as slamming check valves or a water cannon effect on the piping[2] that could affect system operability.

d. Allowable limits on ingested gas volume to mitigate dynamic pressure pulsation.

e. Methods used to evaluate the impact of identified gas voiding if the acceptance criteria are exceeded.

f. The effectiveness of established routine venting.

g. Guidance to control gas formation at locations remote from a vent location.

h. Identification of parts of systems where venting is unnecessary, such as downstream of the containment spray isolation valve to the spray headers provided that there are no water traps in the piping that could result in a water hammer upon system initiation.

[2] A water cannon effect is the result of an interaction between a high velocity liquid stream when the stream encounters an object.

i. Identification of areas where entrained gas in fluid systems could go undetected.

j. Evaluation of gas detection and measurement techniques and associated accuracies.

In general, suction piping concerns involve gas that can potentially move into pump suctions and cause loss of functionality or operability. ECCS and RHR discharge piping concerns generally include water hammer and the potential effect of gas if injected into the reactor coolant system (RCS). The latter can usually be addressed via an approximate bounding approach that considers both forced and natural circulation in the RCS and the effect in such components as steam generator tubes as the RCS is depressurized.

Reference 2 provides criteria that address some of the allowable gas conditions. The criteria are believed to be conservative and, if the items being investigated are bounded by the criteria, then the items may be accepted by NRC staff members without further justification. Less conservative criteria may also be used if acceptable justification is provided.[3] Industry is continuing to investigate GL issues pertaining to gas movement and pump response and future revisions to these criteria are anticipated as new information is obtained. NRR's assessment report that evaluates the licensee's responses to the GL will identify the latest version of Reference 2.

With respect to acceptable voids, a surveillance requirement (SR) that a system be "filled with water" or "full of water" is not the same as "water solid." This is clarified in Reference 3 which states "When voids are discovered in piping, if the licensee can establish through an operability determination that there is a reasonable expectation that the system in question will perform its specified safety function, the system piping can be considered filled with water such that the surveillance requirement is met." Voids that meet the Reference 2 criteria may be assumed to meet this requirement.

02.02 Regulatory Considerations. The regulations in Appendix A to Title 10 of the Code of Federal Regulations (10 CFR Part 50), "General Design Criteria for Nuclear Power Plants," or similar plant-specific principal design criteria provide design requirements, and Appendix B to 10 CFR Part 50, plant TSs, and licensee quality assurance programs provide operating requirements. Requirements applicable to gas management in the subject systems include the following:

a. Appendix A, General Design Criterion (GDC) 1, requires that the subject systems be designed, fabricated, erected, and tested to quality standards.

b. Appendix A, GDC 34, requires a residual heat removal (RHR) system.

c. Appendix A, GDC 35, 36, and 37, require an emergency core cooling system (ECCS) design that meets performance, inspection, and testing requirements.

[3] Some of the criteria provided by industry are non-conservative and unacceptable. For example, industry has provided criteria for conditions that are stated will not cause pump damage. These do not address such conditions as several seconds with no water entering the pump and, further, some licensees have used the criteria to conclude that acceptable conditions exist without addressing conditions where operability or functionality is lost but the pump is not damaged.

The regulations in 10 CFR 50.46 provide specified performance criteria.

d. Appendix A, GDC 38, 39, and 40, require a containment heat removal system design that meets performance, inspection, and testing requirements.

e. Appendix B, Criteria III and V, require measures to ensure that regulatory requirements and the design basis are correctly translated into controlled specifications, drawings, procedures, and instructions. Criterion III also requires the verification of the adequacy of the design via test or analyses.

f. Appendix B, Criterion XI, requires a test program to ensure that the subject systems will perform satisfactorily in service. Test results shall be documented and evaluated to ensure that test requirements have been satisfied.

g. Appendix B, Criterion XVI, requires that conditions adverse to quality are promptly identified and corrected, and that the cause of the condition is determined and corrective action is taken to preclude repetition for significant conditions adverse to quality.

h. Appendix B, Criterion XVII, requires maintenance of records of activities affecting quality.

i. Licensees have committed to quality assurance provisions that are identified in TSs and quality assurance programs and that use guidance of Regulatory Guide (RG) 1.33, Revision 2, which endorses American National Standards Institute (ANSI) N18.7-1976/American Nuclear Society 3.2, or equivalent licensee-specific guidance. Section 5.3.4.4 of ANSI N18.7 states that procedures for monitoring performance of plant systems shall be required.

j. Federal Register Notices 58 FR 39132 and 60 FR 36953 provide the final Commission policy statement on TSs for 10 CFR 50.36. 10 CFR 50.36(d)(3) defines TS SRs as "relating to test, calibration, or inspection to assure" maintenance of quality, operation within safety limits, and operability.

k. 10 CFR 50.73, "Licensee Event Reporting System," requires reporting of an event if it occurred within three years of the date of discovery and identifies such items as "procedural errors, equipment failures, and/or discovery of design, analysis, fabrication, construction, and/or procedural inadequacies."

02.03 Additional Information.

GL 2008-01 and information that was provided during training will provide additional information covering the background, event history, and technical and regulatory considerations applicable to the subjects addressed by this TI.

2515/177-03 INSPECTION REQUIREMENTS

General Guidance.

This TI does not specify which regional organization is responsible for implementation. Assignment of inspection personnel is a regional decision. See Section 10.03.

The systems addressed in the GL were selected because they were important with respect to gas issues. However, there are other safety related and non-safety related systems that are not addressed in the GL or the TI where gas can jeopardize system operability. For example, auxiliary feedwater (AFW) issues are identified in Information Notice 2007-18, "Operating Experience Regarding Entrainment of Gas or Debris into Auxiliary Feedwater Systems." Our expectation is that licensees will apply the lessons learned from addressing the GL to other potentially affected systems. Inspectors, at their option, may pursue potential gas issues in any potentially affected system during their normal inspection functions.

GL 2008-01 identified the four principal concerns which were the focus of the GL as (1) the licensing basis, (2) design, (3) testing, and (4) corrective actions. Guidance to licensees for preparation of the requested nine-month responses and many of the licensee responses are organized to address each principal concern. The first step in the formal investigation of the nine-month responses is an NRR assessment that follows the same organization for consistency.[4] This NRR assessment will address the information provided by the licensees to support a conclusion that there is a reasonable assurance that the subject systems are and will remain operable. The inspection addressed in this TI is to verify that (1) plant-specific information is consistent with the information used by NRR in its assessment, and (2) plant-specific information supports a conclusion that subject systems operability is reasonably ensured.

In its GL assessment report of the licensee's response to the GL request for information, NRR will provide guidance regarding the scope of the inspection as part of its assessment of the GL submittals, but there is no intent to restrict the inspector's freedom to pursue any inspection scope that is considered warranted to complete the verification. The actual depth of the inspection will be flexible and is a regional decision that should consider NRR's guidance and the region's assessment of the licensee's status with respect to the issues identified in the GL. Essentially, the inspectors should verify enough items to support their conclusion that, with respect to plant-specific information, Items (1) and (2) at the end of the above paragraph have been verified. We anticipate that some inspections will be minimal or perhaps unnecessary; a conclusion that will allow inspection resources to be concentrated on licensee plants where significant issues have been identified and in-depth inspections are necessary.

[4] Many licensees will submit supplemental reports to address issues that were not complete when the nine month report was submitted. Typically, these will include the results of walkdowns where an outage was necessary to complete the walkdown. The NRR assessment report will include coverage of the supplemental reports if they are available at the time of NRR's assessment.

Specific Requirements.

03.01 Licensing Basis. Verify that selected licensing basis documents that have not been provided on the docket but are available at the plant site are consistent with the NRR assessment report and have been acceptably processed by the licensee.

03.02 Design. Verify that selected design and operating characteristics are acceptably addressed.

03.03 Testing. Verify that the licensee has approved and is using selected procedures for (1) void surveillances and testing associated with power operation, shutdown operation, maintenance, and subject system modifications and (2) void determination and void elimination methods.

03.04 Corrective Actions. Verify that selected corrective actions described in the licensee's nine-month and supplemental submittals are acceptably documented including completed actions, a list of incomplete actions with an accompanying completion schedule and verification that commitments are acceptably included and dispositioned in the corrective action program (CAP) with appropriate consideration of extent of conditions and actions to prevent recurrence.

2515/177-04 INSPECTION GUIDANCE

General Guidance.

The inspection addressed in this TI is to verify that plant-specific information supports a conclusion that subject systems operability is reasonably assured.

NRR is assessing licensee responses to the GL request for information. Training of regional personnel to support the TI inspections was completed in June, 2009.

The depth of inspection will vary from plant to plant depending in part on NRR's assessment of the acceptability of each licensee's response to the GL request. Some licensees are expected to need little or no follow-up inspection because they will have demonstrated an in-depth understanding of the issues and have acceptably addressed them. Other licensees will need a more comprehensive inspection to conclude they have achieved the goal of assuring subject system operability. NRR will provide inspection guidance in its assessment reports and during training. In some cases, the NRR guidance will recommend that some of the inspection items identified in Section 04 be relaxed or eliminated. As is the case for all aspects of this TI, inspectors have flexibility to address areas where they judge inspection is needed.

The Section 03 Specific Requirements are generally to verify "selected" items. The inspectors should verify enough items to support their conclusion that, with respect to plant-specific information, (1) subject system operability is reasonably assured, (2) any information that has not been provided by the licensee in response to GL 2008-01 that is identified in NRR's assessment report is fully described in the CAP or commitments, and (3) such information is confirmatory.

Inspectors may find it necessary to walk down parts of the subject systems to accomplish the verifications. Entry into containment at power or entry into plant areas where radiation levels are high is not necessary under this TI. Such inspection activities can be scheduled at appropriate times when environment conditions are acceptable and consistent with ALARA guidance. Walkdowns may also involve inspection of piping that is covered with insulation. In some cases, licensees may have removed insulation to obtain pipe slope measurements and then replaced the insulation. In other cases, the licensee may have opened holes in the insulation to obtain insulation thickness measurements to enable it to correlate pipe geometry to the outside of the insulation where visible measurements were made. In such cases, it will not normally be necessary to remove the insulation for the inspection if the licensee has acceptably documented its activity. In other cases, piping may be buried or may pass through penetrations where it is not practical to remove insulation or to perform a visual inspection. In these cases, it may be helpful to examine alternate locations but, in the end, inspectors should use their judgment to determine the acceptability of the licensee's evaluation. Finally, NRR will assess information provided by the licensees in response to the GL request, and will document this assessment in its review of the licensee's GL responses to provide additional guidance.

Specific Guidance.

04.01 Licensing Basis.

Licensing basis verification should include verification of an inspector-selected sampling of the following documents when they have been changed in response to the GL:

a. TS Bases.

b. The updated final safety analysis report (UFSAR).

c. Licensee controlled documents and bases, such as the Technical Requirements Manual (TRM).

Where applicable, verification of the selected documents may include:

a. That selected documents that describe the plant and plant operation, such as calculations, P&IDs, procedures, and CAP entries, acceptably address the areas of concern and have been acceptably changed if needed following plant changes.

b. Confirmation that one or more surveillance procedures require surveillances that are at least as frequent as required by TSs or the TRM.

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The inspection should also verify that the commitment to evaluate and implement the applicable changes that will be contained in the technical specification task force (TSTF) traveler is consistent with the commitment described in NRR's assessment report and that it acceptably addresses any comments provided by NRR.

04.02 Design.

The purpose of this section's inspection is to verify that design and design documentation is consistent with reasonably assuring that the subject systems are operable consistent with applicable requirements. This purpose will be realized by the inspectors selectively addressing the following items in a detail consistent with (1) guidance in NRR's assessment reports and (2) their knowledge of the licensee's plant and operations:

a. Verify that the licensee has isometric drawings that describe the subject system configurations, select one or more drawings that describe regions where voids may accumulate, and verify that the licensee has acceptably confirmed the accuracy of the drawings.

    1. High point vents are identified.

    2. High points that do not have vents are acceptably recognizable.

    3. Other areas where gas can accumulate and potentially impact subject system operability, such as at orifices in horizontal pipes, isolated branch lines, heat exchangers, improperly sloped piping, and under closed valves, are acceptably described in the drawings or in referenced documentation. Note that some keep-full systems have been ineffective due to gas trapped at orifices. Also note that small gas accumulations are not of concern if located in regions such as valve bonnets where the gas may be beneficial to prevent thermal binding or at locations that do not potentially impact subject system operability.

    4. Horizontal pipe centerline elevation deviations and pipe slopes in nominally horizontal lines that exceed specified criteria should be identified. Note the licensee should have an acceptable rationale to support its criteria.

    5. All pipes and fittings are clearly shown. Note this is important because even small sampling or instrumentation lines can potentially challenge subject system operability by becoming a gas leakage path or affecting instrumentation calibration.

    6. The drawings should be up-to-date with respect to recent hardware changes. Any discrepancies between as-built configurations and the drawings should be documented and entered into the CAP for resolution,

b. Verify that one or more Piping and Instrumentation Diagrams (P&IDs) accurately describe the subject systems. The P&IDs should be up-to-date with respect to recent hardware changes. Any discrepancies between as-built configurations, the isometric drawings, and the P&IDs should be documented and entered into the CAP for resolution.

c. Licensee walkdowns should provide confirmation that system orientations and vents, in combination with TS, SRs, TRM instructions, procedures, and training, will ensure that each system is sufficiently full of water to be operable when operability is required. Unless NRR found a delay to be acceptable, walkdowns should have been completed for (1) accessible piping that is uninsulated, does not require scaffolding for access, is outside containment, and is not located in high radiation or hazardous areas and (2) all areas by the end of the first refueling outage that was initiated after October 14, 2008[5]. For item (2) walkdowns, a supplemental report should have been submitted to NRC within 90 days of startup from the outage and NRR plans to assess that report as part of its assessment of the licensee's nine-month report or within 90 days of the submittal, whichever occurs later.

1. The inspectors should verify that walkdowns have been completed or that plans are in place for walkdown completion consistent with the above discussion.

2. If walkdowns are incomplete, the inspectors should verify that the licensee has established a walkdown schedule and provided written justification for acceptable system operation without having completed the walkdowns.

3. The inspectors should selectively verify that information obtained during the walkdown(s) is consistent with items identified in Items a and b, above, and is acceptably addressed in procedures, the CAP, and training.

d. Conduct one or more walkdowns of selected regions of one or more subject systems in sufficient detail to reasonably assure the acceptability of the licensee's walkdowns. The following guidance may be useful in verifying the results of the licensee walkdowns:

1. The guidance provided in the last paragraph of Section 04, General Guidance.

2. It is not necessary that the licensee remove pipe insulation to determine pipe slope if the insulation is tightly wrapped and in good condition or the insulation thickness has been acceptably determined by such methods as boring holes and measuring insulation thickness.

3. It is not necessary for the licensee to walk down sections of piping that are usually void such as a containment spray discharge pipe that is downstream of a containment spray system discharge valve provided the pipe configuration has been acceptably established as not having traps where water could accumulate that could cause a water hammer concern.

4. In selecting regions for inspection walk down, consider potential areas where gas may accumulate that the licensee may not have acceptably addressed.

[5] The original date was October 11, 2008. We are using October 14, 2008 to be consistent with the regulations that allow a delay when the specified date falls on a weekend or holiday.

5. Licensee walkdowns should have determined that high point vents are correctly installed to vent piping and component high points. Vents have been found that were on the low elevation end of sloped pipes and that were located on the bottom of pipes so that they were drains rather than on the top where they would be vents – conditions that were not identified in the isometric drawings.

6. Licensee walkdowns should have identified the high points that are not vented. The licensee's response to such identifications should be described in the licensee's walkdown report which should (1) establish that gas will not accumulate at such high points or (2) reference a surveillance procedure that ensures acceptable void monitoring and a procedure that acceptably addresses void reduction should void reduction be necessary to ensure meeting acceptance criteria. If the second item applies, the licensee should either justify not conducting a corrective action or should have entered a corrective action in the CAP.

e. While considering guidance provided by NRR's assessment report, verify that the licensee has acceptably identified the gas intrusion mechanisms that apply to the licensee's plant and, where the licensee's evaluation is incomplete, that corrective actions have been placed into the CAP. The following areas of potential gas intrusion are examples of areas for consideration:

1. Leakage from accumulators or other high-pressure sources can result in gases coming out of solution.

2. Leakage from the RCS can result in the formation of steam pockets or hydrogen coming out of solution.

3. Dissolved gas can come out of solution due to a pressure reduction such as through control valves, orifices, and ECCS sump screens, or because of elevation changes or venting.

4. Inadvertent draining, system realignments, and incorrect maintenance and testing procedures can result in gas intrusion.

5. Air in-leakage can occur through system pathways which allow drain-back to the system.

6. Failure of level instruments to indicate the correct level for tanks used as a pump suction source can result in gas intrusion.

7. Leakage through multiple in-series isolation valves or through multiple in-series check valves can result in gas transport from the intrusion location to other locations.

8. Leakage through vent valves can occur when the local system pressure is less than the nominal atmospheric vent pressure.

9. Temperatures at or above saturation temperature can occur due to heat conduction through piping connected to the RCS, due to leakage of RCS fluid through isolation valves, and by fluid circulation in connecting pipes that contain higher temperature fluid even if the elevation of the higher temperature pipes is greater than the pipes in the subject systems.

10. Gas can be introduced from suction sources due to formation of air entraining vortices if sufficient level is not maintained to prevent this occurrence.

11. Gas may be introduced from air-operated valves if leakage can potentially occur from the air region into subject systems.

f. Selectively verify that the licensee's void acceptance criteria are consistent with NRR's void acceptance criteria[6] or, if NRR's acceptance criteria are not met, then verify that the licensee has justified the deviations. In assessing void acceptance criteria, confirm that the licensee addressed the effect of pressure changes during system startup and operation since such changes could have significantly increased the void fraction from the initial value. The range of flow conditions evaluated by the licensee should be consistent with the full range of design basis and expected flow rates for various break sizes and locations.[7] Typical areas to consider when conducting the verification include the following:

1. Pump suction piping.

2. Pump discharge piping

3. Pump response to ingested gas with respect to damage, developed head, NPSH, and operability.

4. Impact of injecting gas into the RCS.

5. Provision of calculation methodologies to correlate voids and void acceptance criteria throughout the subject system piping with (1) voids entering pumps so that pump void acceptance criteria are met and (2) void movement associated with water hammer concerns.

6. Provision of void acceptance criteria throughout the subject system piping or provision of bounding criteria.

7. Provision of water hammer analysis methodologies. Note that the maximum water hammer may occur at a void volume intermediate between no void and a large void as well as when more than one void exists in the piping.

[6] The current criteria were provided in Reference 2 at the time of writing this TI. The most current criteria will be identified in NRR's assessment report covering the licensee's nine-month GL response.

[7] Design basis flow rates may not be limiting when assessing void transport and pump response since the design basis addresses bounds with respect to RCS, core, and related systems performance. Actual operations may result in different behavior than addressed by the design basis analyses.

g. Selectively verify the acceptability of the licensee's review of applicable documents, including calculations, engineering evaluations, and vendor technical manuals, with respect to gas accumulation in the subject systems. Typically documents will address:

1. Venting requirements.

2. Keep-full systems.

3. Aspects where pipes are normally void such as some spray piping inside containment.

4. Void control during system realignments due to actuations and tests.

5. The effect of debris on strainers in containment emergency sumps causing accumulation of gas under the upper elevation of strainers and the impact on NPSH requirements. Part of the concern is the potential that gas may accumulate below strainers due to a differential pressure that induces outgassing. In addition to affecting NPSH margin, if sufficient gas accumulates, it could move as a slug into the pipe suction piping.

04.03 Testing.

Verify that selected procedures are acceptable for (1) testing associated with power operation, shutdown operation, maintenance, and subject system modifications, (2) void determination and elimination methods, and (3) post-event evaluation.

a. Unless NRR's assessment report recommends otherwise, review one or more procedures used for conducting surveillances and determination of void volumes to reasonably ensure that the void criteria discussed in Section 04.02.f are satisfied and will be reasonably ensured to be satisfied until the next scheduled void surveillance. Areas to consider when conducting the verification are identified in Sections 04.03.c through 04.03.f.

b. Unless NRR's assessment report recommends otherwise, review one or more procedures used for filling and venting following conditions which may have introduced voids into the subject systems to verify that the procedures acceptably address testing for such voids and provide acceptable processes for their reduction or elimination. Areas to consider when conducting the verification are identified in Sections 04.03.c through 04.03.f.

c. General Considerations

1. Gas intrusion prevention, refill, venting, monitoring, trending, evaluation, and void correction activities are acceptably controlled by approved operating procedures.

2. Procedures should reasonably ensure the system does not contain voids that may jeopardize operability.

3. Procedures should reasonably establish that the void criteria discussed in Section 04.02.f are satisfied and will be reasonably ensured to be satisfied until the next scheduled void surveillance.

4. The licensee should have reviewed, updated, and verified applicable void control procedures including their application. This includes licensee verification that procedures exist to (1) vent locations where gas may accumulate that can be removed by existing vent valves and (2) when necessary, such as after system draindown or if the geometry can result in gas accumulation, ensure venting of instrument lines, including the backfilling of level and flow transmitters.

5. The licensee should enter changes into the CAP as needed to ensure acceptable response to issues. A clear schedule for completion should be included if CAP entries have not been completed.

6. Procedures should include independent verification that critical steps have been completed.

d. Surveillance and Void Detection

1. At a minimum, specified surveillance frequencies should be consistent with TS SR requirements.

2. Surveillance frequencies should be specifically stated or the process for their determination should be described when they are to be conducted more often than required by TSs.

3. Surveillances may be conducted by ultrasonic testing (UT), venting, or by other methods when the other methods are acceptably established to achieve the needed accuracy. At this time we are not aware of other methods that have been shown to achieve a stated uncertainty or accuracy.

4. Surveillance procedures should include up-to-date acceptance criteria.

5. Procedures should include effective follow-up actions when acceptance criteria are exceeded or when trending indicates that criteria may be approached before the next scheduled surveillance. Exceeding acceptance criteria requires an immediate operability assessment and/or declaration of inoperability. Entry into a CAP is suggested. It is not sufficient to simply forward results to someone in the licensee's organization without a requirement that corrective action will be taken.

6. Measured void volume uncertainty should be considered when comparing test data to acceptance criteria.

7. Venting procedures and practices should utilize criteria such as adequate venting durations and observing a steady stream of water.

8. An effective sequencing of void removal steps should be followed to ensure that gas does not move into previously filled system volumes.

9. Qualitative void assessment methods are acceptable if expectations are that the void will be significantly less that allowed by acceptance criteria; otherwise, quantitative methods of acceptable accuracy are necessary.

10. Licensees should trend periodic venting results to confirm that the systems are sufficiently full of water and that the venting frequencies are adequate. Records on the quantity of gas at each location should be maintained and trended as a means of preemptively identifying degrading gas accumulations. Note that gas quantities well below the acceptance criteria may be described in qualitative terms.

11. Surveillances should be conducted at any location where a void may form, including high points, dead legs, and locations under closed valves in vertical pipes.

12. The licensee should ensure that systems are not pre-conditioned by other procedures that may cause a system to be filled, such as by testing, prior to the void surveillance.

13. Routine sampling of vented gas for analysis is not required. However, procedures should include gas sampling for unexpected void increases if the source of the void is unknown and sampling is needed to assist in determining the source.

e. Filling and Venting

1. Revisions to fill and vent procedures to address new vents or different venting sequences should be acceptably accomplished.

2. Fill and vent procedures should provide instructions to modify restoration guidance to address changes in maintenance work scope or to reflect different boundaries from those assumed in the procedure.

f. Void Control

1. Void removal methods such as venting, dynamic void removal, and vacuum refill should be acceptably addressed by approved procedures. For example, dynamic methods may be used to remove voids in lieu of venting if they have been established to be effective by test or by acceptable analyses.

2. A gas-related event in which pump acceptance criteria are exceeded when gas enters the suction of an operating subject system pump requires follow-up to reasonably ensure the pump has not been damaged. It may not be sufficient to test the pump and check for pump vibration because these steps are not always sufficient to reasonably establish that the pump was not damaged.

04.04 Corrective Actions. The inspection should verify that selected corrective actions identified in the licensee's nine-month and supplemental reports are acceptably documented. This includes completed actions, a list of incomplete actions with an accompanying completion schedule, and verification that commitments are acceptably included in the CAP.

A purpose of the NRR review and this TI is to reasonably assure that the subject systems are operable when this condition is required by applicable regulations and the design basis. The only items that have not been completed at the time of the inspection under this TI are anticipated to be walkdowns, associated follow-up activities that should be fully described in the licensee's CAP[8], and a few remaining actions that are also described in the licensee's CAP. If the inspection concludes that the licensee is expected to acceptably complete incomplete items and the information to be incorporated into the licensee's design basis and operations is confirmatory, then the TI inspection will have been completed and any follow-up inspection can be accomplished as part of the regularly scheduled Regional / Resident Inspector activities. If these conclusions are not achieved, then the TI must remain open and additional inspection will be necessary using this TI.

The following items are provided for inspector consideration in conducting the corrective actions inspection:

a. Corrective actions should be selectively reviewed for completeness and timeliness.

b. The CAP should identify needed procedures and should provide a schedule for change completions and implementations.

c. The CAP should address installation of new vent valves and modification of existing vent valves.

d. The CAP should address needed calculation revision.

e. The acceptability of the licensee's methods for evaluation of previously unidentified void accumulations should be acceptably addressed.

f. The accuracy of the summary and description of the CAP provided in the nine-month response should be verified.

[8] Long term topics such as improved void acceptance criteria based on fluid flow and pump tests, the TSTF, and TS improvements should be covered in licensee commitments but follow-up inspection of these topics is outside the scope of this TI.

g. The inspection should verify the list of evaluation items that have not been completed in each of the above Section 04 categories and assess the acceptability of the completion schedule and the basis for the schedule. The list should include improved pump void acceptance criteria and void transport analyses. A decision process should be in force to address response to discovery of voids.

h. The licensee should have a list of actions that were completed in response to GL 2008-01 that is available to NRR for NRR assessment of the success of the GL in addressing the issues associated with gas accumulation.

i. The licensee should have a design control program that incorporates design change review checklists that establish if the design change introduces or increases the potential for gas accumulation beyond established acceptance criteria.

2515/177-05 REPORTING REQUIREMENTS

Document inspection results including findings, if applicable, in a resident inspectors' integrated inspection report (i.e., quarterly inspection report) and send a copy of the applicable sections via e-mail to Diana.Woodyatt@nrc.gov, Warren.Lyon@nrc.gov, David.Beaulieu@nrc.gov, and the NRR Project Manager for the inspected licensee that addresses the Section 2515/177-03 inspection items and summarizes the inspection findings.

2515/177-06 COMPLETION SCHEDULE

NRR reviews of licensee nine-month responses to GL 2008-01 are scheduled to be completed by 06/30/2011. NRR reviews of supplemental licensee responses to the GL are scheduled to be completed within 90 days of receipt of the licensee response or at the time of completion of the review of the nine-month response, whichever is later. The inspection should be completed by 12/31/2012.

2515/177-07 EXPIRATION

This TI will expire on 6/30/2013.

2515/177-08 CONTACT

For questions regarding performance of this TI or emergent issues, contact Diana Woodyatt at 301-415-8583 or Diana.Woodyatt@nrc.gov, Warren Lyon at 301-415-2897 or Warren.Lyon@nrc.gov, or Gregory Cranston at 301-415-0546 or Gregory.Cranston@nrc.gov.

2515/177-09 STATISTICAL DATA REPORTING

All direct inspection effort expended on this TI is to be charged to 2515/177 with an IPE code of TI. All indirect inspection effort expended on this TI for preparation and documentation should be attributed to activity codes TIP and TID respectively.

2515/177-10 ORIGINATING ORGANIZATION INFORMATION

10.01 Originating Organization. This TI was initiated by the Reactor Systems Branch (NRR/DSS/SRXB).

10.02 Resource Estimate. The estimated direct inspection effort for the NRC Regions to perform the inspection requirements listed in this TI will vary from minimal effort because the licensee has established that a follow-up inspection is not necessary to a maximum of approximately 100 hours per unit. NRR will provide guidance in its assessment of the licensee's GL response.

10.03 Training. A minimum of IMC 1245 App A (Basic Inspector) qualification is required. Specialized training will be provided by DSS during June, 2009. If specialized technical support is needed during the inspection, contact Diana Woodyatt at 301-415-8583 or Diana.Woodyatt@nrc.gov, Warren Lyon at 301-415-2897 or Warren.Lyon@nrc.gov, or Gregory Cranston at 301-415-0546 or Gregory.Cranston@nrc.gov .

2515/177-11 REFERENCES

1. "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," NRC Generic Letter 2008-01, ML072910759, January 11, 2008.

2. "Revision 2 To NRC Staff Criteria For Gas Movement In Suction Lines And Pump Response To Gas," ML090560528, March 26, 2009. Note revisions are expected as additional information is obtained by industry and made available to NRR.

3. "Task Interface Agreement - Emergency Core Cooling Systems (ECCS) Voiding Relative to Compliance with Surveillance Requirements (SR) 3.0.1.1, 3.5.2.3, and 3.5.3.1 (TIA 2008-03)," ML082560209, October 21, 2008.

END

Attachment 1 – Revision History Page

Attachment 1

Revision History for Temporary Instruction 2515/177, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems (NRC Generic Letter 2008-01)"

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	06/09/09 CN 09-014	This is a new document issued for inspections related to Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems." Completed 4 year historical CN search and found none.	Yes – VTC a presentation from headquarters to the regions by Reactor Systems Branch Staff.	June 2009	ML091540482
N/A	Rev. 1 03/17/10 CN 10-009	Updated sections 4, 6, and 7 to reflect completed regional training as well as revised schedule to review GL 2008-01 responses.	No	N/A	N/A