Environmental Defense Institute
News on Environmental Health and Safety Issues

February 2006	Volume 17 Number 2

DOE Managers Discuss Shutdown of Forty-year-old Advanced Test Reactor

Despite public statements from the Department of Energy (DOE) for long-term operation of the Advanced Test Reactor (ATR), recent reports show department managers' internal discussions on the shutdown of the antiquated plutonium production reactor at the Idaho National Laboratory (INL).

Revelations are poignant from the DOE sponsored National Institute of Standards and Technology meeting on Safety of Reactor and Nuclear Operations, March 1-3, 2005 for Senior Department of Energy Headquarters managers, field representatives, and contractor managers to discuss safety performance, good practices, and lessons, learned from recent events to improve safety performance at Office of Nuclear Energy, Science and Technology (NE) managed reactors and nuclear facilities DOE managers expressed major concerns about the continued operation of the antiquated Advanced Test Reactor (ATR).

"John Dwight [Battelle Energy Alliance current operations contractor for the ATR] stated: Seismic design standards/issues for the [Advanced Test Reactor] ATR were presented. The Seismic Category I Structures, Systems, and Components for the ATR are not fully qualified. The ATR seismic qualification is needed per the latest DOE Safety Evaluation Report (SER) but the analysis is incomplete and has not been fully funded (DOE/ID) believes this is needed.) However, the SER approved ATR operations. The ATR is in the process of completing a Design Basis Reconstruction (DBR) Program. **Problems with emergency coolant and supporting Structures, Systems, and Components were shown to be worse than originally believed.** [emphasis in original text]

"ATR plant personnel have developed a questioning attitude relative to the safety basis assumptions. A number of seismic related issues have been identified and inadequacies in the Safety Analysis have been declared. There is currently no systematic approach at ATR for evaluating and correcting seismic qualification issues. **There is a crisis-mode approach resulting in band-aid fixes rather than systematically evaluating the problems together and developing long term corrective action strategy to correct the noted deficiencies. Mission impacts are becoming more severe. A full seismic evaluation should be undertaken and judgments/fixes on the identified problems should be delayed (unless there is an imminent danger) until the evaluation is completed and all seismic problems are understood.** This approach would require an agreement with DOE/HQ. Approximate funding for the seismic evaluation at ATR is about $2M. It is understood that the current fire water system will probably require additional upgrades to survive the evaluation. ATR staff will require some external assistance to help with the evaluation. [emphasis in original text]

"DOE/Environment, Safety, Health position – How the site deals with an identified [inadequacies in safety analysis/unreviewed safety question] PISA/USQ is a line management function. However, as an immediate hazard is identified, it needs to be evaluated and engineering judgment made to see if an immediate shutdown may be required. **However, the site could be below an established threshold based on engineering judgment and DOE/HQ approval, and may be able to continue operations. However, if these types of hazards become too numerous, shutdown may be required, Don't ignore problems.** The line must make an operability decision after evaluation. The question needs to be asked on **how the risk profile may be altered.** Need to make decision on how the fix gets made. The promptness of the corrective action is a question. There is no timeline established by DOE Order or guidance for how quickly an identified problem is resolved. It needs discussion with DOE on when a fix is required." [emphasis added]

Rather than fix this huge hazard DOE wants to "alter the risk profile" or "lower the bar" so it appears that the ATR is safe to operate. In fact, major ATR safety problems were identified over a decade ago, yet no corrective action has been taken. In August 1995, a DOE report stated "**The Advanced Test Reactor Emergency Fire Water Injection System would be rendered inoperable during a design basis earthquake.** The purpose of the injection system is to pump water into the reactor core to prevent irradiated fuel elements from being uncovered in the event of a loss-of-coolant accident or a complete loss of coolant flow during an earthquake.

"Idaho Operations Office Manager Beth Sellers stated in a letter on the issue "**DOE/ID does not want to treat everything as a shutdown."** This is a clear a statement of DOE's priorities which put continued ATR operation above the safety of everyone living downwind of INL.

"Rick McCraken (BEA) added: The two pilot systems review resulted in 62 gaps between physical, safety, and design systems. Out of the 62 gaps there were 15 [inadequacies in safety analysis] PISA assessments which resulted in 8 positive PISA assessments and 6 positive Un-reviewed Safety Questions (USQs.) The information is provided to the safety specialists/engineers and incorporated into action plans and annual SAR updates."

This sounds like ATR operators are actively correcting safety problems, however no substantive changes are made. It is nothing more than "cover their butt paper" for appearances only.

"Brooks Clements (ATR) discussed the first scram [emergency reactor shutdown] event attributable to operator error since October 1993, and discussed the ensuing review process." [1] On July 21, 1998 the Advanced Test Reactor Critical Facility emergency shut down when an unplanned **power excursion** resulted from control cylinder withdrawal failed to operate. Power excursions are defined as an uncontrolled surge in reactor power which can result in a core meltdown and major radioactive emissions if the reactor cannot shutdown quickly enough.

Additional documents gained by the Environmental Defense Institute via Freedom of Information Act states: "During a [ATR loss of coolant accident] LOCA, the rapidly decreasing system pressure (with reactor core decay heat still significant) results in rapidly deteriorating thermal margins. To maintain acceptable thermal margins, a significant amount of primary coolant system (PCS) flow (greater than emergency flow) is required following the reactor scram. The decrease in PCS pressure results in PCP cavitation [sic], but the pump flow is sufficient to maintain adequate thermal margins. Low primary system pressure allows the air volume in the surge tank to expand into the PCS piping. This air has the potential to degrade the flow from the operating emergency coolant pump."

In plain language, a runaway ATR core will produce steam pressure that will be greater than the emergency coolant pump capacity to force coolant water into the reactor core. This "cavitation" or a pump without water can itself cause the pump to fail. In this event, a reactor meltdown would likely occur with the resultant huge radiological emissions.

"These analyses suggest that degradation of [emergency coolant pump] ECP flow due to surge tank air migration is unlikely, but they are not of sufficient depth, nor sufficiently unified to draw any firm conclusions. **It is not quantifiably certain, but it seems likely that ECP flow will be lost due to near or sub-atmospheric suction head before air binding becomes and issue."** [emphasis added]

"The pumps have not been evaluated for continuous operation at extremely low suction heads, and it is possible that pump damage could occur further breaching the [Primary Coolant System] PCS and exacerbating the event if left running." [2]

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[1] National Institute of Standards and Technology, Meeting on Safety of Reactor and Nuclear Operations, March 1-3 2005, Summary Report.
https://www.ornl.gov/nuclear_operations/2005-03-01_nist_nfsm_summary.pdf

[2] Safety Systems of the Advanced Test Reactor Loss of Coolant Accident – Primary Coolant Pump Shutoff System, June 2005, USDOE Idaho Operations Office, FOIA Document # 42

Many of the documents DOE does release under the Freedom of Information Act are heavily censored/redacted claiming bogus National Security exemptions. Despite every page having redactions, one report states: "**Neither [Office of Nuclear Facilities Management] NE-ID nor NE-HQ line management has procedures in place to conduct in-depth vertical slice reviews of the complex ATR safety systems to assess their current compliance with the [Safety Analysis Report] SAR.**" [3]

In other words, DOE is unable to control its nuclear reactor operations. This is nothing less than a recipe for disaster, especially with respect to the forty-year-old ATR that should have been shut down decades ago when it exceeded its design life and safe operating parameters. No commercial nuclear power reactor would be allowed, under Nuclear Regulatory Commission regulations, to continue operating under these ATR hazardous conditions.

Whose security is DOE protecting by withholding crucial safety documentation from the public on how decrepit the ATR reactor is ? The answer can only be DOE, Idaho Governor Kempthorne, Republican Congressional policy makers (including Idaho's Congressional delegation) that put more value on plutonium production than on the huge risks to the public from continued ATR operation.[4]

The ATR has no "sealed concrete dome" structure required by the Nuclear Regulatory Commission (NRC) that prevented most of the radiation releases from the Three-Mile-Island (TMI) commercial reactor melt-down in Pennsylvania in 1986 yet still released 13 curies of iodine-131. The NRC knew prior to the construction of TMI in the 1980s the importance of the "steel-reinforced concrete sealed dome." [i] Now it's 2005 and DOE publicly claims that the ATR's thin steel/aluminum skinned industrial building is adequate to prevent radioactive releases. This is categorically not true. [ii]

Freedom of Information Act (FOIA) documents EDI has received revealed that ATR (unfiltered) vents will open to the atmosphere if there is a steam or hydrogen gas explosion caused by a reactor loss-of-coolant fuel meltdown to prevent the entire building from total destruction. [iii] The radiation release to the atmosphere in such a case could be horrendous. DOE's own estimates of ATR radiation releases during a "loss-of-coolant" accident would be 175 million curies which includes six million curies of radioactive iodine-131. [iv] This is about half the 340 million curies of radiation released by Chernobyl which permanently contaminated thousands of square miles in Russia. President Bush and Idaho Governor Kempthorne are playing "Russian roulette" with all INL downwinders' lives just like Gorbachev did with the downwinders of Chernobyl. There is not even an off-site evacuation plan on record for a major INL radiation release. [v] Even if there were an evacuation plan, we all saw how totally inadequate the Federal Emergency Management Agency response to the gulf coast hurricane disasters was for these residents.

DOE refuses to disclose the seismic soil spectra report (completed in 2000) on the ATR that shows the reactor and support facilities vulnerabilities to survive the existing seismic analyses. This report shows how large the earthquake accelerations are (nearly twice) for the soil. Other DOE documents show this analysis was completed in 2000 but DOE refuses to release the report. [vi] The ATR location on the Snake River Aquifer Plain and deep alluvial deposits of sand and gravel and inter-spaced thin volcanic horizontal flows results in the seismic **acceleration** being 1.8 times greater than that of bed-rock. [vii]

Another revealing DOE document states: "An identified deficiency in the interim seismic [probabilistic risk assessment] PRA model is in regard to the assumption in the model that off-site commercial power could be recovered; a review of other seismic PRAs shows that other PRAs do not assume that recovery of commercial power is possible. Inadequacies in the original seismic PRA model coupled with inadequate development of an interim seismic PRA including assumptions regarding

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[3] ATR Planning Assessment Team, 2/13/04, Report to Elizabeth Sellers, Manager of Idaho Operations Office, page 10, FOIA document # 43

[4] See EDI August and September Newsletters for more information.

recovery of off-site commercial power prior to exhausting above ground emergency makeup inventories are the subject of this Unreviewed Safety Question." [5]

In plain language, if commercial power to the ATR is cut off and cannot be restored within ~ 72 minutes the reactor could face a loss-of-coolant accident when surface storage tanks are exhausted.

Another DOE document shows additional seismic hazards at the ATR. "Because the seismic design criteria at the time ATR was designed were essentially the 1961 Uniform Building Code (UBC) for zone 2 with a lateral base acceleration of 0.05g, conservatism regarding reactivity insertions from experiment loop seismically-induced leakage or rupture is recommended. Although experiment loop pipe stress calculations have been performed, there may be a lack of seismic review of the lateral restraint of components as has been the case with [Primary Coolant System) PCS components."

"As discussed above, other reactor scram parameters would occur following a significant ground motion, and do not provide the protection of fuel thermal margins that the seismic reactor trip provides. Therefore, only the seismic perimeter trip is included in the event tree. Based on review of detailed fault trees for the reactor trip and failure to insert [control] rods. Failure of this function is assigned to plant damage state P4 [highest category]." [6]

Bechtel BWXT Idaho (BBWI) INEL operating contractor until 2/05 was cited for major Resource Conservation Recovery Act (RCRA) violations. The BBWI Integrated Safety Management System, Annual Report, FY 2004, states; "The May 2004 RCRA inspection resulted in a Notice of Violation and civil penalty of $5,100 for two violations identified. A Notice of Violation and civil penalty of $162,500 was received in FY 2004 for five violations identified during a RCRA inspection conducted in FY 2003.

"The DOE Office of Enforcement did not conduct any investigations of non-compliances reported during FY-2004. However, a Preliminary Notice of Violation (PNOV) and associated Civil Penalty (CP) of $41,250 were issued to BBWI on January 20, 2004 by the DOE Office of [Price Anderson Amendment Act] PAAA Enforcement for a report of programmatic failures that led to the waste stack toppling event which occurred at the [Radioactive Waste Management Complex] RWMC during FY 2003. The PNOV and CP were accepted by BBWI by letter dated February 5, 2004." [7]

"Because the seismic design criteria at the time ATR was designed were essentially the 1961 Uniform Building Code (UBC) for zone 2 with a lateral base acceleration of 0.05g, conservatism regarding reactivity insertions from experiment loop seismically-induced leakage or rupture is recommended. Although experiment loop pipe stress calculations have been performed, there may be a lack of seismic review of the lateral restraint of components as has been the case with Primary Coolant System components." [8] This is a rare official acknowledgement that the ATR design, when constructed, was based on forty-five year old seismic criteria. Increasing the seismic hazard review to an earthquake lateral acceleration to 0.05g to evaluate the sustainability of the ATR primary operating systems is still inadequate. Seismic design reviews at other INL operations using the soil amplification of (1.8) show structures must be able to withstand greater than 0.76 g or 14 times the 0.05g. [9]

DOE has finalized the ATR Safety Analysis that shows the significant earthquake vulnerability hazards, yet refuses to release the report even under the Freedom of Information Act claiming "national security exemption."

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[5] Un-reviewed Safety Question, 6/10/04, Advanced Test Reactor, ATR Seismic Safety Basis Determination # TRA-USQ-2004-214, FOIA doc # 26

[6] Engineering Design File, EDF-5622, Interim Seismic Probabilistic Risk Assessment for the Advanced Test Reactor, Approved 3/14/05, FOIA doc # 56, page 12 through 14;

[7] BBWI Integrated Safety Management System, Annual Report, FY 2004, September 2004, INEEL/EXT-04-02262, FOIA doc # 45, pages 32 to 37.

[8] Engineering Design File, EDF-5622, Interim Seismic Probabilistic Risk Assessment for the Advanced Test Reactor, Approved 3/14/05, FOIA doc # 56, page 12

[9] Development of Design Basis Earthquake Parameters for the Argonne National Laboratory-West, INL, 16 March 1998, Table 8, Woodward Clyde.

Clearly, DOE is withholding the pertinent Chapter 15 of this report because they don't want the severity of the accident consequences to be known, nor do they want the assumptions and methods scrutinized from the outside. Recent DOE contract independent engineering reports say that new seismic data shows the ATR must be in category PC4 and Hazard Category I or the highest vulnerability category and the same as San Francisco because the ATR has the potential to release significant radiation to off-site populations during an accident.

Editors note: it's a difficult decision on how best to present the above information. EDI decided that readers would prefer to see the actual document text rather than a dumbed-down polemic version, with limited credibility, so they can make their own informed decisions. Your feedback on this would be greatly appreciated.

Fallout study corrects old estimates

The Radiation Research Society (RRS) recently published the results of a health study of downwinders that was originally funded by the Centers for Disease Control and Prevention (CDC), but prematurely terminated. CDC has a long history of canceling studies whose preliminary results produce information the government does not made public. The RRS report notes: "While the mean of all doses has not changed significantly**, individual doses have changed by more than an order of magnitude."** The report concludes: "The experience here is likely to be similar to other large dose reconstruction studies, where mathematical models have been relied on to reconstruct doses to thousands of subjects in the absence of direct measurements of individual exposures." [10]

One of the authors of the RRS report laments that it's truly a sad thing that CDC has terminated this important epidemiological study. I'm surprised that the CDC could get away with termination of research that is finding a statistically significant association between increasing dose and increasing prevalence of disease. It appears that the press and the public have been distracted by other events.

Radiation Research Society (RRS) independently published the paper and ensured it met editorial standards and that it was properly peer reviewed. The University of Utah paid for the page charges. The work on the paper itself was conducted while there was still CDC funding. It was submitted for publication about one year ago. **Autoimmune thyroiditis and all neoplasms combined were found to be statistically significant with increases in disease prevalence associated in a linear relationship with increases in thyroid dose.**

What CDC terminated was the more detailed ongoing follow-up program that would have allowed for 50 years of follow-up and Phase III medical exams for all 3500 members of the Nevada Test Site (NTS) cohort. There would have been more detailed uncertainty analysis for the Phase III dose reconstruction as well.

RRS believe that the Phase III dose reconstruction would have constituted a more comprehensive analysis of the effects of uncertainty in dose reconstruction on the interpretation of epidemiological results. It is truly sad that CDC chose to terminate this study before its time.

The CDC was of the mind-set that fully accounting for the effect of uncertainty in reconstructed doses would reduce the statistical power of the study, which is one of the reasons they gave for canceling the study. I should point out that issues of statistical power are mainly a concern when dose-response relationships are inconclusive, which is not the case with the evidence gathered to date.

Researchers also suspect that some inside CDC and elsewhere were concerned that the University of UT study is finding epidemiologically significant results that contradict the non-significant statistical findings of the Hanford Thyroid Disease Study with respect to childhood exposure to I-131 during the

[10] Radiation Research Society, 2006, 208-222, 2004 Update of Dosimetry for the Utah Thyroid Cohort Study.

1950's and the occurrence of thyroid disease in later life. Researchers believe the decision to terminate the U of UT epidemiological study was more a political one than a technical one. The absence of strong public/political support certainly did not help, either.

Joe Bauman reports in the Utah *Deseret Morning News* 1/29/06 "A new fallout study has corrected some mistakes made in estimates of radiation dosages to the thyroid glands of people living downwind of the Nevada Test Site, when about 100 nuclear weapons tests spread fallout in the 1950s and 1960s.

And the study, just published in a scientific journal, apparently validates the work of Utah researchers whose long-term thyroid study was shut down last year by the federal Centers for Disease Control.

The average dose is close to that calculated earlier for Utah's Washington County; Lincoln County, Nev.; and Graham County, Ariz. However, the report adds, "there was about a twofold increase in the mean of individual doses for those living outside of those areas."

Also, in calculating the exposure of individuals, some doses were changed. Dr. Joseph L. Lyon of the University of Utah saw his project ended after the expenditure of $8 million in federal funds. The CDC cited "lack of scientifically defensible dosimetry, power and treatment of uncertainty."

However, the new report, of which Lyon is one of the authors, cites rigorous scientific analysis, and it corrects dosimetry mistakes in earlier efforts.

Lyon was pleased with the fact that the latest study has been published in a scientific journal. "The people in the radiation community think our methods are very good and we've done a very good job," he said. The Centers for Disease Control was negative on the study, "but they haven't published papers in the radiation literature."

That thyroid cancer has a connection to radiation exposure is no longer doubted by most researchers. But the claim that exposure causes thyroiditis, a noncancerous inflammation, has been the subject of debate since it was first made in the early 1960s.

Besides that difference, the report adds, "there was about a twofold increase in the mean of individual doses for those living outside of those areas." In Graham County, Ariz., more than one-third of the group examined were found to have had exposure that was actually one-half to one-tenth of that earlier believed.

But another group — people conceived after May 19, 1953 — "had the largest proportion of changes to higher values," it adds. Among these, "nearly 20 percent increased by more than 10 times."

The report notes that in one of the earliest studies, exposed people were twice as likely to have thyroiditis than those not exposed. "The overall effects of the risk analyses due to the revisions to dose estimates have been evaluated and are being prepared for publication," says the report. "An important result is the now-identified statistically significant dose response for thyroiditis, which was not apparent" in the analysis before this one.

In other words, the amount of thyroiditis showed up as related to fallout exposure. Anspaugh, research professor of radiobiology, says "The bottom line is that the findings are still pretty much the same. There is an association of thyroid disease with dose." Some of the doses are statistically significant and some are not, he said. "Nevertheless, the same association is there." The fact that Lyon's study was shut down is "I think, really a sad thing," he said

Groups Petition DOE to Post INL Accident Reports

Five groups and individuals (including the Environmental Defense Institute) sent a letter January 31, 2006 petitioning Elizabeth D. Sellers, Manager, DOE-Idaho Operations Office and the State of Idaho requesting internet posting of accident and occurrence reports at the Idaho National Laboratory (INL)

Limiting the public's access to health and safety information will increase, not decrease, the risks and perceived risks to workers and communities living in the shadows of DOE facilities. Those who live near INL have a desire and a right to know what is happening at the Site and limiting access to these

reports will cause repercussions we do not believe are in the best interest of DOE or the public.

We do not believe DOE has provided adequate grounds for restricting the availability of occurrence reports via the internet. Of more concern is the DOE's sudden reversal of its commitment to include report numbers with bi-weekly summaries.

Occurrence Reports Already "Sanitized" of Sensitive Information

It is our understanding that occurrence reports for DOE sites are made available to those with usernames and passwords via the web-based Occurrence Reporting and Processing System (ORPS). Further, we understand that the ORPS manual DOE M 231.1-2 states, "Occurrence Reports containing any classified information, Unclassified Controlled Nuclear Information (UCNI), or other controlled information must not be entered into the ORPS database. In other words, the obstacle you cite has already been surmounted and occurrence reports are in fact posted on the web.

Additional Reports

Our initial request referred to several reports, not just occurrence reports. These reports include: "DOE Site Manager Reports to Headquarters," "Active Emergency Duty Officers Log," "Occurrence Reports," "Unusual Occurrences," "Potentially Inadequate Safety Analysis," and "Unreviewed Safety Questions." Do occurrence reports include the information available in these reports?

INL Naval Facility

The DOE's reporting regulations (Section 3, page 6 of 85, and elsewhere) give the Naval Nuclear Director exclusion. Accidents at the INL Naval facility have the same potential to harm workers and communities as other DOE facilities. It is important that the public has the ability to track accident and safety problems here too. It appears appropriate to accept a regularly provided summary of occurrences.

Again, we ask that the DOE make available via the internet the full occurrence reports, including the report numbers. As DOE itself has acknowledged, any individual or organization can FOIA occurrence reports and post these reports on the internet. If DOE chooses not to post these occurrence reports, we will be left with no option but to FOIA and make available via the internet INL occurrence reports ourselves.

Endnotes

I. Nuclear Regulatory Commission Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, 10 CFR Part 50 Appendix B. Also see NRC Regulatory Guide 1.4.

II. Advanced Test Reactor Upgraded Final Safety Analysis Report, SAR-153, Page 6-36 that states there is no emergency safety feature that filters venting radioactivity to the atmosphere in an accident that causes over-pressurization of the ATR (i.e. a hydrogen explosion). Hereinafter called SAR-153.

III. SAR-153, Section 6.2.2.9 and Section 7-71.

IV. Final Programmatic Environmental Impact Statement for Accomplishing Extended Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility, December 2000, DOE/EIA-0310, Section I.1.1.1.2.

V. Idaho's present Federal Emergency Management Administration (FEMA) plans posted on http://www.bhs.idaho.gov/

VI. SRA-153, pages 7-35 through 7-71.

VII. Final Report, Development of Design Basis Earthquake Parameters for the Argonne National Laboratory-West, Idaho National Engineering and Environmental Laboratory, prepared for Lock Heed Martin Idaho Technologies 16 March 1998, herein after called ANL-W.

Website Endnotes

i. Nuclear Regulatory Commission Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, 10 CFR Part 50 Appendix B. Also see NRC Regulatory Guide 1.4.

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