Eliminating chemical safety deficiencies in the workplace can empower organizations to satisfy regulatory requirements and pass workplace chemical audits

**ABSTRACT**

Every year, many organizations fail to pass audits of their workplace chemicals because those chemicals and related supplies are not managed and controlled in a safe manner in accordance with regulations. One of the main causes for the continuing chemical safety deficiencies in the workplace that drive audit failure is the large number of requirements governing chemical-related work. Numerous local, state and federal requirements have been promulgated to protect workers, equipment, facilities and the environment from the hazards associated with chemicals. Because such requirements can number in the thousands, simply identifying all of the applicable chemical safety-related requirements that govern any particular work activity with chemicals can be a monumental task. In addition, many of these requirements approach chemical safety from different perspectives, contain overlapping provisions, are sometimes contradictory and often confusing.
This white paper examines the challenges and presents best practices solutions to assist chemists in understanding and addressing the myriad chemical inventory management requirements with which they must comply. To assist in chemical management audits, the white paper includes a series of activity-based checklists governing chemical-related work activities — with overlap and duplication of requirements removed.

INTRODUCTION

From lubricants to solvents, from flammable materials to corrosives, many organizations today handle and store a number of different chemicals that must be managed safely. It’s not enough to ensure that you know where chemicals are, provide training and information about correct handling procedures and ensure that chemicals are stored and disposed appropriately. There are many rules and regulations to ensure that these minimum requirements are met. Rather, because of all these requirements – some of which conflict – it is extremely important to ensure that your organization is able to pass chemical management audits to prove that your system works both well and safely.

The U.S. Environmental Protection Agency (EPA), for example, not only has legal authority to enter a facility and conduct a chemical safety audit under sections 104(b) and 104(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Actually, they are required to do so.

The penalties for failing such an audit can be severe; the best course is a best practices approach to ensure that your chemical management program works and your audits are successful.

BEST PRACTICES IN CHEMICAL SAFETY

Best practices are “best in class” business policies, procedures and processes that have continuously proven successful for many organizations.

Best practices in chemical safety are applied to an organization’s chemical management processes, and involve more than just managing chemical inventory. Audits, whether internal or external, are focused not just on whether your chemicals are where they are supposed to be, but whether your procedures for managing those chemicals in a safe manner are appropriate and performed correctly. Safe chemical management starts the moment a shipment arrives and continues until materials are either used or disposed. Best practices in chemical safety therefore focus on eliminating chemical safety deficiencies and ensuring chemical inventory safety.

A best practices chemical management solution uses defined processes and robust software that take advantage of industry-leading techniques such as Pareto analysis, Just in Time (JiT) and Material Requirements Planning (MRP). Leveraging these and other tools will enable your organization to perform effective chemical stock monitoring, storage, handling and hazards analysis as well as successfully pass audits against those processes.
WHY CHEMICAL SAFETY DEFICIENCIES HAPPEN

There are a number of ways in which an organization’s chemical management processes can be deficient and safety deficiencies can occur. In fact, it sometimes seems that no matter what measures have been put in place or how much training is provided, unforeseen errors still occur and audits still uncover problems with process design or execution. Still, the goal is the eradication of chemical safety deficiencies and these tend to be driven by three main causes: people, processes and technology (Figure 1).

Staff training on safe chemical handling is not a one-time event. It must take place at regular intervals and chemical handling tasks should be periodically monitored, either through regular checks or internal audits, to ensure that staff continue to perform tasks as specified. Studies show that the vast majority of safety problems arise through poor handling.

“Whenever there are processes that use temperature and pressure to change the molecular structure or create new products from chemicals, the possibility exists for fires, explosions or releases of flammable or toxic liquids, vapours, gases or process chemicals. The control of these undesired events requires a special science called process safety management. The terms process safety and process safety management are most commonly used to describe the protection of employees, the public and the environment from the consequences of undesirable major incidents involving flammable liquids and highly hazardous materials. According to the United States Chemical Manufacturers’ Association (CMA), ‘process safety is the control of hazards which are caused by maloperation or malfunction of the processes used to convert raw materials into finished products, which may lead to the unplanned release of hazardous material’ (CMA 1985).”

— Developing Process Safety Management Programme, by Richard S. Kraus
Sometimes safety problems are caused by a poorly designed process. If the process is difficult to perform or difficult to understand why it should be performed in a certain way, errors are bound to occur. Not just errors; fatalities, injuries and significant property losses can result when people do not understand the full ramifications of the chemicals or materials they are handling, either because they didn’t receive notification or didn’t follow training or weren’t trained appropriately. The challenge therefore is to design processes that are as simple and foolproof as possible. That’s not easy, but it wouldn’t be a challenge if it were!

Technology can smooth out a process and make it easy for people to perform, or technology can add unnecessary layers of complexity to a process and cause users to perform workarounds to get the job done faster. A software solution, therefore, must enhance the performance, handling and monitoring of chemical management, and not cause bottlenecks or usage problems. Many companies use an off-theshelf chemical inventory system to support their chemical management program. A poorly designed system isn’t particularly easy to use, and won’t have necessary functions or provide information required to pass audits. A well-designed system will address regulatory requirements, accommodate safe chemical handling and storage, and make it easy for users to perform tasks.

When these three criteria are addressed with a strong training program, carefully planned processes, and a comprehensive chemical inventory system – particularly when utilizing best practices – you are well on the way to ensuring that your system and processes will pass an audit successfully.

**GAINING CONTROL OF CHEMICAL INVENTORY**

To survive a chemical management audit, you need to have control of your chemical inventory. The most effective way to do so is to have an environmental management system (EMS) in place that enables your laboratory to perform safe usage, storage and disposal of chemicals.

The EPA states that “an EMS is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency.” It is a continual cycle of planning, implementing, reviewing and improving processes and actions based on a “Plan, Do, Check, Act” philosophy (Figure 2).

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**Figure 2:** An EMS should be based on a continual cycle of planning, implementing, reviewing and improving processes and actions based on a “Plan, Do, Check, Act” philosophy.
The International Organization for Standardization (ISO) has developed an EMS called ISO 14000 that has been widely adopted by industry and highlighted by the EPA as one approach that has proven consistently successful. If your organization has already adopted ISO 9000, the popular quality management system, then supplementing it with ISO 14000 should prove relatively easy to perform. Alternatively, the EPA web site (www.EPA.gov) lists a number of other approaches for consideration.

In any case, a formalized EMS will provide your lab with a structured means to conduct regular audits to assess regulatory compliance and occupational health and safety issues as well as determine chemical incompatibilities, what to do in the event of a chemical spill and how and when to perform workplace inspections.

The steps required to gain control of chemical inventory are:

- Identify chemical inventory
- Identify existing chemical safety processes
- Utilize the Best Practices Chemical Safety Audit Checklists (Appendix A)
- Audit existing chemical safety processes
- Conduct a gap analysis
- Develop end-to-end chemical safety SOPs
- Implement a chemical inventory system that addresses regulations and dovetails with SOPs
- Train users in safe chemical management
- Conduct an internal chemical safety audit

Some of these steps will be relatively simple to perform; some may already be in place; some may take several weeks to implement.

**Identify Chemical Inventory**

Identifying your chemical inventory would appear to be easy, but chemicals get moved and not replaced, or tucked in a corner for convenience and forgotten. Just getting a handle on exactly what chemicals are in stock and their status, and managing that information electronically in a chemical inventory system can provide an accurate picture of all the chemicals on site as well as cut inventory costs by eliminating over-ordering and waste.

**Identify Existing Chemical Safety Processes**

It’s vitally important to handle your chemicals safely and in compliance with regulatory requirements. If you haven’t already, you need to identify and catalog your existing chemical safety processes. Chemical process safety management is the safe management of potentially hazardous chemical processes and materials and involves hazard identification, hazard resolution/control, etc. The term is also applied in a more specific and limited sense to the OSHA-mandated procedure by 29 CFR 1910.119 for managing and controlling the hazards involved in chemical processes utilizing certain specified highly hazardous materials.

**Utilize the Best Practices Chemical Safety Audit Checklists**

Now that you know what chemicals you have and the processes for managing those chemicals, use the five best practices chemical safety audit checklists at the end of this white paper to determine if you are meetings all the requirements in the OSHA and National standards (see Referenced Regulations). The checklists are designed to be answered with a simple Yes or No; either you are or are not performing a process. They list the questions you need to ask to ensure you are in compliance with regard to managing your workplace chemicals.
For example, a task as basic as correct storage of flammable gas seems mundane until it isn’t performed correctly. On January 25, 2005, a gas explosion caused by the accumulation of flammable gas in an enclosed space killed three workers at an Acetylene Service Company plant in New Jersey that produces, repackages and distributes acetylene used in welding. The blast originated in a wooden shed located near six large storage tanks that received liquid waste from the plant’s acetylene-generating system. More than any other type of organization, this company should have known to ensure that acetylene gas containers were stored correctly and the valves checked on a regular basis. The cost for non-compliance is just too high; written checklists backed by regularly audited SOPs are of critical importance in accident prevention. Best practices Checklist 2 in the appendix addresses chemical storage requirements.

**Conduct a Gap Analysis**

Compare the deficiencies identified by the chemical safety audit checklists against your existing chemical safety processes to determine what’s missing and develop a comprehensive gap analysis. Now that you have an accurate assessment of how chemicals are managed at your site, you can begin to develop a platform to establish and maintain effective chemical management policies and procedures.

You’ll be looking for gaps in your chemical handling processes. You’ll also be developing hazards assessments, process hazard evaluations and analyses, a process safety audit plan, risk management plans, and an emergency response program if these are not already in place.

Leveraging the chemical safety audit checklists provided in this white paper will enable you to develop a comprehensive approach. Keep in mind that there are many other best practices techniques you can employ during your gap analysis, including Hazard and Operability Studies (HAZOP), Failure Mode and Effects Analyses (FMEA) and Fault Tree Analyses to examine your chemical management program in detail.

**Develop End-To-End Chemical Safety SOPs**

Now that you know where the gaps in your processes are, develop end-to-end processes that fill those gaps. Your Standard Operating Procedures (SOPs) will become part of the EMS, and will be regularly reviewed and audited internally in the future to ensure that the processes change as your laboratory does and that the lab continues to manage chemicals safely and effectively.

In addition to developing comprehensive safe chemical management procedures, you should also develop a Preventative Maintenance Program plan, appropriate operations and maintenance procedures and, of course, a program of regular internal process safety audits.
Implement a Chemical Inventory System that Addresses Regulations and Dovetails with SOPs

If you haven’t already, now is a good time to implement a Commercial Off-The-Shelf (COTS) chemical inventory system that will enable you to better manage your chemical inventory. Because access to the most current Safety Data Sheet (SDS) is critical, an electronic solution that provides direct access to the manufacturer’s latest version of relevant SDS can eliminate uncertainties associated with tracking this particular requirement. A well-developed chemical inventory system will provide not only all the particulars concerning current inventory status but also deliver automated reports to appropriate personnel in a timely manner. It will enable your chemical safety efforts to be proactive rather than reactive.

A COTS inventory management solution enables your organization to keep track of where chemicals are and how much are available. The solution can also generate reports listing chemicals by location, vendor, name, CAS number, formula, etc., and it can quickly access hazard information during an emergency.

A truly effective best practices chemical inventory system, however, goes beyond inventory management and government compliance. Such a best practices solution will address each stage of the chemical management lifecycle, which begins with procurement and extends through use and disposal of chemicals.

Best practices inventory solutions provide a high-performance, relational database system for tracking chemicals and other laboratory supplies. Accurate, real-time inventory information enables all types of laboratories to operate more effectively, regardless of whether the facilities are regulated or nonregulated. A chemical inventory system that works with other IT solutions can be seamlessly integrated with other systems such as purchasing, accounts payable, etc.
Keep in mind how you will use this system and seek not only a robust feature set, but also an easy-to-use system that will be accessed by a variety of users with different permission levels. The ability to search the chemical inventory system for pre-existing material records and view data associated with the unique material record is an important feature. Users should be able to search for materials by trade name, chemical name, barcode, CAS# and structure (any synonym).

Why are these features important? A common problem many labs stumble over is how to keep track of bulk chemicals, equipment and solvents. Knowing who has taken an item, what condition the item is in upon return, and whether it needs to be reordered are just a few of the questions that need to be addressed to ensure accuracy. A spreadsheet may be easy to implement, but if the information is not kept up to date, it will not yield accurate chemical inventory information, resulting in frustration and discontinued use. Consider too that the system utilized must not only maintain information about what chemicals are being lent out in an efficient and logical manner, but users must also not be restricted from locating chemicals if they don’t type in the exact name(s) or identification number(s) for the compound or make spelling errors. Users should not be expected to second-guess the system.

Another point to consider is that organizations subject to EPCRA (Emergency Planning and Community Right-to-Know Act) must provide not only Form R but also SARA Title I, II and III reports concerning chemical management at the site. Streamlining the process of generating the reports using a chemical inventory system that can customize the reports for the appropriate federal, state or local authority can greatly reduce the calculations, labor and information retrieval typically involved with manual efforts to comply with the regulations.

A best practices system addresses these and other problem areas, allowing the organization to make the best use of all chemicals in all facilities. Features like bar code labeling and tracking, remote inventory control and automatic e-mail notifications are all part of a best practices solution that enables the organization to maintain accurate chemical inventory information in real time.

In addition, the system can also maintain current up-to-date safety information to ensure immediate facility-wide access to SDS or in-house handling instructions in the event of an accident or chemical spill. The most robust chemical inventory systems even address local fire code requirements.
Finally, the downfall of many custom-designed chemical inventory systems is that they are too difficult to use. The result is that only a few people in the company have the knowledge and patience to use the system. As a result, accuracy and timeliness of the chemical inventory data suffer. Valuable time may be lost when experiments must be stopped because the necessary chemicals are not on hand. A best practices solution is easy to learn and use, ensuring adoption and use.

Best practices in chemical inventory management enable chemical inventory accuracy driven by error-resistant processes, well-trained users and intelligent use of technology. Understanding how to achieve best practices involves understanding the conditions under which errors occur and why systems fail.

An effective chemical inventory system can improve staff productivity by eliminating chemical management from staff responsibilities, enabling lab staff and management to focus on mission-critical tasks, not repetitious chores.

Train Users in Safe Chemical Management
It’s also important to provide access to material handling procedures and safety data – particularly SDS – that your organization is required by law to make available on site. Eliminate the task of maintaining such a system. Your chemical inventory system should allow you to upload SDS document and/or have links to online SDS solutions, such as ChemWatch, that automatically provide access to current SDS information. ChemWatch is one of the most widely used chemical information and SDS databases in the world. The ChemWatch database provides detailed information on chemical hazards identification, first aid, first response, personal protective equipment, physical properties, toxicology and regulations. Data is available for 40,000 pure substances and 85,000 common mixtures. When this type of database is accessible online at your organization, users have instant access to all required data.

Once your system is implemented, educate and train your employees on how to use it. Training is part of post-sales follow up by the inventory system vendor to ensure that policies and procedures are in place to leverage the system effectively at your organization. It should only take half a day to learn how to use an intuitive solution. In fact, it should take no more than a week to install and populate the system and train people how to use it.

Beyond having a chemical inventory system and knowing how to use it, one of the most critical components of an EMS (and one that you will be audited against) is user training. Access to process safety information, incident investigation reports and process hazard analyses should be provided to all appropriate employees including contract employees working in the designated area or handling chemicals to which they may be exposed. The training should cover everything from process operations and process hazards to safety and health hazards related to the process, catalysts and materials.

Chemists who handle chemicals need to be trained how to do so safely, and that training needs to be documented and readily accessible. Here again, your chemical inventory system should be linked to the EMS to provide instant access to training records and email notification when retraining is necessary.

Conduct an Internal Chemical Safety Audit
Internal chemical safety audits are not one-time events, but need to be conducted regularly both for your own peace of mind, as well as to ensure that your organization will pass an external chemical safety audit.

Workplace inspections and audits play a key role in preventing accidents and injuries by identifying hazards, implementing corrective measures and monitoring the effectiveness of the controls. It is recommended that laboratory supervisors with the assistance of one or two workers conduct inspections as a team on a regular basis.

Remaining in compliance with chemical safety rules and regulations is an ongoing task. Your laboratory needs to guarantee that processes for handling chemicals are performed correctly, that every container is labeled properly at all times and that all training is documented in a timely manner. If you are not in compliance with all the rules, severe financial penalties may be assessed for non-compliance.
One of the simplest tools you can use to stay in compliance (and avoid expensive fines) is to perform internal compliance audits on a quarterly or semiannual basis. Internal audits with proper follow-up show regulatory agencies that your laboratory is proactive in its compliance duties. Even the best system isn’t perfect and regulatory agencies will take your proactive measures such as internal audits into account when determining whether a fine should be issued for specific violations.

Remember that whether the audit is internal or external, the auditor will be looking closely at whether there is proof that the process was performed as specified. Amazingly enough, this is the area where most employees make mistakes; e.g., not providing the proof that they performed the required steps.

The primary objectives of safety audit programs are to identify the potential causes of accidental releases of hazardous substances and to enable management to employ the proper means to prevent such releases from occurring, to promote government and industry safety initiatives in these areas and to share these results with the community, targeted industries and other specified interested groups.

Your audit should consist of interviews with laboratory personnel and an on-site review of various aspects of laboratory operations related to the handling of chemicals on site. The goal of the audit is to ensure that your organization has a chemical management program designed to prevent accidental chemical releases. Observations and conclusions from the audit are detailed in a report that identifies both problematic and successful chemical process safety management practices, as well as technologies for preventing and mitigating areas of deficiency.

**SUMMARY**

In conclusion, using best practices in chemical safety management significantly increases the ability of an organization to ensure that chemicals are received, stored, identified and disposed of as safely and efficiently as possible. Government regulations have been promulgated to help identify and correct the processes, material and equipment most susceptible to problems, but it is the responsibility of every site that handles chemicals to put processes in place and follow those processes correctly to avoid the consequences of deviations.

Chemical safety management is as much about risk management as it is about ensuring that your organization’s chemical inventory processes are as streamlined and optimized as they can be. Minimize the risks by maximizing the safety. Addressing the various chemical safety regulations with an industry-proven commercial chemical inventory system can keep your organization in compliance with the least amount of effort while significantly reducing typical errors found during internal and external chemical inventory management audits.

Leveraging industry best practices for chemical inventory integrity further ensures that your company is performing due diligence in meeting safety obligations.

**BIOVIA CHEMICAL INVENTORY MANAGEMENT WHITE PAPERS**

For more about chemical inventory management best practices, please request these other white papers from BIOSA:

- Best Practices for Managing Laboratory Chemical Inventory
- Best Practices: Quantifying the Financial Benefits of Chemical Inventory Management
- Best Practices: How to Gain Complete Control of your Chemical Inventory
- Best Practices: How to Successfully Contract Chemical Tracking to Managed Service Providers
- Best Practices: Integrating SDS’s with your Chemical Inventory System
- Best Practices: How to Ensure Accurate Fire Code Reporting of your Chemical Inventory
- Best Practices: How to Drive Down Lab Operating Costs with Web-Delivered SaaS Solutions
- Best Practices: How to Ensure Chemical Inventory Safety and Compliance with Regulations
ABOUT BIOVIA
Dassault Systèmes’ BIOVIA provides a scientific collaborative environment for advanced biological, chemical and materials experiences. Sophisticated enterprise solutions from BIOVIA support Collaborative Science, Unified Laboratory Management, Process Production Operations and Quality/Regulatory Management, driving innovation for science- and process-based industries. For more information, visit www.3ds.com/products-services/biovia

ABOUT BIOVIA CISPRO
The BIOVIA CISPro chemical inventory management system enables organizations to manage chemicals safely from receipt to disposal along the entire lab-to-plant value chain, ensuring Environmental Health and Safety (EH&S) compliance across the enterprise. For more information about BIOVIA CISPro, visit www.accelrys.com/cispro

APPENDIX A
The Best Practices Chemical Safety Audit Checklists
There are so many requirements to protect workers, equipment, facilities and the environment from the hazards associated with chemicals that it is extremely difficult to ensure that work activities with chemicals are performed safely. In addition, the large number of requirements governing chemical-related work is one of the main causes of continuing chemical safety deficiencies in the workplace. Many of these requirements approach chemical safety from different perspectives and contain provisions that overlap and are sometimes contradictory. Accordingly, we have developed a series of activity-based best practices checklists governing chemical-related work activities to assist chemists in understanding and addressing the many requirements with which they must comply. We have eliminated overlap and duplication of requirements to make the checklists easy to use.

There are five best practices checklists provided to help you manage various processes involved with chemical use at your site. They include:

• Chemical Inventory and Tracking (Checklist 1)
• Chemical Storage (Checklist 2)
• Chemical Purchases (Checklist 3)
• On-site Chemical Transportation (Checklist 4)
• Hazards Analysis (Checklist 5)

Each checklist is preceded by an introduction and a discussion of applicability and requirements. The checklists are meant to be a guide and are not inclusive of every regulatory requirement, just the key ones that affect most chemical facilities (see Instructions for Using Checklists). They will, however, enable just about any organization to identify areas of weakness or deficiencies in chemical safety that can be corrected to ensure a successful chemical management audit.
Because auditors pose questions using very specific terminology, the language in the questions is designed to closely mimic the questions that an auditor will ask.

**CHECKLIST 1: CHEMICAL INVENTORY AND TRACKING**

**Introduction**
This checklist identifies and consolidates existing user safety and health requirements in OSHA chemical-related safety and health regulations and National standards that address the inventory and tracking of chemicals and chemical products. This checklist specifically consolidates requirements found in OSHA and certain EPA regulations. Direct requirements for an inventory and tracking system are found in OSHA's 29 CFR 1910 and EPA's 40 CFR 370 regulations. In addition, there are many regulations and standards for which an inventory and tracking system is an implied requirement, since inventory information facilitates compliance. For example, OSHA regulations mandate an Industrial Hygiene Program with surveys of all work areas and operations to evaluate potential health hazards through appropriate workplace monitoring. A chemical inventory system can help to identify locations where chemical health hazards may be present. Therefore, implied requirements are summarized here but are not included as mandatory requirements. Implied requirements are shaded blue.

**Applicability**
The information presented here applies to all locations that use or store chemicals or chemical products. It applies to chemicals prior to their becoming waste. (NOTE: Throughout this checklist, the term “chemical” is used to indicate chemicals or chemical products.)
### Requirements for Chemical Inventory and Tracking

The information that follows is a consolidation of existing Federal safety and health requirements and National standards that relate to the inventorying and tracking of chemicals. It therefore contains “shall” statements that are taken from, or based on, “shall” statements in those existing requirements. While requirements from National standards that are referenced here are not in and of themselves mandatory, they are made mandatory by Federal requirements such as OSHA regulation 29 CFR 1910 which incorporate them by reference.

#### Checklist 1: Chemical Inventory and Tracking

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
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<tr>
<td>Do you maintain a list of the hazardous chemicals known to be present using an identity</td>
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<td>that is referenced on the appropriate safety data sheet (SDS)?</td>
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<td>Do you annually submit an inventory form (Tier I or equivalent state or local form)</td>
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<td>containing information on specified hazardous chemicals present at the facility during</td>
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<td>the preceding calendar year above specified threshold levels to the State emergency</td>
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<td>response commission, the emergency planning committee or the fire department with</td>
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<td>jurisdiction over the facility?</td>
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<td>Do you submit a Tier II form for any specific hazardous chemical in lieu of the Tier I</td>
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<td>information?</td>
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<td>Do you maintain a chemical inventory for laboratories within facility limits?</td>
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<td>Do you maintain a list of the major workplace fire hazards and their proper handling</td>
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<td>and storage procedures, potential ignition sources and their control procedures, and the</td>
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<td>type of fire protection equipment or systems that can control a fire involving the</td>
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<td>identified hazards?</td>
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<td>Do you maintain a chemical inventory for particularly hazardous substances, including</td>
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<td>carcinogens, reproductive toxins and substances with a high acute toxicity, when</td>
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<td>working in a laboratory environment?</td>
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<td>Do you have an approved Chemical Hygiene Plan covering the tasks, hazards of chemicals</td>
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<td>and controls before beginning work with these particularly hazardous substances?</td>
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<td>Do you provide your employees with information and training to ensure that they know of</td>
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<td>the hazards of chemicals in their work areas upon given an assignment?</td>
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<td>Do you provide this information and training on chemical hazards to employees prior to</td>
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<td>the start of any work in the area, including the start of any new operation or task?</td>
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<td>Do you provide your employees with access to SDSs or to a chemical inventory or any</td>
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<td>other record that may reveal the identity of toxic substances or harmful physical agents</td>
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<td>and when they are used?</td>
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<td>Do you provide your employees access to procedures that may reveal where and when toxic</td>
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<td>substances or harmful physical agents are used?</td>
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<td>Do you have an Industrial Hygiene Program with surveys of all work areas and operations</td>
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<td>to evaluate potential health hazards through appropriate workplace monitoring?</td>
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<td>Do you maintain chemicals on OSHA’s Process Safety Management List below threshold</td>
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<td>limits?</td>
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<td>Do you keep chemicals on the “Chemical Accident Prevention” List below 80% threshold</td>
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<td>quantity limits?</td>
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<td>Do you contact state and local emergency response personnel on the consequences and</td>
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<td>action required in case of a chemical release if chemicals on the “Chemical Accident</td>
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<td>Prevention” list are above the 80% threshold quantity limits?</td>
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<tr>
<td>Do you register emission sources and quantities of air contaminate emissions?</td>
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CHECKLIST 2: CHEMICAL STORAGE

Introduction
These checklists identify and consolidate existing user safety and health requirements in OSHA chemical-related safety and health regulations and National standards that address the storage of chemicals and chemical products. In addition, these checklists specifically consolidate requirements found under ANSI Z49.1, CGA G-1, CGA P-1, NFPA 30, NFPA 45, NFPA 51, NFPA 55, NFPA 430, NFPA 432, and OSHA regulation 29 CFR 1910. Where appropriate, they include requirements that are cited in 29 CFR 1910 (“incorporation by reference”) and technical standards that are made mandatory by their specific reference within a regulation or rule.

Applicability
The information presented here applies to all locations that use or store chemicals or chemical products.

This checklist does NOT apply to the following:
- Chemicals stored in tanks with greater than 735-pound water capacity
- Drums that have greater than 55 gallon capacity
- Chemical distribution systems
- Storage containers attached to a system
- Waste chemical storage
- The building or design of chemical storage areas

Special laboratory requirements presented in these checklists apply to laboratories that are constructed and operated in accordance with NFPA 45, “Standard on Fire Protection for Laboratories.”

These checklists apply to chemicals prior to their becoming waste. It is important to note that throughout these checklists, the term “chemical” is used to indicate chemicals or chemical products.

The requirements for chemical storage have been segregated into five categories: general, compressed gases, flammable and combustible liquids, oxidizers and organic peroxides. Hence, there are five checklists.
**Requirements for Chemical Storage**

The information in the checklists that follow is a consolidation of existing Federal safety and health requirements and National standards that relate to the storing of chemicals. The checklists therefore contain “shall” statements that are taken from, or based on, “shall” statements in those existing requirements. In addition, please note that where indicated a compressed gas cylinder shall be considered “in use” in a laboratory if it is the following:

- Connected through a regulator to deliver gas to a laboratory
- Connected to a manifold being used to deliver gas to a laboratory operation
- A single cylinder secured alongside a cylinder connected through a regulator to deliver gas to a laboratory as the reserve cylinder °F.

**Checklist 2A: Storage of General Chemicals**

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you evaluate facilities to determine chemical storage limits?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you evaluate facilities to determine allowable chemical container storage sizes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you evaluate facilities to determine chemical storage stacking limits?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you review the identification of chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you review the design of chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you review the maintenance work on chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you take into account the need for containment to protect the environment from oxidizers, fire suppression agents and decomposition products when designing a new facility?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you take into consideration the potential for large quantities of smoke and toxic fumes when approving of chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you remove all organic peroxide formulation before carrying out cutting and welding operations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you secure chemical storage areas using physical or administrative controls to prevent unauthorized entry?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you post “No Smoking” signs at all entrances to areas where oxidizers, organic peroxides or flammable gases are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you review and approve ignition sources such as open flames, smoking, spark- producing equipment and other hot sources where chemicals are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ensure that all chemicals are properly labeled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store chemicals together that are compatible and in a way to prevent contact with incompatible materials? This includes preventing liquids from flowing out of a chemical storage area into another area where they may be exposed to incompatible materials.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store chemicals in cabinets that are compatible with chemicals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you take special care to prevent the contamination of chemicals in storage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store flammable and combustible liquids in segregated warehouses separated from oxidizers by a distance of 25 ft.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have dikes, drains or sloping floors present to prevent the flammable liquid from encroaching on the separation?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you date chemicals when first opened that might become hazardous upon prolonged storage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you evaluate chemicals that might become hazardous upon prolonged storage for safety every 6 months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you dispose of chemicals that are found to be unsafe and cannot be made safe in compliance with applicable requirements and safely?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have either natural or mechanical ventilation designed to provide a minimum of 6 air exchanges per hour for your indoor chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you discharge the exchanged air a minimum of 50 ft. from any air intakes for air handling systems, air compressors, etc. for your indoor chemical storage areas?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Checklist 2A: Storage of General Chemicals (continued)

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have a manual shutoff outside the toxic gas and flammable/combustible liquids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>storage areas adjacent to the entry door?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a manual shutoff labeled “Ventilation System Emergency Shutoff”?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you prevent recirculation exhaust ventilation within any room or building?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you maintain good housekeeping in areas where chemicals are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you maintain aisles clear of obstructions, including stored chemicals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you immediately manage spilled chemicals and broken containers using appropriate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>procedures?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store each used and empty container in a manner appropriate for the chemical that</td>
<td></td>
<td></td>
</tr>
<tr>
<td>existed in that container until it is disposed of or cleaned?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store each used and empty container in a detached or sprinklered area until disposed</td>
<td></td>
<td></td>
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<tr>
<td>of or cleaned?</td>
<td></td>
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<tr>
<td>Do you arrange storage operations to prevent the accumulation of fugitive dust from the</td>
<td></td>
<td></td>
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<tr>
<td>stored chemicals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have specific disposal procedures for all areas where organic peroxides are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you keep hazardous chemicals stored in the open in laboratory work areas to the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>minimum necessary for the work being done?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Checklist 2B: Storage of Compressed Gas

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have hazard identification signs placed at all entrances to areas where compressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gas is stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ensure that those signs have not been obscured or removed?</td>
<td></td>
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</tr>
<tr>
<td>Do you have signs that prohibit smoking or an open flame within 20 ft. of where toxic,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pyrophoric, oxidizing or flammable gases are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store compressed gas cylinders away from stairways, elevators, exit routes and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gangways in assigned places, where they will not be exposed to physical damage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store compressed gas cylinders in an upright position with their valve protection</td>
<td></td>
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</tr>
<tr>
<td>caps in place and secure to prevent cylinders from falling over or being knocked over?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have overhead cover for outdoor storage areas of compressed gases that are made of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-combustible construction, open on three sides and not considered indoor storage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you keep outdoor storage areas of compressed gases clear of dry vegetation and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>combustible materials for a minimum distance of 15 ft. in all directions?</td>
<td></td>
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</tr>
<tr>
<td>Do you keep cylinders stored outdoors from direct contact with the earth or on surfaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>where water can accumulate?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not let cylinders in storage to be heated above 125°F?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you segregate compressed gases in storage from incompatible materials or combustibles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in storage by either a distance of 20 ft. or by a noncombustible partition with a fire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resistance rating of 1/2 hour and extending not less than 18 inches above and to the side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have noncombustible barriers that are at least 5 ft. high for those cylinders that are less than 3.5 feet tall?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store flammable gas cylinders a minimum distance of 20 ft. from storage of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>flammable and combustible liquids and solids?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a separate room, compartment or special storage building for the inside</td>
<td></td>
<td></td>
</tr>
<tr>
<td>storage of more than 2,000 standard cubic ft. (scf) of flammable gas, or more than 300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lbs. of liquefied petroleum gas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store indoors in one fire area multiple groups of cylinders containing flammable</td>
<td></td>
<td></td>
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<tr>
<td>gas with a fire resistance rating of 2 hours instead of by a minimum distance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you allow different flammable gases to be stored together?</td>
<td></td>
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</tr>
</tbody>
</table>
### Checklist 2B: Storage of Compressed Gas (continued)

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you store indoor flammable gases with a collective volume between 2,501 and 5,000 scf in rooms or enclosures with a minimum 1-hour fire resistance rating?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store multiple groups of flammable gases in one sprinklered fire area a minimum of 100 ft. apart?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store indoor flammable gases with a collective volume greater than 5,000 scf in rooms or enclosures with a minimum 2-hour fire resistance rating?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store compressed gases in rooms sprinklered according to NFPA 13?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a continuous monitoring system that would provide warning of toxic gas concentrations that could present a hazard to life in indoor compressed gas storage areas used to store toxic gases?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store toxic gases outside at least 75 ft. from a line of property, public way or place of assembly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have either natural or mechanical ventilation designed to provide a minimum of 6 air exchanges per hour for your indoor chemical storage areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a minimum of two NIOSH approved self-contained breathing apparatus (SCBAs) available at all times for use in upset conditions?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you clean and disinfect the SCBAs after each use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you properly maintain and store the SCBAs?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you inspect the SCBAs at least monthly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you check the SCBAs for proper function before and after each use?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you provide NIOSH-approved SCBAs where protection is deemed necessary for entry into atmospheres containing asphyxiating or corrosive gases?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a qualified backup person present at the scene when one or more of the SCBAs are being used?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Checklist 2C: Storage of Flammable and Combustible Liquids

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have aisles in areas that qualify as indoor liquid storage areas for flammable and combustible liquids that are at least 4 ft. wide?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have aisles in other flammable liquid storage areas that are at least 6 ft. wide?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have aisles where necessary to allow for access to doors, windows or standpipe connections that are at least 3 ft. wide?</td>
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</tr>
<tr>
<td>Do you prevent Class I flammable liquids from being stored in basement areas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you prevent Class II and Class IIIA flammable liquids from being stored in basement areas unless those areas are protected with automatic sprinkler systems?</td>
<td></td>
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</tr>
<tr>
<td>Do you prevent Class I flammable liquids from being stored such that a fire in the liquid storage area would prevent egress from the area?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you prevent flammable and combustible liquids storage in general purpose warehouses in the same pile or on the same rack as ordinary combustibles?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store ordinary combustibles, other than those used for packaging flammable liquids, a minimum of 8 ft. from flammable or combustible liquids?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you consider on the basis of whichever commodity predominates, where to store flammable liquids that are packaged together with ordinary combustibles, such as in kits?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not store empty or idle pallets inside a flammable liquid storage area that exceeds 2,500 ft.2 and 6 ft. in height?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you stack containers in piles in such a manner as to provide stability and to prevent excess stress on container walls?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store portable tanks over one tier high nested securely without dunnage?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have material handling equipment suitable for handling containers and tanks safely at the upper tier level?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consolidated Requirements</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Do you not store containers over 30 gallons in size that contain Class I or Class II liquids over one level high in inside rooms?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store stacks of flammable or combustible liquids closer than 3 ft. to the nearest beam, chord or other construction?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store stacks of flammable or combustible liquids 3 ft. below sprinkler deflectors, discharge orifices of water spray or other overhead fire protection systems?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have available suitable fire control devices at locations where flammable and combustible liquids are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have at least one portable fire extinguisher having a rating of not less than 40-B units located outside but not more than 10 ft. from any door to a flammable and combustible liquids storage room or any area where Class I or Class II liquids are stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not store water-reactive materials in the same area with flammable or combustible liquids?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store Class I and Class II flammable liquids in plastic containers only in flammable liquids storage rooms or flammable liquids storage cabinets?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store liquids used for building maintenance, painting or other similar infrequent maintenance purposes temporarily in closed containers outside of flammable liquids storage cabinets or flammable liquids storage areas, if the amount stored does not exceed a 10-day supply at anticipated use rates?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store 25 gallons or less of Class IA flammable liquids in containers per fire areas outside a flammable liquid storage room or flammable liquids storage cabinet?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store 120 gallons or less of Class IB, IC, II or IIIA liquids in containers per fire area outside a flammable liquid storage room or flammable liquids storage cabinet?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store 570 Liters (150 gallons) or less of Class I liquids in sprinklered laboratory units?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store 757 Liters (200 gallons) or less of Class I, II, or IIIA liquids in sprinklered laboratory units?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store all Class I, II, or IIIA flammable and combustible liquids in flammable liquids storage cabinets when not in use and outside a flammable liquid storage room?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not store over 120 gallons of flammable and combustible liquids in a flammable liquids storage cabinet?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have flammable liquid storage cabinets that are FM-approved or UL-listed or built in accordance with NFPA 30?</td>
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</tr>
<tr>
<td>Do you allow in any single fire area no more than three flammable liquid storage cabinets?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store no more than 400 gallons of Class I, II, and IIIA flammable and combustible liquids in a laboratory fire area?</td>
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</tr>
<tr>
<td>Do you store no more than 300 gallons of Class I flammable liquids in a laboratory fire area?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you review sites for outdoor storage lockers to ensure proper placement, separation, etc?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you separate multiple outdoor storage lockers at a given site according to requirements in NFPA 30?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store containers in their original shipping packages either on pallets or in piles in outdoor storage lockers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store unpacked containers on the floor in outdoor storage lockers?</td>
<td></td>
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</tr>
<tr>
<td>Do you not store other materials at designated outdoor storage locker sites designed for flammable or combustible liquids?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you placard outdoor storage lockers according to NFPA 704?</td>
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</tbody>
</table>
### Checklist 2D: Storage of Oxidizers

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you conspicuously identify oxidizer storage areas with the words “Class (appropriate classification number) Oxidizers?”</td>
<td></td>
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</tr>
<tr>
<td>Do you mark areas used to store oxidizers of different classes as containing the most severe hazard?</td>
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<tr>
<td>Do you use water-based manual fire fighting equipment in oxidizer storage areas?</td>
<td></td>
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<tr>
<td>Do you prohibit the placement and use of dry chemical extinguishers containing ammonium compounds (Class ABC) in oxidizer storage areas where oxidizers that can release chlorine are stored?</td>
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</tr>
<tr>
<td>Do you not use Halon extinguishers in oxidizer storage areas?</td>
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<td></td>
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<tr>
<td>Do you coat combustible construction materials that could come into contact with oxidizers with a compatible material to prevent their impregnation with the oxidizers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you immediately relocate to a safe outside area and properly dispose of absorptive packing materials, wooden pallets, etc., that are exposed to water containing oxidizers or that contain water soluble oxidizers, and are exposed to water?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not store oxidizers where they can be heated to within 25°F of their decomposition temperature or above 120°F, whichever is lower?</td>
<td></td>
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</tr>
</tbody>
</table>

### Checklist 2E: Storage of Organic Peroxides

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you conspicuously identify chemical storage areas used for the storage of organic peroxides with the words “Organic Peroxides” and by class?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you mark areas used to store organic peroxides of different classes as containing the most severe hazard?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ensure that individual packages containing organic peroxide formulations are marked with the chemical name and other pertinent information to allow proper classification?</td>
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</tr>
<tr>
<td>Do you ensure that packages containing organic peroxides that require temperature control are marked with the recommended storage range?</td>
<td></td>
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</tr>
<tr>
<td>Do you maintain a clear space of at least 2 ft. between organic peroxides storage and noninsulated metal walls?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you store organic peroxide formulations in chemicals storage areas at least 25 ft. away from incompatible materials and flammable liquids?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you use a 1-hour liquid fire barrier if a 25 ft. separation cannot be maintained?</td>
<td></td>
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</tr>
<tr>
<td>Do you allow only closed containers to be permitted in an organic peroxides storage area?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not stack 55-gallon drums of organic peroxide formulations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you maintain storage temperatures in chemical storage areas within the recommended storage temperature range for the organic peroxides being stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you provide high and low temperature switches, as applicable, in addition to normal temperature controls?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ensure prompt response by having high and low temperature switches that actuate an alarm?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you use heating systems with low-pressure steam, hot water or indirectly heated air?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not use cooling systems with direct expansion of a flammable gas?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you ensure that heating or cooling pipes and other heat transfer devices do not come into contact with organic peroxide containers to cause their overheating or cooling?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you use Class I, Group D and Division I (i.e., “explosion-proof”) refrigerators for storing organic peroxide formulations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you not use or consider unventilated, unrefrigerated storage cabinets as Division I qualified for storing organic peroxide formulations?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you consider ventilated storage cabinets as Class I, Division II for storing organic peroxide formulations?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Checklist 2E: Storage of Organic Peroxides (continued)

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you maintain a minimum of one cubic foot/minute/square foot of floor area for your ventilated storage cabinets?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you evaluate chemicals that might become hazardous upon prolonged storage for safety every 6 months?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you dispose of chemicals that are found to be unsafe and cannot be made safe in compliance with applicable requirements and safely?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CHECKLIST 3: CHEMICAL PURCHASES

**Introduction**

This checklist identifies and consolidates existing user safety and health requirements in OSHA chemical-related safety and health regulations and National standards that address the purchasing of chemicals and chemical products. This checklist specifically consolidates requirements found in NFPA, OSHA and the Bureau of Alcohol, Tobacco and Firearms and certain EPA regulations, including technical standards that are made mandatory by their specific reference within a regulation or rule.

**Applicability**

The information presented here applies to all locations that purchase chemicals or chemical products or services that involve the use of chemicals or chemical products. This checklist consolidates existing, core safety and health requirements that all sites must follow when engaged in chemical-related activities. Non Health and Safety Requirements are provided for informational purposes.

**Requirements for Chemical Purchases**

The information that follows is a consolidation of existing Federal safety and health requirements and National standards that relate to the purchase of chemicals. It therefore contains “shall” statements that are take from, or based on “shall” statements in those existing requirements. While requirements from National standards that are referenced here are not in and of themselves, mandatory, they are made mandatory by Federal requirements, including OSHA regulations 29 CFR 970, 29 CFR 1021 and 29 CFR 1910 and EPA regulations 48 CFR 22 and 48 CFR 908.

### Checklist 3: Chemical Purchases

<table>
<thead>
<tr>
<th>Consolidated Requirements</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you identify and evaluate before purchase, hazards associated with all activities involving chemicals that could put employees at risk of injury or illness?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you evaluate substitution of materials that are less hazardous and/or have less of an environmental impact before purchase?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you determine a chemical’s hazards when it is ordered?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you provide information to those who will receive, store, use and dispose of the chemical?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you follow restrictions imposed by local governmental regulations and in-house rules?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you obtain the manufacturer’s SDS for all new chemical purchases?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you make readily available to employees who receive, store, use and dispose of the manufacturer’s SDS for all new chemical purchases?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you submit applications to purchase tax-free alcohol to the ATF?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you make acquisitions of arms and ammunition readily procurable in the civil market in accordance with local site acquisition procedures?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**CHECKLIST 4: ON-SITE CHEMICAL TRANSPORTATION**

**Introduction**
This checklist identifies and consolidates existing user safety and health requirements in OSHA chemical-related safety and health regulations and National standards that address the on-site transport of nonradioactive chemicals and chemical products. This checklist specifically consolidates requirements found in NFPA, OSHA, ANSI and CGA regulations and guidelines, including technical standards that are made mandatory by their specific reference within a regulation or rule.

**Applicability**
The information presented here applies to all transport of chemicals or chemical products on site. This includes hazardous materials being transported on site, and the packaging, labeling or marking of hazardous materials for transportation on site. This checklist consolidates existing core safety and health requirements that all sites must follow when engaged in chemical-related activities. Non health and safety requirements are provided for informational purposes.

**Requirements for On-Site Chemical Transportation**
The information that follows is a consolidation of existing Federal safety and health requirements and National standards that relate to on-site chemical transportation. It therefore contains “shall” statements that are take from, or based on “shall” statements in those existing requirements. While requirements from National standards that are referenced here are not in and of themselves mandatory, they are made mandatory by Federal requirements, including OSHA regulation 29 CFR 1910, which incorporates them by reference.

<table>
<thead>
<tr>
<th>Checklist 4: On-Site Chemical Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidated Requirements</td>
</tr>
<tr>
<td>Do your on-site hazardous material transfers comply with the Hazardous Materials Regulations that cover shipper’s responsibilities? Yes No</td>
</tr>
<tr>
<td>Do your on-site hazardous material transfers comply with the Hazardous Materials Regulations that cover shipping papers? Yes No</td>
</tr>
<tr>
<td>Do your on-site hazardous material transfers comply with the Hazardous Materials Regulations that cover packaging and labeling of material containers? Yes No</td>
</tr>
<tr>
<td>Do your on-site hazardous material transfers comply with the Hazardous Materials Regulations that cover placecarding and emergency response information? Yes No</td>
</tr>
<tr>
<td>Do you handle in-plant all compressed gases in cylinders, portable tanks, rail cars or motor vehicle cargo tanks in accordance with CGA P-1? Yes No</td>
</tr>
<tr>
<td>Do you have portable cylinders used for the shipment of compressed gases constructed and maintained in accordance with the regulations of the U.S. DOT 49 CFR 171-179? Yes No</td>
</tr>
<tr>
<td>Do you have compressed gas cylinders that are legibly marked for the purpose of identifying the gas content with either the chemical or the trade name of the gas? Yes No</td>
</tr>
<tr>
<td>Do you have markings that are not readily removable by means of stenciling, stamping or labeling? Yes No</td>
</tr>
<tr>
<td>Do you locate the marking on the shoulder of the cylinder whenever practical? Yes No</td>
</tr>
<tr>
<td>Do you have valve protection caps in place and secured when not in use or being transported? Yes No</td>
</tr>
<tr>
<td>Do you not use ropes, chains or slings to suspend cylinders unless provisions have been made on the cylinder for appropriate lifting attachments such as lugs? Yes No</td>
</tr>
<tr>
<td>Do you use for lifting suitable cradles, sling boards, platforms or pallets to hold the cylinder, where appropriate lifting attachments have not been provided on the cylinder? Yes No</td>
</tr>
<tr>
<td>Do you not use hoist or transport cylinder by means of magnets or choker slings? Yes No</td>
</tr>
<tr>
<td>Do you not move cylinders by tilting and rolling them on their bottom edges? Yes No</td>
</tr>
<tr>
<td>Do you not roll cylinders in the horizontal position? Yes No</td>
</tr>
<tr>
<td>Do you not drag cylinders? Yes No</td>
</tr>
<tr>
<td>Do you not drop cylinders intentionally? Yes No</td>
</tr>
<tr>
<td>Consolidated Requirements</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Do you not intentionally strike cylinders?</td>
</tr>
<tr>
<td>Do you not intentionally permit cylinders to strike each other violently?</td>
</tr>
<tr>
<td>Do you use a suitable hand truck, forklift, cylinder pallet system or similar material-handling device to transport cylinders?</td>
</tr>
<tr>
<td>Do you ensure that these cylinders are properly secured to the device?</td>
</tr>
<tr>
<td>Do you not use valve protection caps for lifting cylinders from one vertical position to another?</td>
</tr>
<tr>
<td>Do you not use bars under valves or valve protection caps to pry frozen cylinders loose?</td>
</tr>
<tr>
<td>Do you use warm, not boiling, water to thaw frozen cylinders loose?</td>
</tr>
<tr>
<td>Do you remove regulators from the cylinders and put in place valve protection caps before cylinders are moved, unless cylinders are firmly secured on a special carrier intended for this purpose?</td>
</tr>
<tr>
<td>Do you close the cylinder valve when cylinders are moved at any time?</td>
</tr>
<tr>
<td>Do you move cryogenic liquids with a four-wheel hand truck designed to move cryogenic liquefied gas containers with capacity greater than 20 gal (76L)?</td>
</tr>
<tr>
<td>Do you keep this hand truck in good operating condition?</td>
</tr>
<tr>
<td>Do you perform in-plant transfer of acetylene in cylinders in accordance with CGA G-1?</td>
</tr>
<tr>
<td>Do you call acetylene by its proper name “Acetylene” and not refer to it merely by the word gas?</td>
</tr>
<tr>
<td>Do you not subject acetylene cylinders to abnormal mechanical shocks that might damage the cylinders, the valves or the fusible pressure relief devices when acetylene cylinders are moved?</td>
</tr>
<tr>
<td>Do you exercise care to ensure that acetylene cylinders are not dropped?</td>
</tr>
<tr>
<td>Do you exercise care to ensure that acetylene cylinders are not permitted to strike each other violently?</td>
</tr>
<tr>
<td>Do you not drop acetylene cylinders while being unloaded or loaded from a truck or dock?</td>
</tr>
<tr>
<td>Do you never use for hoisting the acetylene cylinders, the cylinder itself as a part of the carrier, when transporting acetylene cylinders by crane or derrick, lifting magnets, slings, ropes or chains or any other device?</td>
</tr>
<tr>
<td>Do you protect cylinders from damage when transporting acetylene cylinders by crane, a platform, cage or ladle?</td>
</tr>
<tr>
<td>Do you keep cylinders from falling out when transporting acetylene cylinders by crane, a platform, cage or ladle?</td>
</tr>
<tr>
<td>Do you use a positive method such as chaining in securing acetylene cylinders that stand upright?</td>
</tr>
<tr>
<td>Do you not transport acetylene cylinders when lying horizontally with the valves unprotected in a position that would allow the valves to collide with stationary objects during movement?</td>
</tr>
<tr>
<td>Do you never drag acetylene cylinders from place to place?</td>
</tr>
<tr>
<td>Do you always close valves before acetylene cylinders are moved?</td>
</tr>
<tr>
<td>Do you remove pressure regulators from acetylene cylinders to be moved unless they are secured in an upright position to a suitable hand truck?</td>
</tr>
<tr>
<td>Do you attach valve protection caps to acetylene cylinders to be moved (if provided for in the cylinder design), unless the cylinders are secured in an upright position to a suitable hand truck?</td>
</tr>
</tbody>
</table>
CHECKLIST 5: HAZARD ANALYSIS

Introduction
This checklist identifies and consolidates existing user safety and health requirements in OSHA chemicalrelated safety and health regulations and National standards that address the hazard analysis of activities involving chemicals and chemical products. This checklist specifically consolidates requirements found in NFPA, ANSI, CGA, OSHA and certain EPA regulations.

Applicability
The information presented here applies to all locations that use or store chemicals or chemical products. It applies to chemicals prior to their becoming waste. This checklist is intended only to address safety and health-related hazard and risk analysis requirements applicable to chemical user activities. It is important to note that throughout these checklists, the term “chemical” is used to indicate chemicals or chemical products.

Requirements for Hazard Analysis
The information that follows is a consolidation of existing Federal safety and health requirements and National standards that relate to the hazard analysis. It therefore contains “shall” statements that are taken from, or based on, “shall” statements in those existing requirements. While requirements from National standards that are referenced here are not, in and of themselves, mandatory, they are made mandatory by Federal requirements, including OSHA regulation 29 CFR 1910, which incorporates them by reference.

<table>
<thead>
<tr>
<th>Checklist 5: Hazard Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consolidated Requirements</strong></td>
</tr>
<tr>
<td>Do you evaluate hazards associated with all activities involving chemicals that could put the employee at risk of injury or illness?</td>
</tr>
<tr>
<td>Do you include the design of new facilities or modification of existing facilities and equipment in hazards analysis?</td>
</tr>
<tr>
<td>Do you include operations and procedures in hazards analysis?</td>
</tr>
<tr>
<td>Do you include equipment, products and services that are selected or purchased in hazards analysis?</td>
</tr>
<tr>
<td>Do you document hazards analysis and have the documentation approved by the appropriate safety official or manager?</td>
</tr>
<tr>
<td>Do you inform employees of the hazards present in their work area before they begin work?</td>
</tr>
<tr>
<td>Do you analyze hazardous processes for possible natural and man-made events that could lead to or result in a loss of control of hazardous materials?</td>
</tr>
</tbody>
</table>

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