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Chemical Exchange Program Analysis

Pascale Waffelaert

Prepared by
Sandia National Laboratories
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Chemical Exchange Program Analysis

Pascale Waffelaert
Environmental Management System
Environmental Planning Department
Sandia National Laboratories
PO Box 5800
Albuquerque, NM 87185-1050

Abstract

As part of its EMS, Sandia performs an annual environmental aspects/impacts analysis. The purpose of this analysis is to identify the environmental aspects associated with Sandia's activities, products, and services and the potential environmental impacts associated with those aspects. Division and environmental programs established objectives and targets based on the environmental aspects associated with their operations. In 2007 the most significant aspect identified was Hazardous Materials (Use and Storage). The objective for Hazardous Materials (Use and Storage) was to improve chemical handling, storage, and on-site movement of hazardous materials. One of the targets supporting this objective was to develop an effective chemical exchange program, making a business case for it in FY07, and fully implementing a comprehensive chemical exchange program in FY08.

A Chemical Exchange Program (CEP) team was formed to implement this target. The team consists of representatives from the Chemical Information System (CIS), Pollution Prevention (P2), the HWMF, Procurement and the Environmental Management System (EMS). The CEP Team performed benchmarking and conducted a life-cycle analysis of the current management of chemicals at SNL/NM and compared it to Chemical Exchange alternatives. Those alternatives are as follows:

- Revive the "Virtual" Chemical Exchange Program
- Re-implement a "Physical" Chemical Exchange Program using a Chemical Information System
- Transition to a Chemical Management Services System

The analysis and benchmarking study shows that the present management of chemicals at SNL/NM is significantly disjointed and a life-cycle or "Cradle-to-Grave" approach to chemical management is needed. This approach must consider the purchasing and maintenance costs as well as the cost of ultimate disposal of the chemicals and materials. A chemical exchange is needed as a mechanism to re-apply chemicals on site. This will not only reduce the quantity of unneeded chemicals and the amount spent on new purchases, but will also avoid disposal costs. If SNL/NM were to realize a 5 percent reduction in chemical inventory and a 10 percent reduction in disposal of unused chemicals the total savings would be $189, 200 per year.

Acknowledgements

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Contents

Figures

Tables

Attachments

Acronyms and Abbreviations

CEP	Chemical Exchange Program
CHEW	Chemical Exchange Warehouse
CIS	Chemical Information System
CMS	Chemical Management Service
DOE	U.S. Department of Energy
EM	Emergency Management
EMS	Environmental Management System
EOD	Explosives Ordnance Disposal
ES&H	Environment, Safety & Health
FD	Fire Department
HWMF	Hazardous Waste Management Facility
IT	information technology
JIT	Just-In-Time
KAFB	Kirtland Air Force Base
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LLNL	Lawrence Livermore National Laboratory
MESA	Microsystems and Engineering Sciences Applications
P2	Pollution Prevention
R&D	research and development
SLAC	Stanford Linear Accelerator Center
SNL/NM	Sandia National Laboratories/New Mexico
SRS	Savannah River Site
WIMS	Waste Information Management System
WDDR	Waste Disposal Description Request

1.0 Introduction

The purpose of this report is to analyze the need for reviving the Chemical Exchange Program (CEP) at Sandia National Laboratories/New Mexico (SNL/NM). When implemented at facilities similar to SNL/NM, such as Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), and the Savannah River Site (SRS), Chemical Exchange programs have proven effective in successfully reducing chemical inventories and the corresponding purchasing and waste disposal costs.

1.1 Background

The SNL/NM CEP was developed in 1989 by Lewis Marlman as a Hazardous Waste Management Waste Minimization program. From 1989 to 1994 Mr. Marlman and one part-time contract technician, responsible for chemical transportation, operated the CEP. Excess chemicals, previously sent for disposal, were put into the chemical exchange using a Chemical Waste Disposal Request Form. Mr. Marlman, with the help of procurement, searched for other lab workers who previously ordered the same or similar chemicals. Item(s) were stored at the Hazardous Waste Management Facility (HWMF) until a user requested the chemical. At that time the chemical was delivered to the requestor. Chemicals available for exchange were advertised in the Sandia Weekly Bulletin, a communication instrumental to the success of the CEP. During this time, approximately 90 percent of the chemicals coming into the chemical exchange were re-applied. The quantity of chemicals and their cost avoidance (purchase of new chemicals and disposal costs avoided) was reported on a monthly basis. From August 1989 to March 1993 SNL/NM saved $217,830.13 (approximately $62,240 annually) by reapplying chemicals.

In 1994, Bill Suderman took over as the manager of the CEP and the handling and transportation duties were taken over by Rinchem Company, the HWMF Operations & Management contractor. The transportation of chemicals for CEP was combined with routine waste transportation activities. By combining the tasks, there was no longer a need for the half-time technician. After mid 1994, budget reductions and increased work no longer allowed the program manager the necessary time to track materials as closely as was the case in earlier years. Additionally, improved Environment, Safety & Health (ES&H) and procurement practices resulted in a reduction in the volume of chemicals passing through the CEP.

In 1998, the CEP was suspended. A virtual CEP was put in place in 2002 and functioned through a website. When a chemical owner deemed an item to be excess, the owner emailed the information to the CEP database custodian who entered the information into the “Material Available” database. The owner would continue to store the excess chemical until either someone requested the chemical or the owner determined they had waited long enough and declared it waste. If a request was made for the chemical, the CEP custodian contacted the owner of the chemical and arranged for transfer to the new owner. The website was advertised using links on other websites, the Sandia Daily News, and the Porcelain Press. Currently, the website still exists but is not functional. Chemicals continue to be posted on the CEP database; however, the system is not user-friendly and no chemicals have been reapplied for several years.

In 2005, as part of its EMS, Sandia performed an annual environmental aspects/impacts analysis. The purpose of this analysis is to identify the environmental aspects associated with Sandia's activities, products, and services and the potential environmental impacts associated with those aspects. The most significant aspect identified was Hazardous Materials (Use and Storage). Division and environmental programs established objectives and targets based on the environmental aspects associated with their operations. The objective for Hazardous Materials (Use and Storage) is to improve chemical handling, storage, and on-site movement of hazardous materials. One of the targets supporting this objective is to develop an effective chemical exchange program, making a business case for it in FY07, and fully implementing a comprehensive chemical exchange program in FY08.

A team was formed to implement this target. The team consists of representatives from the Chemical Information System (CIS), Pollution Prevention (P2), the HWMF, Procurement and the Environmental Management System (EMS). The team meets a regular basis to discuss logistics of all aspects of the CEP.

2.0 Chemical Management Benchmarking

Jack Mizner and Pascale Waffelaert performed benchmarking of chemical management systems at two U.S. Department of Energy (DOE) facilities, LLNL and the Stanford Linear Accelerator Center (SLAC) in May 2007. In addition, Pascale Waffelaert conducted benchmarking of the chemical management systems being used at SRS and LANL via telephone. The purpose of the benchmarking is to compare the chemical management processes at similar sites to identify best practices and to determine areas of improvement at SNL/NM.

2.1 Lawrence Livermore National Laboratory

LLNL, a DOE facility operated by the University of California, serves as a national resource of scientific, technical, and engineering capabilities. The Laboratory's mission focuses on nuclear weapons and national security, and over the years has been broadened to include areas such as strategic defense, energy, the environment, biomedicine, technology transfer, the economy, and education. The site occupies an area of 3.28 square kilometers on the eastern edge of Livermore, California. Lawrence Livermore has a staff of over 8,000 employees of which over 3,500 are scientists, engineers, and technicians.

The program at LLNL is called the Chemical Exchange Warehouse (CHEW) and it is linked to Chem. Track, their chemical information database, as well as their procurement and waste management systems. The combination of these systems provides a holistic, life-cycle approach to managing chemicals. There are several ways of getting chemicals from CHEW:

1. If a requester is ordering a chemical that is already available through CHEW, then a flag/warning box is displayed informing the requester that they can obtain the chemical at no charge through CHEW.

2. The CHEW can be searched directly for desired chemicals either through web or by calling the CHEW Hotline.

Once a chemical is requested, a CHEW Technician takes the chemical from the warehouse and delivers it directly to the requester and ownership is transferred to the new owner in Chem. Track.

A chemical comes to CHEW when either the owner deems it excess or during lab clean-outs. The chemical must meet specific criteria to be accepted into the CHEW. These criteria include, the integrity of the container; the expiration date of the chemical, the original container with its label, the type of chemical and a maximum storage quantity for each chemical,. A given chemical may be denied for the CHEW if that quantity has already been met. If a chemical is denied for the CHEW it is then deemed as waste and disposed.

Since the launch of the CHEW, LLNL has experienced a 5 percent reduction in chemical inventory per year.

2.2 Stanford Linear Accelerator Center

The SLAC is a government-owned facility operated by Stanford University and is located on about 430 acres of Stanford land leased to the federal government. SLAC is open to all scientists worldwide on the basis of proposals submitted for peer review. SLAC conducts fundamental research, unclassified in nature, and widely published in the scientific literature. 3000 scientists from about 25 nations use SLAC facilities to do their research.

In response to new regulatory requirements, SLAC evaluated their management of chemicals during 1999-2000. They realized that the chemical "flow" across SLAC needed improvement and a chemical information management system should be part of any solution. During 2000-2001, SLAC participated in the Silicon Valley Pilot Project conducted by Chemical Strategies Partnership. The goal of the project was to test Chemical Management Services (CMS) throughout facilities in the Silicon Valley. CMS is defined as a service, performed by a qualified provider, to manage all or a portion of the procurement, quality, material management, Environmental, Safety and Health (ESH), and waste management tasks related to chemicals and hazardous materials. A CMS program seeks to optimize the chemical supply chain through supplier replenishment at the point of using a pull strategy. This strategy emphasizes improving material consumption data, shelf-life management, environmental reporting, and Material Safety Data Sheet management and reducing non-value added operator time, inventory levels, storage requirements and waste. SLAC was the only research and development (R&D) facility that participated. Based on the success of the pilot study, SLAC implemented a CMS in 2005. Eight companies bid on the contract and Haas was chosen as SLACs CMS contractor.

Haas manages chemicals and hazardous materials at SLAC through procurement and on site inventory but does not yet manage the waste. Currently, the Haas services include the following:

- 1 full-time Haas employee on site
- Office support and purchasing
- Information Technology (IT) support
- Local warehouse storage

- Delivery services
- Consulting services

In addition to these services, Haas is expected to evaluate operations to identify better ways to manage chemicals. If, through these evaluations, changes are made and there is a cost reduction the resultant savings are split between SLAC and Haas. On the other hand, if the change is initiated by SLAC the savings are not split.

2.3 Savannah River Site

The Savannah River National Laboratory is the applied R&D laboratory at the SRS. The laboratory applies state-of-the-art science to provide practical, high-value, cost-effective solutions to complex technical problems. The SRS, a 310 square mile site, is located in South Carolina.

The SRS uses a life-cycle approach to manage chemicals through their Excess Program in their Chemical Management Center. The center includes staff from procurement, chemical technicians, chemical coordinators and IT and waste management personnel. To prevent unwanted chemicals from coming on site, a requestor must complete a Chemical Request Form. Chemical Request Forms are screened for, but not limited to, threshold limits, ozone depleting substances, and availability in the Excess Program. If the request is denied, the requester is notified by telephone. The chemicals are stored on site in a warehouse until it is requested. Anything not inherently waste like is accepted into the Excess Program with the exception of mercury compounds and contaminated opened containers. The material is kept in the warehouse for two to three years after which it is disposed. If a chemical can not be re-applied to a new owner on site, the program will attempt to donate the material to U.S. Government Services Administration listed entities. The donor and requester of chemicals in the Excess Program are responsible for the transportation between the warehouse and their chemical storage location. Waste generation has greatly diminished at SRS since the Excess Program was put into place. Between 2002 and 2006, the Excess Program at SRS reapplied approximately 100,000 pounds of chemicals a year. This represents a cost savings (purchase of new chemicals and disposal costs avoided) of approximately five million dollars a year.

2.4 Los Alamos National Laboratory

LANL is a DOE national laboratory, managed and operated by Los Alamos National Security, LLC (LANS), located on 36 square miles in Los Alamos, New Mexico. The laboratory is one of the largest multidisciplinary institutions in the world. It employs approximately 12,500 LANS employees plus approximately 3,300 contractor personnel and 700 students. The staff collaborates with universities and industry in both basic and applied research to develop resources for the future.

LANL is also working on improving the management of chemicals on site. Currently, LANL is upgrading their computer inventory system, ChemLog, to interact with the waste inventory system to have a more accurate inventory of chemicals on site. In addition, LANL is moving toward a unified “punch card” system where only Designated Purchasing Representatives will be able to purchase chemicals online through the Just in Time (JIT) supplier. This will help prevent

unneeded or excess chemicals from coming on site. Currently, orders take 8-10 days but the goal is a maximum delivery time of 4 days.

LANL does not currently have a Chemical Exchange. In the past, a physical chemical exchange did exist and was successful. Unfortunately, the person running the program left that position and no one else took it over. The storage location was left unmanaged and eventual became a liability to the lab. In the future, LANL does plan on incorporating a "Recycle" button into the ChemLog system and exchanging chemicals within Tech Areas.

2.5 Summary of Benchmarking

The benchmarking studies revealed several key factors for successful chemical exchange programs at facilities similar to SNL/NM. These include the following:

- **Physical Location for Chemical Storage.** Not all chemicals sent to the Chemical Exchange Program have immediate needs for redistribution. Therefore, for the system to work, it is necessary to have a designated storage location until a request for the chemical is made. The success of the LLNL and SRS Chemical Exchange Programs is partially attributed to having a physical location to store the chemicals until they are requested. At SNL/NM, the HWMF could serve this function.

- **No Cost to the Requester or Submitter.** This is a major incentive to acquiring needed chemicals or dispositioning unneeded chemicals. In an atmosphere of continually tightening budgets, any initiative that allows projects or departments to reduce costs is welcome and will be used. The idea of obtaining needed chemicals or disposing of unneeded chemicals at zero cost would likely be as successful at SNL/NM as at the facilities that were benchmarked.

- **Quick Turn-around Time.** It is crucial that request for both pickup and delivery of chemicals is completed in as short a timeframe as possible. Ideally, the time between a request for a chemical and the time it is delivered should be no greater than the time it takes to deliver a new chemical order. At SNL/NM, personnel from the HWMF could perform the transfer of chemicals.

- **A Life-Cycle Approach to Chemical Management.** For the Chemical Exchange Program to be successful, the true cost of chemicals must be viewed in total. This life-cycle view must include the purchase price as well as the cost of storage and disposal. Facilities such as LLNL and SRS have successfully communicated this concept to their employees, engaging their support for chemical exchange. A similar publicity campaign at SNL/NM will likely have the same positive results.

3.0 Analysis of Current Management of Chemicals at SNL/NM

As a part of the EMS Corporate Target to develop an effective chemical exchange program, the CEP Team conducted a life-cycle analysis of the current management of chemicals at SNL/NM and compared it to Chemical Exchange alternatives. The scope of the analysis included the cost

of chemical purchases, waste disposal, inventory management, and related incidents for the last four to six years.

3.1 Current Operations

At SNL/NM chemicals are purchased a number of ways. The most common method is to acquire chemicals through the JIT contract by either calling or faxing an order to the JIT provider (Fisher Scientific). Although systems are in place to prevent P-Card purchases of chemicals and discourage the use of purchase order for chemicals, approximately 15 percent of the chemical inventory is purchased outside the JIT contract. The majority of these purchases are low-value, commercially available materials. If the chemical is ordered through the JIT contract company, a barcode is placed on the chemical, and it is delivered to the user. The barcode information is provided to the CIS staff for processing. If the chemical is obtained by other means, it is the user's responsibility to order and place a barcode on that chemical and enter the information in CIS. If a chemical is entirely used then the container is disposed as solid waste or recycled and the chemical is removed from the CIS inventory. If a chemical is no longer needed it either remains in laboratory storage or is disposed of a hazardous waste. Once it is processed as waste it is taken out of the CIS inventory. Annually, CIS conducts a physical inventory of all chemicals on site to reconcile the CIS database with the physical inventory. Figure 1 is a flowchart of SNL/NM's current chemical management.

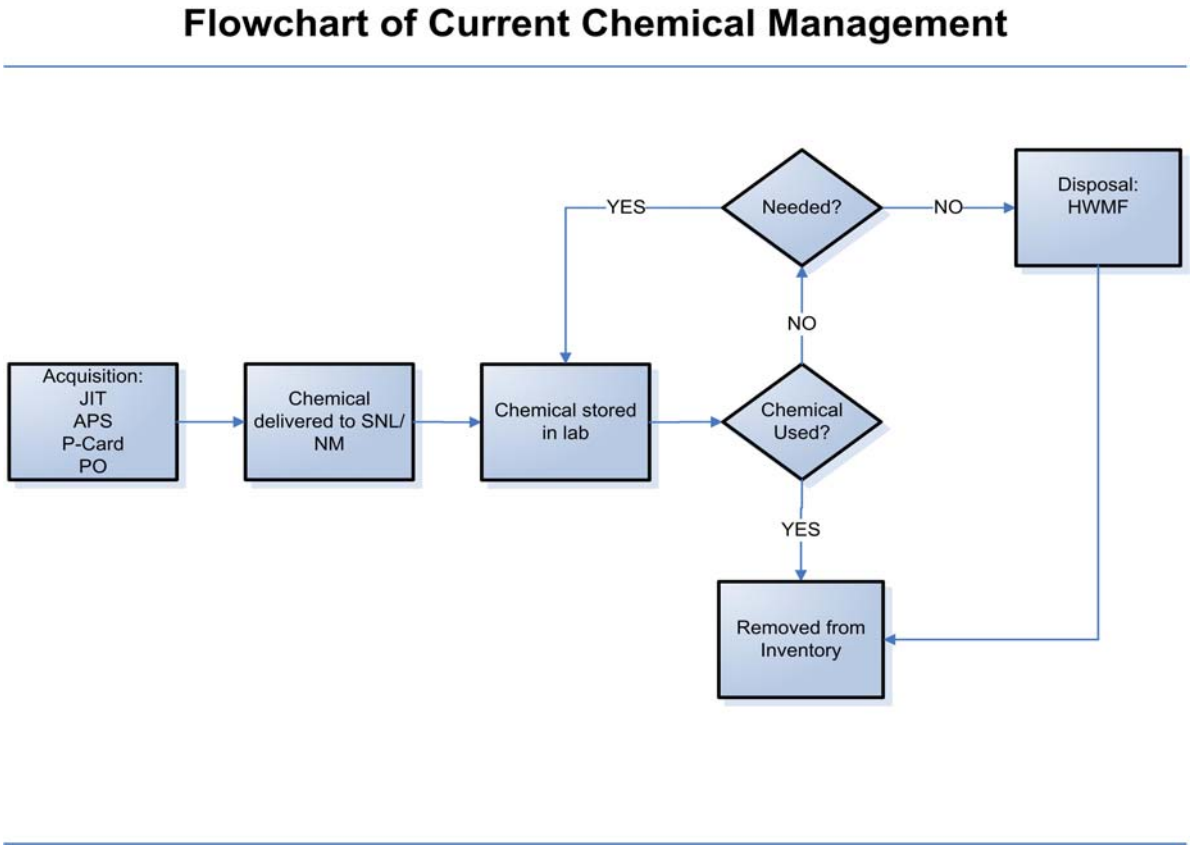

Figure 1. Flowchart of Current Chemical Management.

The baseline cost to manage chemicals at SNL/NM is currently approximately $7,278,800/year. This cost includes chemical purchases, waste disposal through the HWMF, inventory management and maintenance of the CIS, and chemical related incidents. Figure 2 shows each of these functions and their associated costs. The cost of chemicals purchased outside of the JIT contracts is not captured in this analysis. The total disposal costs include the costs for transportation, the Waste Information Management System (WIMS) maintenance and storage, and disposal by the HWMF. The cost for unused chemicals is only for those chemicals that were described as unused on the Waste Disposal Description Request (WDDR). It should be noted that not all the items marked as Unused on the WDDR may in fact, be unopened and unused (a proposed criteria for SNL/NM's CEP). There is no distinction between partially used (residual left in container), opened and unused and unopened. It should also be noted that many waste generators do not mark unused chemicals as unused on the WDDR. Chemicals described on the WDDR as unused account for 25 percent of total packages sent for disposal and one percent of the total weight. Table 1 provides the weight, number of packages and cost for unused chemicals since 2001. The cost of managing chemicals was estimated by using the cost to maintain the CIS and the cost to store chemicals. The cost of storing chemicals was estimated by using space charge costs for space types associated with hazardous waste or chemicals (general lab space, high bay lab space, special lab space and hazardous waste facilities). Other costs of managing chemicals, such as barcoding and delivery are incorporated in the procurement costs.

The cost of chemical-related incidents is summarized in Tables 2, 3 and 4. This cost does not include the cost of root cause analysis or corrective actions resulting from the chemical incident. A breakdown of estimated costs for chemical related incidents was separated into two categories: Table 2 provides a listing of incidents where a building was evacuated and Table 3 lists incidents where no evacuation occurred. An estimated yearly total for chemical related incidents is shown in Table 4.

The cost of an incident causing an evacuation was estimated using data from the evacuation of Building 897 on January 11, 2007. The incident occurred because two incompatible chemicals were stored in the same un-vented cabinet, causing the formation of crystals on one of the containers. The following personnel numbers were involved in the event:

- 1 Incident Commander for 7 hours
- 1 Operations Chief for 7 hours
- 6 ERT members for 7 hours
- 2 Paramedics for 2 hours
- 5 members of the Kirtland Air Force Base (KAFB) Fire Department (FD) for 3 hours
- 4 members of the KAFB Explosives and Ordnance Disposal (EOD) Team for 4 hours
- 1 Security Lieutenant and 3 Security Police Officers for 6 hours
- 200 personnel from 897 were evacuated for 2 hours

Current Chemical Management Costs at SNL/NM

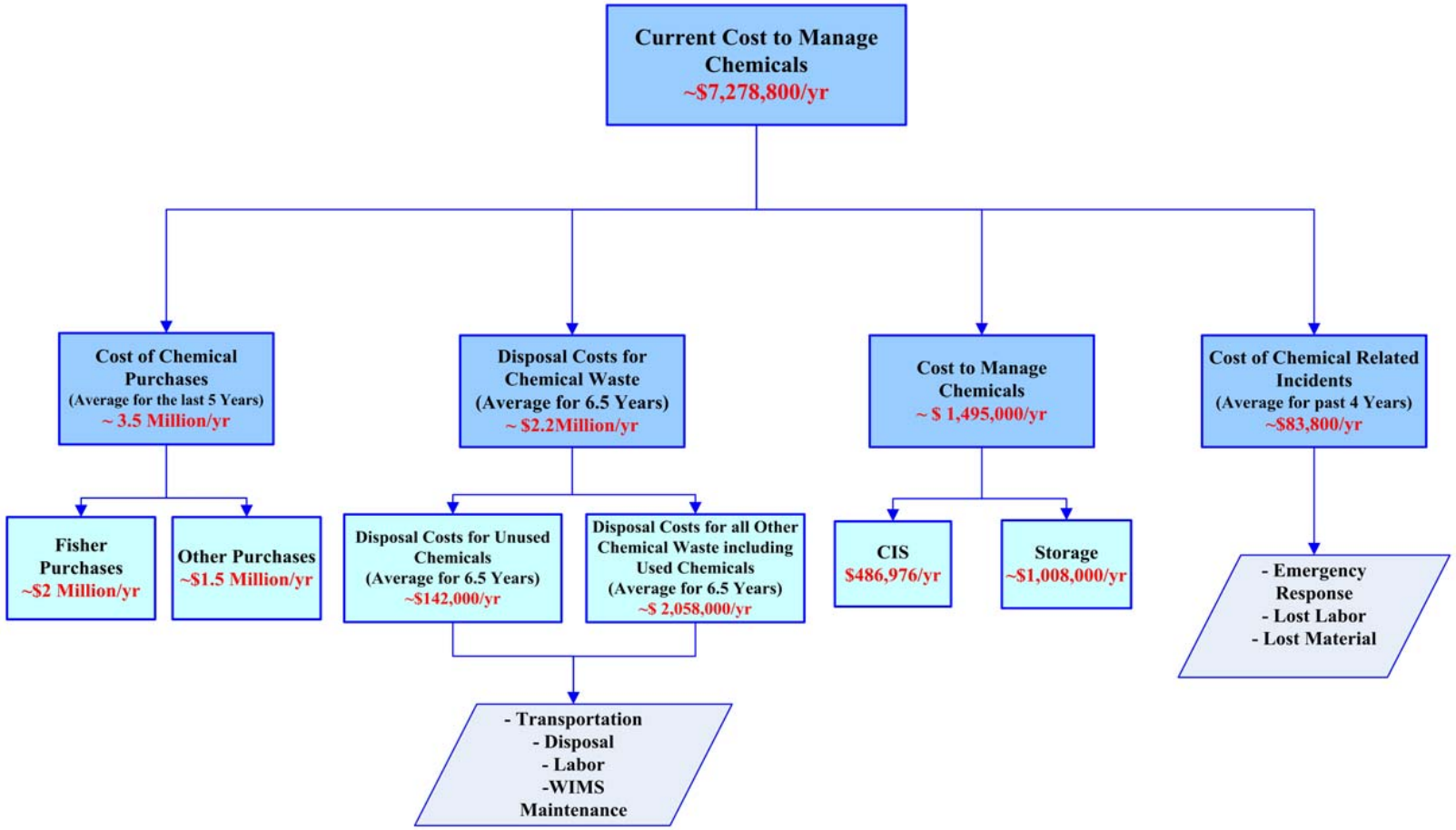

Figure 2. Current Chemical Management Costs at SNL/NM.

Table 1. Cost of Disposal for Unused Chemicals.

Record Year	Weight (kg)	Number of Packages	$ Invoiced at $24.00/kg
2001	540.03	327	$12,960.73
2002	3,628.60	1461	$87,086.40
2003	8,234.02	1520	$197,616.36
2004	5,285.70	2850	$126,856.80
2005	13,646.40	2581	$327,513.60
2006	5,594.60	2940	$134,270.40
2007 (YTD)	1,531.80	1326	$36,763.20
Total	**38,461.15**	**13,005**	**$923,067.49**

Table 2. Estimated Evacuated Chemical Related Incidents (Based on Incident on January 11, 2007 at Building 897).

	Emergency Management (EM) Response	Number of People	Cost
SNL/NM EM TEAM	Incident Commander	1	$385
	Operations Chief	1	$455
	ERT members	6	$1,680
	Paramedics	2	$140
	Security Lieutenant	1	$300
	Security Police Officers	3	$630
	Emergency Operations Center was staffed with approximately 15 personnel for 4 hours.	15	$3,000
KAFB	Members of the FD (In kind service)	5	$0
	Members of the EOD (In kind service)	4	$0
SNL/NM STAFF	Evacuated Personnel for two hours	200	$40,000
Materials Cost	N/A		$15,000
	Total	**238**	**$61,590**

Table 3. Estimated Non-evacuated Chemical Related Incident (Based on Incident at MESA).

	EM Response	Number of People	Cost
SNL/NM EM TEAM	Incident Commander	1	$220
	Operations Chief	1	$260
	ERT members	6	$960
	Paramedics	0	$0
	Security Lieutenant	1	$200
	Security Police Officers	3	$420
	Emergency Operations Center was staffed with approximately 15 personnel for 4 hours.	4	$800
KAFB	Members of the FD (In kind service)	0	$0
	Members of the EOD (In kind service)	0	$0
SNL/NM STAFF	Evacuated Personnel	0	$0
Materials Cost	N/A		$1,000
	Total	**16**	**$3,860**

Table 4. Estimated Yearly Cost of Chemical Related Incidents at SNL/NM.

Type of Incident	Cost of Incident	Number of Incidents (2003–2007)	Average Cost per Year
Evacuation Incidents	$61,590	3	$46,193
Non-Evacuation Incidents	$3,860	39	$37,635
	Total	**42**	**$83,828**

Rates are estimated and assumed to represent fully burdened costs. Material costs were taken from the estimate the non-evacuation scenario. The cost of incidents where no evacuation occurred was provided by Richard Saiz using a recent spill at the Microsystems and Engineering Sciences Applications (MESA) complex as a representative example. The estimate for a four-hour response assumes the use of materials that include resistant suits, spill pillows, drums, floor dry, and neutralizer. The estimate also included hazardous waste disposal costs, responder costs, and self-contained breathing apparatus refill cost. Neither estimate considered collateral damage such as equipment or product loss. Rates are estimated and assumed to represent fully burdened costs.

3.2 Alternative Options

Based on the effectiveness of both past and current chemical operations at SNL/NM, three alternative options were developed as possible paths forward. The three options are as follows:

- Revive the “Virtual” CEP
- Re-implement a “Physical” CEP using CIS
- Transition to a Chemical Management Services System

3.2.1 Revive the "Virtual" Chemical Exchange Program

The website for the CEP and the corresponding database containing CEP information is still in existence. Chemical owners can easily go to the website, fill out the form, and submit a chemical for exchange. Individuals who need specific chemicals can browse the list of chemicals for chemicals of interest. Once a needed chemical is identified, the CEP custodian arranges for transportation of the chemical to the laboratory where it is needed. Based on benchmarking, the history at SNL/NM, and transportation efficiency, this option was not pursued for future evaluation.

3.2.2 Re-Implement a "Physical" Chemical Exchange Program Using a Chemical Information System

SNL/NM already reuses and reapplies many items, including excess office and electronic equipment. The reuse of excess chemicals is the next logical step. Not only is a chemical exchange good practice, but it can also significantly reduce costs by avoiding new purchases and eliminating waste disposal.

Based on the history of the CEP at SNL/NM, combined with a study of the benchmarking performed at LLNL and SRS, the best results occur when the CEP occupies a specific physical location. The logical storage location for the SNL/NM CEP is the HWMF, which has the available facility space and existing regulatory and health and safety rigor. The CEP database will be programmed to send out notifications automatically therefore the advertising will not rely on one person. Chemicals will be picked up and delivered by properly trained HWMF Staff during routine operations and will not add an additional transportation burden.

Figure 3 illustrates the process flow of the proposed CEP. Lab owners identify chemicals as available for exchange and submit them to the CEP database via the CEP Website. This automatically notifies the CEP custodian via email that a new chemical was added to the system. Chemicals are approved by the CEP custodian based on the CEP Acceptance Criteria (Attachment 1). Once approved, the system notifies other users that that chemical is available through CEP. The chemical may then be transferred to the CEP storage location or may remain in the laboratory depending on the HWMF pick-up schedule. A list of available chemicals will be posted on the CEP Website, making it easy for interested parties to browse the database and request desired chemicals.

When a chemical is requested, the CEP Custodian will arrange the transfer. Transfer of the chemical either to the storage location or to the requester will be done by a technician of the HWMF. On a weekly basis, the CEP will send an updated list of available chemicals to the researchers. The CEP Custodian will also advertise available chemicals through the Sandia Daily News, the Porcelain Press, P2 Representatives, and Environmental Compliance Coordinators.

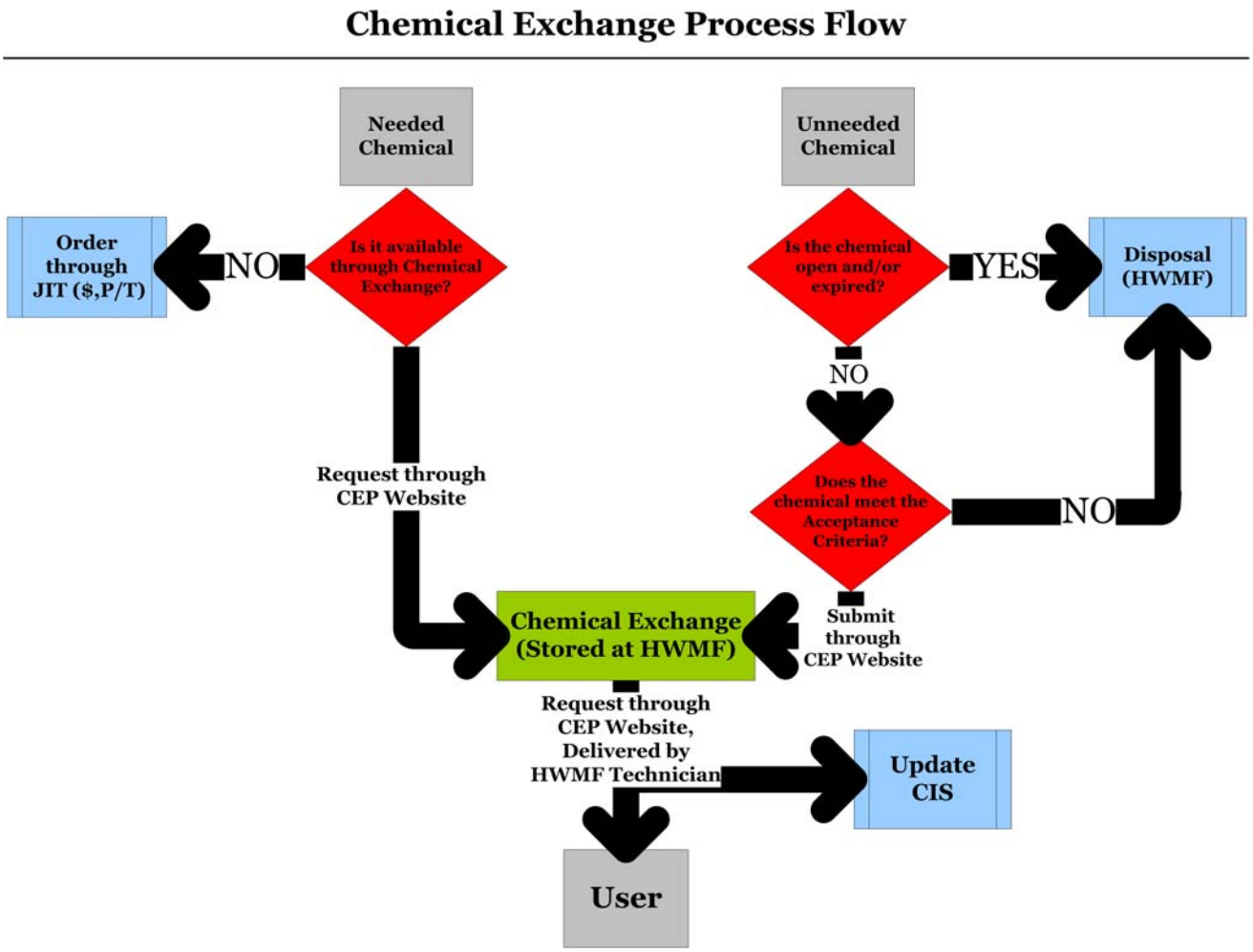

Figure 3. Chemical Exchange Process Flow.

3.2.3 Transition to a Chemical Management Services System

A third option involves establishing a contract with a qualified CMS provider to manage all or a portion of the procurement of chemicals and hazardous materials. The contractor would also be responsible for quality, material management, ES&H, and waste management tasks related to chemicals and hazardous materials at SNL/NM. This option is currently being explored by the corporation.

4.0 Recommendation

At the present, management of chemicals at SNL/NM is significantly disjointed, as researchers can procure chemicals using a wide variety of procurement methods. Typically, these individuals do not check existing inventories or ES&H limits when placing an order. This results in the accumulation of excess chemicals in laboratories. Many times chemicals are disposed

because they exceed the expiration date or are no longer needed by the project. In many cases, these chemicals could have been used by another researcher. Clearly, this is an inefficient process as it wastes resources and generates unnecessary hazardous waste and costs. A life-cycle or "Cradle-to-Grave" approach to chemical management is needed at SNL/NM. This approach must consider the purchasing and maintenance costs as well as the cost of ultimate disposal of the chemicals and materials.

It is recommended that mechanisms be developed and implemented to regulate the chemicals being ordered. This includes implementing a system to determine if the chemical is already available onsite or if less hazardous or more environmental friendly alternatives are available either through the CEP or the supplier. Since SNL/NM is a R&D facility, the need to order a variety of chemicals is ongoing and as a result, excess chemicals will continue to exist due to changing or ending projects and processes. A chemical exchange is needed as a mechanism to re-apply chemicals on site. This will not only reduce the quantity of unneeded chemicals and the amount spent on new purchases, but will also avoid disposal costs.

For example, if SNL/NM were to realize a 5 percent reduction in chemical inventory, as did LLNL, this will result in a $175,000 reduction in new chemical purchase per year. Concurrently, a decrease in disposal cost of unused chemicals would be seen. If 10 percent of the chemicals submitted as unused chemicals on the WDDR were placed in the CEP, it would avoid $14,200 in disposal costs. In this scenario, the total savings of purchases and disposal would be $189,200 per year.

During FY07, the CEP was partially implemented to support the Unneeded Material and Chemicals (UMC) Initiative. As part of the UMC Initiative an inventory of unneeded chemicals was established. Unopened, unexpired chemicals with no further use in their current location were submitted to the CEP. Once a chemical was submitted, the CEP Coordinator advertised by email the new chemicals available for exchange. Researchers interested in those chemicals then requested them via email or phone. A lab move form was then submitted by the CEP Coordinator to the HWMF, who executed the transfer. From July – August 2007, 161 chemicals were submitted to the CEP of which 38 were reapplied. A reapplication rate of 24 percent in such a short time frame is evidence that the CEP can again be successful. Looking forward to full implementation, a database was developed and the CEP website was completely revamped to allow chemical users to list and request unneeded chemicals, to track the pick-up and delivery of chemicals, and to provide a full reporting and analysis capability. The web site will be fully functional by the end of FY07.

The cost to fully implement and maintain the CEP should be modest. It will require approximately $22,000 to support the CEP Coordinator for FY08 and a maintenance budget of $15,000 for the following years. Currently, the HWMF is transporting the chemical exchanges as part of their normal waste pick-up schedule, and providing interim storage at no cost. Database development and maintenance is being funded by Center 4100 support. If the volume of chemical transfers greatly increases or the HWMF funding profile changes, additional funding for pick-up, storage and delivery of chemical may be required.

In summary, a life-cycle approach, which includes procurement controls and chemical reapplication, will create a more efficient management of chemicals and, in turn, save money and decrease liability for the corporation. A flowchart of the life-cycle approach is shown in Figure 4. Based on this analysis, the author recommends that SNL/NM implement a CEP that includes the following essential elements:

- A physical Chemical Exchange Location
  - An option for funding could be a tax on new chemical purchases

- A unified procurement system that is integrated with both the CIS and WIMS

Alternatively, a CMS is also a viable option provided that the contract includes the current chemical inventory and provides for take back and reapplication of unneeded chemicals.

Life Cycle Approach

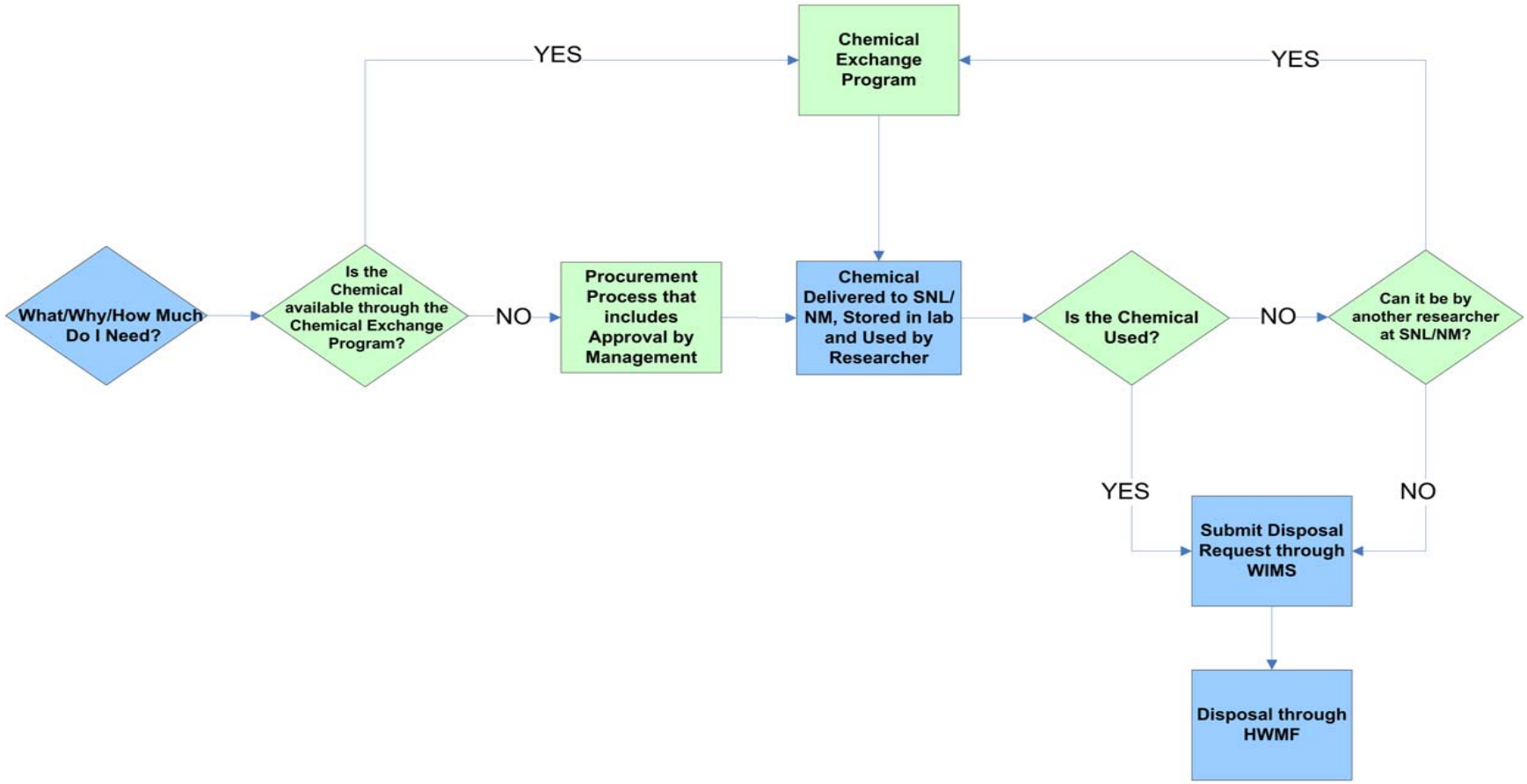

Figure 4. Life-Cycle Approach Flowchart.

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ATTACHMENT 1

Acceptance Criteria for Chemical Exchange

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Acceptance Criteria for Chemical Exchange

Chemicals eligible for the CEP should meet the following requirements:

- Unopened
- Unexpired (and will not expire within 6 months)
- Has a CIS Barcode
- Has the original manufacturer's label

Chemicals not eligible for the CEP:

- Specialized chemicals (e.g. no other potential users)
- Aerosols
- Paints
- Gases
- Explosives
- Radioactive material
- Organic Peroxides (e.g., crystallized chemicals, including isopropyl ether, divinyl ether, ethyl ether, tetrahydofuran, styrene, vinyl chloride).
- Poison-Inhalation Hazards (e.g., hydrogen sulfide, arsine, hydrogen cyanide, hydrogen selenide).
- Infectious substance or Biosafety Level 2 substance.
- Special storage requirements.

Chemicals will be evaluated on an individual basis for acceptance into the CEP.

Distribution:

1	1037	Brandhuber, Robert, 4131
1	1042	Hue-Su A Hwang, 4131
1	1050	Lisa Hooper, 4127
1	1042	Jack Mizner, 4131
3	1050	Pascale Waffelaert, 4131
1	1117	Lorenz Spangler, 4139
1	1483	Amy Ellington, 10248
1	1037	Randy Castillo, 4127
1	1093	Bonnie Little, 4131
2	0899	Technical Library, 04536
2	9018	Central Technical Files, 08944