Safety in Construction Design

Every single worker deserves to go home to his family in the same condition he arrived in!!!!

Sudhir Mishra

Safety Credo

ACHIEVEMENTS

1 million man-hours without LTA in

- Block 5 Development Package 14, MOQ
- 9 Well platform project, ONGC
- Songo Songo, Tanzania

No work related ill-health

No occupational accident & material damage

No harm to the environment

No personal injuries

ZERO INCIDENT CREDO

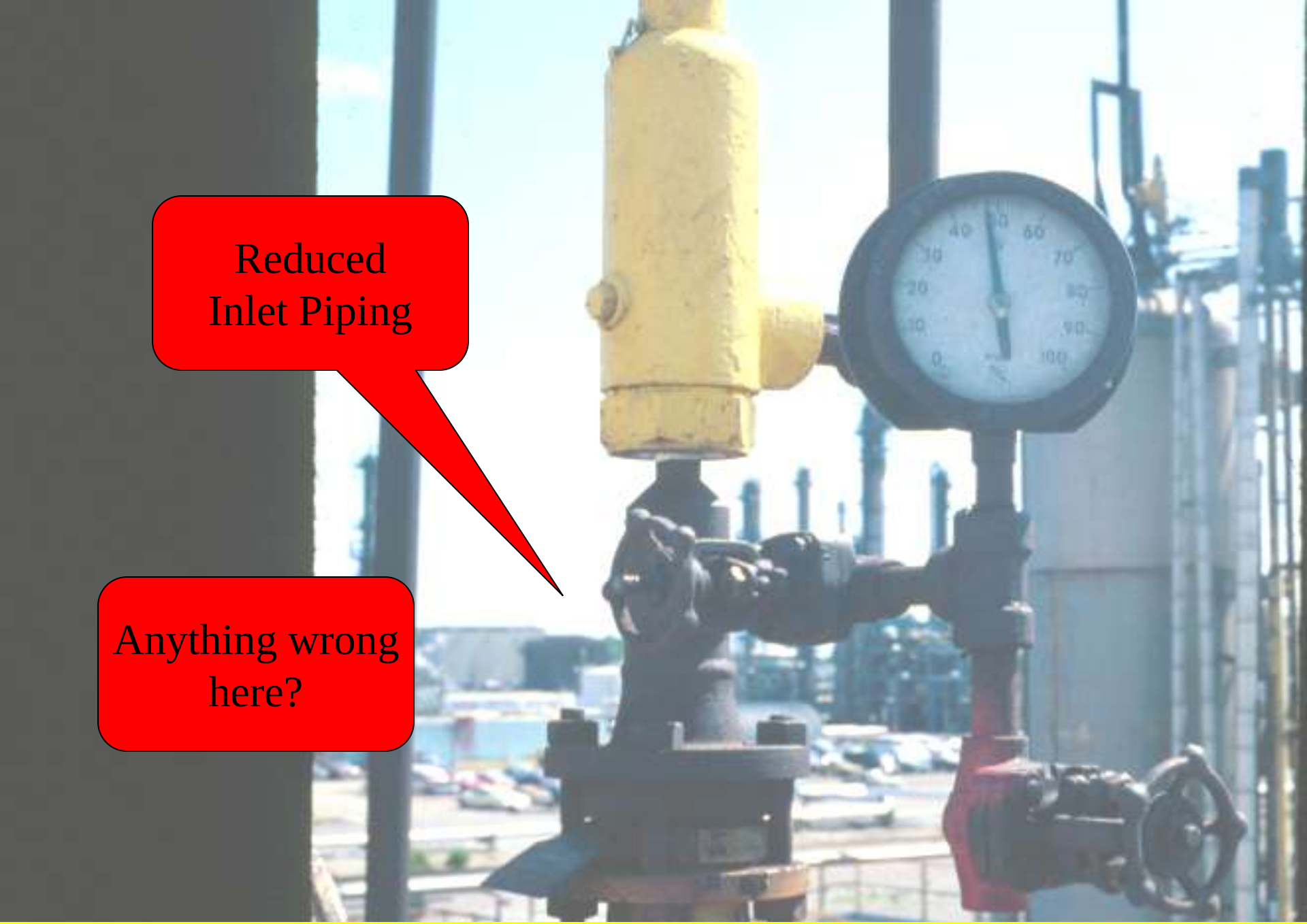
All operations OHSAS 18001 and ISO 14001 certified

Construction Accidents

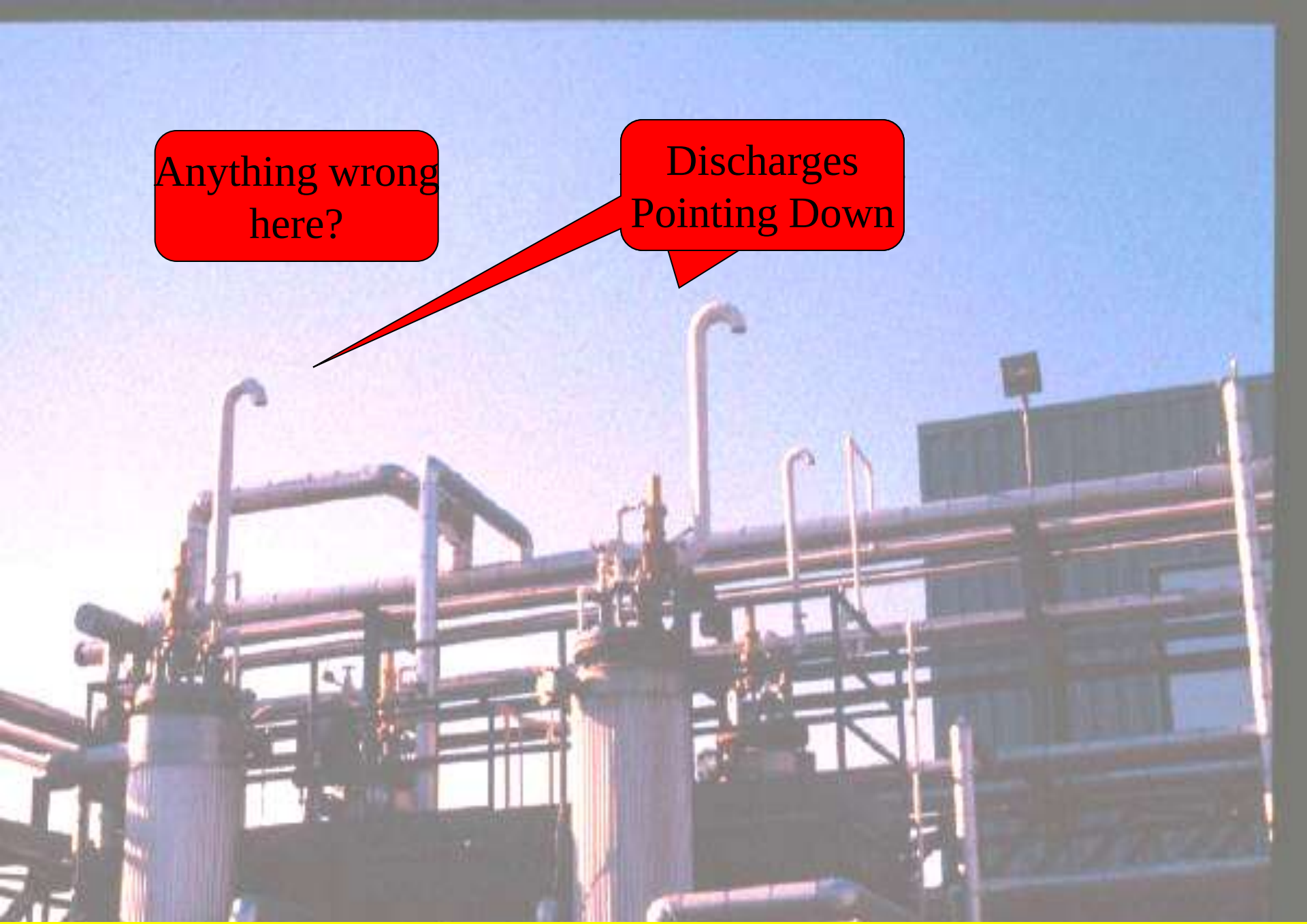
- 56% falls from height
- 21% trapped by something collapsing or overturning
- 10% struck by a moving vehicle
- 5% contact with electricity or electrical discharge
- 4% struck by a flying/falling object during machine lifting of materials
- 3% contact with moving machinery or material being machined
- 1% exposure to a hot or harmful substance

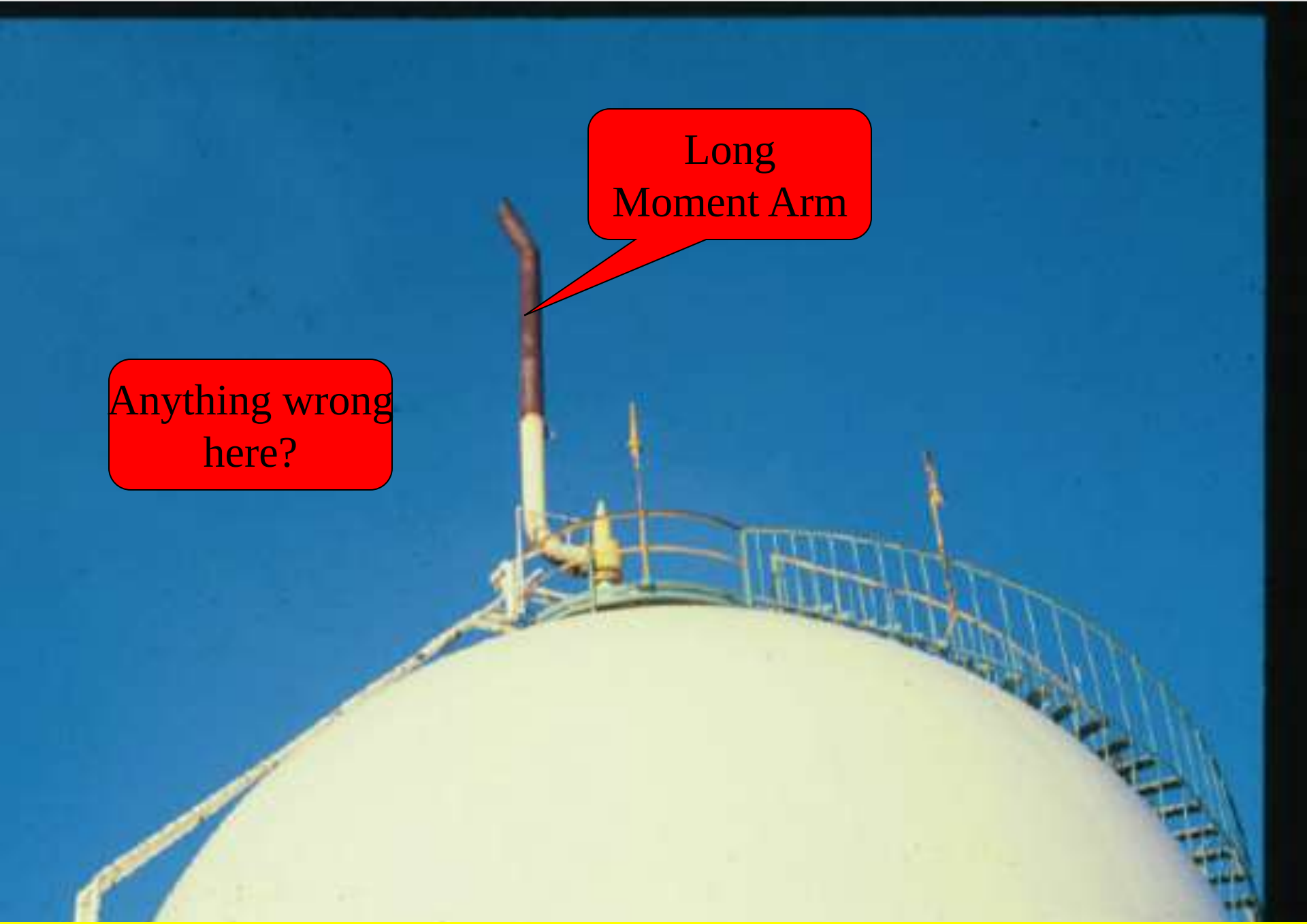

DANGER! AN ACCIDENT WAITING TO OCCUR!
No Fall Protection.
Scaffold missing planking. Competent Person?
DON'T BECOME A STATISTIC !!
DON'T GET CAUGHT IN THE DROP ZONE
FALLS KILL

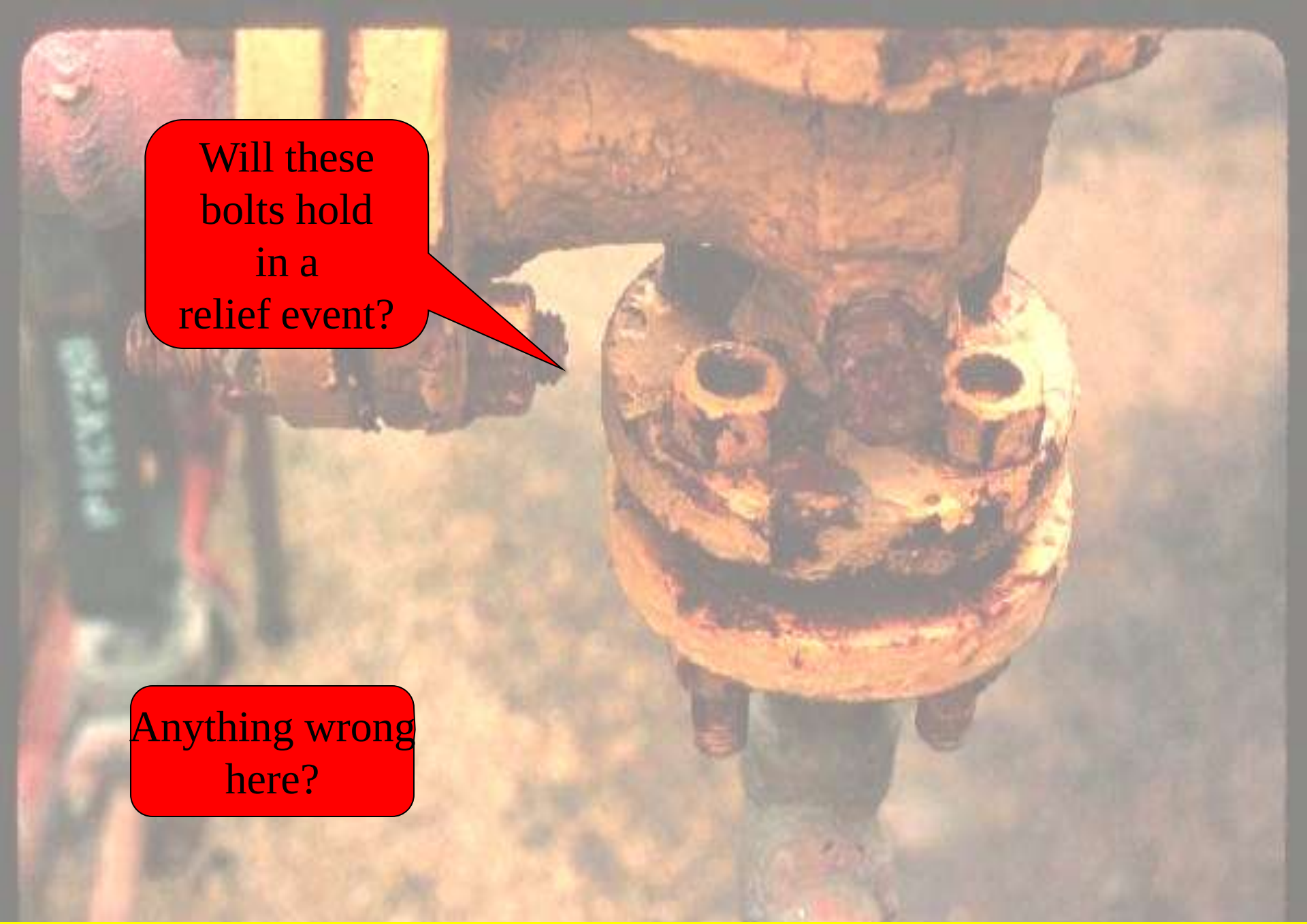

Excessive overhang on planks
No fall protection
Guardrails missing on working levels


Reduced
Inlet Piping
Anything wrong
here?


Anything wrong here?
Signs of Maintenance Issues
Bellows plugged in spite of sign
Failed Inspection Program
BELLOWS SEALED
SAFETY VALVES
ENSURE PLUG IS REMOVED
FROM BONNET

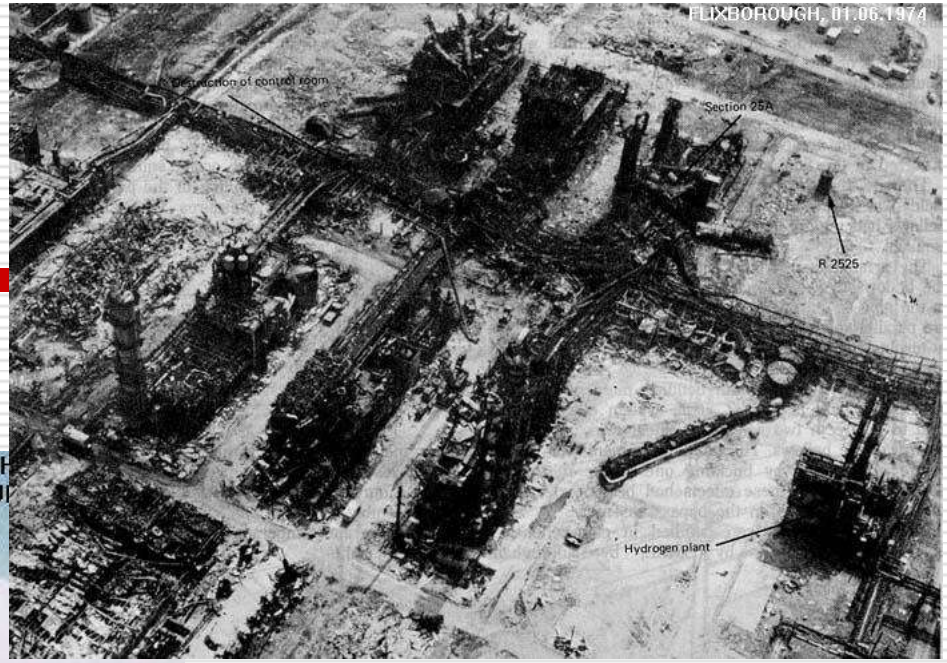

Anything wrong here?
Discharges Pointing Down


Long
Moment Arm
Anything wrong
here?


Will these bolts hold in a relief event?
Anything wrong here?

Flixborough

1 June 1974



- Modification Control
- Use suitably trained, educated and responsible people
- Know what you don't know

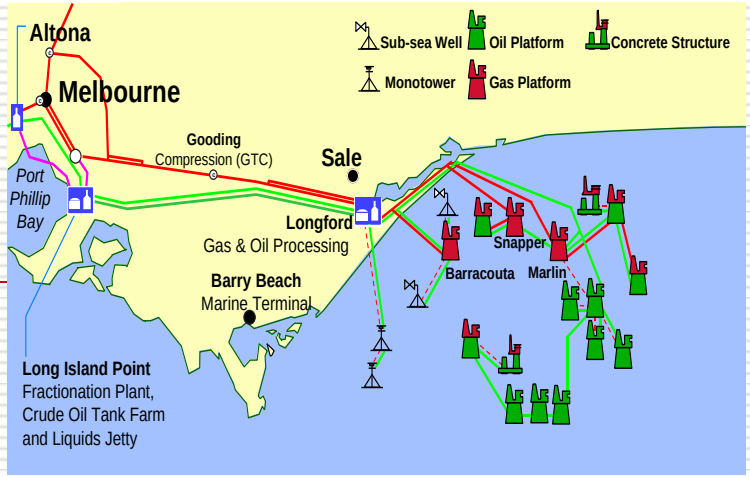
Seveso

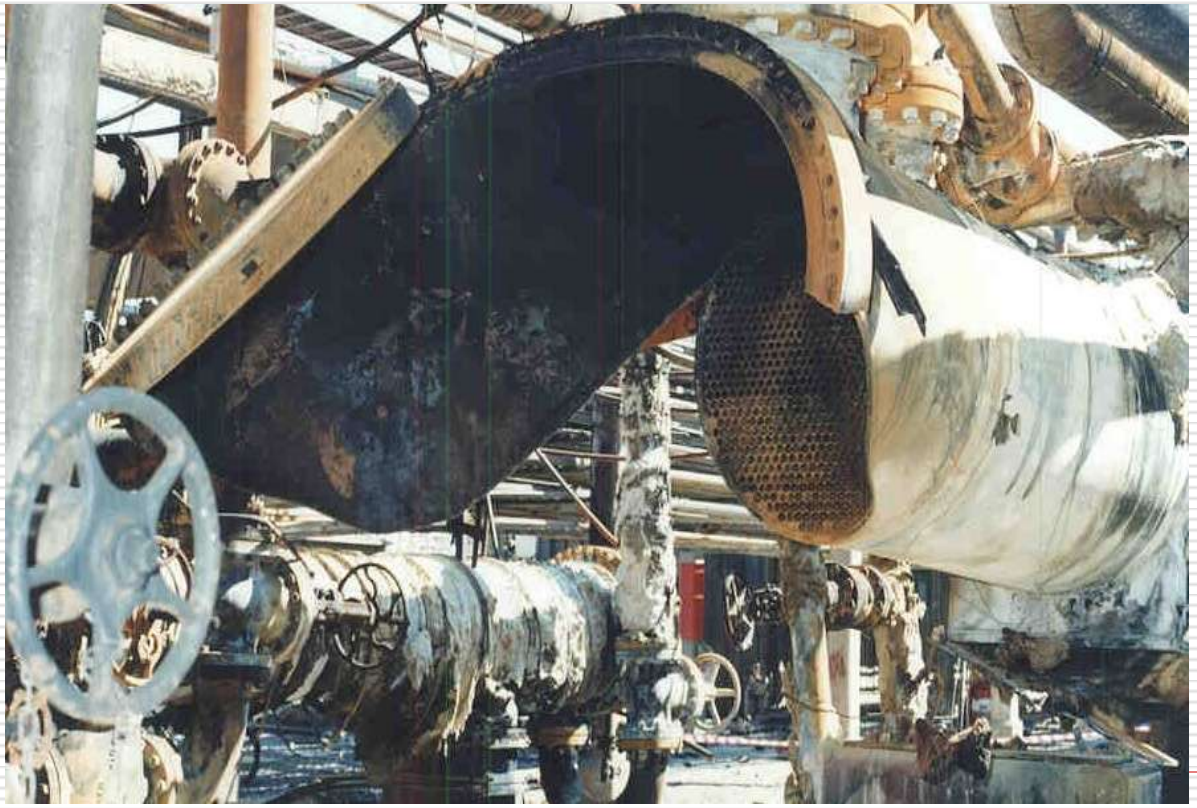
July 1976

- Understanding safe state to leave reactions
- Multiple layers of protection
- Automated Reaction stop systems for exothermic systems

Longford

25 September 1998





- Training needs to impart and refresh knowledge.
- Must identify other hazards and provide relevant training.
- Corporate knowledge must be captured and kept alive

Major Accidents

Piper Alpha

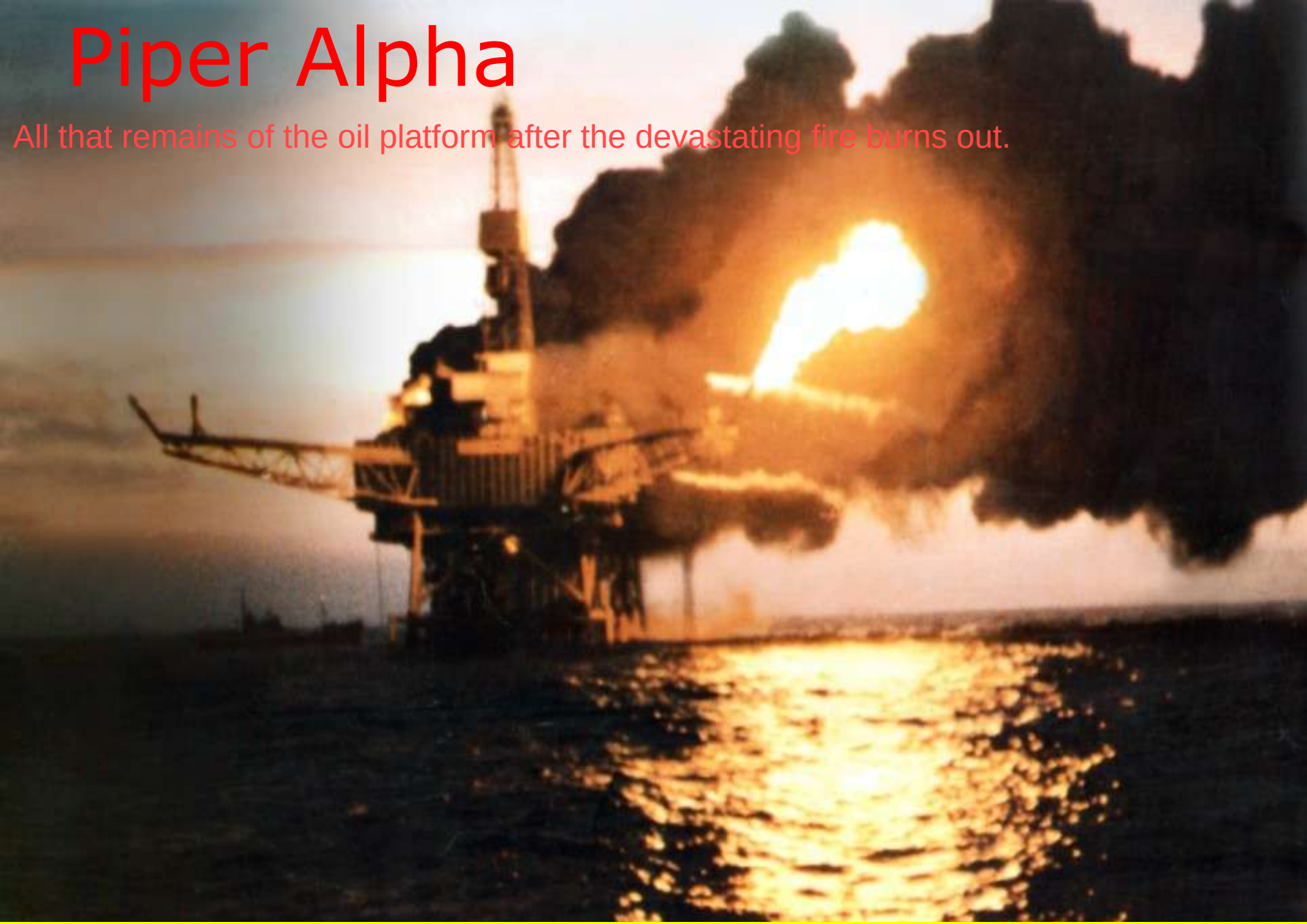
- Deadliest Accident so far: 1988 Piper Alpha (167 fatalities)
- Caused by a Simple Mistake
  - A Pressure Safety Valve was accidentally left open after Maintenance
  - Plant started without knowing this
- Oil Fire ruptured Gas Riser leading to Massive Release of Gas

Piper Alpha

The Piper Alpha, as seen from a crew change helicopter, before the fire started.

Piper Alpha

All that remains of the oil platform after the devastating fire burns out.



Major Accidents

Deepwater Horizon Rig (2010)

- Explosion on Transocean Rig Deepwater Horizon
- Fire followed by the Rig sinking
- 24000 Gallons of Oil leaking from BOP Riser
- Worst Environmental Disaster in USA

Deepwater Horizon Rig

The Deepwater Horizon Rig, before the fire Accident (2010).

Deepwater Horizon Rig Capsizes (2010)

Bombay High offshore installation 2005: Risk assessment identified that the installation was vulnerable to ship collision because a critical pipe was unprotected. Work was planned to build a guard around the pipe.

On 28 July 2005 the dive support vessel collided with the installation, the edge of the vessel's heli-deck cut the pipe. 10 employees (from 220) and 40% of India's crude oil supply were lost.

The hazards identified in risk assessment are real and require action

LOAD OUT
MHN RD N-14 PLATFORM

When Finished……Past Glory Restored
MHN RD N-14 PLATFORM

Common failures can be avoided by robust design

Successful Thought is One Thought Away From Normal Thought….

Structural/ Environmental

Causes:

Structural failures due to extreme weather

Corrosion

Inadequate design

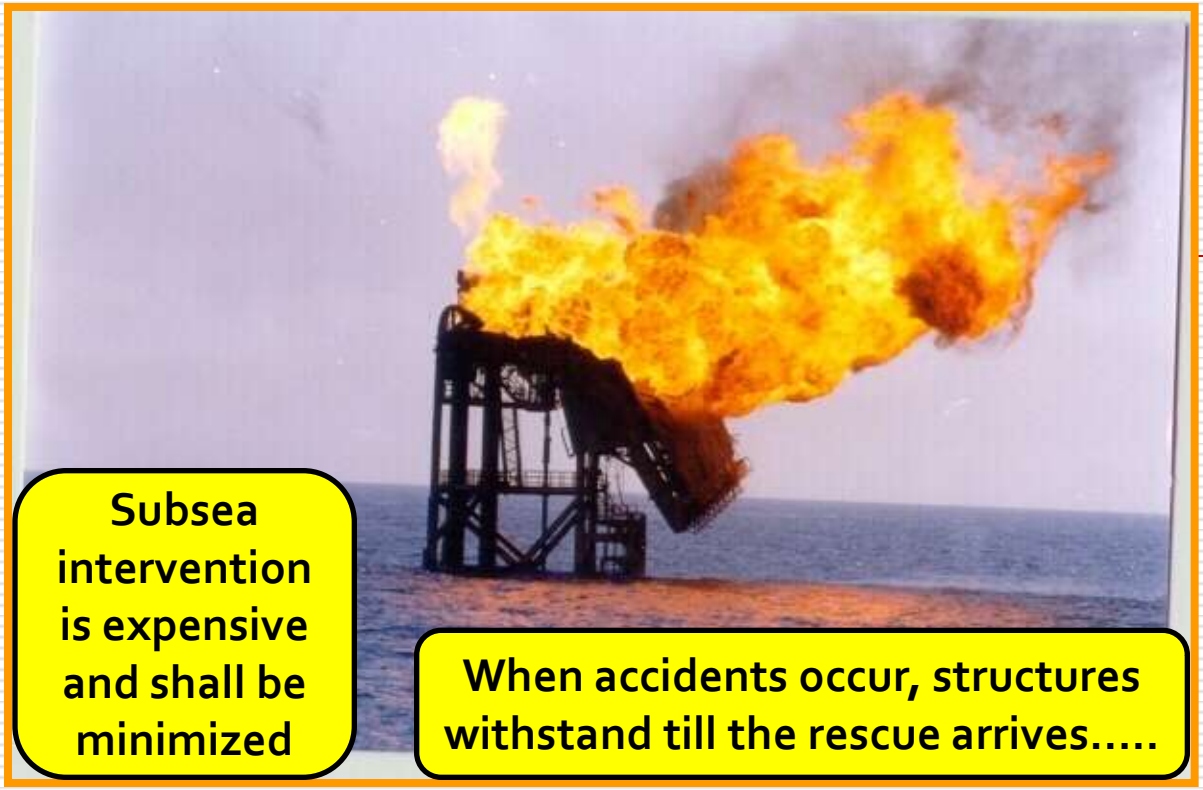
Crane boom collision

Consequences:

Asset damage

Multiple fatalities / injuries

Platform Destroyed by Drifting SEMI



Subsea intervention is expensive and shall be minimized

When accidents occur, structures withstand till the rescue arrives…..

Excessive deflections are cause of worry….

Inadequate Deck Height due to Subsidence

The seafloor at this location has subsided 10 feet. The (+)10 is at the waterline.

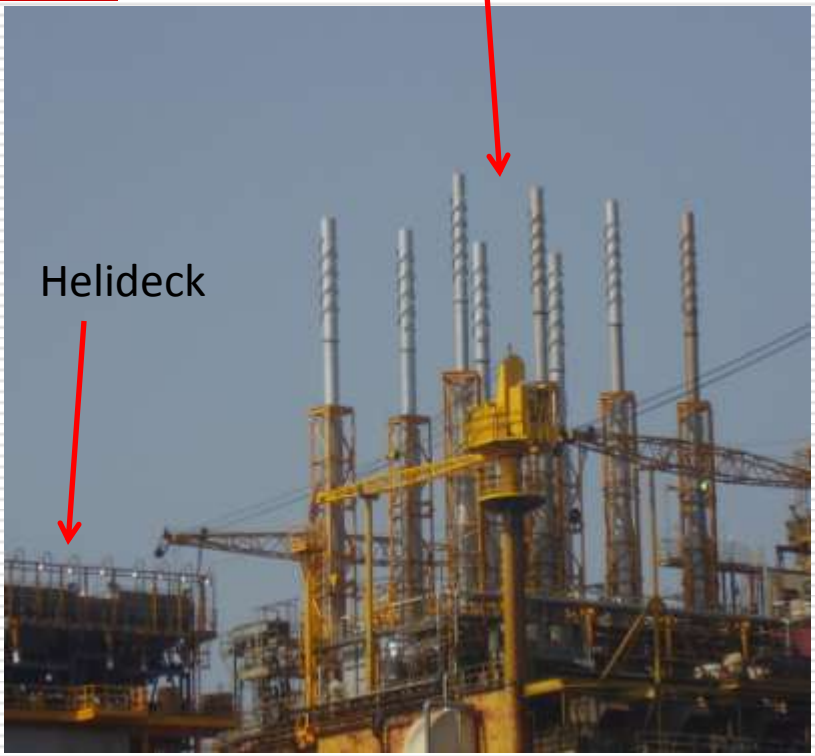
Mitigation

Reduce Consequence of Failure

1. Reduce Load on Platform
2. Increase Strength of Platform

Horizontal Exhaust of WHRE

Vertical Exhaust (25 m from deck plate)



Before

After

Job: Modification of Exhaust Duct to Prevent Hot Air during Chopper Take-off

Exposed Hot Oil Line

Crane Pedestal

Line Protective Shed Structure

Before

After

Job: Protective Shed Installation for Hot Oil Lines (NQO-NQP Bridge)

Deteriorated Heat Insulation

Replaced with new A-60 Rated Insulation

Before

After

Job: Insulation below switch gear, control rooms and transformer rooms

No Secondary Staircase for Emergency

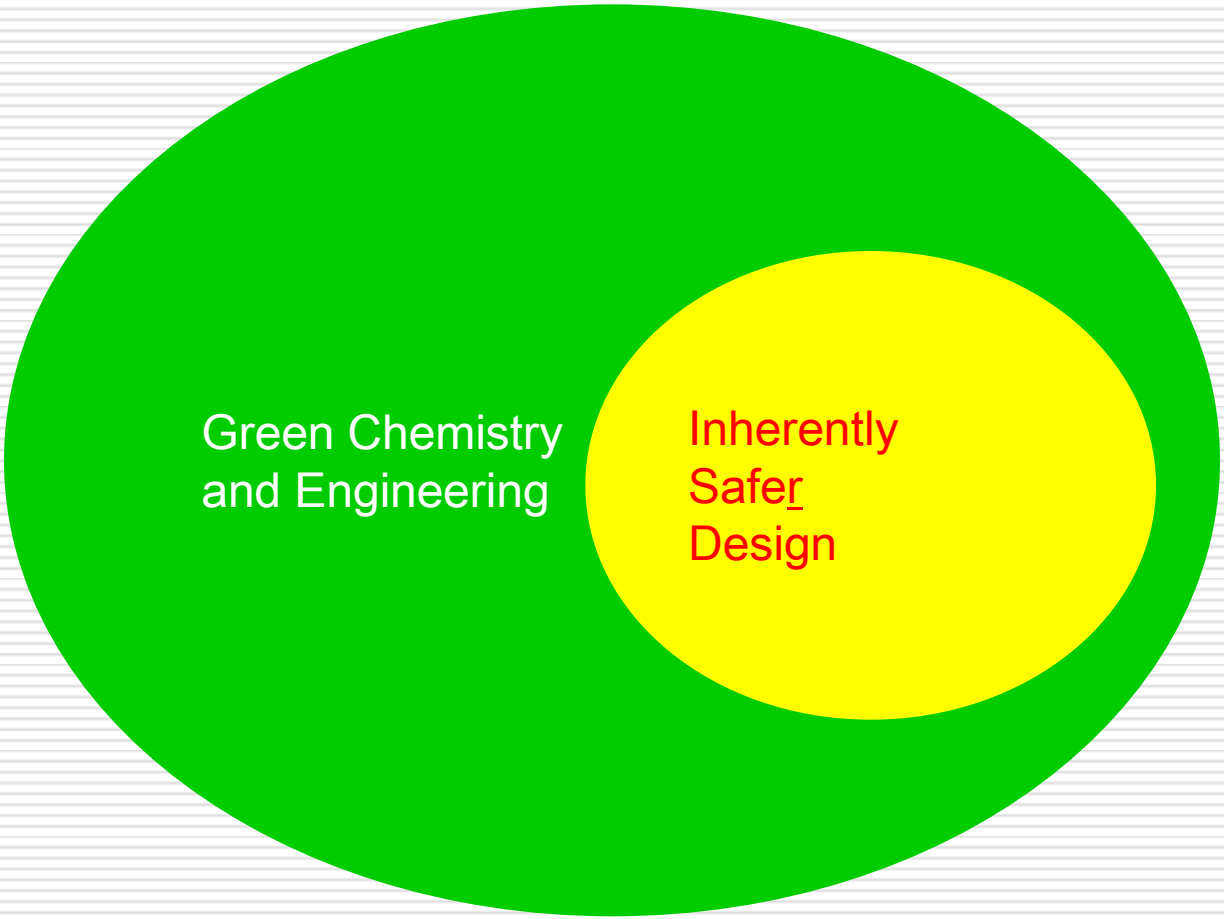
Before

New Staircase Installed

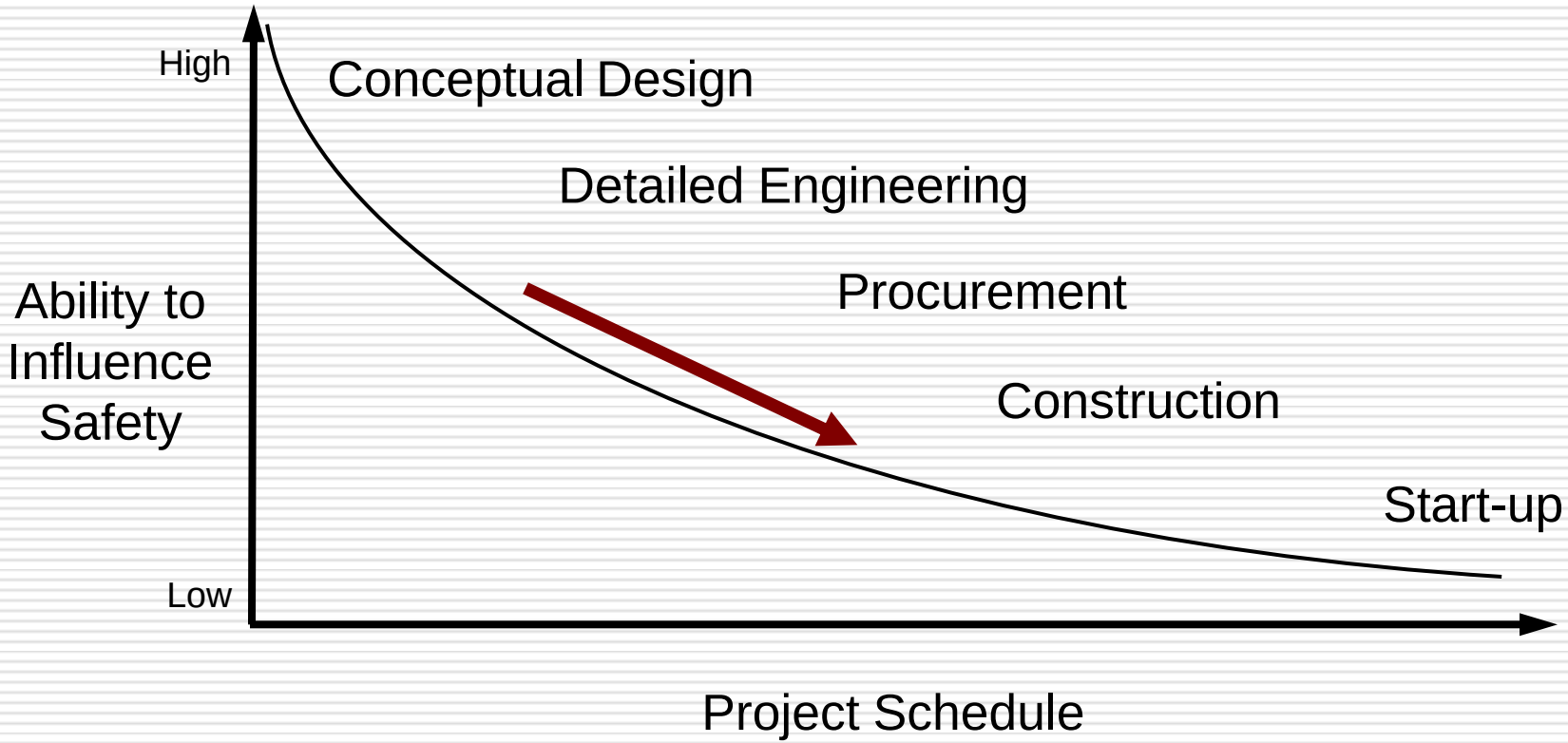
After

Job: Additional Staircase for Emergency from TG Top to Control Room

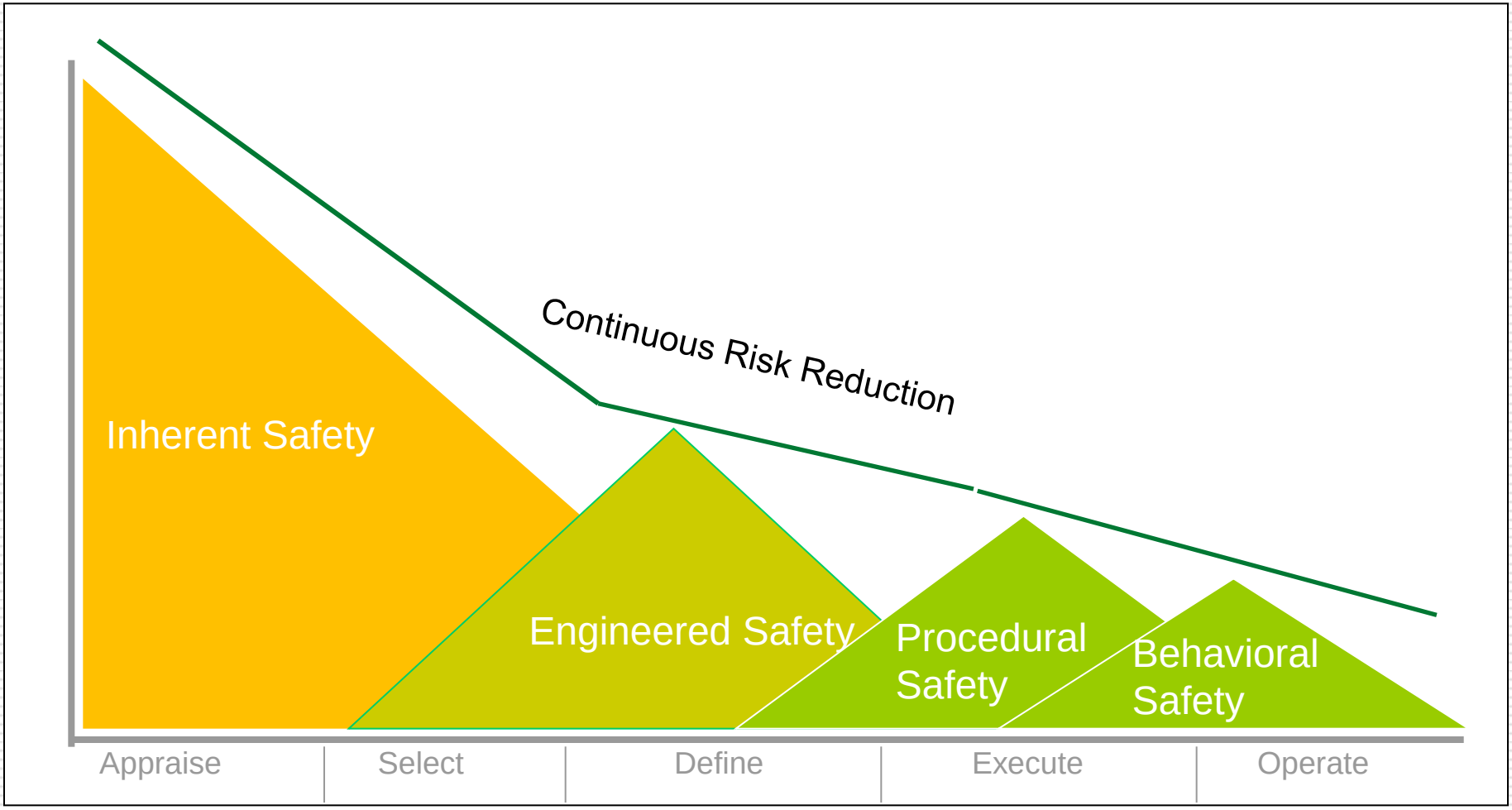
Inherently Safer Design, Green Chemistry and Green Engineering



Ability to Influence Safety

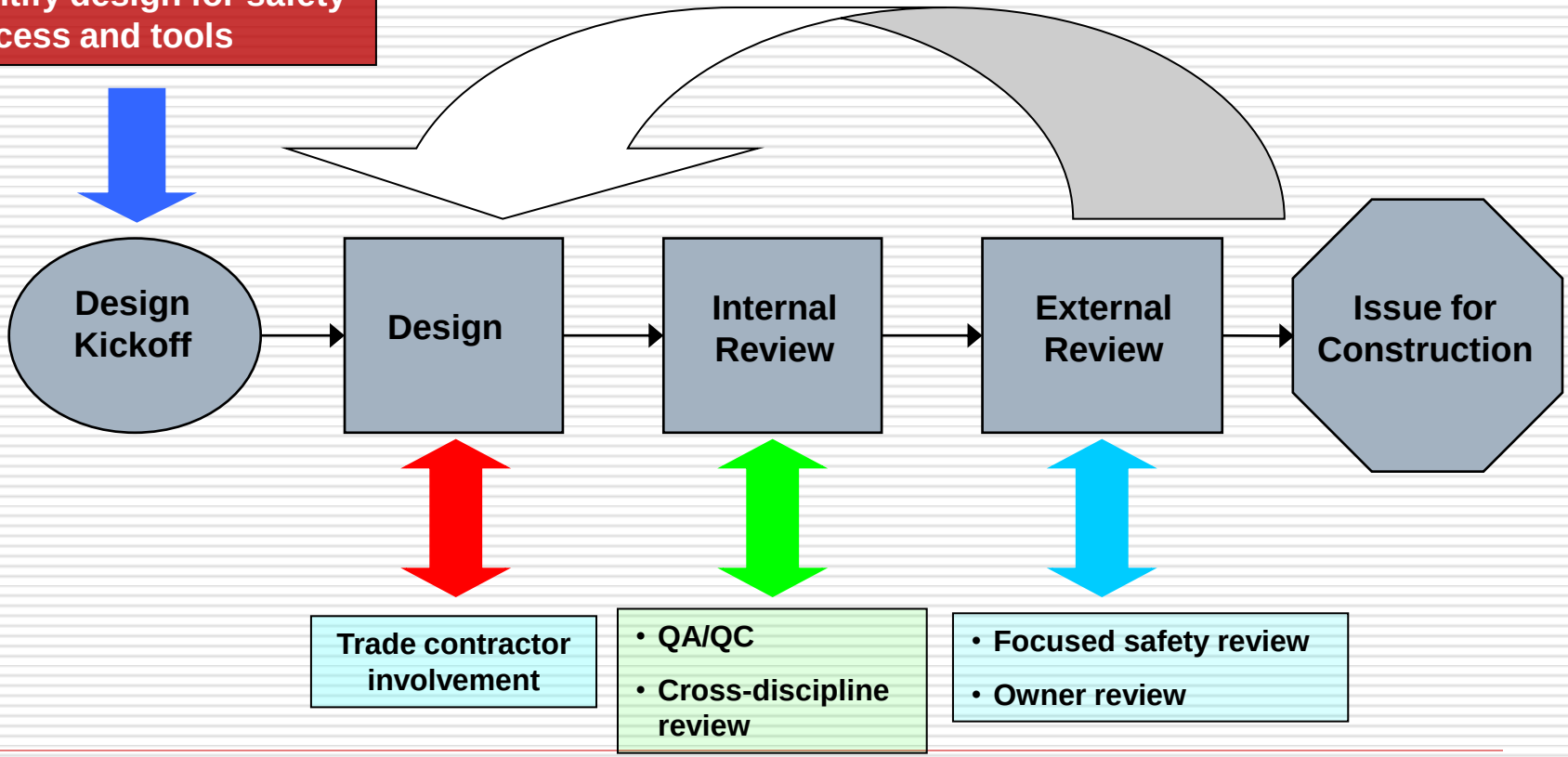


Design Hazard Management

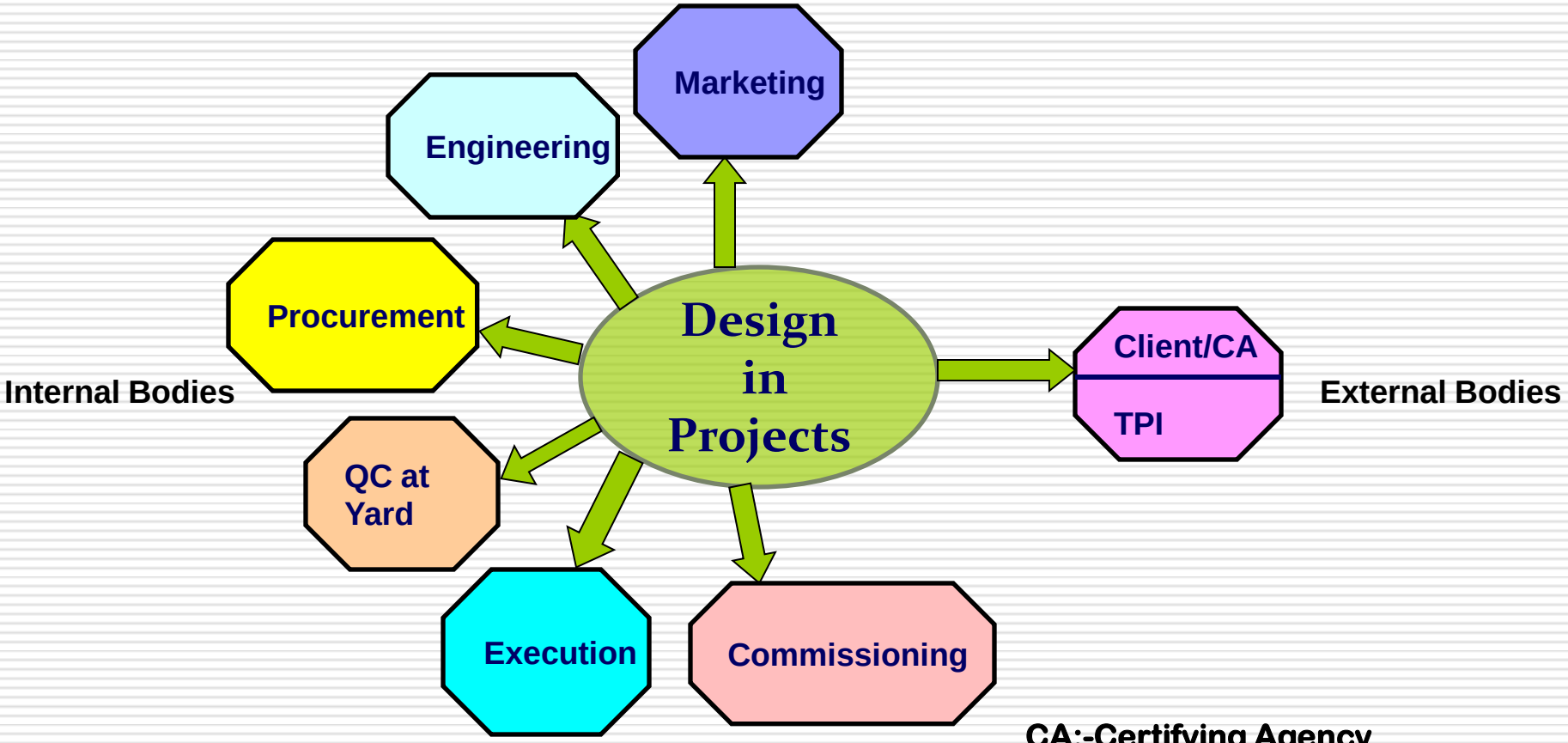


Design Verification Process L&T

- Establish design for safety expectations
- Include construction and operation perspective
- Identify design for safety process and tools



L&T Design Interfaces Methodology



CA:-Certifying Agency
TPI:-Third Party Inspection Agency

Example of Integral Relation
Fire Protection

QHSE	Engineering
Fireproof Structural Steel	Structural
Layout for Escape Routes	Facilities
Fire Water Systems	Piping / Facilities
Fire-fighting Equipment	Facilities
Alarm and Shutdown Systems	Instruments and Control
Vapour Detection Systems	Instruments and Control

Example of Integral Relation
Fire Protection (Contd)

QHSE	Engineering
Heating / Ventilating (smoke)	Civil / Structural / Facilities
Electrical Classification	Electrical
Emergency response plans	Operations / Maintenance
Fire size / duration	Process
Fire and blast simulations	Structural / Civil
Regulations / standards	Contracts

Example of Integral Relation
Other Examples (Contd)

QHSE	Projects
Safety of Barges	Incorporate Safety Clauses in Barge Contract
Safety at Site	Incorporate Safety Clauses in Subcontracts
Safety at Site	Yard Disciplinary Protocol
Safety of Equipment	Safety Specs in Procurement

QHSE Studies

- Preliminary Noise Study
- Preliminary Fire Study
- Preliminary Explosion Study
- Preliminary Toxic Gas Dispersion Study
- Preliminary Smoke Study
- Preliminary Hazardous Area Classification
- Preliminary Health Program
- Checklist Studies (*say* 30)
- What-If Studies
- Third Party Interfaces
- QHSE Audit Plan
- Project Behavioral Safety Plan

QHSE Studies

Design HAZOP

Gas Dispersion Study

Fire / Explosion Study

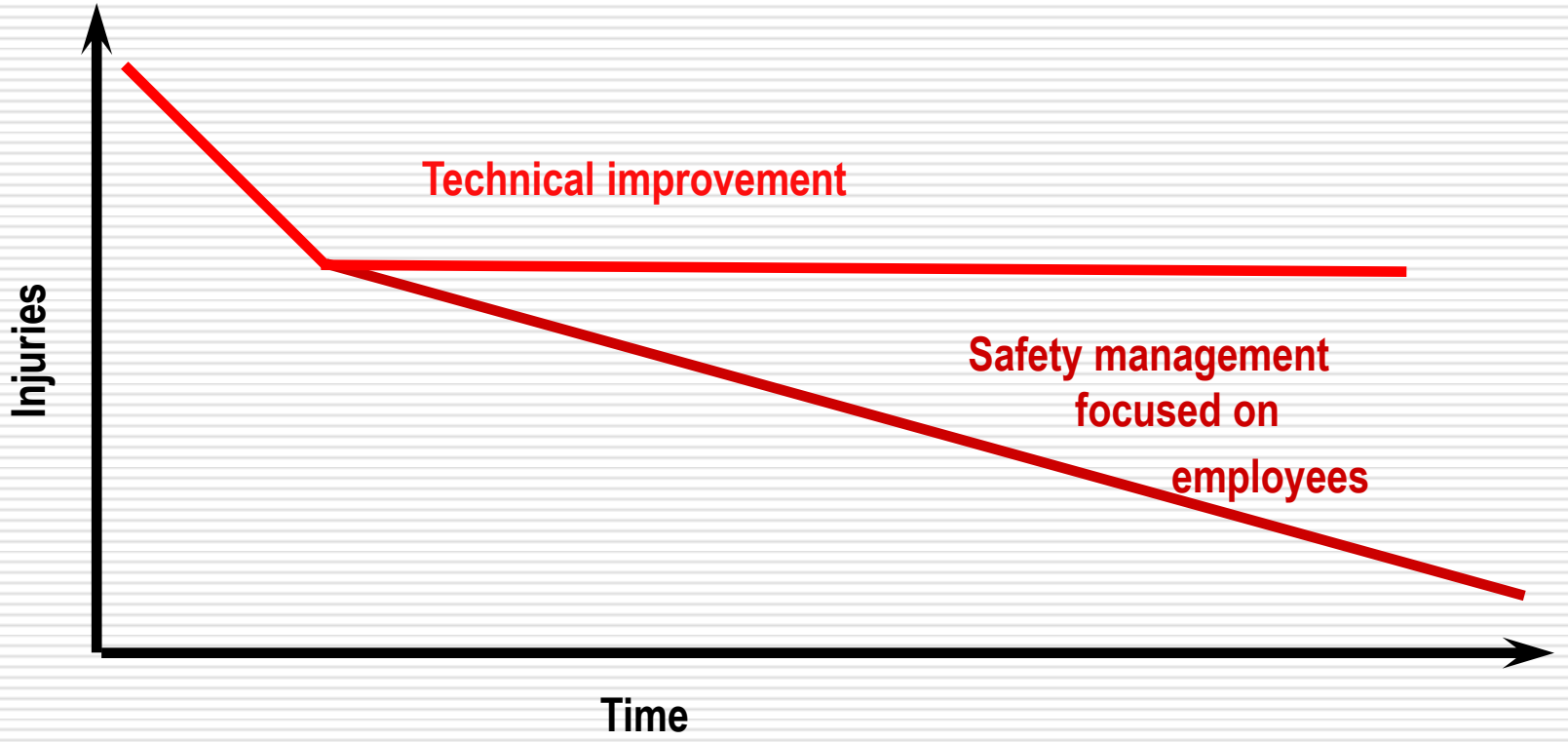
Noise Study

Smoke / Ventilation Study

Hazardous Area Classification

Management of Change program

Focus on people



Safety culture improvement

Risk Containment at L&T

- Highest priority to people
- Behavior based safety management
- PTW and JSA in place
- Training & Courses for employees
- Identify High Risk Activities
- Action Plan Development
- Governance Structure Facilitation
- Safety Field Audit (SFA) – Including training on the tool and field coaching
- Implementation of Action Plan

Safety Tool Box Talk

CCTV Monitoring

Hard Barricading for Ground Movement

Safety Nets

Safety Instructions in Cabins

Tenets of Operational Excellence

We always:

- Comply with all applicable safety rules and regulations
- Operate within design or environmental limits
- Use/Involve right tools, equipment, procedures and people for the job
- Ensure safety devices are in place and functioning
- Follow instructions and ask in case of doubt
- Correct & report unsafe conditions, near misses and even minor Injuries
- Keep the job site clean and orderly
- Follow written procedures for high risk and unusual situations
- Use, maintain and repair equipment by authorized personnel only
- Meet customers' requirements and specifications

There is always time to do it right

L&T Policy on Contractor Management

- Contractors HSE capability checks at the time of RFQ.
- Internal audit and verification of fitness for employment in terms of resources.
- Verification of certification and interviewing the employees to assess the competency level.
- Assessment of HSE documentation system and HSE statistics

Structural marvels are created on everyday basis…

Challenging Journey of Offshore Structures …