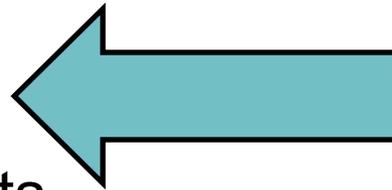


CAST Analysis Accidents and Hazards

CAST Process

- Identify the Accident (Loss)
- **Identify the Hazards**
- Identify the Safety Constraints
- Identify the Proximal Events
- Draw the Safety Control Structure
- Analyze each component (Next class)



One of the
hardest parts
to do!

Definitions

- Accident (Loss)
 - An undesired or unplanned event that results in a loss, including loss of human life or human injury, property damage, environmental pollution, mission loss, etc.
 - May involve environmental factors **outside our control**
- Hazard
 - A system state or set of conditions that, together with a particular set of worst-case environment conditions, will lead to an accident (loss).
 - Something we can **control** in the design

Accident	Hazard
Satellite becomes lost or unrecoverable	Satellite maneuvers out of orbit
People are exposed to toxic chemicals	Toxic chemicals are released into the atmosphere
People are irradiated	Nuclear power plant experiences meltdown
People die from food poisoning	Food products containing pathogens are sold

Practice: Accidents and Hazards

- Accident (Loss)
 - ?
- Hazard
 - ?

Practice: Accidents and Hazards

- Accident (Loss)
 - A-1: Two aircraft Collide
- Hazard
 - H-1: Two aircraft come within 5nm of each other

Aviation accident examples

- Accident A-1: Two aircraft collide
- Accident A-2: Aircraft collides with terrain or sea
- Accident A-3: Aircraft collides with another object during touchdown (or during takeoff)

Aviation hazard examples

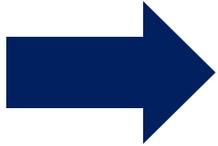
- *Hazard H-1*: a pair of controlled aircraft violate minimum separation standards
- *Hazard H-2*: aircraft enters unsafe atmospheric region
- *Hazard H-3*: aircraft enters uncontrolled state
- *Hazard H-4*: aircraft enters unsafe attitude (excessive turbulence or pitch/roll/yaw that causes passenger injury but not necessarily aircraft loss)
- *Hazard H-5*: aircraft enters a prohibited area

Citichem Accidents and Hazards

- Accident A-1: Death, illness, or injury due to exposure to toxic chemicals.
- **Public health control system**
 - Hazard H-1: Exposure of the public to toxic chemicals
 - SC-1.1: The public must not be exposed to toxic chemicals.
 - SC-1.2: Measures must be taken to reduce exposure if it occurs
 - SC-1.3: Means must be available, effective, and used to treat exposed individuals outside the plant
- **Chemical plant process**
 - Hazard H-2: Uncontrolled release of toxic chemicals
 - SC-2.1: Chemicals must be under positive control at all times
 - SC-2.2: Measures must be taken to reduce exposure if inadvertent release occurs
 - SC-2.3: Warnings and other measures must be available to protect workers in the plant and minimize losses to the outside community
 - SC-2.4: Means must be available, effective, and used to treat exposed individuals inside the plant.

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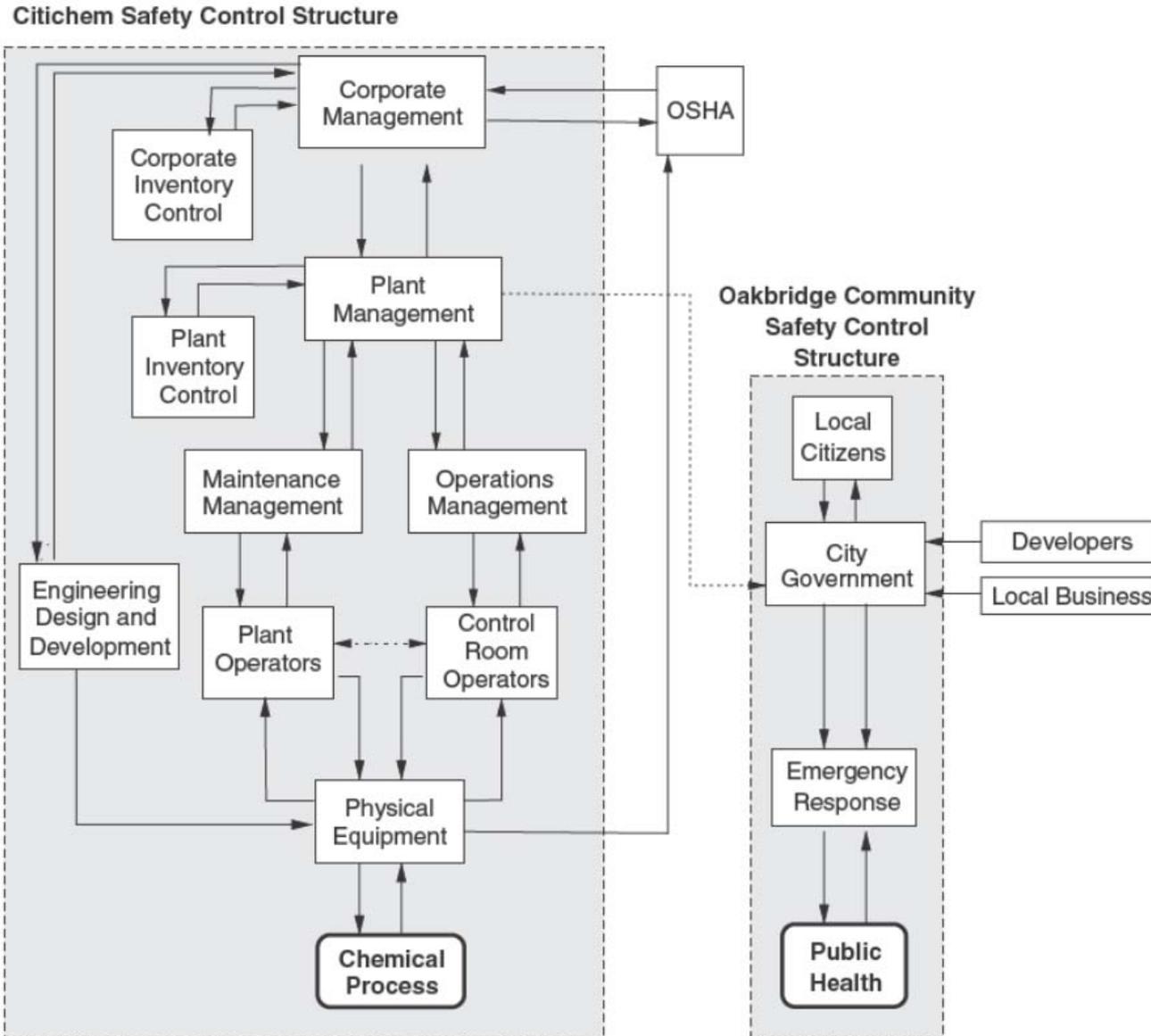


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Safety Control Structure



From Leveson, Nancy (2012). Engineering a Safer World: Systems Thinking Applied to Safety. MIT Press, © Massachusetts Institute of Technology. Used with permission.

CAST Process

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16.63J / ESD.03J System Safety
Fall 2012

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