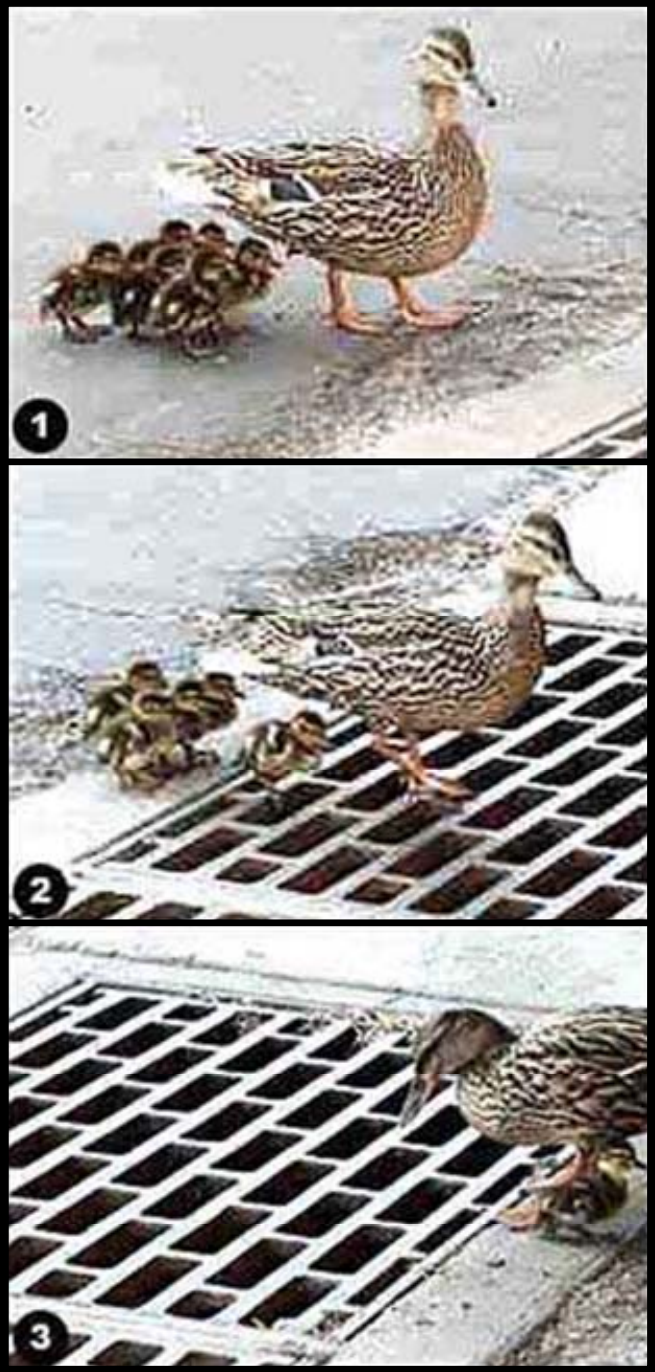
A Practical Approach to Hazard Identification

. . . for operations and maintenance workers

Tim Humbke, Shell Canada, Senior Process Safety Engineer
Robert Wasileski, Senior Process Safety Engineer, NOVA Chemicals Inc.
Christy Franklyn, Director, Process Safety, RRS/Schirmer
Dennis Attwood, Senior Consultant, RRS/Schirmer

Presented at:
American Institute of Chemical Engineers
2009 Spring National Meeting
5th Global Congress on Process Safety
24th Annual CCPS International Conference
Tampa, Florida
April 26–30, 2009



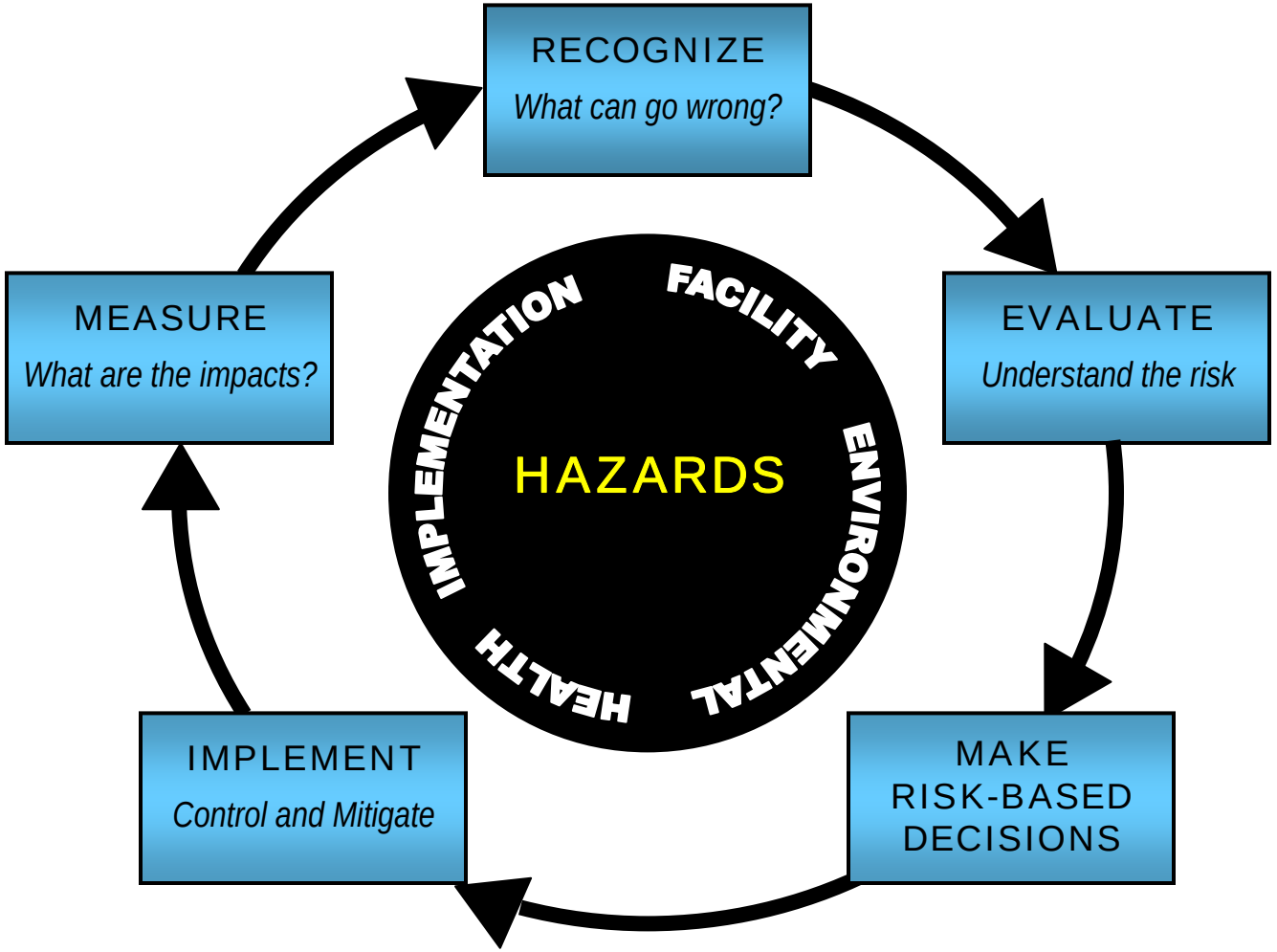
Hazards are all around us . . .

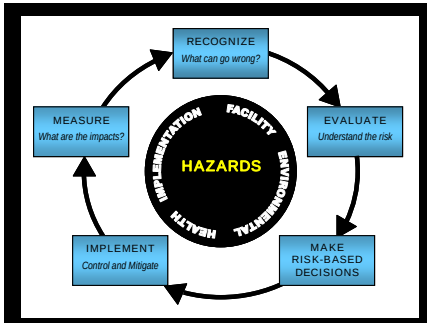
the challenge is to recognize hazards *and then to do something about them!*

New CCPS Concept Book

A Practical Approach to Hazard Identification

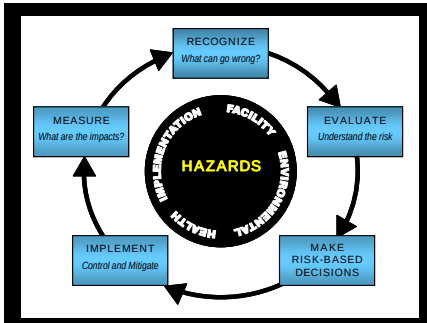
. . . for operations and maintenance workers





Objectives

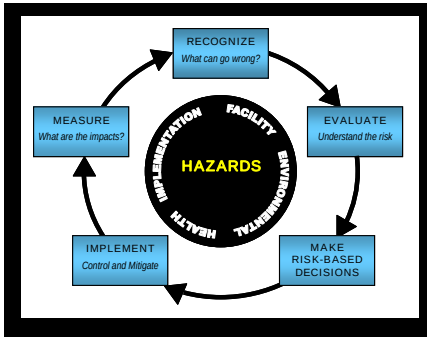
- **This book provides guidance for identifying and controlling hazards in the workplace to help:**
  - **Improve your ability to detect hazards**
  - **Prevent injuries and accidents**
  - **Raise hazard recognition awareness**
  - **Empower you to take action and follow-up**



Intended Audience

- **Operations and maintenance personnel**
- **This book should also provide benefit for those persons who:**
  - **Are planning on participating in a formal process hazards analysis or safety review**
  - **Occasionally enter a process facility and have not received formal training**
  - **Implement new designs in an existing operating facility**
  - **Are new employees**
  - **Are responsible for providing resources for hazard control and elimination**


shown on iSNiCHWAHR.com



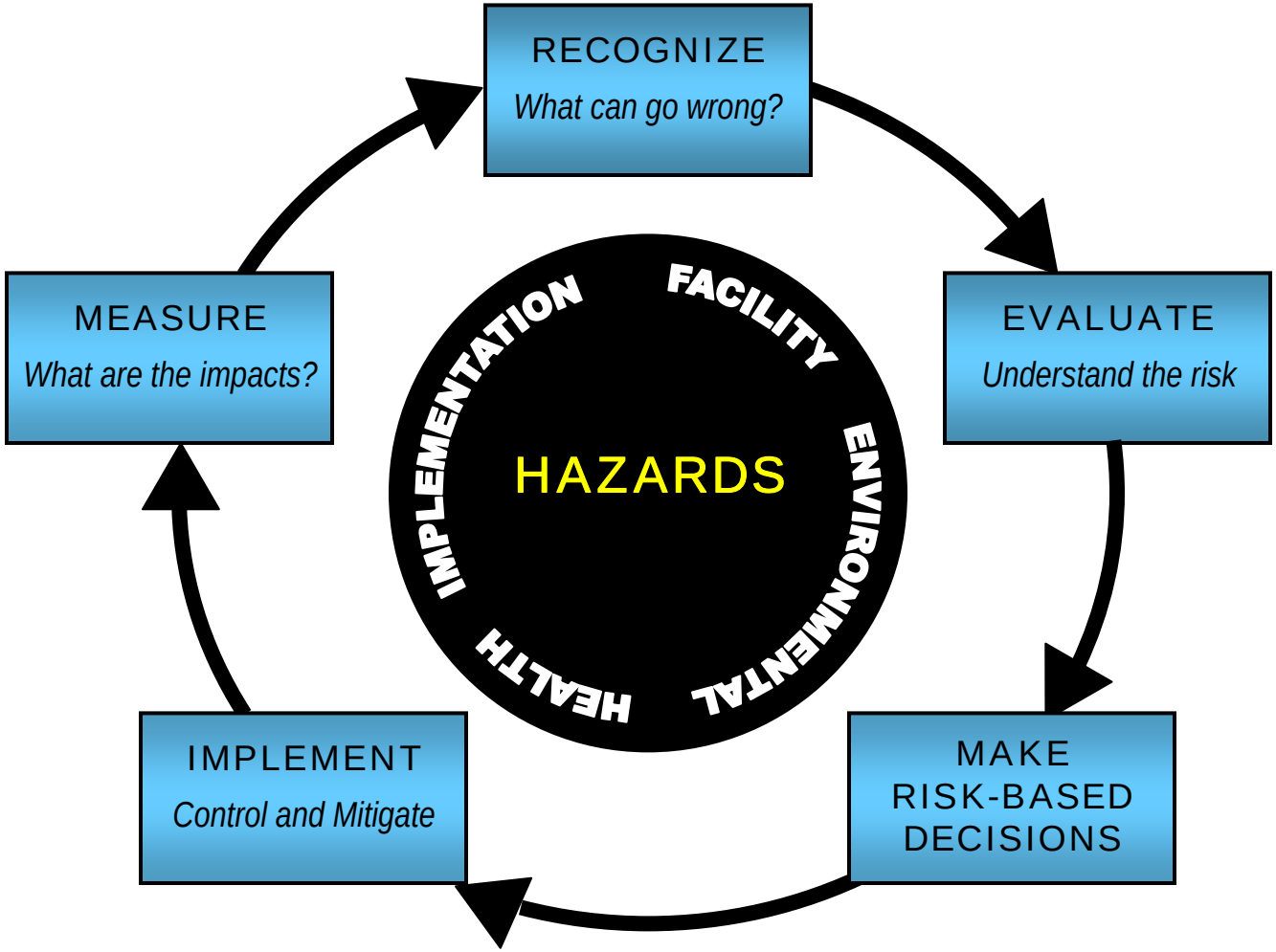
Motivation

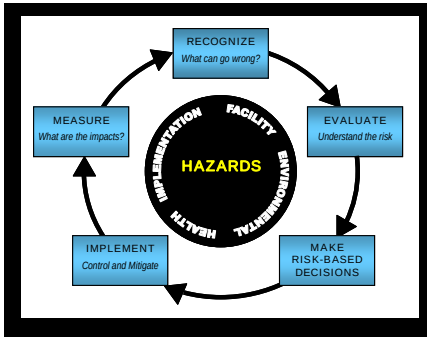
- **The motivation for identifying and managing hazards is simple:**
  - **Everyone wants themselves, their friends, and coworkers to go home safely every day**
  - **Everyone wants to keep their job and process incidents can cause a company to be shutdown**
  - **Process incidents can have consequences for communities located around them. Worker's families and friends often live in these communities.**
  - **We all share the environment and events can cause long-term damage to the environment and the living things that coexist in the same spaces**

AS HISTORY INDICATES, INCIDENTS TEND TO REPEAT THEMSELVES.

How can we learn to manage these hazards and reduce the risk at our facilities?

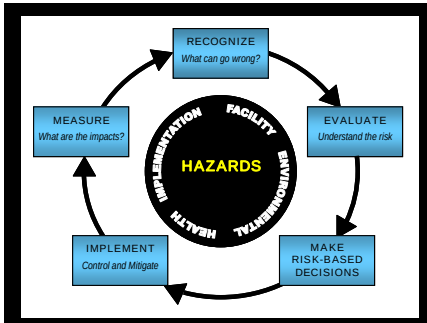
RECOGNIZE


RECOGNIZE
What can go wrong?
EVALUATE
Understand the risk
MAKE
RISK-BASED
DECISIONS
IMPLEMENT
Control and Mitigate
MEASURE
What are the impacts?
HAZARDS
FACILITY
ENVIRONMENTAL
HEALTH
IMPLEMENTATION



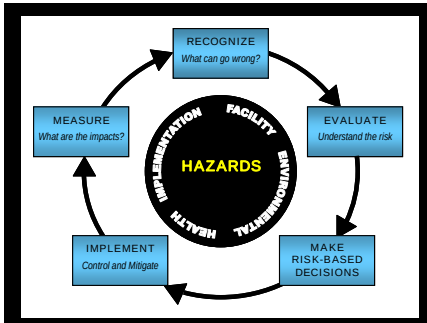
What can go wrong?

HAZARD IDENTIFICATION IS NOT OPTIONAL. IT'S AN ESSENTIAL PART OF DAY-TO-DAY ACTIVITIES.



Hazards

- **Hazards are conditions that can directly cause harm to people and/or damage to equipment and to the environment.**
- **Hazards may be natural or may be the result of some controlled or uncontrolled event.**
- **Hazards in the workplace include chemicals, process equipment, operating conditions and physical activities.**



Physical Hazards

- **Physical hazards are visible and tangible.**
- **Exposure to physical hazards typically results in injuries that are a function of energy, area of contact, and duration of contact.**
- **Physical hazards are often considered occupational safety hazards and include:**
  - **Impact, speed**
  - **Rotating or high energy equipment**
  - **Sharp or cutting edges**

Physical Hazards

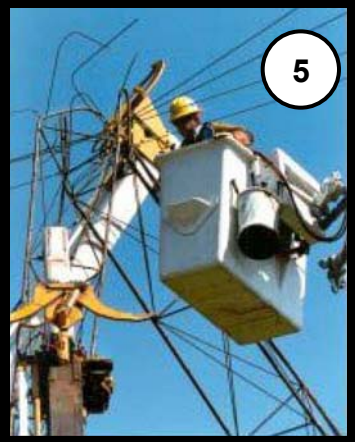
Impaired access to safety shower

Physical hazards include impairing the ability of personnel to access safety equipment, like safety showers and eye wash stations. Improper maintenance of safety equipment also affects their effectiveness in the even of an emergency.

Dirty eyewash station with protective caps removed

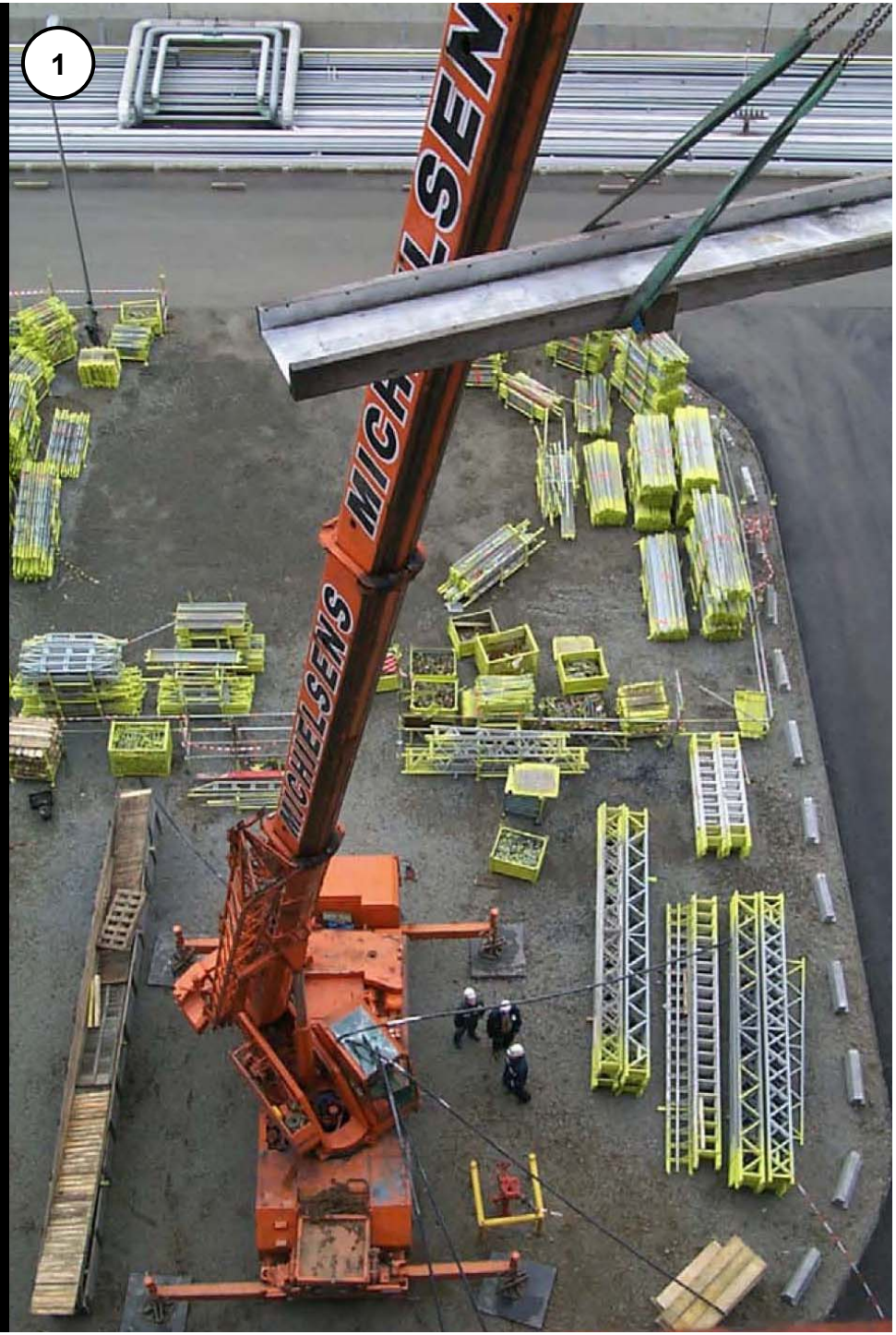
Electrical hazards are usually easy to identify and fix, yet incidents related to exposure to electricity continue to occur.

1) Open electrical equipment;
2) Exposed electrical wiring;
3) Exposed electrical wires near fill connection; 4) Overfull electrical box;
5) Congested power lines.

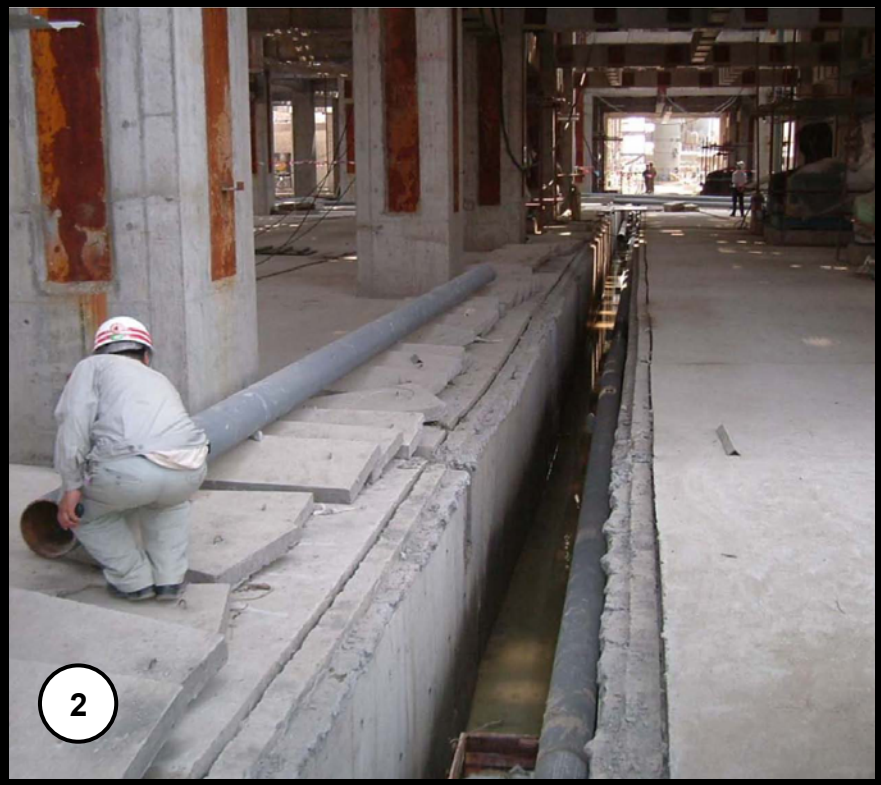


Improper lifting and/or crane operations expose workers to dropped object hazards.

1) Lifting load over people;
2) Lifting pipe over worker below.



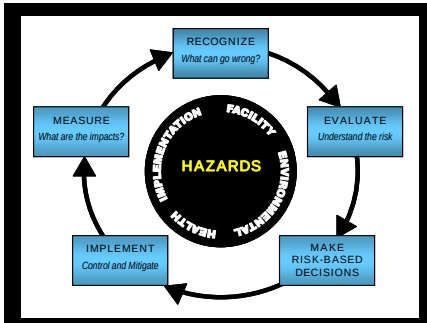
The physical hazards associated with excavation and trenching operations can be very dangerous. Improper trenching (improper sloping or shoring) leads to cave-ins and worker injury. Inadequate barriers also expose workers to hazards.



1) Open excavation, improper sloping and shoring;
2) Open trench without protective barrier.

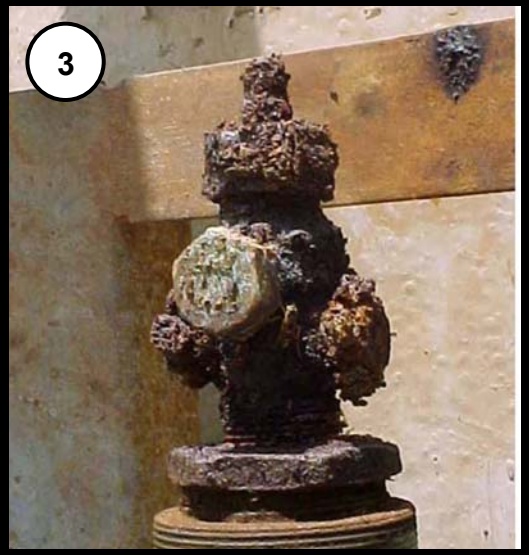
1) Guard too far away from wheel, glove too loose.

Rotating equipment hazards expose workers to hazards that can cause significant injury. Machine guards must be in place to protect worker exposures. Loose clothing should be prohibited around rotating equipment and rings, necklaces, and gloves should not be worn.



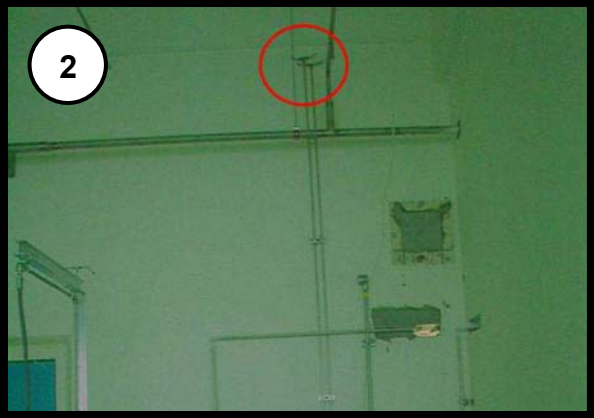
Process Hazards

- **Process hazards are less tangible can be more difficult to recognize than physical hazards - and have much more significant consequences if they are not mitigated.**
- **The potential consequences of process hazards are a function of the type of material involved, its properties and the process conditions.**



Corrosion can lead to the loss of containment of a hazardous material, resulting in a fire, explosion or exposure to toxic material.

1) and 2) Corrosion under insulation causes pipe failure; 3) and 4) Corrosion causes valve malfunctions or leaks



As evidenced by recent incidents in the process industries, atmospheric relief valves and their location can pose significant hazards.

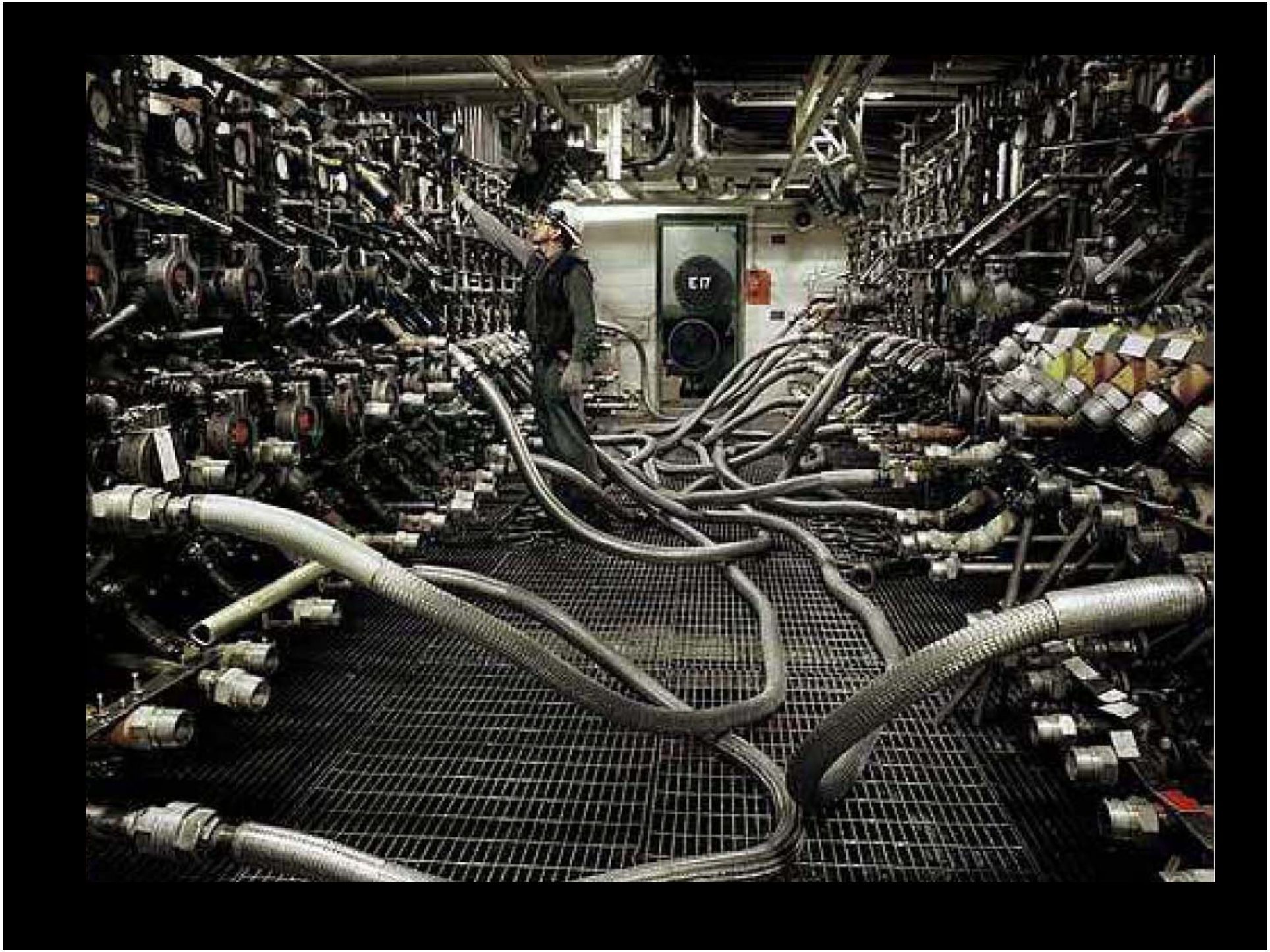
1) Liquid hydrocarbon relief valve not piped to closed system; 2) Vent stack piped indoors; 3) Unsafe PSV venting location; 4) Safety relief valves discharge into an enclosed area, creating a hazardous atmosphere.

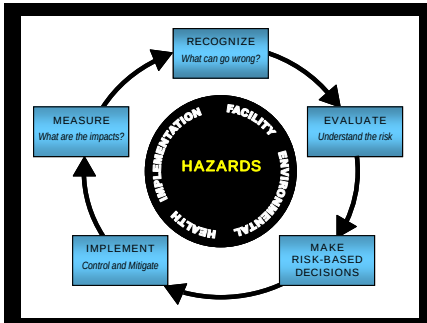
Repairing operational issues without going through a facility's Management of Change program can lead to unforeseen process incidents.

1) Pipe flanges used as vibration anchor point; 2) Relief valve (critical safety device) used as vibration anchor.

Often, hazardous situations have existed at a facility for a period of time and because we see them everyday, we fail to recognize their significance as a process hazard.

1) Broken or malfunctioning instrumentation could lead to process upset and subsequent release of hazardous material;
2) Highly congested area creates fire hazards and poor operator access/egress;
3) Fireproofing integrity lost;
4) Building HVAC intake in process area;
5) Storage tank in enclosed area creates hazardous atmosphere.

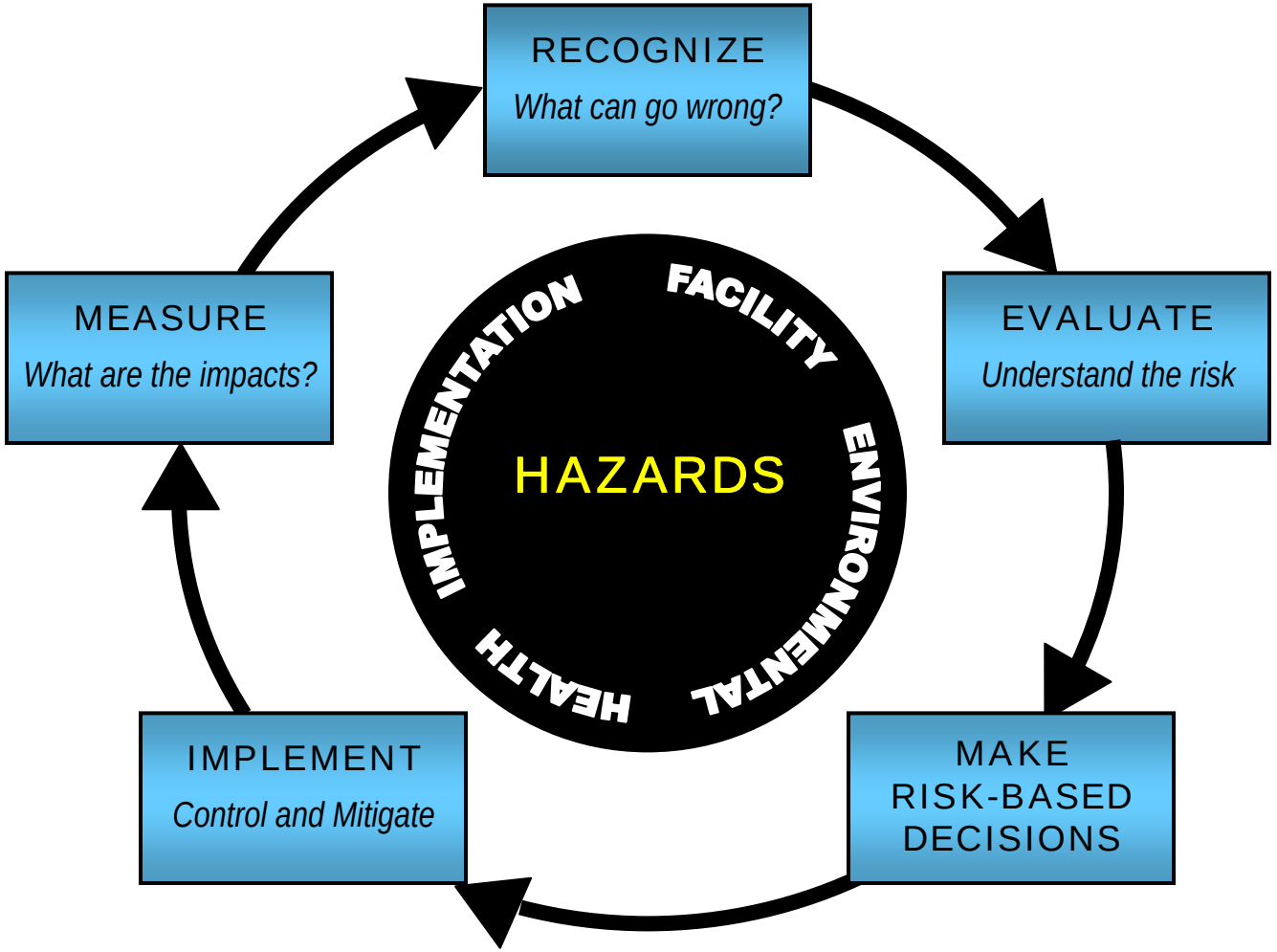


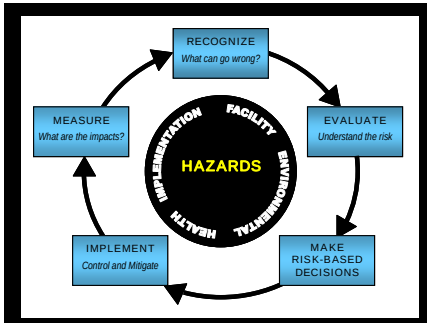


Hazard Recognition

- **Identifying hazards often depends on our ability to recognize the hazard. Hazards are most often recognized using our basic senses:**
  - **Sight**
  - **Sound**
  - **Smell**
  - **Touch**
- **The Concept Book will provide guidance on how our senses are used to detect hazards in the workplace – as well as the limitations of our senses.**

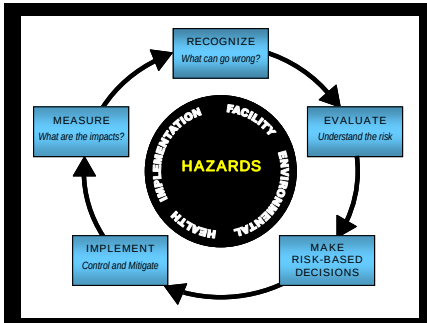
EVAULATE


RECOGNIZE
What can go wrong?
EVALUATE
Understand the risk
MAKE
RISK-BASED
DECISIONS
IMPLEMENT
Control and Mitigate
MEASURE
What are the impacts?
HAZARDS
FACILITY
ENVIRONMENTAL
HEALTH
IMPLEMENTATION



Understand the Risk

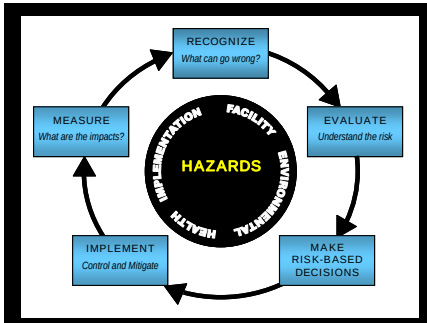
- **There are a number of hazard identification methods that have been developed in the process industry over the last 20 years. They can be categorized into three groups:**
  - **<u>Field Surveys</u>: Tools that are designed to collect data in the field either through walk-through surveys using custom-designed checklists, or through the observation of personnel as they perform operations or maintenance tasks.**
  - **<u>Pre-job Assessments</u>: Tools that are designed to evaluate the job site to identify hazards in the area of interest.**
  - **<u>Plant Assessments</u>: Tools that are designed to identify hazards either before the plant is designed or in an existing plant with the thought of improving the design of facilities or equipment.**



Field Surveys

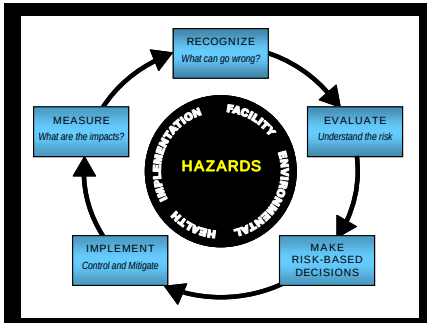
Behavior Observation

- **Behavior is defined as what workers do or say - i.e., their actions - not what they think or feel. Thus, behavior is an objective observable concept.**
- **Observing the behavior of operators can provide insight on:**
  - **Errors that are committed during the performance of the task**
  - **Time required to perform each activity**
  - **Difficulty or ease with which the task is performed**
  - **Improved ways of performing the task or alternative tools that could be used to perform more safely or efficiently**
  - **Quality of procedures**



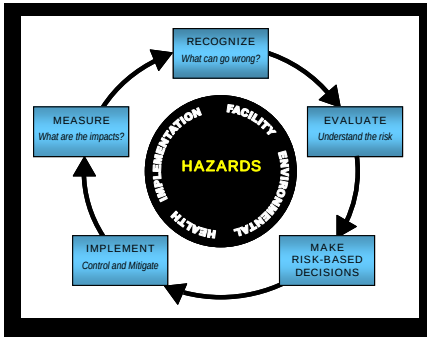
Performing Behavior Observations

- **Direct observation: Where an observer deliberately observes another person (or persons) performing a task. This is arguably the most frequent method used and is key to behavior-based safety programs.**
- **Indirect observation: Where those being observed do not know they are being observed. Traffic and pedestrian surveys fall into this category.**
- **Participatory observers: Where the observer is the one performing the task.**



Preparation is Key

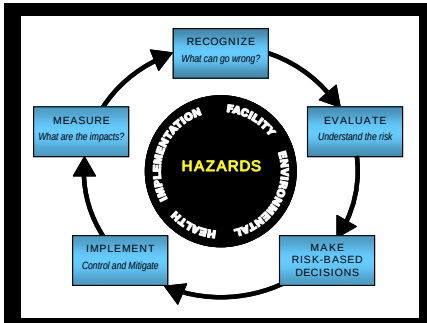
- **What activities will be observed?**
- **What is the instrument that is used for observation?**
- **Who is being observed?**
- **Who is making the observations?**
- **What data are being collected?**



Field Surveys

Plant Walkthrough Checklists

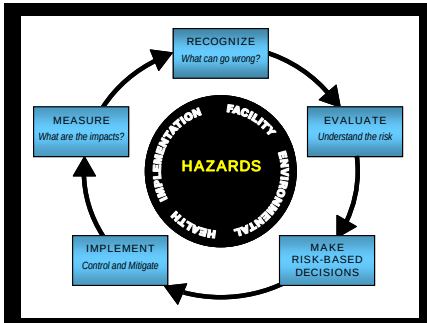
Checklist Question	Illustration	Present (√)	Responsible Group			Potential Mitigation
			Maint.	Oper.	Design	
Potential adverse outcome from inadvertent leaning against control panel, switches, etc.?						
Labels on critical switches, valves, piping and vessels inadequate?						
Valve access inadequate?						



Pre-Job Assessments

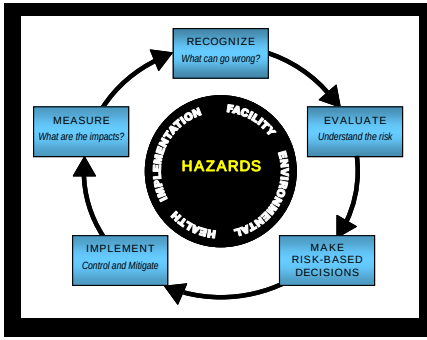
Job Hazard Analysis

- **A Job Hazard Analysis (JHA) is a technique that is used to identify and assess the hazards in a job before they occur. The JHA focuses on a specific job and examines the:**
  - **Steps required to perform the job**
  - **The relationship between the job and the worker(s), the tools used by the worker(s) and the work environment**
- **It evaluates the risk of injury involved in the task and specifies interventions to reduce the risk. Other terms used to describe this technique are Job Safety Analysis (JSA) and Job Hazard Breakdown (JHB).**



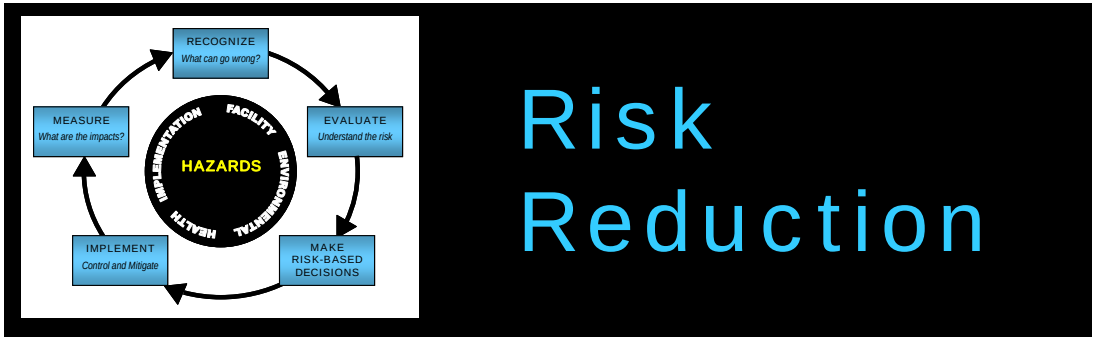
Plant Assessment
Critical Task Analysis

- **Critical Task Identification Analysis (CTIA) is a systematic method of:**
  - **Identifying critical tasks within a process plant**
  - **Prioritizing their importance**
  - **Analyzing those tasks that are considered most critical**
  - **Identifying appropriate interventions to mitigate the risk**
- **Team approach:**
  - **Process Technician**
  - **Maintenance Technician**
  - **Plant Engineer**
  - **Health and Safety Specialist**
  - **Human Factors Specialist**



Plant Assessment
Critical Task Analysis

- **Step 1 – Create Process Flow Diagram**
- **Step 2 – Identify Process Significant Tasks**
- **Step 3 – Identify the Risk of a Loss Event**
- **Step 4 – Identify Highest Risk Tasks**
- **Step 5 – Identify Steps to Mitigate Risk**



Risk Reduction

- **Inherently Safer Designs**
- **Engineering Controls**
- **Administrative Controls**
- **Personal Protective Equipment**

Hazard

Risk

Eliminate the hazard or risk

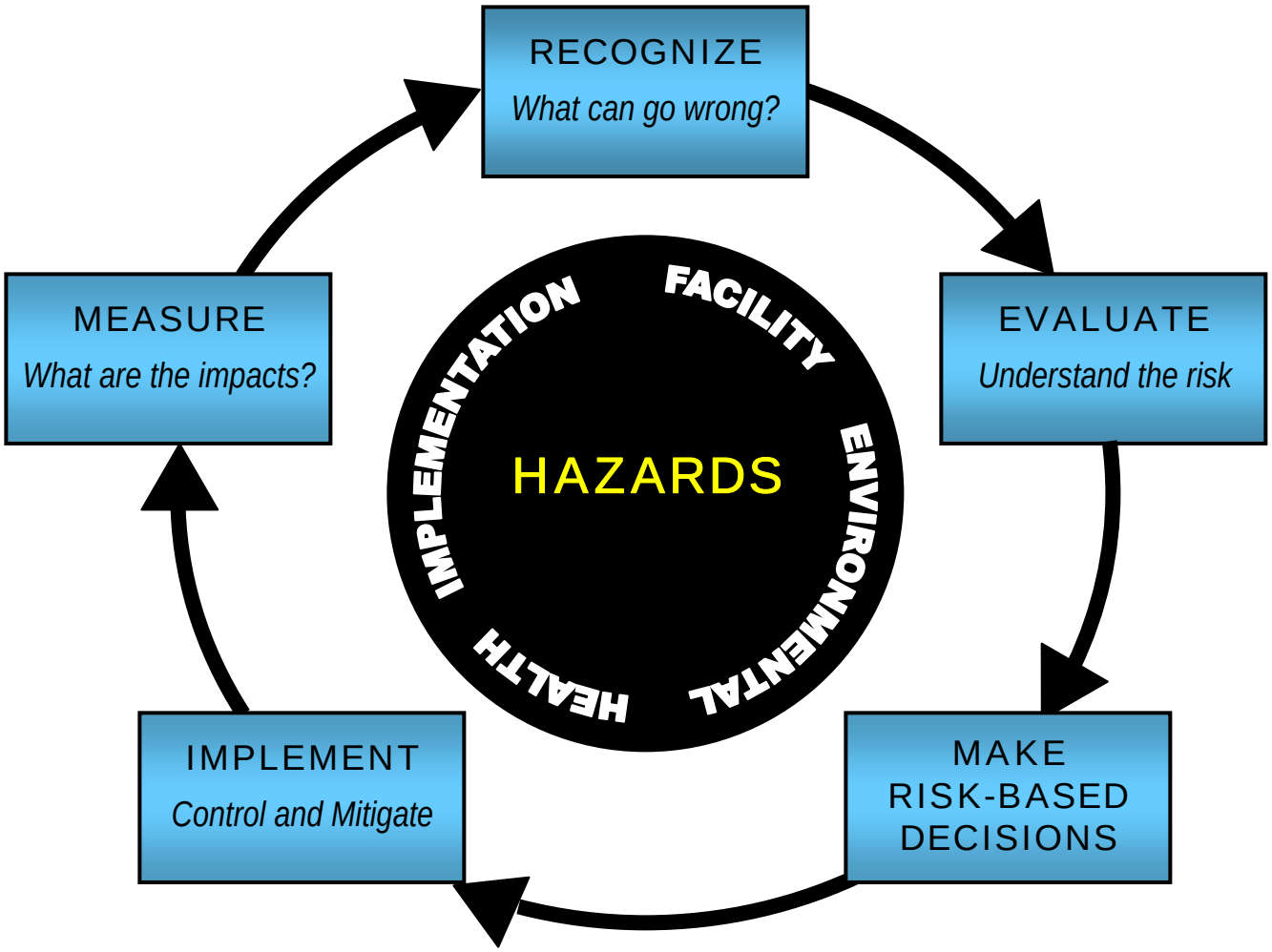
Engineer out the problem

Introduce administrative controls

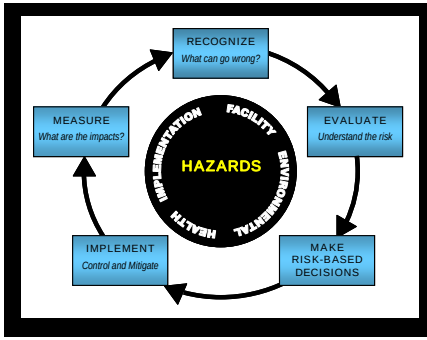
Provide personnel protective equipment

What's Next?

- **Make Risk-Based Decisions**
- **Implement**
- **Measure**




TOYOTA



Summary

- **The CCPS Concept Book will provide a practical approach for hazard identification for operations and maintenance workers.**