

CHAPTER 4 - SAFETY RISK MANAGEMENT PROGRAM

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CHAPTER 4 - SAFETY RISK MANAGEMENT PROGRAM

A INTRODUCTION

1. SI policy (SD 419) is to “ensure that all alleged hazardous conditions are investigated, that identified safety and health risks are properly assessed and controlled....” Operating environments of the SI comprise a wide variety of health and safety risks that can never be totally eliminated. However, through the application of effective risk management principles and resources, associated risks can be reduced to acceptable levels.
2. This Chapter describes the Risk Management decision-making process that shall serve as the SI foundation of a strong and effective Safety, Health and Environmental Management Program to accomplish these policy goals.
3. This Chapter (together with [Chapter 5, “Safety Assessments, Log of Deficiencies and Corrective Action Plan”](#) of this *Manual*), contains tools and techniques developed to enable Directors to accomplish all of the aspects of this policy. Attachments to this Chapter provide spreadsheets, hazard analyses and checklists that will aid Directors, supervisors, Safety Coordinators and safety committees in performing the duties necessary to comply with this policy.
4. The goal of risk management is to accomplish a balance between performance at the height of one’s potential and still maintain a safe working environment effectively controlling known hazards. Compliance with existing codes and federal, state and local regulations is often viewed as being quite expensive to implement. However, the cost of not complying is also great. The Smithsonian’s 2006 costs owed the Office of Workers Compensation Program of present and past injuries exceeded \$3 million. Compliance with standards, ensuring availability of sufficient resources for a strong and effective safety program will save millions of dollars as well as keep our workforce and environment healthy and safe. This systematic, decision-making process is a proven highly effective method for reducing mishaps that has been used extensively by organizations such as NASA and the Department of Defense and now for reducing injuries to the Smithsonian’s employees and visitors.

B. DEFINITIONS

1. Deficiency is an uncontrolled hazard that poses risk of injury, property or environmental damage and demonstrates non-compliance with SI Safety Policy and/or consensus standards.
2. A hazard is a condition with the potential to cause injury, illness, or death of personnel; damage to or loss of equipment, property or collections; or curtailment of operations.
3. Risk is the probability that the hazard will actually cause injury or damage. Many hazards are Inherent to the workplace or process or piece of equipment used to accomplish our mission, but risk can be reduced by deciding on ways to change or control the hazard (controlling the equipment, using safer materials, doing the process in a safer manner) and still accomplish the facility's mission.
4. Risk Management (RM) is the process that guides management decisions to a safer workplace.

C. ROLES AND RESPONSIBILITIES

1. Directors shall ensure implementation of a safety risk management program that follows the Guiding Principles and the SI Risk Management Five-Step Process that are fully addressed in Attachment 1 and Section C.2 below.
2. Safety Coordinators and Supervisors shall employ the SI Five-Step Risk Management Process listed below and further defined in Attachment 1 of this Chapter and [Chapter 5, "Safety Assessments, Log of Deficiencies and Corrective Action Plan"](#), of this *Manual*.
 - a. Step 1- Identify hazards using the following tools and techniques discussed in this Chapter and Chapter 5, and the requirements of this *Manual's* Operational Chapters.
 - (1) Employee reports of workplace hazards;
 - (2) Lessons learned from incidents and near misses; and
 - (3) Self-Assessments to include Management Evaluation and Technical Reviews (METRs), Safety Coordinator Self-Assessments, Safety Committee Inspections and IH assessments of hazardous exposures.
 - b. Step 2- Assess risks to life, property and the environment from those hazards using the Risk Assessment Code, tools and techniques explained in this Chapter. Consult with the Office of Safety, Health and Environmental Management (OSHEM) for risk reduction techniques for RAC 1 and 2 risk assessments.

- c. Step 3- Develop controls and make decisions on what risks are acceptable
 - (1) Develop Job Hazard Analyses (JHA) and Workplace (WHA) (refer to examples in Attachments 1, 2, 3 and 4 of this Chapter), to eliminate or minimize the risks to an acceptable level to meet the requirements of this *Manual*. **Hazards that are judged to be immediately dangerous to life and health must be controlled immediately (e.g., process or equipment shut-down).**
 - (2) Frequently interact with and observe the employee to ensure the employee knows and understands the requirements of the job and workplace hazard analysis and performs safely. Refer to Attachment 6, Job Observation Form.
 - (3) Apply controls listed in the applicable Operational Chapters of this *Manual*.
 - (4) Provide Safety Training, per the requirements of Chapter 6, "Training", of this *Manual*, to raise employee awareness of workplace hazards the means to guard against being injured by those hazards.
 - (5) Develop Risk Management Worksheets (refer to example in Attachment 5 of this Chapter) for specific operations that involve multiple hazards; e.g. installing large objects in an exhibit, moving collections for storage or because of renovation, etc.
- d. Step 4- Implement controls and track corrective actions through completion.
 - (1) Maintain a current and fully auditable Log of Deficiencies and Corrective Action Plan, per tools and techniques presented in [Chapter 5, "Safety Assessments, Log of Deficiencies and Corrective Action Plan"](#), of this *Manual*.
 - (2) Assign personnel to track deficiency abatement.
 - (3) Review JHAs and/or WHAs regularly and change whenever personnel/processes change, or new hazards are introduced into the workplace.
 - (4) Fellow employees should periodically use the Job Observation Form, Attachment 6 to ensure safe behavior
- e. Step 5- Periodically evaluate the effectiveness of this 5-step risk management process. Drop controls that clearly do not work and continue to develop controls that do work. When there are changes in the environment, reassess the heightened risk that change usually causes. Continue to evaluate the deficiency abatement process.

3. Employees shall provide input in their JHA and will adhere to the safe work practices identified for each task and periodically review the JHA to either improve it or change it to accommodate changes in procedures or environment.
4. Office of Safety, Health and Environmental Management (OSHEM) shall:
 - a. Provide technical assistance and a “Train-the-Trainer” course, upon request, to Directors and Safety Coordinators in all aspects of the Risk Management process.
 - b. Conduct and manage all aspects of employee health exposure assessments and medical surveillance to meet regulatory standards for quality assurance, quality control, and legal liability.
 - c. Evaluate the facility or organization’s Safety Risk Management Program annually for compliance with this Chapter.

D. REPORTING AND RECORDKEEPING. Documentation for the Risk Management Program includes:

1. Job/Workplace Hazard Analyses periodically reviewed and changed whenever personnel/processes change, or new hazards are introduced into the workplace.
2. Safety Program Self Assessments and the Log of Deficiencies/Corrective Action Plan as described in further detail in [Chapter 5, “Safety Assessments, Log of Deficiencies and Corrective Action Plan”](#), of this *Manual*.

Implementing an Effective Risk Management Program

The Guiding Principles of Risk Management (RM)

- A. **Integrate RM into all phases of missions and operations.** Effective RM requires that the process be integrated into all phases of mission or operational planning, preparation, execution, and recovery on a continuing basis. It is much more cost effective to plan up front during building construction and renovation to imbed safety, fire and environmental protection systems than to retro-fit after the fact.
- B. **Make risk decisions at the appropriate level.** As a decision-making tool, RM is only effective when the information is concentrated on the appropriate supervisory level for decision. The higher the risk, the higher the management level of who should make the decision to accept a risk or not. Often this will require the decision to apply resources, whether manpower, dollars or both, to mitigate risks to an acceptable level so the management decision-making level must be where the purse strings are controlled.
- C. **Accept no unnecessary risk.** Accept no level of risk unless the potential gain or benefit outweighs the potential loss. RM is a decision-making tool to assist the supervisor or individual in identifying, assessing, and controlling risks in order to make informed decisions that balance risk costs (potential losses) against mission benefits (potential gains). An unnecessary risk is one that if not taken, you can still accomplish the mission. For example, an employee forgets or refuses to use eye protection during grinding operations. The risk is painful damage to eyes, maybe even loss of sight, yet the grinding can be successfully accomplished without risk of eye injury, simply by using eye protection.
- D. **Apply the process cyclically and continuously.** RM is a continuous process applied across the full spectrum of museum and research operations, individual and collective day-to-day activities and events, and facility operations. It is a cyclic process that is used to continuously identify and assess hazards, develop and implement controls, and evaluate outcomes particularly when changes occur in operations or environment. To a certain extent RM is intuitive, but it has been proven most effective when applied in the planning stages of an operation 30, 60, 90 even 120 days out, if possible. Refer to Attachment 5 to see an example of formalized risk management. The process is continuous, and therefore synergistic. Evaluation of the process helps continuously improve the process, dropping controls that don't work and incorporating new and better controls for future similar operations. In essence, this process is demonstrated and accomplished when Safety Coordinators and OSHM review plans for renovation or new construction in order to incorporate OSHA, EPA and NFPA mandated controls and requirements. Fully compliant facilities are the product of early planning and involvement of fire, health, environmental and safety experts throughout the planning stages of the new or renovated facilities.

Requirements of a Risk Management Program

Apply the 5 step risk management process to all SI organization safety programs. The following provides a brief outline of the 5-step process requirements.

Step 1 – Identify hazards.

Step 2 – Assess hazards to determine risk.

Step 3 – Develop controls and make risk decisions.

Step 4 – Implement controls.

Step 5 – Supervise and evaluate.

Figure 4-1 illustrates how these five steps are cyclical, forming a continual improvement process with the first two steps being part of the assessment phase and the last three steps belonging to management to make decisions, delegate responsibilities and continually supervise and evaluate to insure improvement.

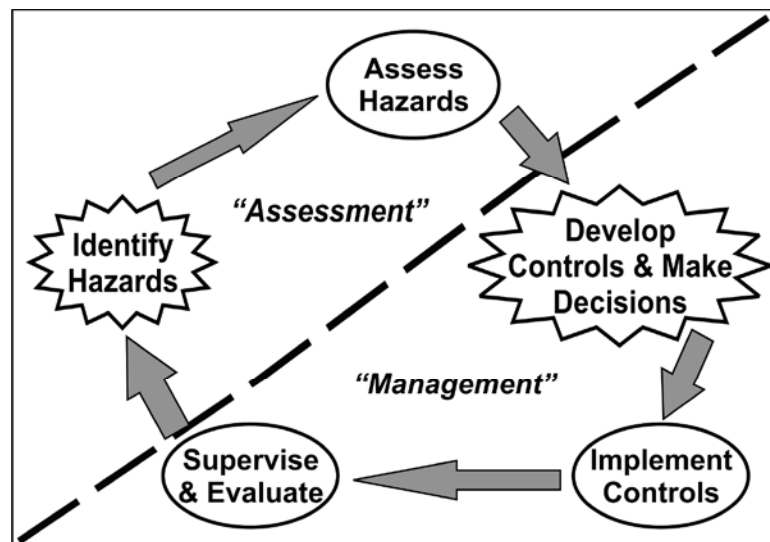


Figure 4-1

Table 4-1 Graphic display of the RM 5-step Process and identifies specific tools and techniques for accomplishing the program requirements.

STEPS IN RM PROCESS	TOOLS AND TECHNIQUES discussed in this Safety Manual
Step 1 – Identify hazards.	<ul style="list-style-type: none"> ▪ Safety committee inspections, ▪ Employee identification of workplace and environmental hazards ▪ Hazards identified while investigating mishaps ▪ Supervisors identifying hazards for workplace or job hazard analyses ▪ Safety Coordinator inspections
Step 2 – Assess hazards to determine risk.	<ul style="list-style-type: none"> ▪ Using the Risk Management Risk Assessment Matrix, assign a risk assessment code (RAC) to identified hazards. ▪ An initial RAC is assigned to uncontrolled hazards and a residual RAC is assigned to controlled hazards. ▪ Safety Coordinator safety program evaluation
Step 3 – Develop controls and make risk decisions.	<ul style="list-style-type: none"> ▪ Operational Chapter requirements ▪ Safety Training ▪ Risk Management Worksheet (Att 5) ▪ Job Hazard Analysis (JHA) and/or Workplace Hazard Analysis (WHA)
Step 4 – Implement controls and track corrective actions through completion	<ul style="list-style-type: none"> ▪ Log of Deficiencies and Corrective Action Plan ▪ Assign personnel to track deficiency abatement ▪ Review JHA/WHA weekly or whenever changes occur
Step 5 – Supervise and evaluate the success of the control and the process.	<ul style="list-style-type: none"> ▪ Drop controls that clearly do not work ▪ Add other controls that do work ▪ Add hazards missed during first ID process, particularly when changes in environment, equipment or personnel occur. ▪ Evaluate and track abatement of deficiencies

Table 4-1

STEP 1 - IDENTIFY HAZARDS

Each job task or work area within a facility shall be assessed by the supervisor (with assistance from the Safety Coordinator) to identify sources (e.g., locations, equipment, processes, etc.) of safety hazards. Individual hazards are identified by answering the questions: “**What could go wrong, what could cause someone to be hurt or cause damage to property or environment?**” This determination may be made using:

- Brainstorming with staff, seeking staff input on unsafe aspects of their operations, considering “what if” scenarios.
- Self assessments/inspections.
- Employee complaints of unsafe working conditions.
- Identifying past injuries or locations where injuries occur including review of OSHA 300 Log information
- Injuries or incidents other similar organizations have experienced.
- Relying on professionals experienced in identifying hazards for specific jobs or environments.
- Results of employee exposure monitoring (industrial hygiene surveys).
- Identifying locations or processes that could cause an environmental release or environmental pollution.

What is a hazard? A hazard is a condition with the potential to cause injury, illness, or death of personnel, damage to or loss of equipment, property or collections, damage to the environment, or curtailment of operations. A hazard may also be a situation or event that could cause a museum or research center to close or stop vital operations. Hazards exist in all environments—laboratories, collection storage, workshops, warehouses, greenhouses, landscaping areas, public display areas.

What are the sources of hazards? Hazards may arise from any number of areas. Hazards can be associated with accident potential, weather or environmental conditions, health, sanitation, behavior, material or equipment conditions or terrorist activity. RM does not differentiate among the sources of the hazard. The loss of personnel, equipment, or collections or damage to the environment due to any hazard has the same disruptive impact on the Smithsonian mission no matter what the source. The bottom-line is the effect of the hazard, not its source.

STEP 1 (cont.)

- **What factors should you consider in identifying hazards?**
- **Disrupters (Change, weather, legal issues)**
- **Activity**
- **Time**
- **Employees or Visitors**
- **Environmental Health Factors**

Disrupters - A new process or piece of equipment introduced into the workplace, weather conditions such as the flood we experienced in July 2006, equipment failure, or legal issues such as a visitor who sues because an unsafe environment caused injury.

Activity - some activities involve higher risk and are inherently more dangerous than others. Some things that make activities more dangerous would include job complexity, tools or equipment requiring extra skill or training to use, or lack of clear procedural guidance and training to perform the activity with no misunderstanding.

Time - Was there sufficient time to plan or perform an operation? This could also refer to the length of time personnel are exposed to a hazard; the greater the length of the exposure the greater the probability of injury.

Employees or Visitors - What is the condition of the employees or visitors? Are they healthy? We may have no way of knowing the health status of a visitor, but we can certainly anticipate and prepare for the unexpected, again, asking what could go wrong. Are employees new and untrained or experienced and trained? It follows that an untrained or less experienced employee is more likely to be injured. How many personnel are exposed to a hazard? If a set of stairs does not have railings that meet the OSHA requirements and the stair leads to the roof where only one person uses the stair maybe once or twice a month, there will likely be fewer injuries than if the stairs are in a public exhibit space used by employees and hundreds of visitors a day. Are there sufficient trained personnel to safely perform an operation? Lifting heavy objects is less likely to cause injury if the weight is shared with 2 or more employees.

Environmental Health Conditions - This category includes a variety of health-related factors to include ergonomics, hearing conservation, radiation and chemical hazards, etc. Generally, OSHEM approaches these subjects as a team or task force of several disciplines such as Industrial Hygiene for measuring noise, air flow, exposure to hazardous substances, etc., a health specialist who can assess health effects of specific hazards to employees, and safety specialists who insure OSHA standards are understood and met. All of these categories are covered in greater detail in the operational Chapters of this *Manual*.

Example #1: Hazard- Confined Spaces. Hazard is necessary and cannot be eliminated.

WHO is exposed: Supervisors, personnel trained on Confined Space.

WHAT is the control: Ensure confined spaces are properly labeled, access is limited and personnel who enter the spaces are trained to know the hazards and take the required and proper precautions based on the hazards involved.

WHERE: Any confined space.

WHEN: Before entering the confined space.

HOW: Trained, qualified personnel identify and inventory confined spaces and all hazards associated with the confined space, label appropriately, and follow all safety requirements of the confined space program.

Example # 2: Heavy Lifting

WHO is exposed: Supervisors, leaders, employees.

WHAT is the control: Back Injury Prevention. General safety training on back injury prevention; insure proper material handling equipment (forklifts, dollies, rolling racks) are available and appropriate for the job; more to lift a heavy load is better; plan a lifting operation to avoid twisting; heavy loads should be stored at chest high level to avoid bending or retrieving load above the head; ladders and step stools are in good condition and easily available; good housekeeping to avoid tripping hazards.

WHERE: During material handling and moving operations. Generally in warehouse operations, loading docks, but can also occur in office or public spaces when heavy furniture or equipment is being moved.

WHEN: Provide training before performing a lifting operation.

HOW: Delegate who does the training and how often. Identify what material handling equipment is necessary and purchase; insure everyone is aware of back injury hazards and are doing everything necessary to prevent them.

Job and/or Workplace Hazard Analysis

The most valuable and necessary tool, or control, to be used in SI facilities is the job and/or workplace hazard analysis. This tool/technique actually transcends several of the risk management steps, because you must identify and assess hazards, but is best considered a control used to manage the hazards that must remain in the workplace for mission accomplishment.

These are valuable tools for the supervisor and Safety Coordinator to document either the hazards of performing a particular job (Job Hazard Analysis-JHA) and/or identify hazards in the workplace (Workplace Hazard Analysis- WHA) for everyone who works in the location, regardless of their job requirements. The WHA would also take into account visitors or delivery personnel.

Generally, you need to do a JHA for the more complex jobs with several steps that require written instructions and have several hazards associated with the job. All employees performing these jobs would be covered by the JHA.

A WHA is appropriate for offices or public spaces and locations that have general hazards rather than job performance hazards.

It is entirely possible that a work location, such as large woodworking or machine shop, would require both a JHA and a WHA because there may be hazards within the workplace that are not necessarily associated with a particular job, such as dust accumulation, hazardous chemical storage, fire prevention concerns, ancillary employees who deliver wood or stock, etc.

Additional JHA Guidance:

The JHA is a tool that focuses on job tasks as a way to identify hazards that are necessary to the workplace but, uncontrolled, could cause injury. It focuses on the relationship between the worker, the task, the tools, and the work environment. For this to be an effective tool, a supervisor should develop the JHA with the employees who perform the job, getting their input and buy-in. Also, it must be a living document. It must not be developed then put in a drawer and forgotten. The less often an employee performs a particular job, the more often that employee should review the JHA. When a supervisor periodically observes job performance, safe job performance, in accordance with the JHA, should also be observed and enforced. The JHA is a valuable safety training tool as well, particularly for new employees. The JHA should identify the appropriate training for the job task(s). Don't forget the definitions of "competent" and "qualified." Review the JHA and alter as appropriate whenever a process or piece of equipment changes.

Additional WHA Guidance:

The WHA can be as simple as a floor plan for a specific area. Onsite surveys should include inside and outside areas, compiling information as to the presence and concentration of chemicals, the location of entries and exits, the availability of emergency equipment, and potential trouble spots – just to name a few items. An effective WHA includes provisions for the systematic identification, evaluation, and prevention or control of general workplace hazards and those potential hazards which may arise from foreseeable conditions.

The scope of your workplace hazard analysis should include every area within and outside the facility to include exhibit spaces, exhibit storage, libraries, shops, warehouses, loading docks, etc. In addition, *as a minimum, include the following:*

- Emergency Action Plans. 09-11-01 is a very good reason for this requirement.
- Fire Prevention Plans.

- Processing, Receiving, Shipping and Storage – potential back injuries, incidental delivery personnel exposed to hazards.
- Building and Grounds Conditions.
- Housekeeping Program. Prevention of slips, trips and falls.
- Electricity, including your written Lockout/Tagout Plan.
- Lighting.
- Heating and Ventilation.
- Machinery. Pay attention to machine guarding, lack of, or improper guarding which is normally in the top 5 OSHA violations for general industry. Be certain to identify and mark machinery or equipment that were inspected and found to have shortcomings that could cause injury (NOT lock-out/tag-out. When equipment is placed in an “out of service” status for business or production purposes, e.g. poor efficiency, recycled, etc., and not related to servicing or maintenance then lock-out/tag-out does not apply.)
- Hand and Power Tools, Ladders.
- Chemicals. Don't forget that 3 of the top 5 most common OSHA violations for general industry fall under the scope of hazard communication.
- Maintenance. Maintenance and servicing of machines and equipment is the reason for lockout-tagout.
- Personal Protective Equipment.
- Required Safety Training.
- Storage that is appropriate, with proper clearance for sprinklers, clear aisles, ladders and stepstools appropriate to the storage task, etc.

This <http://www.osha.gov/Publications/osha3071.pdf> link is the OSHA Booklet, 3071, which provides guidance on performing JHAs. This website provides some excellent examples and forms for JHAs:

<http://www.setonresourcecenter.com/safety/jha/>. Attachment 2 provides an example of a JHA.

STEP 2 - ASSESS HAZARDS TO DETERMINE RISK

The risk of a hazard actually causing environmental damage or injury severe enough for someone to miss a day of work or cause a museum or research center to close or stop a vital operation is a function of the severity of the hazard and the likelihood the incident will occur. In almost all cases, applicable codes and regulations were written because groups or specific types of injuries occurred with such frequency that a code or regulation was required to prevent future injuries or property damage. It follows that code violations are indicators that increase the probability an injury will occur.

Risk Assessment Codes (RAC)

- Almost all deficiencies are hazards that pose a risk of injury, property damage or mission or environmental impairment.
- Hazards are assessed and risk is assigned in terms of probability and severity of adverse impact of an event/occurrence.
- This step considers the risk or likelihood of an event or incident adversely impacting mission, capabilities, people, environment, equipment or property.
- “What are the odds (probability) of something going wrong and what is the effect (severity) of the incident if it does occur?”

Tables 4-2 and 4-3 define the levels of **severity** and **probability** while **Tables 4-4 and 4-5** defines the **level of risk in the matrix combining severity and probability**.

Severity	
Catastrophic	Worst case scenario, exposure to this hazard will cause one or more deaths, permanent total disability or hospitalization of 3 or more personnel, destroy a major facility or process, a toxic or dangerous chemical release causing irreparable environmental damage or death, or force a curtailment of a major institutional mission for more than 3 months.
Severe	Worst case scenario, exposure to this hazard will cause a permanent partial disability or serious injury causing more than 3 months of lost work days; a chemical release causing irreparable illness or long term damage to the environment, impair an important process or major institutional mission for more than 3 days and less than 3 months.
Marginal	Worst case scenario, exposure to this hazard will cause days away from work or restricted work activity other than the day of injury; a reparable but reportable chemical release or it will impair an important process or major institutional mission for 1 to 3 days.
Negligible	Worst case scenario, exposure to this hazard may require medical treatment but will result in no lost time other than the day of injury, or there is little or no property or environmental damage or the hazard may not cause injury but is a minor violation of consensus standards.

Table 4-2

		Probability
	How Often/How long	Description
Frequent	The exposure is daily for short periods or weekly for long periods of time.	Every day many personnel or major missions or facilities are exposed to the hazard often or for long periods of time and chance of injury or mission impairment is high. Or the history of injuries indicates that this hazard causes injury often.
Likely	Exposure is weekly for short periods or less often but for longer periods of time	Occurs several times, a common occurrence. Examples include periodic use of a hazardous substance or operation, egress blocked or restricted several times a week, etc.
Occasional	Exposure is sporadic	Occurs sometimes, but not a common occurrence.
Seldom	Remotely possible, could occur at some time.	An example might be exposure to confined space entry hazards.

Table 4-3 Risk Assessment Matrix

			Hazard Probability			
			<i>Frequent</i>	<i>Likely</i>	<i>Occasional</i>	<i>Seldom</i>
			A	B	C	D
S E V E R E R I S T Y	Catastrophic	I	1	1	1	2
	Severe	II	1	2	2	3
	Marginal	III	2	3	3	4
	Negligible	IV	3	4	4	4

Table 4-4

RAC	LEVEL OF RISK	ACTION REQUIRED
1	Critical risk to health safety, environment (High severity / High probability of occurrence). Also think in terms of how many are exposed for what period of time. The level of risk is very high when many are exposed for long periods of time. For example, tripping injuries on steps may be high in our facilities because so many are exposed to the hazard everyday.	IMMEDIATELY CORRECT HAZARDOUS CONDITION (or reduce to LOW risk) WHEN IDENTIFIED. Report immediately interim risk reduction measures taken and in 30 day report describe actions taken and program measures in place to prevent recurrence.
2	Significant risk to health and safety (High-to-moderate severity / High-to-moderate probability of occurrence) In terms of exposure, one individual may be exposed only occasionally, but worst case of exposure to hazard is death.	Immediate action to mitigate completely or reduce risk to LOW. In 30 day report, describe actions taken, interim plans for completion, and program measures in place to prevent recurrence.
3	Moderate risk to health and safety (moderate-to-low severity/moderate-low probability of occurrence)	Within 60 days, action taken to mitigate completely or reduce risk to LOW. In 120 day progress report, describe actions taken, interim plans for completion, and program measures in place to prevent recurrence.
4	Low risk to health and safety (Low severity / low probability of occurrence); could include administrative deficiencies with minimal risk but high probability of regulatory citation.	Within 120 days, complete mitigation. In 120 day progress report, describe actions taken and plans to prevent recurrence.

Table 4-5

STEP 3 - DEVELOP CONTROLS AND MAKE RISK DECISIONS

After assessing each hazard, supervisors develop one or more controls that either eliminate the hazard or reduce the risk (probability and/or severity) of a hazardous incident occurring. In developing controls, supervisors must consider the reason for the hazard, not just the hazard itself. The decision must be made at this point as to whether the hazard can be eliminated or must remain in the workplace in order to accomplish the mission. If they must remain, then in most cases there are consensus standards that require controls or countermeasures be put in place to insure employee and environmental safety. The hazard is reassessed to determine a residual risk once controls are in place. Risk decisions are always based on the residual risk. The process of developing and applying controls and reassessing risk continues, and may require assistance from OSHEM personnel, until an acceptable level of risk is achieved or until all risks are reduced to a level where benefits outweigh the potential cost. That is the point to which a decision can be made to take the risk or not.

Controls can take many forms, but normally fall into one of three basic categories:

- **Elimination/Avoidance Controls.** This is your best option if it is possible. These controls include positive action to prevent contact with an identified hazard or the total elimination of the hazard. For example, substitute a non-hazardous chemical for a hazardous one.
- **Engineering/Physical Controls.** These take the form of barriers and guards, PPE, or signs to warn or protect individuals, units, or organizations of existing hazards. Other examples include ventilation hoods, sound-proofing or attenuation, improving lighting, ergonomic chairs and computer stations, etc.
- **Educational (awareness) Controls.** These controls are based on the knowledge and skills of units, organizations, or individuals. It includes their awareness of the hazard and control. Effective educational control is implemented through individual and collective training.

To be effective, each control developed must meet the following criteria:

- **Suitability.** It must remove the hazard or mitigate (reduce) the residual risk to an acceptable level.
- **Feasibility.** The organization must have the capability to implement the control.
- **Acceptability.** The benefit gained by implementing the control must justify the cost in resources and time. The assessment of acceptability is largely subjective.

Sources such as personal experience, lessons learned from previous accidents or from similar past operations can provide or identify possible control measures for specific events or operations. The key to effective control measures is that they reduce the effect of or eliminate the identified hazard. Effective control measures must specify who, what, where, when, and how.

STEP 4 - IMPLEMENT CONTROLS

Arguably, this is the most important step, where “rubber meets the road”. Many are good at coming up with ideas, controls and solutions, but when it comes to implementing those controls, often there is a budgetary or personnel void or finger pointing that it is someone else’s job. Once controls have been agreed upon, personnel should be assigned to put the controls in place and supervisors must resource the controls with budgeting, personnel and time. Sometimes the controls require work tickets to accomplish, in which case make certain someone is assigned the responsibility to follow up and track the work ticket to completion. If the hazard is RAC 1 or 2 then the Safety Coordinator should ensure implementation of interim controls to secure the safety of employees or visitors until a permanent solution can be put in place. For example, a piece of equipment may need to be locked out, or an outlet marked as out of order until a qualified electrician can bring the equipment or outlet into compliance.

STEP 5 - SUPERVISE AND EVALUATE

The exceptional value of this step in the process is the ability to continuously improve for a safer and safer environment. This step assigns responsibility and accountability to managers, supervisors, Safety Coordinators, safety committee members and OSHEM personnel to continuously evaluate the 5-step process for effectiveness in lowering injury rates. We continue with what works and eliminate controls that do not work. If an injury occurs, we gather lessons learned and incorporate new countermeasures into our plan. If elements or components in the work environment or operations change, then this step must evaluate elevated risk and continue the 5-step process to accommodate the changes.

An important part of this step is the MANAGEMENT OF CHANGE

Change is always with us and will always raise the level of risk in any environment or operation where change occurs.

Each facility and organization director must institute a planned approach to identifying and addressing changes that impact operations and the Safety Program. These changes can include:

- New or modified equipment
- New or changed operating conditions
- Facility renovations or remodeling
- Relocation to a new facility
- Introduction of a new chemical
- New or re-assigned employees
- New or changed regulations or SI standards
- Emergencies such as weather-related floods, winds, extreme temperatures, or terrorist related activities

These changes can introduce new or increase existing health and safety hazards and environmental impacts. Changes can be both expected (planned) or encountered (unplanned). The change management process should address both types of changes in a way that ensures the Safety Program is current.

Change management can be either *'reactive'*, in which case management is responding to external changes, or *proactive*, in which case management is initiating the change in order to achieve a desired goal, evaluates the elevated risk, identifies extra hazards and develops a plan to reduce the risks prior to the change. With a reactive process, the Safety Program is modified once the change has occurred. This process is typically utilized for unplanned events, but still requires a system to be in place to identify the changes that have occurred. A proactive process is more effective by identifying the changes before they occur and with time to react and plan for the change.

Change management can be conducted on a continuous basis, on a regular schedule (such as an annual review), or when deemed necessary on a program-by-program basis or within work environments anticipating changes. Staff members that have been assigned the responsibility of maintaining the Safety Program (Safety Coordinators, safety committee members, supervisors) should ensure that they participate in or are kept abreast of all organizational activities that are likely to result in operational changes and those unplanned events that can cause operational changes. Complex changes may require the use of a systematic process of analysis such as adjusting the Job Hazard Analysis (JHA) to adapt to the change(s). Most of the tools and techniques listed in this Chapter, to include the JHA/WHA, Risk Management Worksheet (App. A), Log of Deficiencies/Corrective Action Plan, can be used to anticipate and plan for environmental or operational changes.

In conclusion, the Risk Management Five-Step Process is the very foundation of a facility/organization safety program. RM processes are applicable to all aspects of our professional and personal experiences. Using it can even make safer something as simple as planning a vacation. The more we use it, the more aware we become of where the hazards are and how we can avoid, manage or eliminate them. Take advantage of the Chapter attachments and carefully review Chapter 5 to further understand how fundamental and valuable and yet how simple and sustaining this process becomes once the tools and techniques have been developed and become second nature. Without question, effective risk management can change the safety culture of an organization and risk management will be the most effective tool in achieving the “Zero Injury” goal of the Smithsonian Institution.

Example of a Job Hazard Analysis

Job Hazard Analysis Form

JOB TITLE:	Grinding Operator	Date of Analysis:
OPERATION:	Cleaning Plastics Grinder	
JOB LOCATION:	Plastics Extrusions	

PROCEDURAL STEP	HAZARD	NEW PROCEDURE OR PROTECTION
1. Shut off grinder, lockout and tag-out	None	Follow unit's LO/TO Program
2. Open clean-out door	Contact with cutting knives, airborne plastic dust	Wear cotton gloves and particulate and dust mask
3. Open cutting chamber and take clamp off blower pipe	Door is heavy, overexertion	Use caution, 2 person job
4. Remove screen chamber	Heavy, could fall and cause damage	Should be removed by 2 persons
5. Remove screen	Contact with cutting knives	Wear cotton gloves
6. Clean all parts	Cutting knives, plastic dust	Wear cotton gloves and particulate dust mask
7. Clean cyclone and filter	Falling parts and plastic dust	Use cage attached to forks of forklift, use particulate mask
8. Install screen and cradle	Cutting knives, cradle is heavy	Wear cotton gloves, install cradle by 2 persons
9. Install chamber and clamp on blower pipe.	Could fall and cause damage	Should be installed by 2 persons
10. Install clean out door and clean floor area	Cutting knives	Wear cotton gloves

**JOB HAZARD ANALYSIS****Welding Operations**

		JOB TITLE: Oxy-Acetylene Welder		Created: 5/15/2007		Revise Date:		JHA Creator: Beverly Maki		Title: OSHEM Saf Spec	
		WORK LOCATION (ROOM NO.): Most welding shops		DEPARTMENT:				TOOL/MACHINE MAKE AND MODEL: Oxy-Acetylene welding machine, model xxx			
		POTENTIAL HAZARDS		REQUIRED CONTROLS/WORK PRACTICES		REQUIRED PPE					
Task(s)	Define Activities/Equipment Used (note frequency/duration)										
	Oxy-Acetylene welding, used on average <u>X</u> times a day, <u>X</u> days a week by <u>X</u> # of welders.										
1. Turn torch on	1a. Wipe down work area with damp cloth (water) 1b. Uncoil and straighten hoses from cylinders. 1c. Adjust screws on regulators so they are backed off. 1d. Open cylinder valve slowly by turning counterclockwise. 1e. Turn adjustment screw clockwise to desired pressure	Spilling water could cause slip/trip. Not cleaning area could leave dust particles/combustibles that could flare Loose hose on floor could cause slip/trip. Damaged hose could cause leak/fire Gas leak could cause fire None None None		Slowly apply small amount of water to cloth and wipe down work area. Ensure fire extinguishers are available and charged. Ensure uncoiled hoses will not be a tripping hazard. Ensure there are no kinks, cracks or damage to hoses. Ensure all torch valves are closed and inspect for possible leaks. Ensure adjustment screws on regulators are backed off so no tension is present for both acetylene and oxygen. None		None Know the correct pressure for type equipment		N/A N/A Safety glasses, work gloves			
	1f. Crack open acetylene valve on torch body.	Potential gas accumulation if not prepared to light		Have striker available				Safety glasses, work gloves			
	1g. Use striker to ignite torch	Potential gas accumulation Spark production (could ignite other material)		Quickly, so not to let gas accumulate, hold torch facing away from face, body and portable unit. Using other hand, strike flint approximately 2 inches from tip of torch.				Safety glasses, work gloves			
	1h. Adjust acetylene torch body valve	Incorrect adjustment could cause flame out, undesirable magnitude		Adjust acetylene torch body valve to desired flame				Safety glasses, work gloves			
	1i. Open oxygen valve on torch body	Incorrect adjustment could cause flame out, undesirable magnitude		Slowly open oxygen valve on torch body to achieve desired flame.				Safety glasses, work gloves			
2. Perform weld	2a. Have flux and welding rods appropriate for type weld and material being welded	Improper weld due to improper selection of flux and welding rods		Welding training should cover when and how to use different fluxes and welding rods. Adhere to the trianing.							



Task(s)	Define Activities/Equipment Used (note frequency/duration)	POTENTIAL HAZARDS	REQUIRED CONTROL/WORK PRACTICES	REQUIRED PPE
	2b. Perform weld	2b1. Fire or Explosion	<ol style="list-style-type: none"> 1. Updated (annual) Welding shop burn permit required. 2. If welding outside shop, Burn Permit from Authorized Person required. 3. Do not weld near flammable material. Move flammables at least 35 feet away or protect them with flame-proof covers. 4. Do not weld on drums, tanks or any closed containers unless a qualified person has tested it and declared it or prepared it to be safe. 	Welder's cap, safety glasses, oxygen fed respirator, if required; Welder's face shield; welder's gloves; welder's apron
		2b2. Breathing welding fumes	<ol style="list-style-type: none"> 1. Use enough forced ventilation or local exhaust (forced suction) at the arc to remove fumes from breathing area. 2. Use portable smoke eater when out on a job. 3. Use welding helmet that has fresh air supply. 4. Keep your head out of the fumes and do not breathe fumes. 	Welder's cap, eye protection, face shield, gloves, apron
		2b3. Sparks could burn eyes, hands, clothes	<ol style="list-style-type: none"> 1. Wear welder's cap, eye protection, face shield, gloves, apron 2. If welding outside with breeze, use wind break and line of sight barrier to protect passers-by. 	Welder's cap, eye protection, face shield, gloves, apron
	3c. Perform weld with arc welder	2b4. Arc rays can burn eyes	<ol style="list-style-type: none"> 1. Use welding helmet with correct shade of filter. 2. Use welding curtain to shield other employees and visitors from arc rays. 	Welder's cap, eye protection, face shield, gloves, apron
		2b5. Smoke may set off smoke alarm or sprinkler system	Follow procedures/protocols listed in Chapter XX, Fire Protection Impairment Permit whenever working closer than 35 feet from a sprinkler head or smoke detector.	Welder's cap, eye protection, face shield, gloves, apron
	2c. Weld heating, AC, water, steam, condensate return lines.	2c1. Contents of piping could cause burns	Drain piping at welding area, wearing insulated gloves, eye protection or whatever other PPE based on pipe contents.	Welder's cap, eye protection, face shield, gloves, apron
	2d. Perform weld on or near electrical devices	2d1. Electrical shock, cuts and burns	Use lock-out/tag-out procedures.	Welder's cap, eye protection, face shield, gloves, apron
3. Turn off torch	3a. Close acetylene valve on torch body	Valve and stem (pinch points)	Position fingers on acetylene valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	Welder's cap, eye protection, face shield, gloves, apron



Task(s)	Define Activities/Equipment Used (note frequency/duration)	POTENTIAL HAZARDS	REQUIRED CONTROL/WORK PRACTICES	REQUIRED PPE
	3b. Close oxygen valve on torch body	Valve and stem (pinch points)	Position fingers on oxygen valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	Welder's cap, eye protection, face shield, gloves, apron
	3c. Turn the acetylene valve clockwise	Valve and stem (pinch points)	Position fingers on acetylene valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	Welder's cap, eye protection, face shield, gloves, apron
	3d. Turn the oxygen valve clockwise	Valve and stem (pinch points)	Position fingers on acetylene valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	Welder's cap, eye protection, face shield, gloves, apron
	3e. Close adjustment screws on acetylene regulator	None	N/A	None
	3f. Close adjustment screws on oxygen regulator	None	N/A	None
	3g. Slowly open Acetylene valve on the torch body to bleed lines.	Gas (potential inhalation, explosion)	Position torch nozzle away from personnel and any heat source. Open valve on torch body.	None
	3h. Slowly open oxygen valve on the torch body to bleed lines.	Gas (potential explosion)	Position torch nozzle away from personnel and any heat source. Open valve on torch body.	None
	3i. Close acetylen valve on torch body	Valve and stem (pinch points)	Position fingers on acetylene valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	None
	3j. Close oxygen valve on torch body	Valve and stem (pinch points)	Position fingers on acetylene valve ensuring they do not come in contact with the valve stem. Turn valve clockwise.	None

Operational Risk Management Worksheet

ATTACHMENT 5

Operation: Plan Exhibit of very large and heavy collections

Date of Operation: 7/10/2006

Worksheet developed by: Safety Coordinator's name

Operation Description: An exhibit is scheduled that includes canvases that are 12' x 18' and other large sizes coated in massive amount of lead so they weigh hundreds of pounds, and one sculptural piece that weighs 10,000 lb.

Step 1 Identify Hazard	Step 2 Assess Hazard	Step 3 Develop Controls	Residual Risk	Step 4 How/Who to Implement	Step 5 Supervise/Evaluate
During heavy objects causes back injury or other body trauma	RAC 2	Back injury prevention training; sufficient weight handling equipment; sufficient personnel to share load.	RAC 3	Contract movers; SC arranges for training; Supervisors ensure personnel have and wear safety shoes; use contracted workers	Director or designate/SC note if effective, other possible countermeasures
Dropped heavy objects could cause foot injury	RAC 3	Safety Shoes; safety awareness training	RAC 4	Supervisors ensure personnel have and wear safety shoes; use contracted workers	SC/supervisor enforce PPE
Sharp objects or wood splinters on crates could cause hand injury	RAC 3	Leather gloves to prevent splinters, cuts	RAC 4	Supervisors ensure personnel have and wear gloves; use contracted workers	SC/supervisor enforce PPE
Weight exceeds forklift capacity	RAC 2	In planning stage determine weight/lift/space requirements. Limit exhibit to meet present capacities, or contract for necessary equipment	RAC 4	Director determines limitations and resource capabilities and assigns personnel capable of determining weight and size restrictions.	Director or designate/SC note if effective, other possible countermeasures
Weight exceeds elevator capacity	RAC 2	In planning stage determine weight/lift/space requirements (see 8 above)	RAC 4	Same as 8 above	Same as 8 above
Pieces are too large to fit in the elevator	RAC 2	In planning stage determine weight/lift/space requirements (see 8 above)	RAC 4	Same as 8 above	Same as 8 above
Mounting challenges to prevent pieces from falling from wall	RAC 1	In planning stage determine weight/lift/space/mounting requirements; check with previous museum showing exhibit for lessons learned	RAC 3	Employees are trained and provided necessary equipment to install safely	Supervisor/SC insures safe installation operations
Unbalanced pieces could topple	RAC 1	Same as 11 above	RAC 3	Same as 11 above	Same as 11 above
Insufficient space for full exhibit and visitor viewing space	RAC 2	Thorough planning and involvement of OSHEM fire and safety personnel to insure sufficient space for exhibit; employees and visitors	RAC 4	Exhibit planners use scale drawings and coordinate with OSHEM	Supervisor/SC insures safe installation operations
Sharp protrusions could injure visitors	RAC 2	Same as 13 above	RAC 4	Same as 13 above	Same as 13 above
Exposure to lead dust	RAC 2	Coordinate with qualified OSHEM personnel to evaluate exposure hazard.	RAC 4	Once provided factual exposure hazard assessments, Director determines exhibit limitations.	Same as 13 above

Highest residual risk level: LOW

MEDIUM

HIGH

EXTREMELY HIGH

Accepted by:

Date:

Job Observation / Task Analysis

Date/Time: _____ Supervisor Name: _____
 Observer Name: _____ Facility Name: _____
 Person on Job: _____ Department: _____
 Job Title: _____ Area/Location: _____

Identify Potential Hazards

<input type="checkbox"/> Chemical Burn	<input type="checkbox"/> Electric Shock	<input type="checkbox"/> Inhalation Hazard	<input type="checkbox"/> Thermal Burn	<input type="checkbox"/> Loud Noise
<input type="checkbox"/> Fire	<input type="checkbox"/> Pinch Point	<input type="checkbox"/> Overexertion	<input type="checkbox"/> Cave-In	<input type="checkbox"/> Particles in Eye
<input type="checkbox"/> Elevated Work	<input type="checkbox"/> Heat Stress	<input type="checkbox"/> Inadequate Guards	<input type="checkbox"/> Overhead Work	<input type="checkbox"/> Slips, Trips and Falls
<input type="checkbox"/> Spills	<input type="checkbox"/> Abrasions	<input type="checkbox"/> Laceration	<input type="checkbox"/> Falling Hazards	<input type="checkbox"/> Sprains and Strains
<input type="checkbox"/> Rotating Equipment	<input type="checkbox"/> Inadequate Lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Identify Hazard Elimination/Correction

<input type="checkbox"/> Rubber Gloves/Face Shield/Rain Suit	<input type="checkbox"/> Face Shield/Mono	<input type="checkbox"/> Toe Boards/Netting	<input type="checkbox"/> Erect Barricades
<input type="checkbox"/> Personal Protective Equipment	<input type="checkbox"/> Fire Hose/Extinguisher	<input type="checkbox"/> Hearing Protection	<input type="checkbox"/> Use Respirator
<input type="checkbox"/> Scaffolds/Safety Harness/Fall Protection	<input type="checkbox"/> Proper Sloping/Shoring	<input type="checkbox"/> Contain Sparks	<input type="checkbox"/> Proper Tools
<input type="checkbox"/> Electrical Gloves/Flash Suit	<input type="checkbox"/> Proper Body	<input type="checkbox"/> Leather Gloves	<input type="checkbox"/> Get Help
<input type="checkbox"/> Spill Containment Supplies	<input type="checkbox"/> Improve Housekeeping	<input type="checkbox"/> Temporary Lighting	<input type="checkbox"/>

Job Preparation, Set-up and Review	Yes	No	N/A
Supervisor job scope discussion performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Job scope understood?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special Requirements/Checklist?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Permit/work clearance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hot work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confined Space	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excavation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hoisting/Rigging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proper safety equipment available at the job site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire watch understands responsibility?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confined space procedure/rescue plan reviewed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Excavation checklist completed properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All required equipment isolated and locked out?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Test starts performed (local and remote)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lines drained and purged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Proper tools available/used for the job?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MSDS reviewed with work group?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Job Completion Review	Yes	No	N/A
Work area cleaned? Tools/parts/materials removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All guards replaced and secured properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All locks removed and permits signed completely?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Permit/work clearance permit turned in?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Job status communicated to affected personnel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Deficiencies
Recommendations

Reviewed by (Name/Title): _____

Job Observation Form OSHEM JO 001

 Creation Date: 30 August 2007
 Revision # _____ and Date: _____