THE ERGONOMICS OF CHEMICAL CONTROL AT THE PALO VERDE NUCLEAR GENERATING STATION

Kent Anderson
Associated Technical Resources, Inc.
Park Ridge, Illinois

Thomas Hillmer and Mannie Carpenter
Palo Verde Nuclear Generating Station
Wintersburg, Arizona

ABSTRACT

Over the past three years the Palo Verde Nuclear Generating Station has developed and implemented a comprehensive chemical control program. The program encompasses all regulatory requirements, industry guidelines, and manufacturer recommendations related to hazardous chemicals for both the compliance groups and employees. More than 35,000 man-hours were expended in the development, implementation, and maintenance of this program. This paper details that effort and outlines the resource allocation and summarizes the lessons learned.

SITE INTRODUCTION

The Palo Verde Nuclear Generating Station encompasses seven square miles and includes, three 1270 Mega Watt Combustion Engineering reactors, a water reclamation facility that processes all the water used at the site and all site ancillary buildings. When the primary construction was completed, a 15 year project, approximately 3,500 chemicals were turned over from the primary contractor. When preparing to implement the Occupational Safety and Health Administrations (OSHA) Hazard Communication requirements, these chemicals could not be matched with specific Material Safety Data Sheets (MSDS) even though 40,000 MSDS were available on site. This was because there was no tracking program used during construction.

BACKGROUND

In response to findings associated with the control of chemicals, a commitment was made to set up a site wide chemical control program to control (regulate/manage) chemicals during procurement, storage, issue, use, and disposal. The goal was to insure the protection and safety of the public, employees, and plant equipment. This would facilitate compliance with all applicable Regulatory Guidelines and Industry Good Practices and, as an added benefit, simplify compliance for all employees.

The primary action taken on the program development was divided into two phases. The initial phase included the determination of regulations or controls required for site chemicals. The second phase included the performance of an industry wide survey to determine how other nuclear utilities controlled their chemicals.

REGULATIONS

The initial phase identified the following regulations or controls for site chemicals; Nuclear Regulatory Commission (NRC) and Burial Site specific regulations for radioactive waste disposal; System Compatibility with radioactive waste processing systems (Because the site is zero discharge, additional controls were needed to minimize foaming in the evaporators and organic and sodium fouling in the resin beds); Joint EPA/NRC guidance clarifying the definition of "Mixed Waste"; System Compatibility for chemicals introduced into or on primary and secondary systems to maintain system warranties; INPO Performance Objectives; Resource Conservation and Recovery Act (RCRA); Superfund Amendments and Reauthorization Act (SARA); OSHA Hazard Communication Program; and National Fire Protection Association (NFPA) requirements.

ESTABLISHING THE PROGRAM

The regulations and guidelines outlined above were controlled through individual procedures managed by several compliance groups (see Fig. 1). There were fundamental problems identified with the existing procedures. The most notable problem being the volume of low visibility procedures, that is, most of the work force was not aware of their specific requirements. An additional problem was that the procedures sometimes gave unclear guidance or if specific guidance was given it often conflicted with other site procedures.

The second phase identified different programs industry wide but none encompassed all the regulations under one high visibility program. Upon completion of the survey, sites with the most encompassing programs were visited to discuss how they set up their program, what problems they encountered, how effective were their programs, and, the lessons learned during development and implementation. In addition to the site visits, all commercially available software was evaluated. This software, for the most part, was specific for each regulation and modifying it for the nuclear application was not feasible.

A task force was established to review this information and develop a Chemical Control Program. The initial task force included representatives from the seven primary com-

Compliance groups controlling chemicals at PVNGS.

COMPLIANCE GROUP	REGULATIONS
1) Radwaste	NRC Radwaste Systems Compatibility Mixed Waste
2) Safety	OSHA
3) Industrial Hygiene	OSHA
4) Environmental	SARA RCRA
5) Chemistry	INPO
6) Nuclear Engineering	PRIMARY SYSTEM COMPATIBILITY
7) Fire Protection	NFPA

Fig. 1. Compliance groups.

pliance groups (see Fig. 1) and over twenty end user groups. Initially, the compliance groups outlined what regulations or controls were required. Once the task force was familiar with the requirements and the pros and cons of other utility programs, they broke into small working groups for discussion. Each group developed a mockup program that would insure and simplify compliance. These programs were evaluated and a final program developed.

The final program included the formation of a Chemical Use Review Board (CURB). This board, made up of the seven primary compliance groups (see Fig. 1), met on a weekly or as needed basis to review chemicals prior to their purchase. The requestor of a new chemical was responsible for obtaining a new Material Safety Data Sheet (MSDS) and any additional data required. The request for additional data was required for products used in the radiologically controlled area and on/in the primary and secondary systems. An example of the form used for the additional data requested is outlined in Fig. 2.

With the final program developed, all site procedures that controlled the purchase, issue, storage, use, and disposal of chemicals were revised. At this point, all new chemicals were reviewed and approved prior to their purchase.

CHEMICALS ALREADY IN USE AT THE SITE

With the program established to control the purchase of all new chemicals completed, efforts were then focused on reviewing chemicals already in use at the site. All site chemicals were inventoried several times and a Master Chemical List generated. Because of the time required to match the 3,500 chemicals to the 40,000 MSDS's, and the fact that most of them were out dated, the task of collecting MSDS's and the additional information was turned over to a contractor. In addition to this, the contractor developed custom software tailored to our specific needs. This software was developed because commercially available software could not be easily modified to produce the site required forms and reports.

The MSDS's and additional data compiled by the contractor, was collected, organized, and distributed to the CURB members for their review. The CURB members reviewed the data and during their weekly meetings discussed specific concerns. The result of this was the development of the Chemical Use Permit (CUP) for each product (see Fig. 3). The CUP is a single page document, modeled after the Radiation Exposure Permit, that provides all the necessary guidance for the employees to properly use, store, and dispose of the chemicals and chemical wastes in compliance with all site requirements.

CHEMICAL INFORMATION FORM

PRODUCTS NAME: _____

PART NUMBER: _____

LEACHABLE CHEMICAL CONSTITUENTS:

Chlorides: _____ ppm or mg/l
Fluorides: _____ ppm or mg/l
Sulfur: _____ ppm or mg/l

TOTAL CONSTITUENTS:(all data MUST be expressed in ppm or mg/l)

Mercury: _____ Halogens: _____ Sodium: _____
Fluorides: _____ Organics: _____ Chlorides: _____
Chromium: _____ Hexavalent Chromium: _____
Chelating Agents: _____ Sulfur Compounds: _____
Low Melting Point Metals (including; Lead, Antimony, Zinc, Bismuth, Cadmium, Tin, Aluminum, etc.): _____ ppm or mg/l

PHYSICAL CHARACTERISTICS:

Vapor Pressure: _____ Ignition Temperature: _____
Vapor Density: _____ Specific Gravity: _____
Lower Explosive Limit: _____ PH: _____
Upper Explosive Limit: _____ Boiling Point: _____
NFPA 704 Rating: Reactivity: _____ Special: _____
Flammability: _____ Health: _____
Flash Point:_____F (an actual value is required; a response of non-flammable or "greater than 200 degrees F" is unacceptable)

Does this product contain Explosive Material? _____ yes/no
"Explosive Material" means any chemical compound, mixture, or device which produces a substantial instantaneous release of gas and heat spontaneously or by contact with sparks or flame.

Does this product contain Pyrophoric Liquid? _____ yes/no
"Pyrophoric Liquid" means a liquid that ignites spontaneously in dry/moist air at or below 130 degrees F.

When disposed of, assuming the product is not mixed with other chemicals, is this product a Hazardous Waste? _____ yes/no
If yes list EPA Waste Number: _____ "Hazardous Waste" means those wastes designated as hazardous by the Environmental Protection Agency (EPA) Regulations in 40 CFR, Part 261.

ALSO, PLEASE ENCLOSE A COPY OF THE MOST RECENT MSDS.

Fig. 2. Additional information requested by a chemical requester prior to purchase.

CHEMICAL USE PERMIT

CUP#:_____ **REV.:**_____ **SUPPLY SYSTEM #:** _____

CHEMICAL/PRODUCT NAME:_____

MANUFACTURER:_____

MFR. TEL#:_____ **MAJOR FUNCTION:** _____

MAX. SITE QTY: _____ LBS **MAX. WORK AREA QTY:** _____ LBS

HAZARD CODES: (0=Low 4=High)

Health [ ] Flammability [ ]
Reactivity[ ] Special Hazard [ ]

PART #:_____ **USE CATEGORY:** _____

MSDS NAME:_____

ADDITIONAL LABELING REQUIREMENTS: _____

SYSTEM HAZARD DESCRIPTION:_____

EQUIPMENT/MATERIAL PROTECTION INSTRUCTIONS:_____

USE AND HANDLING INSTRUCTIONS: _____

FIRE PROTECTION REQUIREMENTS:_____

SPILL INSTRUCTIONS:_____

RCA USE INSTRUCTIONS: _____

DISPOSAL INSTRUCTIONS:_____

OTHER COMMENTS:_____

APPROVED BY: _____ **DATE:** _____

Fig. 3. Sample chemical use permit.

Each CUP was assigned a specific number and was coupled with the manufacturers' MSDS. The CUP number was used to organize all the chemical information for final distribution. The contractor developed a data base tracking system that reported the chemicals by: CUP number, chemical manufacturer, supply system number, product name, and use category. The CUP's and MSDS's were organized numerically by CUP number and centrally distributed to five site locations.

MAN-POWER SUPPORT

The chemical control program was divided into three sections; program development, implementation, and maintenance.

THE PROGRAM DEVELOPMENT PHASE INCLUDED:

1) Date: January 1988 to April 1988
   Man-hours: 1,000
   Groups involved: Environmental, Chemistry, Radwaste, Fire Protection and Safety

A) Determine what regulations or controls were needed for site chemicals.

B) Determine what regulations other sites were controlling through their chemical control programs and how effective were their programs.

2) Date: April 1988 to June 1988
   Man-hours: 1,000
   Groups involved: Environmental, Chemistry, Radwaste, Fire Protection, Safety, Industrial Hygiene, Water Reclamation, Nuclear Engineering, Operations, Mechanical Maintenance, Electrical Maintenance, Planning, Building Services, Purchasing, Contracts, Warehousing and Inventory Control.

A) Established a task force to:

Present what regulations must be controlled and why.

Present what information other sites were tracking both why and how.

Discuss how these regulations and controls could be managed at Palo Verde.

Develop the structure for the chemical review process, specifically, the development of the CURB and how an employee will get a new chemical reviewed and approved.

Review all procedures to determine the programs impact in regard to revisions.

3) Date: May 1899 to August 1988
   Man-hours: 2,000
   Groups involved: Environmental, Chemistry, Radwaste, Fire Protection, Safety, Industrial Hygiene, Water Reclamation, Nuclear Engineering, Operations, Mechanical Maintenance, Electrical Maintenance, Planning, Building Services, Purchasing, Contracts, Warehousing and Inventory Control.

A) Revise and write procedures to include the chemical control program interface.

B) Obtain final approval of the new procedures and procedural revisions.

THE PROGRAM IMPLEMENTATION PHASE INCLUDED

1) Date: August 1988 to December 1989
   Man-hours: 1,800
   Groups involved: Environmental, Chemistry, Radwaste, Fire Protection, Safety, Industrial Hygiene, Water Reclamation and Nuclear Engineering.

A) Review new chemical requests and process CUP's.

2) Date: August 1988 to November 1988
   Man-hours: 1,000
   Groups involved: Contractor.

A) Inventory the site and correlate this information with the sites supply numbering system.

3) Date: December 1988 to December 1989
   Man-hours: 8,000
   Groups involved: Contractor.

A) Request MSDS's and additional information on existing site chemicals.

B) Develop the data base tracking program.

C) Request MSDS's and additional information on new chemicals as they are requested.

D) Distribute MSDS and additional information to CURB members, incorporate their comments on the CUP, and distribute final CUP's for review and approval.

E) Revise CUP's when MSDS's were revised.

4) Date: August 1988 to December 1989

Man-hours: 10,000

Groups involved: Environmental, Chemistry, Radwaste, Fire Protection, Safety, Industrial Hygiene, Water Reclamation and Nuclear Engineering.

A) Review data on existing site chemicals.

5) Date: November 1989 to February 1990

Man-hours: 2,000

Groups involved: Contractor.

A) Product substitution and inventory reduction.

6) Date: November 1989 to December 1989

Man-hours: 4,000

Groups involved: Site.

A) Site wide training on the new Chemical Control Program.

7) Date: November 1989 to March 1990

Man-hours: 2,000

Groups involved: Inventory Control.

A) Label warehouse chemicals.

THE PROGRAM MAINTENANCE PHASE INCLUDED

1) Date: December 1989 to January 1991

Man-hours: 1,600

Groups involved: Environmental, Chemistry, Radwaste, Fire Protection, Safety, Industrial Hygiene, Water Reclamation and Nuclear Engineering.

A) Reviewing new chemicals for specific concerns and discussing the concerns and comments during the CURB meetings held every two weeks.

B) Reviewing new MSDS's for previously approved chemicals.

2) Date: December 1989 to January 1991

Man-hours: 1,000

Groups involved: Environmental Data Entry Clerk.

A) Receives new chemical request, logs the request, reviews the data base to ensure there isn't a chemical already on site that will perform the required function, and copies the information for distribution to the CURB members.

B) Incorporate CURB comments, route CUP's for final review and approval, copy approved CUP's and route to Drawing and Document Control for final distribution.

LESSONS LEARNED

1) Complete product review and classification, on existing site chemicals, before program implementation.

The program was implemented by generically categorizing all site chemicals. Then over the next twelve months specific data was collected and reviewed. Many of the chemicals had to be reclassified. This created confusion within the general work force and hindered overall acceptance of the program. Had there been more time during implementation to allow a proper review and classification of the chemicals much of the initial confusion would have been eliminated.

2) Close all loop holes in the procurement system before implementing chemical controls.

The supply system is the key to managing a chemical control program. The supply system had two problems. Problem #1 was the supply system stock numbers. The stock numbers identified a chemical but was not manufacturer specific. Because of this there were sometimes three to five products per stock number. Problem #2 was open purchase or blanket purchase orders. Blanket purchase orders allow chemicals to be purchased and delivered to the purchaser without going through the supply system. Both of these problems allow chemicals to be purchased and delivered to the site before a review can be performed. In many cases previously approved products could have been used that were less hazardous from both the employee and environment standpoints. We strongly recommend tight supply system controls. This should include one product per stock number or blanket purchase order.

3) Determine what information is needed for each chemical prior to performing an inventory.

Three site inventories were performed by having site personnel inventory their work area using a standard form. The first two forms did not request enough information to adequately describe the product to allow MSDS collection from the manufacturers. This confusion reduced the programs implementation effectiveness. The form outlined in Fig. 4 contains the necessary information for MSDS collection. Additionally, incomplete information was returned from the chemical users. We recommend a small group inventory the entire site to insure consistency in the information collected. This will stream line the data collection process.

4) Inform and educate management.

To develop, implement, and maintain a Chemical Control Program will require additional resources. The resource allocation for this program is typically more

CHEMICAL INVENTORY FORM

PERSON COMPLETING THIS FORM: (if there are any questions about the information on this form we will contact you directly)

NAME _____ TELEPHONE _____

1. PRODUCT NAME, as written on the container:

_____

2. MANUFACTURER NAME, as written on the container:

_____

3. MANUFACTURER ADDRESS, as written on the container:

Street: _____

City: _____ State: _____ Zip: _____

4. MANUFACTURER PHONE NUMBER, if available: (_____) _____

5. MANUFACTURER PART/PRODUCT NUMBER,if available: _____

6. CONTAINER SIZE(S): _____

7. MAJOR FUNCTION: circle appropriate:

CLEANER SOLVENT MOTOR OIL GREASE PESTICIDE

SPECIALTY LUBRICANT LABORATORY REAGENT RESIN

BULK WATER TREATMENT CHEMICAL COATING/PAINT

ADHESIVE ABSORBENT LAPPING COMPOUND BOTTLED GASSES

OTHER, please be specific:_____

8. IS THIS PRODUCT IN AEROSOL FORM, circle appropriate: yes / no

9. IS THIS PRODUCT USED ON PRIMARY OR SECONDARY SYSTEM PRESSURE BOUNDARIES, circle appropriate: yes / no

10. USE LOCATION: _____
(Power Block, RCA, Turbine Bldg., etc.)

ATTENTION!

THE INFORMATION SUPPLIED ABOVE MUST BE ACCURATE AND COMPLETE TO INSURE A TIMELY REVIEW OF THE PRODUCT. THIS INFORMATION INSURES CONTINUED COMPLIANCE WITH 29 CFR 1900.

Fig. 4. Chemical inventory form.

complex because of all the different disciplines involved. Each discipline should contribute, man-power and/or dollar resources, to the program development. To insure program success, we strongly recommend that upper management be informed and educated as to what is being done and why, and just as important how much it will cost. Without upper management support it will be very difficult if not impossible to have an effective chemical control program.

5) Reduce your chemicals before you implement your program.

There were many one of a kind, used only as a test, type chemicals. The task of MSDS collection, product review and information distribution is time consuming. Initial reductions based on chemical use volumes will save valuable resources.

CLOSING STATEMENTS

Controlling new chemicals, product substitution, reviewing updated MSDS's, and reducing the number of chemicals will continue until the fewest chemicals can be used to support the widest variety of applications. Palo Verde now has a Chemical Control Program that facilitates compliance with regulations and industry good practices of today with the flexibility to adapt to the ever changing regulations of tomorrow.