

Presentation Title **OBSOLETE CHEMICAL DISPOSAL – A CASE STUDY**

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Introduction

Often chemicals are used in the laboratory for doing research and teaching. Most of the chemicals have low shelf life, while the characteristics of the chemicals vary widely from poisons to hazardous to toxic. As chemicals are purchased under separate project grant, central purchasing and storage is not practiced. Most of the projects do not consider for the ultimate disposal of chemicals should there be any excess. Over a period of time, the accumulation of chemicals in National University of Singapore (NUS), now to be termed as 'Obsolete chemicals' pose a serious threat to environment, besides safety and health of lab personnel.

Applicable rules and regulations

In Singapore, the usage, storage and disposal of chemicals is governed by different agencies. The related applicable laws for the use of chemicals are:

Factories Act, under the Ministry of Manpower (MOM), Singapore requires organizations to maintain Material Safety Data Sheets (MSDS) which are current and can be easily accessible by employees. MSDS is supplied by the supplier and normally updates for any revision. So, under the law, the characteristics of the obsolete chemicals are available due to the possession of MSDS.

Environmental Pollution Control Act (EPCA), under the Ministry of Environment (ENV), Singapore regulates organizations in the storage, disposal and transportation of chemicals. Further a person is given the license for the ultimate storage of chemicals within a premise.

Fire Safety Act (FSA) under the Singapore Civil Defense Force (SCDF) regulates the storage of flammable chemicals

Poisons Act (PA) under the Health Science Authority (HAS) regulates the control of poisons in the premises. Based on the act, it is an offence to receive a package or unbroken case on chemicals received from the manufacturer. The act also states that the

name of the substance contained therein and should bear some distinction mark indicating that the chemical is poison.

Obsolete Chemical Waste Generation

Obsolete chemicals vary widely in characteristics and toxicity. Storage of chemicals posed a serious safety and health hazards. The major exposure routes are either by inhalation or by skin absorption. The labels of some of the bottles in the shelves containing chemicals were not recognizable. Almost 20 departments generated obsolete chemicals as waste. It required elaborate and coordinated efforts to dispose the chemicals in an orderly and safe manner. More than 3 tons of chemicals were generated as obsolete chemicals.

Types of chemicals

The obsolete chemicals were either toxic, hazardous or highly flammable in nature. These include aromatic chlorinated compounds, organic, inorganic, solvents and hydrocarbons.

Handling and Storage

A Risk Assessment (RA) was carried out to ensure the storage of the chemicals were safe and environmentally safe. The chemicals were stored based on their compatibility and quantity. Proper engineering controls (ventilated cabinets) were in place and administrative controls (use of proper PPE) was adopted. Intermediate bulk containers and proper

Spill control and emergency preparedness

Dedicated spill control kit were not placed as the spill control kit for the use in the labs were made use off. During an emergency the standard operating procedures would take place. The employees were trained in the Emergency Response and Preparedness. The university has wellness centre handling the first aid and other minor injuries that are likely to happen during the handling, storage and disposal of the obsolete chemicals.

Disposal

The choice of disposal of chemicals were limited to either treat in-house or reuse by other departments or dispose to outside agency for further treatment and disposal. Due to the economic considerations, wide nature of the chemicals, and the quantity of the chemicals, it was decided to dispose the chemicals through approved and licensed specialized waste treatment company (WTC). There was little problem in disposing inorganic, organic and hydrocarbons. The Aromatic Chlorinated compounds (Polychlorinated Biphenyl -PCB compounds) had to be exported overseas for disposal and further treatment. This requires special license and approval by National Environmental Agency (NEA), Singapore. Licenses were obtained and disposed off in a safe and environmentally sound manner.

After disposing through the WTC, it is important that the company provides details and information on how the waste has been handled and treated. NEA requires waste

generators to do a e-filling (electronic version) to indicate the quantity and quality of the waste, while the WTC has to complete the data after the waste has been disposed. In this way, a cradle to grave report can be obtained.

Lessons Learnt

The disposal of obsolete chemicals posed a big challenge in terms of quantity and characteristics of the chemicals. The final aim of the disposal exercise was to ensure such disposal practices are not repeated. The disposal consumed large resources, in terms of money, storage area and manpower.

Waste minimization

In order to have minimum waste accumulation and generation, it was felt to have the following 4R principles adopted from the beginning.

- 1) Reduce - Try as much as possible to procure only those quantities that are required for the project. Otherwise, try to dispose off the chemicals at frequent intervals, thereby reducing inventory and reducing the hazards of storage.
- 2) Reuse and Recycle- Once a project/research is completed and excess chemicals generated, the quantity and composition can be sent out to other departments/ faculties, so that other interested staff can use them.
- 3) Review – Review the process of waste minimization and make recommendations for suitable remedial measures.
- 4) Inventory Control - Centralized purchasing and creating a database or inventory of the chemicals would reduce duplication of chemical purchased. Further it can have reduced inventory which means cost savings and less hazards to handle.

Any one or all of the above measure will result in savings and create a good and safe working. Further as part of the effort to minimize waste generation, awareness campaign and promotions were launched, which will also have cost savings.

Conclusion

Chemicals are mainly used in science, engineering and medicine faculties of National University of Singapore. Like most universities, NUS also carries research and teaching, involving the use, handling, storage and disposal of obsolete chemicals. Adopting the 4R principles, it is economical to handle waste chemicals and to ensure less hazards at workplace.

Reference:

- www.mom.gov.sg; www.nea.gov.sg; www.scdf.gov.sg; www.hsa.gov.sg;
- In-house Standard Operating Procedures for chemical waste disposal.