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Best Practices In Chemical Management for Textile Manufacturing

Doug Cahn
Robert Clifford

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ACRONYMS

ACM	Asbestos-containing materials
ANSI	American National Standards Institute
BWH	Better Work Haiti
GHS	Global Harmonization System
HMIS	Hazardous Materials Identification System
IDB	Inter-American Development Bank
ILO	International Labor Organization
ISO	International Organization for Standardization
NFPA	National Fire Protection Association
OELs	Occupational Exposure Limits
OHSAS	Occupational Health & Safety Advisory Services
OSH	Occupational Safety and Health
PCBS	Polychlorinated Biphenyls
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
SDS	Safety Data Sheets
TLV	Threshold Limit Value

Introduction

A. Project Background

This project was initiated and funded by The Inter-American Development Bank (IDB), which has participated in the growth of the textile manufacturing industry in Haiti during the past several years through its investment strategy. Such investments include the Caracol Industrial Park (PIC) and individual factory operations such as Industrial Revolution II and Willbes Haitian.

IDB is keen to support the industry with parallel efforts in risk management, and one broad area of concern in the textile industry is Occupational Safety and Health (OSH). As one means of risk management on OSH issues, and generally on other labor issues in this sector, the IDB seeks opportunities for collaboration with organizations such as Better Work, which during the past decade has established a presence in the apparel industry in eight developing nations around the world, one of which is Haiti.[1] Better Work is a global partnership of the International Labor Organization (ILO) and the International Finance Corporation (IFC) which utilizes the labor expertise of the ILO with that of the IFC in private sector development. The focus of Better Work is on the working conditions in global apparel supply chains, offering monitoring and customized advisory and training services to factories in this sector. The Better Work program aims to improve factory compliance with the ILO core labor standards and national labor laws, and to enhance the competitiveness of participating factories. OSH issues comprise one aspect of the Better Work assessment and advisory programs.

Since 2012, IDB has worked with the Better Work Haiti (BWH) organization and The Cahn Group, LLC, a corporate responsibility consultancy, on projects designed to raise awareness of OSH issues in the Haitian apparel industry and to build the capacity of factory managers and workers to recognize and mitigate OSH risks in their workplaces. This project is a logical continuation of these efforts.

Serge-Henri Troch and Melissa Barandiarán of the Environmental Safeguards Unit of the IDB (VPS/ESG) were the liaisons from the IDB for the purposes of creation, implementation and funding of this project. Janika Simon was the primary liaison from BWH for the purpose of supporting the delivery of the training workshops.

[1] The other nations in which Better Work programs operate are Cambodia, Nicaragua, Jordan, Lesotho, Vietnam, Indonesia and Bangladesh.

The Cahn Group was selected to lead the training workshops and draft this Guidance Note. Doug Cahn, principal of The Cahn Group, and Bob Clifford, senior advisor to The Cahn Group and industrial hygienist, comprised The Cahn Group project team.[2]

B. Project Objectives

The apparel industry in Haiti is poised to move beyond the "cut and sew" processes which have characterized its operations to the present time. Chemical usage has largely been limited to spot cleaning and some washing activities, but as washing increases and other fabric treatment processes are integrated into the Haitian industry, chemical usage at these factories will increase and become more varied. The factories must be prepared to identify and control the chemical hazards associated with these newly integrated operations which may pose risks to workers, the community and the environment.

These hazards are not new to the apparel sector, but they will be new to the industry in Haiti. While some chemical management issues must be addressed in the current state of chemical use in the Haitian sector, the establishment of a chemical management system becomes an even more necessary response from individual factories as new chemical concerns may arise.

This project is intended to provide relevant factory personnel with the foundation upon which to build a chemical management system. Such personnel may include compliance managers, supervisors in areas with chemical activities, and others with responsibilities related to some aspect of chemicals in the factories. The specific objectives include:

- Introduce the need for a systematic approach to the factory use of hazardous chemicals and the basic principles of management systems in general;
- Identify the likely scope and reasonable elements of a chemical management plan, including best practices which may be incorporated into newly developing systems; and
- Emphasize the importance of documentation, and provide a basic framework for a written plan.

These objectives will be accomplished via two means:

- Training Workshops for personnel who have responsibility for some aspects of chemical use at their factories. These were conducted at the Metropolitan Industrial Park in Port au Prince and at the PIC in the north of Haiti in October of 2014.

[2] For more information about The Cahn Group, LLC, see: http://www.thecahngroup.com.

- After the workshops, this Guidance Note will serve as a continuing resource for the apparel industry in Haiti as it develops appropriate mechanisms to address the current and future aspects of chemical use in its operations.

C. Overview of the Guidance Note

Section II of this document is entitled *"Why a Management System for Chemicals?"* and it argues for the need for a chemical management system at factories through discussion on two separate questions: (i) "why chemicals?", and (ii) "why a management system?". First is a general overview of the range of hazards which can be posed by chemical materials, with specific mention of those hazards which exist presently or are likely to be encountered as a result of an expansion in the operations in the apparel industry in Haiti. This is followed by an introduction to the basic principles of management systems in general, offering this as a reasonable approach to the issues which will be presented as chemical usage at the factories becomes more intensive and diverse.

Section III identifies the scope of chemical concerns at a typical apparel factory and then the aspects associated with these chemicals over their anticipated life cycles. This chemical life cycle approach is employed as the way to introduce the critical elements of chemical management. As each element is discussed, specific factory practices are identified as appropriate and necessary to achieving the ultimate goal of chemical risk mitigation.

Finally, Section IV provides a framework for the initial documentation of chemical management efforts at the apparel factories in Haiti. This information is consistent with the approach which is utilized by the International Organization for Standardization (ISO) and similar organizations in their standards for management systems; e.g. ISO 14000 series (environmental management), and the British Standards Institute OHSAS 18001 and the American National Standards Institute (ANSI) standard Z10 (both on occupational safety and health management). However, the level of the introductory information in this Guidance Note is not intended to lead directly to certification under any of these standards.

II. Why a Chemical Management System?

The apparel sector certainly is not as chemical intensive as other global industries, but its variety of chemical operations and materials does present a range of potential hazards to its workers and the surrounding communities and environment. The recent prevalence of acute silicosis, a deadly lung disease, among workers in the denim processing factories of Turkey and elsewhere provides an excellent example of a scenario in which a proactive approach to chemical management may have avoided the use of crystalline silica abrasives, and consequently avoided the illnesses and suffering of workers in the industry.[3]

To appreciate the need for a chemical management system at apparel factories, one must first recognize the potential risks that are created by chemical usage, and then acknowledge that a systematic approach is the most effective manner to control chemical hazards and mitigate their risks. This Section of the Guidance Note is intended to describe the need for and the benefits of such an approach.

A. Why Chemicals?

Virtually all chemical materials present one or more types of hazard to some degree. A paraphrase of a simple dictionary definition of "hazardous" could be: "involving or exposing someone to danger or the chance (or risk) of harm or loss". Various global and national regulations and laws may define "hazardous chemical" in slightly different terms, depending upon the purpose of the particular regulation or law. As a preliminary matter, it may be instructive to review the entire range of chemical hazards and become familiar with their identification. Chemical materials have the potential to be harmful to workers and to the environment.

The Global Harmonization System (GHS) is the product of an effort by the United Nations to create a uniform system for the classification and ranking of chemical hazards and the methods by which hazard information will be communicated. The European Union and other developed nations have utilized the GHS for some time, and its recent adoption by the United States should ensure that the GHS does achieve its global aspiration.

The GHS hazard pictograms or symbols represent perhaps the most obvious means of hazard communication, and their recognition by personnel is important in any industry in which chemical materials are used. Under the GHS, there are nine chemical hazard symbols: four representing classes of physical hazards, four representing health hazards, and one for environmental hazards. However, each symbol may represent several distinct hazards. They are described below:

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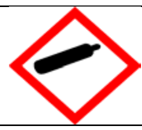
[3] For example, refer to the New York Times article: http://www.nytimes.com/2011/11/01/health/silicosis-from-work-on-blue-jeans-killed-workers-study-says.html

GHS Hazard Pictogram/Symbol	Relevant Hazards
	Explosives and extremely reactive chemicals, such as organic peroxides, water-reactive chemicals, and some self-reactive chemicals (unstable in heat)
	Flammable liquids, solids and gases; including pyrophorics (ignite on contact with air), some self-reactive chemicals and chemicals that release flammable gases (hydrogen)
	Gases under Pressure: compressed gases (cylinders) and liquefied gases (such as LNG fuel)
	Oxidizers: chemicals that are not necessarily combustible, but may, generally by yielding Oxygen during a fire, cause or contribute to the combustion of other materials
	Acute Toxicity: poisons by inhalation, ingestion or skin exposure; may be fatal or rapidly toxic
	Corrosive: to the skin (severe burns), to the eye (damage), and corrosive to metals
	Moderate Health Hazards: Irritation of the skin or eyes; skin sensitizer (allergic reaction); nervous system effects such as drowsiness or dizziness (generally: not severe and reversible)
	Serious Health Hazards: Cancer, Reproductive Toxicity, Respiratory Sensitization (Asthma), Target Organ Toxicity (Liver, Kidneys, Nervous System, Lungs), Aspiration Hazard
	Hazardous to the Aquatic Environment: to Fish, Plants and Organisms; or Bioaccumulative

Recognition by management of the potential hazards created by the use of chemicals in the workplace, and awareness of these hazards by workers so that both management and workers can take appropriate steps to prevent and avoid potential harm, are essential to a safe workplace and environment.

B. Why a Management System?

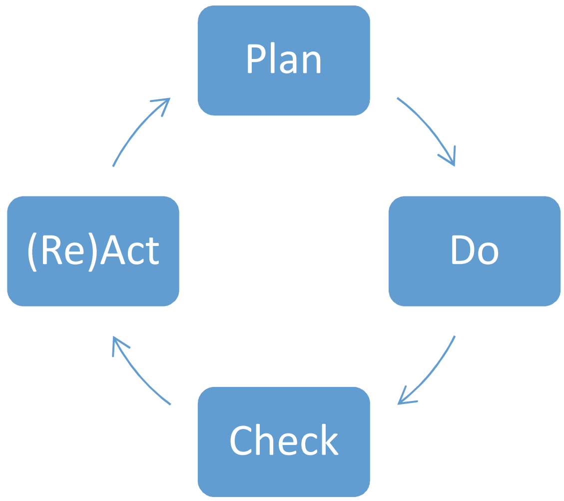
To achieve the safe use of chemicals and to control the hazards that they present to workers, the community and the environment, a factory must be organized in its approach to the various aspects of chemical use. It should recognize steps in factory operations where chemical risks may exist – from purchase until disposal - and then identify appropriate measures and controls to reduce or eliminate these risks. And a mechanism should exist to ensure that these risks remain controlled over time, and that new risks are identified before they cause any harm.

A necessary prerequisite to such an organized approach to chemicals is the recognition by factory management that chemical safety is an important issue, and the expression of that importance and of management commitment to the issue in a factory policy. The policy should be a written statement which reflects a reasonable goal or set of goals (e.g. the effective protection of workers from chemical hazards and the reduction of workplace injuries and illnesses related to chemicals, and compliance with all national and international laws and regulations pertaining to chemicals). Once a policy has been developed by the factory management, then it should be communicated to the workers.

However, the policy is merely the first step in the creation of a systematic approach to the management of chemicals in a factory. Management must demonstrate its commitment by designating qualified personnel to evaluate the issues associated with chemicals: what is being done, and what should be done? Appropriate work practices and procedures should be identified, and those that appear to be inadequate should be changed and improved. Then these practices and procedures should be written to ensure consistent performance over time, and collected so that together they represent a single systematic approach to chemicals.

This type of approach may be familiar to personnel in apparel factories – perhaps not associated with chemical use, but rather with product quality. To meet the company goal of consistent quality in its products, management may establish written procedures, inspections, and other requirements which comprise a systematic approach to achieving product quality.

What has just been described are the fundamentals of any type of management system, whether for chemicals, product quality, or another particular factory issue. The following diagram illustrates the traditional approach for improved performance on any issue in the workplace:



A simple explanation of this diagram would be:

PLAN: Say what you should Do

DO: Then Do what you Say

CHECK: Prove it

(RE)ACT: Are you satisfied? Can you improve?

All active apparel factories in Haiti have passed the "Plan" phase and are already in the "Do" phase. The "Plan" may or may not include written documents related to chemicals, and may or may not address every issue associated with chemicals at the factory. The "Do" phase may comply precisely with the "Plan", or variability may exist due to lack of documentation, communication or training. "Check" and "Re(Act)" may have a role only when something goes wrong, such as a chemical spill or other type of accident or worker exposure. To the extent that any factory engages in the cycle of these four fundamental activities, it is utilizing a management system approach to the particular issue.

National and international standards have been established by ISO and other organizations to define the minimum requirements for various types of management systems, and some of these standards may be familiar:

- ISO 9000 series – Quality Systems
- ISO 14000 series – Environmental Management Systems
- OHSAS 18001 (British), ANSI Z10 (American) and ISO 45001 (in draft form in 2014) – OSH Management Systems

These standards provide the recommended framework for the particular type of management system, and specify generic requirements for compliance with the standard. Third-party certification of individual company management systems is possible in many instances.

The apparel industry in Haiti first should focus solely on a management systems approach to its use of chemicals without additional concern for standards certification. While certification may be suitable as an aspirational and ultimate goal, factory management should now seek to employ the fundamental principles of management systems as they create a plan to effectively manage all aspects of chemical use in their factories.

III. The Scope and Elements of a Chemical Management Plan

A. The Scope of Chemical Management

The preliminary decision that a factory must make pertains to the scope of its management efforts: what chemical materials in the factory, and at what stages in the manufacturing process, should the factory include in their Plan? The best answer is: all chemical materials in the factory, at every stage during their life cycle in the factory (that is, from the time that they enter the factory until they depart). By selecting a broad scope for the Plan, the factory is less likely to overlook a chemical material or a particular chemical hazard that could at some point result in harm to people or the environment.

The inclusion of all chemical materials in the factory means that other aspects of factory operation beyond the manufacturing processes must be evaluated. This will include:

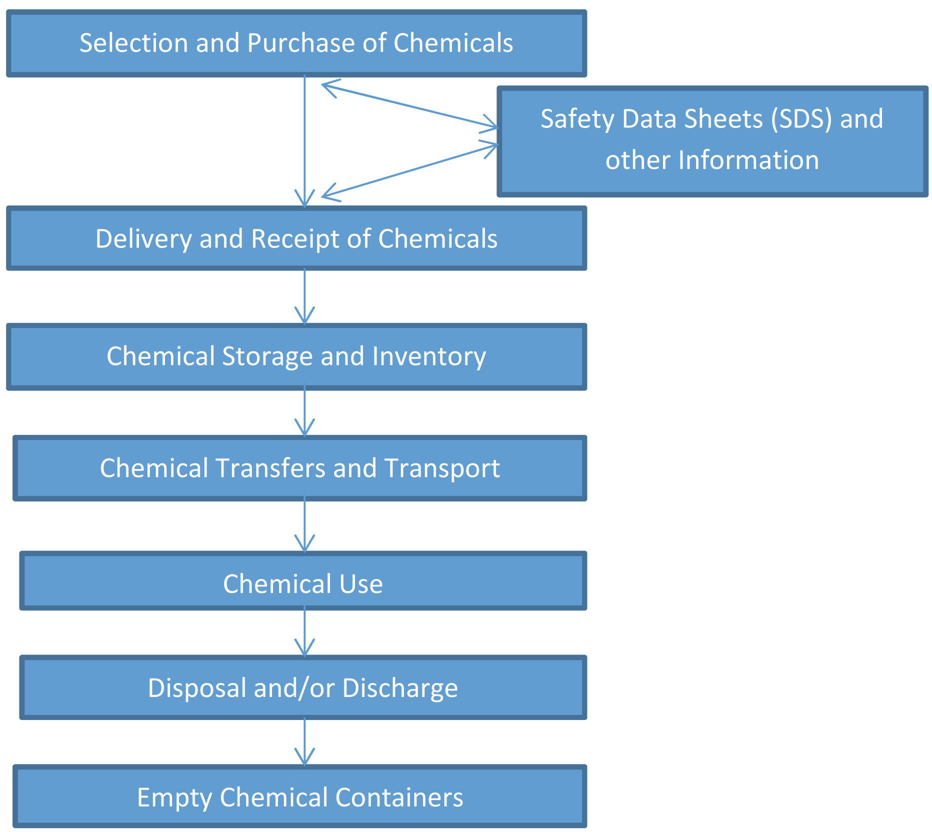
- Chemicals used for maintenance purposes, such as machine oils and cleaning products
- Chemicals used for fuel
- Chemicals present in building materials, such as asbestos and polychlorinated biphenyls (PCBs)
- Future uses of chemicals should be anticipated (e.g. washing and fabric treatment) so that these chemicals may be managed proactively

Considerations of hazardous chemicals which may be present in building materials is often overlooked and represents a best practice in chemical management. Asbestos-containing materials (ACM) may be used as thermal insulation or fireproofing on building structures or in hot equipment. PCBs are often found in dielectric and coolant fluids in equipment, but also may be a constituent of caulking materials. While the production of ACM and PCBs is largely prohibited throughout the world at the present time, their presence remains a possibility in older buildings and equipment. Their identification in a factory will: (i) permit factory personnel to take appropriate precautions when handling or disturbing the materials, and (ii) allow for disposal of these materials as other than nonhazardous construction waste.

Management of hazardous chemicals throughout their anticipated life cycle is critical for a successful system, and this is discussed in greater detail in the next section of this document. As mentioned, for our purposes the life cycle of a chemical begins at the time of the decision to purchase it, and concludes when the chemical leaves the factory – into the air, the water, in a waste container or otherwise. Given that this is the desired scope of the chemical management efforts of a factory, it is reasonable that the significant elements of a chemical management plan reflect the life cycle of the chemicals.

B. The Elements of a Plan Based on the Life Cycle of Chemicals in the Factory

As a factory evaluates the points in time when its management of chemicals may have a positive impact on chemical risk reduction, it should adopt a systematic approach which follows the life cycle of the chemicals. For example, the chemical life cycle may be viewed as:



While Safety Data Sheets (SDS) and other information on chemical materials are not parts of the chemical life cycle per se, they do play an important role in the first two stages of the life cycle and are included in the flow chart for that reason. This also serves as a reminder of the need for hazard communication among and training of all levels of factory personnel who have some role in chemical activities.

The various stages of the life cycle can form the outline for the chemical management plan. While every stage may not be relevant in every factory, it is proposed that the major elements of the plan will come from this list:

- Selection and Purchase of chemicals
- Delivery and Receipt of chemicals
- Safety Data Sheets (SDS) and other Information
- Chemical Storage and Inventory
- Chemical Transfers and Transport within the Factory
- Chemical Use
- Disposal and/or Discharge
- Empty Chemical Containers

A factory may decide that any one of these elements can be divided into two or more, e.g. Storage and Inventory as two separate elements. On the other hand, certain elements may not be applicable, or at least not warrant much attention after the initial evaluation (e.g. spot cleaning solvents may be entirely evaporated as fugitive emissions at the point of use, and so there is no disposal, stack discharge or discharge to wastewater). This list is provided simply as a set of signposts along the road to proper chemical management.

The important aspects of these elements of a chemical management plan are discussed below. Good industry practices are highlighted as an aid to the development of specific management procedures.

Selection and Purchase of Chemicals

The importance of management intervention even before a chemical material enters a factory should be obvious: the elimination or reduction of all or many of the chemical hazards <u>before</u> they entered the factory would eliminate or reduce the corresponding need for hazard control measures such as personal protective equipment (PPE), other exposure controls, and waste disposal issues. For example, avoiding the use of a corrosive material by identifying a non-corrosive alternative may eliminate the need for use of protective gloves and eye protection.

Management of chemical selection represents a best practice. It requires that the SDS be obtained from the chemical supplier before the chemical material is purchased. It also requires that a knowledgeable person at the factory review the SDS, evaluate the information, and decide if lower toxicity alternative materials may be available and should be considered. Toxicity should be a determining selection factor along with cost, suitability for the purpose of use, etc.

Purchasing of chemicals should be done through a centralized office or individual. Subsequent aspects of chemical management are made more difficult if anyone, such as supervisors or maintenance personnel, is allowed to buy a chemical material and bring it into the factory. While many different factory personnel may identify the need to purchase chemical materials, the ultimate authority to approve and proceed with the purchase from a supplier should reside in one or a few individuals.

If an SDS is not obtained for a material during the selection and purchase process, then as a minimum routine requirement, the chemical supplier should be requested to provide an SDS for the material to accompany the shipment. Maintenance of an SDS file for chemical materials is a Better Work requirement, and it is most easily and effectively satisfied at this point in the process. Further discussion of SDS and other chemical information will follow.

Delivery and Receipt of Chemicals

There are several issues to consider when a chemical material is delivered to the factory and enters the factory environment. Receipt of chemical materials should be the responsibility of only a few workers who are familiar with the recommended process.

As a preliminary matter, the SDS should be obtained and its identification of the chemical material matched with the label on the container and with the purchasing records to ensure that the material and the quantity are in fact what were ordered. If there is no label on the container, or if the container label does not match the SDS or the purchasing records, the supplier should be contacted for clarification.

A further inspection of the container before acceptance of the delivery is warranted. Any evidence of leaks, bulging, dents, corrosion, etc. may be grounds to refuse acceptance and insist that the chemical container be removed from the factory premises. This may help to avoid subsequent problems with that container.

Finally, where should the chemical container go? A loading dock or other doorway is not appropriate for chemical storage, especially if the doorway serves as an emergency exit. Some workers should have responsibility to ensure that an incoming chemical container is promptly moved to the appropriate storage area or location of use. Depending upon the size of the container, this may necessitate the availability of appropriate equipment such as a hand truck (see the illustrations in Figure 1 below).

Figure 1. Examples of hand trucks which would provide assistance in the transport of large chemical containers from the receiving dock area to the chemical storage area.

Safety Data Sheets (SDSs) and Other Information

The availability of SDSs (formerly known as Material Safety Data Sheets, or MSDS) and other chemical hazard information has been mentioned already, and their use may be relevant throughout the life cycle of a chemical. As such, this topic deserves some discussion in this Guidance Note as a specific element of chemical management.

Obtaining SDSs from chemical suppliers is best done before, but at a minimum at the time of, the purchase of a chemical material. If the supplier cannot provide an SDS, the factory should not proceed with the purchase of the material. A central file of SDSs should be maintained by one or more responsible people in an appropriate office area which is accessible during working hours. In addition, it may be prudent to have relevant SDSs available in chemical storage areas or even at the locations of use (e.g. spot cleaning areas).

The general purpose of SDSs is to provide the chemical users with information related to the hazards and the physical characteristics associated with the specific chemical ingredients and the chemical material as a whole, and the precautionary measures which are appropriate during routine uses and emergencies. The format of the SDS content is similar throughout the world, but the usefulness and accuracy of the information varies greatly depending upon the chemical material and the supplier (presumably the preparer of the SDS).

The GHS – the same system that produced the hazard pictograms on page 7 – has specified sixteen required sections of information on an SDS. Unfortunately, the United States has only recently adopted the GHS and is in a period of transition to this system, and Haiti has not yet adopted the GHS. This means that the SDSs which are currently in circulation in the apparel industry in Haiti likely do not meet the GHS requirements, although presumably this may change over time. At present, the impact of this situation may be reflected in SDSs which do not contain the GHS hazard pictograms, the GHS signal words and precautionary statements, and which utilize hazard rating systems other than the GHS.

This final discrepancy is noteworthy. The GHS hazard rating system utilizes “1” to indicate the most severe degree of hazard, and has a scale of 1-3 or 1-5 depending upon the particular class of hazard, with “3” or “5” as the least in terms of hazard severity. Two common American systems – HMIS (Hazardous Materials Identification System) and NFPA (National Fire Protection Association) – have an opposite rating system: “4” represents the most severe degree of hazard, and “0” indicates the least. It is important that this difference be understood by factory personnel who rely on SDS information, since one or more of these rating systems may appear on any particular SDS.

It is fair to say that much of the information on most SDSs is generic and probably of limited usefulness. In addition, some information may not be accurate – and at the level of an apparel factory, this problem will likely be difficult to recognize. Be that as it may, certain SDS content can be very helpful to the ordinary users in the factory:

- Date of SDS creation or most recent revision – this will signal how likely it is that some information may be obsolete, and that it may be prudent to request another SDS from the material supplier.

- CAS# and EN# - these are unique identifiers for individual chemicals. They may be used to verify the identities of the chemical ingredients of the material which are listed on the SDS.

- Health Hazards – check for any mention of cancer risk (carcinogenicity), reproductive toxicity or teratogenicity (harm to fetal development).

- Occupational Exposure Limits (OELs) – these refer to the limits on concentrations of the chemicals in air, as vapor, dust or in other form, which are thought to protect workers against occupational illnesses or other adverse effects over a working lifetime. Other acronyms which may appear are TLV (Threshold Limit Value) and PEL (Permissible Exposure Limit). While these OELs are intended to be used as criteria in quantitative exposure assessments such as air monitoring, they do offer some value in ordinary hazard assessment. They may be used as an estimate of the health hazard severity that is presented by a particular chemical, although the identity of the particular health hazard(s) must be specified on the SDS. As a rough rule of thumb, the greater the OEL value, the lower the hazard severity. The following guidelines are offered in Table 1 for those chemicals which are associated with published OEL values:[4]

Table 1. Estimating the Hazard Severity of a Chemical
From its Published OEL Value

Estimated Hazard Severity	**OEL – Vapor Concentration (parts per million, ppm)**	**OEL – Concentration of Dust, Mist, Fume – mg/m^3 (milligrams per cubic meter)**
Negligible	> 500 ppm	> 5 mg/m^3
Minor	250 – 500 ppm	2.5 – 5 mg/m^3
Estimated Hazard Severity	**OEL – Vapor Concentration (parts per million, ppm)**	**OEL – Concentration of Dust, Mist, Fume – mg/m^3 (milligrams per cubic meter)**
Moderate	50 – 250 ppm	1 – 2.5 mg/m^3
Major	10 – 50 ppm	0.1 – 1 mg/m^3
Extreme	< 10 ppm	< 0.1 mg/m^3

- Flash Point – for a Flammable Liquid, this is the temperature at which there is sufficient vapor above an open container of the material to support combustion (i.e. fire). This characteristic may be used to determine the severity of the flammability hazard associated with the chemical material. When the Flash Point of a material is near or below the typical ambient temperature in the factory (~80^{o}F or 25^{o}C) then the flammability hazard should be considered severe. As the Flash Point exceeds the normal temperature range and reaches values of 200^{o}F or greater, then the hazard becomes less and less severe.

- Unusual Reactivity Characteristics or Storage Requirements – this may assist in the identification of chemical materials which should not be stored near each other. The most obvious example of possible relevance to the apparel industry is the recommended segregation of Flammables from Oxidizers (refer back to page 7 for their hazard symbols).

[4] Taken from *Guidance For Conducting Control Banding Analyses"* (2007), American Industrial Hygiene Association

- GHS "Signal Words" – if the SDS is GHS-compliant, it may contain a signal word – either "Danger" or "Warning" – for one or more particular hazards. "Danger" indicates a greater degree of hazard than does "Warning".

Finally, the SDS information cannot be useful if it is not communicated to the workers who actually use the chemicals. Training is an essential aspect of chemical management, and should be provided for workers who use chemicals as well as those who may be involved in chemical storage, transport, or other related activity.

Chemical Storage and Inventory

As a general practice, chemical materials should be stored in one or more designated areas that are designed and constructed for that use. The location should be out of direct sunlight, somewhat remote from high occupancy areas, and not near exits that will provide egress during emergency evacuations. The floor surfaces should be made of a material which is impervious to the types of chemicals being stored therein. Generally, some type of ventilation equipment (e.g. a mechanical exhaust fan) is needed to provide adequate ventilation and avoid the accumulation of highly flammable or toxic atmospheres in the area in the event of a chemical leak or spill. It is prudent to keep these storage areas secured (i.e. locked) when the factory is not in operation.

For the storage of flammable liquids and other flammable chemicals, the presence of possible ignition sources is a major concern. At a minimum, smoking and hot work (welding, torch cutting) should be prohibited in or near such flammable storage areas. The presence of electrical equipment, including switches, inside the room is problematic unless the equipment is rated as "intrinsically safe" or certified as "explosion-proof".[5] Equipment such as generators, boilers, etc. should not share the same space as chemical storage. Portable fire extinguishers should be positioned just outside the entrance to flammable storage areas.

Secondary containment of chemical containers while in storage is a basic principle of good practice. This provides containment of liquid chemicals if the container leaks, spills, ruptures, etc., and prevents dispersion to other areas of the factory or to the environment. The

[5] These are two common terms associated with equipment intended for use in locations which may contain flammable vapor atmospheres. "Intrinsically safe" is a rating which indicates that the power or stored energy of the equipment is not sufficient to act as an ignition source if sparking or arcing were to occur, and thus could not start a fire. "Explosion-proof" is a certification of equipment design: that the enclosure will prevent entry of the flammable vapor to the interior of the equipment, or that the maximum operating temperature of the equipment is less than the minimum temperature which is required to ignite the flammable vapors.

secondary containment may be a physical feature of the storage area, such as a berm around the perimeter of the entire area or some part of it, or a stand-alone device which accomplishes the same purpose (refer to Figure 2 for examples). There are some recommendations on the capacity of secondary containment:

- At least 110% of the volume of the largest individual container in the area
- At least 25% of the total volume of containers in the area
- Berms – should extend at least 4 inches above the surface of the storage area

Awareness of chemical incompatibilities is essential for safe chemical storage. While the number of chemicals with some incompatibility issue is virtually endless, a good general rule is to segregate Flammable liquids (and other flammables) from chemicals that are Oxidizers or Corrosives. In addition, check the SDSs for any information which might identify other possible incompatibilities.

Figure 2. Two examples of secondary containment for chemical storage. On the left, the berm structure raised above the floor is part of the room construction. On the right, a stand-alone secondary containment device. It should be noted that the quantity and arrangement of containers in the photograph on the left may not represent safe conditions.

If separate storage areas are not available, then adequate segregation may be accomplished by physical separation of >5 meters and provision of separate secondary containments. In other words, any chemical container of an Oxidizer or Corrosive should be stored at least 5 meters away from a container of a Flammable, and it should be within a different secondary containment facility (see Figure 3).

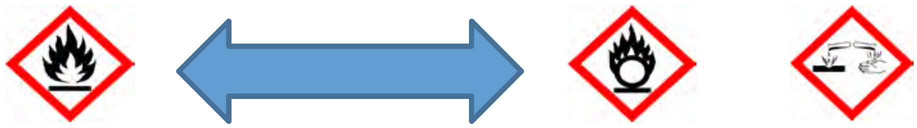


Figure 3. The GHS hazard symbols are used to indicate that Flammables (left) should be segregated from Oxidizers or Corrosives (right).

Finally, some type of adsorbent material should be available near the storage area to remove any liquid chemical from the floor or other surfaces after a spill or leak. Sand may be used for this purpose, although commercial adsorbent products are preferable. In addition, equipment such as shovels, a container and suitable PPE (protective gloves, eyewear, etc. depending upon the extent of the spill and the hazards of the particular chemical) should be available. Alternatively, the secondary containment area may be provided with a drain or drains which are connected by piping to a sealed container or tank to hold the spilled material.

Maintaining a current inventory of chemical materials in storage is beneficial for at least two reasons: (i) it will inform purchasing decisions so that excessive quantities of materials are not on site, and (ii) it is a requirement of Better Work. The inventory records should include the names of the chemical materials on the containers (which should match the SDSs), the approximate amounts in storage, and the locations if more than one chemical storage area exists in the factory.

Chemical Transfers and Transport within the Factory

For some factory operations, it may be convenient to transfer chemical materials from the larger original containers to smaller containers which are then transported from the storage area to the point of use. This activity raises several issues which are appropriately addressed by chemical management efforts:

- Smaller container labeling
- PPE for workers
- Other equipment – carts, spill materials, bonding & grounding wires

The labeling issue is important for health and safety reasons as well as quality, since once an unlabeled container reaches the factory floor its contents may not be known to the workers who use it. At a minimum, a label for the smaller container should have: (i) the identity of the material as it appears on the original container label, and (ii) any hazard pictograms associated with the material, so it is identifiable as flammable, corrosive, toxic, etc. An alternative approach is to copy the original label. The new label may be adhered to the container or it may be a tag which is tied to the container.

Depending upon the hazards which are presented by the chemical materials, any worker who is involved in transferring chemicals from one container to another may need PPE such as safety glasses or goggles, protective gloves, apron, or others. Determination of the need for and type of PPE should be based on a hazard assessment of the chemical material and the transfer activity.

Other equipment may be useful. A cart for transporting the smaller containers to the locations of use may be convenient. Adsorbent materials should be available in the event of a spill, but these should be available in a chemical storage area at any rate.

Finally, for the transfer of flammable liquids, especially from large metal or plastic containers, precautions should be taken to prevent static energy discharge which might ignite flammable vapors during the transfer. The larger container should be electrically grounded, and the two containers should be connected by a bonding wire or cable. If done properly, these steps will ensure that all items are electrically neutral and no discharge will occur (refer to Figure 4).

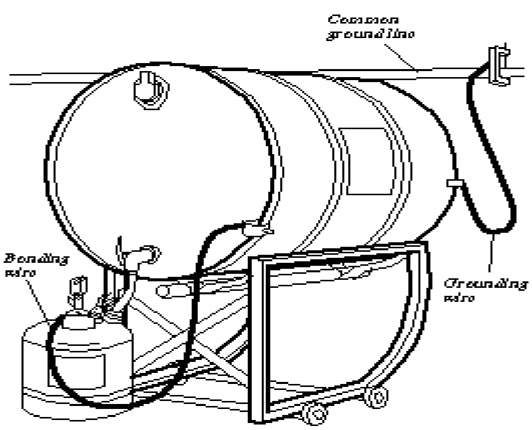


Figure 4. An illustration of the proper grounding and bonding techniques when flammable liquids are transferred between two non-conductive containers (e.g. metal or plastic). Taken from www.grainger.com, Quick Tips Technical Resources, Quick Tips #255, “Bonding and Grounding”.

Chemical Use

At the present time, the three major uses of chemicals at apparel factories in Haiti are: (i) spot cleaning operations to remove oil stains and dirt from fabric; (ii) machine oils for sewing machines and other equipment; and (iii) fuel oil combustion in boilers, generators and other equipment.

There are a number of issues which should be considered and included in a chemical management system approach. The primary objective in the approach to each issue is to ensure that all hazards associated with the chemicals are controlled adequately to minimize the harm that could result. The issues include:

- Container Labeling at points of use – this has been discussed previously (refer to page 20). However, the workers involved in the use of the chemical should know that they should not remove the labels or put different chemical materials in the labeled container.
- SDS Availability and Worker Training – workers should be informed of the principal hazards that are associated with the chemicals that they use, and of the precautions that are needed to prevent exposure to themselves or other harm (e.g. flammability).
- Chemical Hazard Assessment – a basic assessment of the hazards and subsequent risks associated with the particular uses of chemicals should be conducted by factory personnel who have had some training in such assessments and/or some knowledge of chemical hazards. At each point of use, the assessor should consider: are there risks to the worker or to the factory during the particular chemical use because of the nature of the chemical, that is, its toxicity, corrosivity, flammability, etc.? After the initial hazard assessment of an operation, subsequent assessments may be warranted if a new chemical material is introduced to the operation, if there are other changes to the process, equipment or its location, or if the factory experience (e.g. worker illness, injury or other incident) suggest that the initial assessment may not have been accurate or thorough.
- Exposure Controls – this issue is closely related to the hazard assessment. If it appears that a risk does exist from the use of the hazardous chemical(s), then are there control measures that may be implemented to reduce these risks? For example, if chemical odors at the spot cleaning operation indicate that the workers are receiving some degree of exposure to the chemical, should new ventilation equipment be installed, or the existing ventilation improved, in order to reduce the amounts of chemicals in the air in the vicinity of the workers and to disperse the vapors outdoors? If so, should the workers be instructed to always have the ventilation equipment in operation before they begin any spot cleaning activity?
- Personal Protective Equipment (PPE) – this represents one type of exposure control, but it is the least preferable and should be relied upon only if other control measures are not feasible. However, under certain circumstances the use of PPE is quite appropriate. If the hazard assessment reveals that spot cleaning is performed by spraying the chemical onto the fabric, then risks of eye and skin contact with the chemical seem apparent. To reduce these risks, protective eyewear (safety glasses or goggles) and protective gloves should be worn. Similarly, if a corrosive material (e.g. bleach) is being

poured into a machine or handled in some other manner, similar concerns about eye and skin contact arise because of the corrosive nature of bleach. Again, eye and hand protection may be appropriate. However, the proper selection and proper use of PPE does require knowledgeable workers and management. Workers must understand how the PPE protects them from the particular hazard in order to appreciate how it should be worn. Management must understand that PPE should be maintained and replaced when necessary or it will fail to provide the anticipated protection. Finally, there are many issues associated with the use of respiratory protection which make it an ineffective choice for exposure control: suitability of the workers for use of the equipment (i.e. medical evaluations), selection of the proper type of respirator and cartridge for the airborne hazard, proper fit on each worker's face, cartridge replacement, and equipment maintenance and cleaning.

- Spills or other Emergencies – planning is needed for the possible occurrence of chemical spills or other related emergencies in the factory. Are the workers at the location aware of how to respond if a chemical spills? Are adsorbent materials and other equipment accessible? If workers experience a chemical exposure and are ill or do not feel well, do they know how to seek first aid or medical attention?

As new chemical materials and processes are introduced to the factory, or as existing materials are used in new processes or at new locations, these same issues need to be addressed by the factory personnel who are responsible for chemical management.

Disposal and/or Discharge

This element represents the end of the chemical life cycle, and it may occur in different ways depending upon the chemical material and its particular use at the factory. The three most likely fates are: (i) emission to air, (ii) discharge to water, or (iii) accumulation as waste material.

Emission to air is the likely fate of two common chemical uses: spot cleaning and fuel oil combustion. In the first case the chemical evaporates as it is used and is dispersed into the air, and in the latter the chemical undergoes combustion and the products (primarily carbon dioxide) are discharged through the stack into the air. In each case a good management practice would be to record the amounts of each type of chemical being consumed, so that baseline information is available in the event that the factory undertakes an effort to reduce air emissions in the future. Such recordkeeping should be simple if chemical purchasing records are available.

Discharge to water should not be a fate for any chemicals in the current “cut & sew” operations in the apparel industry in Haiti. However, if washing or other fabric treatment processes are incorporated into factory operations, then chemicals in wastewater will become a management issue. Depending upon the characteristics and amounts of the process chemicals which will enter the wastewater stream, it may not be appropriate to discharge them directly into the sewer or other waterway without some form of treatment. If an industrial wastewater treatment facility is available to the factory, then collaboration between these parties will be necessary. The factory must inform the facility of the chemical constituents that are likely present and other characteristics (e.g. pH, temperature) of its wastewater, so the facility can ensure that the treatment method is appropriate and the wastewater is compatible with the method.

What of materials such as used machine oil or hazardous building materials such as asbestos or PCBs? In Haiti, at the present time there is no disposal facility which satisfies recognized international criteria as a suitable hazardous waste disposal site. Certainly this creates a dilemma for apparel factories. If these waste chemicals are accumulated by the factory to await ultimate disposal, then the containers should be stored in an area that has similar features to a chemical storage area, as discussed on pages 17-19. However, the area and the containers should be clearly marked as “Waste Chemicals”.
A best management practice in regard to waste chemicals is to track and document their transport and eventual disposal (or reuse or recycling) location. This should involve an inventory of the chemical materials that leave the factory, and receipts or manifests from the transporter of the wastes and from the owner of the ultimate disposal/recycling facility.

Empty Chemical Containers

Empty chemical containers present an eventual environmental hazard and an attractive nuisance to the community, who may see them as useful and not understand their possible hazardous nature (see Figure 5).

Figure 5. A photograph of empty chemical containers that have been left outside an apparel factory in Haiti.

The best solution is to have an agreement with the chemical supplier that all empty containers will be returned. There should be strong insistence on this point by the factory management.

If that solution cannot be achieved, then the factory needs to manage the fate of these containers. They should not be released for public use, since there is still residue of the original chemical material. If these empty containers were used by the public to hold drinking water, the water could become contaminated and the people could be ingesting the residual chemicals. Because the residue may be flammable, there should be no torch cutting or welding of metal containers that once held chemicals. The factory may reuse the containers as ordinary trash receptacles only if the chemical residue can be safely removed or cleaned. Another possible reuse is as containers for the accumulation of waste chemicals, although the containers should be designated for the same chemical material that they originally held or materials with very similar characteristics.

IV. A Basic Approach to Creating a Written Chemical Management Plan

A. A Recommended Approach

A fundamental requirement of management systems is documentation. A chemical management plan need not be a single document, but rather may be a collection of related documents which are intended to achieve various aspects of the same objective: the safe management of hazardous chemicals at the factory.

Section III of this Guidance Note has recommended the proper scope of chemical management efforts at a factory and has laid out the likely elements of a Chemical Management Plan, based on the anticipated life cycle of chemicals in the factory. Also, specific issues which arise within each element and are appropriate subjects for a systematic management approach have been identified. Clearly, addressing each of the relevant elements in a manner which ensures adequate and consistent chemical safety performance appears to be a complex task. Just as clearly, it will require the involvement of more than one factory management representative.

However, if the approach adopted by the factory is to look at one issue or element at a time, and the relevant information is recorded, then eventually the whole of these documents will comprise a relatively comprehensive chemical management plan.

The policy which acknowledges management recognition of the importance of chemical safety and which drives the chemical management efforts, created and written by factory management (refer to page 8), may serve as the introductory section to the plan. This states the broad objectives which provide the targets for all of the text which follows. After the policy statement, the plan may be organized in sections by documents which are related to each of the elements which are discussed in Section III.

There are several benefits to the creation and maintenance of such documentation:

- The specification of tasks, equipment, personnel and other information to ensure chemical safety in the factory.
- The assignment of responsibilities to individuals or groups of factory personnel, so that some level of accountability may be achieved.
- The assurance of consistent performance of these chemical-related activities over time (so long as everyone is aware of their responsibilities under the plan).
- Evidence to interested stakeholders and other third parties that the factory has undertaken such chemical management efforts.
- And presumably, movement towards the achievement of the stated goal(s) in the original policy.

B. A Framework for Written Procedures

The preliminary step in creating procedures, before any writing is done, should be the collection of information at each factory location of relevant chemical activity. Observe what is done and how the chemicals are handled, and talk to workers and supervisors to determine if they have standard work practices which have become routine. Then consider if the existing work practices provide adequate control of the chemical hazards: should the work practices be changed or do they need to be improved? Are there certain aspects of the work practice which are lacking at present, but which should be included in the future (e.g. use of a hand truck for movement of chemical drums, use of eye protection when pouring chemicals into smaller containers, etc.)

Once this step has been completed, then the writing may begin. One reasonable approach would be to create a set of written procedures for each element which is discussed in Section III. It may be convenient to create more than one procedure for some elements; e.g. Chemical Use may have procedures for Spot Cleaning, Machine Oils, and Fuel Oil. However, any approach which accounts for and documents the significant steps taken by the factory to manage chemicals during their life cycle may be effective.

It will be helpful to have a uniform framework for each written procedure. The following is recommended as a relatively simple approach which is consistent with good management systems:

- What are the subject and objectives of the procedure?
- Who are the responsible factory personnel?
- How and Where are the actions to be performed?
- When and How Often are the actions to be performed?
- What is done to Check on the actions and the procedure?
- Is the Procedure (and the Management Plan) working as intended?

The final two bullets account for the final two steps of the fundamental management system cycle: Plan – Do – Check – (Re)Act .

What are the Subject and Objectives of the Procedure?

The first thing that the procedure should state is its subject: which of the elements of the chemical management plan is addressed by this procedure?

The very next content of the procedure should be its objective(s): what is the intended outcome of this procedure? (e.g. safe chemical storage, or safe disposition of empty containers). The objective(s) of the procedure also may be related to the policy: how will this procedure support the goals of the policy statement prepared by factory management?

Who are the Responsible Factory Personnel?

The next section of the procedure should identify everyone at the factory who has some responsibility for the actions that will be described in the procedure. This may include people who were involved in the planning stage, workers who are involved in the activity, and those who may be responsible for checking on the procedure to see if it is being followed successfully. These factory personnel should be identified specifically, either by name, job title or job classification. So for example, the procedure on Chemical Delivery and Receipt should clearly identify who is responsible to inspect the container and receive the SDS, and who is responsible to move the container to the chemical storage area.

This section of the procedure may also identify occasions for worker training, particularly in the element of Chemical Use but for other elements as well. Again, it should identify by name, job title or job classification, who should provide the training and who should receive the training.

It also should be mentioned that members of factory OSH Committees may be usefully employed during the Check phase of the procedures. Chemical management activities represent a significant OSH issue, and Committee members may be better qualified by previous training to recognize and evaluate the risks associated with chemical hazards.

How and Where are the Actions to be Performed?

This section of the procedure is where the good work practices should be described. It need not contain every detail of the work practice, but should include those aspects of the tasks which are relevant for chemical hazard control. In addition to the work practices, consider these two other types of information that might be appropriate:

- Are there any specific requirements for particular tasks or activities? For example, what types of PPE are required when transferring chemicals from large containers to smaller ones? Or, should mechanical ventilation be put in operation (i.e. turn on the exhaust fan) before any spot cleaning activity begins? These should be spelled out in this section of the procedure.
- Are there only certain factory locations where these activities should occur? Several obvious examples come to mind: when SDSs are received, where should they be kept? Or newly received chemicals should be brought only to a specific chemical storage area, not just anywhere in the factory. Or spot cleaning: may it be done anywhere in the factory, anywhere as long as it is near an exhaust fan, or only in a designated spot cleaning area?

When and How Often are the Actions to be Performed?

The procedure should also state if there is a required frequency to any particular actions, or if there is critical timing. Frequency may be most relevant to the Check section of the procedure (e.g. a supervisor will inspect the chemical storage area at least once per week, or the receiving area or loading dock should be inspected at the end of every day to ensure that all new chemical containers have been moved to a storage area), but it may be applicable to other issues as well. For example, how often should chemicals be delivered from the storage area to any particular point of chemical use? The specific frequency for any particular action will depend on the action itself, the nature and needs of factory operations, and the associated chemical hazard(s).

Critical timing may be an aspect of several procedures, and should be clearly stated. Several examples can be provided:

- If the factory decides to embark on a best practice, the SDS for a chemical material should be obtained and reviewed <u>before</u> the material is purchased.
- Labels should be attached to small containers before transferring the material from a larger container in the chemical storage area.
- When should PPE be worn during certain tasks? It is uncomfortable and unproductive to require that workers wear PPE all day if they only need protection from hazards at certain times.

What is done to Check on the Actions and the Procedure?

At this point in the procedure, a few relatively simple steps should be identified which will provide a check on the effectiveness of the procedure: (i) do the actions and work practices reflect what is specified in the procedure? and (ii) has the procedure met its objective(s)?

The first of these may be evaluated by inspection of the particular work location, observation of workers at their tasks, and/or interviews with workers and supervisors. If they are not following the procedure, determine why not: are they not aware of the procedure, was necessary equipment or PPE not provided, are they not aware of the possible chemical hazard(s), or are they simply neglectful?

To answer the second question, there should be additional investigation into the safety of the workers during the particular activity. Have there been any accidents or injuries associated with chemicals? Have workers been exposed to the chemicals, either through inhalation or skin? Have unlabeled containers created problems? In addition to observations and interviews at the location, this may warrant a look at the factory accident and injury/illness records.

There are at least four possible outcomes of the Check phase:

- The procedure is being followed, and workers appear to be safe from the chemical hazards
- The procedure is being followed, but one or more unsafe conditions related to the chemical activity seems to exist
- The procedure is not being followed, but workers appear to be safe and no unsafe conditions appear to exist
- The procedure is not being followed, and one or more unsafe conditions related to the chemical activity seems to exist

When this type of Check has been performed for each procedure, which in combination cover each element of the chemical management plan, then the effectiveness of the plan as a whole can be evaluated.

Is the Procedure (and the Management Plan) working as intended?

The final necessary content of any written procedure is the authority to revise or change the procedure, based primarily on what has been learned during the Check phase of the procedure. Certainly if workers appear to be at risk or unsafe conditions exist despite adherence to the procedure, then a change in work practices and revision of the written procedure may be needed.

If similar chemical risks and unsafe conditions are found to exist, but the procedure has not been followed, then some type of encouragement, training or enforcement may be needed rather than a revision to the procedure. It is difficult to evaluate the effectiveness of a procedure when it is not being followed by the responsible personnel.

Factory management should anticipate that a periodic review and editing of the written procedures of the chemical management plan will be necessary to keep the document current and relevant. Chemical materials and their associated hazards may change over time, factory processes and layout may change, factory personnel may change jobs or leave the factory, and all of these may result in written procedures which have become obsolete.