

Risk Based Emergency Response and Crisis Management Plan with Consequences Modelling at Saudi Electricity Company (SEC)

Buncefield Case Study

On December 11th, 2005 Fire occurred on hydrocarbon storage tank due to process incident - Fire size 100m x 100m & Time to respond 1 hour

Incident Response
150,000 liters of Foam estimated – with margin for error up to 300,000 liters which were completely utilized to respond to incident.



- Due to delay in response to incident:
- 22 tanks went on fire
 - Time to fully extinguish fire is 104 hours
 - 642 fire appliance used to combat fire
 - Foam and water actual utilization :
 - 786000 liters of foam
 - 53 million liters of clean water

SEC Consequence Modelling

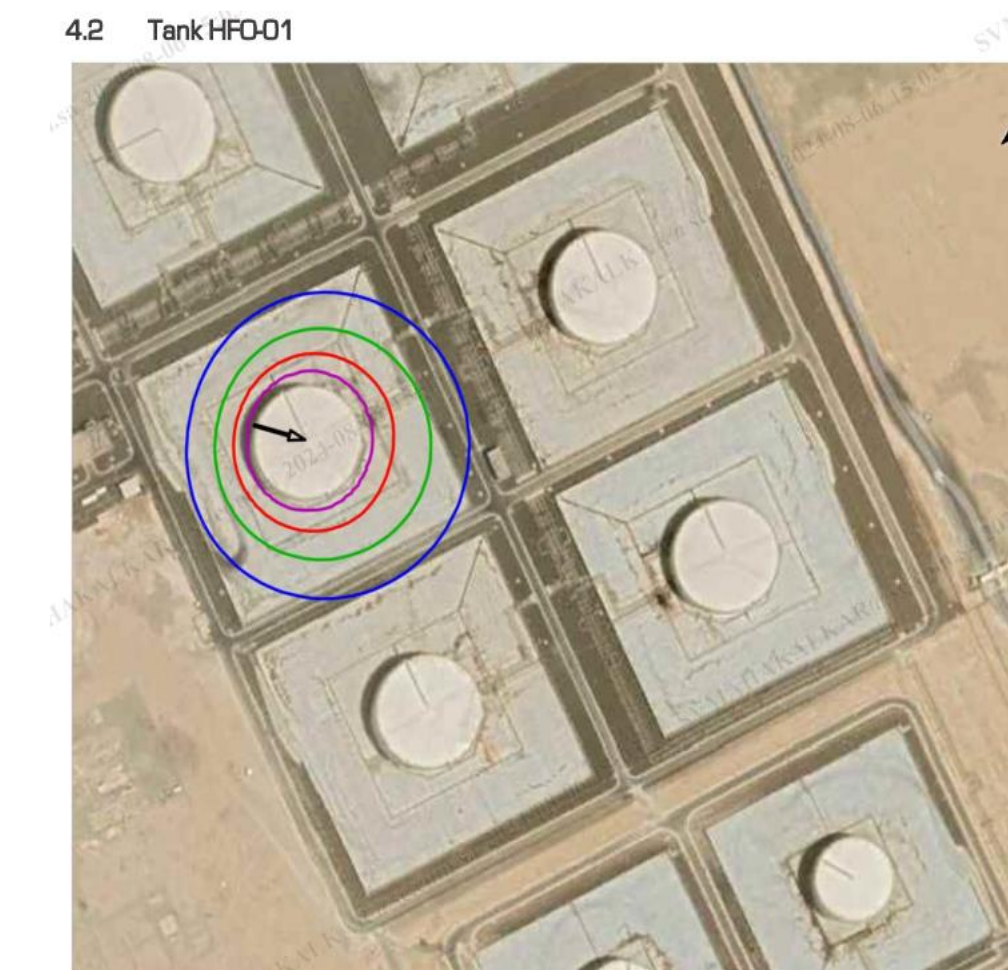
Criteria for Developing Consequences Modelling

- 01 Identification of highest consequences scenarios C4/C5
- 02 All process scenarios from HCIS –SAF 20 .
- 03 Business Impact Analysis



Contour Development for Impact Analysis

- 01 Thermal Heat Radiation : (3 KW/m², 12.5 KW/m², 32 KW/m²)
- 02 Over pressure (0.02 , 0.13, 0.20 bar)
- 03 Toxic (1 % ,10 % and 90% Lethality)



Benefits of Consequences Modelling



Why Consequence based Emergency Response Plan?

Purpose

To identify necessary information to develop Crisis Management and Emergency Response Plan, which sets forth critical guidance and procedures to manage crises and emergencies during incidents with potential to result in harm to :

- People,
- Property,
- Environment; and
- Disruption to operations at facilities

Heavy Fuel Oil Tanks

Consequence Model Parameters

- Software: DNV Phast 8.9
- Model – Standalone Pool Fire
- Material – Heavy Fuel Oil (HFO)
- Wind direction – West - NorthWest (WNW)
- Pool Fire (Tank) Diameter – 80m
- Pool Fire (Tank) Height – 24m
- Solar Radiation Flux – 1 kW/m²
- Relative Humidity – 0.05
- Wind Speed – 6m/s
- Pasquill Stability – Moderate Unstable – Moderate Sun & High Wind
- Atmospheric Temperature – 45 °C
- Heat Contours – 3 kW/m² (1st-degree burns if exposed to 40 seconds without protective equipment).
- Heat Contours – 6 kW/m² (Personnel injured if they are not wearing protective equipment and do not escape quickly).
- Heat Contours – 32 kW/m² (Fire escalation if no protection – consider flame impingement).
- Heat contours at tank height

Results:

Legend	Heat Radiation	Radius
Blue	3 kW/m ²	125 m
Green	6 kW/m ²	96 m
Red	32 kW/m ²	52 m

Technology Deployment

Robot Monitor



Crisis and Disaster Center



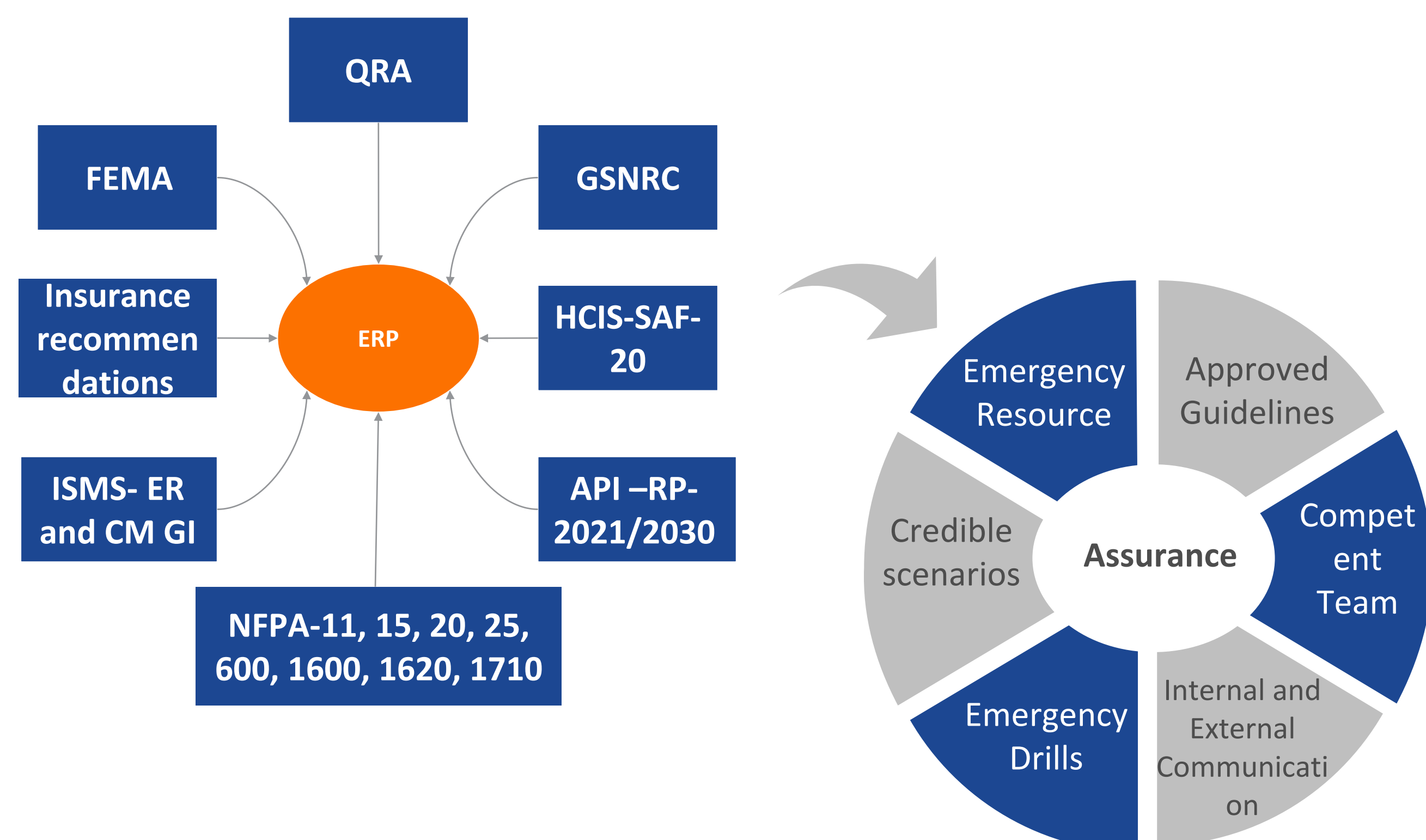
Crisis Management System



Crisis Management Vehicles



Potential Inputs to ERP and Assurance



Key Learnings

- ❖ Learning from company & world wide Incidents
- ❖ Development of Risk based ERPs and its linkage to Process Safety
- ❖ Competent Manpower based on developed competency training matrix
- ❖ Training to Emergency Response Staff, Incident Commander and relevant Mutual Aid Partners
- ❖ Internal and External Drill/exercise on developed scenario
- ❖ Ensuring required resources and logistics at sites and with Mutual Aid partners.