

Before the
Defense Nuclear Facilities Safety Board

**Public Hearing on Hanford's
Waste Treatment Plant**

Kennewick, Washington

October 7 and 8, 2010

**Written Comments of Tom Carpenter,
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Thank you for soliciting public comment on the vital issues surrounding the design and construction of Hanford's Waste Treatment Plant (WTP). The Defense Nuclear Facilities Safety Board (DNFSB's) hearing and meeting on October 7 and 8 is notable in that it has been so far the only public hearing and meeting on the subject of the WTP.

Hanford Challenge supports the mission of the Waste Treatment Plant to treat Hanford's high-level nuclear waste through the vitrification process. We recognize the urgency of finding a treatment and disposal pathway for these wastes, which are currently stored in large underground tanks, a third of which have failed. The 53 million gallons of high-level nuclear waste threatens the short and long-term health and safety of the public, the environment and future generations, and must be dealt with expeditiously.

Our major concerns with the Waste Treatment Plant are simply stated:

- The quality and reliability of the Waste Treatment Plant is suspect when employee concerns have been effectively suppressed through the design and construction phase of the facility.
- "Closing out" unresolved design concerns for resolution at a later time (such as start-up) perpetuates a delay-and-deny strategy that continues to set the WTP up for failure.
- The "fast-track approach," now renamed as "design-build," has been sharply criticized by the GAO for years, and yet DOE has continued to utilize this approach.
- The bedrock for nuclear safety in any facility is the quality assurance/quality control program, a program that has been found to be highly deficient at the WTP in various reports, especially in the area of vendor procurement.
- DOE and contractor assurances that the risks of hydrogen deflagrations or detonations and nuclear criticalities are acceptable because they can be contained, rather than prevented, are intolerable in a first-of-a-kind, \$12.3 billion dollar nuclear facility designed to process high-level nuclear waste.

According to the Government Accountability Office (GAO), a key reason that the WTP's costs have spiraled is that Bechtel and DOE decided on a "design/build" strategy, also known as "fast track." In this model, as the plant's design is completed, construction begins without waiting for a full-design to be completed. However, as technical information is compiled and reviewed, problems with the existing design surface, and design changes begin to compound and cause problems and rework. These problems have the potential to affect the safe operation and performance of the plant.

In 2006, the GAO issued a report¹ stating: "There are three main causes for the increases in the project's cost and completion date: (1) the contractor's performance shortcomings in developing project estimates and implementing nuclear safety requirements, (2) DOE management problems, including inadequate oversight of the contractor's performance, and (3) technical challenges that have been more difficult than expected to address."

¹ *Hanford Waste Treatment Plant: Contractor and DOE Management Problems Have Led to Higher Costs, Construction Delays, and Safety Concerns*; GAO—06-602T, Statement of Gene Aloise, Director of Natural Resources and Environment; April 6, 2006, Testimony before the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives.

The same 2006 GAO report blamed DOE specifically: “DOE’s lack of oversight of Bechtel’s activities has also been unfortunate. DOE did not ensure adherence to normal project reporting requirements and, as a result, status reports provided an overly optimistic assessment of progress on the project. For example, in January 2005, DOE’s project status report indicated that costs and scheduled work to date were proceeding as planned. However, Bechtel was not providing accurate information. The project almost always appeared to be on schedule because Bechtel adjusted the project baseline schedule to match actual project results. In addition, DOE headquarters oversight officials were generally unaware of the full extent of the problems with the project.” (*Id.*, p. 14). Little has changed in 5 years except that the cost has grown by over 150% and the startup delayed until the end of this decade.

Waste Mixing Issue Presents Safety Concerns

As the Board has noted, if the high-level waste is not sufficiently mixed in pre-treatment plant tanks, plutonium could settle out and cause a nuclear criticality -- an undesirable outcome. Also, hydrogen gas bubbles can form and possibly cause an exothermic reaction. Even if neither of those scenarios develops, poorly mixed waste can gum up the works, rendering the plant ineffective or inefficient. A breach of the system could cause a radiological and chemical release that, at a minimum, could result in worker fatalities and injuries, and likely take the plant off-line for years.

The Nuclear Regulatory Commission first identified the problems associated with insufficient waste mixing in 2001.²

3.5.3 UNCERTAINTIES AND UNRESOLVED NUCLEAR CRITICALITY SAFETY ISSUES

In addition to the unresolved technical issues that are identified in the nuclear criticality safety (NCS) program document, there are additional technical items identified in the limited number of criticality safety evaluations submitted to the NRC, such as studying the possibility of solids precipitation from the mixing of fissile streams, verifying the maximum density of solids and verifying the maximum fissile concentration in the glass product. A major point of concern is the large amount of uncertainty in the waste tank feed material. It seems extremely difficult to determine the “worst-case” conditions for analysis when there is so much question as to the make-up of the input waste stream. Especially when considering the possibility of build-up on resin (such as ion exchange) filters and processes like solvent extraction and precipitation where fissile material could reach potentially high concentrations, great variability in the input waste stream could lead to large differences in process conditions.

In 2004, the GAO wrote³:

² *Overview and Summary of NRC Involvement with DOE in the Tank Waste Remediation System-Privatization (TWRS-P) Program*, NUREG 1747, June 29, 2001, p. 94.

³ *Absence of Key Management Reforms on Hanford’s Cleanup Project Adds to Challenges of Achieving Cost and Schedule Goals*, GAO-04-611, Page 28 GAO-04-611, June 2004.

Resolving key technical challenges for processing the waste has fallen behind ... One such challenge involves the generation of hydrogen gas during waste separation activities. The Defense Nuclear Facilities Safety Board stated in October 2002 and again in September 2003 that problems with this flammable gas, involving buildup of gas in excess of safety limits, could result in significant safety and operational problems. Bechtel National has been addressing this issue through design changes. However, even though it has been more than 1 year since the Board first raised this issue, this problem has yet to be fully resolved. An even more critical technical challenge involves how the wastes are mixed during treatment processes. To expedite resolution of this technical challenge, Bechtel National initially decided to rely on computer modeling of special mixers, called “pulse jet mixers.” But because computer modeling did not provide adequate assurance that the mixers would work, the contractor decided in April 2003, just 9 months before the design configuration for the mixers was to be completed, to conduct more stringent tests. Efforts to resolve the uncertainties associated with the mixers have delayed the testing schedule by more than 4 months, increased costs by more than \$15 million, and postponed the purchase of several thousand feet of pipe for the treatment facilities. In March 2004, Bechtel National reported that modifying the facility design to reflect improvements to the mixers could require an additional \$70 million and take about 16 months to complete. In its March 2004 monthly contract status report, Bechtel National stated that such delays have affected the project’s critical path and will increase costs.

Despite the NRC and GAO’s warnings, the problem remained unaddressed. In 2006, the GAO wrote:

“In June 2004, we reported on the possibility of hydrogen gas building up in the plant’s tanks, vessels, and piping systems, and noted that the buildup of flammable gas in excess of safety limits could cause significant safety and operational problems. Although DOE and Bechtel have been aware of this problem since 2002, the problem has not been fully resolved. As of March 2006, Bechtel continued to assess how to resolve this technical problem but has not identified final solutions. In April 2005, Bechtel estimated that this problem contributed about \$90 million to the project’s cost growth.”⁴ (p. 16, GAO, *Contractor and DOE Management Problems*)

Also in 2006, the DOE formed the External Flow Sheet Review Team (known locally as the “Best and Brightest” review team), an external and independent team of over 50 experts brought in to conduct a thorough review of technical issues associated with the WTP. That team

⁴ *Hanford Waste Treatment Plant: Contractor and DOE Management Problems Have Led to Higher Costs, Construction Delays, and Safety Concerns*; GAO—06-602T, Statement of Gene Aloise, Director of Natural Resources and Environment; April 6, 2006, Testimony before the Subcommittee on Energy and Water Development, Committee on Appropriations, House of Representatives, p. 16.

identified 28 (17 major, 11 potential) technical challenges to the design of WTP. Bechtel and URS, the two contractors on the project, were ordered to resolve those issues.

In the fall of 2009, the DOE was under tremendous pressure to resolve the one remaining issue still open from the Best and Brightest review – the waste mixing issue. The Manager for ORP requested Bechtel to appoint Dr. Walter Tamosaitis to be the technical lead for resolving the mixing issue.

Dr. Tamosaitis is considered an expert in his field with over 40 years in the chemical industry, specializing in flow sheet development and issue resolution. He worked at DuPont for many years. In 2003 he transferred to Hanford to work solely on the WTP. He was the Manager for Research and Technology and later appointed the Deputy Chief Engineer for the WTP. Dr. Tamosaitis was given the job of tackling the waste mixing issue at the beginning of October, 2009.

Dr. Tamosaitis attempted to work with Bechtel to bring about a resolution of the issue, but was unwilling to accept the disposition of the mixing issue without large-scale testing of the mixer technology to validate the design. Outside experts reporting to Dr. Tamosaitis concluded that the issue could not be resolved without large scale testing.

Nonetheless, on June 30, 2010 Bechtel declared all of the design issues “closed” to the concern of many, including Dr. Tamosaitis. On July 1, 2010, Dr. Tamosaitis raised a list of about 50 unresolved issues, and talked about the need for large-scale testing (a development resisted by Bechtel). He also expressed concerns about sampling, heel buildup, and process control systems all of which have safety implications. To show their enthusiasm for his suggestions, a high ranking Bechtel manager invited Dr. Tamosaitis to “choke on the cherries” she had brought to the meeting.

At 7 am the next day, Dr. Tamosaitis went into work to attend a planning meeting. He was met in the hallway, escorted to an office and abruptly terminated from his position at the WTP without explanation. He has still not been given a reason. He was told that the Project Manager for Bechtel, Frank Russo, who took over for the previous manager in early 2010, wanted him out. Dr. Tamosaitis kept his job at URS, but his badge was taken from him and with it his site access, he has been given no assignment comparable with his experience, no people to report to him, and was given a basement office in Richland, sitting next to the company copying machines. He went from managing a budget of \$500 million to managing no funds and no one, overnight.

Response to Dr. Tamosaitis Termination

Upon his termination from WTP, Dr. Tamosaitis wrote a letter to this Board (DNFSB) on July 19, 2010, which detailed many of the technical challenges of the WTP design, and reported the conditions surrounding his dismissal by Bechtel and URS, noting the detrimental effect his termination would have on the safety culture on the project.

As a result of publicity surrounding Dr. Tamosaitis’ letter, the Department of Energy opened “reviews” into Dr. Tamosaitis’ allegations. One was a review conducted by the Office of Health,

Safety and Security Administration,⁵ and the other an aborted review by the DOE Office of Inspector General. The DOE has yet to undertake any kind of inquiry or investigation into the circumstances behind the termination of Dr. Tamosaitis from his position at WTP.

The DOE's Office of Health, Safety and Security raised issues about the alleged closure of the waste mixing issue, in its October 2010 report. The report states, "Although formal closure of the *Pulse Jet Mixing Design* issue (also referred to as the M3 issue) has been declared, and authorized by ORP based on risk acceptance, calling the issue closed appears inconsistent and confusing with reference to the documented expectations of the Engineering Technical Issues Identification Management guide (compliance with this guide is mandatory according to the applicable process)" (HSS report, p. 12).

Evidence of Lack of Safety Culture at WTP

The termination of Dr. Tamosaitis was not an anomalous event. Bechtel has a documented history of suppressing employees with safety concerns. In 2005, the Department of Energy itself confirmed the existence of a hostile working environment at the Waste Treatment Plant in a report⁶. The investigation team interviewed 117 employees, and found:

"Greater than 50% of the workers interviewed believed their job would be in jeopardy due to their participation in this inquiry. Most of the interviewees mentioned other workers had issues but felt they could not risk their employment by coming forward. .. Roughly 20% voiced the belief that when individuals raise safety concerns, those individuals are targeted for future lay-off lists. Roughly 15% of the interviewees claimed there was fear of lay-offs for workers who reported issues to Labor Relations or with the Employee Concerns process" (DOE Employee Concerns Inquiry and Analysis Report, p. 2).

In 2008, the DOE imposed a civil penalty for nuclear safety violations against Bechtel National, Inc. based upon the findings of a DOE hearing officer that a Bechtel engineer had been terminated after having raised nuclear safety concerns.⁷

The 2010 DOE HSS review looked at the safety culture in the engineering division at the Waste Treatment Plant. The report found that a framework was in place for a Safety Conscious Work Environment at WTP, but also had this finding:

"Chilled Work Environment. Some individuals within WTP believe that BNI management has created a "chilled" atmosphere that discourages individuals from reporting safety concerns. Further, some individuals expressed their belief that individuals who raise safety concerns could be subject to retaliation, including the

⁵ *Independent Review of Nuclear Safety Culture at the Hanford Site Waste Treatment and Immobilization Plant Project*, Office of Health, Safety and Security, Department of Energy, October 2010.

⁶ Letter, R. Schepens, DOE ORP to J.P. Henschel, BNI, "Contract No. DE-AC27-01RV14136 – Employee Concerns Inquiry and Analysis Report," January 18, 2005, Att. p. 2.

⁷ Letter, M. Thompson, DOE-HSSA, to W. Elkins, BNI, Preliminary Notice of Violation, September 15, 2008.

threat of losing their jobs. One of the most significant concerns was subtle retaliation – i.e., that individuals who raise safety issues would not be selected for new assignments as their current assignments are completed. . . In this environment, a significant number of employees are understandably concerned that a reputation as a “trouble maker” could adversely impact their opportunities for continued or future employment. In addition, several interviewees, including senior staff and managers, indicated that the situation surrounding the individual who raised concerns to the DNFSB (prompting the request by EM to perform this review) contributed to a chilling effect that may reduce their willingness to raise technical or safety issues. While some organizations had a higher fraction of personnel with concerns than others, the concerns about a chilled environment were not limited to a single organizational element or job category” (DOE HSS review, p.15).

The public cannot have confidence in a nuclear facility where employees – especially top managers like Dr. Tamosaitis – are removed after raising technical and safety concerns. The poisoned atmosphere created by management’s harsh and uncalled for treatment of such employees creates a chilling effect on others that might need to raise safety concerns. The correlation that raising safety and technical issues that threaten the schedule of the plant and associated payments to the contractor, will threaten the concerned employee’s job, is problematic and overrides the pronouncements of the contractor that it “encourages the raising of safety concerns.”

Likewise, the Department of Energy is too heavily-invested in the WTP to be able to assure that safety concerns are not subordinated to the all-important schedule/cost issue. Its failure to investigate the termination of a key manager as important as Dr. Tamosaitis – the Manager for Research and Technology – is a key indicator of the DOE’s inability to rise above its inherent conflicts of interest as owner of the WTP. The pattern and practice of reprisal against employees who raise concerns at WTP is laid out in a series of decisions and actions documented by DOE itself, as shown above, and yet it fails again and again to take action.

This conflict of interest is in part why the DNFSB was created by Congress. The Board has a critical role in overseeing nuclear safety issues at DOE facilities, not only because of its technical competence, but because of its independence. Yet the Board’s historical refusal to consider chilled work environments in nuclear facility construction and operation runs counter to that mission. The Board’s commercial counterpart, the Nuclear Regulatory Commission, has made the establishment and maintenance of a safety conscious work environment an enforceable expectation of an operating license.⁸

A safety conscious work environment (SCWE) is defined as a work environment in which employees are encouraged to raise concerns and where such concerns are promptly reviewed, given the proper priority based on their potential safety significance, and appropriately resolved

⁸ See, *NRC Regulatory Issue Summary 2005-18*, “Guidance for Establishing and Maintaining a Safety Conscious Work Environment”, Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Office of Nuclear Material Safety and Safeguards, August 25, 2005, and 10 CFR 50.7.

with timely feedback to employees. Attributes of a safety conscious work environment include (1) a management attitude that promotes employee involvement and confidence in raising and resolving concerns; (2) a clearly communicated management policy where safety has the utmost priority, overriding, if necessary, the demands of production and project schedules; (3) a strong, independent quality assurance organization and program; (4) a training program that encourages a positive attitude toward safety; and (5) a safety ethic at all levels that is characterized by an inherently questioning attitude, attention to detail, prevention of complacency, a commitment to excellence, and personal accountability in safety matters.

Our comment is that DNFSB should recognize the integral part that the safety culture plays in matters of nuclear safety, investigate reprisals and chilled work environments and issue comments and recommendations as it normally does as part of the Board's jurisdiction.

The Waste Treatment Plant is over 90% designed and over 50% constructed. Yet, the history of employee reprisals calls into question the quality and safety posture of the facility. At the very least, no future work or design should proceed unless and until there is a robust and independent investigation of the safety conscious work environment aspects of the facility – one that considers all relevant information, such as the removal of employees like Dr. Tamosaitis from the project. It is likely such an investigation will result in a need for corrective action that assures the establishment of a non-chilled work environment, before the resumption of work.

Other Issues of Concern

- We are concerned about the fact that Bechtel National, Inc., the prime contractor chosen to design and build the Waste Treatment Plant, is both the design agent and design authority. Bechtel determines what needs to be built, and then gives itself permission to build it. This seems to pose a clear conflict of interest. Additionally, Bechtel will not be the operator of the WTP. It therefore will not live with or be responsible for the consequences of a plant failure. The behavior of cutting corners on safety and design is therefore consistent with the reality that Bechtel simply has to deliver a Waste Treatment Plant. Whether it works, works well, doesn't work, or blows up, is simply of no concern of Bechtel's. They will have been paid and gone. They will have been rewarded for their delay and deny strategy.
- The testimony of Hanford officials at the DNFSB hearing and meeting made clear that one way that Hanford officials were planning to respond to the mixing concerns was to guarantee that the waste delivered from the tank farms would meet a specified Waste Acceptance Criteria. However, there are no pre-treatment facilities in the tank farms that could accomplish this task. Further, there are no criteria developed. There exists no infrastructure, design, budget or plan for such a facility. How could this not affect the budget and timeline of the Waste Treatment Plant? Given the ten-year failure to deal with the waste mixing issues detailed above, the notion that we will fix this "down the road" with an unspecified facility that has not been budgeted for or designed is the latest urgent red flag that not all is well with this project, and that serious intervention is required to salvage the nation's largest, most complicated and expensive environmental

remediation project in history. By most accounts, the WTP is the fourth attempt by DOE to stabilize the hazardous waste at Hanford. As taxpayers we cannot afford a fifth.

- A few years back, Hanford officials realized that there was more aluminum in the tank waste than was anticipated. Since aluminum is bad for glass formation, it is necessary to remove a portion of the aluminum from the waste in the pre-treatment process. The classic way to remove the aluminum is to use sodium hydroxide. However, this would significantly increase the amount of nuclear waste to be processed, especially low activity waste (LAW). Alternate processes are being investigated including pre-treatment at the tank farms. The combination of major flowsheet changes combined with a pre-treatment plant that is plagued with issues appears to be a disaster looming on the horizon. Hanford Challenge is concerned that this issue, raised so late in the design process, is indicative on how poorly the waste and the process are understood, and we wonder what other unpleasant surprises lay in store. We are very concerned about pursuing unplanned, unbudgeted and yet-to-be-designed facilities to support WTP when insufficient effort has been put into making the WTP operate effectively.

Hanford Challenge has the following questions which we hope the Board will take into consideration:

- Why is a design that cannot prevent flammable gas explosions considered acceptable? There is a design solution that prevents these explosions, but it is considered too expensive. What happens if an explosion occurs twice in the same pipe? What happens to other system components? Are explosions in a hazardous nuclear facility ever acceptable?
- Why is the possibility of a nuclear criticality considered acceptable at the WTP? Internal documentation indicates that a nuclear criticality could occur if the waste tanks are not adequately mixed, and plutonium settles to the bottom of a tank.
- Has Bechtel proposed redefining firewalls in the facility as non-safety items to save on costs? If so, what justification can there be, besides money, to propose such a move?
- Is the DNFSB considering the implications a broken safety culture has on the safety of the Waste Treatment Plant? How will concerns surface if employees who notice critical issues are afraid to raise their concerns?
- Why did DOE suddenly approve the closure of technical issues after their own work plans concluded that it will take 18 months or more to resolve these issues? Is this approval related to the fact that DOE had a legally-binding Tri-Party Agreement cleanup milestone to meet and that Bechtel had 5 million dollars at risk if they didn't close the key technical issue (M3) by June 30th, 2010?
- Is DOE evaluating the impact of assigning one contractor to design and build the WTP, and another contractor to operate the plant? Since Bechtel is not responsible for

operating the plant, there is no contractual penalty if they build a plant that does not work.

- Why has DOE assigned the Design Agent role *and* the Design Authority role to Bechtel, when Bechtel clearly has a conflict of interest in authorizing its own work? Shouldn't these roles be separated, and the Design Authority operate independently of the contractor responsible for building the plant? We would suggest that DNFSB or the Nuclear Regulatory Commission be given the job of Design Authority over WTP design decisions.
- Is Bechtel the right contractor to build this facility given the history of failures, reprisals and mis-steps? Secondly, is DOE providing the necessary oversight and imposing the required rigor of operations to safeguard human health and safety and protect the public's massive investment of taxpayer dollars?
- For the first six years of design and construction of the WTP, Bechtel lacked a vendor quality assurance program. How can we assure that the quality of procured equipment and instruments is adequate without the necessary pedigree? Would this facility even be considered for licensing by the Nuclear Regulatory Commission, or denied due to its "quality indeterminate" state? Doesn't the public deserve a plant that meets the safety standards of an NRC-licensed facility?

Closing Comments

After spending ten years and \$6 billion dollars (so far) designing and building the Waste Treatment Plant, it remains mired in controversy and uncertainty. The warnings from independent agencies and reviews, including the NRC, the GAO, the DOE and the DNFSB, have been largely ignored, with the result that the WTP is in a quality indeterminate state, and plagued with unanswered technical design and safety issues.

The strategy of closing out unresolved safety concerns and waiting until operation begins in 2019 to address them, instead of resolving the issues now, guarantees far greater cost increases and schedule delays in the long-run.

When the work atmosphere at the WTP has been poisoned by a history of reprisals against employees who raise concerns, the quality and safety of the plant will always remain "indeterminate," because it is uncertain whether or not important issues affecting future operations have been raised and addressed.

The Waste Treatment Plant design, especially the pre-treatment waste process is on the path to failure. Building a plant to meet deadlines has overridden safety and design considerations for safe and effective operation of the facility.

The DOE cannot proceed with business as usual. Systemic changes to the process are necessary to better our chances of success. These changes should include re-thinking the mission of the Waste Treatment Plant (in light of the closure of Yucca Mountain); replacing the Department of Energy as the overseer/regulator since it is conflicted as an owner; resolving the conflict of interests within Bechtel as design agent and design authority; and considering a licensing approach utilized by the NRC to ensure that the waste treatment facility does not open unless it meets rigorous standards of safety and reliability.

We appreciate the Defense Nuclear Facilities Safety Board's oversight on the Waste Treatment Plant, and the willingness of the Board to accept input from the public.

Respectfully submitted,

A handwritten signature in blue ink that reads "Tom Carpenter". The signature is written in a cursive, flowing style.

Tom Carpenter, Executive Director
Hanford Challenge

DATED: January 6, 2011