

**A LONGITUDINAL STUDY OF CITIZENS' VIEWS ON THE FATE OF THE COLUMBIA  
RIVER IN WASHINGTON STATE:  
TRITIUM CONCERNS AT HANFORD**

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**ABSTRACT**

The Columbia River in eastern Washington borders the U.S. Department of Energy's (DOE) Hanford installation, a former nuclear weapons production facility. The River provided a necessary source of water that cooled the installation's nuclear reactors during the years of the Manhattan Project and the Cold War. Large volumes of waste resulting from almost five decades of research, processing and manufacture have contaminated the area, including the groundwater beneath the site that flows toward the Columbia River. The end of the Cold War in 1989 forced Hanford, like many of DOE's installations, to shift its focus from weapons production to site cleanup. Beginning in 1989 DOE became more open about past practices and current activities at its weapons facilities. As new information on tritium contamination became known, the public responded with increased interest and concern.

Xavier University's Consortium for Environmental Risk Evaluation (CERE) Program has collected and catalogued over 5000 documents published between 1989 to 1999 expressing citizens' views related to the Hanford installation. CERE has captured a picture of stakeholders' concerns that have been voiced in many forums, including public meetings, newspaper articles, editorials, journals, and letters. In this paper specific citizen concerns regarding tritium production and contamination were extracted from our database and analyzed in order to assess shifts in the salience of issues over a ten-year period.

In general, public commentary has oscillated between concerns over tritium production and concerns over present and future contamination, usually in response to news releases or milestone events at the Hanford site. A difference in priorities given to economic issues or to environmental quality of life issues among various stakeholders was also evident in the shifting public debate. An understanding of the perspectives of various stakeholders will help DOE program managers improve communications between and among various stakeholders and assist in identifying the perceptions of risk held by different publics.

**INTRODUCTION**

The Hanford Site is one of the installations in the Department of Energy's nuclear weapons complex. It covers approximately 560 square miles, an area more than half the size of Rhode Island, along the Columbia River in southeastern Washington State. Hanford was built in 1943 as part of the Manhattan

Project to produce plutonium for nuclear weapons. Water from the river was used for reactor cooling, and after almost five decades of nuclear weapons production and research, large amounts of radioactive wastes were produced. The Columbia River was critical for both operations at the site and life in the surrounding Tri-Cities area (DOE, 1994: 98). Water from the Columbia River continues to provide a crucial resource for drinking, crop irrigation and recreational activities, and maintains the health of river and riparian ecosystems.

In 1989, the mission of the Hanford installation was changed from weapons production to site cleanup. The years of operations at the Site produced large amounts of wastes that were disposed of in tanks, trenches, cribs, ponds and burial grounds. There are currently 177 waste storage tanks at Hanford holding a combined radioactive waste volume of 56 million gallons. The majority of these, 149 of the total, are of single shell design with a twenty-year life span. These tanks have exceeded their design life and about half are known to have leaked in the past or be leaking in the present. The remaining tanks are a newer double-shelled design and have performed without leaks.

As a byproduct of plutonium production, radioactive tritium poses a threat to human and environmental health through exposure to contaminated ground and surface water sources. Monitoring wells at the site revealed that tritium concentrations in the groundwater have reached a level of concern to both government officials as well as area residents. Potential pathways for human exposure to tritium contamination include public and private wells and subsistence, commercial, or recreational use of the Columbia River.

The debate on tritium production at Hanford focused attention on the Fast Flux Test Facility (FFTF), located in the southern portion of the site. The FFTF is a liquid metal test reactor that began full power operation in 1982 and shut down in 1993 due to cost concerns. Initially, the facility served as a test tool for advanced reactor technology, then expanded into other areas of research and development, such as fusion research, medical isotope production, and international research programs. Currently DOE is maintaining the FFTF in a standby condition while the department evaluates possible uses of the reactor, including tritium production.

## **METHODOLOGY**

In this study, public environmental concerns associated with the tritium production and contamination were analyzed using comments expressed by various members of the public. These comments were captured in a database developed by Xavier University's Consortium for Environmental Risk Evaluation (CERE) Program. The database includes written documents collected about the Hanford installation for the ten-year period from January 1989 to the present. These documents contain the views and concerns of various stakeholders, tribes and citizen groups about DOE's environmental management activities. Approximately 5,200 documents in the form of newspapers, stakeholder meeting minutes/transcripts, letters, survey summaries, journal publications, dissertations/theses, federal facility agreement comment/response documents, environmental impact statements, site plans, and other DOE documents and reports were collected and analyzed. Based on these documents, a total number of 9,732 individual comments or expressions of concerns have been identified. Comments were

abstracted and coded according to a standardized list of issues that was developed as part of the database. In addition to the particular issue being addressed by the commentary, the database also contains information on the commentator's affiliation, date of comment, and source of comment to the extent known. The structure of the database allows one to perform a temporal study on any of the more than 100 listed issues. This paper focuses on public and tribal comments made on tritium production and radioactive tritium contamination.

## RESULTS

The CERE database contains information that makes possible a chronological survey of public concerns about a particular risk over a ten-year period. On the tritium issue, the expressed concerns generally fall into two categories, tritium production and tritium waste contamination. Examination of the data also reveals the relationship, if any, between site/media events and the intensity of citizens' concerns.

The earliest references to tritium in the database were from February 1989, in comments generated by contradictory news events. An eight billion-dollar funding request by DOE to Congress to build new reactors for tritium production accompanied the confirmed news reports disclosing that the U.S. Government was selling stockpiled tritium overseas.

Those announcements were the beginning of continued concerns about the use of a linear accelerator, construction of new reactors, and conversion of a mothballed Washington Public Power Supply System (WPPSS) reactor (WNP-1) to produce tritium at Hanford. By April of 1989, the conversion plan was hailed as "glimmers of good news" in terms of employment prospects for the Tri-Cities. The conversion plan suggested that the WPPSS plant would continue to operate for thirty years to produce tritium and low-cost electricity. There was opposition to the proposal, however, as commentators made repeated requests that DOE should demonstrate the need for more tritium production. An environmental group noted that converting the WPPSS to a tritium plant would violate the spirit of an agreement not to use civilian reactors for military purposes. The announcement that the N Reactor full shutdown would be delayed was considered good news to those Hanford workers facing possible layoffs, as was the news that Hanford was still in the running for tritium production.

However, in October 1989, an announcement was made that the N Reactor was to be shut down after all, and several commentators expressed concerns about national defense, fearing no production of tritium in the United States would compromise national security. Perhaps because the Berlin Wall came down in November, the concern about tritium did not once again become a salient issue until the New Year when tritium contamination superseded production as a recurring focus of concern. The increase in expressed Tribal concerns in 1990 was related to the suit by the Yakama Indian Nation against Hanford contractors for damage to the Columbia River. This suit drew even more public attention to tritium. This time, however, comments shifted from production issues to concerns regarding tritium contamination. Public comments focused on existing conditions at Hanford and the need for environmental monitoring in order to be able to inform the public about how radioactive the aquifers were, how "hot" the Columbia River was downstream, and how fast tritium was seeping into the river.

Hearings concerning the Programmatic Environmental Impact Statement (PEIS) for Environmental Restoration and Waste Management in December 1990 generated a plea that more effort should be made on negotiating test bans and arms reductions treaties to reduce the need for tritium, as concerns once again addressed production and radioactive waste generation. The February 1991 hearings on proposed changes in the Tri-Party Agreement (TPA) also produced comments about tritium. Numerous commentors were opposed to the production of any more plutonium or tritium, and several emphasized that more stockpiling at the expense of meeting TPA deadlines was not acceptable. However, conversion of the WNP-1 plant was endorsed by some as a source of additional revenue to subsidize cleanup. Levies imposed on use of the converted plant could be used for paying for the processing of nuclear waste as well as for environmental restoration programs. Other commentors were opposed to the conversion, stating that there was no justification for new production and that disposal of waste was an important issue to resolve.

A candidate was criticized in April of 1991 for his continued opposition to the conversion of a civilian reactor for tritium production that would bring jobs to the area. However, during that summer, a draft Environmental Impact Statement (EIS) on the potential placement of a new production reactor at Hanford prompted public commentary on the negative environmental impact of a new reactor. A prevalent comment was made that DOE had not established the need for producing more weapons grade tritium in light of the disintegration of the former Soviet Union. Comments were made that tritium should be recycled and that there was sufficient tritium supply in the US so that a new production reactor would not be needed. Commentors also argued that funds were being sacrificed to build new bomb factories and that DOE's commitment to cleanup was questionable. A commentor was emphatic about putting a stop to nuclear weapons production, saying that Hanford was supposed to be the flagship for nuclear waste cleanup and that tritium production facilities across the country had all been shut down. That same year, responses were received on the Proposed Five-Year Plan for Hanford. Many comments were voiced on contamination to groundwater aquifers and the Columbia River. Citizens wanted DOE to install barriers to prevent waste migration to the aquifer and the river.

The most numerous comments on tritium in 1991 involved responses to the PEIS on Reconfiguration. For the first time, waste contamination concerns about tritium outnumbered those on production, 57% to 43%, and even those concerns about production were expressed negatively. Comments showed a preference for an end to tritium production. Concerns addressed the diversion of cleanup funding to weapons production and the need to encourage further negotiations on test bans so as to decrease the need for tritium. The negative environmental impacts of reconfiguration, modernizing, and rebuilding were termed reason enough to reject the proposed actions, as was the failure of the EIS to include the intended use of the weapons and materials produced (including tritium). Waste issues were perhaps best exemplified by the descriptive reference to the "trashing of America by the nuclear weapons program." Conversely, one commentor saw the problems of contamination as a boost to the area economy, reflecting the ongoing public debate between economic and environmental or quality of life concerns.

A DOE Hanford Environmental, Safety and Health Advisory Board meeting in 1992 generated public comments about the high concentrations of tritium and other radionuclides reaching the Columbia River

and creating health hazards for its users. Hearings on the Hanford Remedial Action EIS later in the year also produced comments about tritium waste contamination in the river and subsequent health risks to the public, especially those likely to catch and consume unsafe fish. Radioactive waste disposal in the 300 Trench was also opposed because of the danger to the river. A GAO Report in 1992 discussed tritium waste problems related to the tank farms, noting that the largest tanks held over a million gallons of high level radioactive waste from tritium and plutonium production for nuclear weapons. Although the tanks were known to be leaking, the report claimed that the contaminants were stuck in the soil and had only moved halfway to the groundwater in 30 years. A major public concern was the lack of effective technology to treat underground radioactive plumes.

An explosion at the Tomsk-7 Uranium and Plutonium Processing Plant in Russia in the spring of 1993 generated concerns among area residents who feared a similar incident at Hanford, which could spread even more radionuclide contamination, including tritium. An environmental group claimed that a review of Hanford documents revealed that the Uranium Oxide Plant and the Plutonium Finishing Plant did not have modern safety systems that would prevent any future explosions similar to the kind that occurred not only at Tomsk but also at the Hanford and Savannah River plutonium processing plants. Furthermore, if defense-mission production were to continue, the operation would discharge millions of gallons of waste into the soil, thus increasing the threat to the Columbia River. Once again, the public was concerned about the diversion of cleanup funds to waste-generating production.

The creation of the Hanford Tank Waste Task Force (HTWTF) in 1993 drew public's attention to contamination from leaking tanks. According to a member of the HTWTF, tritium was present in the Columbia River. Public commentators wanted tritium removed from the river, and aquifer and surface water sources protected from tritium migration. Comments expressed concerns that there was no technology in place to treat existing tritium contamination.

Comments on the Columbia River Impact Evaluation Plan noted that tritium in the groundwater was a particular threat to mammals because of bioaccumulation. Commentors termed the impact on eagles and ospreys "too much of a sacrifice," and asked that those species be monitored. These individuals concluded that the cumulative effects on humans, especially among Native Americans, should be included in the evaluation. Further comments about tritium included demands that effects on sediments downstream and behind dams be included, and that sources of tritium be considered in the plan. There was particular concern that the report minimized river sediment as a source of contamination.

Early in 1994 problems of tank waste contamination were the subject of public hearings for the EIS on Tank Waste Remediation System (TWRS) and Safe Interim Storage. The consensus among commentators was that whatever action was necessary to forestall further leakage to the soil, and eventually to the river, should be taken. According to public commentators, tritium should not be allowed to reach the groundwater, and the buffer zone should remain a buffer and not a disposal zone. Later in the year the publication of the Public Scoping Record for the TWRS chronicled additional public fears about tritium. The leakage of tank waste was an often-addressed concern. One person feared that the double-shelled tanks would be unable to contain tritium and that retrieval and transportation of the wastes would increase the risks of further contamination.

By May of 1994, renegotiations of the Tri-Party Agreement were complete, and once again there was concern about the treatment of tritium wastes. Commentors asserted that not enough funding was slated for research and development of technology to deal with tritium, and they also believed the lack of focus and funding for tritium problems reflected an indifference to downstream neighbors. The effect on human health from radioactive isotopes, including tritium, was also a subject of concern in the meeting of the Defense Nuclear Facilities Safety Board in the fall of 1994. Production of tritium was apparently a less important issue during that year, judging from the absence of comments on the subject.

The Columbia River Comprehensive Impact Assessment (CRCIA) team, formed in 1995, called attention to the many problems resulting from weapons production associated with the Columbia River. Comments were expressed that while Hanford contained some of the most contaminated lands, it also contained some of the most pristine. Plutonium (and tritium) production meant secure areas and buffer zones with no agricultural, industrial, or residential development. Other public comments, however, addressed existing and potential contamination to these formerly protected regions. Scoping meetings in connection with an EIS on K-Basins Spent Nuclear Fuel Management produced many expressed concerns about the sludge and liquid waste in the basins. One suggestion was to process the liquid waste by ion exchange separation technology, and to empty it far from the river to allow the tritium to decay. The necessity of such action was supported by a commentor who faulted a DOE contractor for "lackadaisical" research, evidenced by river tritium levels that were much higher than drinking water standards required. Others made a similar suggestion to dilute the tritium-contaminated water to near-natural concentrations before being disposed of in order to avoid any possible cancerous effects. The question of water disposal was of great importance to the tribal nations, whose commentors supported the dry storage concept, or dilution of tritium to natural background concentrations. A recurring comment from representatives of Indian tribes was their desire to get cleanup going so that they could once again use the lands that were ceded to the government.

Tritium production reappeared as a concern at the end of 1995 when it was announced that there would be a hold on dismantling the reactor at the Fast Flux Test Facility (FFTF). There was a possibility of radioactive isotopes, including tritium, being produced for medical use by a private consortium at the plant. In the next few years, there were hundreds of concerns about tritium associated with the restart of the FFTF. During 1996 the question of whether or not Hanford would be selected for tritium production dominated public commentary, and even those documented concerns about waste were in relation to operation of the facility. Public comments in favor of restart/tritium production outnumbered those in opposition 67% to 23%. Comments that reflected a neutral, willing-to-listen attitude comprised 10%. Of those in favor of tritium production, most did so for job and/or economic reasons. Mention was made in several comments of an estimated 1000 new jobs resulting from production. Among those comments opposing production, 35% expressed distrust of the stated reasons for restart, asserting that isotope production was just a charade to allow production of nuclear weapons materials. Other objections concerned the creation of more nuclear waste, the diversion of public's concerns on contamination issues, and the misuse of cleanup funds to finance additional production.

In 1997 Hanford and other sites were in the running for tritium production, and concerns about the FFTF restart continued to dominate public commentary. However, the percentage of expressed

opposition rose slightly from 37% to 40%. Many of the commentators argued that there was not a big enough demand for more medical isotopes to make the FFTF economically viable. Others believed that as the Cold War fades into history, there is no longer a reason for Hanford to be in the bomb making business, even as an interim facility, until the isotope demand is higher. Another argued the FFTF might "blow up like a bomb" if its aging reactor core was reconfigured. The disclosure by DOE that radioactive tritium had leaked from a reactor at Brookhaven Lab in New York and had found its way into drinking water prompted concerns that a similar situation could develop at Hanford. Further objections developed from the belief that cleanup funds would be sacrificed either for production or for keeping the plant on standby status.

The percentage of comments in favor of production declined to 51% in 1997. Proponents of FFTF restart/tritium production repeatedly pointed to the humane aspects of fighting cancer with isotopes made at Hanford (90% of US medical isotopes are produced in Canada). Also, the creation of new jobs to counteract transitional work force decreases was repeatedly mentioned as greatly benefiting the economy of the area. Others favoring tritium production noted that it was something that Hanford had "done well for 40 years," and stated that the reactor was one of the most modern and safe in the world.

In 1998 there were fewer comments for or against FFTF tritium production, especially after a report in June stated that Hanford could not meet the tritium requirement. Prior to that report, cumulative figures were 72% for, and 28% against, tritium production. Employment and economic concerns were the primary reasons for support of FFTF restart, while concerns about nuclear weapons, waste production, and cleanup funding dominated those in opposition.

The debate over the FFTF plant did not end, however, since discussion shifted to the possibility of producing plutonium-238 for space batteries. Concerns were once again voiced over the difficulty of high-level nuclear waste disposal. The announcement that the reactor would remain on stand-by status while options were being explored prompted concerns that funding that should be going to cleanup was being diverted to maintain the reactor.

Many other comments about tritium were expressed following a melting test of obsolete nuclear bomb components. Commentors were concerned about the level of tritium that goes into the atmosphere and about furnace monitors being turned off during tests conducted on April 14-17, 1998. Officials stated that public's health was not threatened, but the Department of Health wanted Hanford to make sure that hazardous emissions were not overlooked.

The publication of a report prepared for the Columbia River Comprehensive Impact Assessment (CRCIA) initiative (DOE 1998) focused attention on the area water resources. The CRCIA report was a subject of study undertaken by the Groundwater/Vadose Zone Integration Project, established in 1997. The stated mission of the project was "to develop and conduct defensible assessments of the Hanford site's present and post-closure cumulative effects of radioactive and chemical materials that have accumulated throughout Hanford's history." Tritium movement was a part of the project, although most public concerns about the groundwater/vadose zone did not specifically refer to tritium contamination.

Concerns about groundwater/vadose zone continued into 1999, when the restart of the FFTF once again emerged as a salient issue. In February and March, commentators were concerned that cleanup funds were being diverted to maintain the standby status, and argued that the TPA required DOE to shut down the reactor. In August of 1999, Secretary Bill Richardson announced that a scoping study from the past spring "determined that a range of research and development activities would best be served by restarting the FFTF." However, any concerns voiced about the restart only mentioned tritium in the context of plant history or production capabilities.

On September 2, 1999, DOE announced increased tritium levels in shoreline vegetation and in groundwater monitoring wells south of the 300 Area and in three monitoring wells in northern Richland. The presence of increased tritium in the environment was again confirmed in tests of well samples taken from north of Richland, as reported in a Jan 2000 local news article. The finding has stepped up efforts by DOE to monitor groundwater more frequently. These news events unexpectedly had not generated the public commentary that accompanied other negative news events in the past.

## CONCLUSION

Concerns expressed by commentators who apparently placed national security above all others reflected their fears that the US nuclear arsenal's supply of tritium would not be adequate to meet future demands unless production continued. Others who endorsed tritium production were concerned about the economic condition of the Tri-Cities area and the reductions in the Hanford workforce. The debate that ensued over the shutdown or restart of the FFTF reflected a desire by most residents to keep the area economy healthy. A predominance of comments in favor of restart showed a concern by many residents for their job security.

Objections to tritium production were generally based on three main concerns: (1) the question of need in light of the disintegration of the former Soviet Union; (2) the diversion of cleanup funding to production and maintenance of the plant on standby status; and (3) the threat of additional contamination. Commentors already concerned about existing tritium moving toward the Columbia River argued that any additional tritium contamination would add to the existing problems of soil, groundwater, aquifer, and river contamination threatening human and environmental health. Concerns about tank and K-Basin leakage usually targeted health effects, as did concerns about the possibilities of accidents and explosions.

In general, the number and content of concerns expressed about tritium are related to news events, DOE announcements, and public hearings. Public hearings and forums generated the highest number of comments, demonstrating the usefulness of these public engagement venues.

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