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Little Reason for Confidence in DOE Nuclear Operations

Improvements are needed in Battelle Energy Alliance (BEA's) effort to control nuclear hazards at INL's Materials and Fuels Complex, writes Tami Thatcher 9/19/13 in the Idaho Falls *Post Register* .

Idaho National Laboratory Director John Grossenbacher stated in a recent opinion article concerning the contamination of a local home with plutonium: "Without information about the levels detected or analysis methods used, it's impossible for us to assess the credibility of these statements." [1]

Perhaps Grossenbacher should consider his own statement to reassess BEA's approach to transparency. BEA's delayed descriptions of the 2011 Zero Power Physics Reactor (ZPPR) plutonium contamination event doses omitted mention of the organ (bone) doses and omitted explanation of the methodology and uncertainty in the dose estimation.

Alpha particles from plutonium inhalation cause highly localized multiple DNA damage at the chromosomal level, much more so than exposure to gamma radiation. This damage is detected even many years after the occupational exposure, as shown in studies of Russian Mayak plutonium workers. [2]

Plutonium inhaled into the lungs is slowly absorbed into the blood stream and some of it is deposited in bone tissue. The preliminary dose estimates documented in the Department of Energy ZPPR accident investigation report stated that the bone organ dose could be as high as 257 rem.[3] [4]

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[1] John J. Grossenbacher's Post Register opinion editorial "Family declined help" August 18, 2013.

[2] Hande, M. Prakash et al., "Complex Chromosome Aberrations Persist in Individuals Many Years After Occupational Exposure to Densely Ionizing Radiation: An MFISH Study," Genes, Chromosomes & Cancer 44:1-9, Wiley-Liss, Inc.,2005.
http://onlinelibrary.wiley.com/doi/10.1002/gcc.20217/abstract;jsessionid=5E362E0AAA8D098B341D801A296640CA.d03t04

[3] U.S. Department of Energy Office of Health, Safety and Security Accident Investigation Report, "Plutonium Contamination in the Zero Power Physics Reactor Facility at the Idaho National Laboratory, November 8, 2011," January 2012.

[4] Occurrence Report NE-ID—BEA-ZPPR-2011-0001, "ZPPR Workroom Pu Contamination Event in MFC-775"
https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Etjz%5D%91

BEA has strong incentives to minimize the dose estimates, both in its goals to promote positive public perception of its operations and nuclear energy and in achieving DOE award fees. There is also a history of DOE contractors being less than forthcoming about the actual doses workers have received.

Frankly, neither BEA nor the Department of Energy should be allowed to perform the dose estimates that result from accidents from their operations. BEA has emphasized that it will be "strongly defending" against the filed complaint brought by two workers exposed in the ZPPR plutonium contamination event. [5] "Strongly defending" what? BEA's right to put cost and schedule ahead of safety with impunity? After all, BEA was cutting corners that DOE wanted cut, and DOE is paying BEA's legal fees and withholding the release of information to the best of its ability. [6]

DOE waived away the problems of DOE-approved safety basis documents that "did not fully meet 10 CFR 830 requirements" — which are the analysis and controls to protect workers, the public and the environment — by deciding that it didn't matter because INL's MFC had a strong integrated safety management program. That the DOE ZPPR accident investigation report found serious problems in all aspects of its integrated safety management program does not appear to have been much of a wake-up call for BEA or for DOE.

DOE saved money by taking a multi-year approach to improving the MFC safety basis documents without curtailing operations, and by stipulating that there should be no reporting of safety basis problems, the discovery of missing or inadequate supporting technical documents, or seismic capability deficiencies. [7] [8] When DOE's contractors are encouraged to side-step the fundamentals necessary for rigorously analyzing, reporting and correcting nuclear safety problems that put workers and the public at risk, there is little reason to have confidence in the level of safety of DOE's nuclear facilities. [9] [10]

Thatcher is a former nuclear safety analyst at INL and a nuclear safety consultant.

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[5] Post Register, "Living in fear – family faces uncertainty after plutonium exposure, August 11,2013, Reporter Alex Stuckey.

[6] Russia Today (RT.com), "Radiation-exposed workers demand release of nuke plant accident video," August 19, 2013. http://rt.com/usa/radiation-exposed-workers-suit-687/

[7] Occurrence Report NE-ID—BEA-MFC-2006-0005 "Deficiencies Identified with MFC Safety Analyses"https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Erawb%8D

[8] Robert Boston et al., Department of Energy Review of the Materials and Fuels Complex Documented Safety Analysis, EFCOG 2007 Conference Paper http://www.efcog.org/wg/sa/docs/minutes/archive/2007%20Conference/SAWG_Website_Info/papers/SBD-Boston.pdf

[9] GAO-09-61, Oct 23, 2008, "Nuclear Safety: Department of Energy Needs to Strengthen Its Independent Oversight of Nuclear Facilities and Operations."

[10] GAO-13-767T United States Government Accountability Office, Observations on DOE's Management Challenges and Steps Taken to Address Them, July 24, 2013.

INL's MFC Plutonium Storage Vulnerabilities and Risk to Workers

The Materials and Fuels Complex (MFC), previously called Argonne National Laboratory-West (ANL-W) is located on the Department of Energy (DOE) Idaho National Laboratory (INL) site. Insights can be gained from reading the INL contractor's own investigation of the 2011 ZPPR accident documented in the event occurrence report NE-ID-BEA-ZPPR-2011-0001[11], as their own words describe concisely the problems leading to the plutonium contamination event:

> "The BEA investigation team concludes that Pu plates with unknown integrity being opened in a hood instead of a contained environment, coupled with insufficient ventilation due to improper ventilation system line-up to the hood likely caused the contamination spread and subsequent contamination of 16 individuals. From a causal standpoint, Idaho National Laboratory (INL) personnel involved in planning and executing the work failed to recognize the hazard of a breached plutonium plate and missed opportunities to identify this hazard either by better understanding of past operations and events and thorough response to abnormal indications as the work was occurring.
>
> "INL operations, radiological controls, safeguards, and engineering personnel involved in the work and planning for the work failed to recognize and plan appropriately for the hazard of a breached plutonium plate. The operations procedures, As Low As Reasonable Achievable (ALARA) review, Radiological Work Permit (RWP), and Documented Safety Analysis (DSA) all failed to identify the hazards of a breached plutonium plate and as a result, appropriate mitigations were not in place. Written history of operations and events in the Zero Power Physics Reactor (ZPPR) facility and knowledge of personnel who worked in the facility in the past indicated a potential for cladding breaches in plutonium plates; however, this information was not effectively understood or relayed to those planning and performing the work. In addition, indications of differences between this work evolution and recent plutonium plate surveillances were not evaluated properly due to lack of understanding the hazard including abnormal labeling noted on the clamshells and finding a plate wrapped in plastic. Although personnel at the job site correctly contacted management for direction on the abnormal indications, management incorrectly determined it was safe to move forward. This report also documents weaknesses in operations and engineering understanding of the facility ventilation system, poor ventilation system configuration and status control, inadequate

[11] DOE Occurrence Report NE-ID-BEA-ZPPR-2011-0001
https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Etjz%5D%91

training and knowledge retention of Plutonium hazards and chelation treatment, weaknesses in facility abnormal response procedures, and lack of attention to detail in ensuring operations and maintenance procedures correctly identify and control TSR systems in ZPPR.

"There exist poor material conditions within ZPPR. The lack of investment in equipment over a number of years has resulted in maintenance problems with old and failing equipment. Poor material/facility condition tends to lead to low expectations and tolerance of maintenance problems. Workers then resort to developing work-arounds to an inability to upgrade/replace/maintain equipment. These are not optimum conditions for performing work with potentially dispersible material, particularly dispersible Pu. Additionally, during transition of fuel inventory databases, information related to plate history and condition was lost. Additionally, after the ZPPR reactor was shut down and the ZPPR facility transitioned from a Research to Nuclear Operations, corporate knowledge of plate behavior, potential damage, proper handling, and past events was lost. It was unclear if this was intentional (i.e. loss of records) or occurred through retirement, attrition or reassignment to other positions. Previous work practices when handling Pu plates at ZPPR included the use of respiratory protection, CAMs, and much more stringent contamination control measures."

"When the ISRC Chairman identified a concern regarding the anticipated failure of Pu fuel plate cladding, communications between the chairman and the MFC Nuclear Operations Director (in 2009 and again in 2010) and Deputy Director in 2011 failed to convey the importance of the problem.

"Additionally, when a request to change the BIO [safety analysis document] was submitted to DOE one and a half months prior to the event, the anticipated failure of Pu plate cladding was not communicated to the operators by either the SS or the NFM. Had it been, it may have made them question the markings and plastic wrapped fuel plates and how to safely handle them. Additionally, the potential for Pu plate cladding failures did not transfer from Nuclear Safety to Radiological Controls to be used in radiological work planning even though personnel from Radiological Controls are on the DSA review team and are represented on the ISRC."

The 1994 Plutonium Working Group Report (DOE/EH-0415) identified the safety basis deficiencies, the lack of a formal documented plan for inspection and surveillance of the materials in the ZPPR vault and these problems were not corrected in 2011. The DOE/EH-0415 report also documents that in 1994, the Department of Energy, Nuclear Energy office advised the site to defer upgrading safety analysis reports at ANL-W. (DOE/EH-0415 pages 4, 5 of ANL-W). The inadequate safety analyses were then later signed off as "approved under the rule," despite recognized deficiencies and failure to meet 10CFR830 safety basis rule requirements that DOE was suppose to implement by 2003 for facilities to remain operational.

Inadequate hazard controls at MFC are not limited to the ZPPR workroom. The following accidents at MFC resulting in fires, explosions and worker plutonium contamination which inexplicably did not result in an MFC stand-down until April 19, 2012:

- March 17, 2011: Based on six ORPS and 14 non-ORPS issues since April 2009, a Radiological Work Control Noncompliance Issues Occurrence Report was issued.[12]
- April 5, 2011: It was determined that surveillance for safety exhaust system filters at the Fuel Conditioning Facility did not meet applicable standards. [13]
- November 8, 2011: MFC ZPPR accident that exposed 16 workers to plutonium contamination.[14]
- November 11, 2011: MFC-766 facility is evacuated after sodium excursion/explosion caused fracture of secondary piping while personnel were treating passivated [sic] sodium.[15]
- April 17, 2012: A fire resulting from welding activities was detected on the roof of the Analytical Laboratory at the Materials and Fuels Complex, a hazard category 3 nuclear facility.[16]
- April 18, 2012: While performing hoisting and rigging operations at the Hot Fuels Examination Facility, a load shifted, causing a 3000-pound sliding door to disengage from the shutter shield housing. This load drop was a repeat event.[17]

While prevention of the ZPPR accident would have been simple, the number and complexity of other worker safety hazards at MFC pose challenges. The lack of adequate safety basis analyses also puts the public at risk. Rather than mitigate accidents, the approach has been to finagle the analyses to use unjustifiable assumptions for release fractions and the material at risk.[18] [19]

Seismic deficiencies identified in 1994 (DOE/EH0415) are only beginning to be addressed now in 2013. In addition to plutonium storage in various forms, including unirradiated fuel and plutonium scrap, 56 MTHM of spent fuel including sodium-bonded fuels from EBR-II, FFTF, and Fermi reactors is stored at MFC.[20] The spent fuel is stored in the Radioactive Scrap and Waste Facility and pyro-processed in the Fuel Conditioning Facility (FCF). Spent fuel and high level waste are transported between processing facilities and the RSWF.

Accidents at MFC could release airborne radiological emissions from MFC facilities offsite that could affect Idaho for generations.

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[12] DOE Occurrence Report NE-ID—BEAINLPROGRM-2011-0001

[13] DOE Occurrence Report NE-ID-BEA-FCF-2011-0002

[14] DOE Office of Health, Safety and Security, Accident Investigation Report, Plutonium Contamination in Zero Power Physics Reactor Facility at the Idaho National Laboratory, November 8, 2011

[15] DOE Occurrence Report NE-ID-BEA-FCF-2011-0009

[16] DOE Occurrence Report NE-ID—BEA-AL-2012-0002

[17] DOE Occurrence Report NE-ID—BEA-HFEF-2012-0003

[18] http://www.hss.doe.gov/IndepOversight/docs/reports/eshevals/2011/2011_INL_FCF_Upgraded_Safety_Basis_Independent_Followup_(March21-April62011)_final.pdf

[19] DOE Occurrence Report NE-ID--BEA-FMF-2005-0001

[20] http://nsnfp.inel.gov/program/strategymtg/Fact%20sheets/INL_factsheet_final.pdf

MFC's plutonium inventory shows a total of 4,229 kg (4.229 metric tons) that includes ZPPR fuel (4,000 kg), Metal feedstock (200 kg) and other plutonium material (29 kg). That's enough for over 400 nuclear bombs. [21]

> "Concerns included discrepancies between the Secretary of Energy's plutonium inventory disclosure and that of ANL-W; exclusion of safeguards and security issues from the assessment; questions about nuclear weapons assemblies in the assessment scope; verification that ZPPR and other un-irradiated plutonium-bearing fuel were within scope; and adequacy of Departmental coordination of various disposition efforts, the environmental impact statement, and programmatic decisions involving fissile materials."

As DOE's own reports show, the vulnerabilities of plutonium storage at MFC have been known for decades – yet nothing was changed to protect the workers.

"Oxide removed from the surface of plutonium metal during repackaging is collected in synthetic 'tack cloths.' These cloths are then placed into storage containers and held in the FMF vault pending disposal in transuranic waste drums. The radiolytic [sic] decomposition of organic cloth in contact with plutonium metal particles (fines) and resultant hydrogen generation could lead to fires or explosions within drums. The plutonium metal particles could also ignite combustibles within the waste drums. The consequences could be worker injuries and exposures." [22]

"A criticality accident could expose workers for potentially fatal doses of neutron and gamma radiation, depending on how close to the accident the workers are and how long they are exposed….

"Inhalation of plutonium, even in microgram quantities, delivers significant internal radiation doses to the body. Absorption of plutonium through contamination of open wounds also delivers an internal dose. Absorption of plutonium via ingestion delivers a much lower internal dose than inhalation. Plutonium deposition on the ground can be re-suspended in the air and can deliver an internal dose if inhaled.

"Inhaled small plutonium particles less than a few microns in diameter, penetrate deeper into the lung, where they are aggregated in place by cellular encapsulation or are translocated to lymph nodes and liver. Massive inhalation doses from smaller particles can cause pulmonary injury, fibrosis and even death, while intermediate doses pose a potential for delayed lung cancer. Very small plutonium particles and ionic forms are complexed in the blood serum and then deposited in liver and on bone surfaces. These deposits are metabolized very slowly, with biological elimination half-lives of about 50 to100 years. A fraction of the plutonium being

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[21] Plutonium ES&H Vulnerability Assessment, Argonne National Laboratory-West, Tom Hull, DOE-HQ, 1995

[22] Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage, Vol. I, November 1994, pg.45 and 46, Hereinafter referred to DOE/EH-0415.

translocated is excreted in urine; the urinary plutonium level can provide an estimate the total body plutonium content. Plutonium's potential long term radiological consequences, i.e., cancer are proportional to the local absorbed dose from short range alpha particles, and the consequences are confined to the organs of concentration: lung, liver and bone." [23]

Vulnerability ID Number	Executive Summary[24]
ANL-W-1 ZPPR	Material is improperly packaged. Hydrogen buildup, oxidation, and expansion can cause rupture on can and potential for worker contamination.
ANL-W-2 ZPPR	Material is improperly packaged. Pressurization can cause rupture of can and potential for worker contamination.
ANL-W-3 TREAT	MK III sodium testy loops in the TREAT Facility represent a potential hazard to workers and the environment since their seals have not bee inspected in approximately 5 years. Some of the loops are remnants of a canceled Hanford program, while others are from ANL-W programs.
ANL-W-4 FMF	Pu metal or oxide could expand or pressurize can until it breached, contaminating the facility and or personnel.
ANL-W-5 FMF	It is believed that the ANL-W planned disposition of 1-3 kg of Plutonium oxide fines, which may be generated during inspection and repackaging of cans of metal and alloys, may not represent the safest approach.
ANL-W-6 ZPPR + FMF	Both the FMF and ZPPR vaults are planned for long term storage of Pu and Pu-bearing materials at ANL-W. However, DOE-HQ rejected the sites implementation plans for upgrading the FMF and ZPPR vaults safety documentation. Under the new requirements of 5480.23, both vaults would be coassif9ed as Hazard Category II, but the documentation currently reflects Hazard Category III, and in the case of ZPPR, the only documentation is a 1980 Safety Assessment Documentation which contains no independent analysis for the vault.

ZPPR- Zero Power Physics Reactor; FMF – Fuel Manufacturing Facility

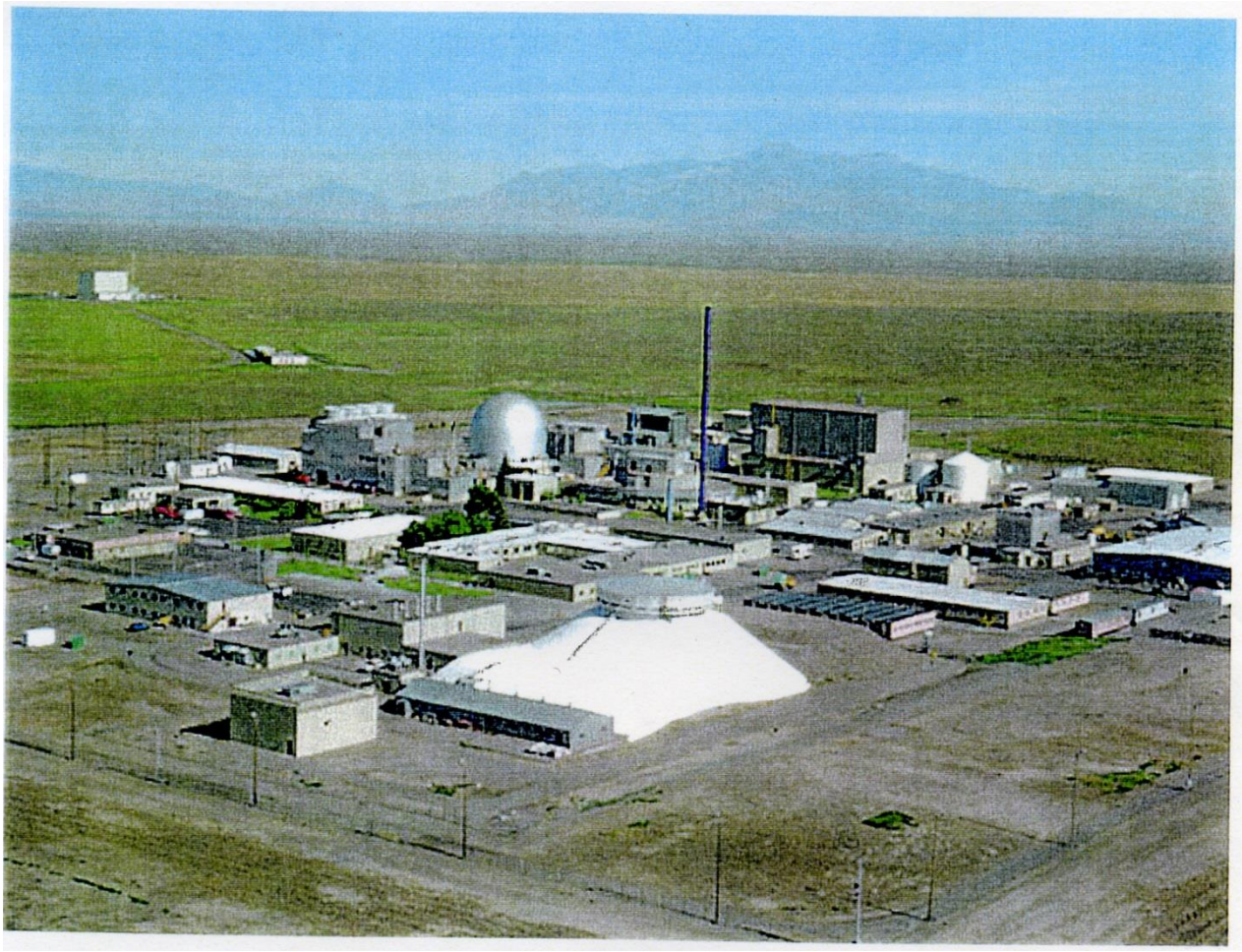
[23] DOE/EH-0415, Vol. I, pg.9

[24] Plutonium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Plutonium Storage, Vol. II, Part 5, Argonne National Laboratory-West Working Group Assessment Team Report, , November 1994, Attachment A, pg.A-2.

Argonne National Laboratory – West

now called

Materials and Fuels Complex



Idaho National Laboratory
Idaho Falls,
Idaho

Get Real

Helen E. Stanton, mother of Ralph Stanton, one of the INL/Materials Fuels Complex exposed workers to plutonium in a 11/8/11 accident writes in a letter to the Post Register Received Sept. 26, 2013:

"Riley Chase, deputy director for nuclear operations, and Art Clark, director of nuclear assurance, want the public to know that Battelle Energy Alliance is trustworthy in their concern for safety in the workplace. They reassure us of their integrity and dedication to transparency and truth.

"I believe people who work with complex technologies involving significant hazards do understand health and safety must take top priority. I also believe that when directors know of a problem such as equipment malfunctions, which put workers in jeopardy, and then choose to proceed at risk, the directors are the problem.

"In their recent letter, Chase and Clark used an example which stated there is no perfectly safe airplane and said investments in aircraft safety are not unlimited. That is a strange analogy. Plutonium is not an airplane. Before a flight, a crew checks a plane and if it is found to be unsafe, it is grounded and repaired. All safety factors have to be present and accounted for. Plutonium, on the other hand, is only safe if it is handled in a safe environment. On Nov. 8, 2011, ZPPR was not a safe environment for handling plutonium. No hot showers available; no respirators; malfunctioning safety equipment. The workers had about as much chance to avoid contamination as a Ming vase would surviving a massive hurricane while sitting on the bow of a Florida yacht.

"Clark and Chase, get real, the public is smarter than you give us credit for. My questions are still unanswered."

Questions for BEA

Tami Thatcher reports September 30 2013 in an "Open letter to INL's Riley Chase, deputy director for nuclear operations, and Art Clark, director of nuclear assurance:

In response to your September 26 letter to the editor, if you reread my column printed September 18, you will see that I stated that BEA has incentives to underestimate the accidental radiological doses to workers.

BEA has stressed that the doses did not exceed the safety threshold for radiation workers. Wouldn't it have looked worse to DOE and the public if those thresholds were exceeded?

I also stated that BEA was pressured by DOE to cut corners. This cost-saving pressure by DOE is documented and is nothing new.

If you still think my statements are illogical and untrue, we should chat so I can clear up any remaining confusion you may have. While I left full-time work at INL in 2005, you seem to have forgotten that I worked on contract to BEA through 2008, working on projects from the ATR Complex to MFC.

Even though I am not current on many issues, I know that the USQ reporting requirements of 10 CFR 830 that require reporting the discovery of an increased likelihood of a nuclear accident have not changed.

Would you please explain why BEA did not report the discovery of an increased likelihood of damaged ZPPR plates as required by law? And please explain why this discovery, which BEA managers were briefed on, did not lead to the corrective actions that would have prevented the ZPPR contamination event."