

THE ENVIRONMENTAL LEADERSHIP PROGRAM : PUGET SOUND NAVAL SHIPYARD RESEARCH & DEVELOPMENT OF ALTERNATIVE P POLYCHLORINATED BI-PHENYLS DISPOSAL PROCESS UNDER 40 CFR 761.60(e).

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INTRODUCTION

This paper will discuss the process that was followed by the United States Environmental Protection Agency, Region 10, (EPA) and the Puget Sound Naval Shipyard (PSNS) under the Environmental Leadership Program (ELP) Initiative in conducting PCB Research and Development. The three steps involved in this process were common agreement, regulatory approval, and test and validation.

In 1996 the Puget Sound Naval Shipyard (PSNS) submitted a Research & Development (R&D) Application to the United States Environmental Protection Agency, Region 10 to conduct Engineering Bench Scale Testing of Polychlorinated Biphenyls (PCBs). The testing was conducted at the PSNS on the destruction of PCB-contaminated material using a tube furnace. The purpose of the bench scale test was to demonstrate the destruction of PCBs under an alternative PCB disposal method process. The submittal was made under 40 CFR 761.60(e) which allows the EPA the authority to approve R&D for alternative PCB disposal process.

THE PROCESS

The Environmental Leadership Program (ELP) is the opportunity for partnering with environmental regulatory agencies to pursue the benefits realized in an innovative pollution prevention measure. The partnership became a process for exploring, testing and validating new pollution prevention measures.

Step One, A Common Agreement

The first step in this process was a common agreement between EPA, the Washington Department of Ecology and Puget Sound Naval Shipyard to establish the objectives, protocol and administrative controls necessary to pursue the testing and validation of the Shipyard's PCB proposal. In June of 1995, a Memorandum of Agreement was signed between the EPA, Washington State and the Shipyard establishing a cooperative effort to pursue the PCB proposal. This agreement not only marked a beginning for the Shipyard's ELP but became the "blue print" for future proposals that could be pursued through other Federal and State environmental initiatives.

The approval strategy adopted under the ELP for PSNS was to jointly develop the R&D Application, provide informal feedback, to provide a draft R&D Approval leading to a final R&D Approval. The EPA R&D Application review was a technical review process which

encouraged continued "open dialogue" between both EPA and PSNS. The EPA provided technical assistance to PSNS. Technical experts at EPA's Research Triangle Park (RTP), North Carolina provided invaluable guidance on sampling train requirements .

Step Two, Regulatory Approval

The second step involved the Research and Development Permit required to test and validate a part of the ELP proposal which examined the by-products of PCB containing materials which are incinerated. The unanticipated complexity of the Permit application, coupled with the review and approval cycled, delayed the Shipyard's start of testing until late fall of 1996.

This ongoing open dialogue allowed key technical decisions to be made during this period. Technical discussions included the sampling methodology for the PCBs, dioxins, and furans. This expedited EPA's final review process and issuance of the PSNS TSCA R&D Approval on June 20, 1996. EPA Region 10 continued to work with PSNS in resolving additional PCB disposal issues after issuing the R&D Approval.

Step Three, Test and Validation

The third step was the laboratory testing and validation of the proposal. The Shipyard collected and tested 16 samples of foam rubber and 16 samples of paint from six different submarines spanning a twenty year construction period. These samples represented two type of foam rubber and the four types of paints that have been identified as having been originally formulated with PCBs. Each sample was extracted using the EPA method for chemical extraction of PCBs in solids, Organochloride and Polychlorinated Biphenyls by Gas Chromatography, Method 8080.

Preliminary results indicate a difference in the ramped and preheated bench scale test runs. The recovery of PCBs appears to be elevated at the ramped (cold start) bench runs as compared to the heated (at temperature) runs.

Conclusion

The process described is an Environmental Management System which affords regulatory agencies and industry an opportunity to advance the principles of environmental excellence. The jointly developed R&D Permitting approval strategy resulted in open communication between EPA and PSNS, the integration of national expertise within EPA on PCB, dioxin, and furan sampling methodologies, and an invaluable experience in the development of the EPA National ELP Strategy.

Summation

The ELP Pilot Project afforded the Shipyard an opportunity to develop a process which represents an Environmental Management System designed to explore, test and validate innovative pollution prevention measures. This process relies on the common agreement between the regulatory community and industry to advance the principles of environmental excellence. The ELP was a first step away from the regulatory command and control philosophy of the past towards a more creative forum than can affect measurable improvement to the environment. Creativity often requires industry to "step out of the box." Thus, the challenge for all participants is to achieve complete consensus in the objectives and approach initiatives such as the ELP.

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INTRODUCTION

A. Environmental Leadership Program

Working towards the common goal of advancing environmental excellence for the next century, the EPA Administrator, Carol Browner, forged a new partnership with recognized leaders in industry to develop and share innovative approaches to environmental principles. The Environmental Leadership Program (ELP), initiated in April 1995 as part of the Clinton Administration's Reinventing Environmental Regulation," represented a new alliance between government and industry in the advancement of the major principles embodied in environmental excellence. Twelve competitively selected industrial environmental leaders, in partnership with regulatory agencies, embarked on year long pilot projects designed to advance the principles of:

- o Environmental Management Systems
- o Multimedia Compliance Assurance Processes
- o Independent Verification of Compliance Audit Methods
- o Self-Certification
- o Public Accountability
- o Community Involvement
- o Mentoring

This paper profiles the environmental leadership policy embraced by the Puget Sound Naval Shipyard then focuses on the goals, successes and problems realized during its year long Environmental Management Systems pilot project. This paper also includes a discussion of the Environmental Leadership Program as it relates to the Research and Development conducted by the Puget Sound Naval Shipyard under the Toxic Substances Control Act (TSCA) on the alternate destruction for polychlorinated bi-phenyls (PCBs).

B. Puget Sound Naval Shipyard's Proposal

Puget Sound Naval Shipyard, chosen from approximately forty-one (41) other candidates to participate in the program, expanded the precepts to propose a unique pilot project which models the process for partnering with environmental agencies to explore. Test and validate innovative pollution prevention measures which truly benefit the environment yet are prohibited by unintended regulations. The Shipyard's proposal focused on the Toxic Substances Control Act (TSCA) and the regulations relating to Polychlorinated Bi-Phenyls (PCBs).

One of the primary industrial activities at the Shipyard is recycling of premium grade steel used in Naval Submarines. The PCB regulations at the time of the Puget Sound involvement in the ELP program required that paint, insulation, syntactic foam and other solid materials be removed before the steel can be recycled. This is very costly in terms of manpower, management and waste as often steel pieces cannot be cleaned and become destined for TSCA landfills.

Preliminary assessments by the Navy indicated that although PCBs were used in the production of items such as paints, foam, and plastics, the process converts the PCB to an unregulated final chemical product. In pursuing this hypothesis, the Shipyard's ELP proposal focused on the extraction, analysis and disposal for solid materials that were formulated with PCBs as plasticizer. This proposal, unique from among the other twelve (12) expanded the Environmental Management System precepts to invoke a process for exploring, testing and validating innovative pollution prevention measures. If successful, the Shipyard would then be able to recycle 2500 tons of steel annually, which had been disposed of in TSCA landfills, and eliminate up to seven (7) tons of methylene chloride, a solvent used in the chemical extraction and analysis of PCBs, from its annual air emissions. The success of the ELP Pilot Project represented a true advancement in Environmental Management Systems for the future.

II PUGET SOUND NAVAL SHIPYARD

A. Puget Sound Naval Shipyard's Environmental Commitment

Embracing environmental excellence is a guiding principle in corporate leadership at Puget Sound Naval Shipyard. Being the only nuclear submarine and ship recycling facility in the world and home to over 18,000 civilian and military employees, Puget Sound Naval Shipyard has a responsibility and commitment towards preserving the vitality of the region. It is a recognized leader in industry, having received the prestigious:

- o Commander-in-Chiefs Installation Excellence Award, 1991, 1995
- o Secretary of the Navy's Recycling Award, 1995
- o Secretary of the Navy's Environmental Quality Award, 1994
- o Department of Energy's Federal Energy and Water Management Award, 1993, 1994
- o Secretary of the Navy Energy Conservation Award, 1993, 1994

B. The Industrial Complex

Puget Sound Naval Shipyard is a 344 acre industrial and homeport complex. The shipyard's six dry docks, nine piers and 328 buildings are located on the shores of Sinclair Inlet. The Shipyard is well equipped to support most of its own needs. Its Public Works Department operates a Steam Utilities Plant for power and there is a state-of-the-art manufacturing machine shop facility housed within an 11 acre site. The shipyard has many "mini-industries" on site which employ the following trades: forge, foundry, welding, shipfitter, boilermaker, pipefitter, sheetmetal, insulator, woodworker, painter, electroplater, electric and machinist. Employees work within their shops as well as onboard ships, in dry docks and pierside. In addition, the Shipyard operates and maintains a large fleet of vehicles, a railroad system and numerous cranes.

The Shipyard is also full homeport service for a Nuclear Aircraft Carrier and its complementary support Battle Group. To provide these homeport services, the Shipyard complex includes many

houses, new state-of-the-art bachelor dormitories, a large recreational facility and a complete retail center. Additionally, the Shipyard operates its own Police and Fire Departments who not only respond within the complex but also render assistance within the surrounding community. Additionally, the Shipyard operates a complete retail center.

C. The Shipyard Processes

The Shipyard is workplace to approximately 9,000 civilian and 9,000 military employees. The two primary industrial processes performed are the repair/overhaul of Navy vessels and the inactivation/recycling of nuclear submarines and surface vessels.

The job of maintaining and overhauling these vessels involves all trades at the Shipyard, from engineers who design work to the metal workers who actually make the nuts and bolts that are used shipboard.

The process of recycling involves the dismantling of ships, salvaging of the parts that are reusable, preparing of the other parts for recycling and then disposing of the pieces that cannot be reused or recycled. The goal is reuse, as much as possible, commensurate with the generation of a minimum amount of waste. The ELP Pilot Program focused on the methodologies employed in this process as performed under the environmental regulation that was in effect at the time.

D. Environmental Management Systems

Shipyard Environmental Management policy originates within the Department of Environmental Health and Safety. Under the Director, there are two Divisions, one for Health and Safety and another for the Environment. Within the Environmental Division there are three branches:

- o The Waster, Pollution Prevention, Pretreatment and Air Programs Branch
- o The Hazardous Materials, Hazardous Waste, Remediation and Solid Waste Management Programs Branch
- o The Emergency Spill Response and Prevention, Disaster Preparedness and PCB Branch

There is a manager for every program and most programs are staffed with several engineers, scientists or technicians. Each program manager is responsible for generating the instructions which detail how Shipyard work will be performed in order to comply with the environmental regulations and Navy policy. In addition, the program staff generates all permits, plans and reports required by regulation.

Environmental Coordinators are the liaisons between the Shipyard production workers and program staff. These Coordinators are proactively involved with the employees engaged in the principles and instructions of environmental work. Further, through continuous process improvement, these Coordinators become the vital link in developing new pollution prevention initiatives proposed by employees closest to the work.

III. THE PILOT PROJECT

A. Goals and Objectives

The ELP Pilot Project focused on the principle goal of modeling the process for partnering with environmental regulatory agencies to explore, test and validate innovative pollution prevention measures which truly benefit the environment yet are prohibited by unintended regulations. In doing so, the Shipyard achieved three major objectives:

- o Development of an Environmental Management System designed to explore, test and validate innovative pollution prevent measures.
- o Improved working relationships with the regulatory community.
- o A spotlight on the progress the Shipyard has made in advancing the principles of environmental excellence.

B. Project Description

Identifying an Unintended Regulation

Through the ship recycling program, the Shipyard currently spends 10 to 12 million dollars per year analyzing, removing and disposing of plastic insulated cable, foam rubbers and painted ship structures that test above 50 ppm for PCBs. The PCBs were used a plasticizer and heat stabilization additives in the formulation of these materials and, as such, comprised approximately 5% by weight of the original formula. During polymerization, the PCBs are incorporated with other monomer units to form molecules. So, while PCBs were part of the original formulation, they do not exist in the final product. This is evident in that these materials test negative for PCBs using a standard wipe test, even after rigorous chemical extraction, recoveries average less than 1%. It is thought that the only reason that any PCBs are recovered is that the extraction actually dissolves some of the chemical bonds in the polymer chains whereby some PCBs are released. The reason all the PCBs are not recovered is that dissolution of chemical bonds is random and every possible combination of monomers, from full size chains to single units, will exist in an extraction solution. This means that the PCBs that remain bonded, in some way, to other monomer units would be dismissed, correctly, as something else. By analogy, styrene in one of the monomers used to form Styrofoam. Before polymerization, the styrene monomer is highly flammable, poisonous liquid that is classified as a carcinogen. After polymerization, the finished product is inert and is regularly recycled or disposed of in solid waste landfills.

The PCB disposal policy exposes workers and the environment to tons of volatile organic solvents and uses up large amounts of very limited TSCA landfill resources. Changing that policy requires and innovative a pollution prevention measure coupled with a cooperative effort among the regulatory community to implement it.

Developing An Innovative Pollution Prevention Measure

To demonstrate the theory that PCBs are inextricably bound in a polymer matrix, and concurrently, reduce the amount of volatile chemicals used by conventional extraction methods, the Shipyard explored the principle of Supercritical Fluid Extraction (SFE) for PCB analysis.

The SFE method employs the features of supercritical fluid, a substance which exhibits the characteristics of both fluid and gas when at a specific temperature and pressure, to selectively extract the PCB bound within the polymer matrix of solid materials. In addition, the Shipyard pursued an evaluation of the by-product resulting from the incineration of PCB containing foam and rubber materials to support alternate disposal options for these materials. Testing of inadvertently burned materials of this kind show no detectable levels of dioxins or dibenzofurans.

In 1996 the Shipyard submitted a Research & Development (R&D) Application to the United States Environmental Protection Agency, Region 10 to conduct Engineering Bench Scale Testing of Polychlorinated Biphenyls (PCBs). The testing was conducted at the on the destruction of PCB-contaminated material using a tube furnace. The purpose of the bench scale test was to demonstrate the destruction of PCBs under an alternative PCB disposal method process. The submittal was made under 40 CFR 761.60(e) which allows the EPA the authority to approve R&D for alternative PCB disposal process. This paper will focus on the latter research and development (R&D) under 40 CFR 761.60(e) for alternate disposal of PCB containing material.

C. The Process

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Step Two, Regulatory Approval

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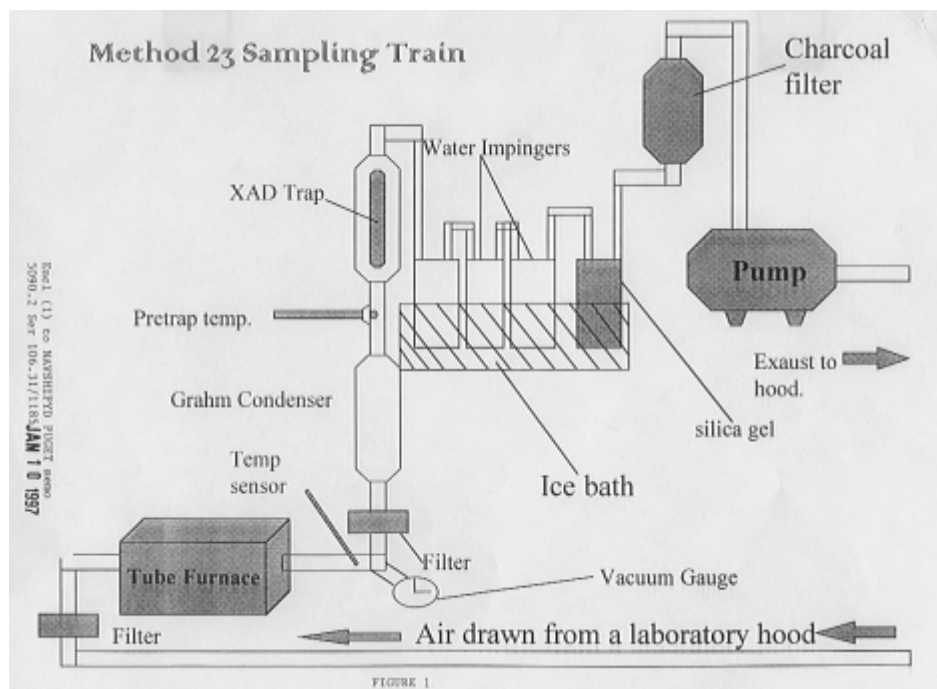
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The following samples that were incinerated in accordance with the Puget Sound Naval Shipyard's TSCA Research and Development Permit using the Method -23 Sampling Train (Figure 1)

- o 185-f-662 Ensolite foam insulation with 14, 000 ppm PCBs
- o 181-f-662 Foam rubber blank with less than 20 ppm PCB
- o 181-f-664 Aramflex foam insulation with 420 ppm PCBs
- o 218-p-663 Paint blank (Mil-p-17545 and DOD-E-24607)
- o 204-p-664 White, Green, and Red Habitability Paints (Mill-p-17545 and DOD-E-24607) with 2900 ppm PCBs
- o 230-p-669 Yellow habitability paint and primer, TT-E-645, with 2900 ppm PCBs.



Preliminary results indicate a difference in the ramped and preheated bench scale test runs. The recovery of PCBs appears to be elevated at the ramped (cold start) bench runs as compared to the heated (at temperature) runs. The data in Table 1 is presented for both ramped runs and preheated runs for specific PCB samples. The initial values of PCB concentration ranged from less than 20 ug/g PCBs up to 2900 ug/g PCBs. The results for the ramped runs indicate PCB concentrations of from 31 ug/g up to 3962 ug/g. The results for dioxins are also indicate recovery of 0.02 ug/g up to 0.85 ug/g. The effect of preheated runs was significant when levels of PCB recovered are compared to ramped runs. The concentration of PCBs in the preheated runs varied from 0.38 ug/g up to 4.4 ug/g. The level of dioxin measured from 0.12 ug/g up to 0.7 ug/g.

TABLE 1 :

The process described is an Environmental Management System which affords regulatory agencies and industry an opportunity to advance the principles of environmental excellence. The jointly developed R&D Permitting approval strategy resulted in open communication between EPA and , the integration of national expertise within EPA on PCB, dioxin, and furan sampling methodologies, and an invaluable experience in the development of the EPA National ELP Strategy.

The ELP Pilot Project afforded the Shipyard an opportunity to develop a process which represents an Environmental Management System designed to explore, test and validate innovative pollution prevention measures. This process relies on the common agreement

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