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DEVELOPMENT OF DISPOSAL PATH FOR NON-INCINERABLE LOW-LEVEL RADIOACTIVE WASTE CONTAMINATED WITH PCBs: PURSUING, OBTAINING, AND IMPLEMENTING REGULATORY SOLUTIONS

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ABSTRACT

For over two decades, radioactive wastes containing polychlorinated biphenyls (PCBs) have presented significant regulatory compliance dilemmas with respect to storage and disposal. Since 1979, regulations implementing the Toxic Substances Control Act (TSCA) have required that wastes with ≥ 50 parts-per-million (ppm) PCBs be disposed within one year of generation. However, until the TSCA Incinerator at the DOE Oak Ridge facility began operations in 1991, no facility in the United States could dispose radioactive PCBs. Disposal of non-incinerable radioactive PCB wastes posed even greater difficulties, as there were no disposal facilities for them prior to the 1998 PCB Disposal Amendments.

The extent of the non-liquid PCB problem, however, was not recognized within the DOE complex until the latter part of 1996, when the Savannah River Site (SRS) discovered several forms of non-liquid PCBs in facilities constructed prior to the passage of TSCA. The Westinghouse Savannah River Company (WSRC), management and integrating contractor for the Department of Energy-Savannah River Operations Office (DOE-SR), detected the PCBs in two facilities scheduled for demolition. PCBs were found in painted surfaces and also in materials such as rubber gaskets and plastic and rubber cable insulation. The presence of PCBs in large volumes of non-incinerable wastes generated during demolition or renovation of facilities causes significant regulatory compliance and logistical issues, particularly if the wastes were also radioactive.

This paper discusses the SRS efforts to obtain regulatory solutions for the compliance and logistical issues involving storage and disposal of low level radioactive waste (LLW) containing non-liquid PCBs. It will summarize the key events and actions from problem identification, to pursuit of solutions via the regulatory development process, through implementation of an on-site disposal program. Actions that facilitated essential regulatory reforms will be highlighted as well as operational challenges and lessons learned to date.

INTRODUCTION

Since 1979, regulations implementing the Toxic Substances Control Act (TSCA) have limited the storage of wastes containing ≥ 50 parts-per-million ppm PCBs to one year from the date of generation. However, until the TSCA Incinerator at the DOE Oak Ridge facility began operations in 1991, no facility in the United States could dispose radioactive PCBs. Disposal of non-incinerable radioactive PCB wastes posed even greater difficulties, as there were no disposal facilities for them.

As a result, large volumes of radioactive PCB wastes remained in long-term storage throughout the DOE complex. These wastes largely consisted of materials such as radioactively contaminated PCB oils, spill cleanup debris, and some PCB electrical equipment. The resulting non-compliance with the TSCA one-year storage limit necessitated the negotiation by DOE and the U.S. Naval Nuclear Propulsion Program (NNPP) of a national Federal Facility Compliance Agreement (FFCA) with the Environmental Protection Agency (EPA). The FFCA imposed certain management and reporting requirements upon DOE and NNPP as an alternative to any other EPA enforcement action.

In late 1996, SRS learned that regulated levels of PCBs were in solid material, particularly dried paint, in two old site facilities that were slated for demolition. The initial discovery was made during preliminary characterization sampling of the Heavy Water Components Test Reactor (HWCTR). Testing of painted surfaces and other solids for PCBs was performed for two reasons. The first reason was a project engineer's knowledge that low levels of PCBs (< 50 ppm) were detected in paint during demolition of a similar test reactor at the DOE Idaho National Environmental and Engineering Laboratory (INEEL). Second, in a December 1994 Notice of Proposed Rulemaking (NPRM) (1) that contained proposed changes to the PCB disposal regulations, the EPA had discussed briefly these types of non-liquid uses of PCBs. The NPRM discussion advised that the U.S. Navy had found these forms of PCBs in certain specialized materials used primarily in submarines.

The testing at the SRS HWCTR revealed PCBs in paints, sealers, and plastic and rubber cable and wiring insulation. PCB concentrations detected from that sampling campaign were as high as 2000 ppm for cable insulation and 1200 ppm in wall paint (a). Soon thereafter, PCBs were detected on painted walls in a deactivated tritium processing facility at concentrations of up to 27,000 ppm.

These discoveries exacerbated the existing compliance difficulties with respect to storage and disposal of radioactive PCB wastes. Many of these wastes were both non-incinerable and radioactive, and there was no disposal path for them. Disposal in a TSCA-permitted chemical waste landfill was the only option for the non-radioactive wastes of this type. Insufficient TSCA-compliant storage capacity existed for the large volumes of waste that could be generated by even a single project, regardless of whether the waste was radioactive. However, storage capacity for the radioactive wastes became a major management issue due to the inability to ship them out for disposal.

Other related issues required immediate attention. Questions arose concerning the extent to which these non-liquid PCBs were in use at SRS and throughout the DOE complex and beyond. The need for and/or appropriate scope of any special PCB testing program, and whether sufficient funding existed to perform such testing, were additional open questions.

SRS immediately initiated efforts to address these problems. Efforts focused on several major areas of concern. First among these was finding a way to allow scheduled and funded projects to proceed without disruption while minimizing the costs associated with regulatory compliance. A second priority was determining how, why, and where the non-liquid PCBs might have been used. Yet another priority was determining the appropriate scope and structure for the site's regulatory compliance program. These three goals were immediate by necessity. A fourth

objective was obtaining long-term solutions to the compliance and logistical issues, preferably in the form of regulatory relief that would allow the disposal of the non-liquid LLW PCBs in DOE-operated LLW facilities.

This paper will focus on efforts to obtain long-term regulatory solutions to the storage and disposal problems and the ultimate implementation of an on-site disposal program for LLW containing non-liquid PCBs. However, the shorter-term objectives, and the efforts to achieve them, will also be discussed briefly as they are integrally related to the pursuit of the long-term solutions.

USES OF NON-LIQUID PCBs

In order to assess the scope of the problem, it was necessary to learn why PCBs had been used in paints as well as in plastic and rubber items. WSRC staff immediately began to research the use of PCBs in paints and solids in order to assess the extent to which they might be present at SRS.

Sources of Data

The ensuing data search quickly revealed that further relevant technical information was not available from on-site sources. Accordingly, WSRC pursued other resources. Initial information was obtained via telephone conferences with several off-site parties. These included several persons associated with the U.S. Department of Defense and/ or its contractors, including a Westinghouse environmental manager for the Charleston Navy contract (b); a technical staff member/coating specialist with the Army Corps of Engineers (c); and a DOE-HQ representative who obtained summary PCB data from the DOE Naval Nuclear Propulsion Program (d). WSRC also obtained data from non-government sources, including a representative of Pittsburgh Paint and Glass Company with knowledge of old paint formulations (e), and a PCB Consultant with Roy F. Weston Associates (f). Subsequently, WSRC staff met in person with representatives of the U.S. Navy Sea Systems Command (NAVSEA) (g) for in-depth discussion of non-liquid PCBs. The information obtained from these sources revealed that PCBs were added deliberately to the formulations of certain specialty paints and other products to obtain the benefits of certain PCB properties.

Indicators of Non-Liquid PCBs

The types of materials in which PCBs likely would be present included products formulated to have certain special properties. Those properties included water resistance, fire resistance, flexibility, heat resistance, chemical resistance, and abrasion resistance. The sources offered a variety of examples for paints, such as high temperature aluminum paints, concrete paints, swimming pool paints, wooden water tank paints, structural steel paints, chlorinated rubber paints, severe weather protection paints, and polyvinyl chloride paints. Examples given for other PCB solids included dampers; rubber and felt gaskets; certain insulating materials, adhesives, sound dampening felt, special gaskets and exposed rubber items used in ships and submarines; and cable insulation. These examples usually were characterized as premium, specialty products. Upon review and analysis of the SRS sample data, WSRC determined that the

SRS data correlated with the patterns of PCB uses reported by the off-site organizations that had been consulted.

In addition, WSRC reviewed U. S. Federal Register notices (2,3) pertinent to the original PCB rulemaking and learned that prior to 1982, PCBs were also commonly present as a carrier impurity in certain dyes and pigments. Those included diarylide yellow pigments and phthalocyanin blue and green pigments. These pigments were in such widespread use when the TSCA regulations were passed that EPA included a "grandfathering" period of over two years past the July 1979 "PCB ban" date--until January 1, 1982--so that industry could develop substitute pigments.

WSRC initially identified pigments as an indicator of possible PCB use. As additional data was collected, however, WSRC determined that regulated levels of PCBs in paints usually could be attributed tot the addition of PCBs to the paint base rather than to a particular pigment. Rarely did SRS find high levels of PCBs in a paint that was not clearly associated with one of the special purposes discussed above, e.g., chemical resistance. It appears that EPA was correct in its presumption that PCB pigments would be diluted to low, non-regulated levels in the products to which they were added.

Non-Liquid PCBs Likely In Widespread Use

Based on the information gathered, WSRC concluded that use of non-liquid PCBs was not limited to SRS and U.S. Navy vessels and submarines. Rather, it was reasonable to expect that these forms of PCBs were in use at many DOE and DOD facilities as well as non-governmental entities nationwide.

COMPLIANCE ISSUES

The intent of the TSCA statute and the implementing regulations is to drive all PCBs to disposal. The manufacture, processing, use and distribution in commerce of all PCBs were banned except as specifically authorized in the implementing regulations. Those activities involving PCBs that are allowed by the regulations are extensively regulated. Unlike certain other environmental statutes such as the Resource Conservation and Recovery Act (RCRA), TSCA is proscriptive: TSCA only allows those activities specifically stated and approved rather than delineating the acts that are prohibited. Thus, unless TSCA regulations specifically state that one may do something, one cannot do it.

Regulatory compliance issues associated with these non-liquid uses of PCBs were not limited to storage and disposal. Following is a summary of other major compliance concerns based on TSCA regulations in effect at the time of problem identification in late 1996. Also included is additional information on compliance issues related to storage and disposal.

TSCA "Anti-Dilution Rule"

The TSCA "anti-dilution rule" is one of the primary tenets of the TSCA PCB regulations. The provision, contained in 40 CFR 761.1(b), prohibits the avoidance of any TSCA requirement as a result of dilution of the PCBs in or on an item. The rule effectively prohibits taking the mass of

an object into account when determining its PCB concentration and regulatory status. Therefore, if a wall is coated with a paint containing a regulated concentration of PCBs, then the entire wall is considered to contain PCBs at that level and is subject to the TSCA storage and disposal regulations. As a result, very large volumes of non-incinerable PCB wastes, e.g., painted concrete, wallboard, etc. can be generated from activities such as facility renovations, major maintenance projects, or facility demolitions. At SRS, such wastes from a single project could have exceeded the total capacity of site facilities that met the existing TSCA regulatory criteria for storage of PCB wastes.

Unauthorized Uses of PCBs

TSCA banned all uses of PCBs except for those specifically named in the regulation. The regulations did not include paints, plastics, or rubber as authorized uses of PCBs. Accordingly, their mere presence represented a regulatory non-compliance. This was true even though the PCBs were initially used or applied prior to the passage of the Toxic Substances Control Act.

Although EPA "grandfathered" the use of PCB-containing pigments for more than two years after the general PCB ban, it did not authorize the use of items containing regulated concentrations of PCBs in a final product containing the pigments. EPA had expected the PCBs to be present only at very low, unregulated concentrations in the final product material. The rulemaking record shows that the "grandfathering" of the pigments only gave industry sufficient time to develop non-PCB formulas, in essence by allowing a specific and very limited exemption to the anti-dilution rule during the transition period. No further provision was made other than the general authorization for use of "excluded PCB products" at 40 CFR 761.20(a)(1). "Excluded PCB products" were items containing < 50 ppm PCBs as a result of historical PCB use of contamination.

During development of the initial PCB regulations, EPA was unaware that PCBs had been added to the formulas for certain specialty paints and that some of those paints contained high concentrations of PCBs. The WSRC PCB Specialist provided this information to EPA during discussions in 1997. Had EPA known this, the initial PCB regulations may have been written differently and perhaps would have authorized the continuing use of items coated with PCB paints that already had been applied. Similarly, EPA apparently was unaware that PCBs were used in other non-liquid forms such as gaskets and insulation. Had EPA known that, it might have addressed those uses in the initial PCB regulations as well.

The issue of unauthorized use is a significant one that SRS has discussed at length with EPA in an effort to achieve a long-term solution. The unauthorized use issue is not the primary focus of this paper. However, relevant aspects of that compliance problem, and the efforts to resolve it, will be discussed briefly in various sections of this paper as appropriate.

No Self-Implementing Decontamination

No self-implementing decontamination or removal of these forms of PCBs was authorized in the TSCA regulations. Authorized decontamination activities were limited to cleanup of contaminated equipment inside PCB storage facilities and cleanup of PCB spills. Otherwise, a

formal EPA alternate disposal approval, similar to a permit, was required to remove or decontaminate PCBs. Obtaining such approvals typically was a lengthy and costly process.

Prohibition on Distribution in Commerce

Unless specifically authorized under the TSCA PCB regulations at 40 CFR 761.20(c), any distribution in commerce of PCBs or PCB-containing materials is prohibited. Under TSCA, distribution in commerce includes selling an item or substance as well as other actions that impact commerce, such as donating or giving items away. The prohibition extends to holding or delivering items for others to introduce into commerce. This provision became a major issue at SRS as it impacted some high profile economic development initiatives involving the donation and/or sale of surplus equipment. It also affected routine excess equipment sales and auctions. Distribution in commerce issues were the subject of many interactions with EPA representatives. Many of those interactions took place in conjunction with SRS efforts to obtain regulatory relief on the waste storage and disposal issues.

Waste Storage and Disposal

As discussed in the introduction, a nationwide disposal capacity shortage for radioactive PCB wastes had existed since the effective date of the PCB disposal regulations in 1978. Within the DOE complex and the NNPP, there was an enormous backlog of radioactive PCB waste in storage in 1996. Generally, these wastes included liquids such as dielectric fluids, other oils, materials associated with the cleanup of spilled PCB liquids, and electrical equipment.

Even prior to the identification of the non-liquid PCB problem, the storage of these wastes presented significant logistical challenges due to the stringent TSCA construction/performance standards for PCB storage facilities. The TSCA standards for curbing and containment were stricter than the standards for storage of hazardous wastes subject to RCRA regulations. PCB wastes could not be stored in RCRA storage facilities unless those facilities met the TSCA performance standards. During the public comment period following the December 1994 NPRM that announced proposed changes to the PCB Disposal amendments, WSRC had urged EPA to allow storage of PCB wastes in RCRA permitted facilities and RCRA Interim Status facilities. Discovery of the non-liquid PCBs and the associated need for additional storage capacity heightened the SRS interest in persuading EPA to allow PCB storage in RCRA facilities.

SRS Screening/Compliance Program

Based on the technical information gathered on the non-liquid PCBs, SRS developed a site program to identify these newly discovered forms of PCBs. The program focused on wastes and surplus items awaiting disposition as either wastes or items to be made available for sale.

The program consists of screening items to determine whether they should be suspected of containing PCBs. The determination is made based on a combination of factors that form a "profile" for identifying items that may contain PCBs. The factors include the age of the item and whether it is similar to items already found to have PCBs. However, the most important factor for evaluation is whether any of the special properties associated with non-liquid PCB use,

e.g., waterproofing, chemical resistance, are likely to have been specified for the item. Using this screening process, only a small portion of SRS wastes and surplus items must be tested for the presence of non-liquid PCBs. Those that contain PCBs at regulated levels are managed in accordance with TSCA requirements. This approach allows SRS to implement a compliance program that keeps sampling costs at a reasonable level.

Prior to its implementation, SRS discussed its approach with EPA Region 4 staff to ensure that there were no EPA objections.

SRS has gradually refined its "profile" of non-liquid PCB uses over time, based on the data actually gathered at SRS. The program has been in effect since early 1997.

PURSUIT OF REGULATORY CHANGE

SRS efforts to obtain additional storage and disposal options for radioactive PCB wastes took place throughout the period from December 1994 through early 1998. Those efforts took three major forms. Participation in the general public comment process associated with federal rulemaking efforts was a major part of the process. The second was direct interaction with EPA personnel concerning specific projects. The projects provided excellent illustrations of compliance problems for which regulatory change was either the best or only solution. The third form of involvement was participation on a DOE-HQ task team/Federal Inter-Agency task team that provided additional comments to EPA during preparation of the draft final PCB Disposal Amendments.

Following the discovery at SRS of PCBs in paints and cable insulation, SRS also sought regulatory relief with respect to continued use and distribution in commerce of non-liquid PCBs.

Formal Public Comment Process

In 1995, management issues associated with radioactive PCBs wastes were the subjects of extensive comments by Westinghouse Savannah River Company (WSRC) and the DOE in response to the Environmental Protection Agency's December 1994 proposed amendments to the PCB regulations. Many of the comments pertained to storage and disposal. WSRC advocated that EPA authorize the use of RCRA-permitted and Interim Status facilities for storage of PCB waste. WSRC also advocated that EPA allow the disposal into LLW facilities of certain "low-risk" wastes such as drained electrical equipment (previously containing < 500 ppm PCB) that had been radioactively contaminated.

The public comment period ended in May 1995, prior to the SRS discovery of the high-concentration, non-liquid PCBs. Although WSRC and DOE did not comment at length on these particular forms of PCBs, their participation in the initial public comment process served as a foundation for subsequent comments via a Federal inter-agency task team.

Project-Specific Efforts

Actions taken to keep ongoing projects in progress directly supported the long-term objective of obtaining regulatory relief. In order for regulations to be changed, regulatory agencies must

understand the issues and their impact. The agencies also must have enough data to evaluate regulatory options. Actual projects provide the best illustrations.

TSCA regulations in effect in 1996 focused heavily on PCB issues associated with electrical equipment and oils. The EPA actually had few options for addressing compliance problems not anticipated by the existing regulations, such as large volumes of painted debris waste or the continuing use of PCB paints. This was due both to provisions in the TSCA statute and the actual regulatory language in effect at that time. The regulations did not include an option for EPA to waive the distribution in commerce ban or to approve alternative storage arrangements. The agency had no mechanism to authorize the continuing use of newly discovered non-liquid PCB uses such as paints. Nor was there a mechanism for EPA to approve an alternate disposal path for these types of PCB wastes; the agency was limited to approving only those alternate disposal methods that destroyed PCBs with the same efficiency as incineration.

As stated in the introduction, SRS first detected non-liquid PCBs during characterization of two facilities scheduled for demolition. Both were nuclear facilities, and a significant portion of the demolition wastes would be radioactive. The presence of the PCBs had enormous implications for the two projects. SRS contacted EPA Region 4 to advise them of the problem and to discuss the appropriate path forward with respect to the construction rubble and other materials that would be generated.

During this time, at the close of 1996 and the beginning of 1997, the EPA was deeply involved in developing the regulatory language for what ultimately became the 1998 PCB Disposal Amendments. The EPA Region 4 PCB specialist was a participant in the EPA regulatory development process. The Region 4 representative recognized that the compliance issues posed by the SRS projects did not have any solutions in the existing regulations. The issues were passed on to EPA Headquarters staff for review with respect to both project execution options and the EPA's in-process regulation development work. The demolition projects furnished EPA with tangible examples of the scope of the radioactive non-liquid PCB problem and highlighted the need for additional regulatory options.

Another project that facilitated long-term efforts was an Economic Development initiative involving the sale of surplus metalworking equipment to a start-up manufacturing business in a county adjacent to SRS. The county was one of the most economically depressed in the state. The surplus SRS equipment, which was being sold at a nominal price, was to be the primary production equipment at the new plant. Over one thousand manufacturing jobs were involved. This project was jeopardized when it was learned that some of the equipment was coated with PCB-containing paint.

Because of the PCBs, the TSCA ban on distribution in commerce of PCBs prohibited the sale of the equipment. Similarly, the regulations prohibited any continued used of the equipment. Cancellation of the project would have dealt a heavy blow both to the DOE Economic Development program and to the adjacent county that would lose a major new employer. WSRC, DOE-SR and DOE Headquarters (DOE-HQ) personnel worked vigorously with EPA in pursuit of a way for the project to proceed. TSCA regulations did not include a mechanism for EPA to allow a waiver or grant a permit.

The ultimate solution for the surplus equipment sale involved two steps. First, SRS conducted surface wipe testing of the painted equipment in accordance with EPA methods set forth in the PCB Spill Cleanup Policy in 40 CFR 761, Subpart G. The tests indicated that the equipment's paint did not pose a dermal exposure hazard. Then, EPA issued to SRS an enforcement discretion letter (EDL) (h). In the EDL, EPA committed to refrain from taking enforcement action regarding the sale, provided certain conditions were met. The EDL allowed the project to proceed. Obtaining the EDL was a major effort that involved representatives of WSRC, DOE-SR, DOE-HQ, EPA Region 4 and EPA Headquarters. Many telephone conferences and some face-to-face meetings were held concerning the EDL. These consultations focused on the distribution in commerce and continued use issues in general and the EDL request in particular. However, SRS personnel took every possible opportunity during those interactions to remind EPA of the need for additional storage and disposal options. The interactions concerning the EDL request, and the data collected showing that the equipment's paint did not present an exposure hazard, greatly facilitated the site's efforts to convince EPA that regulatory changes were appropriate.

Participation in Inter-Agency Review of Draft Regulation

By the spring of 1997, EPA Headquarters had produced a draft set of amended PCB regulations. The revisions reflected EPA's review and analysis of comments submitted to them during the public comment period for the proposed rule. As part of the agency's regulatory development process, the EPA provided the draft of the revised regulation to a Federal inter-agency task team. The team consisted of members from most of the federal agencies and most branches of the military. The team was invited to review the draft regulations and to provide comments to the EPA for consideration in developing the final rule.

To prepare the DOE comments, the DOE-HQ representative on the inter-agency task team called a special meeting of selected PCB specialists from various sites throughout the DOE complex. The WSRC PCB Specialist was among those invited to analyze the draft regulation, assess its impact, and develop comments to be forwarded to EPA Headquarters. During the comment development meetings, the WSRC PCB Specialist took a leadership role in developing DOE's comments and recommendations on management and disposition of non-liquid PCBs. The DOE comments addressed storage, disposal, use, distribution in commerce, and decontamination issues associated with these PCB forms, including special concerns with respect to radioactive wastes.

Following their review of comments from members of the Federal inter-agency task team, the EPA conducted various meetings and follow-up actions. Some of these involved follow-up questions to the commenters. On more than one occasion, the WSRC participant on the DOE task team was requested to provide an answer for EPA. In particular, WSRC furnished information to support use of RCRA Interim Status facilities for PCB waste storage. Participation in the regulatory development process was a unique opportunity to propose potential solutions to difficult compliance problems encountered at SRS as well as at other locations.

PROMULGATION OF 1998 PCB DISPOSAL AMENDMENTS

On June 29, 1998, EPA published extensive revisions to the PCB regulations (4). The revisions contained in the 1998 PCB Disposal Amendments were so extensive they became known within the regulatory community as the "Mega-Rule". The amended regulations became effective on August 28, 1998. Included in the final version were several provisions that afforded greater flexibility for management of radioactive PCB wastes.

With respect to storage, the new regulations allowed PCB wastes to be stored in RCRA-permitted and in certain RCRA Interim Status storage facilities. The new regulation also included mechanisms to obtain risk-based approvals for unusual storage problems. EPA also waived the one-year storage limit for radioactive PCB wastes, provided that waste generators make appropriate continuing efforts to secure a disposal path.

Regarding disposal, the revised regulations provided that certain non-liquid PCB wastes may be disposed in non-hazardous waste landfills. However, disposal of these wastes into state-permitted landfills may be prohibited by state regulations, which is the case in South Carolina. SRS understands that the solid waste regulations in most states still prohibit the disposal of any PCBs ≥ 50 ppm. Accordingly, there may be a significant delay until state regulations are revised to reflect the new TSCA provisions, if the states do choose to revise them.

If radioactive, these non-liquid PCB wastes may be disposed, based on their radioactive characteristics, in appropriate radioactive waste disposal facilities. Several types of wastes may be disposed in LLW facilities. The general categories of eligible wastes are identified in Table I, "PCB Wastes Eligible for Disposal in Low Level Waste Disposal Facilities." The regulatory provisions that are cited provide details on any special conditions or characterization requirements that may be applicable. These provisions of the Mega-Rule allowed SRS to develop an on-site disposal program for many LLW streams containing non-liquid PCBs. The development and implementation of that program is discussed in detail later in this paper.

The "Mega-Rule" also included provisions that allow disposal into RCRA Subtitle C landfills of other, higher-risk PCB wastes. Examples of these higher-risk wastes include bulk remediation wastes containing ≥ 50 ppm PCBs. Such wastes, if radioactive, could be disposed in a RCRA-permitted mixed waste disposal facility, e.g., Envirocare of Utah. Again, the state regulations and facility permit should be consulted to determine whether a specific facility could accept waste with ≥ 50 ppm PCBs.

The "Mega-Rule" also allowed several new, self-implementing decontamination options that provide additional flexibility with respect to disposal of PCB-containing wastes. Many decontamination procedures can now be performed without a special EPA approval. For example, paint can be removed from metal surfaces via sandblasting. Alternatively, metal surfaces can be sent to scrap metal recovery ovens or smelters (certain conditions apply).

Table I. PCB Wastes Eligible for Disposal in Low Level Waste Disposal Facilities

Category	Examples	Regulatory Authorization
PCB Bulk Product Waste	Items coated with PCB paints, dried paint chips, plastics, rubber, felt gaskets	40 CFR 761.62(b)
PCB Bulk Remediation Wastes with < 50 ppm PCBs	Dewatered soil, gravel, dredged materials, sludges, etc.	40 CFR 761.61(a)(5)(i)(B)(2)(ii)
PCB Remediation Waste: Non-Porous surfaces with PCB surface contamination of < 100 ug/100cm2	Uncorroded metal, smooth glass, smooth glazed ceramics, impermeable polished building stone, (e.g., granite), high-density plastics, etc.	40 CFR 761.61(a)(5)(ii)
PCB Remediation Waste: Porous surfaces with < 50 ppm PCBs	Corroded metal, painted surfaces, unglazed ceramics, porous building stone, low-density plastics, concrete or cement, plaster, paper, wallboard	40 CFR 761.61(a)(5)(iii)
PCB Remediation Waste: Cleanup Materials at any PCB concentration	Non-liquid cleanup materials and personal protective equipment, e.g., gloves, shoe covers, rags, scrapers, dustpans, wire brushes	40 CFR 761.61(a)(5)(v)(a)
PCB-Contaminated Electrical Equipment (<500 ppm) drained, and with no free flowing liquids	Transformers, switches, cable, etc., previously filled with liquid containing < 500 ppm PCBs	40 CFR 761.60(b)(4)
Drained PCB Hydraulic Machines	Drained of free-flowing liquids; flushed and drained if previously held ≥ 1000 ppm PCBs.	40 CFR 761.60(b)(3)
Drained (empty) PCB Containers that formerly held < 500 ppm PCBs; and decontaminated PCB Containers that held ≥ 500 ppm PCBs	Drums, metal storage boxes, bottles	40 CFR 761.60(c)
Laboratory Wastes (non-liquid)	Gloves, pipettes, extracted solid sample residuals, etc.	40 CFR 761.64
Decontamination wastes and residues	Gloves, shoe covers, rags, dustpans, wire brushes; filter media with < 50 ppm PCB	40 CFR 761.79(g)(6)

Delay in Authorization for Continued Use and Distribution in Commerce of Non-Liquid PCBs

The "Mega-Rule" did not include a use authorization for non-liquid PCBs. Although convinced that regulatory changes were needed, EPA determined that it needed additional data in order to evaluate the impact to health and the environment. In addition, much of the data in EPA's possession had been received by the Agency after the close of the public comment period in May of 1995. Since the public had not reviewed and commented upon that data, federal rulemaking procedures necessitated that EPA address the authorization of non-liquid PCBs in a separate rulemaking. EPA announced its decision and a call for additional data in the preamble to the "Mega-Rule." WSRC has continued to advocate a use authorization for non-liquid PCBs, particularly paint, and has furnished data to the EPA for their use in evaluating regulatory options.

On December 10, 1999, EPA issued a Federal Register notice (5) announcing its intent to proceed with promulgation of an authorization for use and distribution in commerce of non-liquid PCBs. The notice included a proposed rule to authorize many forms of non-liquid PCBs. It announced the availability for public review of data already received, the establishment of an additional 120-day period for submittal of additional data, followed by an additional 90-day public review and comment period. SRS plans to submit supporting comments to EPA in response to this proposed rule.

IMPLEMENTATION OF AN ON-SITE DISPOSAL PROGRAM FOR LLW WITH NON-LIQUID PCBs

Development and implementation of an on-site disposal program for LLW containing non-liquid forms of PCBs became a high priority for SRS in FY99. SRS already had numerous containers of these types of wastes in storage. A major renovation at an on-site reactor facility was to generate significant volumes of such waste during 1998 and 1999. Furthermore, the DOE Naval Reactors Program (NPP), which disposes LLW at SRS, had large volumes of candidate wastes awaiting disposal and more volumes scheduled for generation in 1999.

Program Development

Following publication of the new rule, SRS environmental compliance and low-level waste engineering staff members performed a detailed analysis of the new regulatory language. The new provisions were compared carefully to the waste acceptance criteria and technical safety requirements for the SRS LLW facilities. The candidate facilities included two concrete vaults as well as earthen trenches. Acceptable types of PCB wastes were identified for each of the SRS LLW facilities.

Another important part of program development was the identification of TSCA record keeping requirements. The revised regulations excluded some, but not all, of the candidate wastes from these TSCA requirements. Those requirements involved tracking PCB wastes from generation to disposal and accounting for them in a PCB Annual Document Log and Annual Records. The wastes that were exempted were PCB bulk product wastes, which include painted items/debris and other non-liquid PCBs such as plastics and rubber. SRS had a quantity of bulk product

wastes in storage that had been subject to those record-keeping requirements when initially generated. Those wastes were already included in the site's PCB Annual Document Log(s) and Annual Records. The DOE Naval Reactors Program also had legacy PCB wastes that were generated and documented in their records prior to the new exemption. Therefore, it was necessary to complete tracking of those wastes into disposal.

After extensive consideration, SRS staff decided to continue maintaining records on these types of wastes. There were several reasons for this decision. An important reason was to maintain accountability of the wastes as PCB. By maintaining records, the site created documentation that radioactively PCB bulk product wastes were properly disposed within the regulatory time period. Another important reason dealt with management of another operations initiative within the LLW facility, the "sort and segregation" program. In that sorting program, legacy wastes are examined to determine whether they can be super-compacted. Processing PCB wastes through a super-compactor was not authorized by TSCA regulation, and would have required a TSCA PCB Disposal Approval. SRS does not, at this time, intend to super-compact the PCB LLW. Maintaining the records provided a tool for ensuring the PCB wastes were not inadvertently processed through the LLW super-compactor.

Following identification of the above requirements and programmatic needs, the Waste Acceptance Criteria (WAC) procedure for the SRS LLW facilities was updated. The revisions provided detailed information on the types of wastes to be accepted, the characterization data needed, and the records and labeling required. TSCA pre-shipment notification requirements were also included. While in its draft form, the WAC was routed for review and comment by several key personnel. The reviewers included WSRC environmental compliance personnel, WSRC LLW engineering staff and management, WSRC LLW operations staff, DOE-SR staff, and SRS waste generators. A separate WAC for off-site generators was developed for the DOE Naval Reactors Program customers. The draft WAC for offsite generators was sent to NPP staff for review and comment as well. This collaborative review process was extremely productive in identifying outstanding issues and in improving the program design prior to its implementation.

Only one major issue remained unresolved as of March 1999. That issue involved the TSCA requirement that PCB wastes must be either disposed or placed into a TSCA-compliant storage facility within 30 days of waste generation. As a result, the waste shipments had to be scheduled carefully as in many cases it was necessary to dispose the wastes on the same day that they were received at the SRS LLW facility. That issue is discussed at length later in this paper.

The final step in preparing for operations was training the operations staff. The cognizant engineer for the PCB LLW disposal project conducted the training and the first pre-job briefing. The training included a detailed briefing on the governing procedure and the new provisions addressing PCB wastes. Emphasis was placed on the requirement for immediate disposal of the PCB wastes to ensure compliance with TSCA temporary storage limits.

Operations Begin

Following resolution of comments, completion of revisions to the WAC, completion of internal reviews, and training of personnel, the SRS LLW Department began acceptance and disposal of PCB LLW. The first disposal action took place on March 10, 1999. It consisted of two 90 cubic

foot steel containers ("B-25s") of painted debris generated in connection with facility renovations at an SRS reactor facility. The waste was not in long-term storage, but was shipped directly from the project's temporary storage area to the SRS LLW facilities. The shipment was carefully planned to take place prior to the expiration of the TSCA 30-day limit on storage of PCB wastes outside a TSCA-compliant storage facility.

Following the initial disposal action, the SRS LLW facilities began routine disposal of LLW with non-liquid PCBs. Both on-site and off-site wastes from the NPP Windsor site have been disposed. Shipments have been received and disposed approximately every two weeks since operations began.

Continuing Compliance Difficulty: TSCA Temporary Storage Limits

As a standard practice, SRS plans to effect disposal of the PCB LLW wastes promptly upon receipt. However, safety considerations and technical constraints associated with managing the radioactive component of these wastes pose significant difficulties with respect to compliance with TSCA regulations. These constraints relate primarily to weather and to waste certification (characterization) issues. Disposal operations are not conducted at the SRS LLW facilities during rain and/or windy conditions, as the necessary radiological controls cannot be maintained. Operations at the trenches also must be suspended if the adjacent ground is too muddy for the safe operation of waste handling and/or earth-moving equipment. Since trench operations began over three years ago, operations have been suspended for up to a month due to weather conditions. Operations at the vaults have been suspended for periods of over three weeks.

The essential compliance issue is that of temporary storage of these wastes after their receipt at the LLW compound but before final disposal in the appropriate LLW facility. TSCA regulations allow storage of PCB wastes outside of a facility that complies with 40 CFR 761.65(b) for only 30 days. For newly generated wastes, the 30-day period is nearing its expiration by the time that the waste actually arrives at the LLW disposal facility. If disposal operations must be suspended due to weather conditions or unexpected technical or equipment problems, the 30-day limit may be exceeded.

In certain situations, temporary storage of radioactive PCB waste could be accommodated in the SRS Hazardous/Mixed Waste Storage Facilities. However, preparation of receipt and storage documentation and characterization to meet RCRA and facility permit requirements would consume additional time that may not be available within the 30-day storage period. The additional involvement of a RCRA facility would be costly, and in may cases, would not be allowable for certain containers and waste types due to permit restrictions. For example, off-site wastes can be stored in RCRA-permitted facilities only in very limited circumstances.

With respect to wastes received from offsite DOE facilities, the 30-day period typically already has been used by the facility that generated and shipped the waste. In many cases, the waste to be disposed is "legacy" waste that has been in extended storage due to lack of a disposal path prior to promulgation of the PCB disposal amendments. Upon waste receipt at SRS, inclement weather or unexpected technical problems that prevent immediate disposal could cause TSCA storage limits to be exceeded.

These issues were discussed with EPA Region 4 staff early in the development of the PCB LLW disposal program. Later, during a joint DOE/EPA training course on PCB management held at SRS in February 1999, class attendees questioned an EPA representative about the applicability of this requirement. Some attendees believed that the temporary storage limits did not apply to LLW disposal facilities. The EPA representatives confirmed again that the requirement applied. However, the Region 4 regulator expressed willingness to consider a special approval based on the new regulation's mechanism that allows EPA to grant risk-based storage and disposal approvals in certain instances. Therefore, SRS personnel took EPA representatives from both EPA Region 4 and EPA Headquarters on a tour of the SRS LLW facilities. Site personnel showed the regulators where and how PCB LLW could be stored safely during any temporary cessation of disposal operations. Feedback was obtained from the regulators on their concerns and/or special areas of interest.

WSRC staff then developed a proposal for internal management reviews by WSRC and DOE. In July 1999, SRS requested approval from EPA for extended temporary storage, outside of a facility that complies with TSCA construction/performance standards, of PCB wastes destined for disposal in the SRS LLW facilities. SRS requested approval to store such wastes in designated locations within the secured LLW facility compound. Based on previous experience with periods of suspended operations, SRS requested approval to store the wastes for up to 45 days from the date of receipt at the SRS LLW disposal facilities, if necessary to accomplish disposal in accordance with established personnel and technical safety and radiological control procedures. SRS further requested a mechanism through which it may seek approval from EPA for storage of wastes past 45 days in the event that operations at the appropriate LLW facility must be suspended for longer than that time.

Following submittal of the SRS request, informal discussions were held between WSRC and EPA staff on specifics of the proposal. On October 18, 1999, EPA issued to WSRC an approval for risk-based storage of non-liquid PCB waste. In the EPA approval, the SRS request was approved with only one change. Instead of allowing SRS to conduct inspections of stored wastes every 30 days, EPA required the inspections to be conducted weekly. The increased frequency of inspection is not expected to cause undue hardship to the program. SRS personnel understand that this is the first risk-based storage approval issued to DOE, and possibly, to any organization.

KEYS TO SUCCESS AND LESSONS LEARNED

Many factors contributed to the ultimate and successful implementation of a PCB LLW disposal program at SRS. Following is discussion of the most important factors.

Participation in Regulatory Development Process

Active participation in the EPA's regulatory development process was crucial to the development of the PCB LLW disposal program. WSRC routinely participates in the opportunities for public review and comment that are part of the environmental regulatory development process. Review and analysis of new and/or revised regulations proposed by EPA (and the State, when applicable) is a high priority task. Comments are prepared and submitted whenever it may be beneficial to the site.

Later, SRS personnel continued participating in the regulatory development process via a DOE-HQ PCB task team. That team directly supported the federal inter-agency review team that provided technical comments to EPA during preparation of late drafts of the PCB Disposal Amendments. Participation on the PCB task team was by invitation of DOE-HQ. WSRC and DOE-SR supported this initiative by allowing the WSRC PCB Specialist to attend a comment development meeting in Washington, DC. As a result, the DOE advisory comments contained several recommendations based directly on the SRS experiences with the non-liquid PCB wastes.

Positive Working Relationship with Regulators

A positive relationship with the regulators contributed immensely to the success of this program. Over time, SRS had established good credibility with the cognizant TSCA regulators at EPA Region 4. When the compliance problems involving non-liquid PCBs required the involvement of EPA Headquarters staff, the good relationship with the EPA Regional staff positively influenced those interactions as well. Likewise, the DOE-HQ staff who had become involved in the issues also had good working relationships with their EPA-HQ counterparts.

Those positive relationships had several benefits. EPA staff appeared to respect that the DOE and WSRC representatives had brought serious issues for discussion and were not merely complaining about an inconvenient regulatory requirement. That greatly facilitated efforts involving specific projects. It also facilitated the regulatory reform process, as EPA appeared to consider very seriously the advisory comments from the DOE task team.

Subsequently, during the SRS pursuit of a risk-based storage and disposal approval, the positive working relationship with EPA Region 4 staff proved beneficial. Discussions were constructive and emphasized problem-solving. The positive working relationship facilitated obtaining the EPA approval.

Preparation

SRS staff studied the new regulatory provisions carefully. Key individuals involved in developing the program attended the DOE "Management of PCBs" training course when it was presented at SRS in February 1999. Operations personnel were thoroughly trained in applicable requirements prior to the commencement of disposal operations.

Team Approach for Program Development

During program development at SRS, the WSRC LLW engineering staff worked closely with environmental compliance staff in identifying requirements and determining waste acceptance and disposal requirements. When needed, other persons with specialized expertise were consulted, e.g. site experts in the Department of Transportation (DOT) Hazardous Material Regulation (HMR). Input from waste generators, both on-site and off-site, also contributed significantly to program development.

Lessons Learned

The keys to success cited in the preceding paragraphs could be considered lessons learned that other DOE sites that choose to develop an on-site PCB LLW Disposal program can apply.

Another important lesson learned is that varying levels of regulatory knowledge existed among the parties impacted by the regulations. This was particularly true with respect to TSCA regulations. Far more SRS personnel, whether staff or management were familiar with RCRA regulations and expected the TSCA regulations to be very similar. In actuality, the two sets of regulations differed substantially. Some persons associated with program evaluation did not realize that unless TSCA regulations specifically authorize an action, the action is prohibited. Acceptance of this fact was difficult for some, particularly with respect to extension of the 30-day temporary storage limit. This was true even for persons with extensive experience in the field of waste management.

Accordingly, for those developing a similar program, efforts should be made to educate involved parties on some of these basic TSCA principles and how they affect a PCB LLW disposal program. Ideally, those education efforts should occur early in program development.

Another action that should take place early in program development is to determine whether a risk-based EPA approval for extended temporary storage is needed. SRS recommends that any site, which expects to dispose off-site wastes into its LLW facility(ies), should pursue such an approval. Sites that expect to dispose only their own wastes also should evaluate carefully whether the wastes can be disposed within TSCA time constraints. An EPA approval for extended temporary storage may be needed to ensure regulatory compliance in the event that disposal operations are suspended or delayed. Since an EPA approval may take several months to obtain, it is important to submit the request as early as possible.

SUMMARY

SRS, like many other DOE and DOD facilities, has held radioactive PCB wastes in long-term storage for many years due to a lack of appropriate disposal capacity. TSCA-compliant storage space, particularly for radioactive wastes, was very scarce. In late 1996, SRS found regulated levels of PCBs in non-liquid forms such as dried paints on walls and floors, and in plastic and rubber items. The PCBs were found in certain nuclear facilities pending demolition. Wastes associated with these forms of PCBs and these types of projects could be generated in very large volumes, and no disposal facility was available for them. Accordingly, a storage and disposal crisis appeared imminent.

Other significant compliance issues were associated with non-liquid PCBs, and they directly impacted important economic development and community outreach projects. Issues included the TSCA prohibitions on use, distribution in commerce, and decontamination.

To address these problems, SRS worked closely with the cognizant EPA regulatory authorities. Initial short-term efforts focused on finding ways to allow the active projects to proceed. SRS also pursued long-term solutions by advocating regulatory reform to allow more and viable PCB storage and disposal options. SRS also advocated regulatory reform to allow continued use and

distribution in commerce of non-liquid PCBs. SRS participated in all known opportunities to advocate regulatory changes. These opportunities occurred via direct interactions with EPA, through provision of PCB test data, by submittal of comments in the rulemaking process, and via the Federal inter-agency review process.

In the 1998 PCB Disposal Amendments (the "Mega-Rule"), EPA included provisions addressing many, though not all, of these issues. Although EPA delayed action on authorizing continued use and distribution in commerce of non-liquid PCBs, the Mega-Rule contained several provisions that greatly facilitated the storage and disposal of radioactive PCB wastes. Of particular importance were provisions allowing the disposal of radioactively contaminated non-liquid PCB wastes into radioactive waste facilities. Using a collaborative, team-centered approach, SRS staff developed an on-site disposal program for these wastes. Operations began in March 1999, and the program is now in a mature state.

Other sites that desire to implement a PCB LLW disposal program may benefit from some of the lessons learned at SRS. SRS has identified several key elements to successful program development and implementation. An important element was using a team approach during program development. At SRS, the engineering, operations, and regulatory compliance staff all participated in program design. Careful preparation of program plans and training of program personnel was also important. Another key element of program success was the maintenance of a positive relationship with the regulators.

Additional lessons learned included the need for early and thorough briefings for involved staff and management on basic principles of TSCA regulations and how they impact the program. Also, SRS identified one significant compliance issue, involving the 30-day temporary storage limit, which was only indirectly solved by the new Mega-Rule options. Since inclement weather or technical/safety problems could occasionally delay or curtail disposal operations, an EPA risk-based storage approval for extended temporary storage was required to avoid compliance difficulties. Such an approval may be necessary for other sites that develop an on-site PCB LLW disposal program.

FOOTNOTES

(a) Subsequent re-testing campaigns in 1998 revealed more non-liquid PCBs at even higher concentrations, e.g., over 66,000 ppm in certain wall paint.
(b) Telephone conversation, Nancy J. Lowry, WSRC and John Harris, Westinghouse-Charleston, SC; November 1996
(c) Telephone conversation, Monte Hawkins, WSRC and Al Beitelman, U. S. Army Corps of Engineers
(d) Telephone and facsimile communications with Mary Beth Burandt, U. S. Department of Energy Headquarters, November 1996.
(e) Telephone conversation, Nancy J. Lowry, WSRC and John Woodyard of Roy F. Weston Associates-San Francisco, November 1996 (and March 13, 1997).
(f) Telephone conversation, Mark Kidd, WSRC and Don Peshak of Pittsburgh Paint and Glass; November 13, 1996

(g) Meeting of WSRC representatives Joseph V. Odum and Nancy J. Lowry, with Thomas S. Scarano of the Naval Sea Systems Command (NAVSEA) and Thomas J. Pape of John J. McMullen Associates, Inc. Meeting held in Arlington, Virginia, February 13, 1997.
(h) EPA has announced that no more enforcement discretion letters will be issued, for distribution in commerce issues or for other reasons.

REFERENCES

1. 59 Federal Register, Vol. 59, No. 233, 62788-62887. Tuesday, December 6, 1994. "Environmental Protection Agency. 40 CFR 761. "Disposal of Polychlorinated Biphenyls; Manufacturing, Processing, and Distribution in Commerce; Proposed Decision on Exemption Petitions; Proposed Rules."

2. 43 Federal Register, 24811, Wednesday, June 7, 1978, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Rules. Proposed Rule."

3. 44 Federal Register, 31535-31536, Thursday, May 31, 1979,"Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce and Use Prohibitions. Final Rule."

4. 63 Federal Register, Vol. 63, No. 124, 35384-35437. Monday, June 29, 1998. "40 CFR Parts 750 and 761, Disposal of Polychlorinated Biphenyls (PCBs); Final Rule".

5. 64 Federal Register, Vol. 64, No. 237, 69357-69364, Friday, December 10, 1999. "Use Authorization for, and Distribution in Commerce of, Non-Liquid Polychlorinated Biphenyls; Notice of Availability; Partial Re-opening of Comment Period; Proposed Rule."