Contract No. and Disclaimer:

Regulatory Strategies to Minimize Generation of Regulated Wastes from Cleanup, Continued Use or Decommissioning of Nuclear Facilities Contaminated with Polychlorinated Biphenyls (PCBs) - 11198

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ABSTRACT

Disposal costs for liquid PCB radioactive waste are among the highest of any category of regulated waste. The high cost is driven by the fact that disposal options are extremely limited. Toxic Substances Control Act (TSCA) regulations require most liquids with PCBs at concentration of ≥ 50 parts-per-million to be disposed by incineration or equivalent destructive treatment. Disposal fees can be as high as $200 per gallon. This figure does not include packaging and the cost to transport the waste to the disposal facility, or the waste generator's labor costs for managing the waste prior to shipment. Minimizing the generation of liquid radioactive PCB waste is therefore a significant waste management challenge.

PCB spill cleanups often generate large volumes of waste. That is because the removal of PCBs typically requires the liberal use of industrial solvents followed by a thorough rinsing process. In a nuclear facility, the cleanup process may be complicated by the presence of radiation and other occupational hazards. Building design and construction features, e.g., the presence of open grating or trenches, may also complicate cleanup. In addition to the technical challenges associated with spill cleanup, selection of the appropriate regulatory requirements and approach may be challenging. The TSCA regulations include three different sections relating to the cleanup of PCB contamination or spills. EPA has also promulgated a separate guidance policy for fresh PCB spills that is published as Subpart G of 40 CFR 761 although it is not an actual regulation. Applicability is based on the circumstances of each contamination event or situation. Other laws or regulations may also apply.

Identification of the allowable regulatory options is important. Effective communication with stakeholders, particularly regulators, is just as important. Depending on the regulatory path that is taken, cleanup may necessitate the generation of large quantities of regulated waste. Allowable options must be evaluated carefully in order to reduce compliance risks, protect personnel, limit potential negative impacts on facility operations, and minimize the generation of wastes subject to TSCA.

This paper will identify critical factors in selecting the appropriate TSCA regulatory path in order to minimize the generation of radioactive PCB waste and reduce negative impacts to facilities. The importance of communicating pertinent technical issues with facility staff, regulatory personnel, and subsequently, the public, will be discussed. Key points will be illustrated by examples from five former production reactors at the DOE Savannah River Site. In these reactors a polyurethane sealant was used to seal piping penetrations in the biological shield walls. During the intense neutron bombardment that occurred during reactor operation, the sealant broke down into a thick, viscous material that seeped out of the piping penetrations over adjacent equipment and walls. Some of the walls were painted with a PCB product. PCBs from the paint migrated into the degraded sealant, creating PCB "spill areas" in some of these facilities. The regulatory cleanup approach selected for each facility was based on its operational status, e.g., active, inactive or undergoing decommissioning. The selected strategies served to greatly minimize the generation of radioactive liquid PCB waste. It is expected that this information would be useful to other DOE sites, DOD facilities, and commercial nuclear facilities constructed prior to the 1979 TSCA ban on most manufacturing and uses of PCBs.

CRITICAL FACTORS IN SELECTING THE REGULATORY PATH FORWARD

TSCA regulations govern the entire life cycle of PCBs, from manufacturing to active use as well as spill cleanup and the storage and disposal of PCB wastes. The appropriate path for managing PCBs in any given situation must take into account the regulations that are applicable to the life cycle of the PCB material.

With regard to PCB contamination resulting from a spill or release of PCBs, different provisions of the TSCA regulations may apply depending on the specific circumstances. TSCA regulations include provisions both for spills to the environment and for spills or releases to buildings and structures. For spills to the environment, requirements vary based on whether or not the contaminated location is comprised of sensitive environmental media such as surface waters, drinking water sources, animal grazing lands, or vegetable gardens. For PCB spills in structures, requirements vary based on whether the facility or location is in active use as well as the potential for human exposure. In some cases, the regulated party may be able to choose among several regulatory options for addressing PCB contamination. For any PCB cleanup, the regulatory path that is chosen (when a choice is possible) can have a major impact on the amount and form of regulated waste that is generated during the cleanup process.

If regulatory options exist, several critical factors must be evaluated in order to select a compliant option that fits the circumstances and simultaneously minimizes the generation of TSCA-regulated PCB wastes. Critical factors that must be addressed include the extent, type and location of the PCB contamination; the source of the PCBs; the date of the spill or release; and the concentration of PCBs. For structures, an important factor is whether or not the underlying materials/facilities are in active use and how much potential there is for personnel exposure to the PCBs and other hazards.

When SRS discovered the PCB-contaminated, deteriorated polyurethane sealant in the reactor buildings these critical factors were carefully evaluated in choosing the regulatory strategy and cleanup approach for each facility. The objectives included regulatory compliance, worker safety and health, minimal impact on operations, and minimal generation of PCB waste. An important goal with respect to waste generation was to limit the generation of liquid radioactive PCB waste due to the difficulties in managing it and the extremely high cost of disposing it.

One of the most important aspects of the selection process was communication. Communication among affected SRS organizations concerning the various options and their associated advantages and disadvantages was critical to the ultimate selection of the cleanup strategy for each facility. Communication between SRS and regulatory personnel at the EPA was also very important. Following is a detailed discussion of the evaluation and communication process and a description of the strategy chosen for each reactor. Available information on the estimated waste minimization that was accomplished is also summarized to illustrate the cost savings that can be attained through selection of an appropriate remedy.

CASE STUDY: MANAGEMENT OF PCB CONTAMINATION AND PCB WASTE MINIMIZATION IN THE FORMER SRS PRODUCTION REACTORS

In 2009, management and operations (M&O) contractor, Savannah River Nuclear Solutions, LLC (SRNS), discovered PCB contamination on the floor of the L-Reactor (building 105-L). PCBs were detected at a concentration of 330 parts-per-million (ppm) in a sample of degraded sealant that had seeped onto the floor on the -20 elevation of the facility. The degraded sealant is a polyurethane product that was used to seal around numerous piping penetrations in the biological shield walls of the reactor. The biological shield wall surrounds the reactor tank in which fuel rods were irradiated during the process of manufacturing nuclear materials for the national defense. During the intense neutron bombardment that occurred during reactor operation, the sealant broke down into a thick, viscous material. The material is not water soluble. It has the general color and appearance of molasses, but is thicker.

Over a period of years, the degraded sealant seeped slowly out of the piping penetrations in at least four of the five reactor facilities. In addition to 105-L, there is a significant amount of seepage in three other reactors: C-Reactor (building 105-C), P-Reactor (building 105-P), and R-Reactor (building 105-R). The sealant seeped over equipment and wall surfaces, including walls covered with a paint that contains PCBs. The paint was applied during the original construction of these facilities during the 1950s. Seepage is present on both the -20 and -40 elevations of these four facilities. There is little evidence of seepage in the K Reactor (building 105-K). Under TSCA regulations, all of the areas with PCB-contaminated sealant fit the definition of a spill. TSCA regulations further require PCB spills to be cleaned up.

EVALUATION OF CONDITIONS

A detailed evaluation of the conditions was performed in order to assess the extent of the PCB contaminated areas and to develop a path forward. The evaluation was conducted using the principles of the SRS Integrated Safety Management System (ISMS). A key element of the evaluation was a "walk-down" inspection. Following is a summary of the evaluation and the associated initial actions and communications.

Facility Conditions/Extent of Contamination

The SRS management and Operations (M&O) contractor, Savannah River Nuclear Solutions (SRNS) conducted a "walk down" inspection in each facility. In the 105-L and 105-C facilities, participants included facility operations management personnel and waste management personnel; the reactor facilities' industrial hygienist; the facilities' environmental specialist; the SRS PCB subject matter expert (SME); and management personnel from the Regulatory Integration and Environmental Services (RI&ES) section.

During the walk down inspections, it was observed that the degraded sealant had accumulated on the floor near open grating in several locations. The open grating provides a direct pathway for liquids to migrate downward to successive lower levels of the facility. In a few locations, the sealant had in fact traveled through the grating onto surfaces below. No sealant has migrated to building sumps or the environment. Photographs were taken of the affected areas to document the situation and facilitate communication and evaluation. Photographs of the seepage are shown in figures 1 and 2.

Separate inspections were conducted in the other facilities by environmental, operations, and industrial hygiene personnel. Degraded sealant was present in both the 105-R and 105-P buildings in similar locations and quantities as in 105-L and 105-C.

Visual inspection of accessible areas in 105-K showed no areas of obvious seepage. At one location on the -20 level there appeared to be dried residue. However, it was not associated directly with a piping penetration, and therefore it is not suspected to be sealant. There are a few locations on the -20 and -40 levels where staining was observed that could not be distinguished from mold or mildew. Because there are no direct piping penetrations in these locations either, it was concluded that these stains likely are not sealant. All stains/residues are dry and not amenable to sampling separately from the underlying paint layer. The single -20 location was posted as a potential PCB contamination area as a precaution, as well as the entry into the general -20/-40 level.

Based on the inspections, it was determined that cleanup of accessible areas would require an extraordinary amount of time and personnel radiation exposure. A high potential for significantly spreading the radioactive and PCB contamination also was noted.

Figure 1. Photograph of degraded sealant leaking from piping penetrations in the reactor biological shield wall.

Figure 2 Photograph of sealant that has seeped to the floor next to open grating.

Personnel Access to Contaminated Areas

In the active facilities (105-L and 105-K), personnel entry into the locations with degraded sealant is infrequent due to changes in mission requirements (no reactor operations) and the radiological conditions. Irradiation of fuel rods has ended, and current missions require minimal access to areas near the biological shield. Routine entries are made only to conduct essential safety inspections such as a monthly inspection of fire extinguishing equipment. These routine entries require only a brief period of time, e.g., approximately 30 minutes per entry. As needed, entries are made for maintenance tasks such as pumping water from sumps. No degraded sealant is present in the locations of 105-L where there are active missions involving routine personnel access. As stated above, there is no apparent seepage in 105-K.

The 105-C facility is inactive, but presently is not slated for decommissioning. Entries into 105-C normally are limited to quarterly maintenance/ engineering surveillances and entries to pump water from sumps. Personnel wear protective clothing during these entries and do not walk on floor surfaces that are contaminated with sealant. No significant changes are forecasted to these entry requirements.

At the time of the evaluation, buildings 105-P and 105-R were in the early to middle stage of decommissioning via the CERCLA process. Entries to these locations were very limited.

Radiological and Non-Radiological Occupational Exposure Hazards

In the 105-C and 105-L facilities, the locations with PCB-contaminated sealant are maintained as Inactive Contamination Areas (ICAs) meaning they area radiological Contamination Areas that are infrequently entered and do not require routine radiological posting updates. The radiation dose rates are typically low in open areas with higher rates around certain items of process equipment. Work in these areas would require one full set of protective clothing and continuous Radiological Protection Inspector coverage at a minimum. Similar radiological conditions exist in the other reactors.

Several potential non-radiological occupational exposure hazards were identified. In addition to PCBs, the potential hazards that could be encountered during cleanup efforts included dioxins, heat stress, radiological contamination and noise hazards. During the evaluation, it was learned that an attempt was made by the previous M&O contractor to remove unsightly degraded sealant in one of the reactor facilities. This occurred before there was information to indicate that the sealant contained PCBs. The attempt was abandoned due to the inability to find solvents that would remove the material without posing unacceptable personnel and/or fire safety risks. It was determined that an Industrial Hygiene assessment would be made to determine the personnel exposure hazards associated with any cleanup options that would be considered.

Determination of the PCB source and the extent of PCB contamination

Available manufacturer's information on the polyurethane sealant raised doubts as to whether it was the actual source of the PCBs. However, building specifications for the original construction of the reactor facilities called for a special coating/paint system to be used in the affected locations. This coating system has been tested a number of times for PCBs at various locations within SRS, and PCBs consistently had been detected. The wall coating/paint thus was identified as a possible source of the PCBs that were detected in the initial 105-L sample. Sampling was needed to confirm the PCB source and delineate the spill area.

In follow-up to the walk down inspections, SRNS conducted an investigative sampling campaign. Samples were collected in both 105-L and 105-C as follows:

- Paint that was not in contact with sealant
- Sealant that was not in contact with paint
- Sealant in contact with paint

Analytical results demonstrated that TSCA-regulated concentrations of PCBs were present only in samples of paint and in samples of sealant that had contacted the paint. Thus, the PCB source was identified as the wall coating that was applied during the construction of these facilities in the 1950s. The sealant itself does not contain TSCA-regulated concentrations of PCBs. SRS used the sample data to delineate the spill area. Included in the spill area were any surfaces with deteriorated sealant that had contacted the PCB paint. Any areas with deteriorated sealant that had not contacted the PCB paint were excluded from the spill area.

The horizontal surfaces where PCB-Contaminated sealant was present comprised approximately 300 square feet in 105-C and another 300 square feet in 105-L. The vertical surfaces with degraded sealant were roughly estimated to comprise an additional 300 square feet or more in each facility.

The sampling results from 105-L and 105-C were used to evaluate the conditions in 105-P and 105-R due to the nearly identical construction materials that were used. A smaller area of PCB-contaminated solvent was determined to be present in building 105-R as many of the walls there were unpainted.

DETERMININATION OF APPLICABLE REGULATORY REQUIREMENTS AND SELECTION OF REGULATORY STRATEGIES

A core "working group" was established to identify and evaluate cleanup options. The working group was comprised of facility environmental compliance staff, an industrial hygienist, facility waste management personnel, and the SRS PCB SME. As needed, they obtained assistance from radiological control and operations personnel. The core group was responsible for identifying all of the applicable regulatory requirements and options, evaluating them to select the most beneficial cleanup approach, and communicating relevant information to on-site stakeholders.

Three regulations were identified as being of major importance in selecting the appropriate path forward for managing the PCB contamination. These included the TSCA PCB regulations at 40 CFR 761, the Department of Energy Worker Safety and Health Program Requirements at 10 CFR 851, and the Department of Energy Worker Safety and Health Program Requirements at 10 CFR 851.

TSCA Regulations for Management of PCBs (40 CFR 761)

The TSCA regulations were examined to determine applicable provisions and options. The Subpart G Spill Cleanup Policy was ruled out because the contamination was older than 72 hours. In the Decontamination section at 40 CFR 761.79, none of the self-implementing provisions addressed the circumstances, although an "alternate decontamination approval" possibly could have been requested. However, experience at SRS and other locations has demonstrated that attempts to remove long-standing PCB contamination from porous materials such as concrete are unsuccessful in most cases.

TSCA provisions for remediation waste at 40 CFR 761.61 were then examined. Under TSCA, structures that are contaminated with liquid PCBs are considered PCB remediation waste. Of three remediation waste options, one was identified as inappropriate due to its establishment of rigid "clean" thresholds that site personnel believed would be unattainable in these facilities. A second option addresses only the disposal of wastes generated during cleanup; it provides no actual direction for determining and implementing a cleanup approach that would be deemed compliant with TSCA. The third remediation waste option, "Risk-Based Disposal" at 40 CFR 761.61(c) was considered a potentially viable approach, particularly for facilities undergoing closure. This provision allows the regulated party to propose, for EPA approval, a customized cleanup or disposal approach tailored to the unique circumstances of a given contamination area. For CERCLA decommissioning actions, the TSCA risk-based disposal option is usually the "Applicable or Relevant and Appropriate Requirement" (ARAR) with respect to PCBs. In the CERCLA documentation for the decommissioning of buildings 105-R and 105-P, the source PCBs (the paint) already had been identified and addressed, with the TSCA risk-based disposal option at 761.61(c) cited as the ARAR. The closure plans for these facilities already provided for the PCBs located below the surface grade level, whether still in the paint or in the sealant, to be grouted in place.

TSCA regulations at 40 CFR 761.30(p) offer yet another option specifically intended for use in active facilities. This provision is entitled "continued use of porous surfaces contaminated with spills of liquid PCBs." The regulation requires the owner or operator of the facility to take several actions including: removing or containing the source of the PCBs; performing a "double wash/rinse" procedure; and barricading entrances to locations that are not accessible for surface cleaning. These steps must be followed by encapsulating the cleaned areas by applying two layers of solvent- and water-resistant paint in contrasting colors, or placing solid barriers on accessible parts of the contaminated area. Once these actions have been taken, the contaminated surfaces are authorized for continued use. This provision was identified as a potentially viable option for the active facilities. However, use of the EPA's "double wash/rinse procedure" was quite problematic. The procedure requires the liberal use of industrial solvents for cleaning. Each square foot of contaminated surface area would have to be wetted thoroughly with solvent, scrubbed for one full minute and then rinsed with one gallon of clean water for one full minute. The procedure provides that the wash and rinse fluids may be mopped up or absorbed, but clearly assumes that there is no open grating or other path for the liquids to escape during the process. The procedure must be performed twice. In the SRS case, most of the PCB-contaminated solvent was adjacent to open grating that provided a direct and immediate path for the contaminated liquids to spill downward to successive lower levels of the facility. In addition the procedure would generate very large volumes of liquid radioactive PCB waste. This regulatory option was determined to be viable 105-L and 105-C, provided SRS could successfully demonstrate to EPA that reliance on barriers and minimal surface cleaning would be an acceptable implementation of the regulation.

Department of Energy Worker Safety and Health Program Requirements (10 CFR 851)

The Industrial Hygienist for the reactor facilities performed an occupational exposure evaluation of the proposed partial removal of PCB contamination in the 105-C and 105-L facilities. The evaluation addressed PCBs, dioxins, heat stress, radiological contamination and noise hazards. The evaluation also considered the impact of leaving the materials in place "as-is."

The occupational analysis of available information from peer reviewed literature and simple industrial hygiene calculations, established very low possible airborne concentrations of polychlorinated biphenyls (PCBs) from those materials targeted for remediation. From an integrated risk analysis perspective, the conduct of the comprehensive remedial activity carried greater risk of an adverse occupational health consequence than doing nothing other than maintaining administrative controls, until such time as a facility modification demanded removal actions. The analysis indicated that the least intrusive corrective action (covering existing leaked sealant with plastic sheeting; building dams at drain trenches) should be conducted to control further PCB contaminated sealant migration.

Although the occupational exposure analysis supported leaving the contaminated sealant "as-is," the "do nothing" approach would not comply with TSCA regulations applicable to active facilities.

Department of Energy Occupational Radiation Protection Requirements (10 CFR 835)
The provisions of 10 CFR 835, Department of Energy Occupational Radiation Protection, require DOE activities to develop and implement plans and measures to maintain occupational radiation exposures as low as reasonably achievable (ALARA). As applied to occupational radiation exposure, the ALARA process does not require that exposures to radiological hazards be minimized without further consideration, but that such exposures be optimized, taking into account both the benefits arising out of the activity and the detriments arising from the resultant radiation exposures and the controls to be implemented. The DOE Radiological Control Standard (DOE-STD-1098-99), Radiological Health and Safety Policy further states, "There should not be any occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure".

With respect to radioactive waste generation/disposal, the DOE Radiological Control Standard also provides that generation of radioactive waste must be minimized in order to reduce the environmental impact of DOE operations, help reduce personnel exposure, and reduce costs associated with handling, packaging, and disposal.

Thus, the applicable DOE regulatory requirements supported the selection of the least intrusive/rigorous cleanup action possible.

Waste Management Issues
Due to the high cost to dispose radioactive PCB waste, particularly liquids, waste minimization was a major objective in selecting a path forward for the 105-L and 105-C facilities. Full implementation of the double wash/rinse method on accessible horizontal surfaces could generate roughly 750 gallons of liquid radioactive PCB waste in each facility. At an estimated disposal cost of $200 per gallon, the cost to dispose the liquid waste, plus approximately $3,500 for drums equals approximately $304,000. If both horizontal and vertical services were cleaned by the double wash/rinse procedure, then the estimated disposal costs would be $608,000. Importantly, this figure does not include labor costs or transportation costs associated with managing the liquid waste. Nor does it include the packaging, storage and disposal of large volumes of non-liquid PCB waste, primarily job control materials and personal protective equipment that also would be generated.

The challenges associated with storage of large volumes of PCB waste are not addressed by this paper. However, it is noted that there are significant logistical issues associated with storage, particularly with respect to secondary containment requirements and time limits on storage of the waste. These storage challenges were a concern, but did not have a major impact on the decision-making process.

SELECTION OF REGULATORY STRATEGIES
Based on the evaluation, a path forward was identified for managing the PCB-contaminated sealant in each affected facility. The strategies were selected on the critical factors of facility operational status, regulatory compliance, worker safety and health, and waste minimization.

Path Forward for 105-K
SRS decided to maintain cautionary postings currently in place at the entry to the -20/-40 level (single access point) and in the -20 level of the facility. No other immediate actions will be taken since no apparent seepage was identified. Locations around the biological shield wall will be inspected annually to determine whether the situation remains stable. In the event that the materials will be disturbed in the future, such as to renovate the facility, the materials will be characterized and managed as appropriate using the ISMS process and site procedures.

Path Forward for 105-P and 105-R. These facilities are being decommissioned via the CERCLA process. The current CERCLA documentation already addresses the presence of PCBs in those facilities. The CERCLA documents identify the TSCA "risk-based disposal" provisions in 40 CFR 761.61(c) as "Applicable or Relevant and Appropriate" standards for the decommissioning action. The net quantity of PCBs in 105-P and 105-R remained unchanged. Project teams for decommissioning 105-P and 105-R were promptly advised of the sealant issue. However, no substantive changes were identified as being required to the previously identified final decommissioning plans for 105-P and 105-R. The sealant in those facilities will be grouted in place during the closure process. No liquid PCB radioactive waste will be generated by this approach.

Path Forward for 105-L and 105-C

The desired approach for the 105-C and 105-L facilities was based upon the provisions of 40 CFR 761.30(p), "continued use of porous surfaces contaminated with spills of liquid PCBs." SRS believed that these provisions could be applied in a manner that fits the circumstances and controls the PCB contamination. SRS determined that the surfaces were not safely accessible for purposes of performing a double wash/ rinse procedure due to the high potential for liquids to spill downward through the open grating Instead, SRS staff desired to perform limited manual removal (i.e., scraping) of the PCB-contaminated sealant from horizontal surfaces that could be accessed safely. This would be followed by installation of floor coverings, berms to control vertical seepage, and barricades. These engineering controls would be supplemented with administrative controls, including continuing limitations on personnel entry. This approach would greatly minimize personnel exposure to radiation and other hazards, reduce the risk of further spreading contamination throughout the facility, and avoid the generation of large volumes of liquid radioactive PCB waste. SRS determined that the occupational exposure to PCBs could be maintained within applicable limits (both during and after the partial PCB removal work) as required by 10 CFR 851. SRS believed that these actions, which focused on controlling the PCB material, constituted the most appropriate management approach for the PCB-Contaminated sealant, taking into account the three applicable regulations (40 CFR 761, 10 CFR 865 and 10 CFR 851). These actions were believed to meet the requirements and intent of 40 CFR 761.30(p) for continued use of porous surfaces contaminated with liquid PCBs. They would prevent any unreasonable risk to health and the environment. The actions would meet the 10 CFR 865 radiological ALARA program requirements pertaining to limitation of personnel radiation exposure, particularly with respect to minimizing the time spent in radioactively contaminated areas. The actions also would meet the requirements in the 10 CFR 851, Worker Safety and Health rule to control all non-radiological occupational exposure hazards.

When the missions for 105-L and 105-C are deemed complete, their final decommissioning will be conducted under CERCLA. The residual PCBs will be addressed by the CERCLA process. It is anticipated that the PCB material ultimately will be grouted in place as is being done in the 105-P and 105-R facilities.

Implementation of this plan was deemed to be contingent upon EPA concurrence. Therefore, SRS arranged a conference call with the EPA Region 4 PCB Coordinator. The objective was both to inform EPA of the situation and to verify that SRS had made a valid interpretation of the regulation. Prior to the call, SRS transmitted several photographs of the contamination to EPA. During the call, SRS discussed its proposed path forward for each facility. The EPA official concurred that SRS had correctly interpreted the regulation and was authorized under the TSCA regulations to proceed with the proposed path forward for 105-L and 105-C. SRS followed up the conversation with a letter to EPA to ensure that both the SRS and agency files were properly documented.

COMMUNICATION OF TECHNICAL AND REGULATORY ISSUES AMONG SRS ORGANIZATIONS

Communication at the site level was multi-faceted due to the cross-cutting nature of the situation. The concerns and programmatic requirements of several organizations had to be addressed. Those organizations included DOE and SRNS management and staff in facility operations, area/facility decommissioning and closure projects, industrial hygiene, environmental compliance, radiological controls and waste management. The various groups shared common concerns, particularly with respect to regulatory compliance and the impact on worker safety and health. However, each group had its own set of issues and programmatic/compliance drivers. Open and frank discussion among these groups was essential to developing a workable path forward. The efforts of core working group members were critical to the communication process.

The communication process began with the initial determination that the degraded sealant in L-Reactor was contaminated with PCBs. SRNS conservatively presumed that any similar degraded sealant in any of the reactor facilities should be considered PCB-contaminated, pending further evaluation. This presumption was made due to the similarity of construction materials used in all of the reactor facilities. Environmental and industrial hygiene staff met with facility supervision and management to explain the situation and answer their questions. Entrances to locations with seepage were barricaded per the SRS Safety Manual. The barricades were labeled with the EPA "Large PCB Mark" and explanatory information to warn personnel. In buildings 105-L and 105-C, SRNS also imposed additional administrative restrictions on entry by revising the "shift orders" to require approval by the facility Shift Manager prior to any personnel entries into the affected areas.

Initial briefings on the situation were made to supervision, management and key staff members of the contractor and DOE. Photographs of the spill areas were used to convey the complexity of the situation. The photographs were particularly useful, especially in communicating with personnel who do not routinely enter the facilities and/or radioactive contamination areas. Initial briefings were followed by regular updates in meetings and e-mail as additional information was gathered and evaluated. Once the working group had identified the preferred strategies, they formally presented them to SRNS and DOE management for approval prior to discussing them with the regulatory agency.

COMMUNICATION WITH THE REGULATORY AGENCY

Authority for administration and enforcement of the TSCA PCB regulations resides with EPA. The program is not delegated to the states. Within EPA, regulatory issues related to PCB uses currently are managed by the Office of Pollution Prevention and Toxics (OPPT). Regulatory issues related to PCB wastes are managed by the Office of Solid Waste and Emergency Response (OSWER). Each EPA Region also has a PCB Coordinator who serves as a general point of contact. At Region 4, the PCB Coordinator is assigned to the RCRA division of OSWER.

The compliance challenges associated with the PCB-contaminated sealant were not limited to the issue of how to address the spill. Another significant challenge relates to the PCB source material, i.e., the paint. The presence and use of PCBs in paint and most other non-liquid materials conflicts with TSCA regulations. Even though the spill containment and facility closure activities could be done in accordance with TSCA provisions, the facilities could not achieve full compliance with TSCA due to the underlying paint.

As background, the use of most PCBs at concentrations of ≥ 50 ppm was banned as of July 2, 1979. The only PCB uses that could remain in use after that date, were those specifically authorized by the TSCA regulations. The pre-TSCA use of PCBs in paints, coatings and caulking was never authorized by EPA. The rulemaking record indicates that EPA was unaware of the widespread use of PCBs in paint and other non-liquid products during the development of the PCB regulations. As a result, their continued presence and use is not compliant with TSCA. However, removing these materials is impractical, if not impossible, in most cases.

In recognition of the many compliance issues associated with paint that contains PCBs, SRS began a dialogue with EPA on this subject in 1996. That is the year when SRS first discovered that PCB paints had been used at site facilities prior to the passage of TSCA. Apart from complete removal of the PCB materials, the TSCA regulations did not then, and do not now, provide procedures or methods through which compliance can be achieved for these materials that remain in use. From a practical standpoint, removal is usually not feasible. As SRS developed a program to manage these materials, it shared information concerning that program with the EPA Region and with EPA-HQ. The regulations do not provide a basis for EPA to formally approve the SRS program. However, the SRS philosophy was to make disclosure and to provide EPA the opportunity to comment on and/or object to the SRS approach. The agency has offered no objection to the SRS approach.

To date, the Environmental Protection Agency (EPA) generally has refrained from taking enforcement action against facilities where non-liquid PCB products such as dried paints are present, provided such materials are intact and do not pose an exposure hazard to personnel. For facilities with these materials, establishing, communicating and maintaining a prudent PCB management program serves to reduce the risk of EPA enforcement action. SRS has continued its practice of informing the Environmental Protection Agency of significant developments concerning those materials. The situation involving the SRS reactors is the most recent example of regulatory issues that directly relate to and/or evolve from, the historical presence of non-liquid PCB materials in SRS facilities that were constructed prior to the TSCA regulations. This ongoing dialogue between SRS and EPA has been a vital and part of developing reasonable approaches for managing these PCBs where the current regulation does not provide a realistic means of achieving compliance.

With respect to the communication with EPA concerning the PCB-contaminated sealant, the history of good communication provided a positive foundation. Several other factors contributed to the successful discussion with EPA about the sealant. SRS personnel made a conscious effort to anticipate the questions that the regulator would ask and to have the answers ready. Both environmental compliance staff and operations personnel participated in the preparation for and the conversation with EPA. The photographs that SRS provided to EPA for reference during the phone conversation proved to be particularly helpful. A verbal description of the situation could not have adequately conveyed the extent of the technical and logistical issues involved with any effort to remediate the PCB-contaminated sealant.

IMPLEMENTATION AND WASTE MANAGEMENT COSTS

The process of scraping the horizontal surfaces and installing floor coverings and barricades began in the L-Reactor on October 4, 2010. The process was completed on October 14, 2010. The C-Reactor cleanup was completed on October 28, 2010. Photographs of the completed actions are provided as figures 3 and 4.

The selected cleanup strategies were highly successful in minimizing the generation of TSCA waste. Only 30 gallons of liquid radioactive PCB waste was generated during the cleanup of the 105-L and 105-C facilities. At an assumed disposal (only) cost of ~$200 per gallon the approximate disposal cost of this waste is $6,000. Had a double wash/rinse process been used for the same amount of horizontal surface area, approximately 640 gallons of liquid radioactive PCB waste would have been generated in each facility. At the same assumed per-gallon fee of ~$200 per gallon, the disposal costs for the liquid waste would have been approximately $256,000. The selected strategy for these two facilities yielded a cost savings of approximately $250,000 related only to the disposal fees for the liquid waste. Additional savings were gleaned with respect to costs for labor, packaging, storage, transportation and miscellaneous overhead.

The volume of non-liquid radioactive PCB waste generated from the cleanup of the two facilities totaled 330 gallons. The non-liquid waste is job control waste composed of personal protective clothing and equipment, tools, and old spill containment devices. Had a double wash/rinse cleanup been conducted, the volume of non-liquid waste would have been much higher. Disposal cost estimates were not available as of the date of this draft paper.

Figure 3. Location in building 105-L at -20 elevation that has been cleaned, covered and labeled. Photo does not show the barricade.

Figure 4. C-Reactor, -20 Elevation location that has been cleaned, covered, labeled and barricaded.

SUMMARY

Positive outcomes were achieved by selecting a TSCA-compliant cleanup approach based on facility status, facility conditions, worker safety and health impacts, and waste management efficiencies. Collaboration and effective communication among affected on-site groups and EPA were critical to this process. An established history of forthright communication with the regulatory agency was an especially important element to the ultimate success in managing the PCB-contaminated material in the SRS reactor facilities.

REFERENCES

40 CFR 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

10 CFR 851 Department of Energy Worker Safety and Health Program

10 CFR 835 Department of Energy Occupational Radiation Protection

DOE-STD-1098-99, DOE Radiological Control Standard