

# Chapter 3.2

## Hazard elimination and control

### 1. Applicability of this chapter

You are required to follow this chapter if you work at JSC or a JSC field site.

### 2. Description of Sub-element 3.2

JSC shall eliminate or control site hazards identified during hazard analyses, inspections, close-call reports, or mishaps by the systems, and by using the hierarchy outlined in subparagraph e below. The following requirements apply:

- a. All affected employees and visitors shall understand and follow hazard controls.
- b. Hazard controls shall adequately eliminate or control the hazards in the work area.
- c. You shall include hazard controls in training, positive reinforcement, and correction programs.
- d. The following hierarchy, 1–4 below, governs JSC’s actions to eliminate or control hazards, with 1 being the most desirable. Subparagraph e deals with required hazard control programs and is a part of hazard elimination and control, but separate from the hierarchy for eliminating or controlling hazards:
  1. **Engineering controls.** These are the most reliable and effective type of controls and shall be considered before using the other controls mentioned. Engineering controls are design changes that directly eliminate (ideally) a hazard or limit the severity or likelihood of a potential mishap, such as reducing pressure or the amount of hazardous material, substituting a less hazardous material, reducing noise produced, designing fail-safe systems, leak before burst, providing fault tolerance or redundancy, ergonomics, etc. A category of engineering controls, although not as reliable as true engineering controls, includes protective safety devices such as guards, barriers, interlocks, grounding and bonding systems, pressure relief valves to keep pressure within a safe limit, etc. These items typically seek to reduce indirectly the likelihood of the hazard. These controls are often linked with caution and warning devices like detectors and alarms that are either automatic (do not require a human response) or manual (require a human response). See paragraph 7 below for more information.
  2. **Administrative controls.** These controls significantly limit daily exposure to hazard by controlling or manipulating the work schedule or the manner in which the work is done, such as job rotation. See paragraph 8 below for more information.
  3. **Safety and health rules.** This is a type of administrative control that includes written workplace rules, safe and healthful work practices, and procedures for specific operations. Work practice controls modify the manner in which an employee does his or her work. Modifications may reduce exposure through methods such as changing work habits, improving sanitation and hygiene practices, or making other

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changes in the way an employee does a job. Rules shall be reviewed regularly for effectiveness and enforced fairly. See paragraph 9 below for more information.

4. **Personal protective equipment (PPE).** This includes any PPE required by federal, NASA, or JSC requirements or deemed necessary by hazard analysis. See subparagraph 10 below for more information.
5. **Hazard control programs.** This includes all required programs to control specific hazards in the work area such as Lockout/Tagout, Respiratory Protection, Hearing Conservation, etc. We shall have written control programs that are implemented, updated by management as needed, and used consistently by employees. See subparagraph 11 below for a list of JSC’s hazard control programs and the appropriate chapters in the Handbook.

### 3. Determining the risk of a hazard

After you have identified a hazard, you shall identify the risk of the hazard to determine how serious it is. This allows us to prioritize hazard correction. Risk considers both the severity of a mishap that could result from a hazard and the chance the mishap could occur. Document both the risk assessment before controls are in place and the risk assessment after controls are in place. Use an RAC matrix in paragraph 2.4.8, chapter 2.4 of this handbook, to assess the risk of each hazard:

- a. Find the “consequence” or the worst-case outcome of a mishap from the hazard along the left side of the matrix.
- b. Find the “likelihood” or probability that you expect the mishap to occur across the top of the matrix.
- c. Find the RAC in the box where the “consequence” and “likelihood” cross.

### 4. Actions to take based on the RAC

The table below tells you what action to take for each RAC. Investigation and abatement shall follow paragraph 6 below and Chapter 3.5 of this Handbook.

<i>If the RAC is . . .</i>	<i>Then the risk is . . .</i>
1	Unacceptable – All operations shall cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work.  A safety or health professional shall stay at the scene at least until temporary controls are in place.
2	Undesirable – All operations shall cease immediately until the hazard is corrected or until temporary controls are in place and permanent controls are in work. Program Manager (Directorate level), Organizational Director, or equivalent management is authorized to accept the risk with adequate justification.*

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***If the RAC is . . . Then the risk is . . .***


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3	Acceptable with controls – Division Chief or equivalent management is authorized to accept the risk with adequate justification.*
4–7	Acceptable with controls – Branch Chief or equivalent management is authorized to accept the risk with adequate justification.*

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\*Never accept the risk of violating JSC, NASA, local, state, or federal requirements. If you think you can't follow any such requirement, you shall request a variance as described in Chapter 1.4, "Written Safety and Health Program," of this Handbook.

## **5. Determining the risk from exposures to physical, chemical, biological, and radiological health and environmental hazards**

Determining the risk from exposure is a complicated process. It includes an evaluation of the hazard, the dose and exposure, acute and chronic health effects caused by the exposure, and other factors. While the table in paragraph 3 above indicates some severity estimates for degree of illness, it is best to determine these risks through a cooperative effort involving the line manager, employee, and occupational health professionals. Call the Occupational Health Branch, x36726, for help in evaluating these risks. For environmental issues, determine the severity and frequency according to JPR 8553.1, "JSC Environmental Management System Manual."

## **6. Investigating and correcting a hazard**

When you investigate a hazard where no event happened but a condition exists that may cause an injury, property damage, or an environmental release or spill, you shall find the cause of the hazard and decide what actions you will take to eliminate or control the hazard. The Environmental Office will take the lead for hazard investigations that are strictly environmental and will help with others that involve environmental issues. Contact the Environmental Office for hazards that are strictly environmental. To correct a hazard, follow the hazard abatement process found in <http://www6.jsc.nasa.gov/safety/hazard/database/default.asp>. Take the following steps to investigate a hazard:

- a. First make sure that other JSC team members are protected from the hazard or environmental concern. This may include blocking trip hazards or spills with orange cones.
- b. For RAC 1 and 2 hazards:
  1. Do a full root cause analysis using an established root cause method. The cause may be simple, but try to look beyond the obvious. Perhaps the hazard was caused by some deficiency in the management system. Perhaps it was caused by human error, which resulted from deficiency in the management system.

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2. Evaluate the root causes and determine which ones you need to fix to prevent injuries or future hazards.
  3. Take action to change, control, or prevent those root causes from causing injuries or future hazards.
  4. Document the results of your analysis and action plan or actions taken. Follow the hierarchy in subparagraph 2 when determining the actions to take. Submit the results to the Safety and Test Operations Division. That Division will track the actions to closure and verify that actions are complete in the Hazard Abatement Tracking System (HATS). See Chapter 3.5 for more details.
- c. For RAC 3–7 hazards:
1. Evaluate and take actions to eliminate or control the hazard as necessary. Follow the hierarchy in subparagraph 2 when determining the actions to take. If no action is necessary, you shall provide rationale.
  2. You are encouraged to look beneath the surface for underlying causes of the hazard, especially if you have seen other similar hazards.
  3. Document the actions taken in the appropriate tracking system. If it will take you more than 30 days from the time it's identified through inspection or investigation to fix the hazard, you shall enter it into the HATS. See Chapter 3.5 for more details. The Safety and Test Operations Division will automatically enter hazards reported through the Close Call system or the Safety Action Hotline into HATS as necessary.

### **7. Engineering controls**

Try to use engineering controls first to correct hazards in your work area before resorting to administrative controls. There are two kinds of engineering controls listed below in order of preference. You shall use the first and resort to the second only if the first choice is too expensive or not feasible:

- a. Change the design so you eliminate or reduce the hazard. For example, use a less hazardous material or lower voltage if you can.
- b. Install safety devices or guards. For example, use safety interlocks, machine guards, or relief valves if you can.

### **8. Administrative controls**

Administrative controls are less effective than engineering controls since they rely more on human performance. Use them only if engineering controls aren't feasible or are too costly. Administrative controls may include altered work schedules, training, administrative barriers, signs, and caution and warning devices. When you use administrative controls:

- a. Everyone in the work area shall understand and follow them.
- b. They shall affect the hazards they are to control.

- c. Management shall enforce them fairly.
- d. Employees and management shall update them as needed.

See Chapter 6.12 of this Handbook for specific requirements on chemical alarms.

## 9. Safety and health rules

Parts 5–10 of this Handbook contain safety and health rules for the entire Center. Individual work areas may need more specific rules, depending on the hazards. You may also include special procedures in work instructions. When you use safety and health rules:

- a. Everyone in the work area shall understand and follow them.
- b. They shall affect the hazards they are to control.
- c. Management shall enforce them fairly.
- d. Employees and management shall update them as needed.

## 10. Personal protective equipment

PPE is not a substitute for engineering or administrative controls. You shall first try to eliminate or control a hazard before resorting to PPE. When PPE is required or used as a control in a hazard analysis or job hazard analysis, follow Chapter 5.6, “Personal Protective Equipment,” of this Handbook. This chapter provides general requirements on PPE and requirements for specific types of PPE. Other chapters of this Handbook or OSHA standards (29 CFR 1910) indicate what PPE is required for specific jobs.

## 11. Hazard control programs

JSC has the following hazard control programs. You shall follow the appropriate hazard control program(s) for your job. Use the table below as a guide and refer to the chapters listed for more details.

<i>Hazard control program</i>	<i>Chapter</i>	<i>Use when</i>	<i>Other Requirements</i>
Asbestos	5.7 Part 12	Working in asbestos area or with asbestos containing materials	None
Biosafety and Bloodborne Pathogens	7.4	Working with blood or other biological materials	None
Confined Spaces	6.10	Entering confined spaces	None
Pressure Systems	6.11	Designing, building, or maintaining pressure systems	JPR 1710.13 (current version)

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<i>Hazard control program</i>	<i>Chapter</i>	<i>Use when</i>	<i>Other Requirements</i>
Hearing Protection	7.1	Working in a noisy environment	None
Respiratory Protection	7.2	Working in areas where respirators are required	None
Radiation Protection	7.3	Working around radiation sources	None
Lockout/Tagout	8.2	Working on equipment with stored energy such as electrical, mechanical, or pressure	None
Hazard Communication and Hazardous Materials	9.1 & 9.2	Working with hazardous materials	None
Pesticide Control	9.3	Applying pesticides	None
Lead	9.4	Working around lead-based materials	None
Ergonomics	5.5	Arranging your workstation and designing your work activities	None

## 12 Responsibilities

Responsibilities for hazard prevention and control are as follows:

- a. As a *line manager*, you are responsible for:
  1. Making sure hazards in your work areas are controlled, preferably with engineering controls and using other controls only as necessary.
  2. Developing and enforcing necessary safety and health rules and procedures for your work areas and employees.
  3. Making sure your employees use the appropriate PPE for their jobs.
  4. Making sure your employees follow the appropriate hazard control programs for their jobs.
- b. The *Safety and Test Operations Division* and *Occupational Health Branch* are responsible for:
  1. Reviewing hazard controls as necessary.
  2. Maintaining Center-level safety and health rules.
  3. Maintaining Centerwide hazard control programs.

### 13. Safety and health records

The following organizational-level records will document hazard elimination and control:

- a. Hazard analyses and job hazard analyses, per Chapter 2.4 of this Handbook, that document hazard controls support this sub-element.
- b. Procedures or work instructions that document safe work practices.
- c. Directives or other documentation that provide safety and health rules for individual work areas or organizations.
- d. PPE hazard analyses and other PPE documentation required by Chapter 5.6 of this Handbook.
- e. Documentation required for hazard control programs described in the chapters listed in paragraph 7 above or any other OSHA-required documentation.