CLP

More than light

# PROCESS SAFETY CONTROL SYSTEM

CLP 中 中電

# Installed Capacity for CLP Power in Hong Kong

**Castle Peak Power Station**

- 4 x 350 MW Coal/Oil fired units
- 2 x 680 MW Coal/Oil fired units
- 2 x 680 MW Coal/Oil/Gas fired units
- 1 X 56 MW Gas Turbine unit

**Black Point Power Station**

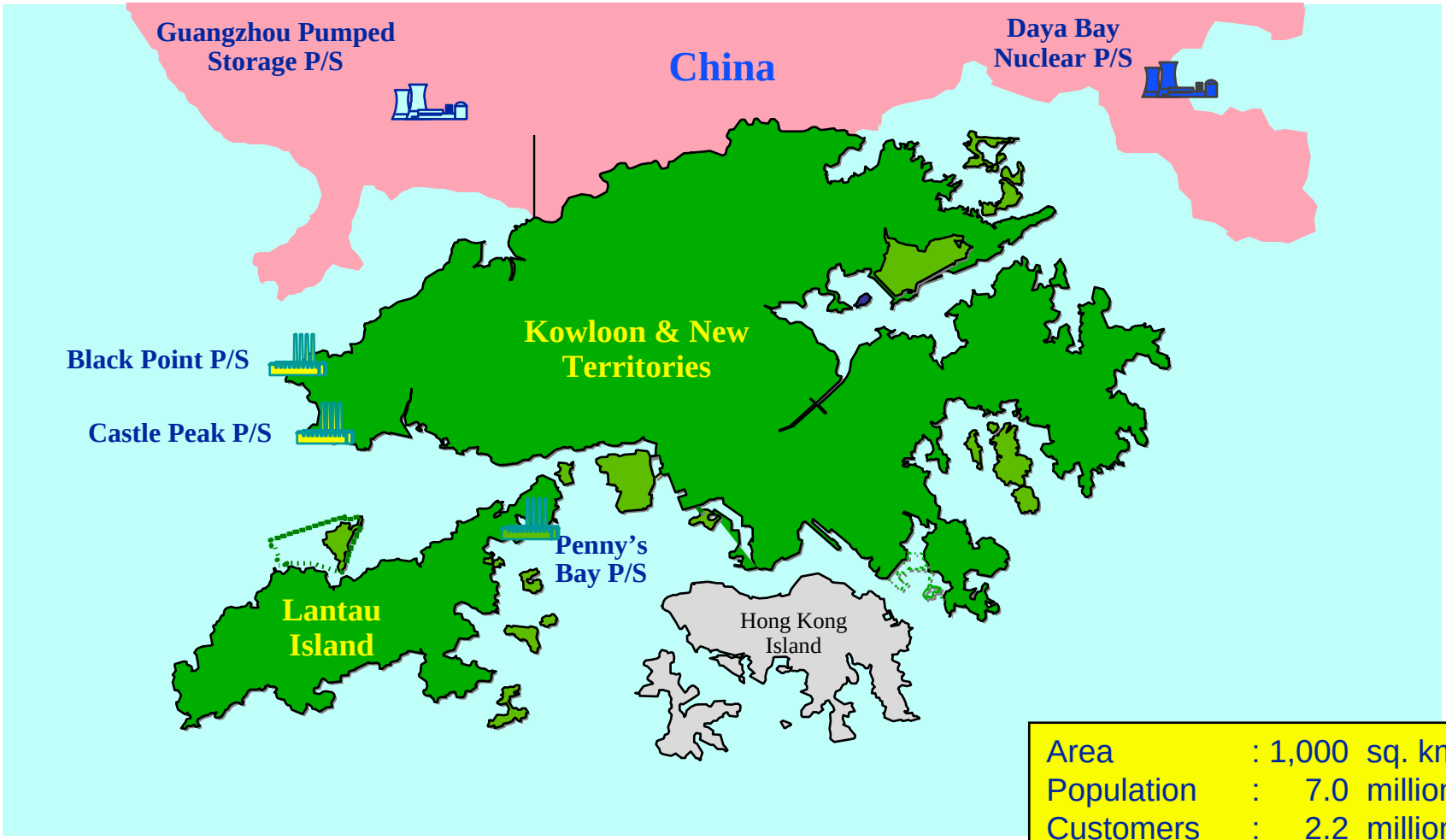
- 8 x 320 MW Gas/Oil CCGT units

**Penny's Bay Power Station**

- 3 x 100 MW Gas Turbines units

**Total Installed Capacity**
**7,036 MW**

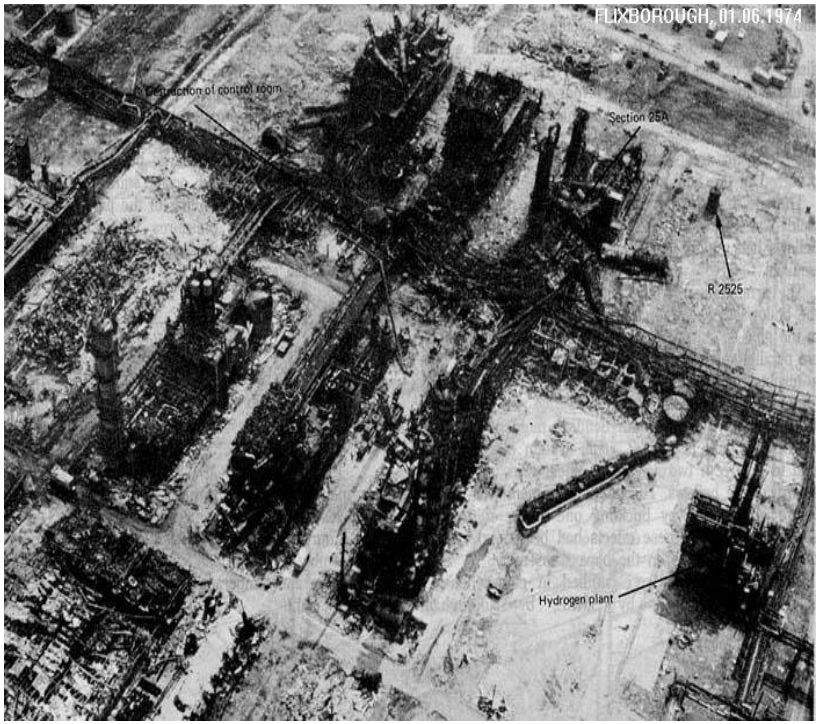
# Power Stations in Hong Kong




| | | |
|---|---|---|
| Area | : 1,000 | sq. km. |
| Population | : 7.0 | million |
| Customers | : 2.2 | million |

# Is it necessary to have Process Safety ?

**In 1974, a vapor cloud explosion at Flixborough, UK, killing 28 people.**

# Is it necessary to have Process Safety ?

**In December 1984 - disaster at Bhopal, India**

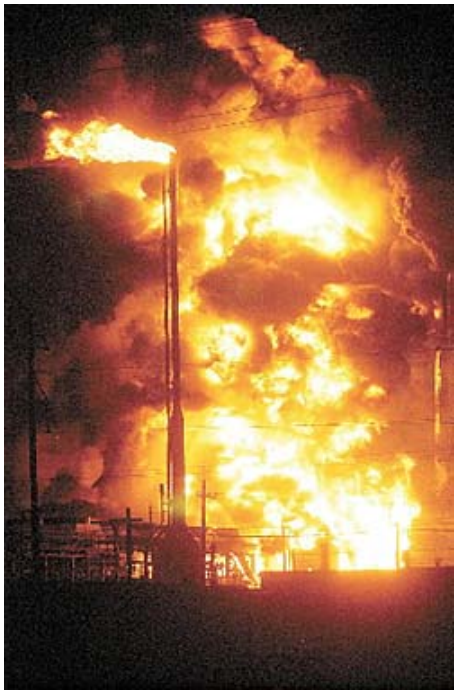
**A pesticide plant released 42 tonnes of methyl isocyanate (MIC) gas explosing 520,000 people to toxic gases and cause at least 8,000 deaths. This is the worst disaster in history.**

# Is it necessary to have Process Safety ?

**In March 2005 – BP Texas City**

**A blowdown drum vent stack release during startup**

**15 fatalities and over 170 injuries, total financial lost > $3 Billion US.**




Anatomy of a Disaster

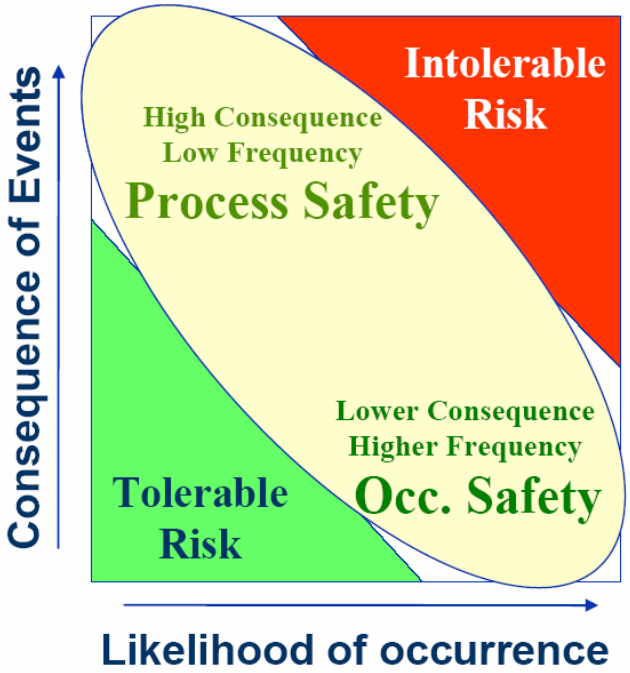
# Is it necessary to have Process Safety ?

**The key recommendations of the BP incident :**

1. Effective process safety leadership.
2. Integrated and comprehensive process safety management system .
3. Ensure appropriate process safety knowledge and expertise.
4. Improve process safety culture.
5. Clearly defined expectations and accountability for process safety.
6. Effective support for line management.
7. Leading and lagging performance indicators for process safety.
8. Effective process safety auditing.

# Process Safety vs Personal Safety

**Process Safety is focus on those high consequences events but in low frequency.**




**Most of the safety management system are focus on occupational safety.**

# Benefit of Process Safety

Companies that implement effective process safety management receive a lot of benefit such as:

- Lives are saved and injuries are reduced.
- Property damage costs are reduced.
- Business interruptions are reduced.
- Good company reputation.
- Lower insurance premium.
- Maintain good relationship with community.
- Strengthen the relationship with regulators.
- Attract and retain the high performance staff.
- …….

# Process Safety Control System

**To create a safe working environment for our staff working in the power station, we have a good safety culture under the leadership from our management.**

**Process safety incident is regarded as the major plant incident that can have catastrophic effect and result in multiple fatalities and substantial economic, property, and environmental damage.**

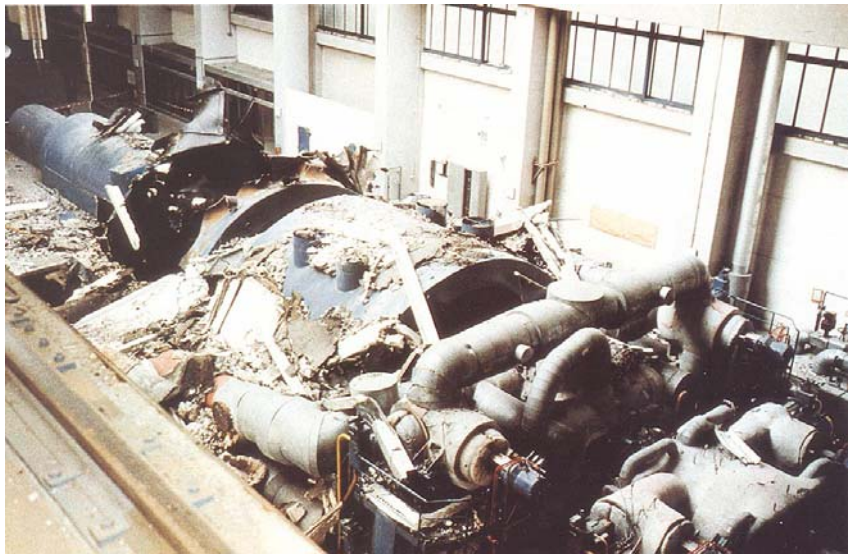
**We develop a Process Safety Control System to identify the hazards and have control measures to mitigate the operational risk.**

# Objective

The objective of Process Safety Management is to ensure that the potential hazards in the daily operation can be identified and mitigation measures are in place to prevent the major incidents due to accidental release of energy or dangerous substance.

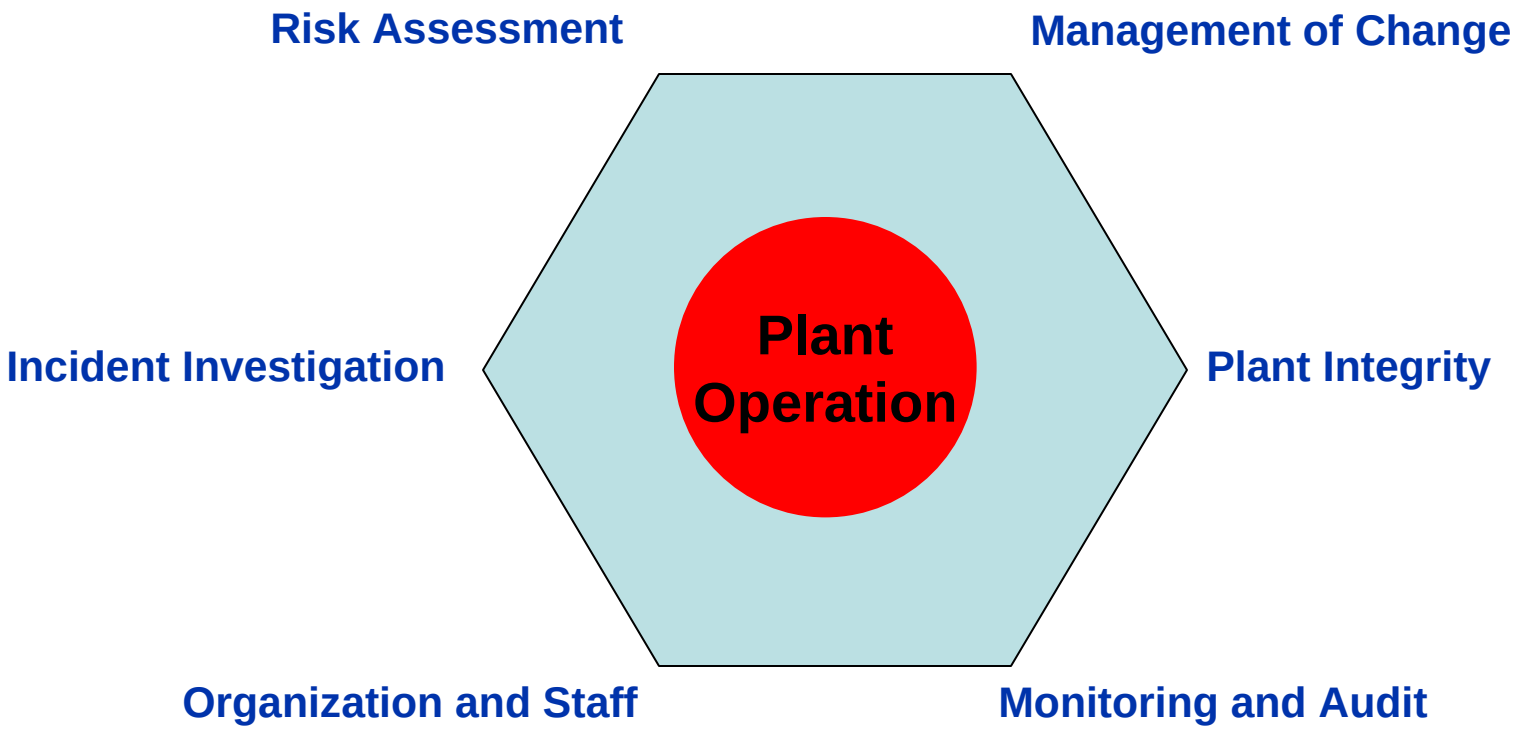
The scenario of major incidents is categorized:

- Fire
- Explosion
- Mechanical failure
- Electrical failure
- Structural collapse
- Loss of primary containment



# Process Safety – Swiss Cheese Model

# Six Key Elements – Process Safety Control



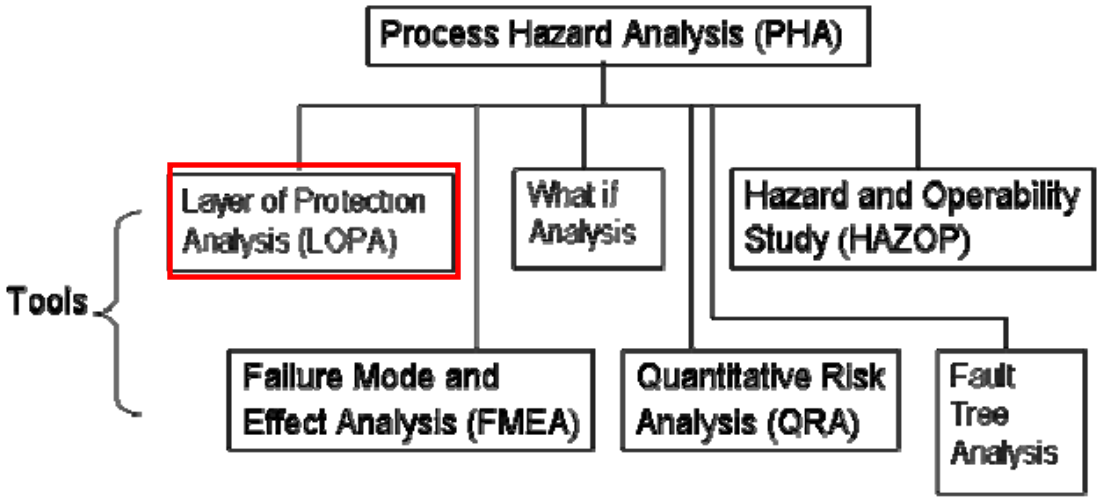
# Process Safety Control System – Principles for Implementation

- User friendly and transparent
- Sustainable
- Minimum additional work load
- Linking up the existing management systems to build a cohesive structure
- Provide tracking and monitoring
- Demonstrate commitment and accountability
- Make continuous improvement

# Risk Assessment (Process Hazard Analysis)

The first risk assessment was conducted in 1993 and over hundreds of assessment was conducted. Five major processes have been identified in the power station namely, fuel handling, steam generation, power generation, electricity generation and balance of plant.

Besides the traditional risk assessment methodology, Layer of Protection Analysis is introduced to indicate sufficient prevention and mitigation measures are in place.




Leading and lagging indicators are established to monitor the effort on the follow up action plans.

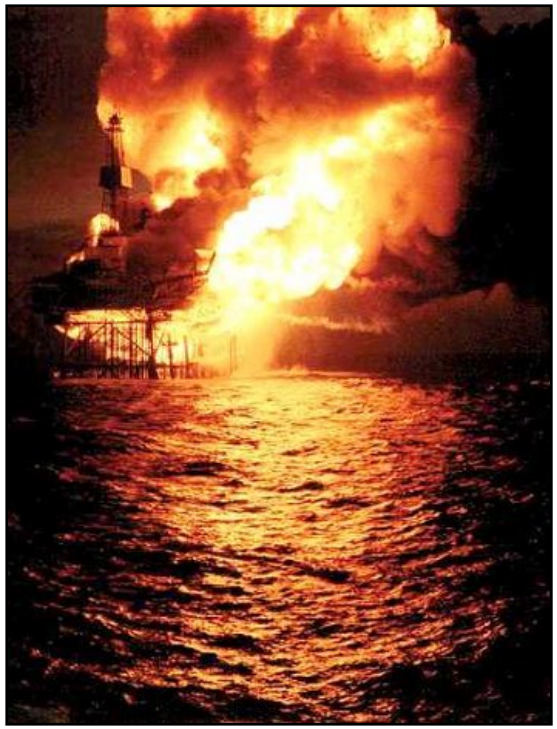
# Management of Change

Uncontrolled change is dangerous to the operation in power plant and it has led to numerous incident. It is important to manage the change in all areas such as design, procedure, equipment, etc.

A standard model has been established such that the front line staffs can be followed and fulfilled the expectations.

Formation of Management of Change committed from senior management is to endorse the change requests that have satisfied a series of safety, environmental and regulatory criteria.

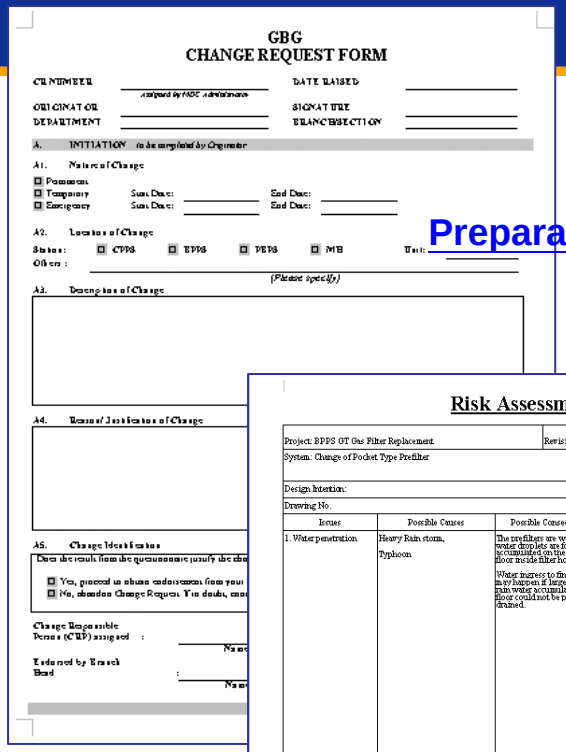
Performance indicators are established to monitor any non-compliance in the process.



# Management of Change Process Diagram

**Applicable to all changes that can have:-.**

- **Adverse Impact on Safety, Health & Environmental.**
- **Impact on Plant Integrity & Reliability.**
- **Regulatory Compliance aspects of the business activities.**



GBG
CHANGE REQUEST FORM

CR NUMBER
DATE RAISED
ORIGINATOR
SIGNATURE
DEPARTMENT
BRANCH/SECTION

A. INITIATION *to be completed by Originator*

A1. Nature of Change
☐ Permanent
☐ Temporary — Start Date: — End Date:
☐ Emergency — Start Date: — End Date:

A2. Location of Change
Station: ☐ CPPS ☐ EPPS ☐ PEPS ☐ MB Unit:
Others:
*(Please specify)*

A3. Description of Change

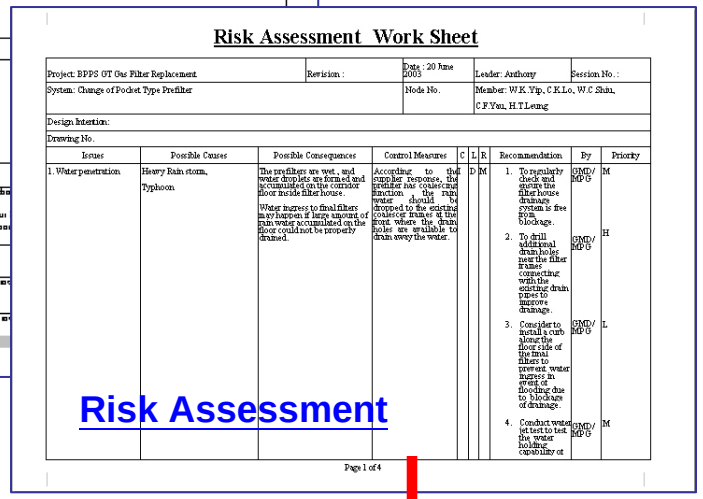
A4. Reason/Justification of Change

A5. Change Identification
Does the result from the questionnaire justify the change
☐ Yes, proceed to obtain endorsement from your
☐ No, abandon Change Request. Via doubt,

Change Responsible Person (CRP) assigned :
Name

Endorsed by Branch Head :
Name

**Preparation and Initiation**



Risk Assessment Work Sheet

| Project: BPPS GT Gas Filter Replacement | Revision : | Date : 20 June 2003 | Leader: Anthony | Session No. : |
|---|---|---|---|---|
| System: Change of Pocket Type Prefilter | | Node No. | Member: W.K.Yip, C.K.Lo, W.C.Shiu, C.F.Yau, H.T.Leung | |
| Design Intention: | | | | |
| Drawing No. | | | | |

| Issues | Possible Causes | Possible Consequences | Control Measures | C | L | R | Recommendation | By | Priority |
|---|---|---|---|---|---|---|---|---|---|
| 1. Water penetration | Heavy Rain storm, Typhoon | The prefilters are wet, and water droplets are formed and accumulated on the corridor floor inside filter house. Water ingress to final filters may happen if large amount of rain water accumulated on the floor could not be properly drained. | According to the supplier response, the prefilter has coalescing function, the rain water should be dropped to the existing coalescer frames at the front where the drain holes are available to drain away the water. | D | M | | 1. To regularly check and ensure the filter house drainage system is free from blockage.<br>2. To drill additional drain holes near the filter frames connecting with the existing drain pipes to improve drainage.<br>3. Consider to install a curb along the floor side of the final filters to prevent water ingress in event of flooding due to blockage of drainage.<br>4. Conduct water jet test to test the water holding capability of | GMD/MPD<br>GMD/MPD<br>GMD/MPD<br>GMD/MPD | M<br>H<br>L<br>M |

Page 1 of 4

**Risk Assessment**

**Committee Approval**

**F. CLOSE OUT REVIEW** *to be completed by Change Responsible Person*

**Completion of Change**

**Documents updated :**

| Drawings updated? | Operating Instructions updated? | Maintenance Instructions. updated? | Other Documents reported (please specify) |
|---|---|---|---|
| Yes / N/A | Yes / N/A | Yes / N/A | |

Recommendation of Risk Assessment implemented? Yes / N/A

**Comments :**

**Change Responsible Person Signed:** _____ **Date:** _____ **Branch / Section:**

**Branch Head signed:** _____ **Date:** _____ **Branch / Section:**

**MOC Administrator Signed:** _____ **Date:** _____ **Branch / Section:**

**Close- Out**

**E. IMPLEMENTATION** *to be completed by Change Responsible Person*

**Implementation**

**E1. For Permanent Change :**

Change / Modification implemented by : _____ Branch / Section: _____

Start Date: _____

Completion Date: _____

**Is additional training required?** ☐ **No** ☐ **Yes** (Please specify) _____

**E2. For Temporary/Emergency Change :** (cross out wherever not applicable)

Proposed Temporary Change Expiry Date : _____

Restore to Normal Date : _____

Remarks:- _____

**Implementation**

# Incident Investigation

Incidents or near misses indicates deficiency in the control system.

Incidents are required to report timely into our “Incident Reporting and Analysis System” and investigated by the qualified person.

Lesson learnt from the incident is shared among the organization such that all staffs are aware of the root cause.

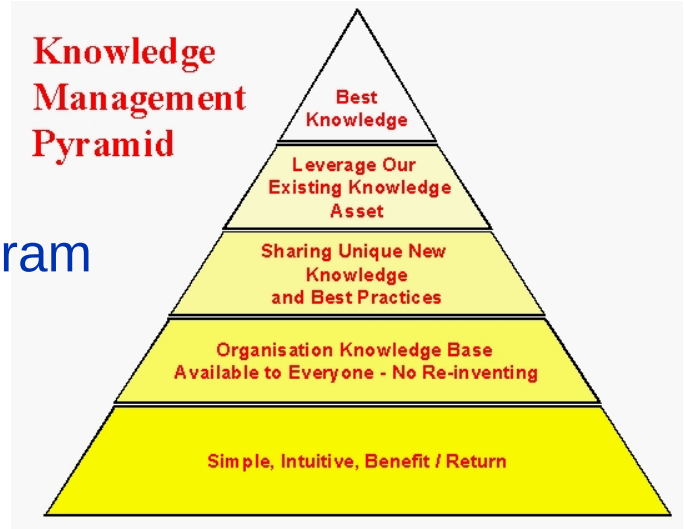
Analysis and trends are also produced to report the type of root causes and develop relevant actions to reduce the gap.

# Organization and Staff

Major incidents always due to changes in organization and staffing such as reduction of competent staff and lack of proper training for new staff.

We use the following methodologies to ensure the people competency:

- Comprehensive training program
- Assessment before authorization
- Emergency response and alarm management diagnostic
- Community of Practice
- After action review
- Refresher training
- Human and Equipment Errors Reduction Program



# Plant Integrity

Improper maintenance and inspection will lead to severe incident. The maintenance decisions are made based on the risk assessment of plant integrity.

Effective management of major hazards requires a proactive approach in which the critical systems are identified, operating and maintaining.

Critical Safety Device (last line of defense to protect the plant) is introduced into the maintenance program.

Information was exchanged from other sources such as external power stations, insurance company, utilities, etc to share the experience on plant integrity.

# Monitoring and Audit

Deficiency in the process safety control systems must be identified and corrective actions must be in place for continue improvement.

The progress of the control systems is monitored by a tracking system and reported to management regularly.

Annual compliance audit is conducted to verify the completeness and effectiveness of the control systems.

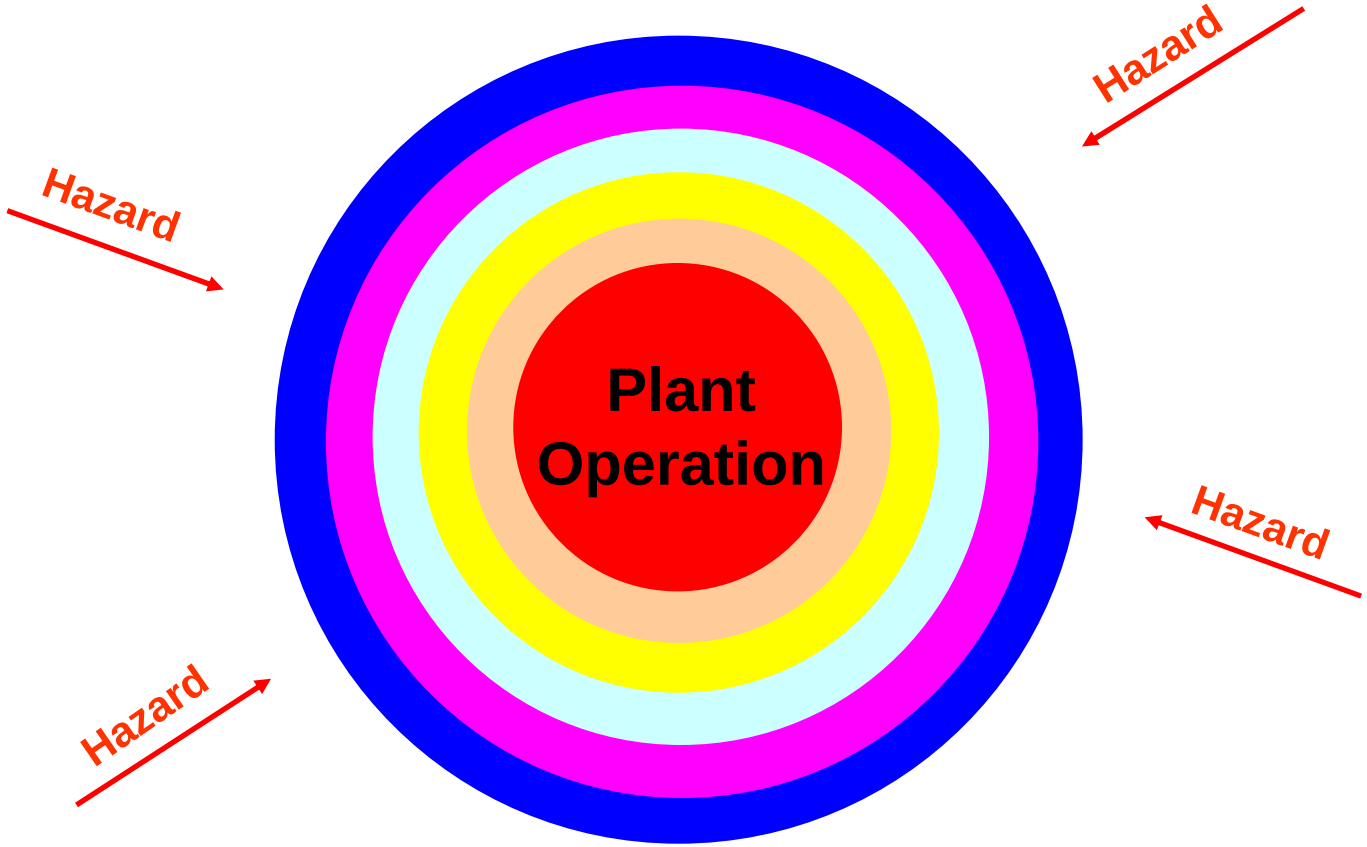
# Summary & Conclusion

- **The success of the process safety control – monitoring of the tracking are important to prevent system deterioration.**

- **Process Safety Culture is sustained at a high standard through continuous updating the knowledge, sharing of lesson learned from incidents, introducing best practices and peer monitoring in place**

- **Apart from the mentioned key elements in the Process Safety Control System, other management systems such as permit to work, contractors management, regulatory compliance, pre-start up review, etc. are also required to keep the Process Safety Control System in good shape.**

# Targeted Result




Onion Model

# END