

Evaluating the impact of chemical waste:

How safety and the bottom line can both benefit

Manufacturing uses labour, machines, tools, chemicals and biological processing to transform raw materials into finished goods on a large scale. All of which have a direct cost that can be easily calculated and tracked.

What are less apparent are the hidden costs of the manufacturing processes; specifically, those involving chemicals. That are used to clean parts, materials and equipment.

Uncovering the hidden costs

It's the hidden costs – not of the chemicals themselves, but of the way they are dispensed, used, and stored – that can have a significant impact on an organization's bottom line.

Simple measures to streamline chemical usage can deliver surprisingly impressive results. More efficient dispensing, application, and storage of Chemicals can lead to safer working conditions as well as lower costs.

This paper sets out to show that the appropriate use of chemicals is as much a process/production opportunity as a health and safety issue. Understanding the real cost of chemical application is vital.



Section 1

Hidden cost of chemicals

In the case of many widely used industrial solvent products such as Methyl Ethyl Ketone (MEK), Methyl Propyl Ketone (MPK) and Methyl Isobutyl Ketone (MIBK), these chemicals can cost a great deal of money and there are few viable and effective alternatives.

Such solvents can be hazardous to workers' health and safety if not used appropriately, and require additional care in handling and disposal to reduce the impact to the environment. Where there may be more environmentally friendlier or safer options, the cost and effectiveness of those options may be prohibitive.

Even when the purchase price of the chemical itself – for example, acetone – is relatively low, the cost of continual replacement and application due to a high evaporation rate can account for a huge expenditure in the industrial supplies budget.

And while it's difficult to attribute an exact cost to the chemical element of any common manufacturing task, an examination of usage over the course of a year will give an idea of the cumulative effect.

Maximizing value

The overall cost of chemicals can be reduced through more efficient application. What would the impact of a 20% reduction in chemical use mean in your operations? The key is to identify ways to reduce chemical waste throughout the process:

- Storage (primary and secondary)
- Dispensing
- Application



Section 1

Hidden cost of chemicals

Standards and training are critical

Routine use of chemicals in the workplace may be overlooked when establishing standards and conducting safety training. Training on safe, effective and efficient application processes is vital to reduce chemical waste.

But first, there must be a standard established. Without proper standards, the amount of chemical each employee uses can vary tremendously. More importantly, a work standard will ensure safety procedures are established and followed.

Workers who understand the processes can be a key factor in identifying and eliminating inefficient practices. Allowing those that are closest to the work to establish the standards will ensure adoption and consistency, which will lead to more effective management of chemical costs.

When employees are part of the problem-solving process, they can often deliver workable, cost-saving solutions while maintaining safety and efficiency. Providing them with vital information – whether it is the impact of chemical usage on the company's bottom line or the hazards of exposure – will raise awareness and lead to workers engaged to solve the issues.

Signage that effectively communicates key information about the application process, including safe handling instructions, can be very effective in reinforcing established standards.

Good visual control (signage) should follow these principles in order to be most effective:

1. Make it obvious and easy to understand
2. Make problems visible
3. Communicate at a glance

Section 2

Storing and dispensing chemicals: Where is the waste?

Correctly managing the use of chemicals through standards and training is the first step towards reducing waste and cost in chemical application processes.

It's worth examining various aspects of chemical usage to understand exactly where and why waste occurs. A detailed review of your own chemical application and storage processes might be overdue, as some may have been in place for years without revision.

Portable containers

The type of portable containers that are used to allow easy access to chemicals at the point of use can affect efficiency and waste in many ways. Open containers (pails or buckets) make it easy to transport small amounts of chemicals to the point of use and allow workers to use as much chemical as they want by applying it directly onto the surface or heavily saturating a towel or wiper.

But open containers can also increase risk of contamination through air particulates or accidental mixing with other chemicals. Exposure to air may initiate degradation and/or evaporation of some chemicals. This results in the need to purchase more over time than may be required.

The evaporation rates of some solvents can be extremely high, resulting in a significant loss of the chemicals prior to use. For example, MEK and acetone evaporate 13 and 19 times faster than water, respectively. Chemicals in an open container evaporate much more quickly than those in enclosed (with a lid) systems.

Additionally, open containers can present significant risk of spills and exposure incidents. Many types of solvents contain Volatile Organic Compounds (VOCs). Some VOCs are suspected of causing, or are known to cause, cancer in human beings.

Local exhaust ventilation (LEV) is an engineering control that can reduce or eliminate exposure to VOC's and is a good option to protect everyone in the work area. High quality ventilation systems can reduce VOC exposure by 80-99%.¹ However, exhaust ventilation systems can also be very expensive – and may not be a feasible option in every manufacturing environment.

Semi-closed containers, such as squirt bottles can be used to control evaporation and significantly reduce the risk of spills. However, there is still the risk of overspray or splash with these systems.

By contrast, pre-saturated wipers provide efficient saturation and reduce loss of chemical evaporation. These systems have been shown to reduce chemical usage up to 20% over a 60-day period. Although the level of the saturation of the wipers cannot be altered in the closed bucket system, the closed bucket system provides enhanced protection to workers by reducing the potential for spills and splash.

Identifying the most efficient and safe portable containers depends on the specific chemicals used and the designated processes for these chemicals. Evaluations of chemical use and storage should be conducted with Environmental, Health & Safety professionals, the affected employees, and manufacturing operations.

Example of solvent plunger



Example of closed-bucket system



Section 2

Storing and dispensing chemicals: Where is the waste?

Dispensing Bulk Chemicals

Chemicals are used at the task point, which means placing them into secondary containers such as bottles or pump cans for portability. The simple task of refilling secondary containers creates additional inefficiencies and hazards.

Bulk chemicals should be stored in areas that are easily accessible by employees. Not only to save time, but also to lessen the risk of slips, trips and/or falls when refilling containers.

Considerations for establishing areas for bulk chemical storage include:

- Local regulations
- Health & safety requirements
- Distance from work stations
- Frequency and number of trips required for each task
- Maintaining safe traffic flow to/from the storage area

Dispensing chemicals into secondary containers may have potential hazards and inefficiencies. A standard work process can help reduce these. The following should be considered:

- Is the correct amount of chemical dispensed into the secondary containers?

- Are one or multiple persons responsible for refilling the containers?
- What is the frequency for refilling containers?
- Do the secondary containers require storage in a fire-proof cabinet?
- Are employees at potential risk for strains or sprains when carrying over-filled secondary containers?

These are some of the questions that should be answered to ensure that workers have adequate chemical supplies when they need it, and are efficiently using the chemicals in a safe manner.

V.I.C.E.S.

The UK Health & Safety Executive recommends following these five principles to minimise risks with flammable substances:

(V) Ventilation

Is there plenty of fresh air where flammable liquids or gases are stored and used? Good ventilation ensures that vapours from any spills, leaks, or releases are rapidly dispersed.

(I) Ignition

Have all the obvious ignition sources been removed from the storage and handling areas? Ignition sources include sparks from electrical equipment, welding and cutting tools and hot surfaces, as well as open flames from heating equipment.

(C) Containment

Are your flammable substances stored in suitable containers? Will chemicals from any potential spills be adequately contained? Equipment such as lidded containers and catchment trays help contain spills.

(E) Exchange

Can you exchange a flammable chemical for another, less flammable chemical? Or is it possible to eliminate flammable substances entirely? Are there other, safer ways of carrying out the job?

(S) Separation

Are flammable substances stored and used in separate, designated areas?

Section 3

Controlling application costs

The wiping process itself is also an important consideration.

Inefficient methods of application can aggravate waste in chemicals. Dipping wipers or rags directly into the chemical may result in excessive chemical usage and unnecessary exposure to the worker. A reusable towel can also contaminate the chemical itself, with dipping and re-dipping of a soiled wiper into the chemical.

Pouring the chemical directly onto the surface is also wasteful and potentially hazardous, such that additional PPE may be required.

The wiper or rag is just as important

In some situations, a general purpose cloth or wiper can serve most chemical application needs. If the rag is not designed for the task, it may create additional wastes and hazards.

Designed for the task

Abrasive and smooth surfaces demand different types and grades of wipers. The durability and pliability of the product should be evaluated for use on crevices, sharp edges and irregular surfaces. Additional chemicals may be used to compensate in environments where the wiper is inadequate for the task. And many times, the chemicals are more expensive than the wiping material used to apply the chemical.

Some rags may shed small particles or lint. The presence of these small particles may negatively impact the quality of a part and require expensive re-work. An example is the paint process where lint and other minute debris can create defects known as “fisheye”. In the Aerospace industry, lint is considered Foreign Object Debris (FOD) which can have a disastrous effect on sensitive equipment. The National Aerospace FOD Prevention, Inc. estimates the cost of FOD to the global aerospace industry at \$4 billion annually.

Certain substrates (polyester and cotton) are less effective in releasing the chemical, such that the wiper must be over-saturated with the chemical to complete the job. Fit-for-task wiper options reduce the amount of chemicals needed by releasing the optimal amount of chemical onto the surface area.

It's not always the chemicals themselves that are hazardous. Reusable cloths, even after laundering, could contain toxic heavy metals. These metals that are not found otherwise in the facility could be introduced by laundered cloths previously used in other facilities.

Manufacturers buy laundered cloths because of the perception that cloth is environmentally-friendly. However, laundered cloths can create inefficiencies and quality issues within manufacturing processes – and they still have a negative impact on the environment. For example, they are tossed in the landfill with the chemicals still in them.

Section 4

Conclusions

This paper demonstrates that it is possible to reduce chemical costs by identifying and limiting the wastes found in dispensing, storage and application. Reducing these hidden costs will also improve productivity and health & safety in the workplace.

And the effects of reducing chemical use are far-reaching, and long-lasting.

According to Deloitte's David Linch in The Evolving Supply Chain: Lean and Green: "Improved resource efficiency can help insulate businesses from commodity shortages and price shocks... It can also create a halo effect [around] an organization's image and brand."

Reducing chemical usage boosts the bottom line

However, it's on the balance sheet that cutting chemical wastage and the associated cost really adds up.

Following these suggestions, your organization could reap the benefits of a cleaner, safer environment and enjoy potential cost savings and efficiency gains.

Getting more out of KIMBERLY-CLARK PROFESSIONAL*

We would like to help support you on your continuous improvement journey, by providing a fresh perspective on your use of chemicals.

By conducting a Site assessment, focusing on where people meet process, we believe we can identify opportunities for reducing:

- Chemical consumption
- VOC emissions
- Re-work due to contaminants
- Over-processing and motion waste

We call it The EFFICIENT WORKPLACE, it is our programme that helps drive continuous improvement in efficiency, safety and occupational health.

Request a Waste & Hazard Walk to review all of the processes that involve chemical usage and determine where incremental improvements can be made.

Book your Waste & Hazard Walk today...



Sources:

- ¹ [Dangerous Substances Handle with Care](#), Magazine of the European Agency for Safety and Health at Work

