Appendix J Program Owner's Group (APOG) Document
10CFR50 Appendix J Option B
Integrated Leakrate Test (ILRT) User's Guide
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PREPARED BY: Po Chang

CONTRIBUTORS: Bob Copeland
Jim Glover
Gregg Joss
Frann Rich
Bob Shirk
George Van Wert

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APOG Steering Committee Sponsor
Gregg Joss

ILRT User's Guide Working Group Members
Po Chang
Bob Copeland
Jim Glover
Frann Rich
Bob Shirk
George Van Wert

1. Objective

The objective of this document is to provide guidance for the process of planning and implementing a station's ILRT. It is assumed that the test will be performed under 10CFR50 Appendix J, Option B requirements.

Topics discussed include responsibilities of various personnel, ILRT scope and objectives, long range planning items, mid range planning items, short range planning items, and ILRT Implementation. Attachment 1 provides a list of planning activities, which are discussed in details in the main body of this guide, for the ILRT with recommended time frames. Adherence to this guidance will optimize the station's success and minimize unexpected problems that may be encountered in performing an ILRT.

2. Responsibilities

Ensure responsibilities for an ILRT are clearly defined. The following are typical for most power plants.

Site Engineering Program Manager

- Ensure funding is included in the station budget to perform ILRT.
- Ensure station resources are committed to performing an ILRT. Allocating resources as needed to effectively plan and implement an ILRT
- Ensure appropriate reviews are performed
- Responsible for all aspects of the ILRT
- Ensuring that activities associated with the ILRT are performed in a timely and cost efficient manner

Site Appendix J Program Engineer

- Overall site Appendix J Program Owner
- Maintains Type A, B, and C test data and reports (or designee)
- Coordinates test equipment with designated contractor (or designee)
- Maintains knowledge of industry practices, changes and events
- Represents Appendix J Program at working group meetings

> NOTE: The Site Appendix J Program Engineer may also serve as the ILRT Test Coordinator. However, it is strongly recommended that another experienced site engineer is assigned this responsibility or that the Appendix J Program Engineer duties be re-assigned to allow focus on the ILRT planning and implementation.

ILRT Test Coordinator

- Ensuring necessary surveillance/test procedures are developed
- Coordinating ILRT activities with appropriate station organizations

Site Operations Manager

- Providing resources to control plant conditions during conduct of the ILRT
- Providing a dedicated SRO (Senior Reactor Operator) on shift for operational ownership of the test and to work closely with the ILRT Test Coordinator.

Site Maintenance Manager

- Providing resources to implement ILRT prerequisites
- Providing corrective maintenance as required

Regulatory Assurance Supervisor

- Responsible for developing and submitting FSAR and Technical Specification changes as required

Work Control Manager

- Responsible for scheduling ILRT and ILRT prerequisite activities
- Responsible for coordinating work plans to implement ILRT prerequisite activities determined by the ILRT Test Coordinator.
- Responsible for coordinating work control strategy determined by the ILRT Test Coordinator during conduct of ILRT

Corporate Appendix J Program Engineer

Note: For sites that do not have Corporate Appendix J Program Engineer, these responsibilities belong to the Site Appendix J Program Engineer.

- Provides technical support for ILRT
- Interface with industry on ILRT issues
- Provide technical interpretation of ILRT requirements

3. ILRT Scope and Objectives

The objective of the ILRT is to demonstrate the containment system overall integrated leakage rate is acceptable under conditions representing design basis loss-of-coolant accident peak pressure to ensure that the integrity of the containment structure is maintained during its service life. The containment system means the principal barrier, after the reactor coolant pressure boundary, to prevent the release of quantities of radioactive material that would have a significant radiological effect on the health and safety of the public. The overall integrated leakage rate means the total leakage through all tested leakage paths, including containment welds, valves, fittings, and components that penetrate the containment system.

All Appendix J pathways must be properly drained and vented during the performance of the ILRT with the following exceptions:

- Pathways in systems that are required for proper conduct of the Type A test or to maintain the plant in as safe shutdown condition during the Type A test.

- Pathways in systems that are normally filled with fluid and operable under post-accident conditions.

- Portions of the pathways outside primary containment that are designed to Seismic Category I and at least Safety Class 2.

- For planning and scheduling purpose, or ALARA considerations, pathways that are Type B or C tested within the previous 24 calendar months need not be vented or drained during the Type A test.

The as-found and as-left leakage rate for all pathways that are not drained and vented must be determined by Type B and Type C testing and added to the Type A leakage rate upper confidence limit (UCL) to determine the overall L_a surveillance acceptance criteria.

4. Long Range Planning Items

The ILRT is typically a critical path evolution during a station's scheduled refueling outage. The critical path can be adversely impacted if planning activities are not conducted carefully, contingencies are not identified, or personnel are not prepared to perform the required activities. This section will discuss long-range activities that should be performed three to five years prior to the scheduled ILRT outage.

ILRT Included in Station Budget

The process of performing an ILRT requires a significant investment by the station. The process involves significant resources for revising the ILRT procedure(s) including valve lineup, developing a project plan and project High Impact Team (HIT), identifying required work orders, and performing other prerequisite/planning items discussed in this guide. These document(s) need to be revised to reflect the changes in Option B to 10CFR50 Appendix J. The last ILRT may have been performed more than 10 or 15 years ago. Knowledge of the changes and current industry practices is required to perform the procedure update. Because this is a specialized area of expertise and requires a significant amount of time to perform the procedure(s) revision, stations may elect to contract this work. A thorough review of the revised document(s) to ensure accuracy and completeness is also required. Most station's applicable Appendix J Program Engineer or ILRT Coordinator performs this review, although other knowledge personnel can perform the reviews. In addition, most stations will need to rent pressurization equipment (100% oil-free air compressors, air dryers, aftercoolers, hoses, piping, manifold), calibrated ILRT instrumentation, and computer hardware/software to perform the test. Experienced contracted personnel will also normally be required to assist in preparing and performing the ILRT.

Each station needs to ensure that budget and resources are allocated to perform the ILRT. Station resources that need to be allocated for the ILRT include the Appendix J Program Engineer/ILRT Coordinator, Operations personnel for valve lineups, and Mechanical, Electrical, and I&C personnel for performance of prerequisite activities. Budget funds also need to be allocated for contract support and equipment rental. Based on station budget processes, ensure that the ILRT cost forecast is included. The ILRT should be included in the budget three to five years prior to the actual outage in which it will be performed.

The station needs to ensure the ILRT resources will be dedicated to this project until the ILRT is completed. Failure to dedicate sufficient manpower or replacing ILRT personnel during the project could seriously jeopardize the successful completion of the ILRT.

Scheduling ILRT off Normal Refuel Cycle

Occasionally a refuel outage is very heavy on secondary side work (turbine, generator, station transformers, etc) and primary side including containment is NOT on the critical path for the outage. In this case it is worth considering pulling the ILRT up into the outage to allow performing the ILRT off critical path. Since the major cost of performing the ILRT is the replacement power costs, it only makes sense to perform the test when these costs are being incurred for other reasons.

Containment cuts for steam generator or head replacements may only require testing via LLRTs and a full pressure test for structural concerns. If a containment full pressure test is being scheduled, consider taking the remaining steps and performing an ILRT even if one is not yet required by the schedule. When considering, look ahead and postulate the remaining ILRT schedule based on a 15 year maximum test interval and a 20 year license renewal to determine the number of remaining ILRTs. If doing the ILRT early does not increase the number of remaining tests, it may make financial sense to schedule the ILRTs early. Pressurization and depressurization account for approximately half the duration of the ILRT timeline. This decision is not clear cut as a future refuel outage may have non-critical path time available for the ILRT. Get help in reviewing this option.

Modifications

The ILRT consists of pressurizing the containment to its design basis accident pressure, stabilizing the containment atmosphere, measuring the integrated containment leakage rate, verifying the measured integrated leakage rate, and depressurizing the containment. The minimum times required to stabilize, measure, and verify are regulatory driven and cannot be reduced below the regulatory minimums. Thus, the only phases of the ILRT where times can be reduced are in pressurizing and depressurizing the containment. The pressurization time can be reduced if sufficient compressor capacity is used and the pressurization flow path is large enough to accommodate the capacity. Similarly, depressurization time can be reduced if a large enough pathway or multiple pathways exist. Current industry practice, depending on containment size (net free volume) is to pressurize the containment at rates of approximately 5-10 psi per hour and to depressurize containment at rates of *approximately* 10-15 psi per hour. It may be necessary to implement modifications in order to achieve these rates. Spare penetrations may be available that could be used for pressurization or depressurization. This needs to be identified and planned far enough in advance to plan, design, and schedule any needed modifications.

5. Mid Range Planning Items

This section will discuss mid range activities that should be performed two to three years prior to the scheduled ILRT outage.

Performing ILRT at Beginning vs. End of Outage

This can only be exercised if the beginning of outage option is not taken away due to containment being cut for steam generator replacement or other post maintenance/modification test requirements that require an ILRT.

Industry Experience:

PWRs
Most PWRs elect to perform end of outage ILRTs. However, since 1991, at least 12 beginning of outage ILRTs (see Attachment 2) have been successfully performed. Therefore, there is no reason to believe that a beginning of outage ILRT cannot be performed routinely and successfully at a PWR. If your facility is considering this option, particularly for the first time, it is advisable to discuss with the PWRs listed in Attachment 2 for input.

BWRs
Under 10 CFR50, App J, Option A, beginning of outage ILRTs at BWRs have not been met with good success, typically due to un-isolable leaks from Feedwater check valves, MSIVs and MSIV drain lines.

Under Option B, it may still be possible to do a beginning of outage ILRT at a BWR since Feedwater is typically not drained and Main Steam lines can be flooded. If MSIV are considered to be part of Appendix J, then a Type C penalty can be taken. If not a part of Appendix J (typically BWR Mark II & III containments, and some Mark I's), then no penalty is required. However, no BWR has performed a beginning of outage ILRT under Option B. Therefore, while there is no reason to believe that such a test cannot be performed routinely and successfully at a BWR, there is not sufficient industry data to definitively draw that conclusion.

Pros for Beginning of the Outage Test:

1. A well executed ILRT can set the outage pace by hitting a major milestone on time.

2. Few things can cause a delay in the start of the ILRT – crud burst cleanup being the exception. At the end of the outage, any number of projects that were planned to be completed before the ILRT may be taking longer than anticipated preventing containment closeout and testing.

Pros for Beginning of the Outage Test Cont.

3. Beginning is better for scheduling outside resources like consultants and compressors. Rarely is there a delay in the start of the test, and when there is a delay it is typically hours not days. This means you do not run into excess rental fees on pressurization system (as much as 100K / week for really big pressurization systems) or additional consultant days on site.

4. Real estate for setting up a pressurization system is typically more readily available before the outage starts. Once the outage is going, real estate near the containment building is often hard to come by. Clearing away trailers, equipment, and personnel that have accumulated around the building near the end of an outage often continues while trying to stage the ILRT pressurization system at the same time. A pressurization system however is typically gone from site within a couple days of shutting down – no one wants to continue renting the equipment after the test is done so out it goes.

5. Beginning gives better as-found representation of containment condition. If nothing has been reworked there are no leakage savings to be added to the ILRT results to determine the as-found ILRT.

6. A beginning of the outage ILRT is better for plants that do not have their local leakage rate program on Option B (there are a few out there). Fewer as-found LLRTs required to be done.

7. Fewer valve lineups to be performed when ILRT is at the beginning of the outage. Fewer systems have been placed in off-normal lineups.

8. At the end of the outage, the ILRT is competing with others in getting resources assigned. Specifically, it can come up short on available operators for line ups.

9. If the test is conducted at the end of the outage, it is more likely to find maintenance errors that may have occurred but would be immediately noticeable when starting up or operating. At PWRs, leaks into steam generators due to handhold cover leaks, manway cover leaks, and pressure/level instruments not reinstalled properly after removal for calibration have been observed. These would have been found during startup /heatup walkdowns as each would have been steam leaks. Instead we found them at end of outage ILRTs.

Pros for Beginning of the Outage Test Cont.

10. An end of outage ILRT must be preceded by a vacuum fill / void sweep / RCS venting as applicable at PWRs to ensure there are not large voids being collapsed during pressurization and large voids reestablished during depressurization. During depressurization voids may appear in places other than where they were collapsed during pressurization. Void creation in a PWR reactor vessel is not a good thing.

11. The beginning of the outage has a higher decay heat which seems easier to stabilize RCS/RHR temperature in SDC than what is seen at the end of the outage. Possibly because SDC is capable of removing so much more heat than is generated at the end of the outage and cooling water is throttled way back to the point where minor variations in temperature or flow have a significant impact on the RCS temperature and hence volume.

Cons for Beginning of the Outage Test:

1. End of the outage is better if the start of the test is delayed or problems are encountered during the ILRT. Most other outage supplemental personnel are already gone and the plant is not paying for them to sit around waiting to get started on their tasks. If the same start-of-test delay or problems are encountered at the beginning of an outage, the plant may be paying for hundreds of supplemental personnel who are simply waiting for their turn to get to work.

2. End of outage tests tend to be lower dose tests for the people doing the ILRT. Going into containment soon after shutdown tends to be the highest dose tests. Then again this is simply a game of which project team gets the dose. If the ILRT is at the beginning, the ILRT Team gets the dose. If the ILRT is at the end of the outage, then the other projects inside containment early in the outage get the dose.

3. If perform the test at the beginning of the outage, we do not know conditions of valves that would have been LLRT'd and repaired during the normal course of the outage (think vent & purge valves).

4. Beginning of the outage has a higher decay heat load, less time to boil – less time to react should a problem occur. If your facility has problem leakage pathways that are difficult to monitor and/or isolate while at pressure, this is a primary concern. A pressurized containment is for all practical purposes inaccessible until blown down to 12 PSIG or less.

Performing ILRT at Beginning vs. End of Outage Cont.

Each plant will need to weigh each of the Pros and Cons considerations accordingly. In addition, it is likely that there are additional or plant specific considerations that also need to be factored into the decision for performing the test at beginning or end of outage.

Pressurization Equipment Requirements

Pressurization equipment for the ILRT typically consists of 100% oil-free diesel driven air compressors, air or water-cooled aftercoolers, air dryers, hoses, piping and manifolds necessary to connect to the station's pressurization pathway. The newer air compressors that are typically available from vendors have built in aftercoolers that limit the temperature rise to approximately 15^{o} F above ambient.

Vendors that have experience supporting ILRTs are recommended. A recent test did NOT use an experienced vendor that supports ILRTs and only obtained 65% of the rated capacity (typically get >80%). This extended pressurization phrase by 1.5 hours of critical path time. This decision was made because there was an open PO with an equipment vendor not experienced in performing ILRTs. If an inexperienced compressor vendor is selected, the vendor may propose the use of compressors that do NOT have onboard after coolers which will mandate the use of external after coolers.

If your facility is subject to strict air emission requirements, factor these into consideration as they may affect the spacing of the diesel air compressors. Explore compensatory measures such as working with the compressor vendor to reduce air emission and/or requesting a temporary waiver from the proper authority for the short duration that the compressors would be run.

Depending on the time of year, it may not be necessary to use additional aftercoolers. The temperature of the air supplied to containment should generally be in the range of approximately 70^{o} – 80^{o} F and the temperature of the air supplied to the air dryer should be below approximately 90^{o} F. If the outside air temperature is too cold, the radiator of the air compressor can be blocked to increase the discharge air temperature. If a separate aftercooler is required, it is desirable to use an air-cooled model. This eliminates the need to run water supply and return piping/hoses to the aftercooler. The air-cooled aftercoolers will slightly reduce the pressurization rate since they use an air-motor that bleeds off a small amount of air from the pressurization pathway.

Refrigerant or desiccant type air dryers may be used to dry the air. Excessive humidity inside the containment can saturate the ILRT humidity sensors and also cause difficulty in stabilizing the containment atmosphere. The use of regenerative twin-tower desiccant air dryers is recommended. This equipment only requires 120 VAC power to the solenoid valves for switching between towers. Refrigerant type air dryers are susceptible to refrigerant leaks that may allow excessive humidity into containment. The regenerative twin-tower desiccant air dryers also will reduce the pressurization rate by bleeding approximately 100 –150 cfm of air from the main pressurization pathway to dry the non-active tower. These reductions should be considered in determining the capacity required. The air compressors and air dryers require a backpressure of approximately 70 psig for efficient operation. Other items to consider in determining the pressurization capacity are pressure drops due to the length of piping and restrictions in the pressurization pathway. The amount of pressurization equipment required will impact the budget needed to perform the ILRT.

Consider the following examples in determining the required pressurization capacity:

A 300,000 cubic foot net free volume containment with a design accident pressure of 45 psig would require approximately 4200 cfm of pressurization capacity to achieve a rate of 10 psi per hour. A four-inch diameter pipe would be required to pass this flow. A capacity of 6200 cfm would achieve a 15 psi per hour pressurization rate and would require a five-inch diameter pipe.

A 2,500,000 cubic foot net free volume containment with a design accident pressure of 50 psig would require approximately 35,000 cfm of pressurization capacity to achieve a rate of 10 psi per hour. This would require a single 10-inch pipe or one 6-inch and one 8-inch pipe.

Given the short outage durations today, real estate near the containment has become a precious commodity. Pressurization systems are being pushed further away from the containment to minimize impact on other outage activities. Moving the pressurization system away from the building, perhaps even outside the PA, requires planning and design of a temporary piping system to convey the air from the pressurization system to the containment penetration(s). Coordination with Security and HP may be required if boundaries are crossed. Compressor vendors typically do NOT have piping, larger flex hose, or other components necessary to make these longer runs. Some of this may be available on loan from other plants or utilities.

When designing longer pipe runs keep in mind that longer runs involve larger pressure drops for a given pipe diameter. Select pipe sizes and number conservatively. Remember too the temporary power requirements for the pressurization system and the need to gain access during system operation for refueling.

Contractor Support Requirements

The station needs to determine the amount of contractor support that it will require. This could range from a nearly turnkey approach to a more limited approach depending on the station's resources and experience in conducting ILRTs. However, even with using a turnkey approach, there will still be many activities that will require station resources to accomplish. A turnkey approach could involve the following contractor activities:

Procedure(s) revisions
Pre-Test site walkdown
Supplying pressurization equipment
Supplying ILRT instrumentation and computer hardware/software
Developing ILRT instrumentation routing plan
On-site coordination of ILRT prerequisite activities
Installation/removal of ILRT instrumentation
Computer data analysis and results
Coordination of ILRT restoration activities
Preparing draft and final ILRT Report

A more limited approach may include only a certain number of the above activities. The number of contractor personnel could vary depending upon the scope between one to four individuals. The amount of contractor support will impact the budget needed to perform the ILRT.

Purchase Order to Contractor(s)

If a station decides to contract for ILRT services, sufficient time needs to be allotted for the procurement process to ensure the purchase order is issued and the contactor is ready to start work 12 months prior to the scheduled ILRT outage. If the station desires to contract separately for the supply of the pressurization equipment, then an additional purchase order for this equipment will be required and should also be awarded and issued 24 months prior to the scheduled ILRT outage.

The ILRT services contract will, most likely, be a quality related contract and there will be QA requirements related to items such as calibration of ILRT supplied instrumentation and verification/validation of computer software. The bidders may also need to be placed on the approved supplier's list. This should be factored in to the time required to accomplish this activity.

LLRT Requirements to Support the ILRT

Penetrations subject to Appendix J testing requirements that will not be lined up, vented, and drained for the ILRT need to have LLRT results within the past 24 months. With many components on extended testing intervals, the 24 months may not be met without careful planning and often require performance of additional LLRTs.

Instrumentation and Calibration Requirements

Instrumentation to conduct the ILRT will consist of temperature sensors, relative humidity or dew point sensors, precision pressure gauges, and flow sensors (mass flow or rotameters). The specification, calibration, and pre-test check requirements for the ILRT instrumentation is contained in ANSI/ANS 56.8 standard Containment System Leakage Testing Requirements. In addition, the ambient pressure (accuracy $\pm$ 0.1 psi) must be measured to establish the test pressure relative to the external pressure of the primary containment. Post-test calibration is not required if a successful verification test has been performed. Calibrated instrumentation must be available to perform the pre-test checks.

In addition, other instrumentation may also be required. Since the precision pressure gauges read out in absolute pressure (psia), a suitable range gauge pressure gauge (psig) may be desired. Plant instrumentation/computer points will need to be calibrated to monitor liquid levels inside containment. Additional pressure gauges may also be used to monitor for leakage into volumes such as steam lines, purge valve interspaces, and airlock barrels.

Plant instrumentation that is over ranged during the ILRT may need to be re-calibrated as part of the restoration from the ILRT.

The station needs to start 12 months prior to the scheduled ILRT outage. If the station desires to contract separately for the supply of instrumentation and calibration, then a purchase order for this will be required and should also be awarded and issued 24 months prior to the scheduled ILRT outage.

6. Short Range Planning Items

This section will discuss short range activities that may be performed six months to two years prior to the scheduled ILRT outage. However, consideration should be given to performing these activities as far in advance of the scheduled ILRT outage as possible. Station planning expectations may require that these items be completed sooner to support development of outage schedules.

FSAR Changes

The station should review the FSAR to determine if there are any requirements or statements that conflict with current industry practice in performing ILRTs. For example, the FSAR may state that cooling water to containment fans will not be drained and vented since the system must remain in service to control containment atmospheric conditions. The current practice is not to run cooling water to fans inside containment during the ILRT since this actually causes instability due to changes in cooling water temperature. Additionally, some FSAR may be very specific with systems that will be drained and vented. With the adoption of 10CFR50 Appendix J Option B, NEI 94-01 contains provisions where system venting and draining are not required. The station should review FSAR statements against the Appendix J Option B documents and resolve any inconsistencies.

Work Orders

Work orders will need to be developed or revised as necessary for craft support to support the ILRT. Mechanical activities may include items such as setup of the pressurization equipment, assistance in leak detection, and flange installation/removal. Electrical activities may include items such as providing temporary power, installing/removing jumpers, and defeating containment high-pressure signals/interlocks. I&C activities may include items such as assistance in installing and removing instrumentation, calibration of plant or M&TE instrumentation used during the ILRT, and assistance in aligning plant instrumentation that penetrates containment. Care should be taken not to route sensing lines for the ILRT pressure and flow instrumentation through any air conditioned spaces. This will cause the warm, moist air to condense in the pressure/flow instruments or in the tubing.

Reviewing work orders from past tests may find a number of past activities that were required to adequately vent and drain a penetration. Many times these included removing tubing from instrumentation. SOME, but NOT all of these, go away and are not used as the penetration is not vented and drained. Some equipment disassembly may still be required such as pressure gauge or relief valve removal to vent tanks inside containment.

Benchmarking

The station should strongly consider a benchmarking trip to a plant that is planning to conduct an ILRT prior to its own ILRT or participating in an ILRT readiness review for another plant, or acting in an “assist” role during an actual performance of an ILRT. Information obtained can be useful in making improvements during the ILRT planning process.

It is recommended that benchmarking trip include the ILRT prerequisite activities since the real work for the ILRT Coordinator is getting the prerequisite activities taken care of expeditiously. Observing the pressurization through the test and depressurization is of less value than observing the completion of the prerequisite activities.

Sampling Requirements

Containment atmosphere and primary coolant sampling requirements should be investigated to determine the location and frequency. This information should be included in the procedure and in the outage/ILRT schedule. A release permit may be required to depressurize the containment and/or to perform the instrument verification test. Sufficient time must be allotted to obtain an air sample and perform the analyses. If conducted correctly, small samples of the primary coolant will not affect the ILRT results. However, the sampling should be scheduled to minimize the impact on the ILRT.

Develop/Revise ILRT Procedure(s)

Development or revision of the ILRT procedure(s) is a major task that may require significant station resources. These procedure(s) need to be revised to reflect the changes in Option B to 10CFR50 Appendix J. The last ILRT may have been performed more than 10 or 15 years ago. Knowledge of the changes and current industry practices is required to perform the procedure update. Because this is a specialized area of expertise and requires a significant amount of time to perform the procedure(s) revision, stations may elect to contract this work. A thorough review of the revised document(s) to ensure accuracy and completeness is also required. Most station’s applicable Appendix J Program Engineer or ILRT Coordinator performs this review, although other knowledgeable personnel can perform the reviews

Timing on the procedure review and revision is a critical issue. In order to have the procedure in shape for the readiness review, the review process needs to start nine to twelve months before the ILRT. Additionally the procedure review will often identify issues and additional work items that must be planned. A Table Top Review involving, at a minimum, Operations, Maintenance, and Engineering is essential. Review with Health Physics, Outage and Scheduling, and Security should also be considered as they provide key support functions.

Develop/Revise ILRT Procedure(s) Cont.

The procedure should allow for conduct of both a BN-TOP-1 and ANSI/ANS 56.8-1994 test, unless there is a prior NRC commitment to perform at least an eight (8) hour ILRT. Both of these methods are approved for conducting an ILRT. Although the ANSI/ANS 56.8-1994 method is preferred, the BN-TOP-1 method allows the measurement phase of the test to be conducted in six (6) hours versus the eight (8) hours required by ANSI/ANS 56.8.

Another reason to retain the BN-TOP-1 is to allow its use in the event the ANSI/ANS 56.8-1994 termination criteria move in and out of acceptance near the end of the hold test. A low leakage rate can have termination criteria failing based on a very small change in RHR (RCS) temperature. So even if there is a commitment to a minimum 8 hours, it is worthwhile to have BN-TOP-1 in the procedure.

Both methods require a minimum four (4) hour stabilization time but BN-TOP-1's stabilization is based on temperature while ANSI/ANS 56.8 is based on changes in the leakage rate. The BN-TOP-1 stabilization criteria are either a rate of change of average temperature less than 1^{o} F per hour over the last two (2) hours OR the rate of change of temperature changes less than 0.5^{o} F per hour averaged over the last two hours. Since there is an option, it is recommended that the first option be used. Meeting the temperature stabilization criteria is normally very easy to achieve. However, the containment may not be stable. The ANSI/ANS 56.8-1994 stabilization criteria are a better indication of stable conditions. Stable conditions are achieved when the mass drops between data points are less than allowable and are consistent.

The procedure should allow calculation of the integrated leakage rate by either BN-TOP-1 or ANSI/ANS 56.8-1994. BN-TOP-1 uses a total time data analysis technique that is highly dependent on the first data point. ANSI/ANS 56.8-1994 uses a mass point data analysis technique where all data points carry an equal weighting. However, the ANSI/ANS 56.8-1994 technique also requires that the data must meet termination criteria that include a linearity test and a data scatter test. The BN-TOP-1 method also uses a two-sided 95% upper confidence limit (UCL) while the ANSI/ANS 56.81-994 method uses a one-sided 95% UCL. The BN-TOP-1 UCL is equivalent to a one-sided 97.5% UCL, which results in BN-TOP-1 UCL leakage rates to be significantly higher than ANSI/ANS 56.8-1994 UCL leakage rates for the same data. There are also differences in the number of data points required and other criteria from both methods that need to be included in the procedure.

There is also a difference in the verification test between BN-TOP-1 and ANSI/ANS 56.8-1994. The BN-TOP-1 method requires a one-hour stabilization period after the leak is imposed on the containment and a minimum duration

Develop/Revise ILRT Procedure(s) Cont.

approximately one-half the measurement test duration. ANSI/ANS 56.8-1994 requires a minimum four (4) hour duration with an optional stabilization period not exceeding one hour. A stabilization period with ANSI/ANS 56.8-1994 is normally not required. ANSI/ANS 56.8-1994 also requires that the verification acceptance criteria be met for the last hour or last four (4) data points, whichever is longer.

The procedure should also include calculation of three (3) containment leakage rates; (1) As-left leakage rate, (2) As-found leakage rate, and (3) Performance leakage rate. Assuming the ILRT is conducted at the end of an outage, the as-left leakage rate is the 95% UCL leakage rate measured during the test plus the as-left minimum pathway leakage of isolated penetrations and corrections for increases in water levels inside containment. The as-found leakage rate is calculated by adding the leakage savings or improvements (differences between as-left minimum pathway leakage and as-found minimum pathway leakage) for Appendix J components that were worked on during the outage. The Performance leakage rate is defined as-left leakage rate plus the as-left minimum pathway leakage of any penetration isolated during the test. The procedure should contain a provision to allow the start of the ILRT measurement phase prior to completing all calculations based on estimates of the additions and corrections that need to be made.

The three (3) major procedural tasks are ILRT prerequisites, including instrumentation installation and removal, system lineups, and ILRT conduct. These tasks may be performed in separate procedures or they may be combined into a single procedure. It is recommended that craft (mechanical, electrical, and I&C) prerequisites be organized such that each craft has its own attachment of activities to be completed and restored. This allows easier status tracking of the tasks.

ILRT Project Plan

It is recommended that an ILRT Project Plan be developed to assist in managing the ILRT. This Project Plan should, at a minimum, address the following items:

Introduction including a summary of key activities, description of test phases, equipment lay down areas, ILRT instrumentation routing plan, and other pictures/figures of key components/areas.

Project Scope and Objectives including scope of tasks to be performed and objectives in terms of cost, critical path schedule, dose, and safety.

ILRT Project Plan Cont.

Project Organization for conducting the ILRT including a detailed description of their roles and responsibilities during preparation, conduct, and restoration. Lead individuals from Engineering, Operations, Maintenance, Outage Management, Scheduling, Radiation Protection, Security, Safety, and Contractor Support should be involved.

ILRT Locations (laydown areas), Communications, and Training including identifying the training needs (confined space, safety practices, etc.) for personnel, locations prior to and during the ILRT that individuals can be reached, and communications (monthly preparation meetings, daily update during ILRT conduct, industry OPEX, IPTE briefings, etc.),

Risk Management should include criteria for aborting the test and an assessment (probability and severity) of potential risks, mitigating strategies, and contingencies.

ILRT Instrumentation Routing Plan

An ILRT instrumentation routing plan should be developed and made a part of the ILRT Project Plan. The ILRT instrumentation should be located at approximately the same place as in previous ILRTs to prevent the need to perform a containment drybulb temperature survey. The ILRT instrument locations should be supported by an existing temperature survey to confirm that they are providing representative readings. The routing plan should identify the junction boxes and/or electrical penetration terminations that will be used to convey the data from inside the containment to the data processing equipment outside containment. Volume weighting factors should also be developed. Special methods may need to be considered for placing instrumentation in the dome area of PWRs. Some stations restrict the use of PVC jacketed cables inside containment and halogen-free cables may need to be used. Other stations mandate the use of IEEE or UL approved cabling. IEEE / UL AND Halogen Free is NOT a readily available combination. Halogen Free is common in Europe where alternative standards exist and IEEE / UL is not common.

ILRT Material/Miscellaneous Equipment Requirements

Provisions should be made to provide diesel fuel oil and lubricating oil to the diesel driven air compressors. The compressors may require refueling during ILRT pressurization. Other material and equipment includes sleeveing for ILRT instrumentation cables (contamination control), UPS supply for ILRT instrumentation, tables and chairs, telephone, and separate computer to monitor plant parameters for ILRT test station, electrical supply for ILRT test station, air dryers and diesel driven compressor engine block heaters (ambient temperature below 40^{o} F).

ILRT HIT Team

A High Impact Team (HIT) composed of key individuals from Engineering, Operations, and Outage Management should be formed and meet weekly starting at least six (6) months prior to the ILRT outage. Additional individuals from Maintenance, Scheduling, Radiation Protection, Security, Safety, and Contractor Support should be involved on an as needed basis. This team should identify, prioritize, and resolve issues relating to the preparation and conduct of the ILRT.

The kickoff meeting should provide a training / briefing for the HIT team, with emphasis on preparation activities but also provide an overview as to how current ILRTs are conducted.

Equipment Tagging Requirements

The equipment and valve lineups for the ILRT will involve a great many components. Placing an equipment tag on each piece of equipment will involve a significant amount of resources and time to accomplish. However, configuration control and control of the ILRT lineup boundary is a critical concern. A philosophy concerning equipment tagging should be developed by Engineering and Operations. The approach used will depend on a number of factors including the comfort level of Operations on the ability to control the plant configuration without the use of tags. Approaches may vary from tagging all components, tagging no components, or tagging only components that are in an off normal alignment. To reduce the manpower and time required to physically verify a component position, consideration should be given to using other documented evidence of component/valve position such as completed system lineup lists, completed containment valve surveillance procedures, and I&C valve checkoff lists.

Outage ILRT Schedule Activities

The sequence, duration, and manpower required for each activity supporting the ILRT should be developed and inputted into the overall outage schedule. The ILRT HIT team should review this schedule periodically to ensure that there are logical predecessors and successors to each activity.

Leak Identification Guides

To assist in locating and identifying leakage during the ILRT, Leak Identification Guides should be developed. This will help to ensure that a systematic approach to looking for leakage is used and prevent some areas from being inspected multiple times while other areas go un-inspected. These guides should be developed on an elevation/room/area basis, include key components to be inspected, and an assessment of the probability and type of leakage to be

Leak Identification Guides Cont.

encountered. Precautions must be included that only identification of leakage is desired and that no repairs are to be made without the approval of the ILRT Test Director. Repair of leakage could result in an As-Found ILRT failure.

Two types of leakage identification are typically conducted, (1) routine and (2) detailed. The routine leak searches are conducted at designated pressure levels during pressurization of the containment and when peak test pressure is achieved. The intent of these leak searches is to identify any obvious leakage paths or anomalies if the ILRT test data indicates a leakage rate above the administrative acceptance criteria, which should be established reasonably below the Tech Spec allowable values. The detailed leak search is conducted if the ILRT data indicates a leakage rate above the Tech Spec allowable values. This is a much more intense search designed to identify and isolate the leakage source to salvage the ILRT from a potential failure.

Major areas of concern for leakage include BWR Main Steam Lines and Feedwater check valves, PWR Steam Generator Secondary Side integrity, purge valves, and airlocks.

Industry/Station ILRT Experience

A search of industry and station ILRT operating experience should be conducted at least one year prior to the ILRT outage. This information will be useful in the planning and procedure preparation stages. Stations that have recently conducted ILRTs should be contacted to obtain lessons learned. Operating Experience that should be reviewed includes OE 21102 (2005), OE 18707 (2004), OE 11981 (2001), OE 11542 (2000), OE 8852 (1998), OE 6497 (1994), OE 4743 (1991) and OE 2739 (1988)

Special Test Analysis/Briefing

The ILRT is an infrequently performed/special test evolution. Requirements are typically identified in specific site procedures. This determines the required controls, ensures the attention of applicable plant personnel to facilitate proper planning, involves proper management during the planning and performance, and assigns the Special Test or Evolution Coordinator. Briefings are typically required for all personnel involved with the ILRT and should be scheduled. Briefings should include plant conditions, including applicable LCOs, precautions, expected reactor and plant parameter changes, contingency plans and abort criteria.

Readiness Assessment

A readiness assessment for the ILRT should be conducted at least six months prior to the ILRT outage. The assessment team should consist of the ILRT Test Director, plant personnel from Operations and Outage Management, other plant personnel, and outside industry personnel. Areas to assess include ILRT procedure(s), scheduling, work orders, and other preparations and plans.

Work Control Practices/Risk Assessments

A method to assess and control work activities in or near the ILRT boundary needs to be established. Several ILRTs have been adversely impacted by uncontrolled work activities that affected the containment leakage rate. In one case, calibration of a containment wide range pressure transmitter during the ILRT caused a significant drop in containment mass. In another case, disassembly of a containment spray check valve caused a change in the measured leakage rate that invalidated the superimposed leakage test. Personnel, other than those involved with conducting the ILRT, need to control work activities during the performance of the ILRT. This control needs to be established at the time that the ILRT valve lineups are started. This will help to ensure that no changes are being made that would invalidate the containment boundary.

Equipment Protection Requirements

Items that would be adversely impacted by the ILRT pressure need to be identified and either protected or removed from the containment. This list would include items such as fluorescent and incandescent light bulbs, non-qualified equipment (typically PWR secondary side equipment), NEMA 4 enclosures, and radiation detector heads. Porous materials inside containment will absorb air as the containment is pressurized. When containment depressurization is started, a differential pressure exists as the air tries to escape from the material. In some cases, paint/coatings have been peeled, ductwork has been dimpled, and gauge glass has been broken.

Modifications Affecting Containment Pressure Boundary

A review should be conducted of any modifications within the containment or to the containment pressure boundary since the last ILRT was conducted. This review may produce additional valves that need to be added to the ILRT valve lineups or additional equipment that might require protection from the ILRT pressure or inspection at pressure.

7. ILRT Implementation

This section will discuss activities that are typically performed in the ILRT outage. However, if the ILRT is scheduled at the start of the outage, then several of these activities will need to be completed prior to the start of the outage. In general, BWR ILRTs are nearly always conducted at end of the outage. For PWRs, the ILRT may be conducted at start or the end of the outage, depending on the best fit for the shortest outage duration.

Badge Contractor Personnel

Contractor personnel need to be scheduled for access training at least one week prior to the start of the ILRT. Additional time may be required depending on their scope of involvement with the ILRT and on their last nuclear plant badging.

Pressurization Equipment On-Site

The schedule for bringing pressurization equipment on-site depends to a large degree on the amount of equipment. Timing of equipment arrivals and being prepared to immediately accept, stage, and setup equipment can keep the rental period down to one week for all but the largest of pressurization systems. For BWR Mark I and II containments, it is normally possible to schedule the equipment in and out within a week. This reduces the contract amount payable for equipment rental. Larger PWR and BWR Mark III containments usually require more equipment and it may not be possible to accomplish the setup, operation, and break down of the equipment within one week. Arrangements should be made in advance with security for bringing the equipment on-site and for removal after the ILRT is completed. Since delays of more than one hour at the security gate usually results in additional transportation charges, it may be advantageous to unload the equipment outside the protected area and have utility personnel bring the equipment in through the security gate.

Wording of the purchase order for pressurization equipment should be framed carefully. The plant is renting a pressurization system – not a bunch of individual components. The purchase order should specify that rental on the pressurization system starts when ALL necessary equipment that makes up the pressurization system is on site.

Security lighting is normally required on the underside of the equipment. In cold weather climates, 120 VAC power should be available for the block heaters on the diesel engines of the air compressors and climate appropriate lubricating oil should be used. All pressurization equipment should be test run prior to the start of pressurization to allow sufficient time for any required maintenance/repair. Health Physics, if required, needs to be notified for clearance of the equipment prior to removal from site. The pressurization equipment is normally kept on site with the contractor mechanic/operator on standby, until there is reasonable

Pressurization Equipment On-Site Cont.

assurance that the test is progressing well and re-pressurization will not be required.

The pressurization system vendor should provide an operator/mechanic to perform the test run of all equipment and be onsite to run the equipment during pressurization. Although plant operating engineers or mechanics can be shown how to run the compressors in as little as a half hour, they will not learn how to optimize the units or identify and correct hunting between units. Running less than optimally or allowing hunting costs much more in critical path time than the cost of having an experienced operator / mechanic “driving” the compressors.

ILRT Instrumentation Installed

The ILRT instrumentation should be installed two (2) to three (3) days prior to the test. This will provide time to checkout the instrumentation operation and make any changes that are required. At BWRs, if the ILRT will follow the OPS Hydro, the instrumentation should be installed prior to the start of the OPS Hydro. The instrumentation installation will need to be coordinated with other outage activities to prevent damage to the instruments.

Routing of the cables needs to be arranged such that it does not interfere with the movement of other equipment and complies with station policy, e.g., no tie-wrapping to Class 1, 2 or 3 cable/raceways. If cables are run on across the floor, they should be protected with a ramp or cover (trip hazard). Special care should be taken that cables are not routed near sharp edges such as grating that may contact and cut the cable.

At BWRs, instruments installed in the torus or suppression pool needs to be coordinated prior to torus/suppression pool closeout. Special installation techniques may need to be used for installation of instruments in the dome area of large PWRs and BWR Mark III containments. After ILRT instrumentation installation, no testing that may cause damage to the instruments should be permitted. For example, introduction of steam into the torus/suppression pool after installation of ILRT instrumentation may saturate the relative humidity sensors. This may not be apparent until after the start of pressurization when the containment pressure drives the moisture into the sensor.

PWRs often have schedule conflicts between ILRT instrumentation and exclusive use of the Polar Crane. For the ILRT, it is desirable is to get the instrumentation installed, operational, and functionally checked as soon as work activities allow. Outage management wants to keep the Polar Crane available as long as possible often with lifts scheduled within hours of containment closeout and pressurization. This has to be resolved and a six hour window set aside for hanging instruments in the dome, on the polar crane, and in the airspace

ILRT Instrumentation Installed Cont.

between the crane and the operating deck. Once instruments are installed the Polar Crane is NOT available for further use until after the ILRT. Polar Crane Lockdown / turnover for ILRT instrumentation should be a milestone on the outage schedule as a reminder that it will not be available for additional lifts. Instrument strings can be pre-assembled to speed deployment and can be staged, electrically connected, and initially checked out on the operating deck in advance of installation in the upper areas.

ILRT Prerequisites

10CFR50 Appendix J, Option B and NEI 94-01 require that a general visual inspection of the accessible interior and exterior surfaces of the containment system for structural deterioration that may affect the containment leak-tight integrity be conducted prior to each ILRT. This inspection may be coordinated with ASME Section XI IWE and IWL. However, during any one outage, the IWE/IWL inspections may not include 100% of the accessible interior and exterior containment surfaces.

The other major prerequisites include system/valve alignment, pressurization equipment installation and checkout, ILRT instrumentation installation and checkout, primary system level and temperature control, access/work control established, pressurization sources inside containment vented or removed, LLRTs, as required, completed such as hatches and airlock door seals, high containment (drywell) pressure instrumentation signals defeated, and verification flow instrumentation installed and checked out. A final containment walkdown should be performed prior to containment closeout to confirm that all pressurization sources such as welding bottles, nitrogen bottles, fire extinguishers, spray cans, and other pressurization sources are removed. After the final closeout, verification that all personnel are out of containment should be made. The inner personnel airlock door should be closed and locked. It is recommended that the outer door on all the airlocks be maintained in the open position. This will prevent a slow increase in airlock barrel pressure that could cause a changing integrated leakage rate that may make it difficult to verify the leakage rate. In addition, this will allow the inner door to be leak checked during pressurization. If significant leakage is detected, the outer door can be closed and the airlock barrel equalized with containment pressure.

Pressurization

After verification that all ILRT prerequisites have been completed, all personnel are out of containment, and the containment is ready, pressurization may begin. Initially, the maximum obtainable pressurization rate should be used. Except for the low pressure BWR Mark III and PWR ice condenser containments, an

Pressurization Cont.

external containment walkdown should be conducted at approximately 20 psig to look for leakage.

Specific instructions need to be provided to the leak detection crews that only observations should be made and no corrective actions taken without the approval of the ILRT Test Director. Unauthorized repairs can result in an as-found ILRT failure. The walkdowns need to be conducted in a systematic manner to ensure all accessible areas are checked and none are missed. During the pressurization phase, the ability of the verification flow meters to achieve the desired flow should be checked.

As the containment pressure approaches approximately 85% of the desired test pressure, the pressurization rate should be reduced by reducing the number of operating compressors. At a containment pressure of approximately 92%, the pressurization rate should again be reduced. The containment temperature will increase, especially in the dome region, due to the heat of pressurization. Gradually reducing the pressurization rate prevents a large drop in pressure when pressurization is stopped and allows the containment temperature to gradually drop. This aids in reducing the amount of time needed for containment stabilization. If water level in the primary system is approaching its lower limit, then water addition should be made before the end of pressurization. This will prevent disturbing stability during stabilization, ILRT measurement, and verification phases.

The procedure should allow for a margin of at least 0.5 psi above the required test pressure but not exceed the containment design pressure. If the design basis accident (DBA) pressure (P_a) is the same as the design pressure or very close, ANSI/ANS 56.8-1994 allows a test pressure of 96% P_a. If P_a is less than 25 psig, then 1 psi below P_a is allowed. For example, if the containment test pressure is 50 psig and there are twelve (12) compressors initially operating, then at 42 psig, four (4) compressors are stopped and at 46 psig, another four (4) compressors are stopped. The final 50.5 psig test pressure is obtained using the last four (4) compressors. The pressurization line needs to be depressurized and a vent established to demonstrate that there is no makeup air being supplied to containment.

Stabilization

The stabilization phase should be started as soon as the containment reaches test pressure. This can be accomplished as soon as the containment is closed and does not need to wait for the pressurization line to be depressurized. Both the BN-TOP-1 and ANSI/ANS 56.8 stabilization criteria should be met. This will allow an option to use either method during the ILRT Measurement phase. Additional time beyond the minimum required four (4) hours should be taken, if

Stabilization Cont.

required, to ensure stable conditions. Depending on the stability of the data, meeting the ANSI/ANS 56.8 stabilization criteria may be difficult. Instrumentation readings should be periodically checked to determine if the sensors are operating properly. Criteria should be developed for sensor rejection, which must be applied uniformly in rejecting sensor data. If a sensor is rejected, all data sets must be re-calculated without that sensor's input. In addition, ANSI/ANS 56.8 includes a statistical data rejection technique. This technique is not used for sensors but for the calculated data point. Historically, this technique has not been of value and its use is not recommended.

If the leakage rate is changing during stabilization, it may result in not being able to verify the measured leakage rate. This will result in additional test time since the test must then revert to the ILRT measurement phase to re-establish the containment leakage rate. It is critical during this phase and subsequent phases of ILRT Measurement and ILRT Verification, that plant conditions (vessel level and temperature) are maintained as stable as possible.

ILRT Measurement

The final data point of stabilization may be used as the initial point of the ILRT measurement phase. The starting point of the ILRT Measurement must be made time forward. That is, data cannot be collected and a starting point chosen at a previous data point. As previously stated, the ANSI/ANS 56.8 method (mass point analysis) is preferred, but there may be time savings using the BN-TOP-1 method (total time analysis). Sensor data should be reviewed as discussed during the Stabilization phase.

As data is collected, a decision as to whether BN-TOP-1 or ANSI/ANS 56.8-1994 method will be used needs to be made. This decision will depend on the initial starting data point, the stability of the data, and whether there is any commitment to the NRC for an eight (8) hour test. Historically, the leakage rate slowly decreases with time. The rate of change needs to be reviewed to determine the impact on the ILRT Verification Test. This will also impact meeting the ANSI/ANS 56.8-1994 termination criteria that must be met if conducting an ANSI/ANS 56.8-1994 test.

ILRT Verification Test

In most cases, it is known well in advance that the ILRT Measurement phase will be successful and it is a matter of satisfying the duration and number of data points criteria. In those cases, the imposed leak should be initiated as soon as the last data point for the ILRT Measurement phase is obtained. The imposed flow is required to be within 75% to 125% of L_a. The same data analysis

ILRT Verification Test Cont.

method/technique (BN-TOP-1 or ANSI/ANS 56.8-1994) used for the ILRT Measurement phase must be used for the verification test phase.

If a rotameter is used as the flow instrument, the readings will need to be corrected for operating pressure (back pressure) and temperature (inlet) versus the calibrated conditions for the rotameter using the following equation:

$$L_O = L_i \sqrt{\frac{T_C}{T_O}\frac{P_O}{P_C}}$$

where:

L_O is the corrected flow reading (sccm, scfh or scfm)
L_i is the indicated flow reading (sccm, scfh or scfm)
T_C is the calibration temperature of the rotameter (^{O}R)
P_O is the operating back pressure of the rotameter (psia)
T_O is the operating inlet temperature of the rotameter (^{O}R)
P_C is the calibration pressure of the rotameter (psia)

The typical rotameter has a sharp edged float. Ensure that the float is properly installed in the tube and the rotameter was calibrated with the float in the proper orientation. Different manufacturers use different orientations. Consult the vendor manual for the proper technique in reading the position of the float. In most cases, the reading is taken at the widest part of the float.

If a mass flow meter is used, then no correction for operating pressure and temperature is required.

If the verification test is not successful, then the imposed leak must be terminated, the ILRT Measurement and Verification test phases repeated. Verify sufficient pressure remains in the containment to preclude dropping below 96% of Pa during the second hold test. If necessary, restart one or more compressors and bring pressure up to an acceptable value. If a compressor is restarted, a stabilization period will be required after re-pressurization.

Depressurization

Preparations for depressurization should be started while the verification test is still in progress to avoid losing time. It is preferred that as soon as the last data point in the Verification test is obtained, that depressurization begins. If a release permit is required, then this should have been prepared and delivered to the Control Room during the Verification test. If air sampling of the discharge is required, personnel and equipment needs to be setup and ready to go in advance of the end of the verification test. In most cases, PWRs can discharge directly to the outside with appropriate sampling. BWRs normally discharge to

Depressurization Cont.

Standby Gas Treatment or directly to the Reactor Building, which are monitored release points.

Standby Gas Treatment should not be used as the only discharge path as this system typically exhausts to low pressure duct work which will significantly limit the discharge flow rate.

Depressurization rates should be monitored to ensure that limits are not exceeded. Rates as high as 10 –15 psi per hour have been used without damage to containment (ex: paint peeling off) or equipment within containment. As containment pressure decreases, adjustments will be required to maintain the depressurization rate as close to the limit as possible. When the primary path is full open, additional pathways should be used to maintain the desired depressurization rate. The last several pounds of pressure in containment will take the longest to release. Consideration should be given to using all available means, such as opening purge valves, to minimize the time required.

Many restoration activities can be started during depressurization and should be allowed by the ILRT procedure. System restorations, pressurization system disassembly, removal of temporary pressure gauges should all be allowed and started during depressurization.

As the containment pressure approaches zero, personnel should be ready to start restoration activities. An initial entry at zero should be made to check for any damage, such as broken light bulbs or displaced insulation.

Restoration

Restoration activities need to be completed as soon as possible to allow the plant to return to power. These activities will include removal/decon of ILRT instrumentation installed in containment, restoring system valve lineups, and restoration of containment/drywell high pressure instrumentation. Pre LLRTs, repair, and post LLRTs may be required for any penetrations that were isolated during the test due to excessive leakage. Recalibration may also be required for plant pressure instrumentation that was over-ranged during the test. Pressurization system breakdown and return of vendor equipment should have been completed earlier, after assurance that the test was successful and no re-pressurization would be required.

Depending upon the remaining outage activities, Polar Crane use may be desired post-ILRT. ILRT Instrumentation can be taken down from the dome and crane area in as little as one hour after the team is allowed inside containment.

ILRT Final Report

Typically, a preliminary report is prepared within 24 hours of the completion of the ILRT, documenting successful completion of the test. The final report should be completed within 60 days of the test in accordance with the requirements of ANSI/ANS 56.8-1994 Section 5.11 and NEI 94-01 Section 12.0. There is no requirement to submit the final report to the NRC. However, the report should be maintained on-site as an official record.

ILRT Critique

Following test completion, an ILRT critique should be developed to document problems encountered and solutions used to correct those problems. Events that went well should also be described. This document will be useful to other plants in planning and executing their ILRTs.

ATTACHMENT 1

ILRT PLANNING SCHEDULE

Long Range Planning	**T-3 to 5 years**
ILRT Included in Station Budget	T-5 years
Scheduling ILRT Off Normal Fuel Cycle	T-5 years
Modifications	T-4 years
Mid Range Planning	**T-2 to 3 years**
Performing ILRT at Beginning vs. End of Outage	T-3 years
Pressurization Equipment Requirements	T-2 years
Contractor Support Requirements	T-2 years
Purchase Order to Contractor. RFQ / Bid specifications to procurement if outside equipment or personnel required. Review of bids. Selection of vendor(s).	T-2 years
LLRT Requirements to Support ILRT	T-2 years
Identify Instrumentation and Calibration Requirements	T-12 months (T-2 years is recommended to include in purchase order if contractor is supplying and calibrating the instrumentation)

Short Range Planning	**T-6 months to 2 years**
Identify FSAR Changes	T-18 months
Identify Work Orders Required	T-18 months
Perform Benchmarking	T-12 months
Identify Sampling Requirements	T-12 months
Develop/Revise Procedure(s)	T-12 months
ILRT Project Plan	T-12 months
Develop ILRT Instrumentation Routing Plan	T-12 months
Identify Material/Misc. Requirements	T-9 months
Form ILRT HIT Team	T-9 months
Determine Equipment Clearance & Tagging Requirements	T-9 months
Input ILRT Schedule Activities Into Outage Schedule	T-9 months
Develop Leak Identification Strategy and Guides	T-9 months
Review Industry ILRT OE	T-6 months
Special Test Analysis/Briefing	T-6 months
Readiness Assessment	T-6 months
Identify Work Control Practices/Risk Assessment	T-6 months
Identify Equipment Protection Requirements	T-6 months
Review Containment Pressure Boundary Modifications	T-6 months

ILRT Implementation	**T-10 to +90days**
Badge Contractor Personnel	T-10 days
Pressurization Equipment On-Site	T-1 week Delivery, setup, system run/checkout
ILRT Instrumentation Installed	T-3 days
ILRT Prerequisites Completed	T-0 day
Pressurization Complete	T+0.25 days
Stabilization Complete	T+0.50 days
ILRT Measurement Complete	T+0.85 days
ILRT Verification Complete	T+1 day
Inform compressor vendor equipment “off-lease”, commence disassembly and shuttle outside PA for pickup.	T+1 day (Disassembly starts upon successful completion of the verification test.)
Depressurization Complete	T+1.25 days
Restoration Complete	T+1.75 days
Pressurization system loading onto trucks outside PA and removal from site.	T+2 Days
ILRT Final Report	T+60 days
ILRT Critique	T+90 days

ATTACHMENT 2

BEGINNING of OUTAGE ILRTs - PWRs

	Plant	Unit	Month	Year
1	South Texas Project	1	January	1991
2	South Texas Project	2	September	1991
3	H. B. Robinson	2	April	1992
4	Shearon Harris	Single Unit	September	1992
5	V. C. Summer	Single Unit	March	1993
6	Comanche Peak	1	November	1993
7	South Texas Project	1	February	1995
8	Shearon Harris	Single Unit	May	1997
9	Comanche Peak	2	October	1997
10	V. C. Summer	Single Unit	October	2003
11	Indian Point	3	March	2005
12	Indian Point	2	April	2006