HISTORICAL RESEARCH IN THE HANFORD SITE WASTE CLEANUP

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ABSTRACT

This paper will acquaint the audience with role of historical research in the Hanford Site waste cleanup - the largest waste cleanup endeavor ever undertaken in human history. There were no comparable predecessors to this massive waste remediation effort, but the Hanford historical record can provide a partial road map and guide. It can be, and is, a useful tool in meeting the goal of a successful, cost-effective, safe and technologically exemplary waste cleanup.

The Hanford historical record is rich and complex. Yet, it poses difficult challenges, in that no central and complete repository or data base exists, records contain obscure code words and code numbers, and the measurement systems and terminology used in the records change many times over the years. Still, these records are useful to the current waste cleanup in technical ways, and in ways that extend beyond a strictly scientific aspect. Study and presentations of Hanford Site history contribute to the huge educational and outreach tasks of helping the Site's work force deal with "culture change" and become motivated for the cleanup work that is ahead, and of helping the public and the regulators to place the events at Hanford in the context of WWII and the Cold War.

This paper traces historical waste practices and policies as they changed over the years at the Hanford Site, and acquaints the audience with the generation of the major waste streams of concern in Hanford Site cleanup today. It presents original, primary-source research into the waste history of the Hanford Site. The earliest, 1940s knowledge base, assumptions and calculations about radioactive and chemical discharges, as discussed in the memos, correspondence and reports of the original Hanford Site (then Hanford Engineer Works) builders and operators, are reviewed. The growth of knowledge, research efforts, and subsequent changes in Site waste disposal policies and practices are traced. Examples of the strengths and limitations of the Hanford historical record are included.

INTRODUCTION

Today, the Hanford Site in eastern Washington state is engaged in the largest waste cleanup endeavor ever undertaken in human history! Just as there were no comparable predecessors to the Hanford Engineer Works (HEW - the original name for the Hanford Site), there are no predecessors or guides for this massive waste remediation effort. Site employees are learning as they go, constantly striving to streamline the cleanup, and to use dollars, manpower, equipment, and time as efficiently as possible.

The Columbia Basin is home to the Hanford Site. It is a northern desert - stark, and lovely for that very characteristic. Among the 15,000 Hanford employees, there is a great desire to understand Site history, and to own whatever problems and challenges are attached to the vast installation. They also want to maintain the Hanford Site as a place that sets precedents in technological development.

HANFORD SITE HISTORICAL RECORDS

For all of these reasons, the study of history is an important part of the Hanford Site waste cleanup. The science of environmental monitoring was pioneered at the Hanford Site. The environmental survey records generated there in the 1940s and 1950s are the most complete in the world, from any governmental agency or private entity of that era. At the time that HEW (and later the Hanford Works - HW) was discharging the bulk of the wastes that must be dealt with today, it was common practice for cities, industries and research facilities to send their wastes up stacks for dispersion in the atmosphere, or into rivers, lakes, oceans, trenches and sewers for percolation into the ground and/or groundwater. In most cases, such wastes were released without being measured. The Hanford Site was unique for developing special instrumentation, as well as a staff and budget that encompassed four percent of the Site's total resources by 1950, to measure and evaluate its wastes.

In the process, a rich and complex body of technological historical records was developed. These records are useful to the current waste cleanup in technical ways, and in ways that extend beyond a strictly scientific aspect. Study and presentations of Hanford Site history contribute to the huge educational and outreach task of helping the Site's work force deal with "culture change" and become motivated for the cleanup work that is ahead, and that of helping the public and the regulators to place the events at Hanford over the years in the context of WWII and the Cold War. Looking back at Hanford's history with the values and priorities of today, may highlight only the mistakes or the events that produced waste releases to the environment.

THE IMPORTANCE OF HANFORD SITE HISTORY

Hanford Site history is just being discovered after over 40 years of secrecy. Sometimes these discoveries are painful. This is true because the history and heritage of the Hanford Site include the largest collection of nuclear waste in the world, outside of the former Soviet Union. It has been difficult for the local community, and for the nation, to deal with this aspect of Hanford's past. However, it is very important to examine and discuss this facet, and all facets, of Hanford's history. Such discussions help to define a new identity for the Site - the Hanford beyond *the Cold War.*

At the Hanford Site today, the words history and identity may be interchangeable. Today's waste cleanup mission is entwined with the former defense production mission. It is a completion of that mission to clean up the tools and the

wastes. The Hanford Site today is living with its history in the most constructive way possible: turning waste into an opportunity and becoming a worldwide leader in waste remediation technology. Thus, the Hanford historical record provides much raw material for open, democratic discourse about American history, goals, and national identity.

WORLD WAR II PERIOD AT THE HANFORD SITE

This paper will present some of the understandings that have been gained from the study of Hanford Site history. HEW (known in secret wartime codes as Site W) was begun by the Manhattan District of the Army Corps of Engineers (MED) and the DuPont Corporation in March 1943. The original mission was to produce plutonium for the world's first atomic weapons, and that mission did succeed. The Trinity bomb test held at Alamogordo, New Mexico, on July 16, 1945 was the world's first atomic explosion, and the material in that device came from the Hanford Engineer Works. The material in the world's second atomic detonation, the bomb that was dropped over Hiroshima, Japan, came from the Clinton Engineer Works (now known as the Oak Ridge Site). However, the material in the bomb dropped on Nagasaki, Japan, came from HEW, and it achieved victory in the costliest war in world history just five days after it was detonated. Whether one approves or disapproves of the use of atomic weapons, it is clear that the HEW mission, as defined at its time in history, did succeed.

During wartime at HEW, construction was large and fast. In just 30 months, over 500 permanent structures and 1,000 temporary construction (TC) structures were built. In addition, prewar Richland expanded from a village of 400 people to a government city capable of housing 17,500 people. All of this was done at a cost of only $230 million. Among the most prominent structures built at HEW were B, D, and F Reactors, the first three large-scale plutonium production reactors in the world. Today, B Reactor, the first, has been nominated by the U.S. Department of Energy (DOE) to the National Register of Historic Places.

Also constructed at wartime HEW were three huge chemical separations facilities - T, B, and U Plants, and their ancillary structures. Fuel fabrication facilities and "process improvement" (research and development) facilities were also built, as were 64 single-shell, underground tanks for the storage of high-level wastes. Historical research into the original construction methods and materials, the technical workings of processes long forgotten, and into the innovations attempted in the early years at HEW, has added to the ability to locate and characterize the wastes produced by these 1940s facilities.

FIRST POSTWAR EXPANSION

After WWII ended, a two-year production lull ensued. During that period, the General Electric Company (GE) became prime contractor at Hanford, and the Atomic Energy Commission (AEC) took over from the MED on January 1, 1947. Immediately, the AEC changed the name to Hanford Works, signifying the institution of civilian control. Later that year, the AEC began at HW the largest peacetime construction project in American history. Richland was expanded to house 23,000 people, and a construction-worker enclave of barracks and trailers was erected nearby. Within one year, this prefabricated "town" was bigger than Richland itself: it housed 25,000 people. The production plant expansion itself included the building of two more reactors (H and DR), the Plutonium Finishing Plant (PFP) for the fabrication of plutonium metal, C Plant for radiochemical trials to develop the new REDOX (reduction-oxidation) separations process, and 42 additional high-level waste storage tanks. Again, historical investigations into the building codes of those years, the subcontractors used, the technical aspects of the old processes, as well as the working assumptions and unknowns of that era have helped point the way to waste locations, quantities, and components.

SECOND POSTWAR EXPANSION

When the huge expansion that began in 1947 was nearly complete in mid-1949, a second expansion swept over HW and Richland. Caused most directly by the explosion of the Soviet Union's first atomic bomb in September 1949, this second HW growth spurt also was fueled by the victory of Communist forces in China, the signing of the Sino-Soviet mutual assistance pact, the outbreak of the Korean War in 1950, and by some of the most famous spy cases in U.S. history. During the eight months that followed the first Soviet atomic detonation, the cases of Alger Hiss, Julius and Ethel Rosenberg, Klaus Fuchs, and others achieved either prominence or resolution.

The second postwar expansion at HW became part of the largest two-year period of expansion ever undertaken in U.S. nuclear history. Between 1950-52, the Nevada Test Site was sited and began testing atomic weapons; the Pacific Proving Ground was refurbished and enlarged; and the following sites in today's DOE complex were constructed: Idaho National Engineering Laboratory (originally called the Reactor Testing Station), Savannah River Site, Rocky Flats Site, the Pantex Plant, the Fernald Feed Materials Plant, the Paducah Gaseous Diffusion Plant, and Sandia Laboratory (as separate from Los Alamos National Laboratory).

At Hanford Works, the 1950-52 expansion encompassed the building of REDOX, C Reactor, seven large and complex research laboratories, 18 additional underground storage tanks, and two evaporators to condense high-level waste volumes. Also, the Uranium Oxide Plant was constructed out of a WWII building to calcine the uranium product stream (uranyl nitrate hexahydrate - UNH) from REDOX and turn it into UO3 powder for use in Paducah Gaseous Diffusion Plant. And, the wartime U Plant was converted into the Metal Recovery Plant. This operation sluice-mined high-level wastes out of some underground tanks in order to chemically reclaim the uranium that was in such short supply. However, the recovery process itself generated unexpected amounts of "new" high-level waste, mixed with additional chemicals. The wastes from this process are among the most challenging ones in the Hanford Site cleanup. Historical research into the recovery process itself, its complications, and the various solutions that were tried in the 1950s has added to the ability of waste cleanup engineers to propose sampling and remediation methods.

THIRD POSTWAR EXPANSION

No sooner was the second postwar expansion ending in 1952, when Hanford Works was plunged into a third such expansion. Known as the Eisenhower Expansion, this 1953-55 spurt was caused by the incoming President's "New Look" in armaments. He believed that the rapidly growing defense

budget must be curbed by building fewer conventional weapons and more cost-effective atomic weapons. At nearly the same time, the explosion of the first Soviet hydrogen bomb, the passage of the Atomic Energy Act of 1954, and the beginnings of the U.S. intercontinental ballistic missile program added impetus to the national need for more special nuclear materials.

At Hanford Works, the Eisenhower Expansion resulted in the construction of KE and KW "jumbo" reactors, the PUREX (plutonium-reduction extraction) plant, a scrap recovery plant known as RECUPLEX, and 21 additional underground tanks. Today, all of these facilities are present or potential cleanup sites. Once again, historical research helps to unravel the old chemical methods used, the atomic processes of those years, the drain and piping systems, and the working procedures.

In assessing the first 12 years of Hanford Site history, which encompassed the hectic WWII construction and then three massive and rapid postwar expansions, one historical fact becomes very clear. During those first 12 years, the Hanford Site almost never experienced a time of "normality," a time not filled with tremendous change. There were no convenient, nor perhaps even possible, times in which to assess problem areas such as waste management. In looking back to evaluate what was done and what was not done, this extremely rapid sequence of change must be considered. Again, the context of the 1940s and 1950s is important.

MAJOR PRODUCTION PERIOD AT THE HANFORD SITE

The Hanford Site's period of peak production, 1956-64, was a time of record-high plutonium manufacture, carried out in response to national Cold War decisions. The militant posturing of Nikita Khrushchev and the inspiring response of President John Kennedy that he would "get America moving again" are both part of a historical era that generated large amounts of nuclear waste in both the U.S.S.R. and the United States. When Kennedy pledged that the United States would "bear any burden" and "pay any price" in defense of its national objectives, few, if any, at that time realized that part of that price would be the nuclear waste legacy now remaining in both countries.

At the Hanford Site, these peak years witnessed the construction of N Reactor, a larger scrap recovery plant called the Plutonium Reclamation Facility (PRF - to replace RECUPLEX), plutonium fuels experimental plants known as the Plutonium Fuels Pilot Plant (PFPP) and the Plutonium Recycle Test Reactor (PRTR), and the Site's last four single-shell, underground tanks. During these years, power and fuel exposure levels also were increased at the eight older reactors, bringing them to operating power levels nearly 10 times those of WWII.

PRODUCTION PHASE-DOWNS

Finally, these reactors all closed between 1964-71, but the N Reactor continued to operate until 1987. Throughout the 1960s and onward, many chemical separations missions also were carried out at Hanford, and 28 double-shell, underground tanks for the storage of high-level wastes were constructed.

WASTE DISCHARGES AND INFORMATION RELEASES

Throughout the years of peak production and onward, voluminous and complex wastes were discharged from various Hanford Site facilities. Sometimes, inadequate technology combined with the urgency of the production mission to allow some of these wastes to reach the environment.

However, in a series of large historical document releases beginning in 1986, the Hanford Site commenced more thorough disclosures about its history than any defense nuclear facility in the world. To date, nearly 90,000 pages of Hanford Historical Documents have been totally cleared and made available to any and all members of the public that care to come and read them. Through these documents, Washington state, the U.S. Environmental Protection Agency (EPA), the General Accounting Office, many other agencies, and the public have learned of the scope of Hanford's waste discharges. There has been, and to some extent continues to be, elements of shock and disbelief at the volumes and complexities of the wastes left behind by the Site's defense production.

Therefore, it has become an important task of the Hanford Site to study the historical record in order to understand and interpret what has taken place. This record is scattered and difficult to decipher even as, piece by piece, it is located. Yet, through the historic Tri-Party Agreement, signed in May 1989, Washington state and the EPA expect to participate in waste cleanup decisions, and they expect clear and concise synopses of events that transpired in the past.

HANFORD SITE PRODUCTION AND WASTE CLEANUP IN HISTORICAL PERSPECTIVE

Historical perspective is useful to an understanding of the Hanford Site's past. The world has just witnessed the end, or at least a vast scaling down, of the Cold War. Nearly everyone in the world seems to rejoice in this fact. However, it is important to recall that the Cold War was not fought on the battlefield; it was fought and won in places like Hanford, Washington (and other DOE sites). Without the vast defense production of these sites, the course of world history today might be far different.

In conclusion, today's waste cleanup at the Hanford Site allows the vast desert complex to take the national lead in environmental restoration, historic preservation, and the preservation of democracy through open disclosure. Further, it gives the Site pride in technical and engineering expertise, and it gives the surrounding region a strong economy. The Hanford Site today is experiencing historic events: it is still making history.