Job Safety Analysis Made Simple

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Summary

In every Canadian jurisdiction, health and safety legislation holds employers accountable for ensuring the health and safety of their employees. Employers are responsible for assessing the health and safety risk (chance that somebody will be harmed) of a job. Based on this assessment, employers must implement safety measures to eliminate or mitigate any risks to their employees. Job safety analysis (JSA) is a proactive approach to ensuring health and safety in the workplace. The JSA process provides a way of identifying job-related hazards and determining preventive measures. This involves carefully analysing each task of a job, identifying potential health and safety hazards at each step, and determining practical ways of preventing or mitigating such hazards. These preventive measures can then be integrated into an employer's work practices and procedures for the job.

This publication outlines the basic concept of JSA and provides a step-by-step procedure for performing a JSA according to two simple techniques: change analysis and the energy barrier approach (see the flow chart on the next page). Examples of job safety analysis for some common jobs are presented. These examples are intended to illustrate the application of JSA and do not necessarily include a comprehensive list of all potential hazards and related preventive measures. In addition, compliance with applicable occupational health and safety regulations must be considered as a part of the overall JSA.

Definitions

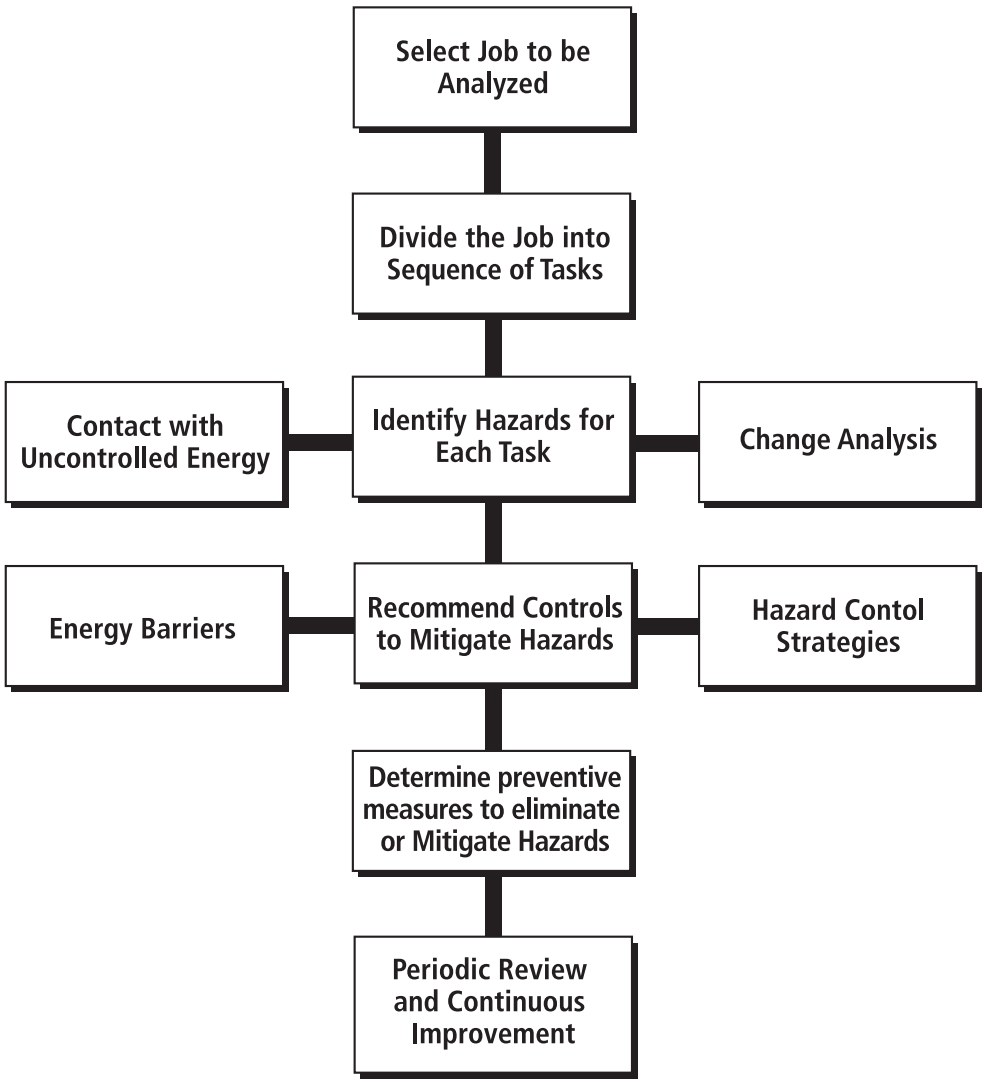
In this publication, hazard and risk are defined as follows:

Hazard means anything that can cause harm. Examples of hazards include toxic chemicals, moving machinery parts, high-voltage electricity, working on heights, temperature extremes, slippery work-surfaces.

Risk means the chance that someone will be harmed by the hazard.

Job Safety Analysis Flow-Chart

The following flow-chart illustrates steps involved in Job Safety Analysis (JSA)



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Introduction

Background

Employers are responsible for ensuring the health and safety of their employees. This includes informing employees of workplace hazards, providing the equipment necessary to safeguard health and safety, and establishing proper health and safety procedures and practices. Therefore, employers have an obligation to assess health and safety risks and to develop safety procedures that will eliminate or mitigate these risks before an employee is required to carry out work.

This publication outlines job safety analysis (JSA) as a method of identifying potential hazards and developing safe work practices to prevent injuries, illnesses, property damage and other losses.

Scope

This publication introduces the concept of job safety analysis and outlines two practical methods of identifying potential hazards and applicable preventive measures. It stimulates the thinking process and empowers the reader to perform job safety analysis. Examples of analysis are included to illustrate the process. The presentation level is narrative and does not require solving mathematical formulas. The level of presentation is suited for persons who are familiar with the workplace but are not necessarily health and safety experts.

Target Audience

This publication is intended for workers, managers and supervisors, members of health and safety committees, and health and safety representatives. Health and safety professionals will find this publication a practical tool for workplace training sessions on health and safety programs and policies.

1. What is a Job Safety Analysis (JSA)?

Job safety analysis (JSA) is the systematic examination of a job intended to identify potential hazards, assess the degree of risk, and evaluate practical measures to control the risk.

It must be kept in mind that JSA is not a workplace inspection or an audit procedure. Workplace inspection is a systematic examination of workplace conditions and practices to determine their conformity with company procedures and compliance with prescribed health and safety regulations. An audit process is a systematic examination of the safety management system to determine if work activities and related results comply with planned prevention policies and established programs. As well, an audit evaluates whether the program is effective in achieving the goals and objectives set out in the policy.

A JSA should be proactive, although it may be used in response to a rising rate of injuries and illnesses. Hazards should be recognized and preventive measures implemented at the planning and organizing stages of the work. It should be emphasized that the focus of JSA is to examine the job and not the person who is doing the job.

Job safety analysis is an important element of a risk management system. It involves analysing each basic task of a job to identify potential hazards and to determine the safest way of doing the job. This procedure is sometimes referred to as job hazard analysis.

Experienced workers and supervisors may perform a JSA by analysing jobs through discussion and observation. This approach has two distinct advantages. Firstly, it involves more people which allows for a wider base of experience. Secondly, the participation of many stakeholders promotes faster acceptance of the resulting work procedure.

Health and safety committee members and representatives play an important role in the JSA and have a legal obligation to participate in the JSA process. They also provide practical work experience related to the risk evaluation and the feasibility of appropriate controls. Health and safety specialists may participate in the JSA to eliminate any oversight in accounting for potential hazards and related preventive measures.

Some individuals prefer to expand the analysis into all aspects of the job, not just safety. This approach is known as total job analysis or task analysis. The total job analysis is based on the concept that safety is an integral part of every task performance and not a separate entity. In this document, only health and safety aspects will be considered; however, it is recognized that this material could be used to conduct a total job analysis.

2. How to perform a Job Safety Analysis (JSA)

A job safety analysis involves five steps:

1. Selecting the job to be analysed.
2. Breaking the job down into a sequence of tasks.
3. Identifying potential hazards.
4. Determining preventive measures to control these hazards.
5. Communicating the information to others.

STEP 1:

What important factors should be considered in selecting a job for JSA?

Ideally, a JSA should be performed for all jobs. However, there are practical constraints on time and resources. Another consideration is that each JSA may require revision when changes occur in equipment, raw materials, processes, or the environment. For these reasons, it is usually necessary to set priorities. Factors to be considered in assigning priorities include:

- Accident, injury and illness statistics: jobs where accidents occur frequently or where they result in disabling injuries or illnesses.
- Absenteeism: jobs where employees take frequent sick leaves or other leaves of absence.
- Signs and symptoms of harmful exposures: the nature of the job poses a danger of harmful exposure.
- Potential for severe injuries or illnesses: the consequences of an accident, hazardous condition, or exposure to a harmful substance are potentially severe.
- Modified jobs: new hazards may be associated with changes in job procedures/processes.
- Infrequently performed jobs: employees may be at greater risk when undertaking non-routine jobs.
- Jobs with frequent work interruptions due to technical difficulties.
- Jobs with excessive waste generation and production losses.
- Jobs where employees are required to work alone in isolated workplaces.
- Jobs with the potential for violence in workplace.

STEP 2:

How are basic tasks of a job established?

A *task* is a segment of an overall job. Completion of each operational task in proper sequence leads to the completion of the job. It is important to keep the tasks in their correct sequence. Any task which is placed out of sequence may cause potential hazards to be missed or introduce hazards which would not otherwise exist.

When conducting a JSA each task is recorded in its proper sequence. Notes should be made of what is to be done rather than how it is done. Each item is started with an action verb.

Appendix A illustrates a format that can be used as a worksheet for JSA.

Dividing a job into tasks requires a thorough knowledge of the job. If the tasks are made too general, specific operations and related hazards may be missed. On the other hand, too many tasks may make the JSA impractical. A rule of thumb is that most jobs can be described in less than ten tasks. If more operational steps are required, it is advisable to break the job into two segments, each with a separate JSA. As an example, Table 1 presents the tasks involved in changing a flat tire.

This part of the analysis is usually prepared by watching the employee do the job. The employee being observed should be experienced and capable of performing all parts of the job. The observation team may include the immediate supervisor, a health and safety professional, and a member of the health and safety committee or the health and safety representative. Key points are less likely to be missed in this way.

Table 1. An example of JSA applied to changing a flat tire.

JOB SAFETY ANALYSIS WORKSHEET

JOB: changing tire on a vehicle

Analysed by: John Supervisor and Tom Worker **Date:** 29 May 2001

Reviewed by: Joe Expert **Date:** 1 June 2001

Approved by: Co-Chairs Health and Safety Committee **Date:** 5 June 2001

Sequence of Tasks	Potential Hazards	Preventive Measures
1. Park vehicle.		
2. Get spare tire and tool kit.		
3. Pry off hub cap.		
4. Loosen lug bolts (nuts).		
5. And so on ……		

Helpful Tips for Performing a JSA

EXPLAIN the purpose of the JSA to ensure full co-operation and participation of the employee.

ASSURE the employee that the purpose of the JSA is to make the job safer by identifying hazards and making changes to eliminate or reduce accidents, injuries, and illnesses.

CLARIFY that the JSA is neither a time and motion study in disguise nor an attempt to uncover individual unsafe acts.

ENSURE the employee understands that the JSA is an evaluation of the job, not the individual.

RESPECT the employee's experience and use it as an important input in making improvements.

OBSERVE jobs during normal working hours and situations. For example, if a job is routinely carried out at night, perform JSA at night. Similarly, only regular tools and equipment should be used. The only difference from normal operations should be the fact that the job performance is being observed.

DISCUSS with the employee:

- tasks of the regular process;
- any incidents;
- communication problems;
- difficulties in performing the tasks;
- training provided in the use of equipment and safety procedures; and
- need for improvements.

DISCUSS the breakdown of tasks with all the participants (including the employee).

ENSURE that all basic tasks have been noted and are in the correct order.

STEP 3:

How are potential hazards identified?

Two commonly used techniques for identifying potential hazards are: A) Kepner and Tregoe method based on change analysis; B) Gibson and Haddon approach based on unwanted energy flow and energy barrier.

A) Change analysis

(Kepner and Tregoe)

Change analysis helps establish the significance of changes in causing accidents and losses. As well, it helps determine counter-changes to prevent these accidents and losses. Change is needed for improvement, but the change may have unwanted side effects. Changes can be planned or unplanned. Sometimes, preventive changes can cause problems if not introduced properly.

In planned changes potential problems can be identified and controlled. Change analysis offers a powerful safety analysis methodology for the unplanned and anticipated changes in the operation of equipment, material, or process. Any unplanned changes may result in accidents and losses unless preventive measures (counter-changes) are implemented.

First introduced by C.H. Kepner and B.B. Tregoe in 1965, as a managerial tool to solve production problems, change analysis technique was eventually adapted to occupational health and safety issues. In the 1970s, the "What if" procedure was developed to identify possible accident event sequences. Once these sequences are established it is easier to pinpoint the hazards, consequences, and potential methods for risk reduction.

The "What If" analysis involves conducting a thorough and systematic examination of each task by asking questions that begin with "What if…?" The formulation of the exact questions is left up to those conducting the examination.

Helpful Tips for Change Analysis

For a specific task, identify the task or process parameters to be investigated for changes (normally one parameter).

Apply the guide words to this parameter in order to qualify or quantify the changes.

Identify and assess the consequences of the changes in terms of risk.

Task parameters are easy to find. Look at the task and find parameters to be controlled in order for the task to be performed normally.

Such parameters can be:

- **a sensory signal:** e.g., colour, the shape of object, the emitted sound, an odour, the light level, the position of handle, the height of a pedal.
- **a process specification:** e.g., pressure, temperature, concentration, flow rate.
- **a dynamic component:** e.g., motion, sequence, pace, speed change, friction.
- **a force or mass:** e.g., electrical power, chemical energy, torque, impulse, impact.
- **a geometric value and time:** e.g., location, dimensions, rate.

Table 2. Guide words for "What if" questions.

Guide Word	Meaning	Examples: What if...
No or not	- Negation of the operation	The operation is stopped and nothing else is produced
More	- Quantitative increase - Sooner (time) - Higher (height, T, P)	- Temperature is higher than normal - Exposure time is greater than regular - Temperature and/or pressure is increased
Less	- Quantitative decrease - Later (time) - Lower (height, T, P)	- Quantity produced is less than usual - Shutdown time is greater than normal - Temperature and/or pressure is decreased
As well as	- Qualitative increase - Somewhere else - At the same time as	- An unwanted product is produced at the same time as the wanted product (contamination) - A product is transferred from one tank to another with environmental release - A product is boiling during transfer with splashes
Part of	- Qualitative decrease - Lack of	- A product is not added during production - An operation is unachieved or interrupted
Reverse	- Logical opposite of the operation	- Tank is being emptied instead of being filled
Other than	- Complete substitution of one operation by another	- A product is heated instead of being evacuated

- **a piece of equipment:** e.g., protective devices, position of a part, part in motion.
- **an environmental or external condition:** e.g., weather, snow, rain, nuisances from neighbourhood.
- Or others.

When the parameter has been identified, apply the "What if" questions to it by using the guide words described in Table 2. All questions have the following format:

> What if the (parameter) is not, more, less, as well as, part of, reverse, other than the one described in the task?

As an example, change analysis can be applied to the "changing a flat tire" scenario. The first task "park vehicle" insists on the "location" of the vehicle as a specific parameter. Normally, the vehicle must be parked off the road on a stable ground before removing any wheel. Table 3 presents examples of applying "What if" questions to this situation.

If the job is well defined, the employee's workstation is geographically limited, or his activities are repetitive in nature, the energy barrier approach is an alternative.

B) Unwanted energy flow and energy barrier approach

(Gibson and Haddon)

The energy-barrier approach was developed by J.J. Gibson in 1961 and structured by W.C. Haddon in 1966. This approach of accident prevention is very popular because it is simple to apply and easy to understand.

We all use energy to perform work. Power is the rate of energy use. In classic industrial processes, high power sources produce large amounts of energy in a short time and are key to high production rates. Controlled energy is essential to accomplish work. Uncontrolled energy flow has the potential to cause accident, injury, equipment damage, or property losses.

For example, controlled flow of electrical energy will run motors, power lighting and

Table 3. Applying "What if" questions for changing a flat tire.

Guide Word	Example of "What if" Question
No or not	What can happen if employee lost the control of his/her vehicle and cannot park?
More	What can happen if the vehicle is parked on the road (on a bridge, obstruction by snowdrift)?
Less	What can happen if employee cannot stop the vehicle rapidly?
As well as	What can happen if employee cannot find a location in the dark?
Part of	What can happen if the vehicle is on a soft shoulder?
Reverse	Not applicable.
Other than	What can happen if towing is mandatory on a road?

heating systems, and energize many other desirable operations. Uncontrolled electrical flow can cause electrocution or electric shocks to people, destroy machines, and pollute our environment. If a person comes in contact with a live electrical wire, the electrical current will flow through his body causing electrocution, or in a less severe case, electric shock. In the same way, a moving belt drive possesses kinetic (motion) energy. If the belt breaks while moving, it can hit a person and cause physical injury, or damage a piece of equipment and cause physical loss.

In the energy-barrier approach, hazard is defined as uncontrolled energy flow and the possible contact between the energy and a person or equipment, resulting in:

- injury to persons;
- damage to equipment and property;
- reduction in the ability of persons to perform work; and
- harm to the environment.

The procedure of the energy barrier technique is to look at each task and:

- identify the energy sources producing a risk (Table 4);
- describe the way the energy can come in contact with employee(s) (i.e., the energy flow) (Table 5);
- find adequate barriers to eliminate or reduce the chances of this contact (i.e., controlling the energy flow).

Table 4. Types of energy.

Type of energy	Examples of contact
Gravitational	Falls from same level, falls from different level, falling objects.
Kinetic	Human energy: repetitive motion, overexertion, awkward posture. Machine energy: struck by moving object, projectiles, airborne particulate, motor vehicle, caught between, caught in, cut by.
Thermal	Burns (hot and cold), hypothermia, heat stress, solar heat.
Biological	Contact with infections resulting in diseases (of the lungs, blood, skin, etc.). Contact with pathogens.
Chemical	Corrosion: degradation of materials. Reactions: exothermic, endothermic, explosive, toxic, corrosive. Fumes; gases, dusts.
Hydraulic	Asphyxiation (drowning), motive force (resulting in crushing, caught between, etc.).
Electrical	Electric shock, electrical burns, electrocution.
Radiation	Ionizing radiation exposure from: radioactive material, cosmic rays, natural radioactive materials in the earth, x-ray machines. Electromagnetic radiation exposure from: microwaves ovens, radio and TV antennas. Ultraviolet radiation from: the sun, UV lamps. Infrared radiation from: the sun, heat sources. Electromagnetic field from: electrical power lines, power transformers, electrical equipment.
Animal	Attacks, bites, stings.
Stored potential energy	Motive force from: coil springs, flexed objects. Pressure: steam, compressed gases.
Noise	Machine noise, human noise, environmental noise (wind, animals, etc.).
Multiple kinds of energy	The interaction of two or more kinds of energy frequently causes accidents. This complexity can be best described or classified by the sequential listing of energies: for example, electrical shock resulting in fall from heights, bee sting resulting in motor vehicle accident.

Table 5. Examples of contact with uncontrolled energy sources.

Types of contact	Examples of contact with uncontrolled energy
Contact between objects and equipment	Struck against object. Struck by object. Caught in or compressed by equipment or objects. Caught in or crushed in collapsing materials. Rubbed or abraded by friction or pressure. Rubbed, abraded, or jarred by vibration.
Falls	Fall to lower level. Jump to lower level. Fall on same level.
Bodily reaction and exertion	Bodily reaction. Overexertion. Repetitive motion. Sustained viewing. Static posture without the application of force to an object. Static posture with the application of force to an object. Bodily conditions.
Exposure to caustic, noxious, or allergenic substances	Exposure to noise. Exposure to radiation. Exposure to traumatic or stressful event. Oxygen deficiency. Exposure to harmful substances or environments. Contact with electric current. Contact with temperature extremes. Exposure to air pressure changes.
Transportation accidents	Highway accident. Non-highway accident (except rail, air, water). Pedestrian, non-passenger struck by vehicle, mobile equipment. Railway accident. Water vehicle accident. Aircraft accident. Transportation accident.
Fires and explosions	Fire: unintended or uncontrolled. Explosion.
Assaults and violent acts	Assaults and violent acts by person(s). Self-inflicted injury. Assaults by animals.

Source: CSA Standard Z795-96, Coding of Work Injury or Disease Information

For each task, the observers use Table 4 to determine all the possible types of energy present in the process, and Table 5 as a checklist to cover all the possible ways in which a person may come in contact with these energies. For example, for the task "park vehicle", the energy types and corresponding ways of contact are:

Kinetic energy:

a) from the employee's vehicle: struck against objects in the environment (tree, snowdrift), caught in motor vehicle.

b) from passing traffic: struck by the oncoming vehicle, caught between oncoming vehicle and employee's car.

Gravitational energy:

a) from the employee's vehicle: sliding of the car into ditch, fall of the vehicle caused by soft shoulder, rolling down a hill.

Potential hazards identified using the energy-barrier approach are listed in the middle column of the worksheet (Table 6), numbered to match the corresponding job task.

Table 6. Identifying potential hazards for changing a flat tire

JOB SAFETY ANALYSIS WORKSHEET

JOB: changing tire on a vehicle

Analysed by: John Supervisor and Tom Worker **Date:** 29 May 2001

Reviewed by: Joe Expert **Date:** 1 June 2001

Approved by: Co-Chairs Health and Safety Committee **Date:** 5 June 2001

Sequence of Tasks	Potential Hazards (Energy type & contacts)	Preventive Measures (Barriers)
1. Park vehicle.	a) Can be hit by passing traffic. b) Can be hit by vehicle on uneven, soft ground. c) Vehicle may roll on the driver.	
2. Get spare tire and tool kit.	a) Lifting spare may cause strain.	
3. Pry off hub cap.	a) Hub cap may pop off and hit the driver.	
4. Loosen lug bolts (nuts).	a) Lug wrench may slip and hurt the driver.	
5. And so on ……..	a)	

STEP 4:

How are preventive measures determined?

The fourth step in a JSA is determining ways to eliminate or mitigate the hazards identified. There are two approaches for doing this:

A) Hazard control strategies.

B) Energy-barrier approach involving controls:

- at the source;
- along the path; and
- at the person.

The objective of both approaches is the same: the prevention of injuries, illnesses, and other losses. Preventive measures depend on the findings of the JSA and not the method to perform it (i.e., the change analysis technique or the energy barrier approach).

A) Hazard control strategies

The following are common hazard control strategies, in order of preference:

1. Eliminate the hazard.
2. Substitute the hazard with less hazardous or non-hazardous options.
3. Minimize the risk due to the hazard:
   - Reduces the exposition.
   - Isolate the hazard.
   - Provide personnel protective equipment and clothing.
   - Implement administrative controls.
4. Have an emergency plan in place.
5. Adopt measures to reduce damage following an accident or emergency.

1. Eliminate the hazard

This is the most effective measure because the risk is eliminated. Examples of options in this category are:

- choose a different process;
- modify an existing process by changing the energy type;
- modify or change equipment or tools;
- lock out energy sources.

2. Substitute the hazard with less or non-hazardous options

This measure is very effective, especially for hazardous substances, but its application in safety field is practicable. Here are some examples:

- replace solvents by water solutions;
- substitute vapour heating by electric devices;
- use electronic controls instead of pneumatic ones;
- crush explosive dusts in inert gas atmosphere instead of air;
- use a non-sparking copper hammer in a flammable atmosphere in lieu of steel hammer.

3. Minimize the risk due to the hazard

If the hazard cannot be eliminated or substituted, efforts should be made to minimize the risk to the employee due to the injurious contact with the hazard. This is achieved by using one or a combination of the following methods of control:

Reduce the exposure

- Change the design of the workstation.
- Improve environment (e.g. ventilation).
- Implement emission controls.
- Add safety and alert devices.
- Develop safety procedures.

- Train the workers to perform the task safely.
- Provide health and safety education.

Isolate the hazard

- Build enclosures to contain the hazard.
- Group noisy machinery in a room.
- Isolate the worker operations in a control room.
- Put a cabin on a lift truck.

Provide personnel protective equipment and clothing

- Use respirators in dangerous atmosphere.
- Select appropriate gloves corresponding to the type of solvent.
- Protect fingers with wire mesh to prevent cuts by knife.
- Wear a wide brim cap to prevent exposure to sunlight.
- Use fall protection when working at height.

Implement administrative controls to reduce exposure to the hazard

- Implement job rotation schedule.
- Reduce time or frequency of exposure to a hazardous substance.
- Evaluate employee's physical, mental and emotional capacity before a job placement.
- Ensure that the employees can perform work without endangering their own health and safety or that of others.
- Institute medical controls and examinations.

4. Have an emergency plan in place

Fires and emergencies may and do happen. Workplaces must have an emergency plan in place to protect people, property, and business in case of such emergencies.

5. Adopt measures to reduce damage following an accident or emergency

Workplaces must have plans in place to deal with the after effects of accidents and emergencies. These include plans for:

- rescue of the victims;
- emergency medical assistance for the injured;
- repair and restoration of the damage; and
- compensation and insurance.

B) Energy-barrier approach

The basic concept in this approach is that accidents occur because of the lack of barriers to control unwanted energy flow. Whether or not a form of energy produces an injury or loss in a given situation depends on the:

- magnitude of energy and rate of release;
- duration and frequency of contact; and
- concentration of forces: force per unit area

The harmful effects of uncontrolled energy transfer can be prevented or reduced by a succession of countermeasures or energy barriers (see Table 7 and Figures 1 and 2).

Energy Barrier and Unwanted Energy Flow

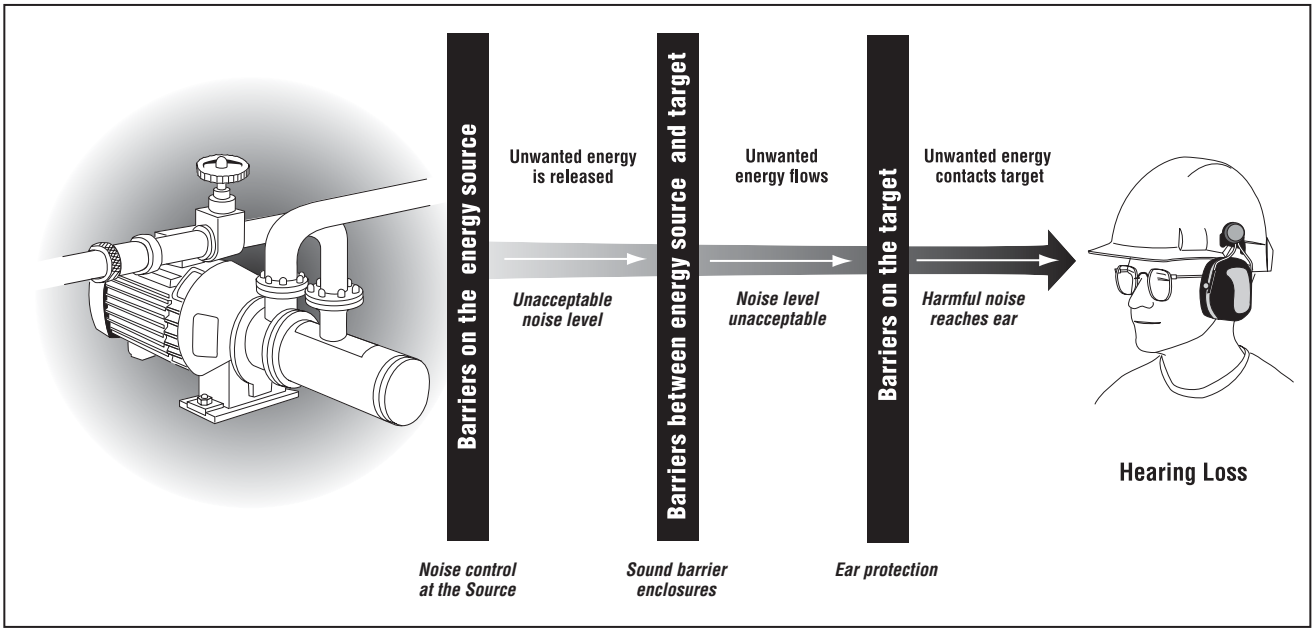

Figure 1. Barriers for unwanted energy flow from an energy source to a person.
(Adopted from the CSA Z796-98 Standard)

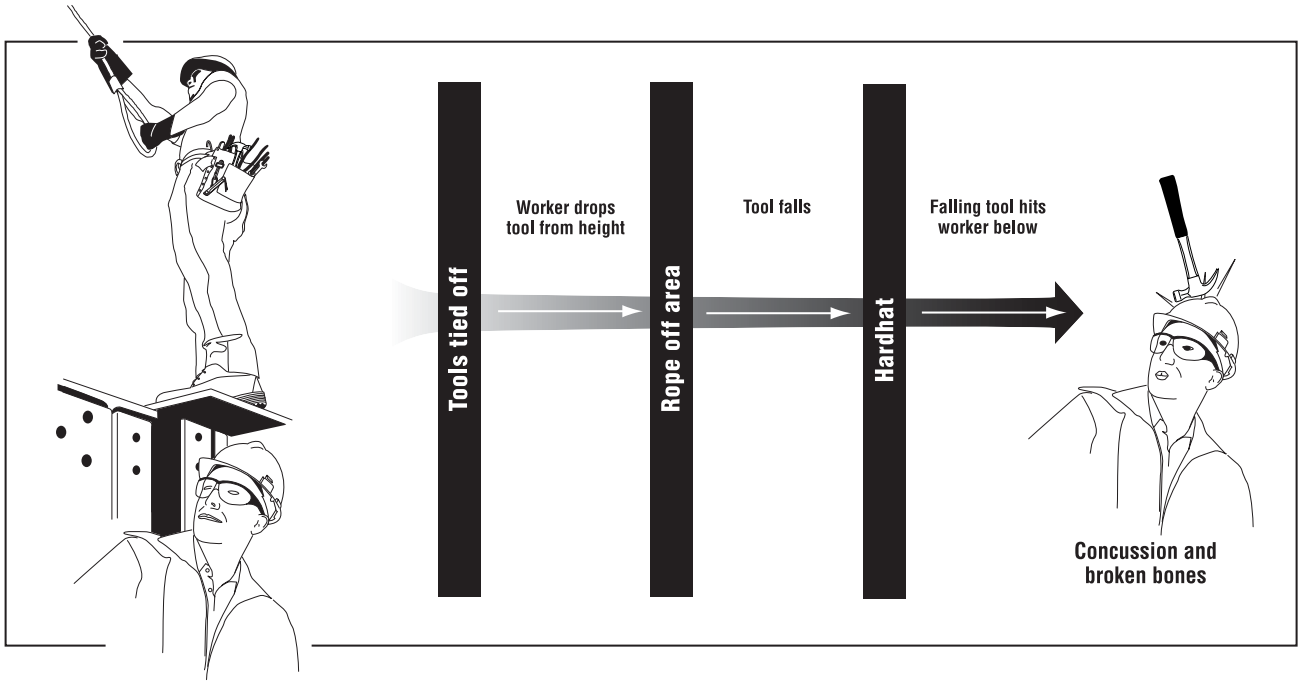

Figure 2. Illustration of energy-barrier approach to describe control measures.
(Adopted from the CSA Z796-98 Standard)

Table 7. Examples of energy barriers (in order of efficiency).

Barrier Type	Examples
1. Limit energy	Lower speed, lower voltage, limit quantity
2. Substitute safer energy form	Safer chemicals
3. Prevent build-up	Fuses, floor loading
4. Prevent the release	Containment, insulation
5. Provide slow release	Safety valves, seatbelts
6. Channel the release (separate in time and space)	Electrical grounding, lockouts, interlocks
7. Apply energy barrier on the source	Acoustic enclosures, sprinklers
8. Apply energy barrier between source and target	Fire doors, welding curtains
9. Apply energy barrier on person or object	Personal protective equipment, machine guards
10. Raise the injury or damage threshold	Selection, acclimatization
11. Limit injury or damage from worsening	Emergency medical aid, emergency showers
12. Rehabilitate	Persons regain health, equipment repaired, special insurance, victim compensation

Table 8. Suggested preventative measures for changing a flat tire using the energy barrier approach.

JOB SAFETY ANALYSIS WORKSHEET		
JOB: changing tire on a vehicle		
Analysed by: John Supervisor and Tom Worker		**Date:** 29 May 2001
Reviewed by: Joe Expert		**Date:** 1 June 2001
Approved by: Co-Chairs Health and Safety Committee		**Date:** 5 June 2001
Sequence of Tasks	**Potential Hazards (Energy type & contacts)**	**Preventive Measures (Barriers)**
1. Park vehicle.	a) Can be hit by passing traffic.	a) Drive to area well clear of traffic. Turn on emergency flashers.
	b) Can be hit by vehicle on uneven, soft ground.	b) Choose a firm, level area.
	c) Vehicle may roll on driver.	c) Apply the parking brake, leave transmission in gear or in PARK, place blocks in front and back of the wheel diagonally opposite to the flat.
2. Get spare tire and tool kit.	a) Lifting spare may cause strain.	a) Turn spare into upright position in the wheel well. Using your legs and standing as close as possible, lift spare out of truck and roll to flat tire.
3. Pry off hub cap.	a) Hub cap may pop off and hit the driver.	a) Pry off hub cap using steady pressure.
4. Loosen lug bolts (nuts).	a) Lug wrench may slip and hurt the driver.	a) Use proper lug wrench; apply steady pressure slowly.
5. And so on ……	a) **……**	a) **……**

Step 5:

How should I communicate the JSA information to everyone else?

Once the preventive measures are selected, the results must be communicated to all employees who are, or will be, performing that job. The side-by-side format used in JSA worksheets is not an ideal one for instructional purposes. Better results can be achieved by using the results of JSA to develop work procedure in a narrative-style format. For example, the work procedure for changing a flat tire might start out like this:

1. Park vehicle

a) Drive vehicle off the road to an area clear of traffic, even if it requires rolling on a flat tire. Turn on the emergency flashers to alert passing drivers so that they will not hit you.

b) Park on a firm, level area so that the vehicle does not roll when you jack it up.

c) Apply the parking brake, leave the transmission in gear or PARK, and turn off the engine.

d) Place blocks in front and back of the wheel diagonally opposite the flat tire to prevent the vehicle from rolling.

2. Get a spare tire and tool kit

Turn the spare tire up into an upright position in its well. Stand as close to the trunk as possible and slide the spare close to your body. Lift out and roll to flat tire.

3. Pry off hub-cap

Pry off hub-cap slowly with steady pressure to prevent it from popping off and striking you.

4. Loosen lug bolts (nuts)

Using the proper lug wrench, apply steady pressure slowly to loosen the lug bolts (nuts), so that the wrench will not slip and hurt your knuckles.

5. And so on…..

If a written job procedure already exists, it should be revised to include health and safety items identified by the job safety analysis process.

3. How and when to use Job Safety Analysis (JSA)

A completed JSA serves as a tool to ensure workplace health and safety. Particularly, JSA serves as an excellent tool for:

Compliance with health and safety legislation.

Employee training.

Workplace inspection.

Safety observation.

Investigation.

Table 9 summarizes the usefulness of JSA in ensuring workplace health and safety.

Table 9. Examples of uses of JSA.

Health and safety activity	How does JSA help
Compliance with health and safety legislation	Employers are required to inform employees about the potential hazards in the workplace and safe work practices to prevent these hazards. JSA serves as an excellent source of such information.
Employee training	Supervisors can use JSAs to provide job specific training. This will ensure that employees learn the safe way of performing each task and the potential dangers of not following the correct procedure. Employee may post a copy of a JSA near his or her workstation for quick reference. For non-routine jobs, JSAs should be viewed as a quick reminder of the potential hazards, safe work practices, and personal protection required.
Workplace inspection	JSAs can be used together with an inspection checklist to ensure that recommended safe work practices are being followed.
Safety observation	Employees can use JSAs as a tool for observing each other's work practices and providing positive feedback to promote safe work practices, and ultimately, develop a safety culture.
Incident investigation	JSA helps in incident investigation in three ways: 1. Provides insight into how accident might have occurred. 2. Identifies new hazards, which were overlooked in the previous JSA. 3. Updates JSA and improves safe work practices.

4. Follow-up and Review of a Job Safety Analysis (JSA)

It is essential to establish a follow-up and review process for monitoring the effectiveness of the preventive measures implemented following JSA. This is done to:

- ensure new hazards have not been created;
- seek feedback from employees performing the job;
- ensure employees are following the procedures and practices required by the JSA;
- assess need for a repeat JSA; and
- implement continuous improvement.

Periodic review (e.g., annually), is useful to ensure components of the JSA remain current and functional and that employees are following the procedures and practices as recommended by the JSA.

A need for a repeat JSA may arise when:

- a new job is created;
- an existing job is changed; or,
- equipment or process is changed.

The economic benefits of JSA include:

- reduced direct/indirect costs of accidents;
- improved quality and productivity; and,
- betterment of employee morale and pride.

The time and effort involved in JSA is an investment to control injury, property damage, and loss of production.

5. References

CSA Z795-96 Standard, *Coding of Work Injury or Disease Information*. Rexdale, Ontario: CSA International, 1996.

CSA Z796-98 Standard, *Accident Information*. Rexdale, Ontario: CSA International, 1998.

Haddon Jr., W. "Energy Damage and the Ten Counter-Measure Strategies" *Human Factors Journal*. Vol. 15, no. 4 (1973), pp. 355-366.

Johnson, W.G. "Change is the Mother of Trouble" in *MORT Safety Assurance System*. New York: Dekker, 1980, Chapter 5.

Johnson, W.G. "Energy: For Work or Harm" in *MORT Safety Assurance System*. New York: Dekker, 1980, Chapter 3.

Kepner, C.H., and Tregoe, B.B. *The Rational Manager*. New York: McGraw-Hill, 1965.

Wuorinen, V. *Job Hazard Analysis* (CCOHS Publication 87-1E). Hamilton, Ontario: Canadian Centre for Occupational Health and Safety, 1987.

6. Examples of Job Safety Analysis (JSA)

1. Transportation of dangerous goods (TDG).
2. Climbing trucks to inspect level of substance in snow and rain.
3. Handling of heavy objects in ports and storage.
4. Machine maintenance.
5. Working at heights on communication towers.
6. Improvisation of tasks.

Example 1 Transportation of dangerous goods (TDG)

(Using the change analysis technique)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Transportation of Dangerous Goods (TDG)

Analysed by: John Supervisor and Mary Worker **Date:** 5 May 2001

Reviewed by: Joe Expert **Date:** 1 June 2001

Approved by: Co-Chairs Health and Safety Committee **Date:** 5 June 2001

Sequence of Tasks	Potential Hazards (Possible changes)	Preventive Measures (Controls)
1. Inspect package	a) Improper packaging.	a) Ensure that the UN recommendations on packaging have been implemented as described in National Standard of Canada CAN/CGSB-43.150-97.
	b) Toxic chemicals.	b) Ensure that packages have diamond shaped safety marks to indicate type of dangerous goods. Ensure that packages comply with TDG regulations. Ensure that the company has a WHMIS compliant MSDS.
	c) Leaking packages, dangerous spills.	c) Inform person responsible for packaging. Do not clean-up unless you are trained to do so. Do not accept leaking packages for transport.
2. Load packages	a) Packages too heavy.	a) Follow proper lifting techniques, e.g., seek assistance, use lifting devices.
	b) Toxic spills.	b) Ensure spill is cleaned up by a qualified person.
	c) Slippery or cluttered surface.	c) Ensure that the walking and working surface is not slippery or cluttered.
	d) Presence of source of flame or heat.	d) Follow safety rules for flammable and combustible materials.

Sequence of Tasks	Potential Hazards (Possible changes)	Preventive Measures (Controls)
3. Transport packages	a) Traffic accidents.	a) Inform your company immediately. Ensure that the shipping document shows: - quantity and type of dangerous goods; - primary and subsidiary product classification; - packaging group; and - shippers 24-hour emergency telephone number. Ensure that there are four identical placards (if required) visible from any direction.
	b) Spills of toxic materials.	b) Ensure that spill is cleaned up by a qualified person.
	c) Extreme weather conditions.	c) Wear adequate clothing to protect from cold and rain. Carry plenty of drinking water in summer months. Carry emergency winter kit (clothing, blanket etc).
	d) Vehicle break down.	d) Call 911 for assistance. Follow your company's emergency procedures.
4. Deliver packages	a) Packages too heavy.	a) Follow proper lifting techniques: e.g., seek assistance, use lifting devices.
	b) Damaged packaging.	b) If package shows signs of leakage do not unload. Call emergency number for assistance and further instructions.
	c) Signs of spill.	c) Inform person responsible for packaging. Do not clean up unless you are trained to do so.
5. And so on ……	a) ……	a) ……

Example 2 Climbing trucks to inspect level of substance in snow and rain

(Using the energy-barrier approach)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Climbing trucks to inspect level of substances in snow and rain

Analysed by: Jane Supervisor and Tom Worker **Date:** 5 May 2001

Reviewed by: Joe Expert **Date:** 10 May 2001

Approved by: Jane Supervisor and HS representative **Date: 5 June 2001**

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Barriers)
1. Park the truck	a) Being hit by passing traffic. b) Being hit by moving or tilting of vehicle parked on uneven and soft ground. c) Being or coming under if truck rolls over.	a) Park in area clear of traffic. Turn on emergency flashers. Wear high visibility vest at night. b) Park on a firm and level area. c) Apply parking brakes. Leave transmission in gear or park. Place blocks in front and back of the wheels.
2. Climb up the truck	a) Fall from slippery surface caused by snow or rain. b) Exposure to cold/rain.	a) Use fall arrest / fall protection. Use proper ladder. b) Wear adequate clothing to protect from cold and rain.

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Barriers)
3. Inspect the contents	a) Contents may be under pressure and may explode. b) Contents may react with water and produce heat, toxic vapours. c) Exposure to toxic dusts, gases, vapours. d) Skin contact with toxic or irritant materials.	a-c) Read TDG documentation and MSDS of the contents. Use proper personal protective equipment such as gloves, footwear, respiratory protection. d) Wear protective clothing and gloves.
4. Climb down the truck	a) Fall from slippery ladder. b) Contaminated clothing and personal protective equipment.	a) Follow ladder safety procedures. b) Keep contaminated gloves, aprons, etc., separate from your normal clothing. Follow recommended cleaning and maintenance procedures.

Example 3 Handling of heavy objects in ports and storage

(Using the energy-barrier approach)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Handling of heavy objects in ports and storage

Analysed by: Jane Expert and Katie Employee **Date:** 5 May 2001

Reviewed by: Joe Expert **Date:** 1 June 2001

Approved by: Co-Chairs Health and Safety Committee **Date: 5 June 2001**

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Controls & Barriers)
1. Inspect before unloading	a) Hazardous working conditions.	a) Inspect and be familiar with the load weight, size and shape capacity of the hoisting equipment. Select proper equipment for the job. Install guards to prevent access to areas with moving overhead objects.
	b) Exposure to hazardous substances.	b) Check the TDG symbols on packages and follow safe work procedures as set out in the MSDS of the product. Identify, isolate and remove hazardous packages.
	c) Exposure to dangerous environment.	c) Make sure there is no danger of hazardous exposure. Use adequate personal protective equipment
2. Unload	a) Being hit by hoisted load.	a) Follow audio and visual signals.
	b) Being hit by or coming under shifting load.	b) Use guards, warning signs, to mark areas under load.

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Controls & Barriers)
3. Transport objects by lift truck	a) Being hit by rollover or tip over of equipment or vehicle.	a) Good housekeeping. Follow safe operating procedures.
	b) Exposure to hazardous substances.	b) Check the TDG symbols on packages and follow safe work procedures as set out in the MSDS of the product. Identify, isolate and remove hazardous packages.
	c) Exposure to dangerous environment.	c) Use adequate personal protection.
	d) Hit persons passing by close to the lift truck.	d) Ensure good visibility. Use warning sounds, lights and signs.
4. Store the objects	a) Coming in contact with moving parts such as conveyors.	a) Proper clothing and equipment.
	b) Overexertion.	b) Establish acceptable limits for manual materials handling. Use mechanical lifting aids.

Example 4 Machine maintenance

(Using the energy-barrier approach)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Machine Maintenance

Analysed by: Expert Company Ltd — **Date:** 5 May 2001

Reviewed by: Co-Chairs Health and Safety Committee — **Date:** 10 May 2001

Approved by: Co-Chairs Health and Safety Committee — **Date: 5 June 2001**

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Barriers)
1. Know proper maintenance procedures	a) Accidents, injuries, losses due to contact with high energy moving parts or stored energy.	– Follow procedures recommended by the manufacturer/your employer. – Use only recommended tools and replacement parts.
2. Turn off power to stop the machine	a) Objects flying off the slowing machine. b) Electrical spark. c) Malfunction of other equipment attached to the machine.	a) Locate and turn off power from a safe location. Use appropriate personal protective equipment. b) Use appropriate eye protection. Ground metal housing of the switch. c) Ensure that auxiliary equipment driven by the machine are isolated or set in a safe position.
3. De-energize the parts by releasing stored energy such as pressures, tensions, raised parts	a) Contact with parts set in motion inadvertently. b) Being crushed under equipment parts raised under hydraulic. c) Electric shock from charged condensers.	a) Secure all attachments and parts against inadvertent motion. b) Lower raised parts to zero energy position (floor) to prevent falling under gravity. Release the hydraulic pressure used to raise the part above ground. c) Discharge electrically charged components using a grounded metal rod.

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Barriers)
4. Isolate energy source to prevent accidental motion	a) Machine is set in motion unintentionally. b) Machine is set in motion by a co-worker.	a-b) Lock out energy sources such as electric switch, hydraulic pressure, steam valves, following your company's lockout procedures. Combination locks are not recommended for lockout. Interlocks are not a substitute for lockout.
5. Clean up debris, wastes, and toxic materials and purge any toxic gases, fumes or vapours	a) Trips and falls on slippery and cluttered floors. b) Contact with contaminated equipment. c) Cuts from sharp edges. d) Exposure to toxic substances.	a) Clean up debris and spills. b-c) Use gloves, aprons and other personal protective equipment. Follow recommended cleaning and maintenance procedures. d) Monitor work environment to ensure that it is safe to go ahead with the work.
6. Perform the maintenance work and reassemble the machine and equipment	a) Cuts, bruises, strains, sprains. b) Harmful exposures to chemicals, noise, etc.	a) Follow procedures recommended by manufacturer. b) Use only qualified persons to do the work.
7. Turn on the power source and perform a trial run	a) Mishaps due to: - incomplete maintenance work; - faults developed during maintenance work.	a) Follow testing procedures recommended by the manufacturer. Stay in a safe location. Keep the area clear of occupants.
8. Document the maintenance work	a) Maintenance oversight.	a) Note the date, the type of maintenance work done, and the name of the employee in charge of the work.

Note: Maintenance tasks could be fairly complex and require expertise, knowledge and skills to perform the job. Each maintenance job will therefore require a detailed JSA. The above example provides a guideline to highlight safety issues in machine maintenance.

Example 5 Working at heights on communication towers

(Using the energy-barrier approach)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Working at heights on communication towers

Analysed by: John Supervisor and Marie Worker **Date:** 5 May 2001

Reviewed by: Kate Expert **Date:** 1 June 2001

Approved by: Co-Chairs Health and Safety Committee **Date:** 5 June 2001

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures (Barriers)
1. Assess and prepare work site	a) Burns and electric shocks from induced electrical charge in equipment and materials by electromagnetic field (EMF) from the antenna.	a) De-energize the tower unless tests have been made which show that no significant electric charge is induced in the equipment and materials. Use grounded equipment materials while working near energized towers.
	b) Fire hazard from sparks caused by EMF.	b) Do not bring flammable and combustible materials near towers.
	c) Falling objects from a damaged tower.	c) Locate people and materials away from areas of falling objects.
	d) Extreme weather and wind conditions.	d) Snow, strong winds, and rain add additional hazards. Postpone non-emergency work during such weather.

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures
2. Climb up the tower	a) Potentially fatal falls from great heights. b) Exposure to cold/rain. c) Being hit by the repair equipment and material hoisted by the crane.	a) Use adequate fall protection and body positioning (belt and safety straps) system. b) Wear adequate clothing to protect from cold and rain. c) Stay away from materials being hoisted. Pay special attention when it is windy.
3. Climb down the tower	a) Being hit by falling objects left on the tower by mistake.	a) Ensure that all tools, equipment and materials are secured before coming down the tower.

Example 6 Improvisation of tasks

(Using the change analysis technique)

JOB SAFETY ANALYSIS WORKSHEET

JOB: Improvisation of tasks

Analysed by: Bill Foreman and Tom Worker — **Date:** 5 May 2001

Reviewed by: Joe Expert — **Date:** 1 June 2001

Approved by: John Supervisor and HS representative — **Date:** 5 June 2001

Sequence of Tasks	Potential Hazards (Possible changes)	Preventive Measures (Controls)
1. Make an assessment of the job, activities around the work area, and the work environment	a) Getting in the way of: - vehicles; - material flow; - energy flow; - moving equipment.	a) Find a safe location. Stay within safety zones. Wear high visibility vest.
	b) Presence of harmful substances.	b) Assess the level of potentially hazardous exposures.
	c) Inadequate clothing and personal protective equipment.	c) Use adequate clothing and personal protective equipment.
	d) Not qualified or authorized to do the job.	d) Seek information about required qualifications, permits, certification, or licensing requirements.
	e) Potentially hazardous to co-workers and visitors nearby.	e) Secure the area using barricades, warning signs, etc.

Sequence of Tasks	Potential Hazards (Energy type & contact)	Preventive Measures
2. Perform job safety analysis	a) Safety concerns for similar jobs.	a) Develop safe work practice. Use adequate protection e.g., fall protection, safety glasses.
	b) Potential harmful exposures to chemicals, noise, radiation etc.	b) Implement engineering controls. Wear personal protection.
	c) Lack of training, education, licensing.	c) Know potential hazards and safe work procedures. Do not perform tasks for which you are not qualified.
	d) What to do in case of emergency.	d) Have a plan to deal with emergencies.

Appendix A Sample form for Job Safety Analysis (JSA)

JOB SAFETY ANALYSIS WORKSHEET

JOB: _____

Analysed by: _____ Date: _____

Reviewed by: _____ Date: _____

Approved by: _____ Date: _____

Sequence of Tasks	Potential Hazards	Preventive Measures

Appendix B Step-by-step Instructions for Job Safety Analysis (JSA)

Step 1

Select a job for JSA.

Step 2

Break the job into ten basic tasks or less.

Step 3

Analyse each task by one of the following methods.

Method 1

A) Find the most important job parameter for each task.

B) Find potential hazards by asking questions that begin by "What if".

Guide words	Parameters
No or not	Colour, shape, height
More	Sound, odour, light, pressure
Less	Motion, sequence, pace
As well as	Power, energy, temperature
Part of	Protective devices
Reverse	Substance, component, ensemble
Other than	Location, environment, etc.

Method 2

A) Determine the type of energy involved in each task.

B) Determine the potential risk of contact between energy and employee.

Type of energy	Type of contact
Gravitational	Contact with objects or equipment
Kinetic	Falls
Thermal	Bodily reaction and exertion
Biological	Exposure to substances
Chemical	Transportation accidents
Hydraulic	Fires and explosions
Electrical	Assaults and violent acts
Radiation	
Animal	
Stored potential energy	
Noise	

Step 4

Determine preventive measure(s) using hazard control strategies or the energy-barrier approach.

Control strategy	Energy barrier
Eliminate the hazard	Limit energy
Substitute the hazard	Substitute safer energy form
Mitigate the risk:	Prevent build-up
- adopt safe work practices;	Prevent the release of energy
- comply with acts and regulations;	Provide slow release of energy
- develop organizational rules;	Channel the release of energy
- reduce exposure source.	Apply energy barrier on the source
Have an emergency plan	Barrier between source and target
Repair damages	Barrier on person or object
	Raise damage threshold
	Limit damage evolution
	Rehabilitate

Step 5

Communicate the information to every person concerned in a narrative-style format.

Appendix C Practical Tips for Performing Job Safety analysis (JSA) and its Implementation

INVOLVE employees in the development, implementation and review of JSA.

KEEP written JSA short and simple, preferably one page long.

ILLUSTRATE safe practices and the use of personal protective equipment with the help of pictures and drawings.

ASSIGN responsibility of JSA and its implementation to supervisors.

TRAIN all employees and supervisors on the benefits of implementing recommendations of JSA.

INCLUDE relevant JSA in the new and transferred employee orientation kit.

EXPLAIN the use of JSA to employees before they start their new or modified job.

IMPLEMENT safe work practices recommended in the JSA as a part of the overall health and safety program.

POST relevant JSA close to the workstation to provide easy access to workers.

MAINTAIN a binder of all JSAs and make it accessible to all employees at all times.

REVIEW JSA when equipment or process changes or new information becomes available regarding potential hazards associated with the job.

INCLUDE implementation of JSA as a measure of the job performance of employees at all levels.

ENCOURAGE the use of JSA in work place inspection and accident/incident investigation.