Process Safety Management in Shell

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Number of well known tragic disasters that show that lack of process safety focus can result in massive consequences.

Design, hazard analysis, material verification, corrosion management, operational competence, equipment maintenance, alarm management, failure investigation… all play a part.

Ref: Baker Report into the Texas City Refinery Explosion
Focus On The Risk


Ratio LTIs/FAT

Often fatal

Seldom fatal

TRCF questionable metric to monitor process safety performance

TRCF useful metric to monitor personal safety performance
‘Process Safety’ is the management of hazards that can give rise to major industrial incidents, involving release of energy and/or potentially dangerous materials.
Shell‘s Approach
Shell Vision: “Our assets are safe, and we know it” ("and we can show it")

We design and build so that risks are As Low As Reasonably Practicable (ALARP)

Design Integrity

Technical Integrity

We maintain the hardware barriers

Leadership

We work within the operational barriers

Operating Integrity

Integrity

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Process Safety Management

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Integrity Barriers (Safety Critical Elements)

- Identify major hazards
- Create barriers (SCE’s) to prevent the Hazard from resulting in an incident
- Create further barriers minimise escalation
Wells Process Safety Bow-Tie

Minimize Likelihood

Standards
- Global Wells Standards
  - Well Design Manual
  - Well Control Manual
  - Well Integrity Manual
- Rig Safety Cases

People
- Competence Testing (rd 1 & rd 2)
- Technical Authorities (DCAF)
- Principal Technical Experts
- Contractor competency

Equipment
- Well Specifications/Design
- Multiple Safety Barriers
- Equipment Qualification and Testing
- Well Integrity Monitoring
- Well Construction – 24/7 Real Time Operating Centre’s

Incident Response

Mitigate Consequences

Standards
- Cap and Contain – Well Design
- Well Control Manual
- Blowout containment plan
- Well Kill Program
- Relief well plan – pre spud

People
- Blowout support contractors
- Technical Authorities (DCAF)
- Principal Technical Experts

Equipment
- Well Control Equipment – Cap and Contain
- Spill containment
- Oil Spill Containment System
  (Joint Project – required GOM only)
Design integrity: Shell Minimum Requirements

- Prevent recurrence of known major process safety incidents by eliminating their main causes

- 11 minimum requirements, e.g.
  - Safe siting of occupied portable buildings
    - BP Texas City Isomerisation Unit Explosion
  - Avoid tank overfill followed by vapour release
    - Buncefield storage terminal explosion
  - Alarm management
    - Three Mile Island, Longford
  - Management of change
    - Flixborough, Chernobyl

- Applied to both new designs and retrospectively
- Derogation from minimum requirements must be approved at the highest level (Shell CEO)
Fit-for-purpose dual shear rams

Design well for cap & shut-off

Two well barriers

Availability of cap and contain equipment
Technical Integrity

- Identify safety critical elements (SCEs)
- Set performance standards for SCEs
- Carry out hardware barrier assessments
- Monitor performance indicators

Hazard
- Structural integrity
- Process containment
- Ignition control (in hazardous areas)
- Operator action
- Process control
- Alarms
- Ultimate safeguards
- Penultimate safeguards
- Loss of containment event
- Fire & Gas detection
- Shutdown systems
- Emergency response
- Major incident

Escalation barriers
- Prevention barriers
Technical Integrity: Hardware Barrier Assessments

- Selected barriers assessed each year
- Carried out by appointed “Technical Authorities”
- Interview staff
- Witness planned function tests
- Site visits with physical observations of equipment
- Corrective action workshop
- Action follow-up
Operating Integrity

Vulnerabilities
- Actively manage latent issues
- Capture vulnerabilities
- Assess the risk & identify measures to eliminate/ control/ mitigate
- Implement required measures
- Review by Senior Leadership

Deviations
- Deviations to normal operation or compromised safety system
- Assess cumulative risk
- Identify mitigations
- Endorsed by Technical Authorities
- Approved by Asset Manager
Operating Integrity

- Operating envelopes
  - Ensure operation stays within the pressure/temperature envelope
  - Reviewed by control room operator every 3 hours
  - Excursions reviewed quarterly by senior management

- Alarm review
  - Spurious alarms detract focus from real issues
  - Weekly review (top 5 alarms and “standing” alarms)

- Alarm Steering Committee
  - Set direction and improvement targets
  - Alarms database to capture alarm purpose, required response etc.
  - Automatic suppression to remove nuisance alarms, e.g.
    - Alarm when pump is shutdown
    - Standing alarms when plant is shutdown
Monitoring

- Monitoring the health of the integrity management system is absolutely critical.
- Use both leading and lagging indicators.
- “Kick the tyres and check the green” Just because report shows green doesn’t mean everything is OK.
- Visit the facilities and talk to staff about process safety.
- Transparency drives compliance.

- Regularly review key indicators throughout the organization.
- FSR (Facilities Safety Reporting) for facilities and e-WIMS (Electronic Well Integrity Management System) for Wells.
Monitoring - Key Performance Indicators

Indicators are developed specific to the business

- Tier 1 – Loss of primary containment
- Tier 2 – Loss of primary containment (lesser consequence)
- Tier 3 – Challenges to safety systems
  - Safe operating envelope excursions
  - Demands on safety systems
  - Primary containment inspection outside limits
- Tier 4 – Operating discipline & management system
  - Safety critical element compliance
  - Manage operation outside normal window
  - Competence
  - Functional leadership

Reviewed quarterly at process safety management meeting

API- RP 754 – Process Safety Performance Indicators
People – Expertise, Competency Testing & Enhancement

- People are the Most important Barrier
  - Enough, right caliber, Right process safety competences
  - Need to know what they need to do in any given role
  - Right technical and behavioural skills to manage the risk they face

- Wells – an Example
  - Round 2 and Round 2 Diploma
  - Trade test before hire for all consultants
  - Advanced Well Control course (2 week duration) inclusive of examination - mandatory every 2 years for all operations staff and contractor supervisory staff.
  - New live well simulator as part of advanced well control for well interventions
  - Contractor Competency: Well CAP and IWCF well control certification standard.
  - Principal Technical Experts – network of industry-renowned experts to support and assure Shell’s well designs and technical standards
Leadership and Process Safety Culture

Can you Say …….. ?

- I understand the errors we cannot afford to make
- My safety cases are living, evolving, and operationalised
- We have good Process Safety KPIs to help monitor effectiveness of our controls & regularly discuss them at leadership meetings
- In my organisation all process safety incidents & near misses are investigated and I ensure actions are tracked & completed

- I understand our standards and make sure they are applied
- Derogations to my company’s standards are risk assessed endorsed by technical authority and are visible to me
- We have an effective Management of Change (MoC) process
- We know the risk of becoming complacent
- We ask the difficult questions and take the right corrective actions before catastrophe strikes

Old Chinese proverb ....... You should dig the well before you’re thirsty