

Review of Recent ATR Occurrence Reports: Reason for Concern

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When operators at the Advanced Test Reactor (ATR) don't know that the valve they are opening can drain the reactor core — or don't know if they are opening or closing a valve, training is deficient regarding reactor safety priorities. They've chalked it up to a communication problem. This and other events should concern anyone who cares about preventing a catastrophic reactor accident at the Advanced Test Reactor that would decimate the economy and contaminate southeast Idaho for decades to come.

The event was not deemed a reportable as a Department of Energy Occurrence Report^{1 2} because the reactor was defueled when it occurred. But to their credit, management decided that an operations stand-down to review the recent event was in order.³

The good news is that control room operators responded quickly to identify and correct the unintentional reactor vessel draining. The bad news is that the reactor could have been fueled. Not only that —freshly used and meltable fuel in the canal is vulnerable to canal draining that could be initiated by the incorrectly opened valve. Much of the fuel stored in the ATR canal is freshly used and has not cooled long enough to withstand a canal draining accident. There is no containment, confinement, or filtering to slow the release of airborne fission products. The hazard analysis evacuation distance for canal draining for the ATR is 65 miles.⁴

In another unplanned reactor vessel draining event during shutdown, the control room operator silenced a low reactor vessel level alarm and ignored the draining for a considerable time.⁵ In that case, it was argued that the event would not have siphoned the core. But in this latest event, the open valve could have drained the core allowing fuel to melt, releasing airborne fission products to the winds over SE Idaho.

¹ DOE-Idaho Operations Summaries at <http://www.id.doe.gov/news/OperationsSummaries.htm>

² Department of Energy “Public Final Occurrence Reports” at <http://energy.gov/ehss/policy-guidance-reports/dashboards>. Choose the link at the top and center of the page. Select the DOE site (it will highlight it in blue). This will change the bar-graph display on the top right. Hover the mouse to see various facilities on the bar chart, and this will display lists of occurrence reports on the bottom left. Highlighting a report will show more detail on the bottom right, and you can click on the bottom right “Subject” title in blue, bringing up a more detailed report.

³ Email communication from Post Register report Luke Ramseth (9/3/2015) who was notified of the stand-down late August or early September 2015.

⁴ INL, Emergency Management Hazards Assessment for Reactor Technology Complex, HAD-3, Revision 7, 2003. INL hazard assessment documents which describe potential radiological releases and EPA “protective action distances” are not available to the public and are not consistently available by Freedom of Information Act request.

⁵ NE-ID—BEA-ATR-2011-0010, “Low Level in Advanced Test Reactor (ATR) Vessel” An unplanned reactor draining in 2011 when the low level alarm sounded and was silenced and ignored (inexplicably) in the control room. The reactor was fueled.

An emergency pump is especially important if commercial power is lost. A seismic event, even a rather small one, can be expected to fail the site's commercial power feeds. Two other recent DOE Occurrence reports document serious problems with ATR safety equipment needed to assure circulation through the core following reactor scram.^{6 7} One involved serious inboard seal leakage of the M-10 emergency pump — causing serious primary coolant leakage while disabling or degrading the emergency pump. The other involved failure of the alternate emergency pump, M-11. Is it due to equipment aging or inadequate maintenance? Had those failures been more ill-timed, they could have led to melting reactor fuel.

With a leak on the primary coolant system, injection of makeup water would be needed in addition to continued emergency pump flow. Some Occurrence reports related to degraded makeup water have occurred.^{8 9 10}

Equipment problems continue to occur in each of these areas needed to prevent a catastrophic reactor melt down at the ATR. Following a seismic event, it is vital to limit the power level increase by assuring experiment loops integrity,¹¹ shutdown the reactor by rapid insertion of

⁶ NE-ID—BEA-ATR-2015-0029 “Advanced Test Reactor M-10 Emergency Coolant Pump (ECP) Inboard Seal Leak” and NE-ID—BEA-ATR-2015-0030, “Advanced Test Reactor M-11 Emergency Coolant Pump (ECP) Trip.”

⁷ NE-ID—BEA-ATR-2015-0020 “M-9 Primary Coolant Pump (PCP) Check Valve Failure to Shut” and NE-ID—BEA-ATR-2013-0031 “ATR M-8 Primary coolant Pump (PCP) Discharge Check Valve (CK-A-1-8)” A discharge check valve on a Primary Coolant Pump (PCP) at the Advanced Test Reactor did not close completely after the pump was shut down. The check valve was declared out of service pending repair or replacement. The ATR was shut down in support of the scheduled outage during the time of the valve failure.

⁸ NE-ID—BEA-ATR-2013-0037 “Inadvertent Entry into TSR LCO Due to Isolating Firewater Path With Irradiated Fuel in Reactor Core” “The upper and lower emergency firewater injection systems were inadvertently isolated during a primary coolant system (PCS) startup evolution at the Advanced Test Reactor. According to the applicable safety documents, the valves should have remained open. The ATR was shut down in support of the scheduled outage, a valve lineup was issued, which restored the EFIS upper and lower flow paths back in to service.” Reactor and canal emergency makeup is provided by the underground firewater supply system. Automatic systems or manual actuation would be ineffective if unintended valve isolation had occurred.

⁹ NE-ID—BEA-ATR-2014-0006 “TRA-786-M-1 Diesel Fuel Transfer Pump Failed to Start at the Advanced Test Reactor (ATR). While performing a test for a technical safety requirement at the Advanced Test Reactor, a diesel automatic fuel transfer pump failed to start and transfer fuel to maintain the onboard fuel storage tank level. The diesel generator provides power to a deep well pump for a long term loss of makeup water inventory event. The test was terminated and the diesel generator was shut down. The cause of the failure was identified as a loose electrical connection for the transfer pump. The connection was repaired and the test was performed satisfactorily prior to the reactor restart. A serious seismic event would be accompanied by the loss of commercial power, so diesel generators are important for post-seismic event safety, especially if the seismic event damages reactor piping systems or other equipment.

¹⁰ NE-ID—BEA-ATR-2013-0029 “ATR Firewater Flow Capability Inadequate Surveillance Testing” A method used to test fire water flow testing paths at the Advanced Test Reactor was determined to be inadequate. The ATR was shut down, defueled and depressurized, at the time of discovery, and the detailed operating procedure used to perform the firewater flow testing was re-written to resolve the issue.

¹¹ DOE Occurrence Report, Idaho National Laboratory, Advanced Test Reactor, NE-ID—BEA-ATR-2014-0036, “Declaration of Positive Unreviewed Safety Question (USQ) Concerning ATR Experiment Loop Pressurizer Seismic Vulnerability,” Notification date 12/16/2014, Final 03/17/2015.

safety rods,¹² assure reactor and canal makeup water, assure that an emergency pump runs following shutdown and protect the canal.^{13 14}

The 2014 event reporting experiment loop leakage led to the subsequent discovery that the loop piping and equipment supports did not meet modern seismic standards. Because back in 2005 I had documented that seismic evaluation of the experiment loops was needed. And it had not been conducted despite my later Freedom of Information Act request asking specifically if this had been done.^{15 16 17}

Human error resulting in inadequate analysis of safety criteria have also occurred.^{18 19} Continuing problems with shortcutting the analysis and reviews to ensure experiment configurations are safe create less visible errors that are just as important as the more visible errors of operators who manipulate valves and other equipment.

¹² NE-ID—BEA-ATR-2015-0008, “Advanced Test Reactor (ATR) South Safety Rod Failed to Fully Insert During Shutdown.”

¹³ NE-ID--BEA-ATR-2014-0013, “Advanced Test Reactor (ATR) Bulkhead Seal Leakage” “...an ATR supervisor observed air bubbles coming from a canal bulkhead seal. Further investigation revealed that the seal pressure indicated that the seal was leaking.” Inflatable canal seals are intended to isolate the hot fuel from cask lifting over the canal. ATR spent fuel in the canal that can melt if the canal water drained would release millions of curies of air borne radionuclides to the environment.

¹⁴ NE-ID—BEA-ATR-2015-0010 “Advanced Test Reactor (ATR) Canal East Short Bulkhead Seal Leak” and NE-ID—BEA-ATR-2015-0028 “Advanced Test Reactor (ATR) West Canal Bulkhead Seal Failure.”

¹⁵ Idaho National Laboratory, *TRA NPH Assessment Plan*, PLN-588, Revision 1, 2005. p. 16 recommends seismic performance assessment of experiment loops.

¹⁶ Idaho National Laboratory, *TRA NPH Assessment Plan*, PLN-588, Revision 2, 2005. p. 3 changes made to Revision 2 of the document allow indefinite delay of reporting seismic deficiencies: “no SSC will be presumed deficient before all reasonable qualification approaches have been exhausted. . . .the USG process does not apply to the process of upgrading DSAs to new requirements or to the use of new of different analytical tools. . . .therefore, deficiencies with respect to new seismic criteria and standards of analysis. . . .will not be cause for entry into the USQ process.”

¹⁷ Post Register Freedom of Information Act Request, July 2013 (ID-2013-00814-F)(OM-PA-13-032) This FOIA requested, among other things, experiment loop seismic performance assessment documentation. DOE provided a seismic risk assessment for ATR stating that the risk was low. No specific documentation concerning the status of seismic performance assessment was provided. Therefore, the risk assessment basis was not adequately supported and it likely underestimated the core damage risk.

¹⁸ NE-ID—BEA-ATR-2014-004 “ATR Manual Shutdown Due to Incomplete Loop 2A Experiment Safety Analysis” Less than adequate human performance in preparing safety analysis documentation resulted in safety criteria not being supported by analysis. Ongoing problems lack of expertise in preparing and reviewing experiment loop safety analysis often result in reactor safety criteria not being properly analyzed and achieved.

¹⁹ NE-ID—BEA-ATR-2014-0017 “Identification of Overstressed Bellows in ATR Loop 1C-W Results in Potential Inadequacy in the Safety Analysis (PISA)” and NE-ID—BEA-ATR-2014-0008, “In-Pile Tube (IPT) Inlet Pressure Used to Calculate Maximum Allowable Temperature Results in Positive Unreviewed Safety Question (USQ).”