



Risk Management: a practical approach towards Safety Management



April 17, 2018

Annual European AIChE Seminar

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Agenda

1. Introduction to Jacobs
2. Risk Management
 - Process Safety Management
 - JPRO
 - Case Study
 - Mechanical Integrity
 - Relief Device Validation
 - Facility Siting Analysis
3. Conclusions

Introduction to Jacobs

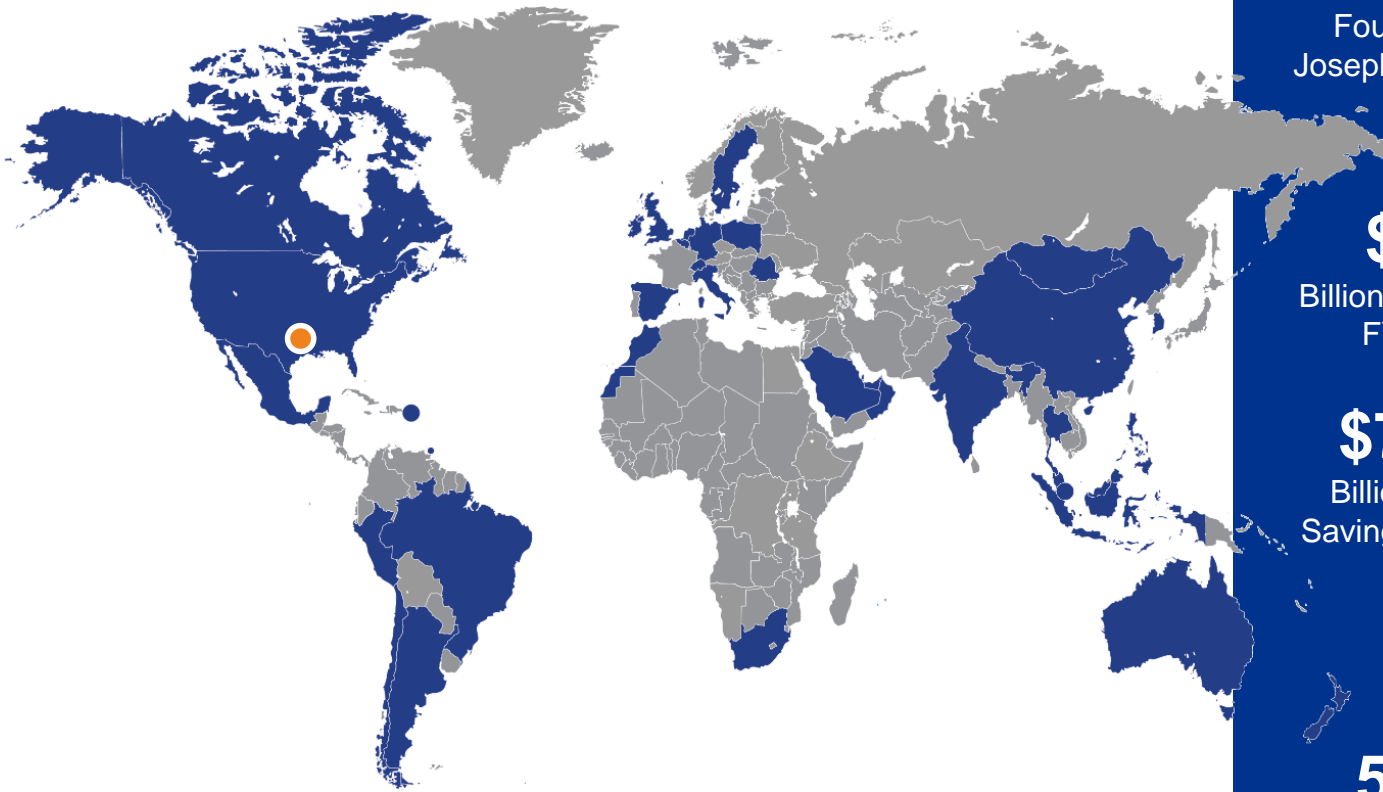
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Our Company at a Glance



1947

Founded by
Joseph J. Jacobs

Dallas

Global
Headquarters

\$15

Billion Revenues
FY2017

74,000+

Employees

\$7.79

Billion Client
Savings FY2016

40+

Countries

54.2

Million Metric Tons CO₂
Client Savings FY2016

400+

Locations

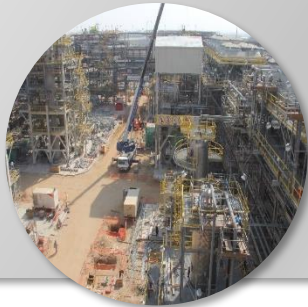
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Our Lines of Business

ECR

Energy, Chemicals and Resources

-  Chemicals
-  Upstream/Midstream Oil & Gas
-  Refining
-  Mining & Minerals
-  Field Services



BIAF

Buildings, Infrastructure and Advanced Facilities

-  Buildings
-  Advanced Facilities
-  Water
-  Transport
-  Aviation



ATEN

Aerospace, Technology, Environmental and Nuclear

-  Advanced Engineering, R&D & Ops
-  Global Environmental Solutions
-  Aerospace & Technology Int.
-  Mission Solutions
-  North America Nuclear



Risk management

Process Safety Management

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Process Safety Risk Management

Process Safety is -

“ Management systems that ensure that hazardous chemicals stay inside the pipes and equipment “

- CSB

Process Safety Management = Seveso requirement

- Seveso is:

- Prevention of major accidents
- Limitation of consequences

- Operator is obliged to:

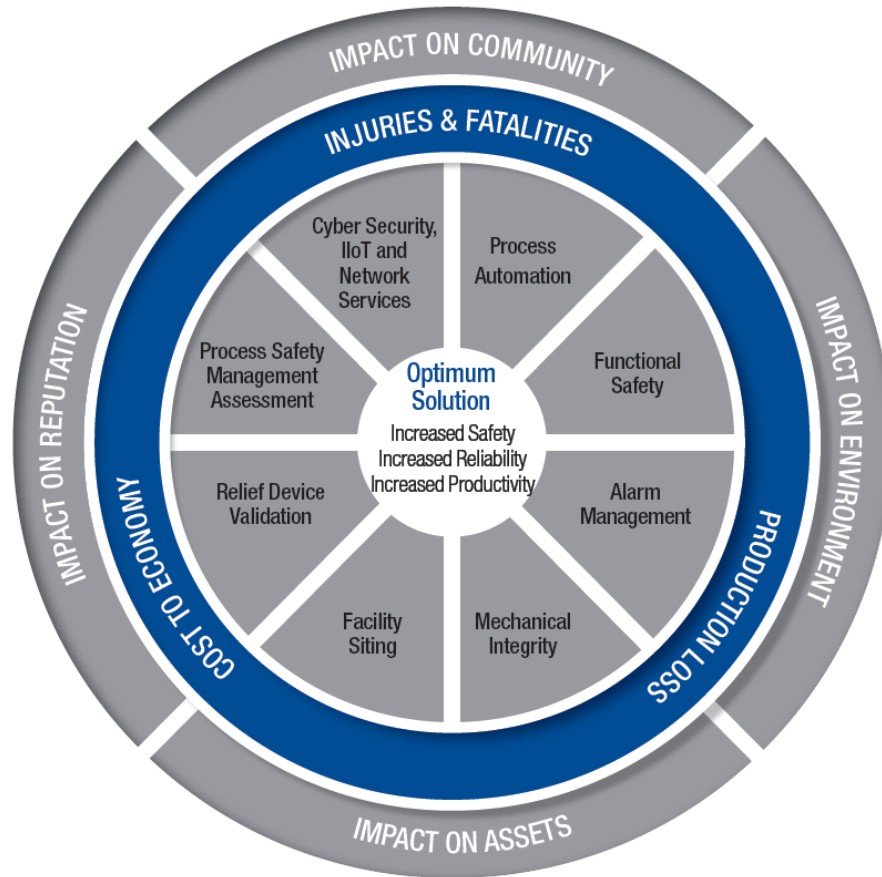
1. take all necessary measures necessary to
 - Prevent major accidents /LOC
 - Limit consequences for man and environment
2. required to prove all necessary measures are taken at any time to competent authority

--> Structured description of preventive and mitigating measures

--> Process safety documentation kept up to date



JPRO - Jacobs Process Risk Optimization



- Assess all aspects of risk management on your site
- Identify gaps to be addressed
- Develop comprehensive and sustainable solution to improve your:
 - Safety
 - Security
 - Reliability
 - Integrity
 - Compliance

Actual Case Study

Background

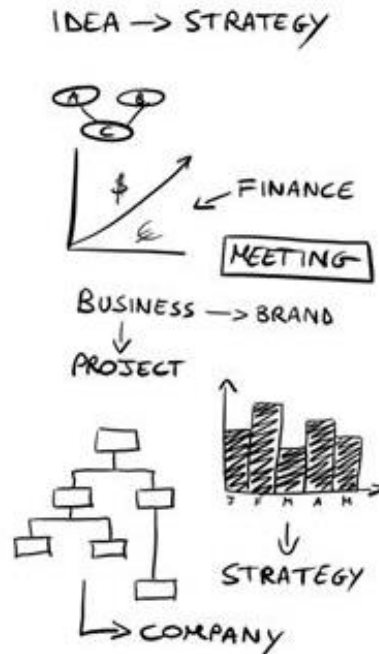
- Operating plant in Europe
- Several changes in ownership over time
- Management encouraged review of site for safe operating standards



JPRO – Practical approach

Keys to Success

- Close collaboration with client team
- Tailor JPRO approach to client needs
- Optimize work process to maximize outcome



JPRO – Interactive Approach is Key

Stage 1 – Where are we now?

- Discovery, interviews
- Visioning session
- Summarize findings

Stage 2 – Where do we want to be?

- Screening workshop
- Analyze and prioritize
- Create road map

Stage 3 – How do we get there?

- Actionable, prioritized implementation plan
- Design basis
- Execution



Stage 0 - Explore Strategies

Comprehensive Site Solution

Requirements:

- Set-up from scratch
- Perform 3D scan, intelligent P&IDs, extensive data mining and data reconciliation

Advantages:

- Consistent and Complete
- A comprehensive follow up system

Disadvantages:

- Time consuming
- Very rigorous maintenance is required

Pragmatic Site Solution

Requirements

Existing information and tools
Least possible effort to ensure consistency

Advantages:

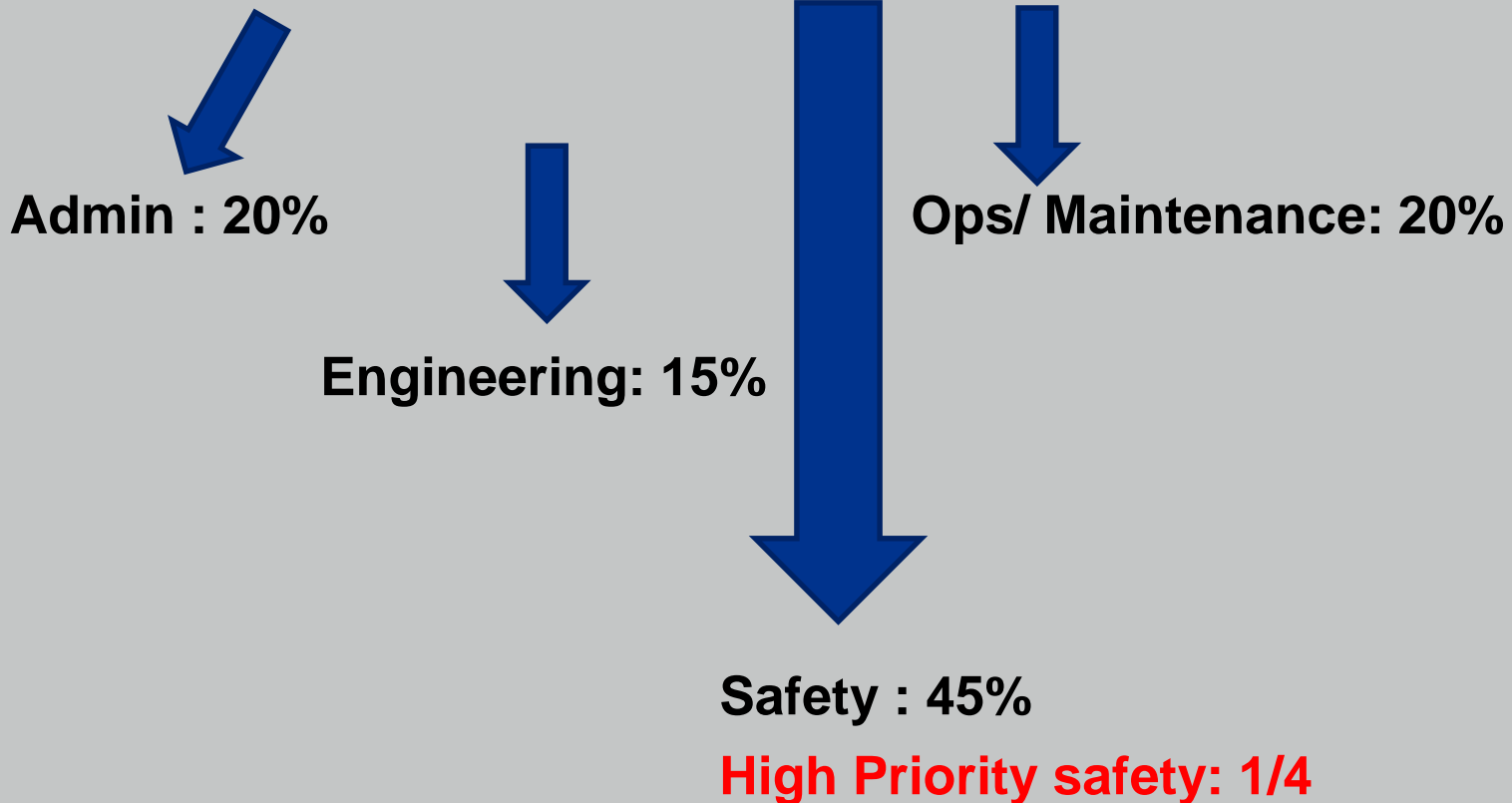
Focus on results

Disadvantages:

Complete As-built compliance not included
Risk of incompleteness and inconsistencies

Case study – Results and Benefits:

Number of recommendations: 700



Case study – Results and Benefits: examples

- Operating versus Design conditions

- Design temperature

installation new burners in steam boiler

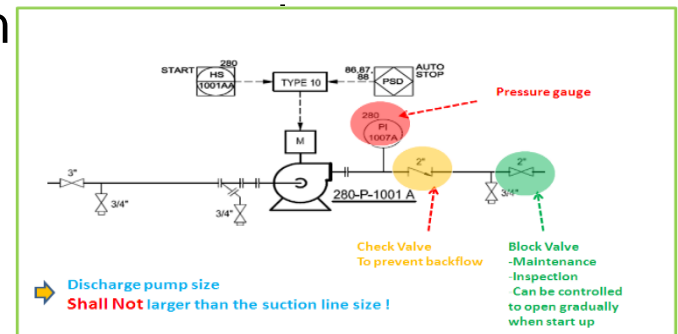
outlet temp 450 °C; above limit CS piping

known by operations, not known by inspection

- Design pressure

shut off pressure pump above design

safety valve blocked by valve



Case study – Results and Benefits: examples

- Inconsistencies documentation and DCS

Fail safe position on P&ID's <-> in DCS

Alarm settings not in line with P&ID , alarm list
and above design conditions



Case study – Results and Benefits: examples

- MOC and operating procedures
 - ✓ Technical document management system
 - ✓ What documents to receive from contractors on site
 - ✓ Development of system for 'Route maps' for line up to storage and loading/unloading
 - ✓ Review of HAZOP/LOPA procedures

Risk management

Mechanical Integrity

7/06/2017

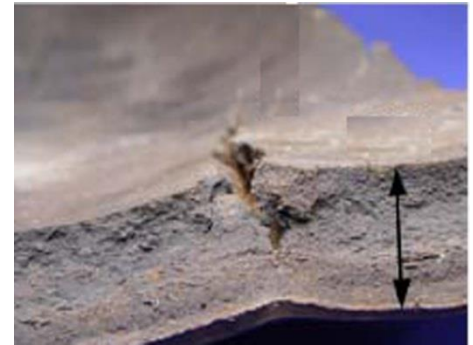


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Mechanical Integrity

- Perform Damage Mechanism Reviews
- Implement a Mechanical Integrity Program
- Provide Mechanical Integrity inspection services
- Implement Inherently Safer Design projects
- Provide engineering and design services if required for Mechanical Integrity lifecycle maintenance
- Provide Jacobs Field Services assistance for lifecycle maintenance



Case study – Results and Benefits: examples

Study of material selection:

- pipe spec selection diagram
- lines not in line with 'corrosion ' requirements

Propose program for replacement / inspection frequency

- High priority replacement
- Next TA replacement
- Increased inspection program



Risk management

Relief Device Validation

7/06/2017

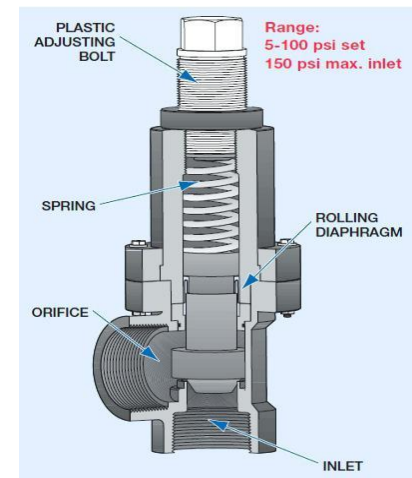


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Relief Device Validation

- Document and validate relief devices based on today standards and requirements:
 - Asses input data
 - Document relief scenario's
 - Calculate relief loads
 - Determine required type and size of relief device
 - Assess present devices and outlet conditions

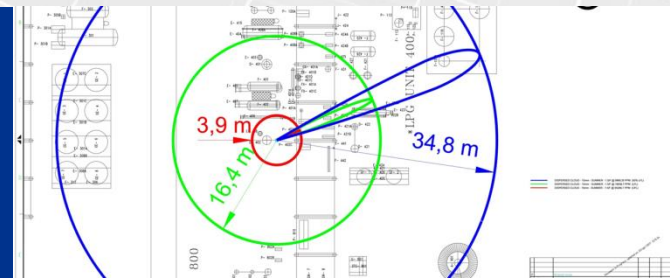


Relief Device Validation

- Document and validate relief devices based on today standards and requirements:
 - Assess flare header if needed
 - Suggest/Define solutions
 - Engineering of solutions
 - Install preventive maintenance program according to SIL/LOPA

Facility Siting Analysis

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Facility Siting Analysis



Why Facility Siting Analysis?

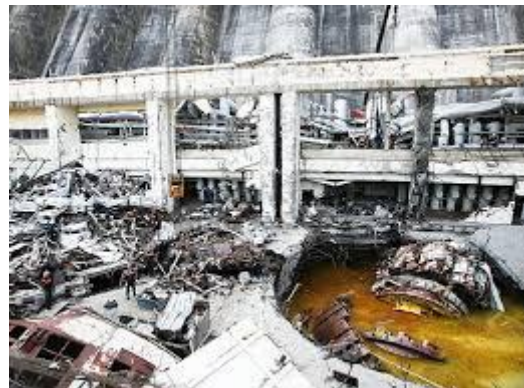
Texas City Refinery

- Operator error caused a massive explosion.
- 15 people died, 170+ injured.
- 11 of those who died were Jacobs employees.



How: Step 1: Identification of ALL Hazards

- Typical types of hazards encountered on sites:



Step 2: Risk assessment Methodology

List all risks on site

- Toxic release
- Fire
- Explosion
- Electrical
- Vehicles
- Cranes
- Natural phenomena



Select safe location

Assess risks

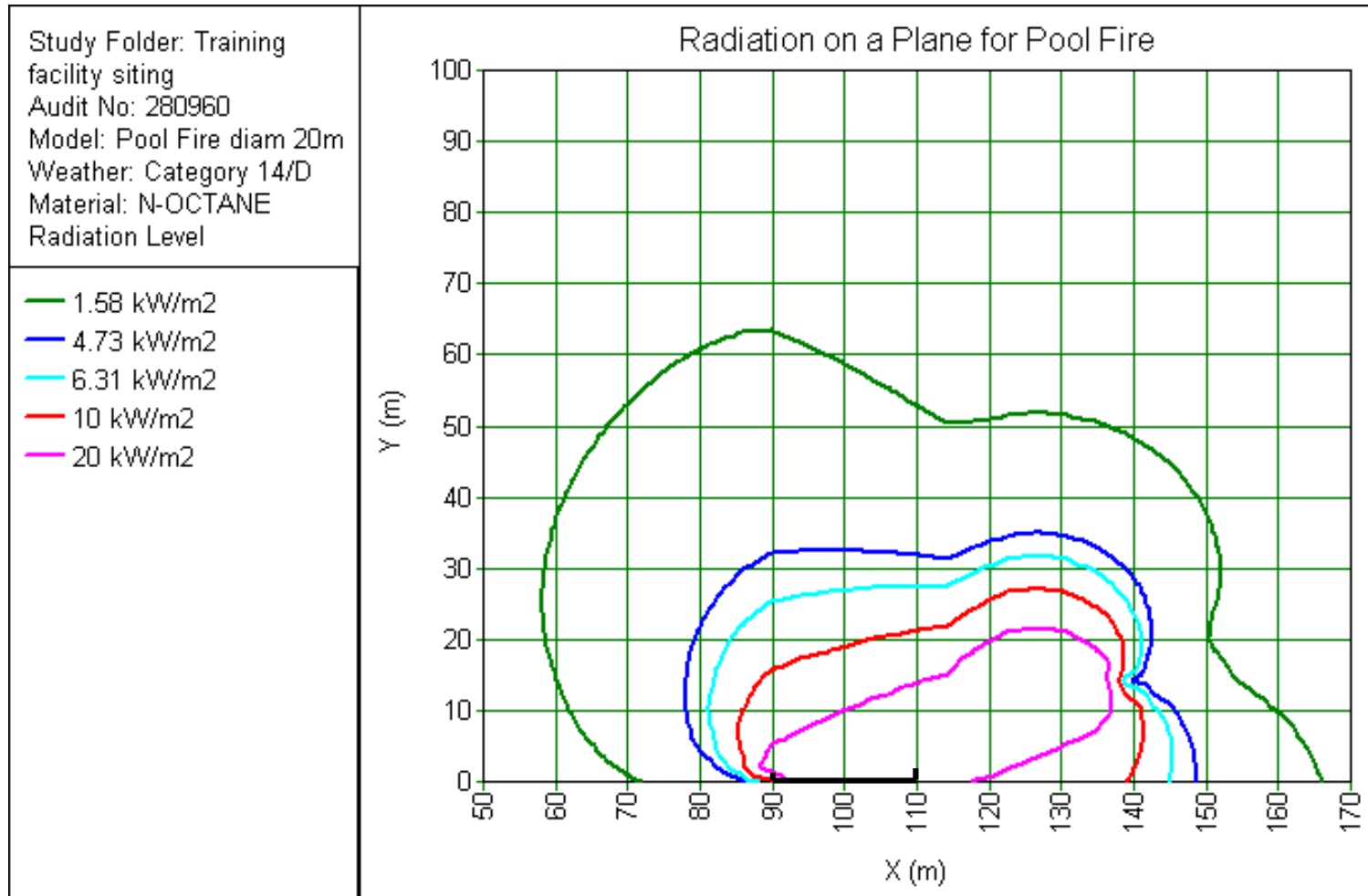
- Quantify extent:
- Assess probability

Evaluate versus evaluation
criteria

Outside hazard zone
Building hazard resistant
PPE

Calculations: Examples effect calculation

Side view heat radiation contours pool fire (diam = 20m)



JPRO: Results and Benefits

- Increased Safety
 - Emphasized focus on safety
 - Initiated a behavioral change within the organization
- Increased Productivity
 - Improved predictability of operations
 - Rigorous implementation of the Management of Change (MoC) process
- Increased Reliability
 - Consistent and comprehensive gap identification (Technical and Procedural)
 - Upgrade of documentation

Thank You!