



# **Introduction to Safety Management**

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**Naryn, 10:52am, January 19, 2023 (-22 °C)**

- Your photo can be here :)



# What is safety management system?

- A safety management system (SMS) is a management system designed to manage safety elements in the workplace.
- It includes policy, objectives, plans, procedures, organization, responsibilities and other measures.
- The SMS is used in industries that manage significant safety risks, including aviation, petroleum, chemical, electricity generation, and others.



# **Introduction to Safety Management**



## **Safety Management**

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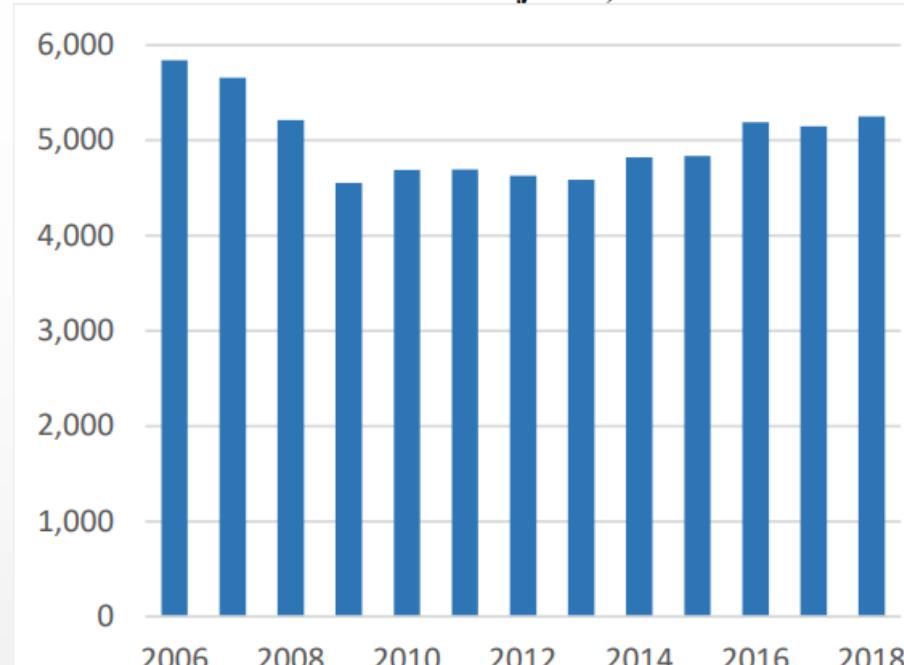
## **Occupational Safety and Health (OSH)**

- Occupational safety and health is a multidisciplinary field concerned with the safety, health, and welfare of people at work.

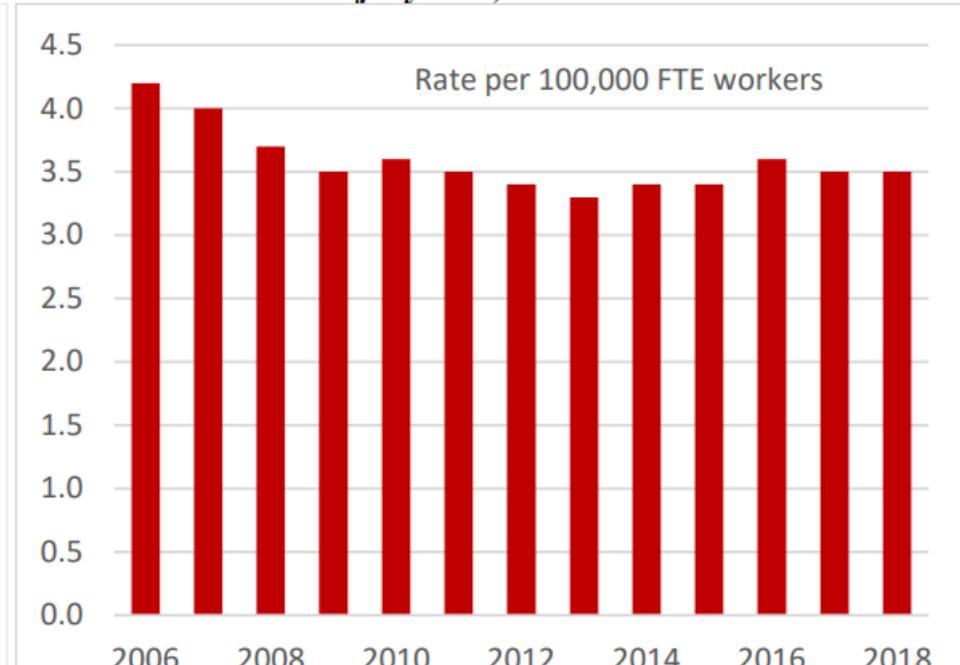
# Motivation to Study Safety Management



**Chart 1. Number of fatal work injuries, 2006-18**



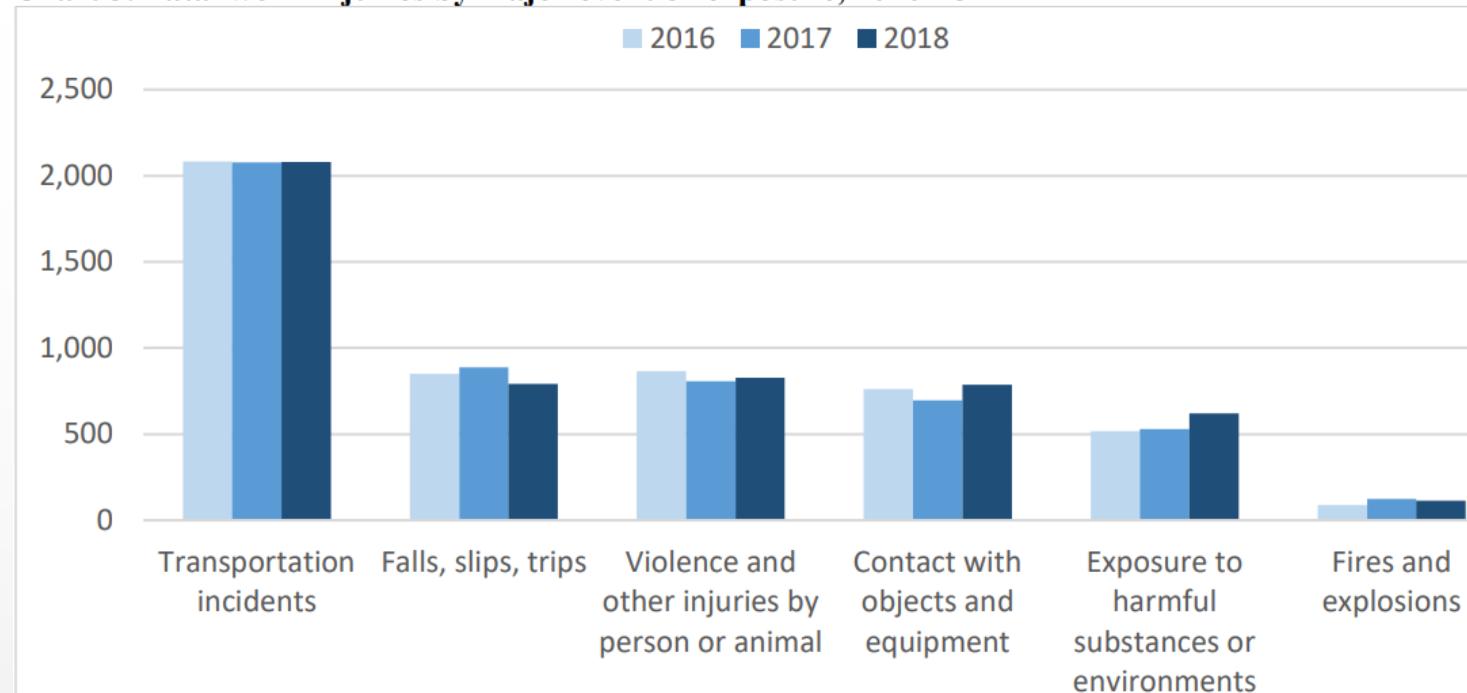
**Chart 2. Fatal work injury rate, 2006-18**



- Each year, thousands of workers die as a result of exposure to hazards in the workplace

# Motivation to Study Safety Management (cont.)

Chart 3. Fatal work injuries by major event or exposure, 2016-18



- Safety and Health Programs can help reduce these fatalities through a proactive approach to find and fix hazards before they cause injury, illness, or death.

# History



- A woman examining her work on a lathe at a factory in Britain during World War II.
- **Eyes are not protected!**
- Today, such practice would not be permitted in most industrialized countries that adhere to occupational health and safety standards for workers. In many countries, however, such standards are still either weak or nonexistent.

## History (cont.)



- Harry McShane, age 16, 1908. Pulled into machinery in a factory in Cincinnati and had his arm ripped off at the shoulder and his leg broken without any compensation.

# What should we do?



## The OSHA Act

- Establishes specific responsibilities to Employer
- Establishes specific responsibilities to Employees
- Is also known as the Williams Steiger Occupational Safety and Health Act of 1970
- OSHA - Occupational Safety and Health Administration. It is an agency of the United States Department of Labor
- Congress established the agency under the Occupational Safety and Health Act (OSH Act), which President Richard M. Nixon signed into law on Dec 29, 1970



# What we gonna discuss today?

- Outline of the course
- Syllabus
- Course project
- Intro to Safety Management
- Prevention and control strategies



# Outline of the course

- Intro to Safety Management
- International Standards and ISO 45001 – Occupational Health and Safety
- COVID-19 and Bloodborne Pathogens
- Electrical Safety
- Health and Safety in the Laboratory
- Intro to Ergonomics



In the context  
of CS, CE, and  
SE!!!

# Outline of the course (cont.)

- Exit Routes, Emergency Action Plans, Fire Prevention Plans, and Fire Protection
  - Personal Protective Equipment and Machine Guarding
  - Fall Protection
  - Hazard Communications and Hazardous Materials
  - Introduction to Industrial Hygiene
  - Materials Handling, Storage, and Disposal
  - Walking and Working Surfaces, including Fall Protection
- Other ideas ? :)**



# References

- Course materials on Moodle and Ms Teams
- Occupational Safety and Health (OSH): European Agency for Safety and Health at Work. <https://oshwiki.eu>
- Occupational Safety and Health Administration: United States Department of Labor. <https://www.osha.gov>
- Charles D. Reese (2016). Occupational Health and Safety Management: A Practical Approach. 3rd Ed., CRC Press



# Syllabus

- Syllabus
- Course project:
  - individual work based on the FYP
  - discussion of the project progress weekly (+/-)
  - pls provide the topic of the course project next week
  - midterm exam: practical part is based on the course project - ?
- Discussion sessions **(in the context of CS, CE, and SE)**
  - work in groups up to 3 students
  - 5-minute presentation for one group
- Attendance: all time-slots, self-check in Moodle first 5 minutes



# Costs of workplace accidents

- Direct costs:
  - Cost of treatment
  - Cost of physician and hospital
  - Cost of medications
  - Cost of medical equipment



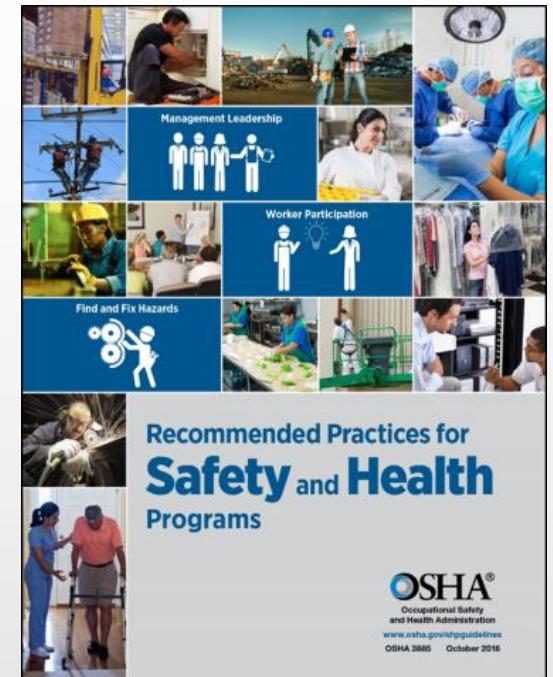
# Costs of workplace accidents (cont.)

- Indirect costs:
  - ° Schedule delays
  - ° Lower morale
  - ° Increased absenteeism
  - ° Poor customer relations
  - ° Re-training



# Benefits of Safety & Health Programs

- Improvements in product, process, and service quality
- Better morale
- Improved recruiting and retention
- More favorable image and reputation

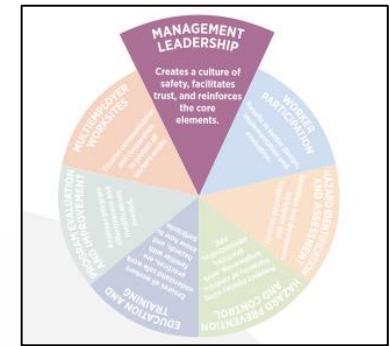


# Elements of Safety & Health Programs

- Management Leadership
- Worker Participation
- Hazard Identification and Assessment
- Hazard Prevention and Control
- Education and Training
- Program Evaluation
- Multi-Employer Worksites

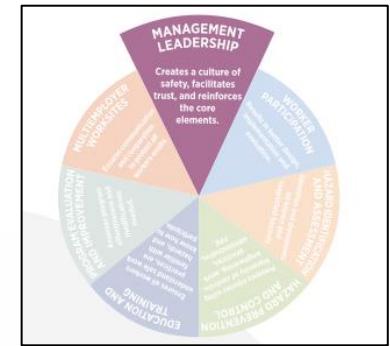


# Elements of Safety & Health Programs: Management Leadership



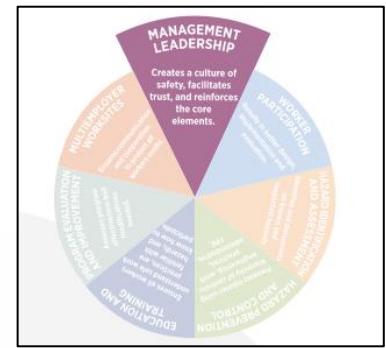
- Management Leadership
  - **Action Item 1:** Communicate your commitment to Safety and Health Programs
- How to accomplish this action?
  - Establish a written safety and health policy statement signed by top management
  - Communicate the policy to all workers, contractors, unions, supplier, visitors, customers, etc.

# Elements of Safety & Health Programs: Management Leadership



- Management Leadership
  - **Action Item 2:** Define program goals and expectations
- How to accomplish it:
  - Establish realistic, attainable and measurable goals that demonstrate progress toward improving safety and health
  - Develop safety and health plans

# Elements of Safety & Health Programs: Management Leadership



- Management Leadership
  - Action Item 3: Allocate Resources
- How to accomplish it:
  - Integrate safety and health into planning and budgeting
  - Allow time in workers' schedule for participation

# Elements of Safety & Health Programs: Management Leadership



- Management Leadership
  - Action Item 4: Expect Performance
- How to accomplish it:
  - Define and communicate responsibilities and authorities for accountability
  - Set an example for workers by following the same procedures

# Elements of Safety & Health Programs: Worker Participation

- Worker Participation
  - **Action Item 1:** Encourage workers to report safety and health concerns
- How to accomplish it:
  - Establish a process to report injuries, near misses and other safety and health concerns
  - Empower workers to temporarily suspend work they feel is unsafe



# Elements of Safety & Health Programs: Worker Participation

- Worker Participation
  - **Action Item 2:** Encourage participation in the program
- How to accomplish it:
  - Provide positive reinforcement to workers who participate
  - Maintain an open-door policy, inviting workers to speak to managers about safety and health



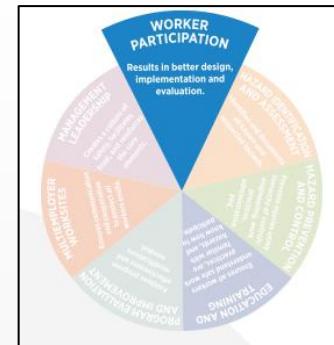
# Elements of Safety & Health Programs: Worker Participation

- Worker Participation

- **Action Item 3:** Involve workers in all aspects of the program

- How to accomplish it:

- Developing a program
- Reporting hazards and developing solutions
- Analyzing hazards
- Defining safe work practices
- Conducting site inspections
- Participating in incident/near-miss investigations
- Serving as trainers
- Developing and evaluating training programs



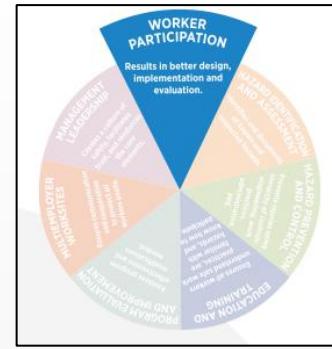
# Elements of Safety & Health Programs: Worker Participation

- Worker Participation
  - **Action Item 4:** Give workers access to safety and health information
- How to accomplish it:
  - Safety Data Sheets
  - Injury Illness Data
  - Results of exposure monitoring



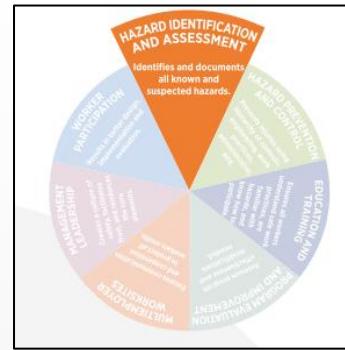
# Elements of Safety & Health Programs: Worker Participation

- Worker Participation
  - **Action Item 5:** Remove barriers to participation
- How to accomplish it:
  - Ensure workers from all levels of the organization can participate regardless of skill level, education, or language
  - Ensure policies and programs do not discourage worker participation



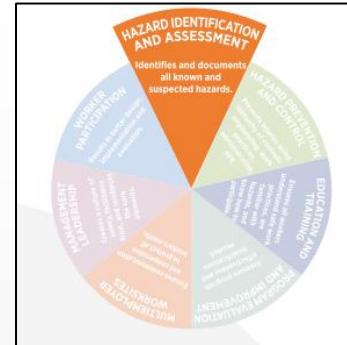
# Elements of Safety & Health Programs: Hazard Identification

- Hazard Identification
  - **Action Item 1:** Collect existing information about workplace hazards
- How to accomplish it:
  - Collect, organize, and review information to determine what types of hazards are present and workers exposed



# Elements of Safety & Health Programs: Hazard Identification

- Hazard Identification
  - Action Item 2: Inspect the workplace
- How to accomplish it:
  - Use checklists
  - Routine inspections of workflow, equipment, materials and talk to workers



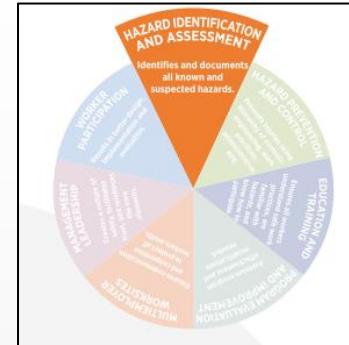
# Elements of Safety & Health Programs: Hazard Identification

- Hazard Identification
  - **Action Item 3:** Conduct Incident Investigations
- How to accomplish it:
  - Develop a plan and procedure to begin investigation immediately after an incident or near miss
  - Conduct root cause analysis and investigate with a team



# Elements of Safety & Health Programs: Hazard Identification

- Hazard Identification
  - **Action Item 4:** Identify hazards associated with emergency and non-routine situations
- How to accomplish it:
  - Assess foreseeable emergency scenarios or non-routine tasks
  - Conduct “table top” exercises to help you plan and test your response plan and procedures



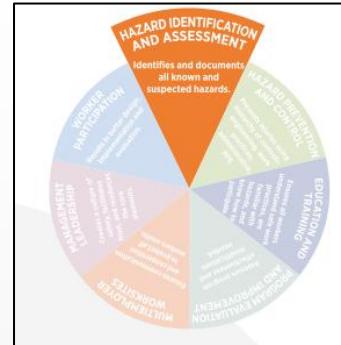
# Elements of Safety & Health Programs: Hazard Identification

- Hazard Identification

- **Action Item 5:** Characterize the nature of identified hazards, determine the controls to be implemented and prioritize the hazards for control

- How to accomplish it:

- Evaluate each hazard by considering the severity of potential outcomes, the likelihood that an event will occur, and the number of workers exposed
- Prioritize hazards so that the greatest risks are addressed first
- Use interim control measures to protect workers until more permanent solutions can be implemented



# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control

- **Action Item 1:** Identify control options

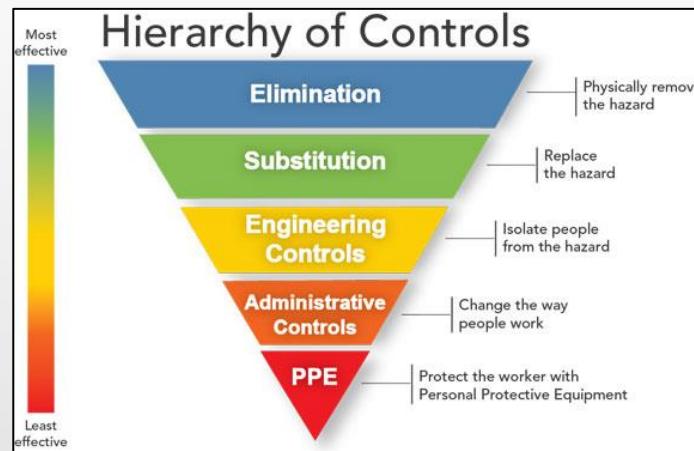
- How to accomplish it:

- Review literature, OSHA standards and publications, Internet, and other resources for potential control measures
  - Get input from workers, safety consultants, or investigate other workplaces with similar hazards



# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control
  - **Action Item 2:** Select controls
- How to accomplish it:
  - Select controls using the hierarchy of controls
  - Use a combination when no single method fully protects the worker



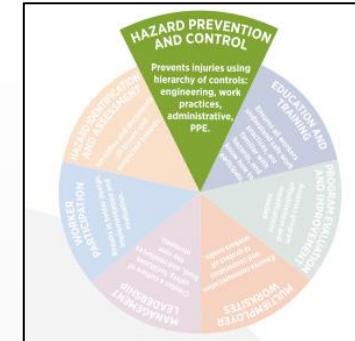
# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control

- **Action Item 3:** Develop and update a hazard control plan

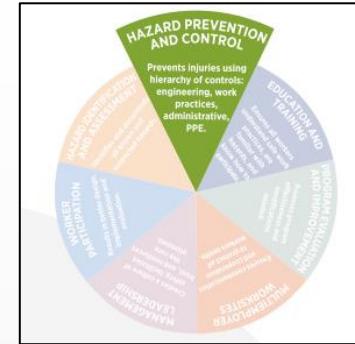
- How to accomplish it:

- List hazards in order of priority, assign responsibility to a person(s), establish a target completion date
- Plan how to track progress and verification of implementation



# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control
  - **Action Item 4:** Select controls for emergency and non-routine operations
- How to accomplish it:
  - Develop procedures to control hazards during these situations
  - Assign responsibility for implementing the plan and conduct emergency drills



# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control

- **Action Item 5:** Implement selected controls in the workplace

- How to accomplish it:

- Implement controls starting with highest priority, however, regardless of priority employers must protect workers from recognized serious hazards



# Elements of Safety & Health Programs: Hazard Prevention and Control

- Hazard Prevention and Control
  - **Action Item 6:** Follow up to confirm that controls are effective
- How to accomplish it:
  - Conduct regular inspections of controls, confirm that work practices are being followed
  - Track progress and implementation



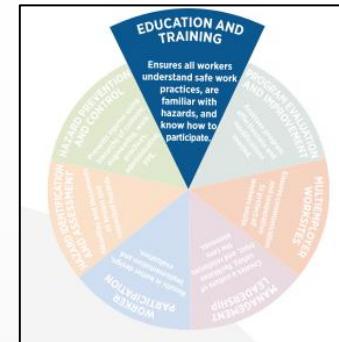
# Elements of Safety & Health Programs: Education and Training

- Education and Training

- **Action Item 1:** Provide program awareness training

- How to accomplish it:

- Provide training to all managers, supervisors and workers as well as contractors and temporary workers on: safety policies and procedures, program functions, emergencies, injury illness reporting, and their rights under the OSH Act
  - Ensure the training is provided in a language and literacy level that all workers can understand



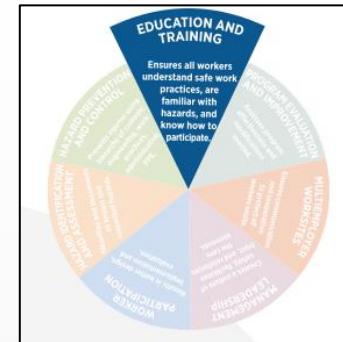
# Elements of Safety & Health Programs: Education and Training

- Education and Training

- **Action Item 2:** Train workers on specific roles and responsibilities in the safety and health program

- How to accomplish it:

- Instruct workers with specific roles within the safety and health program on how they should carry out those responsibilities
- Provide opportunities for workers to ask questions and offer feedback during training



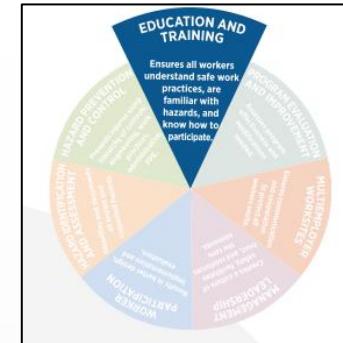
# Elements of Safety & Health Programs: Education and Training

- Education and Training

- **Action Item 3:** Train workers on hazard identification and controls

- How to accomplish it:

- Train managers and workers on techniques for identifying hazards; such as job hazard analysis
  - Have workers demonstrate they can recognize hazards and understand why controls are in place
  - Provide training on new tasks and new assignments
  - Provide training where required by specific OSH standards such as hazard communication and lockout



# Elements of Safety & Health Programs: Program Evaluation

- Program Evaluation

- **Action Item 1:** Verify the program is implemented and is operating

- How to accomplish it:

- Verify the core elements of the program are fully met and key processes are in place and implemented
  - Verify injuries are being reported, inspections are conducted, progress is being tracked in controlling identified hazards to ensure control measures are effective and data collected to monitor the programs performance



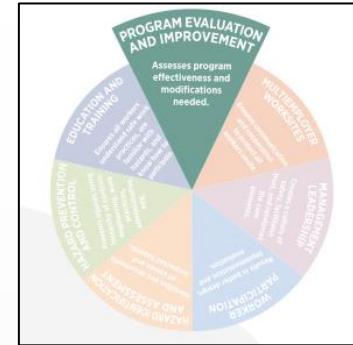
# Elements of Safety & Health Programs: Program Evaluation

- Program Evaluation

- **Action Item 2:** Correct program deficiencies and identify opportunities to improve

- How to accomplish it:

- Proactively seek input from managers, workers, supervisors and other stakeholders on how you can improve the program
- Determine whether changes in equipment, facilities, material, personnel or work practices trigger any need for changes in the program
- Determine whether the metrics and goals are still relevant and how you could change them to more effectively drive improvements



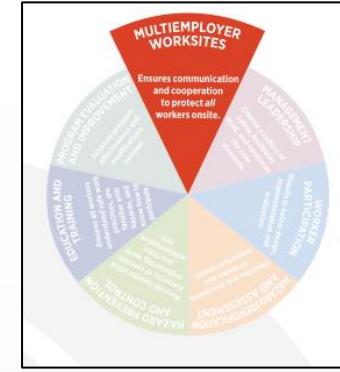
# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites

- **Action Item 1:** Management Leadership

- How to accomplish it:

- Provide a copy of the safety and health policy to all contractors
- Before beginning on-site work, clarify each employer's responsibilities and obligations, such as:
  - Providing training
  - Selecting, providing and maintaining PPE
  - Recording and reporting any injuries or illnesses
  - Procedures for communication between host employer and all contractors



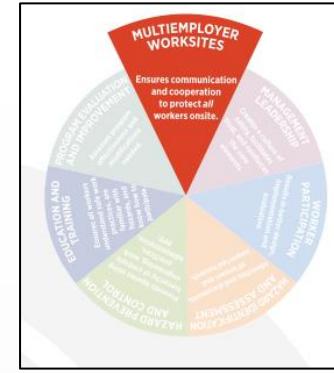
# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites
  - **Action Item 2:** Worker Participation
- How to accomplish it:
  - Encourage employees to raise safety concerns
  - Identify and remove any obstacles to their participation in a program or reporting



# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites
  - **Action Item 3:** Hazard Identification and Assessment
- How to accomplish it:
  - Host employer performs a worksite hazard assessment and shares the results
  - Contractors perform pre-job hazard assessments of the work they will perform



# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites
  - **Action Item 4:** Hazard Prevention and Control
- How to accomplish it:
  - Before beginning work, the host employer gives contractors information about programs and procedures to control workers' exposure to hazards



# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites

- **Action Item 5:** Education and Training

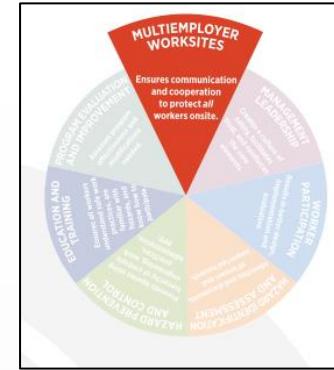
- How to accomplish it:

- The host employer and contractor identify any qualifications and certifications required by the workers
- Temporary and contract workers also receive appropriate hazard and standard specific training



# Elements of Safety & Health Programs: Multi-Employer Worksites

- Multi-Employer Worksites
  - **Action Item 6:** Program Evaluation and Improvement
- How to accomplish it:
  - Exchange data on metrics tracks and use this data to evaluate the program's effectiveness
  - All contractors should participate in these evaluations
  - Sharing the results of the evaluations with contractors, subcontractors and temporary staffing agencies who can then inform the affected workers of the results



# Prevent/Control Workplace Hazards



- Methods to prevent/control workplace hazards:
  - Benefits of effective controls
    - Protect workers from hazards
    - Help to avoid injuries, illnesses, and incidents
    - Minimize/eliminate safety and health risks
    - Help employers provide safe/healthful working conditions



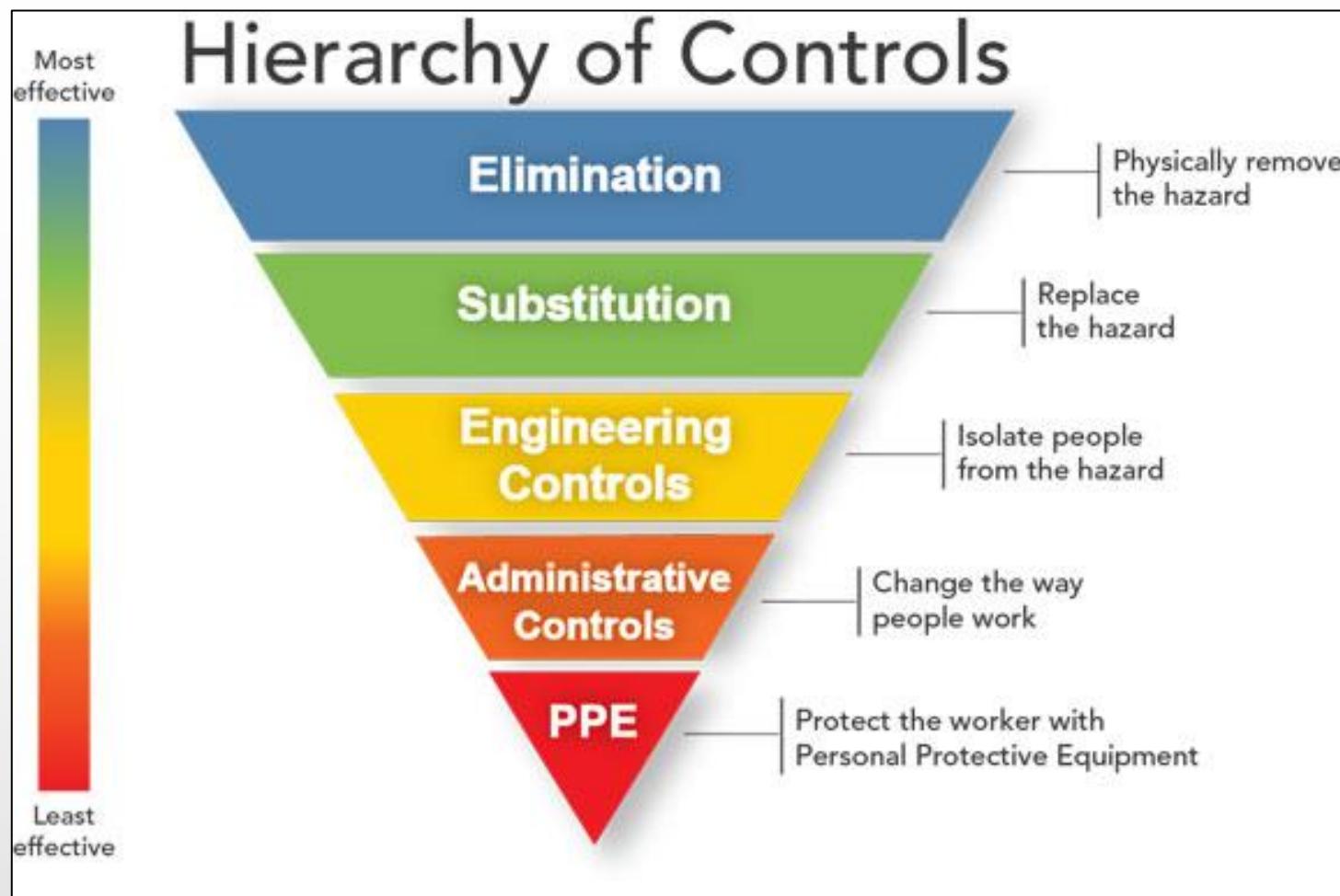
# Prevent/Control Workplace Hazards (cont.)

- Involve workers
  - Understand conditions that create hazards
  - How hazards can be controlled



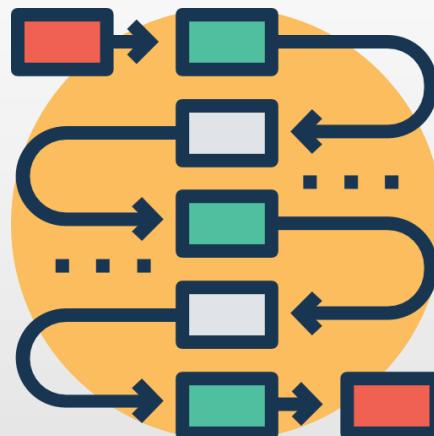
# Prevent/Control Workplace Hazards (cont.)

- Identify and evaluate options in the hierarchy of controls



# Prevent/Control Workplace Hazards (cont.)

- Use a hazard control plan
- Develop plans with measures to protect workers during emergencies and non-routine activities
- Evaluate effectiveness of existing controls and review new technologies

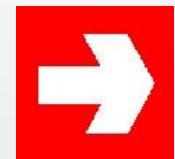


# Prevent/Control Workplace Hazards (cont.)

- Use safety signs to prevent/control workplace hazards
- Some categories of safety signs:
  - Prohibition signs, e.g., “Smoking is not allowed”
    - Circular shape; red with a white background, red band and crossbar
  - Warning signs, e.g., “Flammable”
    - Triangular shape; yellow with black symbol or text
  - Mandatory signs, e.g., “Helmet compulsory”
    - Circular shape; blue with symbol or text in white
  - Safe condition signs, e.g., “Emergency exit”
    - Rectangular shape; green with white symbol or text
  - Fire-fighting equipment signs, e.g., “Fire Hose Reel” sign
    - Rectangular or circle shape; red with white symbol or text
  - Supplementary information signs, e.g., “Directional Arrow” sign
    - Rectangular shape; green, red, yellow, with white or black text



Emergency  
exit



# Safety & Health Programs: Summary



- OSHA encourages employers to create a proactive approach for finding and fixing hazards in the workplace
- An effective safety and health program increases worker involvement, management commitment and allows employers to better manage their resources and environment

# ARDUINO GAS SENSORS KIT



- MQ-135 Air Quality & Hazardous Gas Sensor Module
- MQ-2 Smoke Methane Gas & Liquefied Flammable Gas Sensor Module
- MQ-3 Alcohol Ethanol Gas Sensor Module
- MQ-4 Methane Gas Sensor Module
- MQ-5 Liquefied Gas & Coal Gas Sensor Module
- MQ-6 Isobutene Propane Gas Sensor Module
- MQ-7 Carbon Monoxide Gas Sensor Module
- MQ-8 Hydrogen H<sub>2</sub> Gas Sensor Module
- MQ-9 Carbon Monoxide Combustible Gas Sensor Module

# ARDUINO GAS SENSORS KIT (cont.)



MQ-2



MQ-3



MQ-4



MQ-8



MQ-9



MQ-7



MQ-5



MQ-135



MQ-6

# ARDUINO GAS SENSORS KIT (cont.)



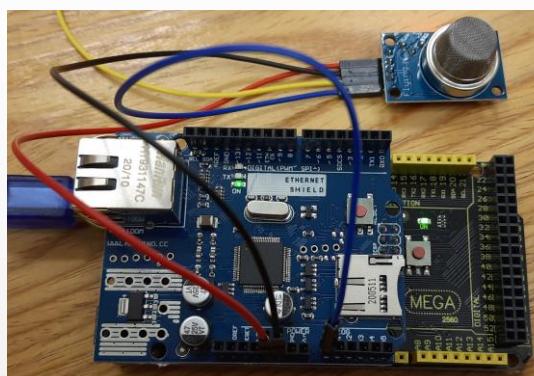
- **Tutorial assignment:** analyze levels of different gases employing sensors MQ-135, MQ-2, MQ-3, MQ-4, MQ-5, MQ-6, MQ-7, MQ-8, and MQ-9 if measurement is possible.

# ARDUINO GAS SENSORS KIT (cont.)

## • An example: Carbon Dioxide (CO<sub>2</sub>) measurement employing sensor MQ-135.

- Normal air returns approximately 100-150 ppm
  - Alcohol returns approximately 700 ppm
  - Lighter gas returns approximately 750 ppm
- PPM stands for “Parts per million”

```
void setup() {  
    Serial.begin(9600);  
}  
  
void loop() {  
    int sensorValue = analogRead(A0); // read the input on analog pin 0:  
    Serial.println("The amount of CO2 (in PPM - Parts per million): ");  
    Serial.println(sensorValue);  
    delay(2000);  
}
```



The moment  
I exhale

Do you have any  
questions or  
comments?





Thank you  
for your attention !

In this presentation:

- Some icons were downloaded from flaticon.com and iconscout.com