Public Comment on Idaho DEQ's Partial Permit for Hazardous Waste at the AMWTP

Submitted by Tami Thatcher, October 12, 2018

The Idaho Department of Environmental Quality has announced that it is seeking public comment on a draft hazardous waste storage and treatment partial permit renewal for the Advanced Mixed Waste Treatment Project (AMWTP) on the Idaho National Laboratory. [i] IDEQ states that "DEQ has reviewed the partial permit renewal application, determined that legal requirements designed to protect human health and the environment have been met, and proposes to issue the 10-year permit renewal." DEQ further states that "The draft partial permit, public notice, and fact sheet are available for public review on DEQ's website (download at right) and at DEQ's State Office."

The AMWTP treats radioactive and chemically-laden waste by compacting the waste. Much of the waste treated at the facility was shipped to Idaho from the Rocky Flats Weapons facility which produced nuclear weapons. Upon my calling the Idaho DEQ with questions, I was informed several times that all operations at the AMWTP over many years of operation have been safe.

The four waste drums that exploded in April 2018 at the nearby Accelerated Retrieval Project (ARP) had been repackaged by Fluor Idaho, the operating contractor for the Idaho Cleanup Project, under the Department of Energy at the Idaho National Laboratory site and the waste that exploded was from the AMWTP. The waste drums were to return to the AMWTP.

The report of why the drums ruptured is not available to the public, yet Idaho DEQ has opened the public comment period for the AMWTP. The public has no way of reviewing the adequacy of the Department of Energy's analysis of the cause of the drum ruptures nor its corrective actions.

The draft permit may require changes in light of the not-yet-completed drum rupture investigation. So why is the Idaho DEQ sure that it will approve the AMWTP partial permit? The answer, unfortunately, is that the Idaho DEQ is nothing but a "rubber stamp" for any permit application from the Department of Energy.

The Idaho DEQ apparently does not relate the fact that the four drums that overpressurized at the Accelerated Retrieval Project on April 2018 were waste from the AMWTP and that the same faulty hazard identification and hazard mitigation processes that allowed the drums to rupture in April could have happened at the AMWTP. The overpressurization of drums at the ARP would have occurred with unprotected workers present or could have occurred outside of any enclosure. Nothing prevented the return of the drums to the AMWTP prior to their rupture.

The claim that there was no release of radioactivity from the April drum ruptures indicates only that the radiological monitoring was inadequate because the filters on the ARP are not 100 percent effective. The radiation monitor failed when the drums ruptured. Firemen entered the facility with face masks not rated for the severity of the radioactive airborne material in the ARP.

The partial permit request documentation for the AMWTP does not address the April transuranic waste drum explosions and does not address the inadequate assumptions made that allowed those explosions.

The DOE's report is not yet available and the current comment period is completely inadequate because the draft permit has not considered the findings of why no one had recognized that unsealing waste containers could lead to explosive levels of hydrogen gas buildup. This could happen when repackaging the waste, or it could happen if a drum were punctured. The Idaho DEQ has ignored all of this in issuing this inadequate draft permit for public comment.

The Department of Energy's Longstanding Inadequate Technical Basis for Hazard Identification of Transuranic Waste at all DOE Facilities, Including the AMWTP

I wrote Environmental Defense Institute newsletter articles regarding the transuranic waste drum explosions at our website. [ii] After searching for the reasons why four transuranic waste drums ruptured in April 2018, just hours after being repackaged, [iii] I came across a report published in 2002 that seemed to provide important clues for the rapid drum overpressurization. [iv]

In the research described in the 2002 report, the transuranic organic waste sludge sample that unexpectedly generated excessive hydrogen apparently had not had material added to the sample or been stirred. The intent of the experiment was to heat the samples and measure hydrogen gas generation. But the hydrogen level was already elevated in one sample when the experiment started. Simply upon unsealing the sample of transuranic sludge waste material, an excessive amount of hydrogen generation was observed. The DOE defunded the research. And it is not clear that the observations were ever followed up on.

In my limited review of the technical bases for concluding that the chemically-laden transuranic sludge waste would not overpressurize drum waste containers, it appears that the technical bases may be awfully thin. It appears that analyses by a single author, John Dick, who tested chemical combinations that had not been exposed to radioactivity, which is normally present in transuranic waste, concluded that as long as the waste materials were not subject to excessively high temperatures and did not have reactive materials added to the waste, that the waste would not overpressurize. [v] [vi]

Therefore, there appears to be an Unreviewed Safety Question concerning TRU waste within the Department of Energy Complex involving inadequate technical bases for concluding there would be no excessive hydrogen buildup when TRU waste containers are opened, intentionally or accidentally, and allowed to take in oxygen. I notified the DOE-ID of this, but no formal communication has been forthcoming to indicate that the matter was reviewed.

It might be narrowly decided that the cause of the April four-drum rupture is limited to the specific chemical constituents present in that waste — or that repackaging the waste into new drums was a necessary condition for the excessive hydrogen generation. But, additional configuration and factors beyond those need to also be considered.

I am concerned about the tendency to continue to rely on an incomplete and now proven to be grossly inadequate technical bases for assuming there would not be significant overpressurization events as long as the waste was stored as normal ambient temperatures and as

long as no addition materials such as organic kitty litter or other reactive waste had not been recently added to the waste.

In light of the TRU waste overpressurization at WIPP in 2014 and now in light of four TRU waste drums that overpressurized at the Idaho National Laboratory site at the Idaho Cleanup Project in April 2018, the 2002 report that identified excessive hydrogen buildup in TRU waste samples is particularly important. Because of the WIPP event being thought to be due to the addition of organic absorbent, a wheat-based kitty litter, initial responses to the Idaho four-drum rupture event in April were to point out that no organic materials had been added to the drum when it was repackaged.

The particle size of the TRU radionuclides as well as the amount of ionizing radiation and neutron radiation and possible reasons for inadequate radioactive material assay also need to be examined. Even for so-called "homogeneous" sludge waste from Rocky Flats, the original waste in the drum would not necessarily have been well mixed which could result in radiation assay underestimation of the TRU material present in the drum. The way that Portland cement and other materials were added to the original TRU waste drums from Rocky Flats (or a supplier to Rocky Flats) might not be well mixed and could result in underestimating the radioactive material present. It would appear that the incorrect assay of the amount of TRU radioactive material present may have been a significant factor in the 2014 WIPP drum explosion.

The transuranic waste involved in the rupture of four drums at the Idaho Cleanup project appears to have involved a waste stream that was particularly poorly understood. This characteristic seems to be the only reason they have offered for deeming it acceptable to continue other shipments to WIPP.

A long listing of chemicals that might be in the waste that was in the four drums that ruptured had been assigned but there was no physical sampling to determine which of the chemicals were in the waste prior to its repackaging. Nonetheless, the contractor, the DOE, and the Idaho Department of Environmental Quality had wrongly deemed the process safe enough based on their very limited knowledge of what was in these drums of "homogenous" sludge.

The bases for concluding that hydrogen generation in the TRU drums should not be a problem appears to stem from analyses largely by the same analyst, John Dick, who concluded that the TRU waste would not overpressurize when ambient temperatures for storing the waste would maintained. It appears that his research regarding mixing of chemicals did not include actual TRU waste and thus would not reflect the possible increased susceptibility to hydrogen generation of chemicals long exposed to radiation.

The four drums that ruptured had been repackaged in Idaho did not add new material. The contents of the drums were mixed around in a trough and then repackaged into new drums. These drums were stored in areas of the facility where no worker respiratory protection would have normally been provided. There was no expectation that these drums were vulnerable to over-pressurization and rupture. If not for the good luck of the timing of the drum ruptures being during the off hours when no workers were in the facility, many workers would have had significant inhalation of radioactive material. And these drums could have been moved from this facility to other locations that also would have put workers and/or the environment at risk.

The question of why there was excessive hydrogen buildup might be explained by research conducted at ANL-W and reported in 2002. The report by David B. Barber and Kevin P. Carney

and Jack C. Demirgian is “Observation of Excessive Hydrogen from Transuranic Waste Type IV Solidified Organics.” This work was funded by DOE’s Transuranic and Mixed Waste Focus Area under contract W-31-109-ENG-38.

However, upon finding unexplained excessive hydrogen buildup in actual TRU waste samples, the Department of Energy defunded the research.

While the published findings did not make final conclusions of the cause of excessive hydrogen buildup in some TRU samples, they did offer possible reasons.

The reasons can include variation in chemical contents of the TRU waste, variation in the amount of ionizing radiation in the sample, increased susceptibility of the compounds to release gases at lower temperatures because of long term exposure to ionizing radiation resulting in “thermal cracking,” and the presence of free radicals formed by the ongoing ionizing radiation.

In the 2002 report by Barber et al., simply opening the container of the TRU sample which allowed in oxygen (and no mention of stirring or mixing the waste) was enough to, in a noted case, result in unexpected and excessive hydrogen gas generation.

Had this finding been further and adequately researched, additional precautions might have been put in place to monitor hydrogen off-gassing (and temperature). So, some of the precautions that have been put in place at least temporarily at the ARP V now, after the four-drum accident, could have been identified years earlier.

The historical bases for the assumption that opening drums, stirring drum material, and repackaging drums and/or storing the drums would not develop pressures that would overpressurize the drums and release large amount of TRU waste material appear to be inadequate.

Other research has noted increased hydrogen generation levels, characterized by G-value, for mixed chemicals. [vii]

TRU Drum Handling Risks Beyond Repackaging, Include Storage and Transportation

The Idaho DEQs permit and the DOE’s safety analyses at the AMWTP and the ARP has been inadequate to address safety issues concerning unintended opening TRU waste packages, allowing oxygen entry to the previous oxygen deprived drum. Therefore, the procedures and processes at the AMWTP (and the ARP) have been inadequate and the Idaho DEQ has no proper basis currently to renew the AMWTP permit as it is currently written.

The wrong conclusion which was that the TRU waste, now opened after a long oxygen limited environment, would not have excessive hydrogen buildup that would result in container drum rupture, has been a very dangerous error made by the Department of Energy.

The bases for concluding that there was no or minimal risk from the newly opened and repackaged drums has long been flawed and not based on chemical risk of chemicals long exposed to ionizing radiation. This issue pertains not only to the repackaging of transuranic waste drums, it also pertains to the necessary precautions and emergency response regarding an accidental drum breach. Forklift tines puncturing a drum, could, for instance, allow oxygen into the drum and put the drum at more risk of an overpressurization within a few hours of the initial breach. The possible buildup of excessive temperature (300 F) in the waste and possible drum lid

popping pressures need to be understood and mitigated in drum handling and transportation incidents.

Summary

A thorough review of the inadequacy of the technical bases for assuming that there was little risk of drum overpressurization needs to be conducted. The results and the adequacy of the Department of Energy contractor's not-at-all-independent review of the April drum rupture cause must also be thoroughly reviewed. The old assumptions — that unless new materials were added to the drum, the drum would not overpressurize at ambient temperatures — are flawed.

So, again I ask, how can the Idaho DEQ currently recommend permit renewal at this time when the Department of Energy has not issued the final report concerning the cause of the transuranic waste drums explosions in April and has not finalized corrective actions?

Currently, hazard identification has relied on the assumption that as long as no incompatible materials were added to the waste and the waste was not subjected to excessive temperatures, there would not be excessive hydrogen generation.

But for the four drums that ruptured, no materials had been added and the drums were being stored at normal temperatures.

The multitude of drum storage and handling configurations and incidents such as puncturing a waste drum also appear to potentially pose a higher likelihood and consequence from potential rapid overpressurization such as would cause additional drum rupture or lids to pop off the drums, during the response to a drum incident that had allowed oxygen to enter to drum.

Please also note that the "Annual Site Treatment Plan" report for 2017 is not available on the DEQ's website or any website I tried of five federal websites, which is another transparency issue.

References

[i] The Idaho Department of Environmental Quality (DEQ) is seeking public comment on a draft hazardous waste storage and treatment partial permit renewal for the Advanced Mixed Waste Treatment Project (AMWTP) on the Idaho National Laboratory, see http://www.deq.idaho.gov/news-archives/waste-idaho-national-laboratory-permit-renewal-comment-092818/

[ii] Environmental Defense Institute newsletter article for May, "Several Barrels of Waste Overpressurize Within Hours After Being Repackaged at the Idaho Cleanup Project ARP V," and for August, "Potential Unreviewed Safety Question Affecting Department of Energy Complex Concerning Hydrogen Generation in TRU Waste Drums."

[iii] Keith Ridler, *The Idaho Statesman*, "Officials say radioactive sludge barrel ruptures now total 4," April 25, 2018. http://www.idahostatesman.com/latest-news/article209827149.html

[iv] David B. Barber and Kevin P. Carney, Argonne National Laboratory, "Observations of Excessive Hydrogen from Transuranic Waste Type IV Solidified Organics," January 2002. Funded by the DOE's Transuranic and Mixed Waste Focus Area.

https://www.researchgate.net/publication/238614280_Observations_of_excessive_hydrogen_from_transuranic_waste_type_IV_solidified_organics The paper describes unexpectedly high levels of hydrogen generation in tests conducted of transuranic Type IV solidified organics. There is a variety of materials present in the sludge (oil, inert and volatile organic compounds) and variation in the localized and drum-total ionizing radiation doses, variation in storage conditions, and variation in radiolysis, recombination and matrix depletion effects. "It has certainly proven difficult to isolate mechanisms for hydrogen production and release from these organic systems. The three mechanisms discussed previously, i.e., storage-and-release, cracking of radiation-produced organic compounds and radiocatalysis, as well as other causes may be at play. Several research paths including inerted sampling remain to be pursued to resolve these questions." The Department of Energy's funding for this research was terminated.

[v] John R. Dick and Brent N. Burton, INEEL, "Evaluation of Chemical Compatibilities of the OU 7-10 Glovebox Excavator Method Project," INEEL/EXT-01-01587, June 2002. https://ar.icp.doe.gov/images/pdf/200304/2003041100126KAH.pdf See also John R. Dick, INEEL/EXT-01-00265 and INEEL/EXT-03-00471 cited in ICP/EXT-04-00248.

[vi] North Wind Inc. for U.S. Department of Energy, Environmental Management, "Historical Background Report for Rocky Flats Plant Waste Shipped to the INEEL and Buried in the SDA from 1954 to 1971," ICP/EXT-04-00248, Revision 1, February 2005. https://ar.icp.doe.gov/images/pdf/200504/2005040400022KAH.pdf

[vii] B. L. Anderson et al., Hydrogen Generation in TRU Waste Transportation Packages, NUREG/CR-6673, UCRL-ID-13852, Lawrence Livermore National Laboratory, February 2000, https://www.nrc.gov/docs/ML0037/ML003723404.pdf p. 77 "Aromatic hydrocarbons, such as benzene, toluene, and cyclohexene protect TBP from radiolysis, while saturated hydrocarbons such as hexane, cyclohexane, and dodecane sensitize TBP to radiolytic degradation (Barney and Bouse 1977). Carbon tetrachloride has also been found to sensitize TBP radiolysis."