

May 17, 2010

Mr. John J. Grossenbacher
INL Laboratory Director
Battelle Energy Alliance, LLC
P.O. Box 1625
Idaho Falls, ID 83415-3695

SUBJECT: Advanced Test Reactor Programs Nuclear Safety Oversight Committee (NSOC) Meeting Report for March 23-25, 2010

Dear Mr. Grossenbacher:

Enclosed is the report for the fifth meeting (March 23-25, 2010) of the Advanced Test Reactor (ATR) Programs NSOC. The committee is planning to meet again at ATR in July 2010.

The following recommendations from this meeting should be noted:

Conduct of Operations, Maintenance and Work Planning

There continue to be important operational events experienced at the ATR Complex due to issues with conduct of operations, maintenance and work planning. These issues are exacerbated and made more complex by latent plant conditions including material condition deficiencies and equipment functional failures that were the subject of our January 18, 2010 letter to you. Further, contributing to these issues is an undersized operational staff that fulfills minimum requirements under the Authorization Basis, but does not fully support compensatory measures that can help in more quickly changing the observed poor operational practices. A recovery and upgrade program has been initiated recently and we judge that it has the necessary elements, if executed effectively, to result in eventual success.

However, the effect of these issues on safety risk is unclear. The NSOC recommends that ATR Programs:

- Prepare an evaluation of the aggregate effects on safety risk of the conduct of operations, maintenance and work planning issues, including the effects of the latent plant conditions.
- Develop a basis for continued operation considering the results of this evaluation.

Safety Analyses

The water power calculator for the ATR is being evaluated for accuracy. There are questions on the accuracy of the quadrant thermal to N-16 power ratio calculation associated with the accuracy of each quadrant power indication. The concern is primarily due to the approaches used in accounting for uncertainties associated with inter-quadrant leakage in the flow distribution tank.

The NSOC Engineering Subcommittee has been and will continue to review the ATR efforts to establish the significance and means to resolve these questions.

Design Control

The constituents and amount of contamination experienced during sizing of the AGR-1 test assembly prior to shipment to HFEF were unanticipated. Although the unexpected contamination was contained, this experience suggests that there may be shortfalls in the experiment design and review process that should be addressed.

The NSOC recommends that a thorough review and causal analysis be performed of the AGR-1 design and review process and of the activities preparing for the sizing of this experiment.

Emergency Operating Procedures

The emergency operating procedure actions that would be taken in the event of a station blackout were reviewed. The NSOC review concluded that it is possible verbatim compliance with these procedures could result in initiation of EFIS even though plant conditions and configuration do not warrant that action.

The NSOC recommends that the appropriate supporting analyses and emergency operating procedures (e.g., addressing station blackout, loss of heat sink, and loss of primary flow) be reviewed and revised, if appropriate, to reduce the potential for unwarranted initiation of EFIS. The NSOC understands that this issue is being evaluated by the LEP in conjunction with determining the correct path for an emergency core cooling system. The ATR Advisory Panel has been and will continue to monitor the activities in addressing this issue.

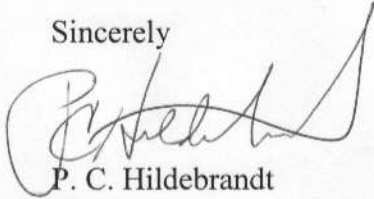
Environmental Releases

Recent experience at the Vermont Yankee commercial power station has focused the industry on its inspection programs for, and the integrity of, buried piping containing potentially radioactive materials.

The NSOC recommends that ATR Programs evaluate the scope and adequacy of inspection and monitoring capabilities for buried systems based on the lessons learned from the recent Vermont Yankee experience.

Your assistance is requested in establishing the appropriate management goals and priorities to address these NSOC recommendations and achieve the necessary improvements.

Sincerely



P. C. Hildebrandt
NSOC Chairman

Enclosures:

Report of NSOC Meeting for March 23-25, 2010

Copy via E-mail:

NSOC Members

Art Clark

Riley Chase

Jack Lance

Wray Landon

ATR PROGRAMS

NSOC Review Meeting #1-2010

AGENDA 23-25 March - 2010

23 and 24 March - ATR Complex Emergency Control Center TRA-680

25 March – EROB Conference Room 398

Time	Item	Activity	Presenter/Discussion Lead
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March 23:

I.	WELCOME & Facility Safety Brief		ATR Programs Operations Director
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Introductions

New Member - Hugh Campbell is replacing Larry Demick as an outside member of the NSOC. He will chair the Nuclear Safety Evaluation subcommittee.

II.	CALL TO ORDER		NSOC Chairman - Phil Hildebrandt
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A.	The NSOC Chairman verified that a quorum was present		
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B.	NSOC Administrative Matters		ATR Programs NSOC Coordinator
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NSOC Charter Changes were reviewed with the committee by Doug Wale – Discussions of suggested changes ensued and comments were incorporated into the revised charter. The most significant changes are:

- Clarification of roles, responsibilities, and interactions between the NSOC Chairperson and NSOC Coordinator
- Strengthening of guidance for identifying recommendations
- Membership update to remove the local or regional university member (will add back when one is appointed).
- Clarification of minutes time lines and transmittal requirements including providing a template executive summary/transmittal letter.

The committee voted unanimously to approve the charter changes.

A discussion was held concerning the potential difficulties to meet the quorum requirement as currently stated in the charter. The potential addition of a “PWR” expert member will alleviate this concern.

ATR Programs NSOC Coordinator Douglas Wale 533-4296

Douglas.Wale@inl.gov

ATR Programs NSOC Administrator Dee Marler 533-4571

Dee.Marler@inl.gov

Revision Number 1

Date Agenda Revised 4/22/10

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Significant Operational Events

ATR Station Manager

Mike Love led a discussion on the most significant events at ATR since the last meeting (see presentation). The committee discussed the issues and concerns raised by the events and actions being taken by ATR management. Specific concerns discussed included configuration management, operating and maintenance personnel practices, and level of management discovering causes of issues. There were no open issues from this discussion.

Corrective Action Program Improvements

ATR Programs Director

Doug Johnson led a discussion on the changes that have been made and that are planned to improve the ATR corrective action program (see presentation). These actions were solidified in a corrective action plan to address the previous NSOC recommendation from the December 2009 meeting. As result of the discussion the NSOC was updated and requested that the described actions be reviewed during subsequent NSOC meetings.

Other discussion points centered on the effectiveness of the critique process for accomplishing prompt investigations and the importance/benefits of single point of entry for all issues.

It is the experience of the outside NSOC members that the current critique process could be expected to be ineffective in investigating events in an operating reactor. Mr. Hildebrandt recommended that ATR Programs review the critique process that is typically used in commercial power reactors and has been found to be effective. Commercial practice uses a dedicated critique team, critiques are conducted immediately following an event (e.g., same shift), interviews are held with individuals (not groups) and senior management is not present.

Mr. Mattson requested to see the documentation brought to the MRC for review and how it was dispositioned – this was brought to the outbrief.

Mr. Hildebrandt requested to receive the ATR Programs Corrective Action Performance Metrics and the ATR Programs Quarterly Performance Indicators Report. The Revised ATR CARB and MRC charter request is still outstanding.

III SUBCOMMITTEE BREAKOUT MEETINGS

ATR Programs NSOC Coordinator Douglas Wale 533-4296

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The Main NSOC adjourned for the day and each of the subcommittees met for the remainder of the day.

March 24:

Time Item	Activity	Presenter/Discussion Lead
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IV. ROUTINE REPORTS AND REVIEWS (NSOC members only)

A. Authorization Basis Changes – Dave McDaniel led a discussion on recent ATR Authorization Basis changes since the last NSOC meeting. The committee had a series of questions, answers and discussion on this topic including the differences between the NRC and DOE SAR approval process and the GAP issues. The discussion ended with no open issues.

B. Potential Inadequacies in the Safety Analysis (PISAs) and Unreviewed Safety Questions (USQs) – Dave McDaniel led a discussion on ATR open USQs and PISAs (see presentation). There was a fairly lengthy discussion concerning the differences in the NRC and DOE USQ processes and questions concerning why some of the LST-100 USQs were actually USQs. The discussion ended with no action items.

C. ATR Programs Operational Summary

Doug Johnson led a discussion on the ATR Operational Summary since the last NSOC meeting (see presentation). There was considerable discussion centered on responses and reactions when events happen, and the risk assessments performed for decisions to put the plant in transient conditions when events happen (e.g., shutdowns). Topics also included what the drivers were behind procedure compliance issues and whether the material condition issues in the plant confound the events that happen. The discussion concluded with no outstanding issues. There was one request to see selected improvement projects engineering jobs and associated USQ documentation.

D. ATR Programs Response to previous NSOC Comments and Recommendations- White Paper

Doug Johnson led a discussion on the key points on the white paper being generated in response to the NSOC recommendations from the December 2009 meeting (see presentation). NSOC stated that they were expecting to see more detail on how the issues were being approached as a whole. This discussion resulted in the mutual understanding that the whitepaper was not yet fully developed and it needed to be expanded before it was reviewed. It is expected to be complete and presented to the Leadership Management Team in

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the next 3 weeks.

V. REPORT OF NSOC OPEN ITEMS

No discussion was held

VI. Opening Remarks “Open Forum” (Working Lunch)

Experiment Life Cycle Management program

Doyle Batt led a discussion on the planned changes to the experiment process to improve the development and design flow, and success rate of the experiment process. Considerable discussion took place that resulted in NSOC agreement to monitor the progress of the improvement initiative over the next year.

This will be an agenda item for next meeting to receive an update.

RERTR Program and Full Element Test Objectives

Dana Hewitt and Mike Cook led a discussion on the RERTR program and full element test objectives. The Committee had numerous questions and discussion points concerning the previous failures, selection process, applicability to ATR, and gained an understanding that current full element testing is not to qualify fuel for the ATR but for NRC licensed researched reactors. The discussion ended with requests for information and requests for additional briefings. The NSOC will review the SAR for the test prior to final submittal to DOE.

Agenda items for next meeting: Safety Case overview for RERTR full element test and update on test program progress.

Information requests: Failure Analysis Reports for RERTR test failures; Developing approach to fuel design – physics behind why it will work (feasibility study); Applicability Study or documentation relating the feasibility study for the fuel design and applicability to ATR.

VII. NSOC SUBCOMMITTEE REPORTS/PRESENTATIONS NSOC Subcommittees

Each of the subcommittee chairmen summarized selected points from the subcommittee reviews. The content of these discussions are included within the minutes for each subcommittee meeting, attached.

Additionally, the subcommittee chairmen recommended:

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- Subcommittee members not provide briefings to other subcommittee to broaden the number of ATR Programs personnel that interact with the NSOC and further, to preclude schedule conflicts
- Example Corrective Action Program items should be selected by ATR Programs prior to subcommittee meetings for review.
- Doug Wale was requested to assist in precluding overlap of topics during planning of agendas for subcommittee meetings. Where common interests need to be addressed, joint subcommittee meetings should be scheduled.

XII. COMMENT/DISCUSSION

NSOC Chairman

Future meeting schedule: July 13, 14, 15 - 2010

Next NSOC Agenda Items

- Technical presentation on RERTR
- Brief on outcome of QA work surveillance
- Safety/Security Interface during drills
- USQ Process Changes – if approved by then

C. NSOC Caucus – Recommendations to INL Director

See close out brief

1700 XII. ADJOURNMENT

ATR PROGRAMS

NSOC Review Meeting #1-2010

AGENDA 23-25 March - 2010

23 and 24 March - ATR Complex Emergency Control Center TRA-680

25 March – EROB Conference Room 398

March 25:

Time Item	Activity	Presenter/Discussion Lead
0800-0900 I.	NSOC OUTBRIEF (EROB CR 398)	Attended by the NSOC external and internal members. Additional personnel were Rick Denning from DOE, Art Clark, Wray Landon, Doyle Batt, Kelly Estes and Paul Henslee.

Discussion was led by Phil Hildebrandt – see handout.

ATR Programs NSOC – RCEP Subcommittee Minutes

Date of Meeting: 03-23-10

Subcommittee Members:

- Robert Brodsky
- Phillip Erickson
- Forest Holmes
- Jessica Waters

The subcommittee addressed the following areas:

1. ATR Complex Emergency Management Hazards Survey and Hazards Assessment support provided by INL Emergency Management Home Organization,
2. Performance in the Radiological Protection Area,
3. Document management process for safety basis document updates,
4. Inspection of buried piping containing or potentially containing radioactive constituents and piping in safety related systems outside the primary coolant system,
5. Extent of condition review for TRA-604 UPS failure.
6. R. Brodsky & J. Waters tour of ATR Plant.

The details, observations and recommendations of these reviews are described below.

1. ATR Complex Emergency Management (EM) Hazards Survey and Hazards Assessment support provided by Emergency Management Home Organization.

The Subcommittee members were given a presentation on the support provided to the ATR by the INL EM home organization in surveying and assessing hazards. Brad Salmonson (hazard assessor for INL EM) was the presenter. The presentation included a review of the requirement basis and screening criteria used in conducting the hazard survey and hazards assessment. The emergency-planning zone (EPZ) for the ATR Complex was reviewed along with the technical basis for determination of the EPZ. The role of the home organization in supporting the ATR Complex with consequence assessment resources during events was also explained.

Attendees were Bob Brodsky, Phillip Erickson, Jessica Waters and Forest Holmes, Brad Salmonson.

2. Performance in the Radiological Protection Area

Paul Nelson, ATR Complex Radiological Controls Manager presented information to the subcommittee about the Digital Radiation Monitoring System (DRMS). During the past year, there have been problems with component failures, which have been resolved for the most part when a source for new fans was found. Paul provided a report “Recommendations for Upgrade of Radiation Monitoring at the Idaho National Laboratory Reactor Technology Complex dated August of 20007. ANNA-RPT-010). The report identified several options for upgrading the system based upon availability of funding. Efforts to implement the recommendations of the report are in progress.

ATR Programs NSOC – RCEP Subcommittee Minutes

Mr. Nelson also reviewed lessons learned in the radiological control area with the recent handling and sizing of the AGR-1 experiment. Significant contamination of the sample handling work space occurred during cutting of the test leads due to an unanticipated release of radioactive hafnium used in the experiment thermocouples while sizing activities were taking place. The fact the thermocouples contained hafnium was not recognized by the program. A brief discussion of the monitoring programs for water wells, INL & ATR specific ground contamination, and monitoring buried radioactively contaminated piping systems identified concerns which led to an additional presentation later in the day by Mr. Jeff Brower of ATR Engineering. The buried piping presentation is covered in more detail later in the minutes. In addition, the legacy contamination of soil and ground water due to past work practices was discussed.

Recommendations

1. Evaluate the current process for reviewing and controlling material composition of components used in experiments in the ATR experiment program. The evaluation should include reviewing lessons learned from the AGR-1 hafnium irradiation and radiological contamination problems that resulted.
2. Radiological Controls personnel should be included in plant training efforts to improve human performance at the ATR.

Attendees were Bob Brodsky, Phillip Erickson, Jessica Waters and Forest Holmes, Paul Nelson.

3. Document management process for safety basis document updates

In response to the subcommittee's request, ATR Complex document management provided a briefing on the safety basis documentation update process. Presenters – Linda Reeder, Desiree Hale, Kirk Stueve, John Stephens

The briefing included the following:

- DOE's approval role, the use of revision implementation checklists, the types of changes and sources for requiring changes, the review and approval process for changes, how USQ items are incorporated, roles and responsibilities for implementing the changes, how plant modifications that trigger safety basis document changes are managed.

Observation:

- The change control and issue process appears to be managed appropriately although there are 20 open USQs according to LST-100.

Attendees were Bob Brodsky, Phillip Erickson, Jessica Waters and Forest Holmes, Linda Reeder, Desiree Hale, Kirk Stueve, John Stephens.

ATR Programs NSOC – RCEP Subcommittee Minutes

4. Inspection of buried piping containing or potentially containing radioactive constituents and piping in safety related systems outside the primary coolant system.

This presentation began as a result of questions raised during the review of radiological protection performance. The recent discovery of tritium in soils and ground water at Vermont Yankee due to pipe leaks raised questions on the extent of the inspection program at ATR on piping containing radioactive or potentially radioactive materials. During the discussion the scope was expanded to include piping in systems important to plant safety (excluding primary coolant system leakage which is monitored). Jeff Brower provided a briefing on the efforts at the ATR Complex to monitor buried piping systems containing or potentially containing radioactive constituents. A report commissioned by the INL in 2007 (Advanced Test Reactor Material Condition Assessment Report for Buried Piping SYS-1255-TR003/R1) was discussed. The report generated an ICARE (42339), which was closed on April 09, 2009. Corrective actions identified in response to the ICARE included the following:

42448 - Review PdM Program for inspecting buried piping whenever excavation is otherwise needed for other repairs/maintenance of buried piping to include photographs and recording "as found" conditions addressing condition of coatings and visible piping. Assigned to Brower, Jeff

42449 - Develop a standard directive/maintenance guide to formalize current practice and reference guide in future excavation work orders. Assigned to Brower, Jeff

42450 - Assist with developing work orders for maintenance of steel piping in TRA-670 to include LDW, EFIS and N-16 systems. Assigned to Brower, Jeff

The report recommended restarting the cathodic protection system to extend the life of the existing buried piping systems. A corrective action for this recommendation was not included in the ICARE. The corrective actions did not include developing and implementing a program to periodically inspect or leak check buried piping using video systems of other leak detection technologies. Mr. Brower provided examples of photos from recent excavations where an external visual inspection was completed. The current practice is to conduct external visual inspections of piping only when an excavation exposes the exterior of nearby buried piping, or an excavation takes place for a new penetration in an existing buried piping system. He stated that these inspections have not identified any material problems to date. He also indicated that if these pipes were to develop leaks, the existence of these leaks would be visible on the ground above the pipe.

Recommendations

1. ATR should re-evaluate if it should perform additional more proactive inspections of exposed and buried piping containing or potentially containing radioactive constituents or other piping systems important to safety.
2. ATR should evaluate the need for the addition of steps in system operations and maintenance programs to preclude clogged contaminated system drains from overflowing into non-contaminated drain systems as occurred at Vermont Yankee.

ATR Programs NSOC – RCEP Subcommittee Minutes

Attendees were Bob Brodsky, Phillip Erickson, Jessica Waters and Forest Holmes, Jeff Brower.

5. Extent of condition review for ATR Complex Evacuation System battery failure

In response to the Evacuation System battery failure event, the committee requested a briefing on an extent of condition review for other battery system and Uninterruptible Power Supply (UPS) systems at the ATR. Mr. Wyatt Parsons provided the subcommittee with a review of the battery and UPS systems affiliated with the ATR. The safety related and instrument UPS systems are located inside of a concrete block walled room in the ATR first basement electrical switchgear room. The PPS UPS systems are located in 4 rooms inside the ATR Diesel Room on the north side of the ATR building. The UPS and battery systems have an IEEE 450 standards based maintenance program. Periodic checks take place on a shift, daily, weekly, monthly, etc. basis. Battery and UPS voltage indications are available on the safety related and instrument UPS units. Battery and UPS voltage indications are available on the safety related and instrument UPS units. The voltage readings for the PPS UPS' are available on meters outside the PPS Battery Rooms.

Recommendation

1. ATR should confirm that the frequency of logging, reviewing and trending of battery condition parameters is adequate to facilitate early detection of battery deterioration or failure.

Attendees were Bob Brodsky, Phillip Erickson, Jessica Waters and Forest Holmes, Wyatt Parsons.

6. Tour of the ATR plant

Bob Brodsky and Jessica Waters (guide) made a brief tour of ATR. Due to time constraints the tour was limited to observing the path and equipment used to unload and partially disassemble the AGR-1 test assembly. They visited:

- the reactor main floor and observed the OG Kelly cask and reactor top area (where the test was removed from the reactor vessel and transferred to the canal area),
- The canal area where the AGR-1 test was sized to make it possible to fit in the OG Kelly cask for transfer to the Dry Transfer Cubicle (DTC) for further resizing prior to shipment to the Materials and Fuels Complex (MFC).
- The DTC which was in the process of being decontaminated.

Observation

The plant areas visited were clean and orderly.

7. Potential Review Topics for Future NSOC Meetings:

1. Review the INL Emergency Management (EM) and Security Response interfaces.
2. Review the performance of, and any plans to update the In Vessel Post Accident Monitoring System (IVPAMS).

ATR Programs NSOC – RCEP Subcommittee Minutes

3. Review the ATR Complex As-Low-As-Reasonably-Achievable (ALARA) activities including a meeting with the ALARA Committee.
4. Review the status of and the corrective action plan for repair/replacement of the ATR Primary Wind Instrument.
5. Monitor complex plant activities requiring the use of procedures.
6. Observe Radiological Control activities in progress.
7. Observe radioactive materials storage areas.
8. Review lessons learned from the hf contamination event.
9. Additional tours of the plant.

ATR Programs NSOC - OM&T Subcommittee Minutes

Members: Phil Hildebrandt
John Stephens
Ron Weaver

Presenters: Mike Love
Ed Schuebert
Ron Elsasser

The subcommittee addressed the following areas:

1. Nature and causes of ongoing conduct of operations issues
2. Operations recovery, improvement and upgrade program
3. Size of qualified operations staff

Mike Love led an overview of nature and causes of the conduct of operations issues. The issues are manifested through repeated deficiencies and inappropriate standards in procedure use, procedure adequacy, peer checking and formal communications. Several examples were discussed in detail that characterized the individual and collective approach that has been historically been considered acceptable or allowed to persist. Some experienced shift supervision has found the practices that have evolved as unacceptable and have requested transfer to other assignments. The conduct of operations issues are rooted in legacy operational practices.

The conduct of operations issues are further complicated and made more complex by the legacy plant issues such as material condition, equipment functional failures and long-standing design issues.

Mike also described the operations recovery, improvement and upgrade program that appears to include the appropriate attributes for success. Most of this program is recently initiated and is a work in progress.

Observations:

- ATR Programs continues to experience important operational events caused by conduct of operations, maintenance and work planning issues
- The conduct of operations, maintenance and work planning issues are made more complex by latent plant conditions including material condition deficiencies, equipment functional failures and design issues.

ATR Programs NSOC - OM&T Subcommittee Minutes

- The undersized qualified operational staff contributes to the observed issues. This undersized staff is marginal to achieve the standards for the appropriate conduct of operations expected by ATR Programs management. (The requirements regarding staffing in the Authorization Basis are fulfilled.)
- The current effect of the conduct of operations, maintenance and work planning issues on safety risk is unclear.

Recommendations:

- Prepare an evaluation of the aggregate effects on safety risk of the issues described above, including the effects of the latent plant conditions. This evaluation needs to be comprehensive in nature, addressing the root and common causes. The distractions to operations, maintenance and engineering personnel caused by the latent conditions need to be objectively addressed through assessment of cumulative effects.
- Develop a basis for continued operation considering the results of this evaluation. This basis can consider compensatory measures that have been implemented.

ATR Programs NSOC – NSE Subcommittee Minutes

Date of Meeting: March 23, 2010

Subcommittee Members:

- Larry Demick
- Hugh Campbell
- Adam Gott
- Veryl Kirkpatrick

The subcommittee addressed the following areas:

- 8. Review Progress in formalizing the review and documentation of PISAs and USQs before plant operation**
- 9. Review progress on obtaining a safety monitor**
- 10. Status of resolving ATR open PISA/USQs**
- 11. Review CAP activities since the last NSOC meeting relevant to the NSE Subcommittee scope**
- 12. Review of the station black-out procedures.**

The following summarizes the discussions, observations, recommendations and requests.

1. Review Progress in formalizing the review and documentation of PISAs and USQs before plant operation

Ed Schuebert provided a copy of a draft revision to the Operations Safety Board (OSB) Charter. Appendix B has been added as a revision to this charter to address the issue raised in the last NSE subcommittee meeting on how the collective significance of outstanding USQs and PISAs is assessed and documented by the OSB prior to each plant restart. This draft revision to the charter includes:

- An explicit requirement for review of LST100 items that summarize the outstanding USQs and PISAs in comparison with Cycle Reference Document -1 (CRD-1) that lists all active interim controls to ensure that CRD-1 items cover the outstanding USQs and PISAs, where applicable.
- A requirement to review the Collective Significance Chart covering USQs and Unresolved PISAs (maintained by John Chapman).
- Include copies of LST100, CRD-1 and the Collective Significance Chart with the OSB meeting minutes.

Request:

- 1) During its next meeting the NSE Subcommittee will confirm that the reviewed changes to the OSB Charter have been made in an approved revision of the Charter and close this issue.
- 2) It is requested that the acronyms used in this charter be defined, (e.g., CRD-1).

ATR Programs NSOC – NSE Subcommittee Minutes

2. Review progress on obtaining a safety monitor

Bentley Harwood provided (1) a presentation on the status of acquiring a Risk Monitor System and (2) an update on the status of certification of the Power Operations Model and the additional models required to complete the PRA model for the plant. A copy of the presentation on procurement of the Risk Monitor System is attached.

In summary, there appear to be two viable alternatives for the Risk Monitor. The first is the Scientech “Safety Monitor”; the second is Revision 8 of the INL SAPHIRE model. The latter appears to be favored based on one to one compatibility with the SAPHIRE based ATR PRA model. Use of the Scientech Safety Monitor would require development of a new translator between the SAPHIRE based ATR PRA Model and the proprietary Scientech software. The cost and schedule to develop this translator are very uncertain. An open issue with procurement of the SAPHIRE risk monitor is obtaining a firm commitment from INL to provide the model on a timely basis. A meeting between the cognizant SAPHIRE management and ATR management is scheduled for 3/24/10 to discuss this issue.

The Power Operations model certification is progressing and is expected to be complete by the end of this fiscal year. An additional four models are being developed covering additional plant states including flood, fire, seismic and confinement.

ATR should continue to support timely acquisition of the Risk Monitor and completion and certification of the remaining PRA models.

3. Status of resolving ATR open PISA/USQs

Dave McDaniel and Keith Penny discussed near term and long term planning for resolution of outstanding USQs. An objective for this fiscal year is to close at least 4 of the outstanding 20 items. There are, however, seven that have the potential for closure this fiscal year.

During the meeting it was learned that the Evaluation of the Safety Situation (ESS) for RTC-USQ-2006-578 which addresses the beryllium reflector cracking issue was approved by DOE and the SER would be received prior to the next scheduled shutdown. This is currently the only outstanding ESS submitted for USQ closure. ESSs will be prepared and submitted for the following USQs that have the potential for closure in FY10:

- USQ-2008-553 – Error in kinetic model
- USQ-2008-137 – Safety rod drop time
- USQ-2009-631 – PCS pH control
- USQ-2009-714 – Seismic qualification of evacuation alarms
- USQ-2004-385 – Surge tank level uncertainty
- USQ-2009-208 – Cask drop into pump motor room

ATR Programs NSOC – NSE Subcommittee Minutes

There are three other USQs that pertain to off-site dose issues and four that relate to the upgrade of EFIS that will be addressed as part of LEP.

This focus on resolving these issues should be continued to close them out as soon as practical.

4. Review CAP activities since the last NSOC meeting relevant to the NSE Subcommittee scope

Keith Penny and Dave McDaniel reviewed four significant items that were entered into the CAP since the last meeting in December 2009.

- 1) The hafnium neck shim rods are burning out faster than experienced in prior intervals between Core Internal Change-outs (CIC). Normally these rods are changed out only during a CIC. At current rates the rods may need to be replaced 12 to 18 months prior to next CIC. Potential causes for the faster burn up that are being explored include (1) effects of the different experiment configurations and temperature requirements, (e.g., AGR-1, TMIST, AGC-1) that require more outer shim cylinder movement than experienced in the past, and (2) changing the initial insertion of the outer shims by ~6 degrees from past experience; 3 degrees is equivalent to withdrawing one neck shim. This issue is still under investigation.
- 2) Stack RMS B has been out of service during this operating cycle. Extensive investigation identified (1) an undocumented coupling added to the signal line and (2) a deficient solder joint in the amplifier drawer. It was determined that the bad solder joint was the cause of the failure of RMS B. The undocumented coupling was removed and the solder joint was repaired and RMS B is currently operational. All of the RMS detectors' signal cabling is to be replaced over the longer term.
- 3) The #2 regulating rod is not operational and the #1 regulating rod operation is degraded. The problems with operation of these rods are judged to be due to aging of the nuclear instruments (NI) that has reduced the signal/noise ratio to the extent that it affects operation of the rod control system. The NIs has not been replaced since 1986. The #2 NIs will be replaced this outage; if time permits the #1 NIs will be replaced this outage or next outage. Replacement of all other NIs will be initiated as required.
- 4) Leakage has been noted from the M-7 PCP cubicle coincident with an increase in plant unidentified leakage of ~1/2 gpm. This pump is not operating; it was secured after the problems with attempting to start the pump with both the suction and discharge valves shut at the beginning of the current operating cycle. Since the cubicle is not accessible the source of the leak is not known. Once the plant is shutdown the cubicle and pump will be inspected to determine the location of the leak.

All of these items are in ICAMS and progressing through the CAP process for resolution, including significance and extent of condition evaluations.

The NSE ATR Subcommittee members need to do better screening of all CAPs items entered between NSOC meetings to identify the more significant ones for NSE sub-committee review. This is needed to assist in assessment of the trend in effectiveness of the CAP in identifying, correcting and tracking issues.

ATR Programs NSOC – NSE Subcommittee Minutes

5. Review of the station black-out procedures.

This review was conducted in parallel with the ENG Subcommittee. A summary of this review is included in the ENG Subcommittee minutes.

ATR Programs NSOC – SQAAB Subcommittee Minutes

Date of Meeting: 3-23-10

Subcommittee Members:

John Chapman, Jack Jacobi and Roger Mattson

The subcommittee addressed the following topics:

1. Implementation of Lessons Learned
2. QA Surveillance of Human Performance
3. Recent QA Assessments
4. Procedure Compliance
5. Security/Safety Interface
6. Status of Earlier Observations and Recommendations

The details of and requests, observations and recommendations resulting from these reviews are described below.

1. Implementation of Lessons Learned

John Chapman raised the question of how lessons learned were being implemented at ATR. Jack Jacobi and Terry Hathaway described a data base of lessons learned available on the INL internal website. Ron Elsasser described how INPO operating experience summaries and NRC generic issuances are received and distributed within the ATR Program. Keith Penny described past efforts to learn from HFIR operations experience at Oak Ridge. There was not a general understanding among those present for the discussion as to how the ATR Program assures that lessons learned are adequately known to and implemented by personnel responsible for the safety of ATR. Subsequent elaboration on this subject in the NSOC meeting on 3/24/10 by Mike Love provided assurance that lessons learned are adequately considered and utilized by ATR Programs.

2. QA Surveillance of Human Performance

Terry Hathaway and Ron Elsasser briefed the subcommittee on their efforts to prepare for a new form of human performance surveillances of work in progress during the April outage of ATR. Hathaway has suggestions and draft schedules from Dave Schoonen of important activities to be conducted during the outage (e.g., repair of regulating rod #2, replacement of flow control valves, repairs of fire water pump seals, repairs of primary coolant pumps M-6 and M-7, cooling tower repairs, reactivation of loop 2A, and experiment handling). Hathaway plans to use some of his less experienced personnel in the surveillances to assure objectivity. They will observe activities on day and back shifts. The objectives of the surveillances are to increase assurance of successful completion of the work, check on procedure compliance and identify opportunities for human performance improvements. Oversight and Operations personnel are developing checklists for the surveillances, and Ron Elsasser and Mike Love will provide joint pre-job briefings to the QA personnel and the operations and maintenance staff to increase the likelihood that this new type of surveillance will produce the desired results. BEA corporate QA personnel are aware and supportive of this new QA enterprise at ATR.

Request: At the next NSOC meeting, the subcommittee would like to be briefed on the outcome of and lessons learned from the human performance surveillances conducted during the April 2010 outage.

3. Recent QA Assessments

ATR Programs NSOC – SQAAB Subcommittee Minutes

Terry Hathaway briefed the subcommittee on two QA assessments conducted by his organization at ATR in the past few months. The first assessment covered elements 1, 5 and 6 of NQA-1-2000: Organization; Instructions, Procedures, and Drawings and Document Control. Implementation of the first two areas was found to be marginally effective, and implementation of the third area was found to be highly effective. The second assessment covered software quality assurance and found implementation of the required standard to be effective. Observations and Issues identified by these assessments are appropriately entered into ICAMS.

4. Procedure Compliance

The subcommittee discussed recent experience with procedure compliance at ATR. Jack Jacobi provided a list he compiled of procedure noncompliance that led to untoward circumstances within the past year. The discussion disclosed uncertainty about whether there is a dependable process for control of work signed into the plant. This matter was discussed further in the context of the report by the OM&T subcommittee on 3/24/10.

5. Security/Safety Interface

Forest Holmes described the uncertainty of safety and security priorities disclosed by a 2009 emergency drill involving a simulated intentional criticality event in the NMIS facility. The subcommittee discussed other potential issues that might arise in similar emergencies.

Request: The subcommittee would like to hold a joint session with the RCEP subcommittee at the next NSOC meeting to discuss with Forest Holmes, Bob Burnham and an ATR operations representative the approaches to be taken in the event of emergencies to assure safety and security.

6. Status of Earlier Observations and Recommendations

The subcommittee reviewed the status of its observations and recommendations from the December 2009 NSOC meeting and found them to be appropriately reflected in ICAMS.

Potential Review Topics for Future NSOC Meetings:

1. Review evaluations, identified corrective actions and effectiveness of corrective actions for significant issues in the CAP that fall within the cognizance of the SQAAB subcommittee.
2. Review current and recent activities of QA staff at ATR.
3. The two requests identified above.
4. INL procedure LWP-18001 controlling Unreviewed Safety Questions describes an “Engineering Job (EJ) and sub-tier approach” for application of the USQ process to SSC modifications. The subcommittee would like to review two past applications of this approach. The subcommittee should be supplied with the EJs, USQs, and all sub-tier eCRs, documents, drawings and work orders for reading in advance of the meeting.
5. Review revisions to the USQ process being developed by ATR Programs in response to a DOE initiative.

ATR Programs NSOC – ENG Subcommittee Minutes

Members: Jeff Brower
Chris Brooks (for Lawrnel Harrison)
Herb Estrada
Stuart Jenson

Presenters: Tony LaPorta
Keith Penny
Gene Matranga

1. N-16 lobe thermal power indicators

Tony LaPorta provided a presentation, “Relationship of Water Power and the Lobe Power Calculating and Indicating System (N-16),” which describes the process whereby the N-16 system is calibrated so as to generate indications of quadrant powers and lobe powers. The process, which is performed at intervals of [several] years, involves:

- (a) The use of silver wires and Uranium – Aluminum wires, activated at very low powers, to establish silver wire calibration factors
- (b) The use of silver wires to establish N-16 detector calibrations at 3 MW, and
- (c) A calibration of the sum of the N-16 quadrant power indications and the sum of the lobe powers each against the total of the thermal power indications from the water power calculators at high power.

There are also constraints on the individual quadrant and lobe powers as determined by the LPCIS as against the quadrant powers determined by the water power calculators.

Observation: The magnitude of the potential errors in quadrant and lobe powers as calculated by the LPCIS appears to be bounded by the process. No quantitative evaluation was made of the magnitude of the uncertainty in the process.

Observation: It was noted that there are no spare N-16 detectors available and that in fact one of the 10 detectors is not functional. ATR engineering is currently attempting to reverse engineer and repair or replace this detector. Preliminary prices for replacements from a commercial source (Reuter Stokes) were high (\$1 million for 20 detectors). The committee considers that this price may be reasonable, given the potential difficulties in reengineering and building these detectors. Nevertheless the committee endorses the site effort to fabricate or repair detectors but considers that replacement from a commercial source should be retained as a backup and used if the reverse engineering effort fails. The committee does not endorse replacement of the N-16 system with a system based on different operating principles.

2. Water power calculator uncertainties

Gene Matranga described an unreviewed analysis of the uncertainties in the new water power calculators (ECAR-5465 rev 1), which, after they are installed, will calculate the thermal power quadrant and total thermal power.

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Observations: Estrada had the following comments:

- The uncertainty calculated in the analysis for the coolant flow measurements (which are derived from measurements of the differential pressure across flow orifices in each quadrant outlet pipe) — less than $\pm 1\%$ — is optimistic. This opinion is based on the low uncertainty ascribed to the discharge coefficients for the orifices. The arrangement of the hot leg piping is such that significant swirl (a rotating flow field) will be present at these orifice plates. Swirl will induce a bias in the order of $\pm 1\%$ in the discharge coefficients vis-à-vis the discharge coefficients that were measured during calibration, where there was no swirl present. This error will be systematic—that is, of the same sign and magnitude in all quadrants— because the piping in all quadrants is essentially the same. When the uncertainties in the calibration process itself and in the d/p transmitters for each flow measurement are considered, a more realistic estimate for the uncertainty in quadrant flow and in the uncertainty of total reactor flow will be something over 1%, probably in the order of 1.1 to 1.2%.
- Of potentially greater importance in the determination of quadrant powers and total power are the measurements of the temperature rises across each coolant loop—the ΔT s. Matranga’s analysis determined a potential uncertainty in each hot and cold leg temperature measurement of about $\pm 1^\circ\text{F}$. The error in ΔT is therefore $(1^2 + 1^2)^{1/2} = 1.4^\circ\text{F}$. Many of the components of the absolute temperature errors are systematic so that the error in the total reactor power due to the error in ΔT may approach the error in the loop ΔT s. Temperature errors of this magnitude are not compatible with the current design objective of a thermal power uncertainty of ± 3.5 MWt at 250 MWt. The full power ΔT for a rated power of 250 MWt is in the 35 to 45°F range depending on the number of pumps operating; at a rated power 125 MWt it is half that. A systematic error of 1.4 °F in ΔT thus results in a power uncertainty approaching 10 MWt at 250 MWt and on a percentage basis substantially more than this figure at 125 MWt, without considering the uncertainty in the flow measurement.
- There is however a means to reduce the uncertainty in the quadrant and reactor temperature differentials. If the individual hot and cold leg loop temperature measurements are carefully recorded when the core power is zero and the pumping power is small (e.g. when operating on the emergency coolant pumps) most of the biases in the loop temperature measurements can be eliminated (the RTD lead imbalance errors, the self heating errors, some of the calibration biases). The loop temperature differentials can be set to zero under these conditions. The only residual errors in the ΔT measurements will arise from uncertainties in the slope of the resistance versus temperature curves of the individual thermometers. (The presence of swirl in the outlet piping will ensure that any temperature streaming that may exist at the core outlet will be well mixed before the fluid reaches the RTDs.) The

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uncertainties in the slopes can be reduced in the ATR operating temperature range by ice bath and a boiling water (steam) bath calibrations, so that ΔT uncertainties in the order of $\frac{1}{4}$ to $\frac{1}{2}$ °F should be achievable. With power uncertainties in this range the uncertainty objective of ± 3.5 MWt may be achievable*.

The quantification of quadrant to quadrant leakage flow was discussed. This flow is important in setting hot channel conditions. The N-16 system establishes the quadrant power with some accuracy. But the flow through the core quadrant is not necessarily equal to the flow measured in the outlet pipe from that quadrant (since cross flow may exist in the outlet plenum). The setting of the high quadrant outlet temperature scram should account for this uncertainty.

Observation: It should be confirmed that the quadrant hot leg temperature setting accounts for inter-quadrant flow leakage.

3. Reactor Vessel Level measurement.

Currently 300 inch range differential pressure transmitters and 30 inch range differential pressure transmitters measure the reactor Δp . Impulse lines for these transmitters connect to the high level overflow at the top of the vessel and to penetrations in the outlet plenum “can” near the outlet pipe connections. The 300 inch d/p transmitter measures core Δp at flows up to rated; the 30 inch d/p transmitter measures core Δp when emergency coolant pumps are in operation. The over-ranging to which the 30 inch d/p is subjected during normal operation apparently does not disturb its calibration; the transmitter reads zero when flow is zero. Thus a reactor vessel level instrument, which would be ranged at about 100 inches and which would be used as a basis for controlling emergency feed to the “can”** following a loss of coolant accident, appears practical.

Matranga described two concerns with the vessel level instrument:

- The impulse line connected to the outlet plenum below the core runs outside the “can” in a space hydraulically connected to the cold leg inlet, thence through the cold leg plenum above the core. It exits the vessel at a relatively high elevation. For cold leg breaks, these spaces might be filled with steam, particularly if decay heat is removed by boiling off liquid in the core can. Thus liquid in this impulse line might tend to boil producing errors in the measurement. It was pointed out that if this situation is confirmed to be a plausible outcome of some LOCA scenarios, the problem could be remedied by a controlled, small flow of cool water, injected into the line from outside the vessel. A similar arrangement is used to maintain the reference legs full for steam generator and pressurizer level measurements, as well as the ATR

* There is some ambiguity concerning the interpretation of the TSR uncertainty requirement.

** The “can” is the stack of the core support tank and the beryllium reflector.

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surge tank.

- There is concern that the impulse lines may not be leak tight. Brower suggested a go-no-go test that would put this question to rest. During refueling after the irradiated fuel has been removed, each line could be pressurized with air. Air emerging from the interior of the can is to be expected. Air from the exterior of the can is indicative of a leak. Air pressure indicates the water level in the can, or the location of a leak if there is one.

Recommendation: Air tests of the impulse lines should be performed during a refueling outage prior to the implementation of reactor vessel level instrumentation.

4. Station Blackout

Using a flow chart, Veryl Kirkpatrick and Ed Schuebert described the emergency operating procedures that would be used in the event of a station blackout.

Observations:

- The critical safety function status trees are called out early in the procedure and are used by the operator to determine actions appropriate to the emergency. Schuebert pointed out that they are not structured to deal with the loss of AC power, so that this step becomes a diversion.

Recommendation: This deficiency should be corrected.

- The “conserve water” step of the procedure may unnecessarily initiate EFIS. In particular, when the plant temperature reaches a specified temperature (in the 200 to 208 °F range), the plant is depressurized (by venting the reactor vessel) and EFIS is initiated *even though the emergency coolant pump remains in operation*. Apparently the objective here is to maintain the reactor vessel temperature below 240 °F (its nominal design temperature) in the ensuing transient. A more prudent sequence would postpone EFIS initiation until forced circulation is no longer possible (the battery is discharged). This maximizes the length of time in which operators can attempt to restore power and also reduces the decay power at which, eventually, flow reversal and boiling will occur.

Observation:

As part of their safety margin improvement analyses, MPR should develop blackout, loss of heat sink and loss of main coolant pump procedures that postpone EFIS initiation as long as is prudent but at the same time minimize the risk of core damage.




ATR Operational Summary

- Current Status
- Previous Quarter Performance
- Current Quarter Outlook

Doug Johnson,
Director, ATR Programs

WWW.INL.GOV


March 24, 2010



Current Status

- **Cycle 146A**
 - Day 45 of Planned 56 Day Operating Cycle
- **Key Experiments**
 - NR Type N (SW-183 and SE-190)
 - NSUF experiments (4) UI, UW, UCSB, and UF
 - AFC 2D/2E
 - GFR-F1
 - TMIST-2
 - NGNP AGC-1
 - RERTR-12
- **Equipment Reliability / Significant Maintenance**
 - M42 Overhaul
 - Radiation Monitoring Seal System
 - Regulating Rod control
 - Water Power Calculator
- **Key Modifications**
 - Plant DCS/CDS replacement
 - Loop 2A Reactivation


2



FY 10 Performance Summary (2nd QTR)

- **Availability (23 March)**
 - Actual Availability 72.9% (5 Year Avg. 52%)
 - Operating Efficiency 86.9% (5 year Avg. 81.9%)
- **Unplanned Shutdowns**
 - 5 in FY10 (13.9 days lost availability)
- **Key Accomplishments**
 - Shipped initial NSUF experiments for PIE
 - Shipped AFIP-3 and AFIP-4 for PIE
 - AGR-1 sizing and shipment and AECL cask shipment
- **Significant Operational Events/Issues**
 - Events
 - improper use or failure to comply with procedures in use
 - failure to adequately address and resolve procedure use issues
 - failure to use appropriate/applicable human performance tools
 - supervisory failures to detect/correct performance issues during operations
 - Current Issues
 - Conduct of Operations/Improper Maintenance (39/22; 22/12; 9/6)
 - Water Power Calculator
 - Regulating Rod control
 - Experiment sizing and shipment issues

3



Future Outlook

- **Operational Schedule**
 - Cycle 146A, 56 EFPD, Completes 3 April 2010
 - Cycle 146B, 14 Day Outage, 56 EFPD, Completes 5 June 2010
- **Key Milestones**
 - Complete SW-183 and SE-190 irradiations
 - Outage Performance to schedule
 - Ship AGR-1 fueled experiment
 - AGR-2 insertion (146B)
- **Challenges / Uncertainties**
 - Managing Experiment and Schedule Margin
 - Preparations for next extended outage
 - Maintenance plan and future ISOP Planning
 - Conflict Resolution
 - Experiment Process Changes

NR Type N Margin (Days)

	Available	Actual
FY08	23.9	23.5
FY09	41.6	45.9
FY10	35.0	14.0
FY11	33.6	

4



RECENT ATR EVENTS

Mike Love - 3/22/2010

SSB during Trouble Shooting 1/6/2010

- On 6 January 2010 the ATR experienced a SSB during troubleshooting to determine the cause for failure of the #1 WPC.
- The reactor was operating at a power level of 107.5MW supporting planned Operating Cycle experiment operations.
- Troubleshooting was being performed in accordance with an approved Work Order (WO). The WO had technicians power down WPC#1, replace a circuit card and power the unit up.
- The WPC is a computer that calculates reactor thermal power based on reactor flow and differential temperature. When WPC#1 was rebooting after power was restored, a high temperature SSB signal was received, causing a reduction in reactor power. A SSB lowers the regulating rod control system set point which results in a reduction of reactor power.

SSB during Trouble Shooting 1/6/2010

- When setting the set points on the WPC per the Detailed Operating Procedure (DOP), a caution in the DOP states that prior to powering down WPC #1 or WPC#2, the test block needs to be removed to disable the SSB on the inlet temperature.
- The DOP was not being used for this evolution. The System Engineer and Operations Management were not aware of the connection between the WPC reboot and the inlet temperature SSB.
- Additionally, the WPC prints did not show the interface between the WPC and the inlet temperature SSB.



SSB during Trouble Shooting Corrective Actions:

- An operator aid has been installed on the WPC
- The new Station Trouble shooting procedure, (in draft), has a lessons learned attachment and direction to check for other applicable procedures when developing trouble shooting plans
- Engineering is reviewing and updating the drawings



Primary Coolant Pump M-7 started with suction valve shut 2/15/2010.

- PCP M-7 was started during performance Operating and Maintenance Manual (OMM) procedure 7.3.13.1.2 to complete startup of the ATR primary coolant system (PCS).
- Operators detected an abnormal noise and pump start indications in the control room were also abnormal. An initial investigation of the unexpected conditions was conducted.
- No problems were identified and a second attempt was made to start PCP M-7 with the same results. The pump was shut down after approximately 30 seconds of operation.
- A subsequent investigation also failed to identify a cause. The Operations Manager decided to use the other two operable pumps for start up.
- PCP M-9, the next pump selected for startup, failed to start, the Operations Manager identified that all pump suction valves were shut instead of in the required open position for pump start.



Primary Coolant Pump M-7 started with suction valve shut 2/15/2010.

- DOP-7.7.13, Emergency Coolant Pump Functional Test, had been completed just prior to startup of the PCS and PCP M-7.
- A review of the procedure revealed that the SRO performing the DOP had shut all PCP suction and discharge valves instead of just the discharge valves as directed by the DOP in Step 4.6.1.



Primary Coolant Pump M-7 Corrective Actions:

- Reassignment of 3 Operations Personnel
- Personnel action
- Test run of the M-7 pump satisfactory
- More investigation of M-7 during the upcoming outage
- Troubleshooting of the PCP interlock on M-7 during the outage
- Validated all the PCP interlock software on all pumps is satisfactory
- Briefed Operations crews on job briefing, place keeping and peer checking expectations
- Re-writing the emergency pump test procedure



Disconnection of the wrong loop pump 3/14/2010

- On 4 March 2010 an ATR Programs maintenance electrician violated a LO/TO.
- The electrician had been assigned to disconnect the M-18 makeup pump motor for the inactive pressurized water loop 2A in accordance with an approved Work Order.
- The electrician electrically disconnected the M-18 makeup pump motor for the active pressurized water loop 2B.
- No hazardous energy was encountered by the electrician; however, the 2B M-18 pump was selected for automatic control of loop pressurizer level.
- Level was such that the pump was not required to be operating, thus there was no electrical energy present during the work.
- 480 VAC would have been applied to the electrical leads being disconnected had the loop control system called for an automatic start of the pump.



Disconnection of the wrong loop pump actions:

- Disqualification of worker
- Personnel action
- Extensive qualification program
- Station clock reset
- Stand down with all Maintenance Personnel
- Meeting with the Union
- Shop meetings with the Union and Worker
- Apply LO/TO to disconnected 2B M-18 make up pump – completed 4 March 2010.
- Make necessary WO revisions to reconnect the 2B M-18 make up pump – completed 4 March 2010.
- Reconnect the 2B M-18 make up pump motor and return the pump to service – completed 4 March 2010.



Commonalities of recent events

- ATR Management believes the apparent and root causes to be tied to a history of allowing interpretation of procedure steps and using procedures as a "guide". Additional contributing causes include:
 - The procedure change process is complex and takes a long time. ATR backlog of procedures in the review cycle >800 procedures, some over 5 years in the cycle, 125 have been in the cycle over 3 years. This is further compounded by the LWP-21220 conversion process with HaRPs. (I believe the bottle neck is Nuc Safety with SAR 16 commitments).
 - Operations procedures are not written with verbatim compliance, or human factors in mind.
 - SS have not embraced and enforced high standards.
 - Management failed to provide real time field observations and coaching on procedure use.
 - A small group of operations personnel have caused a large portion of events.
 - Operations personnel do not see the Commercial Power Industry as similar, "ATR is Different".



Additional Actions

- Shift Mentoring program
 - Focus on Briefings, Procedure Use, Peer Checks and 3-way Communications
- Operations Procedure Upgrade Program
 - Evaluating contract procedure writers
 - Supplemental ATR writer's guide
 - Streamlined review process
 - Ownership of procedures
 - Priority of each procedure with a 1-4 rating
- 3 Day Systematic Industrial Operations Training starting in March
- Farley Benchmarking trip in May for "High Intensity Training"
 - Focus on simulator and CR training to change expectations and behaviors
- INPO Operations Assist Visit in April
- ATR Observation Program
- Targeted QA assessments of Operational Activities
- Use of industry OE
- Personnel Accountability
- Evaluating coaches from outside of ATR
- Evaluating outside vendor for culture change
- Evaluating outside consultant for common cause



Overview of RERTR-FE Goals

NSOC Review Meeting

Wednesday, March 24, 2010

Dan Wachs, Dana Hewit, and Mike Cook
Idaho National Laboratory

www.inl.gov



GTRI/RERTR Fuel Development Program Goal

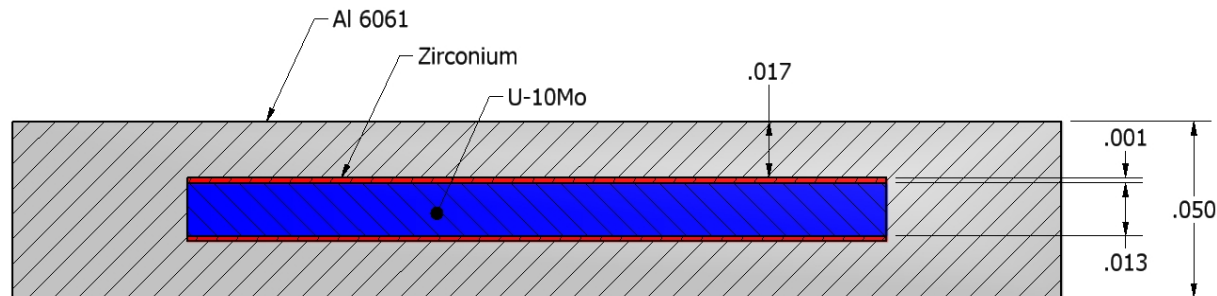
- Develop and Qualify LEU replacement fuels for foreign and domestic civilian research and test reactors
 - U-Mo Dispersion fuel for international community
 - 'Base' U-Mo Monolithic fuel for US NRC regulated reactors
 - MITR (Massachusetts Institute of Technology)
 - MURR (University of Missouri)
 - NBSR (National Institute of Standards)
 - 'Complex' U-Mo Monolithic fuel for US DOE regulated reactors
 - ATR-C (Idaho National Laboratory)
 - ATR (Idaho National Laboratory)
 - HFIR (Oak Ridge National Laboratory)

GTRI/RERTR Fuel Development Program Goal

- Develop and Qualify LEU replacement fuels for foreign and domestic civilian research and test reactors
 - U-Mo Dispersion fuel for international community
 - **'Base' U-Mo Monolithic fuel for US NRC regulated reactors**
 - **MITR (Massachusetts Institute of Technology)**
 - **MURR (University of Missouri)**
 - **NBSR (National Institute of Standards)**
 - 'Complex' U-Mo Monolithic fuel for US DOE regulated reactors
 - ATR-C (Idaho National Laboratory)
 - ATR (Idaho National Laboratory)
 - HFIR (Oak Ridge National Laboratory)

Fuel Development

- Over 320 irradiation tests were conducted on fuel plates to develop the 'Base Fuel Design' consisting of
 - Al-6061 cladding
 - Zr diffusion Barrier
 - U-10Mo fuel



- Qualification of 'Base Fuel Design' underway. Process is centered around prototypic configuration demonstration
 - AFIP-6 (bounding power, burnup)
 - AFIP-7 (mini-assembly under nominal power/ burnup)
 - RERTR-FE (partial LEU based ATR Element)

Low (L) Nominal (N) Bounding (B)
 Power → 200 350 500
 BU → 50 80 > 100

		Dispersion													
Power / BU	L/L	Silicide	U-Nb-Zr alloys				U-Mo alloys						U-10Mo	U-12Mo	Zr Clad
			U-6Nb-4Zr-5Nb-3Zr-2Nb-3Zr	U-6Nb-4Zr-5Nb-3Zr-2Nb-3Zr	U-6Nb-4Zr-5Nb-3Zr-2Nb-3Zr	U-6Nb-4Zr-5Nb-3Zr-2Nb-3Zr	U-Mo ternary alloys			U-4Mo	U-6Mo	U-7Mo			
L/L	RERTR-1 Microplate (3" x 0.875")	U001 U003 W001 W002	F001 F002	I004 I005	J001 J002	U-6Mo-1Pr N002 N003	U-6Mo-0.6Pr M001 M002	U-6Mo-0.55Sn-6.1Mo-0.3Pr-0.17Cs P003 P004 P005	T001 T002	D002 D004	C001 C004	B001 B002	A001 A002 A003 A007 A008 A009 A010 A011 A012 A013 A014 A015		
L/N	RERTR-2 Microplate (3" x 0.875")	U004 U005 W003 W004	F003 F005	I006 I005	J003 J004	N001 N005	M003 M005	P004 P001 P005	T003 T004	D005 D006	C002 C003 C005	B003 B004 B005	A004 A005 A019 A020 A023 A024 A025		
N/N	RERTR-3 Nanoplate (1.6" x 0.4")	U07 U02 U04 U05							M07 M01 M03 M08 M02	E03 E01 E04 E02	S01 S04 C13 C15 C14 K04 S02 C17 S03	R04 R01 R06 R07 R09	B02 B08 B03 B06 V01 Z04 G04 V04 Z05 G03 V07 Z03 V03 A10 A02 G05		
L/L	RERTR-5 Miniplate (1" x 4")	U8007J U8009J U8008J							E8008M E8011M		S8007C S8005C S8011D S8007L S8010D S8001E	Q8009K Q8006K Q8004K S8001K R8005F R8005E Q8007K R8008J	A8005H V8018G A8007H V8015G V8003B A8002L A8009M V8021M A8004L A8008H V8020G V8005B		
L/N	RERTR-4 Miniplate (1" x 4")	U8003J U8005J U8004J									S8002C S8003C S8004C S8008L S8004C S8005E	Q8002I Q8004K Q8001I R8003F R8004F Q8004I Q8003K R8004F	V8001M A8001H V8013G A8002H V8014G V8008B A8001L A8004K V8022M A8003L A8003H V8015G V8007B		
L/N	RERTR-6 Miniplate (1" x 4")	U0R060 U0R040	U-10Mo Dispersion		U-7Mo Dispersion				FSW		TLPB		Zr Clad		
N/N	RERTR-7A - Miniplate (1" x 4")		Al	Al-0.2 Si	Al-0.2Si	Al-6061	Al-2Si	Al-4043	U-10M0	U-7Mo	U-10Mo	U-12Mo	U-10Mo	U-12Mo	M25 M250
N/L	RERTR-7B - Miniplate (1" x 4")		V0R020 V0R010	V0R020 V0R030	R0R010 R0R020	R1R010 R1R020 R1R030	R2R020 R2R010 R2R030	R3R030 R3R010	L1F020 L1F090 L1F040 L1F100 L2F030	N1F090 N1F010 N1F040 N1F030 N1F060	L1F04L L1F140 L1F110 L1F120 L1F160	H1F020 H1F030	H1T010 H1T020		
N/N	RERTR-8 Miniplate (1" x 4")		V0R040 V0R050		Al	R0R010 R0R020	R1R040 R1R050	R2R040 R2R050	R3R040 R3R050			H1F020 H1F030	L1P020	H1P010 H1P020	
N/B	RERTR-9A/B - Miniplate (1" x 4")				Mg	R0R010			R3R010 F3R010	F3R010 F3R030			U-8Mo	U-10Mo	U-12Mo
B/B	RERTR-10A/B - Miniplate (1" x 4")		Al-Si Matrix Required						No Barrier	TS	Zr	Nb			
N/N	AFIP-1 - Full (2.25" x 24")								L1F29C L1F30T L1F330 L1F28C L1F28C L1F32C L1F24C	L1F27C L1F27T L1F30T L1F30T L1F36T	L1F34T L1F27T L1F30T L1F36T	L2F46Z L2F45Z L2F47Z	L1P256 L1P30Z L1P135 L2P15Z L1P234 L1P12Z L1P192 L2P16Z L1P171 L1P266 L1P244 L1P223 L1P202 L1P181	L1P086 L1P09Z L1P10T L1P08T L1P10T	L1P256 L1P30Z L1P135 L2P15Z L1P234 L1P12Z L1P192 L2P16Z L1P171 L1P266 L1P244 L1P223 L1P202 L1P181
N/N	AFIP-2 - Full (2.25" x 24")								L1F381 L1F401 L1F417 L1F427	L2F46Z L2F45Z L2F47Z	L1F44N				
N/N	AFIP-3 - Full (2.25" x 24")														
N/N	AFIP-4 - Mini-plate (2.25" x 7")														
B/B	AFIP-6 - Full (ATR) (2.25" x 4524")														
N/N	AFIP-7														
N/B	AFIP-12														
L/N	Element - Prototype (ATR element)														

US U-Mo Irradiation Testing History

Fuel Alloy Downselection - U-Mo w/ 6-10% Mo

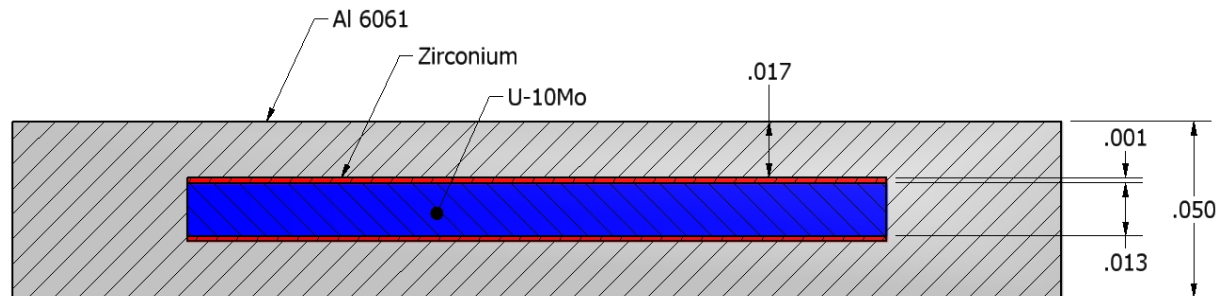
Monolithic

Monolithic Fuel Design Downselection - U-10Mo w/ Zr barrier

(1) Fuel plate breach due to "dog boning." Localized corrosion over a thin clad region exposed fuel meat. Corrected by procurement of programmatic UT scanner for min-clad inspection of all plates.
 (2) Fuel plate failed along bond line exposing fuel meat. TLPB fuel plate bonding process yielded insufficient bond strength to withstand multiple shutdown/startup transient. Fabrication process rejected from future consideration.
 (3) Fuel plate blistered at bounding power condition. Blister formed due to non-bond area between fuel meat and cladding. Blister anneal inspection technique to be implemented in future testing to identify this type of defect.

Fuel Development

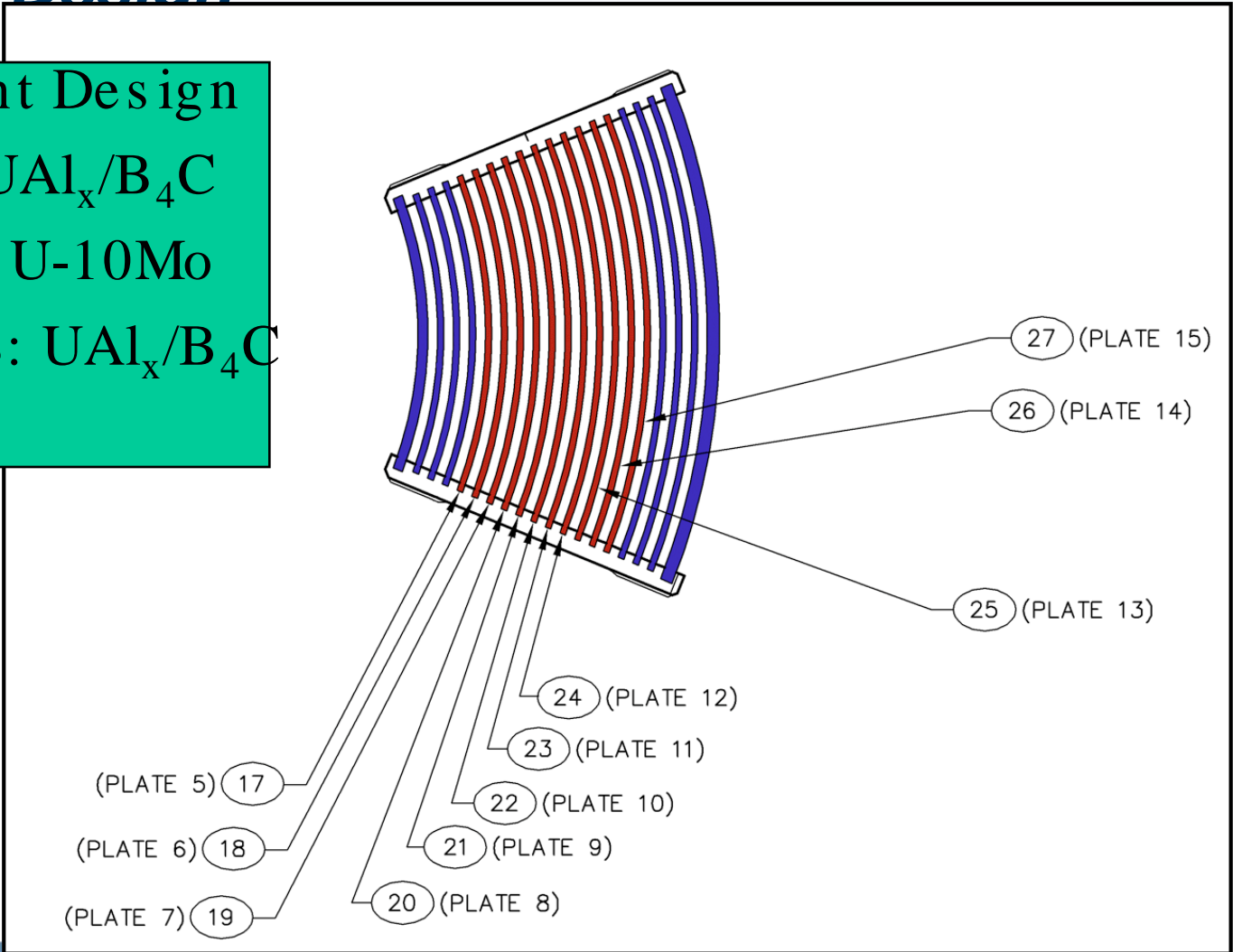
- Over 320 irradiation tests were conducted on fuel plates to develop the 'Base Fuel Design' consisting of
 - Al-6061 cladding
 - Zr diffusion Barrier
 - U-10Mo fuel



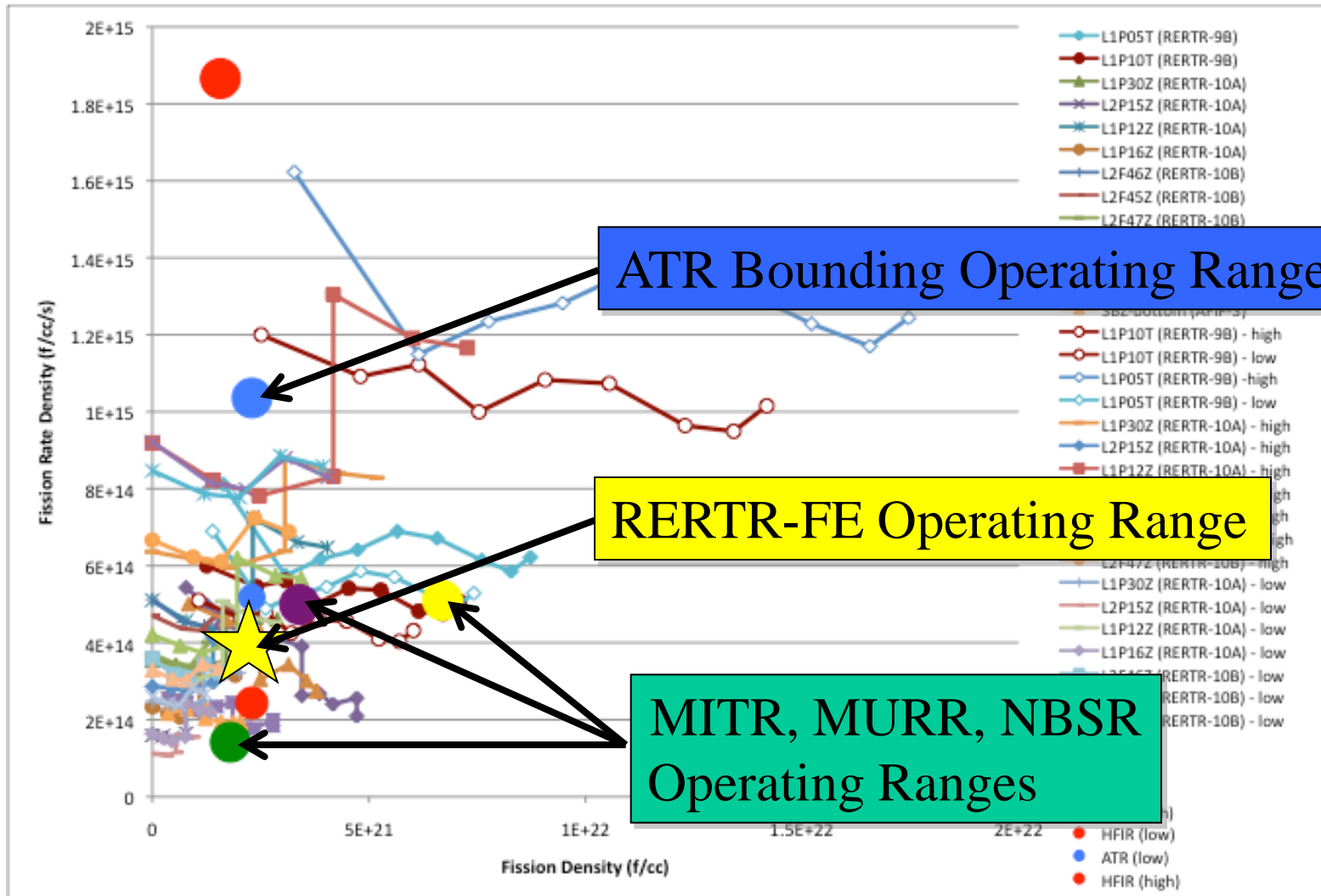
- Qualification of 'Base Fuel Design' underway. Process is centered around prototypic configuration demonstration
 - AFIP-6 (bounding power, burnup)
 - AFIP-7 (mini-assembly under nominal power/ burnup)
 - RERTR-FE (partial LEU based ATR Element)

RERTR-FE Design

- YAM Element Design
- Plates 1-4: UAl_x/B_4C
- Plates 5-15: U-10Mo
- Plates 16-18: UAl_x/B_4C
- Plate 19: Al



Pre-RERTR-FE Base Fuel Design Testing Range

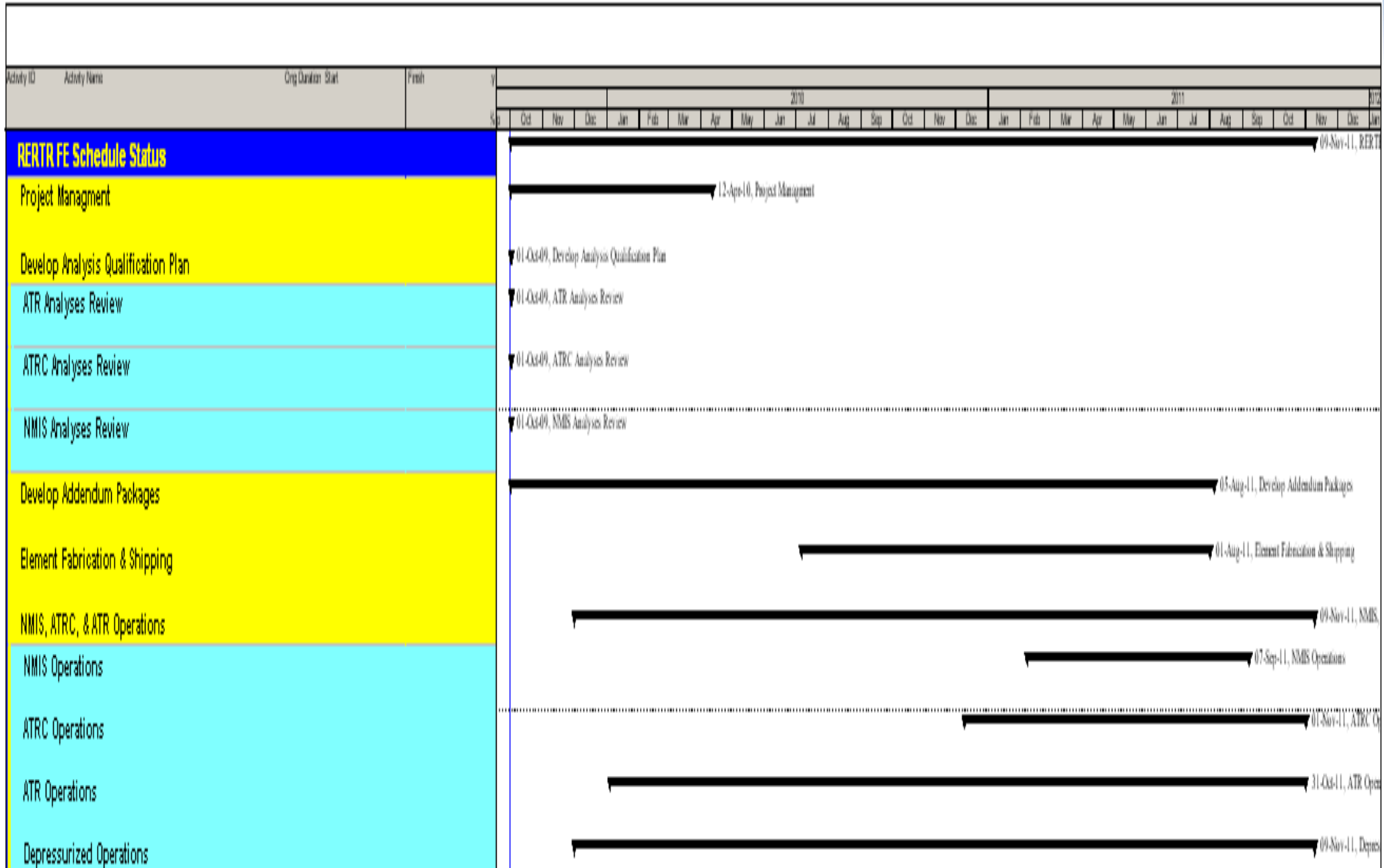


Examinations

- Element channel gaps will be examined between each cycle to confirm fuel plate swelling projections and deformation consistent with typical ATR elements
- Post irradiation examination will be conducted to confirm that fuel microstructural behavior is consistent with that observed during previous irradiation testing

Schedule Overview

- Level IV Schedule is Developed, Approved, and Base-lined
- 3 SAR Addendums to be written
 - Nuclear Materials Inspection and Storage (NMIS)
 - Advanced Test Reactor Critical Facility (ATRC)
 - Advanced Test Reactor (ATR)
- Approximately 100 Analyses need to be performed or validated by July 2010
 - Physics/Neutronics (~50)
 - Thermal (~30)
 - Criticality Safety (~10)
 - Structural/Mechanical (~10)
- Fabricate the Elements (B&W)
- Ready To Insert in September 2011



Irradiation Experiment Life-Cycle Unified Process

Process Implementation Team Recommendations

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Team Composition

Team Champions

Greg Gibbs	NGNP
Jack Lance	Applied Engineering & QA

Team Members

Doyle Batt – Chair	Engineering Technical Authority
Lloyd Brown	Systems and Plant Engineering - ETA
John Cox/Diane Croson	VHTR Technology Development
Sean Cunningham	Nuclear Operations - Production Control & HFEF
Paul Henslee	ATR Life Extension Program
Alan Hoskins	ATR Programs Engineering
Debra Utterbeck/Misti Lillo	Irradiation Testing – Nuclear S&T

Invited SMEs

Frances Marshall	Nuclear Fuels and Materials/NSUF
Cheryl O'Brien	Analysis and Design Engineering
Keith Penny	ATR Programs Engineering
Leonard Stenzel	Quality Assurance Program Support

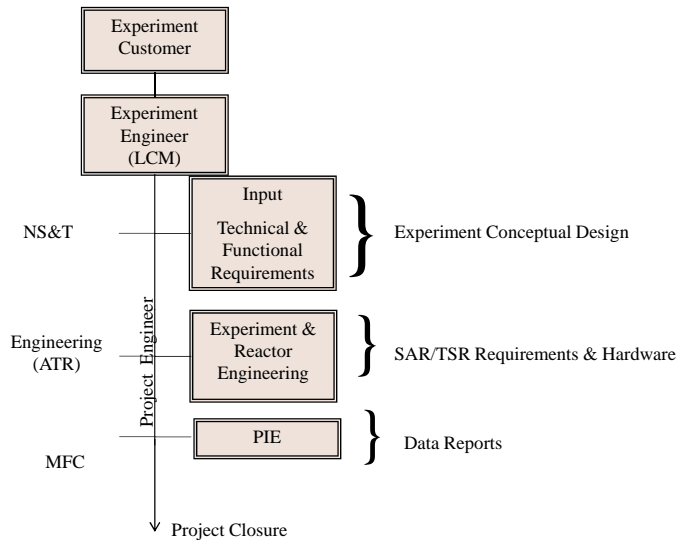
Summary of Major Issues

- Responsibility, ownership and accountability not clear
- Requirements lacking, not clear and sometimes hard to find
- Interfaces between customer, designer, irradiation and PIE not well defined
- Product quality criteria inconsistently identified and applied through the life cycle of the experiment
- Cost and Schedule development is immature
- Risk Management not consistently applied
- Resources not readily available

Essentials for the Success of the Experiment Process Implementation

- A single Life Cycle Manager (LCM) held accountable for the experiment from cradle-to-grave (one belly button)
- Consistent use of the new process and following appropriate company procedures
- A Joint Experiment Group that provides a Laboratory level review of the experiments and resolves conflicts that cannot be resolved by line management
- Organizational re-alignment that provides the required resources for experiment success and minimizes interfaces
- Resources will need to be developed and transitioned into the experiment groups

Experiment Life Cycle



Summary – Success Path

Ownership

- Essential to have a designated LCM for cradle-to-grave experiment product accountability; LCM is qualified, empowered and supported
 - Support management is accountable to LCM for their experiment products

Process

- Consistent use of the new unified process and following appropriate procedures is required.
 - New unified process will provide consistent and defined interfaces and establishes minimum expectations in key activities

Organization

- A Joint Experiment Group providing Laboratory level review and conflict resolution is necessary
- Alignment of personnel resources for experiment success is required

STATUS

- Procedure in final review
- Joint Experiment Charter in final review
- Organizational Alignment
 - One storefront for all experiments in NS&T
 - Experiments Engineering Group being formulated

Advanced Test Reactor Risk Monitor System

Date March 2010

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Advanced Test Reactor Risk Monitor System

- Statement of Work (SOW-8321) approved January 25, 2010
- Request for Proposals issued early February, 2010
- Proposals due March 5, 2010 (including a 2 week bid extension)
- Two proposals received
 - Scientech, Safety Monitor
 - Erin Engineering, Paragon

Advanced Test Reactor Risk Monitor System

- Erin Engineering, Paragon
 - Proposal did not address criteria stipulated in SOW-8321.
 - Proposal requires conversion of ATR PRA into a set of tables and rules for input. (Requirement was to limit the need for the user to revise the ATR PRA)
 - Proposal required software user to determine the method to enter schedule data. (Requirement was to read Primavera files or exported files)

Advanced Test Reactor Risk Monitor System

- Scientech, Risk Monitor
 - Proposal addressed criteria stipulated in SOW-8321, but did not provide sufficient detail
 - Proposal provides some support to convert ATR PRA into the format necessary for the Risk Monitor.
 - Proposal states that the Risk Monitor will import Primavera files (either directly or one of the export formats).
 - Proposal contains costs to collect information concerning SAPHIRE export files that would be used to develop a cost estimate for translation software. (This unknown makes this a high risk activity because of unknown development costs.)

Advanced Test Reactor Risk Monitor System

- SAPHIRE, Version 8
 - Developers of the PRA software SAPHIRE indicated that much of the necessary pieces for a simplified risk monitor are already in SAPHIRE, Version 8, through the significance determination process workspace module.

Advanced Test Reactor Risk Monitor System

- Risk Monitor System Status
 - Contract not yet awarded.
 - Discussions to be held this week to determine whether a SAPHIRE Version 8 Risk Monitor Workspace can be developed with reasonable assurance of completion.
 - Final decision to be made following SAPHIRE discussions with agreement from ATR Operations and other anticipated prime users.
- ATR PRA Status
 - ATR Power Operations model drafted. Supporting documentation and model in comment resolution phase.
 - Expert review by resources external to the INL anticipated to begin late June 2010 and finish July 2010.




ATR Corrective Action Program (CAP) Improvement

Doug Johnson,
Director, ATR Programs


WWW.INL.GOV

March 23, 2010




Objectives

- **Timeliness and quality of Problem Identification and Resolution**
- **Actions Specific, Measurable, Actionable, Relevant, Timely, and Sustainable (SMARTS)**
- **Appropriate management involvement early in the process**
- **High volume/low consequence issues for tracking and trending**
- **Leading indicators to more significant issues**



Management Involvement

- **Changes to MRC and CARB**
- **MRC daily evaluation of all plant conditions, RFS and PIR**
 - Impacts on ATR or SSC operability.
 - Identification /assignment of immediate or compensatory actions.
 - Evaluating and determining issue risk and significance levels
 - Identify trends based on committee participation and identify items that should have been entered into ICAMs.
- **CARB focus**
 - Self-critical evaluations of:
 - Effective Cause Analysis and Extent of Condition Determinations
 - Adequate corrective action plans
 - Effective corrective actions

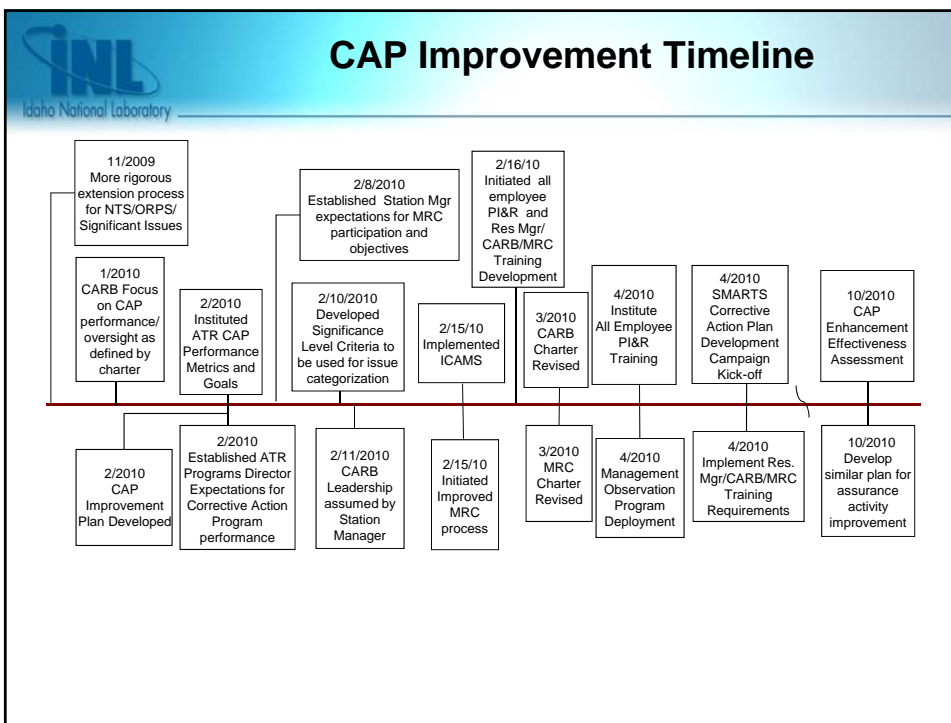


Training

- **Clear expectations for CAP**
 - Use
 - Importance
- **Specific training for new and incumbent employees**
 - Communicate expectations
 - What issues documented
 - How issues documented
- **Systematic Approach to Training**
 - Training/Job Familiarization Guides
 - Continuing Training
 - Requalification Requirements

Implementation

- Stronger more focused MRCs and CARBs
- Implement SMARTS campaign
- Implement ICAMS and migrate ICARE issues
 - High volume/low consequence
 - Tracking and trending
- Evaluate performance goals through metrics
- Assess program effectiveness within 6 to 12 months



Senior Management Outbrief for March 23-24, 2010 Review Meetings

ATR Programs Nuclear Safety Oversight Committee

www.inl.gov



March 25, 2010

Conduct of Operations

Current status:

- Important operational events due to operator and maintenance worker conduct of operation issues are continuing
- Conduct of operations issues are exacerbated and made more complex by latent plant conditions (e.g., material condition deficiencies, equipment functional failures)
- Under-sized qualified operational staff contributes to the observed issues
- Recovery and upgrade program has been initiated recently and appears will result in eventual success

Recommendations:

- Effect of current conduct of operations issues on safety risk is unclear
 - Prepare evaluation of aggregate effects of these issues
 - Develop basis for continued operations

Safety Analyses

- Revise thermal power calculations to better account for uncertainties – current analyses appear non-conservative in fulfilling TSR requirements for quadrant and total thermal power (inter-quadrant flow leakage, quadrant outlet flow and coolant loop temperature rise)

Design Control

- Confirm adequacy of material controls for experiments based on experience gained during AGR-1 dry sizing

Emergency Operating Procedures

- Revise selected EOPs (e.g., addressing station blackout, loss of heat sink, loss of primary flow) to reduce potential for early and unnecessary initiation of EFIS

Environmental Releases

- Confirm adequacy of inspection programs/processes for buried systems containing potentially radioactive materials (note recent experience at Vermont Yankee)

White Paper Summary

- **Approach to Test Plan Development**
 - Capability to project work scope and resources
 - Improved cycle planning
 - Work Force Development
- **Funding Challenges to support objectives**
 - Base O&M increase key
 - Experiment Engineering Group
 - Resources (funding) to complete near term objectives
- **Deviations from existing Lab Processes**
 - Summary of changes
 - Benefit and Justification