CONSOLIDATED INCINERATION FACILITY

FOCUS GROUP

FINAL REPORT

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4/25/04

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4/25/04

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1.SUMMARY

During the March 28, 2000 Savannah River Site (SRS) Citizens Advisory Board (CAB) meeting, the Department of Energy (DOE) stated it was beginning evaluations for suspending the Consolidated Incineration Facility (CIF) operations. During a Waste Management (WM) Committee meeting on April 25, 2000, the reasons to suspend operations were identified as a lack of projected waste streams to be treated by CIF and the resultant high cost to treat the main waste stream, organic solvent and accompanying aqueous phase from the PUREX (see Section 3) and HM solvent extraction processing (PUREX and legacy PUREX in this report). DOE presented additional discussions on the CIF status and future activities during a public workshop on June 5, 2000.

Even though the information was as thorough as could be expected, the SRS CAB members and the public found it to be insufficient to formulate a definitive position regarding the decision to suspend CIF operations. Especially at issue were the lack of verifiable information supplied by DOE to support the decision to suspend CIF operations and the apparent haste in which the decision was being made. The lack of a proven alternative for treatment and disposal of PUREX and the lack of stakeholder involvement in the decision troubled the SRS CAB Waste Management (WM) Committee.

The WM Committee was concerned about the many tasks that must be completed concurrently over the next five years to ensure either re-start of CIF or the implementation of alternate treatment technologies to meet current regulatory commitments. The WM Committee considered the suspension of operations of the CIF to be an important issue to the CAB and the public and decided to form a CIF Focus Group.

The CIF Focus Group (FG) (approved by the SRS CAB on July 25, 2000 see Attachment A) was to follow the activities of the CIF operation suspension and the development of alternative treatment options. The objectives of the FG were to evaluate if the decision to suspend CIF operations was cost effective, if re-start was feasible, and if a less costly treatment alternative was available and could be implemented in a time frame to meet the current regulatory compliance dates.

At the last CIF FG meeting on January 14, 2004, SRS predicted that all of the legacy aqueous PUREX will be disposed of in 2004, as non-hazardous waste through the Effluent Treatment Facility (ETF), and the organic PUREX fraction will be treated by 2007 (approximately 12 years ahead of schedule). While CIF re-start is not cost effective, SRS is well on its way to implementing a less costly treatment alternative for legacy PUREX using a solidification process.

Throughout this time period, South Carolina Department of Health and Environmental Control (SCDHEC) has been working with SRS to determine a regulatory status that allowed CIF to remain in operational suspension, while the alternative treatment option process continued. Without their cooperation and the hard work of DOE-SR and SCDHEC, the expeditious disposal of the legacy PUREX waste would not have happened and the FG thanks them for their effort.

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2. INTRODUCTION/DISCUSSION

During its March 2000 meeting the SRS - CAB was notified that DOE was suspending the CIF operations. At that time, DOE-SR was working with SCDHEC to determine the RCRA permitting status during this interim suspension. It was not clear how the CIF RCRA permit would deal with suspension of operations for an extended period of time, or if restart or closure would be required within a specific time frame. An additional issue of costs related to an alternative disposal technology or restart of CIF was raised.

During a Waste Management (WM) Committee meeting on April 25, 2000, the reasons to suspend operations were identified as a lack of projected waste streams to be treated by CIF and the resultant high cost to treat the main waste stream, spent solvent from the PUREX and HM solvent extraction processes and subsequent aqueous flushes. This organic/aqueous waste liquid is referred to as PUREX.

However, SRS has a Site Treatment Plan (STP) commitment to treat 50% of the legacy PUREX waste by FY09 and the remaining volume by FY19. There are 36,670 gallons of legacy PUREX remaining at SRS that need to be treated. This waste is composed of an aqueous fraction and an organic fraction. Prior to the pause in operations, CIF had treated only 5,330 gallons of the total PUREX volume (42,000 gallons) in three (3) years of operation. The treated volume was associated with the aqueous fraction (i.e., a contaminated liquid that is basically water).

To meet the STP commitments, DOE was required either to re-start CIF at a later time or find another treatment option for the legacy PUREX waste. SRS began a system engineering evaluation in mid FY 00 to determine if there were viable alternatives to re-starting CIF. In either case a RCRA permit modification would be required. In addition to the technical and cost analysis studies performed on each identified alternative, a separate study determined the technical improvements required to increase the throughput rate of legacy PUREX at CIF and to reduce its operational costs.

Clear treatment paths for both PUREX phases have been developed though not fully implemented at the present time. The WM Committee will continue to monitor the progress of PUREX treatment. The CIF Focus Group has subsequently been dissolved.

The CAB contributed to the success of the suspension of CIF operations and path forward to closure and the treatment of aqueous and organic PUREX through the FG. The FG provided review and suggestions to DOE-SR, WSRC, and SCDHEC as to a reasonable path forward which would develop alternatives to the CIF, yet keep CIF as a backup for legacy PUREX disposition. The CAB pushed both the site and the regulators to reach agreements. Nearly half of the legacy PUREX (aqueous fraction) was treated in 2004, five (5) years ahead of the mandate; the remaining legacy PUREX (organic fraction) has a new mandate of 2007, twelve (12) years sooner; and that some stocks of the canyon PUREX (F-Canyon), which was not even on the schedule, is being treated currently and will be finished in 2005. Thus even though the CAB was against the closure of the CIF, it was not apparent in April 2000 that there was a viable alternative for CIF. The CAB and local citizens have worked with both the site and the regulators to accelerate the treatment and disposition of both legacy PUREX and some current stocks of PUREX.

As a result of the FG the CAB adopted the following recommendations:

1. Recommendation #126 (adopted July 25, 2000) – Path Forward for Consolidated Incineration Facility
2. Recommendation #129 (adopted September 26, 2000) – Request for Data/Information on Alternative Technologies to Incineration
3. Recommendation #133 (adopted November 14, 2000) – Consolidated Incineration Facility RCRA Part B Permit Modification
4. Recommendation #136 (adopted January 23, 2001) – Technology Investigation for PUREX Treatment and Incineration
5. Recommendation #141 (adopted July 24, 2001) – Consolidated Incineration Facility (CIF) Closure Schedule Alternatives
6. Recommendation #146 (adopted January 15, 2002) – PUREX Recovery Alternatives
7. Recommendation #152 (adopted April 23, 2002) – PUREX Waste Alternative Treatment Evaluation

3.0 PUREX

The word PUREX is derived from Plutonium-Uranium Recovery Extraction. The PUREX process was developed at the Knolls Atomic Power Laboratory in Schenectady, New York and tested at Oak Ridge, Tennessee. PUREX was adopted for use at SRS in 1954. The PUREX process uses tributyl phosphate in a paraffinic hydrocarbon diluent. Basically, the diluent is a form of kerosene.

At the time CIF operation was suspended, Tanks 33 and 35 contained PUREX waste. Tank 33 had 900 gallons of aqueous and 14,000 gallons of organic PUREX waste. The primary radioactive constituents in Tank 33 included plutonium 238, 239, 240 and 241; americium 241 and 243; and the following fission products: cesium 137; technetium 99; strontium 90; and europium 154. Tank 35 held a total volume of 12,000 gallons of aqueous and 10,800 gallons of organic PUREX waste and had the same radioactive constituents as Tank 33. Plutonium 238 was the most abundant activity in both tanks. The total plutonium in the tanks equaled 2.1 curies. The EPA drinking water standard for total alpha equals 15 picocuries per liter (57 picocuries per gallon). In Tanks 33 and 35, the metal contaminants included arsenic, selenium, mercury, chromium, nickel and zinc.

4. ALTERNATIVES

A PUREX waste alternative treatment study was established to evaluate alternative treatments for the legacy PUREX waste. It used a Systems Engineering Approach to select and develop the best alternative treatments and to compare the best alternative treatments with a defined, optimized CIF treatment. The systems engineering approach, which the study team used, included defining the requirements, identifying potential options, screening out the non-viable options, grading the viable options, establishing a short list of a small number of options, investigating the short list in detail, ranking the short list and selecting the preferred option, and conducting a peer review of the process and results.

The short list of alternatives included the following:

- PUREX Organic Waste
  - Direct Stabilization
  - Offsite Commercial Treatment (with onsite pretreatment)
- PUREX Aqueous Waste
  - Direct to Saltstone
  - Direct Stabilization (if chosen for organic)
  - Tank 50 to Saltstone
  - High Level Waste (HLW) Evaporator/Defense Waste Processing Facility (DWPF)

The stabilization approach for aqueous waste is complicated by its organic content, and the study team didn't pursue the evaporator/DWPF option further because of Authorization Basis problems related to the organic content. For organic waste alternatives, offsite treatment requires an initial pretreatment onsite to lower the alpha radioactivity. Onsite pretreatment is needed because of Department of Transportation (DOT) requirements (only 13 gallons could have been transported at a time in a Type A container) and vendors' technical inabilities to handle high alpha activity.

4.1 Organic

From these alternatives, SRS initiated a Research & Development (R&D) program with Savannah River Technology Center (SRTC). Under the organic waste treatment options, the group worked with a clay material called Petroset II™. This clay material was tested using both the powder and granular forms. In addition to the clay material, two different types of NOCHAR™ Petro Bond and Imbiber Beads™ in both regular and nuclear grade forms were tested. The NOCHAR™ and Imbiber Bead™ products are polymer materials. The samples were prepared with a 1:1 and a 2:1 ratio of waste-to-media by weight, which underwent waste form durability tests in addition to the required regulatory tests.

In addition to examining waste durability, tests also included transportation and disposal stability, which included accelerated aging, vibration cycling and thermal stability. For disposal behavior, tests included radiation stability, microbial degradation, free liquid test, Iodine-129 leachability, saturated water leaching, and pressure stability.

The study team found that for the organic waste, waste stabilization would comply with treatment and disposal requirements. However, pretreatment to remove alpha-emitting radionuclides proved unsuccessful. Stabilization assumes on-site treatment with possible shipment and disposal of the stabilized waste off-site. However, for commercial treatment of liquid wastes, because of the high specific alpha activity, DOT requirements would require a decontamination factor (DF) of approximately 100, which appeared very difficult. In order to overcome the transportation limitations, WSRC spent almost two years procuring an IP-2 container capable of transporting a large volume of legacy PUREX. Such containers were not commercially available in the US and required overseas procurement. Another consideration was the problem with the restrictive waste acceptance criteria (WAC) imposed by off-site thermal treatment vendors to control receipt of high alpha materials. Subsequently, it has been determined that, unlike thermal treatment vendors, there are offsite stabilization vendors whose WAC's will allow them to accept and treat the PUREX organic waste.

The PUREX alternative study recommended that organic PUREX be treated by a new stabilization process. Subsequent to the study's final report, WSRC placed an offsite contract to perform pilot and full size mixing tests for NOCHAR™ and Petroset II™ materials in order to understand mixing parameters and select the preferred stabilization material.

4.2 Aqueous

For the aqueous waste, the team considered onsite treatment including transfer to Saltstone where it would be combined with a grout mixture for stabilization. However, the PUREX aqueous waste exceeds WAC for Saltstone organic content. The Dibutyl phosphate that washes out of the organic phase is in solution in the aqueous phase. These aqueous wastes will not process directly into Saltstone, so mixing is required with the Tank 50 waste. A technical analysis of the addition of aqueous waste to Tank 50 in H-area was preformed. No technical issue was identified other than high organic content for Saltstone. The Tank 50 WAC takes into account the Saltstone WAC.

The PUREX study recommended that aqueous PUREX be transferred to Tank 50 for stabilization in the Saltstone Facility; if Tank 50 is returned to HLW use, the aqueous PUREX should be transferred directly to Saltstone for stabilization. Subsequent to the study's final report, it was recognized that transfers to Tank 50 were not allowed by truck, as assumed in the study, but must be transferred by pipeline. As discussed previously, it was determined that the aqueous waste was non-hazardous and could be treated by the Effluent Treatment Facility (ETF), from where the residual concentrate is transferred to Tank 50 for stabilization in Saltstone.

4.3. DOE Complex

Ms. Helen Belencan (previously with DOE-HQ) gave several briefings to the CIF FG describing the ongoing DOE-HQ use of DOE incineration systems and various study groups (see Attachment C for additional detail on each specific study group). Ms. Belencan outlined each of the studies:

- Blue Ribbon Panel appointed by Secretary Richardson
- Environmental Management (EM) Study Group on Alternatives to DOE Incineration
- SRS Alternative Study Team

5. COSTS

As part of the study of alternatives for CIF, the WSRC study group prepared cost estimates for both CIF optimization and a stabilization process. The table below shows the cost comparison (per page 34 of WSRC-RP-2002-00171).

Option	PUREX Aqueous Treatment	PUREX Organic Treatment	Treatment Cost
# 1	Direct Stabilization	Direct Stabilization	$ 11.1 million
# 2	Consolidated Incineration Facility	Consolidated Incineration Facility	$ 51.8 million
# 3	Tank 50 to Saltstone	Direct Stabilization	$ 10.5 million
# 4	Tank 50 to Saltstone	Consolidated Incineration Facility	$ 52.0 million
# 5	Direct to Saltstone	Direct Stabilization	$ 10.7 million
# 6	Direct to Saltstone	Consolidated Incineration Facility	$52.1 million

The final option selection was based on several evaluation criteria (cost was a major criterion). Based upon the criteria, Option #3 was selected.

6. REGULATORY

On September 27, 2000, SCDHEC initiated a forty-five (45) day comment period on the SRS RCRA Part B Permit modifications to outline the conditions of the CIF's suspension of operations. SCDHEC included in the permit modification a schedule of activities, which SRS must follow. In this schedule, SRS must decide by April 1, 2002 (for the legacy PUREX) to re-start (operate) CIF or pursue an alternative treatment. If SRS decided to pursue an alternative treatment, then CIF must begin final closure on this same date (April 1, 2002). The modification also deleted the permit authorization to operate CIF.

The above modification did not provide the flexibility required to maintain operation of the CIF as an option while alternatives were evaluated. Discussions between SCDHEC and SRS subsequently led to submittal of a RCRA Permit Modification request to SCDHEC on January 8, 2002. In the request, SRS asked SCDHEC to consider the following:

- If SRS decides to pursue an alternative, it would submit annual progress reports to justify continued suspension of CIF operation and request extension of CIF closure
- Within 45 days of denial of extension request SRS would commence CIF closure
- To delete the monitoring requirements for the CIF condensate tanks.

The requested modification was approved and the annual report for 2003 has been submitted.

The aqueous waste from tanks 33 and 35 was transferred to Tank 34 and sampled. Sample results identified it as non-hazardous waste. SCDHEC concurred with the classification of the aqueous legacy PUREX waste as non-hazardous waste to be dispositioned through the Effluent Treatment Facility.

ATTACHMENT

A. CIF Focus Group Charter
B. CIF Focus Group Team Member List
C. DOE Study Group Discussions

Attachment A

Savannah River Site Citizens Advisory Board
FOCUS GROUP CHARTER FORM

Focus Group Title: Consolidated Incineration Facility Focus Group

Sponsoring Committee: Waste Management Committee

Administrative Lead: Wade Waters **Technical Lead:** Bill Lawless

Focus Group Start Date: June 27, 2000 **Focus Group Completion Date:** June 27, 2002

Estimated No. of Members: 12 **Estimated No. of Meetings:** 24

Why is this Focus Group Necessary? The mission of the Consolidated Incineration Facility Focus Group is to stay informed (through DOE/WSRC updates) on the future status/operations of CIF and the review of alternative waste treatment processes; and to participate and offer meaningful input (through peer reviews) in the identification and review process of alternative waste treatment methods and in the decision-making proces on the future status/operations of CIF.

What will the Specific Scope and Activities of this Focus Group Be? The CIF FG will be looking at alternative treatments/technologies for PUREX, non-PUREX, and other potential waste streams identified for incineration throughout the DOE complex. This initiative will complement the following CIF FG topics that were identified in a pre-planning meeting held on June 14, 2000. (See Attachment.)

What is the End Product of this Focus Group? Active participation in the review and future decision-making process regarding CIF. Develop recommendations that align with the FG's mission statement. A final report at the conclusion of the Focus Group's activities, with interim status reports/updates to the WMC.

Submitted By: Wade Waters **Date:** June 24, 2000

Attachment B

CIF Focus Group Members

- Wade Waters, Initial Administrative Lead
- Bill Lawless, Technical Lead
- Perry Holcomb, Technical Lead for PUREX
- Karen Patterson
- William Lawrence
- Bill Willoughby Final Administrative Lead
- Jean Sulc
- Lee Poe
- Bill McDonell
- Lane Parker
- Doug Leader
- Mike French
- Murray Riley
- Ken Goad

Technical Support

- Ray Hannah - DOE-SR/HLW
- Helen Belencan - DOE-HQ
- Peter Hudson - BNFL/SWD
- Sonny Goldston - WSRC/SWD

Public Involvement Support

- Helen Villasor - WSRC/PI/SWD
- Kelly Way - WSRC/PI/HLW

Attachment C

DOE Complex Study Group Discussion

In reviewing the Blue Ribbon Panel, (BRP) Ms. Belencan said it had been formed in April 2000 as a result of a settlement agreement on the *Keep Yellowstone Nuclear Free* lawsuit, which focused on the proposed incinerator component of the Advanced Mixed Waste Treatment Project (AMWTP) at the Idaho Nuclear Engineering and Environmental Laboratory (INEEL). The settlement enabled DOE to proceed with construction of other AMWTP components.

In its charter, the panel was to evaluate whether alternative technologies could be implemented by DOE in time to comply with all legal requirements for treating waste. In addition, the panel was to consider issues raised by the public and evaluate and recommend new technology initiatives that DOE should pursue as alternatives to incineration. The panel also intended to help DOE meet the Secretary's commitment to deal with waste at all of its sites, in Idaho and across the country, and focus DOE efforts on developing the best possible treatment technologies. The Blue Ribbon Panel was chartered solely to look at the Idaho first so that identified technologies could be transferred across the Complex.

The EM Study Group on Alternatives to DOE incinerators studied the availability of viable commercial sector alternatives for waste streams currently targeted for DOE incinerators. Another topic was the decision as to whether DOE should continue its plan to close the Oak Ridge incinerator in 2003. Participants in the EM Study Group included federal and contractor staff from nine DOE field offices/sites and the Navy; DOE-EM-HQ – Office of Integration and Disposition; Idaho EM Integration; and Mixed Waste Focus Areas. Savannah River was a participant.

Both the EM Study Group and the Blue Ribbon Panel relied upon similar resources including the Cooley report, "Analysis of Treatment Systems for Mixed Low Level Waste". Carl Cooley is the lead DOE technical resource for the Blue Ribbon Panel. Ms. Belencan noted that her Study Team is focusing on DOE's three incinerators: CIF, which cannot treat offsite waste under its permit conditions; Toxic Substance Control Act Incinerator (TSCAI) at Oak Ridge, which is slated to treat waste through fiscal year 2003; and the Waste Experimental Reduction Facility (WERF) at the INEEL.

The EM Study Group determined that the majority of wastes could be treated by the commercial sector. Wastes for which commercial alternatives were not identified include those with high levels of mercury contamination, classified waste, sodium-uranium waste, high organic content sludges, and PUREX solvents. Through the Mixed Waste Focus Area, the EM Study Team deferred to the on-going evaluations at SRS to more effectively determine alternatives for the PUREX solvents.

In a March 14, 2001 update, Ms. Belencan summarized analysis performed to date. It appeared that individual sites across the complex had been making unilateral decisions regarding incineration technology. As examples, Ms. Belencan cited the three DOE complex incinerators: the Waste Experimental Reduction Facility (WERF) incinerator at Idaho, which has been shut down; the CIF at SRS, is in a suspension mode while alternatives are evaluated; and the Toxic Substance Control Act Incinerator (TSCAI) at Oak Ridge that was still operational. The

AMWTP incinerator component has been deferred pending the fate of the Blue Ribbon Panel's recommendations. The Oak Ridge TSCA incinerator continues to be the only incinerator (DOE or commercial) capable of treating low-level radioactive waste containing PCBs and other hazardous constituents, and it is the only operating DOE incinerator. The demand for treatment of solid mixed low-level wastes containing PCB's and other hazardous constituents continues through 2007.