

Environmental Safety

E & B Oilfield Services Inc.

1798 W 3250 N.

Roosevelt, Utah, 84066

The designated safety coordinator(s) for ***E & B Oilfield Services Inc.*** is:

Danny Abegglen

Environmental Safety Policy Statement

Environmental Safety in our business must be part of every operation. Without question, it is every employee's responsibility at all levels.

It is the intent of this company to comply with all laws. To do this, we must constantly be aware of conditions in all work areas that can produce injuries. No employee is required to work at a job they know is not safe or healthful. Your cooperation in detecting hazards and, in turn, controlling them, is a condition of your employment. Inform your supervisor immediately of any situation beyond your ability or authority to correct.

The environmental safety of each employee and non-employee of this company is of primary importance. Prevention of occupationally-induced injuries and illnesses is of such consequence that it will be given precedence over operating productivity, whenever necessary. To the greatest degree possible, management will provide all mechanical and physical activities required for a safe environment, in keeping with the highest standards.

We will maintain an environmental safety program conforming to the best practices of organizations of this type. To be successful, such a program must embody proper attitudes towards injury and illness prevention on the part of supervisors and employees. It also requires cooperation in all environmental matters, not only between supervisor and employee, but also between each employee and their co-workers. Only through such a cooperative effort can an environmental safety program, in the best interest of all, be established and preserved.

Our objective is an environmental program that will reduce the number of injuries and illnesses to an absolute minimum, not merely in keeping with, but surpassing, the best experience of operations similar to ours. Our goal is zero accidents and injuries to workers and the environment.

Our environmental safety program includes:

- Providing mechanical and physical safeguards to the maximum extent possible.
- Conducting a program of environmental inspections to find and eliminate unsafe working conditions or practices, to control health hazards, and to fully comply with OSHA safety and health standards for every job.
- Training all employees in good environmental safety practices.
- Providing necessary personal protective equipment, and instructions for proper use and care.

- Developing and enforcing environmental rules, and requiring that employees cooperate with these rules as a condition of employment.
- Investigating, promptly and thoroughly, every accident to find out what caused it, and correct the problem so it will not happen again.

We recognize that the responsibilities for environmental safety are shared:

- This employer accepts responsibility for leadership of the environmental safety program, for its effectiveness and improvement, and for providing the safeguards required to ensure safe work conditions.
- Supervisors are responsible for developing proper attitudes toward environmental safety in themselves and in those they supervise, and for ensuring that all operations are performed with the utmost regard for the safety and health of all personnel involved, including themselves.
- Employees are responsible for wholehearted, genuine operations of all aspects of the environmental safety program – including compliance with the rules and regulations – and for continuously practicing safety and health while performing their duties.

E & B Oilfield Services Inc. shall see that all employees are properly instructed and supervised in the safe operation of any machinery, tools, equipment, process, or practice which they are authorized to use or apply while at work.

Note: An "Environmental Safety Policy Statement" form to be signed by your Company Owner and distributed to all employees is provided for your use at the end of this section. It is your COPY MASTER.

Program Goals

The primary goal of **E & B Oilfield Services Inc.** is to continue operating a profitable business while protecting employees and the environment. This can be achieved by delegating responsibility and accountability to all involved in this COMPANY's operation.

- **Responsibility:** Having to answer for activities and results.
- **Accountability:** The actions taken by management to insure the performance of responsibilities.

In other words, to reach our goal of a safe workplace everyone needs to take responsibility and be held accountable.

Benefits of achieving our goals are:

- Minimizing of injuries and accidents
- Minimizing the loss of property and equipment
- Elimination of potential fatalities
- Elimination of potential permanent disabilities
- Elimination of potential OSHA fines
- Reductions in Workers' Compensation costs
- Reductions in operating costs
- Having the best "Environmental Safety" conditions possible in the workplace

Management Commitment

This COMPANY is committed to building an effective **environmental safety** plan, putting it in **writing**, and **integrating** it into the entire operation.

The management of **E & B Oilfield Services Inc.** is committed to the company's safety policy, and to provide direction and motivation by:

- Appointing Safety Coordinator(s) and/or Safety Committee Chairmen.
- Establishing company safety goals and objectives.
- Developing and implementing this written Environmental Safety program.
- Ensuring total commitment to the Environmental Safety program.
- Facilitating employees' safety training.
- Establishing responsibilities for management and employees to follow.]

- Ensuring that management and employees are held accountable for performance of their safety responsibilities.
- Establishing and enforcing disciplinary procedures for employees.
- Reviewing the Environmental Safety program annually, and revising or updating as needed.

Labor & Management Accountability

All employees, both *labor* and *management*, need to understand their responsibilities under OSHA rules and be held accountable for complying with the rules as well as the company’s related policies.

Remember, it is the employer’s responsibility to provide a safe and healthful work environment for their employees. However, holding everyone accountable for their part in Environmental Safety is critical for a successful injury and illness prevention plan.

Assignment of Responsibility

The Safety Coordinator(s) and/or Safety Committee Members

E & B Oilfield Services Inc. has designated:

<i>Safety Coordinator</i> Danny Abegglen
<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Committee Chair</i>
<i>Safety Committee Vice-chairman</i>
<i>Safety Committee Alternate Chair/Vice-chair</i>

Their cell phone and office phone numbers are:

<i>Safety Person’s Name</i>	<i>Office Phone #</i>	<i>Cell Phone #</i>

It shall be the duty of the Safety Coordinator to assist the Supervisor/Foreman and all other levels of Management in the initiation, education, and execution of an effective safety program including the following:

- Introducing the safety program to new employees.
- Following up on recommendations, suggestions, etc., made at the “Weekly” safety meetings. All topics of safety concerns must be documented accordingly.
- Assisting the personnel in the execution of standard policies.
- Conducting safety inspections on a periodic basis.
- Addressing all hazards or potential hazards as needed.
- Preparing monthly accident reports and investigations.
- Maintaining adequate stock of first aid supplies and other safety equipment to insure their immediate availability.

- Making sure there is adequate number of qualified "First Aid Certified" people on the work site.
- Becoming thoroughly familiar with OSHA regulations and local and state safety codes.
- Defining the responsibilities for safety of all subordinates and holding each person accountable for their results through the formal appraisal system and where necessary, disciplinary procedures.
- Emphasizing to employees that accidents create unnecessary personal and financial losses.

Safety Committee and Safety Meetings

Recognize and support the safety committee as an excellent vehicle for facilitating communication and involvement between labor and management on occupational safety and health issues.

The Committee shall consist of representatives from management and non-management employees with the scheduled person as the chairman. The committee is a forum, created for the purpose of fostering safety and health through communication.

The responsibilities of Safety Committee Members include:

- Discussing safety policies and procedures with management and making recommendations for improvements.
- Reviewing accident investigation reports on all accidents and "near-misses".
- Identifying unsafe conditions and work practices and making recommendations for corrections.

NOTE: Refer to the succeeding section for instructions on Safety Committee protocols.

All employees of **E & B Oilfield Services Inc.** shall attend and participate in the "Weekly" safety meetings. The safety meeting shall be conducted by the designated Safety Coordinator/Supervisor/Foreman. Problems that have arisen, or that are anticipated, shall be discussed along with any other safety and health topics. The meeting shall be kept a valuable educational experience by:

- Starting and stopping according to schedule.
- Keeping the meetings moving.
- Using illustrated material and demonstrations to make the point.
- Discussing each topic thoroughly, providing handouts if possible.
- Evaluating accidents, injuries, property losses, and "near misses" for trends and similar causes to initiate corrective actions.

The designated Safety Coordinator/Supervisor/Foreman must document all aspects of any environmental safety training.

Employee Involvement

Employees are required to *work in compliance* with the safety rules, *report* all accidents and near misses, and report all *unsafe* conditions or *unsafe practices*. To demonstrate this employer's commitment to support the employees in these responsibilities, the employer will do the following:

Communication System:

- Encourage employees to inform the employer about workplace hazards without fear of reprisal.
- Establish and maintain a centrally located "Safety Bulletin Board" where current, relevant information may be easily reviewed by employees.
- Schedule general employee meetings at which time safety is freely and openly discussed by those present. These meetings will be regular, scheduled, and announced to all employees and managers to achieve maximum attendance. The purpose of these meetings is safety, and the concentration will be on:

- Occupational accident and injury history at our work sites, with possible comparison to other locations in the COMPANY.
- Feedback from the Safety Committee.
- Guest speakers concerned with environmental safety.
- When possible, brief audio-visual materials that relate to our business.
 - Conduct training programs for communicating with employees.
 - Provide a safety suggestion box so that employees, anonymously if desired, can communicate their concerns with management.
 - Document all communication efforts to demonstrate that an effective communication system is in place.

Hazard Identification& Control

Periodic inspections and procedures for correction provide methods of identifying existing or potential hazards in the workplace, and eliminating or controlling them. Hazard control is essential to an effective injury and illness plan. We will be sure to look at safe work practices and ensure that they are being followed, and that unsafe conditions or procedures are identified and corrected properly and promptly.

Employees are encouraged to report possible hazardous situations, knowing their reports will be given prompt and serious attention.

Workplace equipment and personal protective equipment will be maintained in good, safe working condition.

Hazards, where possible, will be corrected as soon as they are identified. For those that cannot be immediately corrected, a target date for correction will be set. The employer will provide interim protection for workers while hazards are being corrected. A written tracking system will be established to help monitor the progress of the hazard correction process.

Accident/Incident Investigation

Employers and safety committees are required to investigate or assign responsibility for investigating accidents. Accidents/incidents will be investigated by trained individuals, with the primary focus of understanding why the accident or incident occurred, and what actions can be taken to preclude recurrence. The focus will be on **solutions** and never on **blame**. They will be in writing, and adequately identify the causes of the accident or near-miss occurrence.

Worker Training

Training is another essential element of any injury and illness prevention plan. OSHA rules require each employer to train workers for any job or task they are assigned.

Our plan includes training and instruction:

- For all employees when they are first hired.
- For all new employees for each specific task.
- For all employees given new job assignments for which training has not already been received.
- Whenever new substances, processes, procedures, or equipment are introduced into the workplace and present a new hazard.
- Whenever new personal protective equipment or different work practices are used on existing hazards.
- Whenever the employer is made aware of a new or previously unrecognized hazard.
- For all supervisors to ensure they are familiar with the safety and health hazards to which employees under their immediate direction and control may be exposed.

Periodic Program Evaluation

A periodic review is scheduled to look at each critical component in our environmental safety plan to determine what is working well and what changes, if any, are needed. All employees are encouraged to participate by keeping the employer informed of their concerns regarding the elements of this environmental safety plan.

The success of this environmental safety plan is dependent upon two things: First, the employer must provide a **safe** environment in which the employee has the opportunity to work safe, and second, the employee must **choose** to *work safe*.

Supervisor/Foreman

The Supervisors and/or Foremen will establish an operating atmosphere that insures that environmental safety is managed in the same manner and with the same emphasis as production, cost, and quality control. This will be accomplished by:

- Regularly emphasizing that accident and health hazard exposure prevention are not only moral responsibilities, but also a condition of employment.
- Identifying operational oversights that could contribute to accidents which often result in injuries and property damage.
- Participating in environmental safety related activities, including routinely attending safety meetings, reviews of the facility, and correcting employee behavior that can result in accidents and injuries.
- Spending time with each person hired explaining the safety policies and the hazards of his/her particular work.
- Ensuring that initial orientation of "new hires" is properly carried out.
- Making sure that if a "Competent Person" is required, that one is present to oversee, and instruct employees when necessary.
- Never short-cutting safety for expediency, nor allowing workers to do so.
- Enforcing safety rules consistently, and following the Company's discipline and enforcement procedures.
- Conducting daily job-site inspections and correcting noted safety violations.

Employees

It is the duty of each and every employee to know the safety rules, and conduct his work in compliance with these rules. Disregard of the environmental safety rules shall be grounds for disciplinary action up to and including termination. It is also the duty of each employee to make full use of the safeguards provided for their protection. Every employee will receive an orientation when hired and receive a copy of any COMPANY Environmental Safety Programs. Employee responsibilities include the following:

- Reading, understanding and following environmental safety rules and procedures.
- Signing the Code of Safe Practices and any other policy acknowledgements.
- Wearing Personal Protective Equipment (PPE) at all times when working in areas where there is a possible danger of injury.
- Wearing suitable work clothes as determined by the supervisor/foreman.
- Performing all tasks safely as directed by their supervisor/foreman.
- Reporting **ALL** injuries, no matter how slight, to their supervisor/foreman immediately and seeking treatment promptly.
- Knowing the location of first aid, firefighting equipment, and safety devices.
- Attending any and all required environmental safety meetings.
- Not performing potentially hazardous tasks, or using any hazardous material until properly trained, and following all safety procedures for those tasks.
- STOPPING AND ASKING QUESTIONS IF EVER IN DOUBT ABOUT THE SAFETY OF ANY OPERATION.

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- Employees are responsible for wholehearted, genuine operations of all aspects of the environmental safety program – including compliance with the rules and regulations – and for continuously practicing safety and health while performing their duties.

E & B Oilfield Services Inc. shall see that workers are properly instructed and supervised in the safe operation of any machinery, tools, equipment, process, or practice which they are authorized to use or apply.

Owner Name

Signature

Date

Environmental Safety Committees

E & B Oilfield Services Inc. Safety Committee member(s):

Danny Abegglen

The Safety Committee member will meet with employees a minimum of **four** times per year.

Introduction

E & B Oilfield Services Inc. is committed to accident prevention in order to protect the safety and health of all our employees and non-employees. Injury and illness losses due to hazards are needless, costly and preventable. To prevent these losses, a joint management/worker safety committee will be established. Employee involvement in accident prevention and support of safety committee members and activities is necessary to ensure a safe and healthful environment for all employees and life forms.

Purpose

The purpose of our safety committee is to bring workers and management together in a non-adversarial, cooperative effort to promote environmental safety in the workplace. The safety committee will assist management and make recommendations for change.

Organization

There shall be, in most cases, an equal number of employee and employer representatives. However, there may be more employee representatives than employer representatives if both groups agree. Employee representatives shall be volunteers or elected by their peers. If no employees volunteer or are elected, they may be appointed by management. Employer representatives will be appointed. Safety committee members will serve a continuous term of at least one year. Committee membership terms will be staggered so that at least one experienced member is always on the committee.

Extent of Authority

It must be clearly understood that the safety committee advises management on issues that will promote environmental safety in the workplace. Written recommendations are expected from the safety committee and they will be submitted to management. In turn, management will give serious consideration to the recommendations submitted and will respond in writing to the committee within a reasonable time.

Functions

- Committee meetings and employee involvement.
- Hazard assessment and control.
- Environmental safety planning.
- Evaluation of accountability system.
- Evaluation of management commitment to environmental safety.
- Evaluation of accident and incident investigation program.

Recommendations

All recommendations submitted to management must be written and should:

- Be clear and concise.
- Provide reasons for implementation.
- Give recommended options.
- Show implementation costs and recommended completion dates.
- List benefits to be gained.

Procedures

The committee’s plan of action requires procedures by which the committee may successfully fulfill its role. Procedures developed should include but not be limited to:

- Meeting date, time, and location (Safety Committee Meeting Agenda)
- Election of chairperson and secretary
- Order of business
- Records (Safety Committee Meeting Minutes)

Duties of each member must include, but not be limited to:

- Reporting unsafe conditions and practices
- Attending all environmental safety meetings
- Reviewing all accidents and near-misses
- Recommending ideas for improving safety and health
- Working in a safe and healthful manner
- Observing how environmental safety is enforced in the workplace
- Completing assignments given to them by the chairperson
- Acting as a work area representative in matters of environmental safety
- Others as determined by COMPANY environmental safety needs

The Safety Coordinator(s) and/or Safety Committee Members

E & B Oilfield Services Inc. has designated:

<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Committee Chair</i>
<i>Safety Committee Vice-chairman</i>
<i>Safety Committee Alternate Chair/Vice-chair</i>

Their cell phone and office phone numbers are:

<i>Safety Person's Name</i>	<i>Office Phone #</i>	<i>Cell Phone #</i>

It shall be the duty of the Safety Coordinator to assist the Supervisor/Foreman and all other levels of Management in the initiation, education, and execution of an effective safety program.

Note: A “Safety Committee Policy Statement” form to be signed by your Company Owner and distributed to all employees is provided for your use at the end of this section. It is your COPY MASTER.

Safety Committee Operations

The purpose of a safety committee is to bring workers and managers together to achieve and maintain a safe, healthful environment. It is easy to start a safety committee, but developing an effective one – one that achieves and maintains a safe, healthful environment – requires workers and managers who are committed to achieving that goal. Effective safety committees find solutions to problems that cause environmental accidents, illnesses, and injuries.

Understand a Safety Committee's Seven Essential Activities

Anyone can start a safety committee, but, to make it effective, the committee must be built on a foundation of **management commitment** and must be **accountable** for achieving its goals. The committee must do the following:

- Involve employees in achieving the committee's goals
- Identify environmental safety hazards
- Review reports of accidents and near misses
- Keep accurate records of committee activities
- Evaluate its strengths and weaknesses

1) Commitment

The committee will not survive without management support. Management demonstrates support by encouraging employees to get involved in achieving a safe, healthful environment and by acting on the committee's recommendations.

Representatives demonstrate commitment by attending committee meetings, following through on their assigned tasks, and encouraging other employees to get involved in identifying hazards.

2) Accountability

Representatives should understand that the committee expects them to contribute; each representative shares responsibility for accomplishing safety committee goals, which benefit everyone who works for the COMPANY.

3) Employee Involvement

To become effective, a safety committee needs help from everyone in The COMPANY. The safety committee must have a method for employees to report hazards and to offer safety suggestions.

- Encourage employees to report hazards and unsafe work practices to a safety-committee representative.
- Act on employee suggestions and recognize their contributions to a safer environment.
- Promote the committee's activities and accomplishments.
- Make sure employees know that you are starting a safety committee. Tell them why you are starting the committee, describe its role in the COMPANY's environmental safety program, and explain management's commitment to the committee.

You can inform employees in a memo or a newsletter, by e-mail, or – better yet – meet with them to promote the committee and to answer questions.

4) Hazard Identification

The safety committee plays an important role in keeping the environment safe:

- Ensure that representatives know how to recognize hazards and understand basic principles for controlling them.
- Focus on identifying hazards and unsafe work practices that are likely to cause serious injuries.
- Conduct thorough environmental safety inspections at least quarterly.

- Document hazards during quarterly inspections and discuss how to control them at regular safety-committee meetings.
- Include employer and employee representatives on the inspection team.
- Accident Investigation

The committee must have a procedure for investigating all workplace accidents, illness, and deaths. It is not necessary for the committee to conduct accident investigations or to participate in investigations; however, the committee should ensure that management does so. The committee should also carefully review accident reports to help management identify accident causes and determine how to control them.

You may not think of record keeping as an essential activity, but accurate, well-organized records document the committee’s accomplishments and can inform the committee what it needs to do to improve. The following documents are required for the safety committee’s file:

5) Recordkeeping

You may not think of record keeping as an essential activity, but accurate, well-organized records document the committee’s accomplishments and can inform the committee what it needs to do to improve. The following documents are required for the safety committee’s file:

- Accurate minutes of each safety committee meeting
- Committee reports, evaluations, and recommendations
- Management’s response to committee recommendations
- Employee safety suggestions and hazard concerns
- Evaluation

Evaluation answers the question “Are we effective?” Effective safety committees periodically evaluate their strengths and weaknesses, and the evaluation helps them set new goals.

At least once a year, schedule a half-day safety-committee meeting to accomplish the following: identify the committee’s achievements over the past 12 months, review essential activities, and set goals for the next 12 months.

Start With Your Primary Place of Employment

If you are starting a safety committee, you should do so at your company’s primary place of employment - the workplace where management controls the budget and can act on the safety committee’s recommendations.

Do you have mobile or satellite sites?

If you have workplaces that aren’t primary places of employment – construction sites or field offices, for example – you can have one central safety committee at your primary place of employment that represents all of the other workplaces.

Determine How Many Representatives will serve on the Committee

The minimum number of representatives on your safety committee needs to be effective depends on the number of employees in your company, for example:

<i>Number of Employees</i>	<i>Number of Representatives</i>
Up to 20	At least 2
More than 20	At least 4

Your safety committee can have more than the minimum number of representatives.

Determine Who Will Serve on the Committee

Your safety committee should have an equal number of employee and employer representatives and must have a chairperson elected by the representatives.

Other matters to consider about whom will serve on the committee:

- Employee representatives can volunteer to serve on the committee or their peers can elect them. If your collective bargaining agreement has procedures for selecting representatives, follow those procedures.
- Employer representatives represent the employer. You can have more employee representatives on the committee than employer representatives if no one objects – but not a majority of employer representatives. You can choose any employee to serve as an employer representative.
- Representatives' jobs should reflect the company's major job classifications.
- Representatives must be paid their regular wages for safety committee meetings and safety-related training sessions.
- Each representative must serve at least one year on the committee.

How to Determine Who Does What on the Committee

Your safety committee must have a chairperson and a recorder – someone to take minutes at each meeting. The committee does not have to have a vice-chair; however, someone should be available to prepare an agenda and conduct committee business in the chair's absence. The following table summarizes the duties of the chairperson, vice-chair, recorder, and other committee representatives.

Representatives' Duties and Responsibilities

Chairperson

- Schedules monthly meetings
- Develops agendas for meetings
- Conducts monthly meetings

Vice-chair

- Assumes chair's duties when the chair is absent
- Coordinates training for new representatives
- Performs other duties assigned by the chair

Recorder

- Takes minutes at each meeting
- Distributes copies of minutes to representatives
- Posts minutes for other employees to review
- Maintains the safety-committee file
- Keeps minutes and agendas on file for three years

Other Committee Representatives

- Report employees' environmental concerns to the committee
- Report accidents, near miss incidents, and unsafe workplace conditions to the committee
- Suggest items to include in the monthly meeting agenda
- Encourage other employees to report environmental safety hazards and suggest how to control them
- Establish procedures for conducting quarterly workplace inspections and for making recommendations to management to eliminate or control hazards
- Help management evaluate the company's environmental safety program and recommends how to improve it
- Establish procedures for investigating the causes of accidents and near-miss incidents

Set Practical Goals for the Committee

Purpose and goals: put them in writing

The purpose of your safety committee is to bring workers and managers together to achieve and maintain a safe, healthful environment. But you will need to narrow the focus, set goals, and specify what the committee will do.

Train the Representatives

What representatives need to know:

Representatives must understand the purpose of the safety committee, how to apply OSHA's safety rules, and how to conduct safety-committee meetings. They must also have training in hazard identification and the principles of accident investigation.

Representatives should know whom to contact for information or for help on workplace safety-and-health matters.

Who can do the training? You can do the training if you are confident you can accomplish the objectives, or you can choose someone who has training experience and understands the objectives.

Hold Regular Meetings

Require Participation

Each representative must help the committee accomplish its goals. Make sure representatives understand that they will be committing to attending monthly meetings and to participating in committee activities.

Set a Repeating Meeting Schedule

Your committee should meet at least once a month. Setting a regular time, date, and place for meetings - for example, 10 a.m.-noon, the first Tuesday of each month - makes it easier for everyone to remember.

Establish Ground Rules

Ground rules keep meetings orderly and efficient. All representatives should understand them and the chairperson should enforce them. Important ground rules:

- Keep the discussion focused on agenda topics.
- Listen to others and let them finish before responding.
- Cooperate to achieve effective solutions.
- Finish the meeting on time.

Follow a Written Agenda

The agenda outlines the meeting's discussion topics. The chairperson should understand the agenda topics and keep the discussion focused on them. Send copies of the agenda to representatives a few days before the meeting so they can review it.

Take Accurate Minutes

Accurate meeting minutes are important because they document the committee's accomplishments. The representative who has this responsibility should be able to grasp the main points of a discussion and record them quickly.

Meeting minutes should include the following:

- A brief summary of the discussion of each topic
- A copy of committee reports, evaluations, and recommendations
- A copy of management's response to committee recommendations

Remember to send a copy of the minutes to each representative promptly after the meeting and to post a copy where other employees can see it. If your company has field offices, send a copy to each field office. Keep a copy of each meeting's minutes on file for three years.

Conducting the Meeting

Effective meetings start on time. Make sure the meeting room is ready; allow extra time if you need to set up tables, rearrange chairs, or clean up after others have met. Before getting down to business, start the meeting on the right track by doing the following:

- Distribute the agenda. Make sure everyone has a copy of the agenda and any other handouts.
- Review the ground rules. You may not need to review the ground rules at every meeting, but consider doing so for the benefit of guests and new representatives.

- Make introductions. No one likes to feel left out at a meeting. Welcome new representatives and guests.
- Review the minutes from the last meeting. Request additions or corrections to last month's minutes. Update the minutes to reflect the changes.
- Review the agenda topics. Give representatives and guests the opportunity to suggest changes or to add discussion topics to the agenda.

Unless the representatives agree to continue the meeting, end it at the scheduled time. You can discuss unfinished items during the next meeting or later with concerned representatives. Before you finish, thank guests for coming and schedule the next meeting.

How to Do It

How to accomplish four important activities that helps you take care of safety committee business.

- How to Write Bylaws
- How to Prepare an Agenda
- How to Record Minutes
- How to Identify Workplace Hazards

How to Write Bylaws

What To Include In You Safety Committee Bylaws	
Function	Information to Include
Name, Purpose, Goal, Objectives	State committee's purpose, its goals, and its objectives. Make them clear and keep them brief.
Membership	State how many representatives will serve on the committee. Describe how the representatives are selected to serve on the committee. State how long representatives will serve on the committee.
Officers and Representatives: Duties and Responsibilities	Describe duties and responsibilities of each: -The chair -The recorder -The vice-chair -The other representatives
Training	State what the representatives need to know to fulfill their responsibilities and describe how they will receive their training.
Meetings	Define the following: -The schedule for regular committee meetings. -Who must attend the meetings. -The requirements for preparing and distributing the agenda and the minutes. -The procedures for voting on committee decisions.
Employee Involvement	State how the committee will involve employees in achieving a safe, healthful workplace. -Describe how employees should report hazards and unsafe practices to the committee. -Describe how employees can submit ideas for controlling or eliminating hazards.
Accident Investigation	State the committee's role in investigating near-misses and accidents. -Describe how representatives will review accidents and near-miss incidents. -Describe how the committee will report recommendations for controlling hazards.
Workplace Inspections	State how the committee will conduct regular workplace inspections. -Include the schedule for quarterly workplace inspections. -Identify who will conduct the inspections. -Describe how the committee will report hazard-control recommendations to management.
Evaluation	State how the committee will evaluate the safety-and-health program and assess its activities.

Safety Committee Bylaws: An Example

Although your safety committee does not have to have Bylaws, they can give the committee stability by stating, in writing, how the committee conducts its business. Bylaws can be as simple or complex as you want to make them.

Name

The name of the committee is the XYZ Safety Committee.

Purpose

The purpose of the XYZ Safety Committee is to bring all XYZ Construction Company employees together to achieve and maintain a safe, healthful workplace.

Goal

The goal of the XYZ Safety Committee is to eliminate workplace injuries and illnesses by involving employees and managers in identifying hazards and suggesting how to prevent them.

Objectives

The XYZ Safety Committee has four objectives:

- Involve employees in achieving a safe, healthful workplace.
- Promptly review all safety-related incidents, injuries, accidents, illnesses, and deaths.
- Conduct quarterly workplace inspections, identify hazards, and recommend methods for eliminating or controlling the hazards.
- Annually evaluate the XYZ Construction Company's workplace safety-and-health program and recommend to management how to improve the program.

Representatives

The XYZ Safety Committee will have ten voting representatives. Five of the representatives will represent employees and five will represent management. Employee representatives can volunteer or their peers can elect them. Management representatives will be selected by management.

Each representative will serve a continuous term of at least one year. Terms will be staggered so that at least one experienced representative always serves on the committee.

Chair and Vice-chair

The XYZ Safety Committee will have two officers: chair and vice-chair. One officer will represent labor and one officer will represent management.

Terms of Service

Chair and vice-chair will each serve a one-year term.

Duties of the Chair

The duties of the chair:

- Schedule regular committee meetings.
- Approve committee correspondence and reports.
- Develop written agenda for conducting meeting.
- Supervise the preparation of meeting minutes.
- Conduct the committee meeting.

Duties of the Vice-chair

The duties of the vice-chair:

- In the absence of the chair, assume the duties of the chair.
- Perform other duties as directed by the chair.

Election of Chair and Vice-chair

The election of a new chair or vice-chair will be held during the monthly committee meeting before the month in which the incumbent's term expires.

If the chair or vice-chair leaves office before the term expires, an election will be held during the next scheduled safety-committee meeting; the elected officer will serve for the remainder of the term.

Training

New representatives will receive training in safety-committee functions, hazard identification, and accident-investigation procedures.

Meetings

Monthly schedule — The XYZ Safety Committee will meet the third Tuesday of each month, except when the committee conducts quarterly workplace safety inspections.

Example Page 1

Attendance and Alternates

Each representative will attend regularly scheduled safety committee meetings and participate in quarterly workplace inspections and other committee activities. Any representative unable to attend a meeting will appoint an alternate and inform the chair before the meeting. An alternate attending a meeting on behalf of a regular representative will be a voting representative for that meeting.

Agenda

The agenda will prescribe the order in which the XYZ Safety Committee conducts its business.

The agenda will also include the following when applicable:

- A review of new safety and health concerns
- A status report of employee safety and health concerns under review
- A review of all workplace near misses, accidents, illness, or deaths occurring since the last committee meeting.

Minutes

Minutes will be recorded at each committee meeting and distributed via e-mail to all XYZ Construction Company employees.

The committee will submit a copy of the minutes to the XYZ Construction Company personnel office; the office will retain the copy for three years. All reports, evaluations, and recommendations of the committee will be included in the minutes. The minutes will also identify representatives who attended monthly meeting, and representatives who were absent.

Voting Quorum

Six voting representatives constitute a quorum. A majority vote of attending representatives is required to approve all safety-committee decisions. Issues not resolved by majority vote will be forwarded to management for resolution.

Employee Involvement

The XYZ Safety Committee will encourage employees to identify workplace-health-and-safety hazards. Concerns raised by employees will be presented to the committee in writing; the committee will review new concerns at the next regularly-scheduled monthly meeting.

Safety Log

The committee will maintain a log of all employee concerns, including the date received, recommendations to management, and the date the concern was resolved.

Response

The committee will respond to employee concerns in writing and work with management to resolve them. The committee will present written recommendations for resolving concerns to management. Within 60 days of receipt of the written recommendations, management will respond in writing to the committee indicating acceptance, rejection, or modification of the recommendations.

Incident and Accident Investigation

The XYZ Safety Committee will review new safety- or health-related incidents at its next regularly-scheduled meeting. Safety-related incidents include work-related near misses, injuries, illnesses, and deaths. When necessary, the committee will provide written recommendations to management for eliminating or controlling hazards.

Workplace Inspections

The XYZ Safety Committee will conduct quarterly workplace inspections of all company facilities in March, June, September, and December.

Written Report

The committee will prepare a written report for management that documents the location of all health or safety hazards found during inspection. The report will recommend options for eliminating or controlling the hazards.

Within 60 days of receipt of the written report, management will respond in writing to the committee, indicating acceptance, rejection, or proposed modification of the recommendations.

Evaluation

The XYZ Safety Committee will evaluate the company's workplace-safety-and-health program annually and provide a written evaluation of the program to management. The committee will also evaluate its own activities each December and use the evaluation to develop an action plan for the next calendar year.

Example Page 2

Safety Committee Bylaws

E & B Oilfield Services Inc.

Name

The name of the committee is the _____ Safety Committee.

Purpose

The purpose of the _____ Safety Committee is to bring all _____ employees together to achieve and maintain a safe, healthful workplace.

Goal

The goal of the _____ Safety Committee is to eliminate workplace injuries and illnesses by involving employees and managers in identifying hazards and suggesting how to prevent them.

Objectives

The Safety Committee has four objectives:

- 1) Involve employees in achieving a safe, healthful workplace.
- 2) Promptly review all safety-related incidents, injuries, accidents, illnesses, and deaths.
- 3) Conduct quarterly workplace inspections, identify hazards, and recommend methods for eliminating or controlling the hazards.
- 4) Annually evaluate the _____ workplace safety-and-health program and recommend to management how to improve the program.

Representatives

The _____ Safety Committee will have _____ voting representatives. _____ of the representatives will represent employees and _____ will represent management. Employee representatives can volunteer or their peers can elect them. Management representatives will be selected by management.

Each representative will serve a continuous term of at least one year. Terms will be staggered so that at least one experienced representative always serves on the committee.

Chair and Vice-chair

The _____ Safety Committee will have two officers: chair and vice-chair. One officer will represent labor and one officer will represent management.

Terms of Service

Chair and vice-chair will each serve a one-year term.

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- Schedule regular committee meetings.
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- Conduct the committee meeting.

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The duties of the vice-chair:

- In the absence of the chair, assume the duties of the chair.
- Perform other duties as directed by the chair.

Election of Chair and Vice-chair

The election of a new chair or vice-chair will be held during the monthly committee meeting before the month in which the incumbent's term expires.

If the chair or vice-chair leaves office before the term expires, an election will be held during the next scheduled safety-committee meeting; the elected officer will serve for the remainder of the term.

Training

New representatives will receive training in safety-committee functions, hazard identification, and accident-investigation procedures.

Meetings

Monthly schedule — The _____ Safety Committee will meet the _____ of each month, except when the committee conducts quarterly workplace safety inspections.

Attendance and Alternates

Each representative will attend regularly scheduled safety committee meetings and participate in quarterly workplace inspections and other committee activities. Any representative unable to attend a meeting will appoint an alternate and inform the chair before the meeting. An alternate attending a meeting on behalf of a regular representative will be a voting representative for that meeting.

Agenda

The agenda will prescribe the order in which the _____ Safety Committee conducts its business. The agenda will also include the following when applicable:

- A review of new safety and health concerns
- A status report of employee safety and health concerns under review
- A review of all workplace near misses, accidents, illness, or deaths occurring since the last committee meeting.

Minutes

Minutes will be recorded at each committee meeting and posted & distributed to all employees.

The committee will submit a copy of the minutes to the _____ personnel office; the office will retain the copy for three years. All reports, evaluations, and recommendations of the committee will be included in the minutes. The minutes will also identify representatives who attended monthly meeting, and representatives who were absent.

Voting Quorum

_____ voting representatives constitute a quorum. A majority vote of attending representatives is required to approve all safety-committee decisions. Issues not resolved by majority vote will be forwarded to management for resolution.

Employee Involvement

The _____ Safety Committee will encourage employees to identify workplace-health-and-safety hazards. Concerns raised by employees will be presented to the committee in writing; the committee will review new concerns at the next regularly-scheduled monthly meeting.

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Within 60 days of receipt of the written report, management will respond in writing to the committee, indicating acceptance, rejection, or proposed modification of the recommendations.

Evaluation

The _____ Safety Committee will evaluate the company's workplace-safety-and-health program annually and provide a written evaluation of the program to management. The committee will also evaluate its own activities each December and use the evaluation to develop an action plan for the next calendar year.

How to Prepare an Agenda

The Purpose of the Agenda

The agenda, usually prepared by the safety-committee chairperson, is an outline of topics the representatives will discuss during a monthly meeting. The agenda helps structure the meeting and reminds representatives of their responsibilities – for example, special reports or other assigned tasks.

Preparing the Agenda

Most meetings should follow an agenda that includes the following topics:

- Introductions of new representatives and guests.
- Review of last meeting's minutes for addition or corrections.
- Old business – discussion of items not covered or resolved during the last meeting.
- New business – discussion of new items the committee needs to address or resolve.
- Employee suggestions – review and discussion of suggestions.
- Recommendations to management – review and discussion of recommendations to eliminate or control a hazard or to improve the company's environmental safety program.
- Next meeting – date, location, and time in preparing the agenda, ask committee representatives if they have items to include under new business, employee suggestions, or recommendations to management. Keep the agenda as brief as possible.

Note: An "Agenda" form is provided for your use at the end of this section. It is your COPY MASTER

Distributing the Agenda

Give committee representatives and other employees a chance to review the agenda.

Three to five days before the meeting:

- Send copies of the agenda to committee representatives and management.
- Post the agenda where other employees can read it.

Using the Agenda

After representatives, management, and other employees have had a chance to comment on the agenda, prepare the final version and make enough copies for everyone attending.

Use the agenda to guide the meeting. If you cannot cover every topic during the meeting, schedule them for the next meeting under old business.

How to Take Minutes

Why Minutes are Important

Minutes are the official record of the safety committee's activities, including recommendations to management and accomplishments. The content should be concise, clear, and well-organized.

Note: A "Minutes" form is provided for your use at the end of this section. It is your COPY MASTER.

Who is Responsible for Minutes

Your committee should have a recorder who takes minutes at each meeting and, after the meeting, does the following:

- Distributes the minutes to representatives and management.
- Posts the minutes where other employees can read them.
- Keeps a copy of the minutes on file for three years.
- Ensures that all employees have the opportunity to respond to the minutes.

What to Include in the Minutes

Organize the minutes so that they follow the meeting agenda. Information to include in the minutes:

- Date, time, and place of the meeting.
- Names of attending representatives, guests, and representatives unable to attend.
- A summary of each agenda item discussed.
- Employee suggestions and reports of hazards.
- The committee's recommendations to management.
- Management's response to committee recommendations.

After the meeting, review and edit the minutes. Type a clean copy and post it where employees are likely to see it, or distribute it to all employees.

- Send a copy of the minutes to employees at mobile worksites or field offices.
- Keep the minutes for at least three years. You can file them in a notebook or a computer.

How to Identify Workplace Hazards

What to Do and How to Do It

Effective safety committees prove their worth by helping management keep workplace hazards under control. But you cannot control hazards until you identify them.

- Get training on how to identify workplace hazards.
- Conduct quarterly workplace inspections.
- Discuss the hazards at monthly safety-committee meetings, document them in the minutes, and report them to management.

Getting Trained

Work with a mentor. An environmental safety specialist from your insurance carrier, for example, will attend a safety committee meeting, answer questions, and help representatives learn how to identify hazards.

Know the rules. Know what environmental safety rules apply to your workplace. The rules can inform you about hazards and help you determine how to control them.

Conducting Quarterly Workplace Inspections

Successful inspections involve walking, talking, listening, and writing:

- Walk around the workplace. Look for hazards and unsafe work practices that are likely to cause serious injuries. Focus on hazards rather than rule violations.
- Talk to employees. Ask them about hazards and unsafe conditions; be concerned and listen carefully.
- Take notes. What is the hazard? Where is the hazard? How could the hazard cause an accident and what could be the result? Who could be affected by the hazard?
- Report your findings. Organize your notes and summarize the important information in a report to the safety committee.

Getting Other Employees Involved

Concerned employees help the committee learn about workplace hazards and unsafe practices. Encourage them to report hazards and suggest how to control them.

Discussing Hazards at Safety Committee Meetings

The safety committee receives information about workplace hazards from quarterly inspections, from concerned employees, and from management. But the committee also needs to discuss how that information will lead to a safer, healthier environment and the discussion should take place during a safety-committee meeting.

Reporting Hazards to Management

By reporting a hazard to management and recommending how to control or eliminate it, the committee acknowledges the hazard threatens a worker's safety.

A Safety Committee Evaluation Checklist

After you get your safety committee started, use this checklist to determine if it is necessary to do any fine-tuning to make it more effective.

<i>Done</i>	<i>To Do</i>	
<input type="checkbox"/>	<input type="checkbox"/>	Our safety committee is composed of an equal number of employer and employee representatives.
<input type="checkbox"/>	<input type="checkbox"/>	Employee representatives are volunteers or are elected by their peers.
<input type="checkbox"/>	<input type="checkbox"/>	There are at least four representatives on the committee if the workplace has more than 20 employees – at least two representatives if the workplace has 20 or fewer employees.
<input type="checkbox"/>	<input type="checkbox"/>	The representatives elect the committee chairperson.
<input type="checkbox"/>	<input type="checkbox"/>	Representatives are paid their regular wages during safety committee training and meetings.
<input type="checkbox"/>	<input type="checkbox"/>	Employee representatives serve on the committee for at least one year.
<input type="checkbox"/>	<input type="checkbox"/>	Representatives' terms of service are staggered so that at least one experienced representative is always on the committee.
<input type="checkbox"/>	<input type="checkbox"/>	Reasonable efforts are made to ensure that committee representatives represent the firm's major work activities.
<input type="checkbox"/>	<input type="checkbox"/>	The committee meets monthly except when representatives schedule quarterly workplace inspections.
<input type="checkbox"/>	<input type="checkbox"/>	Committee meetings follow a written agenda.
<input type="checkbox"/>	<input type="checkbox"/>	The minutes for each meeting are maintained for at least three years.
<input type="checkbox"/>	<input type="checkbox"/>	Minutes are available to all employees to read.
<input type="checkbox"/>	<input type="checkbox"/>	All reports, evaluations, and recommendations are included in the minutes.
<input type="checkbox"/>	<input type="checkbox"/>	Management has a reasonable time to respond, in writing, to the committee's recommendations.
<input type="checkbox"/>	<input type="checkbox"/>	The committee has a method for collecting and reviewing employees' safety-related suggestions and reports of hazards.
<input type="checkbox"/>	<input type="checkbox"/>	The committee assists management in evaluating and improving the workplace safety and health program.
<input type="checkbox"/>	<input type="checkbox"/>	The inspection team conducts workplace inspections at least quarterly.
<input type="checkbox"/>	<input type="checkbox"/>	The committee's quarterly inspection team follows a standard procedure for identifying safety-and-health hazards during its inspections.
<input type="checkbox"/>	<input type="checkbox"/>	The inspection team includes employer and employee representatives.
<input type="checkbox"/>	<input type="checkbox"/>	The inspection team documents, in writing, the location and identity of workplace hazards.
<input type="checkbox"/>	<input type="checkbox"/>	The inspection team – or other persons designated by the committee – does quarterly inspections of satellite locations.
<input type="checkbox"/>	<input type="checkbox"/>	The committee has a procedure for reviewing the team's quarterly inspection reports.
<input type="checkbox"/>	<input type="checkbox"/>	The committee recommends to management ways to control hazards and unsafe work practices.

- The committee makes recommendations to ensure all employees are accountable for following safe work practices.
- The committee has a procedure for investigating workplace accidents, illnesses, and deaths.
- Representatives understand the purpose of their safety committee and know how it functions.
- Representatives have access to applicable OSHA safety and health rules.
- Representatives have received safety training for identifying workplace hazards and investigating accidents.

Safety Committee Meeting Agenda

Date: _____

To: All committee members, alternates, bulletin board

Meeting Date and Time: _____

Place: _____

Agenda Items	Person Responsible
1. Old business	
a. Review last month's recommendations	_____
b. Follow-up on last quarterly inspection	_____
2. New business	
a. Hazard reports	All
b. Accident investigation reviews	_____
c. Recommendations review	_____
d. _____	_____
e. _____	_____
f. _____	_____
3. Safety Committee Members Training	
a. _____	_____
b. _____	_____

Notes:

Chair Person's Signature

Date

Safety Committee Meeting Minutes Page 1

Chairperson: _____ Date: _____

Department: _____ Time meeting started: _____

PRESENT

ABSENT

Previous meeting minutes from _____ were read.
Date

Old Business

- Review of last months recommendations

Recommendation Number	Description	Completed	Not Completed	Date
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
R- _____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____

- Follow-up on last quarterly inspection:

New Business

- Hazard (inspection) reports reviewed: _____

Hazard Number	Description	Recommendation Number
H- _____	_____	R- _____
H- _____	_____	R- _____
H- _____	_____	R- _____
H- _____	_____	R- _____
H- _____	_____	R- _____
H- _____	_____	R- _____

Safety Committee Meeting Minutes

- Accident/incident investigation reviews:

Accident Number	Near Miss	Description	Recommendation Number
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____
A- _____	<input type="checkbox"/>	_____	R- _____

Safety Committee Members Training Report: _____

Miscellaneous New Business: _____

Activity/Assignment Report:

Description	Person Assigned
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Committee Remarks: _____

Meeting adjourned: _____ Time/date Next meeting: _____ Time/date

Chair Person Signature

Secretary Signature

Safety Committee Policy Statement

Introduction

E & B Oilfield Services Inc. is committed to accident prevention in order to protect the safety and health of all our employees and non-employees. Injury and illness losses due to hazards are needless, costly and preventable. To prevent these losses, a joint management/worker safety committee will be established. Employee involvement in accident prevention and support of safety committee members and activities is necessary to ensure a safe and healthful environment for all employees.

Purpose

The purpose of our safety committee is to bring workers and management together in a non-adversarial, cooperative effort to promote environmental safety in the workplace. The safety committee will assist management and make recommendations for change.

Organization

There shall be, in most cases, an equal number of employee and employer representatives. However, there may be more employee representatives than employer representatives if both groups agree. Employee representatives shall be volunteers or elected by their peers. If no employees volunteer or are elected, they may be appointed by management. Employer representatives will be appointed. Safety committee members will serve a continuous term of at least one year. Committee membership terms will be staggered so that at least one experienced member is always on the committee.

Extent of Authority

It must be clearly understood that the safety committee advises management on issues that will promote environmental safety in the workplace. Written recommendations are expected from the safety committee and they will be submitted to management. In turn, management will give serious consideration to the recommendations submitted and will respond in writing to the committee within a reasonable time.

Functions

- Committee meetings and employee involvement.
- Hazard assessment and control.
- Environmental safety planning.
- Evaluation of accountability system.
- Evaluation of management commitment to workplace safety and health.
- Evaluation of accident and incident investigation program.
- Environmental safety training.

Recommendations

All recommendations submitted to management must be written and should:

- Be clear and concise.
- Provide reasons for implementation.
- Give recommended options.
- Show implementation costs and recommended completion dates.
- List benefits to be gained.

Procedures

The committee's plan of action requires procedures by which the committee may successfully fulfill its role. Procedures developed should include but not be limited to:

- Meeting date, time, and location (Safety Committee Meeting Agenda)
- Election of chairperson and secretary
- Order of business
- Records (Safety Committee Meeting Minutes)

Duties of each member must include, but not be limited to:

- Reporting unsafe conditions and practices
- Attending all environmental safety meetings
- Reviewing all accidents and near-misses
- Recommending ideas for improving environmental safety
- Working in a safe and healthful manner
- Observing how environmental safety is enforced in the workplace
- Completing assignments given to them by the chairperson
- Acting as a work area representative in matters of environmental safety
- Others as determined by company environmental safety needs

The Safety Coordinator(s) and/or Safety Committee Members

E & B Oilfield Services Inc. has designated:

<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Coordinator</i>
<i>Safety Committee Chair</i>
<i>Safety Committee Vice-chairman</i>
<i>Safety Committee Alternate Chair/Vice-chair</i>

Their cell phone and office phone numbers are:

<i>Safety Person's Name</i>	<i>Office Phone #</i>	<i>Cell Phone #</i>

It shall be the duty of the Safety Coordinator to assist the Supervisor/Foreman and all other levels of Management in the initiation, education, and execution of an effective safety program.

Owner Name

Signature

Date

ENVIRONMENTAL CONTROLS

Open each meeting asking these questions and allowing employees to respond. Pick a topic at the meeting to discuss and expand this discussion into the safe environmental needs for daily operations.

- Are all work areas properly lighted?
- Are hazardous substances identified that may cause harm by inhalation, ingestion, skin absorption, or contact?
- Are employees aware of the hazards involved with the various chemicals they may be exposed to in their work environment, such as ammonia, chlorine, epoxies, and caustics?
- Is employee exposure to chemicals in the workplace kept within acceptable levels? Can a less harmful method or product be used?
- Is the work area's ventilation system appropriate for the work being performed?
- Are proper precautions taken by employees handling asbestos and other fibrous materials?
- Are caution labels and signs used to warn of asbestos?
- Is the possible presence of asbestos determined prior to the beginning of any repair, demolition, construction, or reconstruction work?
- Are asbestos-covered surfaces kept in good repair to prevent the release of fibers?
- Are wet methods used (when practicable) to prevent emission of airborne asbestos fibers, silica dust, and similar hazardous materials?
- Is vacuuming with appropriate equipment conducted, rather than blowing or sweeping dust?
- Are grinders, saws, and other machines that produce respirable dust vented to an industrial collector, or a central-exhaust system?
- Are all local-exhaust ventilation systems designed and operated properly (at the airflow and volume necessary) for the application? Are the ducts free of obstructions? Have you ensured that belts are not slipping?
- Is personal protective equipment provided, used, and maintained whenever required?
- Are employees who are working alongside roadways protected from carbon monoxide poisoning?
- Are there written standard operating procedures for the selection and use of respirators?
- Are restrooms and washrooms kept sanitary?
- Is all water provided for drinking, washing, and cooking, potable?
- Are all outlets for water that is not suitable for drinking, clearly identified?
- Are employees instructed how to properly lift heavy objects?
- Where heat is a problem, have all fixed work areas been provided with a proper means of cooling?
- Are employees working on streets and roadways, where they are exposed to the hazards of traffic, required to wear high-visibility clothing?
- Are exhaust stacks and air intakes located so that contaminated air will not be recirculated within a building or other enclosed area?
- Are polychlorinated biphenyls (PCB's) in the soil that is being worked on?
- Has the working area been checked for former uses of herbicides, insecticides, or any other forms of poisons that may have been administered to the ground?
- Are employees instructed on proper procedures for removing gas or oil spills?
- Does the excavation permit meet all specifications? Will there be a need for a segregated debris pile? Is everything in order at the job-site for run-off prevention?
- Are all containers properly labeled? Are all physical hazards properly marked?

- Have all employees' availability to the written hazard communication program and the MSDS for hazardous chemicals?
- Are all accident prevention signs and tags in place?
- When noise levels exceed OSHA designations, are monitoring programs being used and hearing protection being worn?
- When exposed to any form of hazard, are all employees trained to respond to the incident to the best of their ability?
- Are all employees knowledgeable in first-aid, cpr, and worker hydration? Are first-aid kits available at all times? Are doctor, ambulance, EMT, and hospital phone numbers posted on-site?

ENVIRONMENTAL SAFETY

Introduction

The Environmental Protection Agency is an agency of the United States government that sets and enforces national pollution-control standards. The bulk of environmental law is statutory, and is encompassed in the enactments of legislative and regulatory bodies, and generated by agencies charged by governments with protection of the environment.

- **Environmental laws** are the principles, policies, directives, and regulations enacted and enforced by local, national, or international entities to regulate human treatment of the nonhuman world.
- **Environmental law exists** at many levels. The bulk of environmental law is statutory—i.e., encompassed in the enactments of legislative bodies—and regulatory—i.e., generated by agencies charged by governments with protection of the environment.
- Most environmental law falls into a general category of laws known as “command and control.” Such laws typically involve three elements: (1) identification of a type of environmentally harmful activity, (2) imposition of specific conditions or standards on that activity, and (3) prohibition of forms of the activity that fail to comply with the imposed conditions or standards. All three terms are defined in the statute and agency regulations and together identify the type of environmentally harmful activity subject to regulation.
- Almost all environmental laws prohibit regulated activities that do not comply with stated conditions or standards. A “knowing” (intentional) violation of such standards is a crime.
- The most obvious forms of regulated activity involve actual **discharges of pollutants** into the environment (e.g., air, water, and groundwater pollution). Environmental laws also regulate activities that entail a significant risk of discharging harmful pollutants (e.g., the transportation of hazardous waste, the sale of pesticides, and logging). For actual discharges, environmental laws generally prescribe specific thresholds of allowable pollution; for activities that create a risk of discharge, environmental laws generally establish management practices to reduce that risk.
- The standards imposed on actual discharges generally come in two forms: (1) environmental-quality, or ambient, standards, which fix the maximum amount of the regulated pollutant or pollutants tolerated in the receiving body of air or water, and (2) emission, or discharge, standards, which regulate the amount of the pollutant or pollutants that any “source” may discharge into the environment. Most comprehensive environmental laws impose both environmental-quality and discharge standards and endeavor to coordinate their use to achieve a stated environmental-quality goal.
- Environmental-quality goals can be either numerical or narrative. Numerical targets set a specific allowable quantity of a pollutant (e.g., 10 micrograms of carbon monoxide per cubic meter of air measured over an eight-hour period). Narrative

standards require that the receiving body of air or water be suitable for a specific use (e.g., swimming).

- ❑ Environmental assessment mandates are another significant form of environmental law. Such mandates generally perform three functions: (1) identification of a level or threshold of potential environmental impact at which a contemplated action is significant enough to require the preparation of an assessment, (2) establishment of specific goals for the assessment mandated, and (3) setting of requirements to ensure that the assessment will be considered in determining whether to proceed with the action as originally contemplated or to pursue an alternative action.
- ❑ Unlike command-and-control regulations, which may directly limit discharges into the environment, mandated environmental assessments protect the environment indirectly by increasing the quantity and quality of publicly available information on the environmental consequences of contemplated actions.
- ❑ The **United States National Environmental Policy Act** (1969) requires the preparation of an environmental impact statement for any “major federal action significantly affecting the quality of the human environment.” The statement must analyze the environmental impact of the proposed action and consider a range of alternatives, including a so-called “no-action alternative.” The statute and regulations imposed by the Council on Environmental Quality, which was established under the 1969 act to coordinate federal environmental initiatives, require federal agencies to wait until environmental impact statements have been completed before taking actions that would preclude alternatives.
- ❑ Such assessments must describe and evaluate the direct and indirect effects of the project on humans, fauna, flora, soil, water, air, climate, and landscape and the interaction between them.
- ❑ The use of economic instruments to create incentives for environmental protection is a popular form of environmental law. Such incentives include pollution taxes, subsidies for clean technologies and practices, and the creation of markets in either environmental protection or pollution.

Principles of Environmental Law

The Precautionary Principle

- ❑ The precautionary principle requires that, if there is a strong suspicion that a certain activity may have environmentally harmful consequences, it is better to control that activity now rather than to wait for incontrovertible scientific evidence. This principle is expressed in the Rio Declaration, which stipulates that, where there are “threats of serious or irreversible damage”, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

The Prevention Principle

- ❑ Although much environmental legislation is drafted in response to catastrophes, preventing environmental harm is cheaper, easier, and less environmentally dangerous than reacting to environmental harm that already has taken place.
- ❑ The prevention principle is the fundamental notion behind laws regulating the generation, transportation, treatment, storage, and disposal of hazardous waste and laws regulating the use of pesticides. The principle was the foundation of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989), which sought to minimize the production of hazardous waste and to combat illegal dumping.

The “Polluter Pays” Principle

- ❑ Since the early 1970s the “polluter pays” principle has been a dominant concept in environmental law. Many economists claim that much environmental harm is caused by producers who “externalize” the costs of their activities. The cost of waste disposal in the form of pollution is borne by the entire community. The driver of an automobile bears the costs of fuel and maintenance but externalizes the costs associated with the

gases emitted from the tailpipe. The purpose of many environmental regulations is to force polluters to bear the real costs of their pollution, though such costs often are difficult to calculate precisely. In theory, such measures encourage producers of pollution to make cleaner products or to use cleaner technologies. The “polluter pays” principle underlies U.S. laws requiring the cleanup of releases of hazardous substances, including oil. One such law is the Oil Pollution Act (1990).

The Integration Principle

- ❑ Environmental protection requires that due consideration be given to the potential consequences of environmentally fateful decisions. Various jurisdictions and business organizations (e.g., the U.S. Chamber of Commerce) have integrated environmental considerations into their decision-making processes through environmental-impact-assessment mandates and other provisions.

The Public Participation Principle

- ❑ Decisions about environmental protection often formally integrate the views of the public. Generally, government decisions to set environmental standards for specific types of pollution, to permit significant environmentally damaging activities, or to preserve significant resources, are made only after the impending decision has been formally and publicly announced and the public has been given the opportunity to influence the decision through written comments or hearings. In many countries citizens may challenge in court, or before administrative bodies government, decisions affecting the environment. These citizen lawsuits have become an important component of environmental decision making.

Hazardous-waste management

- ❑ Hazardous waste is any waste material that, when improperly handled, can cause substantial harm to human health and safety, or to the environment.
- ❑ Hazardous wastes can take the form of solids, liquids, sludge, or contained gases, and they are generated primarily by chemical production, manufacturing, and other industrial activities.
- ❑ They may cause damage during inadequate storage, transportation, treatment, or disposal operations.
- ❑ Improper waste storage, or disposal, frequently contaminates surface and groundwater supplies. To remedy existing problems and to prevent future harm from hazardous wastes, governments regulate the practices of management.

Hazardous-waste characteristics

- ❑ Hazardous wastes are classified on the basis of their biological, chemical, and physical properties. These properties generate materials that are toxic, reactive, ignitable, corrosive, infectious, or radioactive.
- ❑ Toxic wastes are poisons, even in very small or trace amounts. They may have acute effects, causing death or violent illness, or they may have chronic effects, slowly causing irreparable harm. Some are carcinogenic, causing cancer after many years of exposure. Others are mutagenic, causing major biological changes in the offspring of exposed humans and wildlife.
- ❑ Reactive wastes are chemically unstable and react violently with air, or water. They cause explosions, or form toxic vapors.
- ❑ Ignitable wastes burn at relatively low temperatures, and may cause an immediate fire hazard.
- ❑ Corrosive wastes include strong acidic, or alkaline substances. They destroy solid material, and living tissue, upon contact, by chemical reaction.
- ❑ Infectious wastes include used bandages, hypodermic needles, and other materials from hospitals, or biological research facilities.
- ❑ Radioactive wastes emit ionizing energy that can harm living organisms. Because some radioactive materials can persist in the environment for many thousands of years before fully decaying, there is much concern over the control of these wastes.

The handling and disposal of radioactive material is not a responsibility of local municipal government. Owing to the scope and complexity of the problem, the management of radioactive waste is usually considered to be a separate engineering task from other forms of hazardous-waste management.

Transport of hazardous waste

- ❑ Hazardous waste generated at a particular site often requires transport to an approved treatment, storage, or disposal facility (TSDF). Because of potential threats to public safety and the environment, transport is given special attention by governmental agencies. In addition to the occasional accidental spill, hazardous waste has, in the past, been intentionally spilled or abandoned at random locations in a practice known as "midnight dumping." This practice has been greatly curtailed by the enactment of laws that require proper labeling, transport, and tracking of all hazardous wastes.

Transport vehicles

- ❑ Hazardous waste is generally transported by truck over public highways. Only a very small amount is transported by rail, and almost none is moved by air or inland waterway. Highway shipment is the most common because road vehicles can gain access to most industrial sites and approved TSDFs. Hazardous wastes can be shipped in tank trucks made of steel or aluminum alloy. They also can be containerized and shipped in 55-gallon (200-litre) drums. Specifications and standards for cargo tank trucks and shipping containers are included in governmental regulations.

The manifest system

- ❑ In the United States a key feature of regulations pertaining to waste transport is the "cradle-to-grave" manifest system, which monitors the journey of hazardous waste from its point of origin to the point of final disposal. The manifest system helps to eliminate the problem of midnight dumping. It also provides a means for determining the type and quantity of hazardous waste being generated, as well as the recommended emergency procedures in case of an accidental spill.
- ❑ A manifest is a record-keeping document that must be prepared by the generator of the hazardous waste. The generator has primary responsibility for the ultimate disposal of the waste and must give the manifest, along with the waste itself, to a licensed waste transporter.
- ❑ A copy of the manifest must be delivered by the transporter to the recipient of the waste at an authorized TSDF. Each time the waste changes hands, a copy of the manifest must be signed. Copies of the manifest are kept by each party involved, and additional copies are sent to appropriate environmental agencies.
- ❑ In the event of a leak or accidental spill of hazardous waste during its transport, the transporter must take immediate and appropriate actions, including notifying local authorities of the discharge. An area may have to be diked to contain the wastes, and efforts must be undertaken to remove the wastes and reduce environmental or public health hazards.

Treatment, storage, and disposal

- ❑ Several options are available for hazardous-waste management. The most desirable is to reduce the quantity of waste at its source or to recycle the materials for some other productive use. Nevertheless, while reduction and recycling are desirable options, they are not regarded as the final remedy to the problem of hazardous-waste disposal. There will always be a need for treatment and for storage or disposal of some amount of hazardous waste.

Surface storage and land disposal

- ❑ Hazardous wastes that are not destroyed by incineration or other chemical processes need to be disposed of properly. For most of such wastes, land disposal is the ultimate destination, although it is not an attractive practice because of the inherent environmental risks involved.
- ❑ Two basic methods of land disposal include landfilling and underground injection. Prior to land disposal, surface storage or containment systems are often employed as a temporary method.
- ❑ Temporary on-site waste storage facilities include open waste piles and ponds or lagoons. New waste piles must be carefully constructed over an impervious base and must comply with regulatory requirements similar to those for landfills. The piles must be protected from wind dispersion or erosion. If leachate is generated, monitoring and control systems must be provided. Only noncontainerized solid, nonflowing waste material can be stored in a new waste pile, and the material must be landfilled when the size of the pile becomes unmanageable.
- ❑ A common type of temporary storage impoundment for hazardous liquid waste is an open pit or holding pond, called a lagoon. New lagoons must be lined with impervious clay soils and flexible membrane liners in order to protect groundwater. Leachate collection systems must be installed between the liners and groundwater monitoring wells are required. Except for some sedimentation, evaporation of volatile organics, and possibly some surface aeration, open lagoons provide no treatment of the waste. Accumulated sludge must be removed periodically and subjected to further handling as a hazardous waste.
- ❑ One option for remediation is to remove completely all the waste material from the site and transport it to another location for treatment and proper disposal. This so-called off-site solution is usually the most expensive option.
- ❑ An alternative is on-site remediation, which reduces the production of leachate and lessens the chance of groundwater contamination. On-site remediation may include temporary removal of the hazardous waste, construction of a secure landfill on the same site, and proper replacement of the waste. It may also include treatment of any contaminated soil or groundwater. Treated soil may be replaced on-site and treated groundwater returned to the aquifer by deep-well injection.
- ❑ A less costly alternative is full containment of the waste. This is done by placing an impermeable cover over the hazardous-waste site and by blocking the lateral flow of groundwater with subsurface cutoff walls. It is possible to use cutoff walls for this purpose when there is a natural layer of impervious soil or rock below the site. The walls are constructed around the perimeter of the site, deep enough to penetrate to the impervious layer. They can be excavated as trenches around the site without moving or disturbing the waste material. The trenches are filled with a bentonite clay slurry to prevent their collapse during construction, and they are backfilled with a mixture of soil and cement that solidifies to form an impermeable barrier. Cutoff walls thus serve as vertical barriers to the flow of water, and the impervious layer serves as a barrier at the bottom.

Air-pollution control

- ❑ Clean air, an essential component of a healthful environment, is a mixture of many different gases. Two gases predominate: nitrogen, which makes up 78 percent of the volume of clean dry air, and oxygen, which makes up 21 percent. Argon, an inert element, accounts for almost 1 percent of clean dry air, and the remainder includes very small or trace concentrations of carbon dioxide, methane, hydrogen, helium, ozone, and other gases.
- ❑ Air is considered to be polluted when it contains certain substances in concentrations high enough and for durations long enough to cause harm or undesirable effects. These include adverse effects on human health, property, and atmospheric visibility. The atmosphere is susceptible to pollution from natural sources as well as from human activities. Only pollution caused by human activities, such as industry and transportation, is subject to mitigation and control.

Types, sources, and effects of air pollutants

- ❑ There are six traditional criteria pollutants. They include fine particulates, carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, and lead. All except ozone are discharged directly into the atmosphere from a wide variety of sources. They are regulated primarily by establishing ambient air quality standards, which are maximum acceptable concentrations of each criteria pollutant in the atmosphere, regardless of their origin.
- ❑ Hazardous air pollutants are emitted in smaller amounts than are the criteria pollutants. They are regulated primarily by emission standards, which are maximum allowable rates at which each air pollutant can be discharged from a particular source. Although the total emissions and the number of sources of these pollutants are small compared with those for criteria pollutants, hazardous air pollutants can pose an immediate health risk to exposed individuals and can cause other environmental problems.

Fine particulates

- ❑ Very small fragments of solid materials or liquid droplets suspended in air are called particulates. Except for airborne lead, which is treated as a separate category, they are characterized on the basis of size and phase (i.e., solid or liquid) rather than by chemical composition. For example, solid particulates between roughly 1 and 100 μm (0.00004 and 0.004 inch) in diameter are called dust particles, whereas airborne solids less than 1 μm in diameter are called fumes.
- ❑ The particulates of most concern with regard to their effects on human health are solids less than 10 μm (0.0004 inch) in diameter, because they can be inhaled deep into the lungs and become trapped in the lower respiratory system.
- ❑ Certain particulates, such as asbestos fibers, are known carcinogens (cancer-causing agents), and many carbonaceous particulates—e.g., soot—are suspected of being carcinogenic.

Carbon monoxide

- ❑ Carbon monoxide is an odorless, invisible gas formed as a result of incomplete combustion. It is the most abundant of the criteria pollutants. Gasoline-powered engines are the primary source, although residential heating systems and certain industrial processes also emit significant amounts of this gas.
- ❑ Exposure to carbon monoxide can be acutely harmful since it readily displaces oxygen in the bloodstream, leading to asphyxiation at high enough concentrations and exposure times.

Sulfur dioxide

- ❑ A colorless gas with a sharp, choking odor, sulfur dioxide is formed during the combustion of coal or oil that contains sulfur as an impurity. This pungent gas can cause eye and throat irritation and harm lung tissue when inhaled. It also reacts

with oxygen and water vapor in the air, forming a mist of sulfuric acid that reaches the ground as a component of acid rain. It causes corrosion of metals and deterioration of the exposed surfaces of buildings and public monuments.

Nitrogen dioxide

- ❑ Of the several forms of nitrogen oxides, nitrogen dioxide—a pungent, irritating gas—is of most concern. It is known to cause pulmonary edema, an accumulation of excessive fluid in the lungs. Nitrogen dioxide also reacts in the atmosphere to form nitric acid, contributing to the problem of acid rain. In addition, nitrogen dioxide plays a role in the formation of photochemical smog, a reddish brown haze that often is seen in many urban areas and that is created by sunlight-promoted reactions in the lower atmosphere.
- ❑ Nitrogen oxides are formed when combustion temperatures are high enough to cause molecular nitrogen in the air to react with oxygen. Gasoline engines and other mobile sources are significant causes of nitrogen dioxide.

Lead

- ❑ Inhaled lead particulates in the form of fumes and dusts are particularly harmful to children, in whom even slightly elevated levels of lead in the blood can cause learning disabilities, seizures, or even death.

Hazardous air pollutants (air toxics)

- ❑ Hundreds of specific substances are considered hazardous when present in trace amounts in the air; these pollutants are also called air toxics. Many of them cause gene mutations or cancer; some cause other types of health problems such as adverse effects on brain tissue or fetal development.
- ❑ Most air toxics are organic chemicals, comprising molecules that contain carbon, hydrogen, and other atoms.
- ❑ Many are volatile organic compounds (VOCs), organic compounds that readily evaporate. VOCs include pure hydrocarbons, partially oxidized hydrocarbons, and organic compounds containing chlorine, sulfur, or nitrogen. They are widely used as fuels (e.g., propane and gasoline), as paint thinners, solvents, and in the production of plastics. In addition to contributing to air toxicity and urban smog, VOC emissions contribute to the Earth's greenhouse effect, and in so doing, may be a cause of global warming.
- ❑ Some other air toxics are metals or compounds of metals—for example, mercury, arsenic, and cadmium.
- ❑ The first hazardous air pollutants regulated in the United States (outside the workplace environment) were arsenic, asbestos, benzene, beryllium, coke oven emissions, mercury, radionuclides (radioactive isotopes), and vinyl chloride.
- ❑ In 1990 this short list was expanded to include 189 substances.
- ❑ Hazardous air pollutants may be released when equipment leaks, or when material is transferred, or they may be emitted from smokestacks. Municipal waste incinerators, for example, can emit hazardous levels of dioxins, formaldehyde, and other organic substances, as well as metals such as arsenic, beryllium, lead, and mercury. Proper combustion along with appropriate air-pollution control devices can reduce emissions of these substances to acceptable levels. Benzene, a component of gasoline, is released as unburned fuel or as fuel vapors, and formaldehyde is one of the by-products of incomplete combustion.

POISON

These are a few of the toxins to be aware of when working above or below the ground.

Polychlorinated biphenyl

- Any of a class of highly stable organic compounds that are prepared by the reaction of chlorine with biphenyl.
- A commercial mixture of such chlorinated isomers of biphenyl provides a colorless, viscous liquid that is relatively insoluble in water, does not degrade under high temperatures, and is a good dielectric.
- PCB's are particularly useful as lubricants, heat-transfer fluids, and fire-resistant dielectric fluids in transformers and capacitors. They also are good plasticizers and have found application in paints, paper coatings, and certain packaging materials.
- PCBs came into widespread industrial use during the 1930s and '40s, but since the mid-1970s the production and application of these chemicals have been restricted because they have been found to be injurious to living organisms.
- PCBs were never intended to be released into the environment, but they found their way into the air, water, and soil via industrial and municipal waste disposal and leaks from mechanical equipment.
- The high resistance of PCBs to decomposition ensures that they remain in soils and bodies of water for many years, enabling them to accumulate and enter the food chain.
- PCBs are particularly toxic to fishes and invertebrates and are fatal to these animals even in small concentrations.
- PCBs cause liver dysfunction, dermatitis, and dizziness in humans exposed to them. The chemicals are also suspected of being carcinogenic.
- PCB concentration levels in the environment have dropped since the manufacture and use of the compounds were curtailed in several countries.
- Miscellaneous organic chemicals include such compounds as phosgene, carbon disulfide, and the halogenated aromatic compounds. Anhydrides and isocyanates, phosgenes are highly reactive.
- Instead of reacting with the mucosal linings of the upper respiratory tract, however, it tends to react with the lungs, causing edema. As a result, the lungs' defenses against bacteria are weakened, and pneumonia may occur.
- Halogenated aromatic compounds with more than one ring, such as polychlorinated biphenyls (PCBs), polybrominated biphenyls (PBBs), and 2,3,7,8-tetrachlorodibenzodioxin TCDD, can produce a number of toxic effects in laboratory animals, including cancer, birth defects, liver injury, porphyria, and immunotoxicity.

Insecticides

- The four main classes of insecticides are organophosphates, carbamates, chlorinated hydrocarbons, and insecticides derived from plants (botanical). Organophosphate and carbamate insecticides act by inhibiting acetylcholinesterase, the enzyme that degrades acetylcholine (the messenger of the parasympathetic nervous system).
- As a result, acetylcholine levels remain high, exaggerating the normal functions of the parasympathetic system. Effects such as salivation, lacrimation, urination, defecation, twitching of the skeletal muscles, and in severe poisoning, death from respiratory depression occur.
- Chlorinated hydrocarbons used as insecticides, such as chlorophenothane (DDT), are larger molecules than the chlorinated hydrocarbons used as organic solvents, such as chloroform. The former stimulate the central nervous system; the latter depress it.

- The major toxic effect produced by these insecticides is convulsions. The use of DDT is banned in many countries because of its environmental effects and because it may cause cancer in humans. DDT is a highly fat-soluble chemical that accumulates in fish, and, when birds eat such fish, the chemical also accumulates in their fat tissues. The DDT in the birds results in fragile eggs, which are prone to breakage. This will ultimately decrease the population of fish-eating birds
- In general, insecticides derived from plants are low in toxicity. Pyrethrins are widely used insecticides in the home. They have a rapid "knockdown" for insects and have a low potential for producing toxicity in humans. The major toxicity of pyrethrins is allergy.

Inorganic compounds

- Examples of metal compounds toxic to humans include manganese, lead, cadmium, nickel, and arsenic compounds, beryllium oxide, and the elemental vapors, inorganic salts, and organic compounds of mercury.
- Chronic manganese exposure can damage the brain, resulting in a condition with symptoms similar to Parkinson's disease, such as slurred speech, masklike face, and rigidity.
- Mercury can also damage the brain, leading to behavioral changes; however, mercury is also toxic to the peripheral nervous system, causing sensory and motor symptoms. In addition, mercury is toxic to the kidney. Methyl mercury is especially toxic to the developing brain of a fetus.
- Lead is probably the most ubiquitous metal poison. Used for numerous purposes, before World War II it was a major constituent in paint, and it has been used in gasoline. Like mercury, lead is toxic to the nervous system and kidney, but its toxicity is age-dependent. In children, the blood-brain barrier is not fully developed, and more lead enters the brain. The extent of damage depends on the exposure; at lower levels of exposure, small decreases in intelligence and behavioral changes may result, whereas high levels result in severe brain damage and death. In adults, lead tends to cause paralysis or weakness, indicative of peripheral nervous system damage.
- In acute cadmium poisoning by ingestion, irritation of the gastrointestinal tract is the major toxicity, causing nausea, vomiting, diarrhea, and abdominal cramps. With chronic exposure by inhalation, however, kidneys and lungs are the target organs.
- Arsenic compounds damage many organs. They cause skin lesions, decrease in heart contractility, blood vessel damage, and injuries of the nervous system, kidney, and liver. Arsenic compounds also produce skin and lung tumors in humans.
- Certain nickel and hexavalent chromium compounds, as well as beryllium oxide, are toxic to the lungs and can cause lung cancer.
- Acids, such as sulfuric and hydrochloric acids, and strongly alkaline compounds, such as sodium hydroxide, and potassium hydroxide are corrosive to tissues on contact and can cause severe tissue injuries. Sulfuric acid, sodium hydroxide, and potassium hydroxide are active ingredients in drain cleaners, the ingestion of which can cause severe chemical burns of the mouth and esophagus.
- Hypochlorites are often used as bleaching agents. In low concentrations, as in household bleaches, hypochlorites have little toxicity but may be irritating to tissues; they can, however, be corrosive at high concentrations. Cyanide ions poison the oxidative metabolic machinery of cells so that insufficient energy is generated. The effect is as if there was a lack of oxygen for the cells, even though there is plenty of oxygen in the blood.
- Hydrogen sulfide and chlorine are highly irritating to the respiratory tract, with pulmonary edema the major toxic effect. Chronic fluoride poisoning is called

fluorosis, which is characterized by tooth mottling and increased bone density. These changes, especially of the bone, are related to a change in body calcium caused by fluoride. Silica and asbestos remain in the lungs for long periods of time, and both produce lung fibrosis. In addition, asbestos is a well-known human carcinogen.

General air pollutants

- Sulfur dioxide, an acidic pollutant, irritates the respiratory tract. It causes violent coughing when it irritates the throat, and may result in shortness of breath, lung edema, and pneumonia when it reaches the lungs.
- Both ozone and nitrogen oxides are oxidizing pollutants. Like sulfur dioxide, they cause respiratory irritation; ozone and nitrogen oxides, however, tend to be more irritating to the lung than to the upper respiratory tract.
- Carbon monoxide, an asphyxiating pollutant, binds to hemoglobin more strongly than oxygen does. Such binding produces a hemoglobin molecule that cannot carry its normal load of four oxygen molecules. In addition, once carbon monoxide is bound, the hemoglobin molecule does not as readily release to the tissues the oxygen molecules already bound to it. Therefore, tissues lack oxygen, resulting in many toxic effects. Because the brain is especially sensitive to the lack of oxygen, most of the symptoms are neurological. Lack of oxygen is termed asphyxiation, and thus carbon monoxide is an asphyxiant.

NOTES: