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Air Pollution Prevention at the Hanford Site: Status and Recommendations

Prepared for the U.S. Department of Energy
Office of Environmental Management

Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
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ABSTRACT

In the past, the focus of pollution prevention/waste minimization at the Hanford Sire was on the reduction of solid and liquid wastes, as well as reduction of hazardous material usage. Now, the focus is becoming more multi-media, including air emissions and resource conservation, in addition to the traditional waste minimization. With the introduction of the Clean Air Act Amendments of 1990 and other air and pollution prevention regulations, there has been increased focus on both pollution prevention and air emissions at U.S. Department of Energy Sites. The Pollution Prevention (P2) Group of Westinghouse Hanford Company reviewed the status of air pollution prevention with the goal of making recommendations on how to address air emissions at Hanford through pollution prevention. Using the air emissions inventory from Hanford's Title V permit, the P2 Group was able to identify major and significant air sources. By reviewing the literature and benchmarking two other DOE Sites, two major activities were recommended to reduce air pollution and reduce costs at the Hanford Site. First, a pollution prevention opportunity assessment (P2OA) should be conducted on the significant painting sources in the Maintenance group and credit should be taken for reducing the burning of tumbleweeds, another significant source of air pollution. Since they are significant sources, reducing these emissions will reduce air emission fees, as well as have the potential to reduce material and labor costs, and increase worker safety. Second, a P2OA should be conducted on alternatives to the three coal-fired powerhouses (steam plants) on-site, including a significant costs analysis of alternatives. This analysis could be of significant value to other DOE sites. Overall, these two activities would reduce pollution, ease regulatory requirements and fees, save money, and help Hanford take a leadership role in air pollution prevention.

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INTRODUCTION & PURPOSE

Pollution prevention has made significant progress at the Hanford Site through the reduction of solid containerized and liquid wastes, as well as minimizing the use of chemicals. Additionally, radiological air releases have been closely monitored and controlled at the "end of the pipe." However, without a significant driver (regulatory, DOE Order, cost, public opinion), air emissions at the Hanford Site have not been subject to distinct pollution prevention actions.

With the implementation of the 1990 Clean Air Act Amendments and associated regulations, air emissions have come under closer scrutiny in the last five years. Additionally, recent pollution prevention regulations and letters have notably included air as one of the media to be subject to pollution prevention efforts.[1]

Thus, the pollution prevention (P2) group at the Westinghouse Hanford Company (WHC) proposed to review the status of air emissions and air pollution prevention at Hanford, obtaining funding through the Department of Energy Waste Minimization Division (EM-334) to complete this review. This document discusses air regulations and orders, as well as applicable P2 drivers that discuss air pollution. Also, a short review of the status of Hanford and other DOE Site's air pollution prevention activities is summarized. Based on this background information, a variety of air P2 options are discussed, including pollution prevention opportunity assessments (P2OAs), cost analysis/ savings, and leadership potential. The paper concludes with recommendations for how to address air pollution prevention at Hanford in the future.

APPLICABLE REGULATIONS & ORDERS

Clean Air Act and Other Air Regulations

Air pollution was first regulated in 1955, but regulations were not strongly enforced until the late 1960s. The Clean Air Act of 1970 put in place the air regulations and the authorities that form the framework of air pollution control and prevention today.[2] The Clean Air Act Amendments of 1990 (CAAA) revamped the Clean Air Act (CAA), greatly increasing air control requirements, permitting, and the scope of air regulations.

Until recently, these regulations were only applicable to industrial sites. Now, they are expanding to the retail level as well as to government-owned sites

such as Hanford. The CAAA is the largest and most comprehensive regulation on air emissions and some consider it the largest and most costly of all environmental regulations, surpassing RCRA, CERCLA and others.[3] The individual states manage the CAAA by submitting a State Implementation Plan to the Environmental Protection Agency (EPA). The CAAA implementing regulations are 40 CFR Part 70 (EPA) and WAC-173-401 (Washington State).

There are three kinds of air pollutant emissions: criteria, hazardous, and radioactive. The federal Clean Air Acts primarily regulates criteria and hazardous air pollutants, although Washington State included radioactive emission requirements in its plan. Criteria pollutants include:

PM10: Solid particulates less than 10 microns in diameter, which are small enough to be inhaled by humans.
SO_2: Sulfur dioxide, a contributor to acid rain.
NO_X: Nitrogen oxide compounds, a contributor to acid rain and smog
VOCs: Volatile organic compounds, which react with sunlight to form ground level ozone, the primary component of smog.
CO: Carbon monoxide
Pb: Lead

Hazardous air pollutants (HAPs) currently include a list of 189 specific toxic compounds and were regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAPS) program.

Radioactive emissions are regulated under NESHAPS and DOE Order 5400.5.[4] In Washington state, they also were included in the CAAA requirements. DOE Order 5400.1 states "Airborne radiation and radioactive materials discharged from DOE facilities shall comply with the requirements of 40 CFR Part 61, 'National Emission Standards for Hazardous Air Pollutants [NESHAPS].' Further, for those radioactive materials not regulated under the Clean Air Act, DOE has established standards to meet its responsibilities under the Atomic Energy Act." Thus, radioactive air emissions are regulated more stringently by the DOE than by EPA.

The Clean Air Act contains six chapters or titles. Title I imposes compliance regulations, sets emission standards, expands research and defines regions.[3] Title II sets standards for mobile sources. Title III identifies the 189 HAPs, lists compliance methods, and discusses litigation. Title IV discusses acid rain regulations (SO_2 and NO_X). Title V sets permit requirements. Title VI regulates stratospheric ozone.

Of particular importance is Title V. Title V requires, as part of a facility or site's air permit application, a complete inventory of all air emissions. One article called this a "herculean effort" for most applicants.[5] The air sources are then categorized as major or minor sources. This designation is determined by potential to emit, not actual emissions. A major source is one that has the potential to emit any of the following:

- 10 or more tons per year of any single HAP, or 25 or more tons per year of any combination of HAPs
- 100 or more tons per year of any criteria pollutant
- 0.1 or more millirem per year radioactive emissions.

Only major sources are regulated after the permit is complete but fees are determined on actual emissions, rather than potential emissions. A major source that has actual emissions over the above limits is called "significant" or "non-insignificant."

There are currently no strong regulatory drivers of air pollution control from city and regional air regulatory offices at the Hanford Site.

Air Pollution Prevention in Regulations and Orders

The 1990 Clean Air Act Amendments discusses pollution prevention, a major addition from previous versions of the CAAA. One of the primary goals stated in the CAAA is to encourage pollution prevention through federal, state and local regulations. Title I and Title III suggest best available control technologies and major compliance paths that are pollution prevention methods and many of which are already encouraged by state and federal agencies. Three compliance paths in Title III with control methods which are applicable to a pollution prevention program are:

- Pollution prevention—Process modifications, product substitution, chemical reformulation, repackaging;
- Operations and maintenance—Prevention of fugitive emissions from leaks, reduction of VOC evaporation, better housekeeping, proper storage;
- Pollution collection and treatment—End-of-pipe control technologies.[6, 7]

These three methods coincide closely with the EPA's pollution prevention hierarchy of source reduction, recycling, and treatment.[7] In addition to Title III, pollution prevention is included in Title II which mandates alternative fuels for automotive fleets, reformulated gasoline and other mobile emission source reduction.[8] Also, Title VI phases out the production of chlorofluorcarbons and other stratospheric ozone depleters.[8]

Even Title V, which regulates permits, contains a feature that will significantly promote pollution prevention. Title V's requirement of a air emissions inventory and designation of major/significant sources is the first step in beginning pollution prevention opportunity assessments, namely listing and prioritizing waste streams.[9] One source stated it clearly, "Despite the challenges it poses, Title V offers operators a unique opportunity to find new ways to optimize process control and pollution prevention at their plants."[5]

Other regulations and orders which mention air pollution prevention include the Pollution Prevention Act of 1990.[10] This act encourages and mandates the EPA and the states to promote source reduction then recycling as the primary methods to reduce pollution. It specifically defines source reduction as "any practice which... reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream, or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal."[10]

Executive Order 12843 enacts Title VI of the CAA for the federal government by calling for the phase out of the use of CFCs and other ozone depleters.[1] Executive Order 12844 enacts Title II for federal agencies by setting requirements for the availability, acquisition and use of alternatively fueled vehicles in federal fleets.[1]

DOE Order 5400.1 regulates all radioactive wastes, including air emissions, and demands a pollution prevention program to minimize radioactive wastes.

AIR POLLUTION PREVENTION STATUS

Others Site's Activities

In order to make better recommendations about air P2 at the Hanford Site, several other DOE Sites were contacted to determine their level of effort and activities concerning air pollution at their sites. The DOE sites discussed in this section are the Kansas City Plant and the Oak Ridge Site. Kansas City and Oak Ridge were chosen since they reported air P2 successes in their Annual Report.[11] No other Sites reported or have advertised significant efforts in air pollution prevention.

The Kansas City Plant (KCP) exists in a residential area in Kansas City, Missouri, thus is subject to strict local and state air regulations on their hazardous emissions (they do not have radioactive air releases). KCP was required to complete an emissions inventory for the City of Kansas City, prior to CAA requirements.[12] The results of this inventory, which is kept updated, are published in the newspaper with other heavy polluters in the City.[12] Also, they have a "Tri-Party" agreement which mandated reductions of HAPs and elimination of CFCs and other ozone depleters. With these drivers, KCP encouraged air reductions through their pollution prevention opportunity assessment (P2OA) process. With P2OAs, they eliminated CFC and ozone-depleter use through procurement control.[12] Also, they achieved significant reduction of SO_2 emissions from boilers through use of natural gas and the conversion to a cleaner burning fuel oil as the backup fuel.[13] In the solvent area, KCP has eliminated toluene and methylene chloride use in their manufacturing process through the use of a furnace for drying, have significantly reduced high-VOC paint use, and placed emission control units on their paints shops and chromium plating operations.[13] They have eliminated all organic and vapor degreasers, instead using soap and water or ultrasonic methods.[13] They also have a program to share their solvent reduction information with small businesses, including parts manufacturers and dry cleaners.[13] However, the only cost savings they document are material purchase reductions, even though regulatory risk reductions would be significant, they are difficult to quantify.

The Oak Ridge Site is located near Knoxville, Tennessee, in what the EPA calls a "marginal" non-attainment area. Because of this status, the state of Tennessee has required them to address their air emissions, particularly from their steam plants, through fees and regulations. Their coal-fueled steam plants were some of their largest emission sources of particulate matter, SO_2, CO, NO_X, and organics. Between 1984 and the present, they put in two new natural gas fired boilers, converted one of their coal fired boilers to natural gas, and closed four older boilers. During that time period they nearly eliminated SO_2 emissions, reduced particulates, organics and NO_X by 90-95%, and halved their CO emissions from their steam plant operations.[14] This significantly reduced fees and "Notices of Violation" fines for violating opacity (visual smoke) regulations.[14] Unfortunately, no return on investment analysis was done to determine the effectiveness and costs of the

steam plant conversions; the regulatory pressures were sufficient.[15] In addition to their steam plants, their Clean Air Task Force, while conducting mostly compliance work, has worked with the Pollution Prevention Task Team to eliminate ozone-depleting substances and the use of solvents in degreasing operations.[16] One of their plants, K-25, has also conducted Level I P2OAs (identification) on their air emissions using their CAA inventory, but have not pursued air P2OAs or costs savings analysis any further.[17]

Hanford Status on Clean Air Act

The Hanford Site was required to complete a CAA Title V Permit application. Based on state requirements, this permit was due to the Washington Department of Ecology on June 7, 1995. The Air & Water Permitting Group of WHC who was responsible for completing this permit met this deadline on-schedule.

In order to complete this permit, a Site air emissions inventory was completed. This was a difficult task due to the size and number of emission points across the Site and the fact that prior regulations had not demanded such extensive characterization, especially of hazardous emissions. Completion of the inventory revealed that Hanford has over 350 minor/insignificant hazardous emission units, including paint shops, degreasers, laboratories, storage tanks, and fugitive sources. There are also over 600 diffuse and fugitive radioactive sources. The sources of most concern to the permit are the major and significant sources:

- 24 major radioactive sources (located at B-Plant, PUREX, TWRS, PFP, 340NTEX, 324 Lab, 325 Lab, 327, 3720)
- 3 power houses (steam plants): 284E in 200E, 284W in 200W, and 384 in 300 Area, which exceed CO, NO_X, SO_2 limits
- 6 maintenance sources: 4 paint shops emitting methyl ethyl ketone and toluene, and 2 burn pits for russian thistle emitting carbon monoxide.

This information and further details on these sources is contained in the draft Hanford Title V permit,[18] as well as materials handed out in review meetings (see Appendix). These should be reconfirmed in June 1995 when the permit application is final.

In other areas of the CAA, the Hanford Site has greatly reduced its use of CFCs and has complied with the mandate for alternatively fueled fleet vehicles through methanol-gasoline flex-fuel government cars.

Hanford Status on Air Pollution Prevention

Currently, the Hanford Site is in compliance with all pollution prevention regulations. P2OAs serve as the primary mechanism to identify and prioritize waste generating activities and reduce the waste they generate. The documentation completed during a P2OA mentions and includes air as a waste stream. However, before this report, no significant effort had been made to identify and address specific air pollution sources from a P2 perspective. While air emissions reduced are sometimes documented, they are usually only a part of a P2OA that is focused more on the reduction of solid/liquid waste or chemical usage.

Two reasons for this exist. First, since the Hanford Site is located in a rural, non-urban area that generally has good air quality and few industries, the state and local regulations have been minimal. Thus, unlike Kansas City and Oak Ridge, there has been no regulatory pressure to address the hazardous air sources or the power houses as a significant source of pollution. Second, without significant "disposal" costs or enforced control technologies, there is little financial incentive to reduce air emissions. The DOE has not addressed the costs savings associated with reducing air emissions as it has done with liquid and solid wastes.

RECOMMENDATIONS FOR AIR POLLUTION PREVENTION AT HANFORD

Pollution Prevention Opportunity Assessments

The most efficient way to address air pollution would be to use the existing P2OA methodology on site. Air emissions are mentioned throughout the P2OA instructions and as a possible waste stream in the P2OA materials, so no additions would need to be made.

The air inventory conducted during the Title V permitting process has completed the identification and prioritization process for air emissions on Site. By conducting P2OAs and reducing air emissions on the significant sources, then cost savings can be realized through reduction of fees and regulatory paperwork, in addition to the usual material and labor savings. If these are done soon enough, fines may not be assessed at all as the permit will take up to 2 years for approval by Ecology. Secondary to that, P2OAs on major but not significant sources, could reduce regulatory tracking and paperwork, but not fees.

The easiest emissions to address would be the criteria/HAP sources, since they directly apply to solid and liquid P2OAs already in progress. Preliminary data was collected to determine the need for these P2OAs. First, a simple P2OA should be conducted on the painting shops that produce MEK and toluene. Substitutes for the two solvents should be easy, since that has occurred at other paint shops across the Site. This area has the potential for significant cost savings in material usage and employee hours, as well as increases in worker safety. Since this is a maintenance source, it should most likely be conducted through ICF Kaiser Hanford's P2 team and the points of contact for the emission sources listed in the draft permit.[18] The second source, the burn pits for russian thistle or tumbleweeds, does not require a P2OA, since an alternative to burning is already being implemented. Due to increasing local restrictions on open burning, a mulcher was purchased to grind the thistles which are then placed in a pit.

Next, a P2OA should be conducted to address different solutions to the powerhouses. This can be done through a current WHC P2 effort to review Site-wide and large projects P2OAs. Initial contact with plant engineers at the powerhouses indicates that, while multiple solutions have been posed, there has been no single study on the best way to provide steam to the Site. Many of the proposed solutions may create significant air emission as well as other wastes. The Title V team felt that without the powerhouses, the Hanford Title V application would have only had to address the radiological sources and thus would have been

much simpler and cheaper to the Site. Changes to the powerhouses could result in significant cost savings to the Site in a wide variety of areas.

It is recommended that the radiological sources and the insignificant sources not be addressed separately at this time. The radiological sources have been tracked previously and would be difficult to reduce, since they ventilate highly radioactive areas that cannot be modified easily. Information about major, but insignificant, sources should be given to the appropriate facilities, so that they can consider at their own discretion since cost savings would be minimal without regulatory fees. These sources include 100N and several maintenance sources.[18] Minor sources should not be considered at all.

Cost Analysis

A study on the costs of air emissions on Site would be an interesting and potentially useful project, but not recommended at this time. During the literature search for this paper, there was little information found on this topic beyond large societal costs or simple material savings. However, this kind of life cycle costing and analysis is beyond the current resources of WHC P2 and not of primary importance to the Hanford Site. While a separate project is not recommended, cost savings conducted on individual air P2OAs may eventually be compiled into a report, if they reveal useful and innovative costs analysis techniques.

Opportunity for Leadership

With the exception of Kansas City's hazardous reductions and the Oak Ridge's power plant efforts, other Sites have either not addressed air pollution prevention or have not reported their successes (besides CFC reduction). Conducting the recommended P2OAs would allow Hanford to branch into a new area. An in-depth P2OA of the powerhouses, including costs analysis, could be of significant benefit to other Sites with similar plants.

CONCLUSION

Overall, this review reveals that air emissions are important at the Hanford Site, in terms of regulatory requirements and significant releases to the environment. Two major pollution prevention activities should be conducted:

- Pollution Prevention Opportunity Assessment should be conducted through the P2 facility contacts on the significant painting/solvent sources in the Maintenance area.
- A major P2OA should be conducted on alternatives to the Powerhouses, including a significant costs analysis of alternatives. This could be of significant value to other DOE sites.

These two activities would reduce pollution, ease regulatory requirements and fees, save money, and help Hanford take a leadership role in air pollution prevention.

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