



Pipeline Threats and Risk Assessment

Date- 10 June 2022

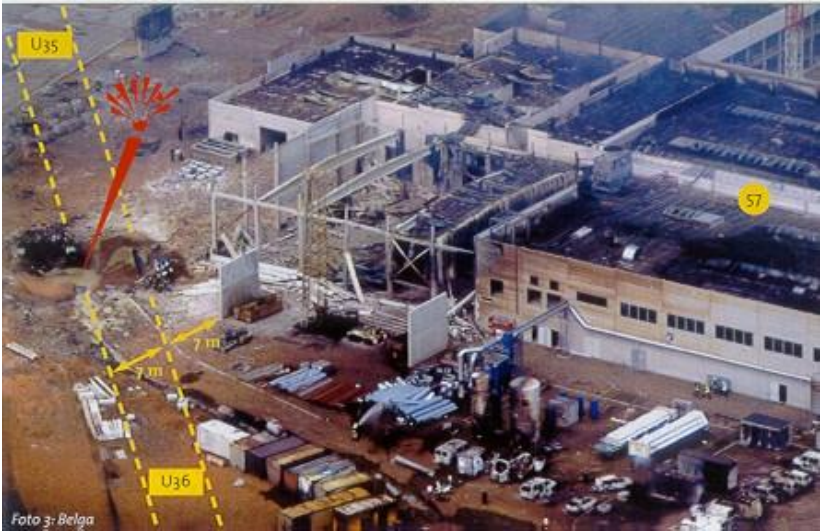
Knowledge Sharing Session on NG pipelines by PNGRB



Agenda

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Pipeline Incidents



TIME INDEPENDENT THREATS

- Third Party leading to mechanical damage
- Incorrect Operations
- Weather related and outside force
 - Lightning
 - Flood
 - Earth Movement

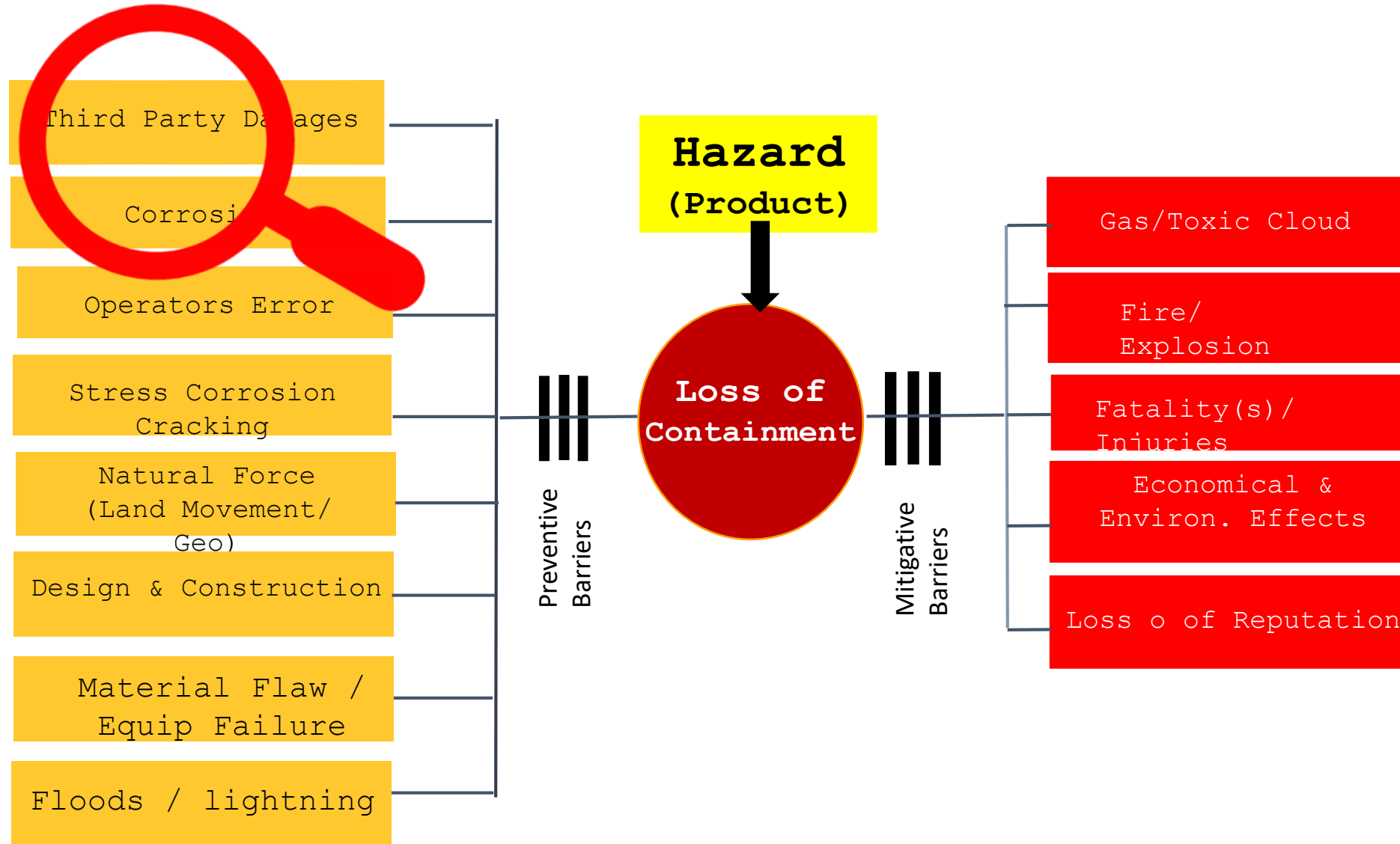
TIME DEPENDENT THREATS

- External corrosion
- Internal corrosion
- Stress Corrosion Cracking

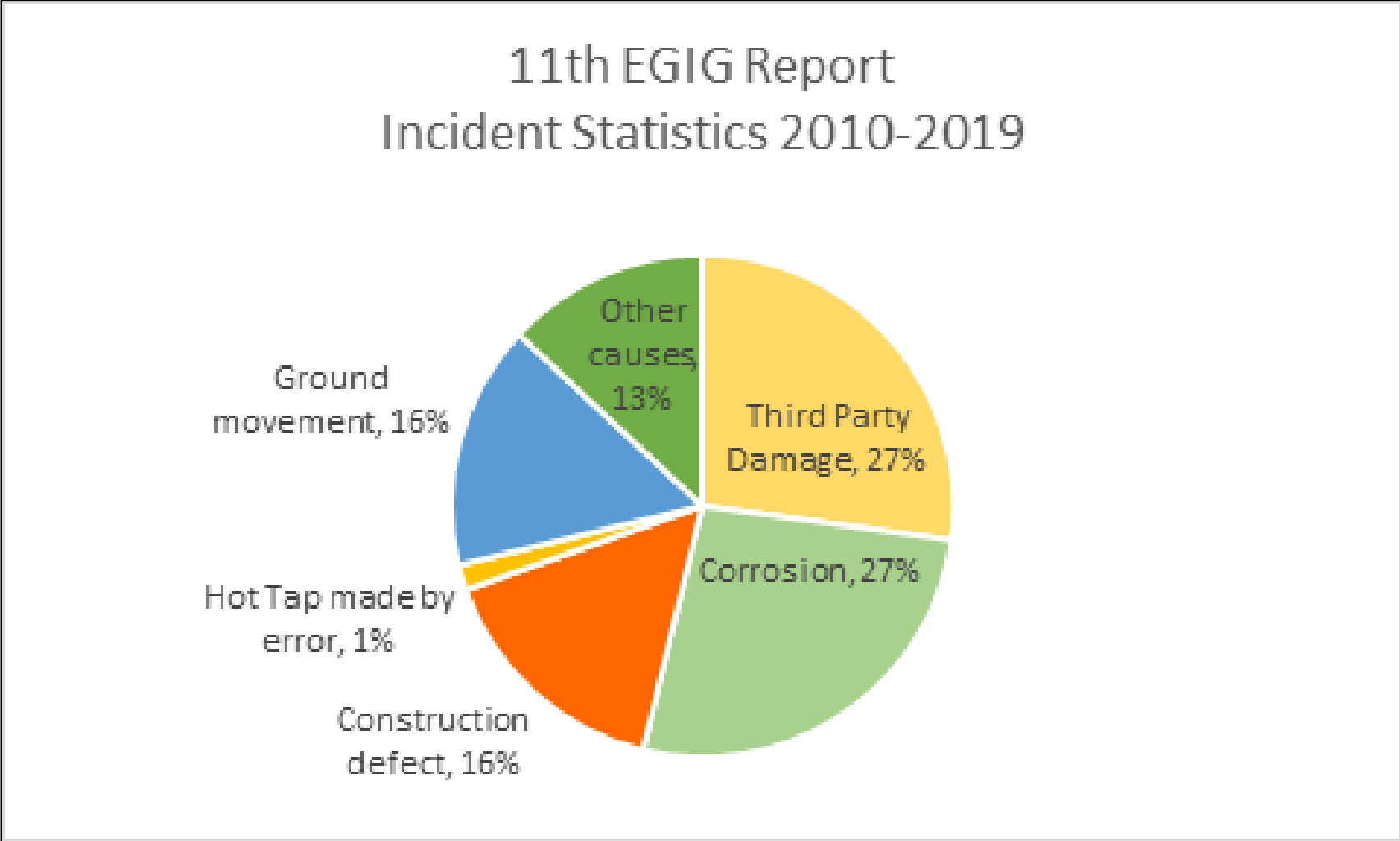
STABLE THREATS

- **Manufacturing related defects** (Defective Pipe/seam)
- **Welding/Fabrication related**
 - Defective pipe girth weld
 - Defective fabrication weld
 - Wrinkle bends or buckle
 - Stripped threads/broken pipe/coupling failure
- **Equipment**
 - Gasket O ring failure
 - Control/relief equipment malfunction
 - Flexible Segment Failure in QOEC

Pipeline Threats



Pipeline Incidents Statistics



Barriers

	Rank	Barriers	Examples
Control Barriers Control the energy <u>independent</u> of the worker	1	Eliminate the Hazard	LOTO, stop usage of HAZCHEM
	2	Min. Energy to Safe Levels	Chem. Substitution. Lesser qnty.
	3	Physical Barriers	Fencing, Lock, Road Closer
Protective Barriers Interact <u>between</u> the energy and the worker	4	Personal Protective Equip.	SCBA , Goggles, FAS, helmet etc.
	5	Warning Devices	F&G system, Alarms, Beacon etc.
	6	Minimize Chances of Error	PTW, TBT, Job Plan, Inspection etc.
Support Barriers <u>Rely</u> entirely on the worker	7	Written Procedure	Gen. Safety Rules, SWP, SMP
	8	Training	Job Specific / other Trainings
	9	Supervision/ Observer	Dedicated observer
"Be careful"	10	Identify the Hazard Only (Warning)	

Highly Effective



Least Effective

THIRD PARTY DAMAGES

- Increased cover depth
- **Marker tape at top of pipe**
- **Increased marker frequency**
- One call system
- **Public awareness/education**
- Increased patrol frequency
- Pipeline Mitra
- **PIDs**
- Reward-Encroachment reporting

INTERNAL CORROSION

- **ILI tool run Risk based/10 years**
- Hydro Test (Risk based)
- **Gas moisture reduction** (separators)
- Internal coupon monitoring
- **Gas quality control**
- **MIC testing**
- External UT exam (B-scan)
- **Iron analysis**
- Cleaning pig run
- Internal corrosion coating
- Radiography
- **ICDA (Non-Pigable lines)**
- Biocide injection
- Inhibitor injection

EXTERNAL CORROSION

- **ILI tool run Risk based/10 yrs.**
- Hydro test -Risk based Affected areas
- **CIS/DCVG survey**
- Upgrade CP coverage by test point data
- Bell hole/ visual inspection
- **Soil corrosivity evaluation (inc. MIC)**
- Buried coupon monitoring
- **Resistivity Survey**
- **EDCA**

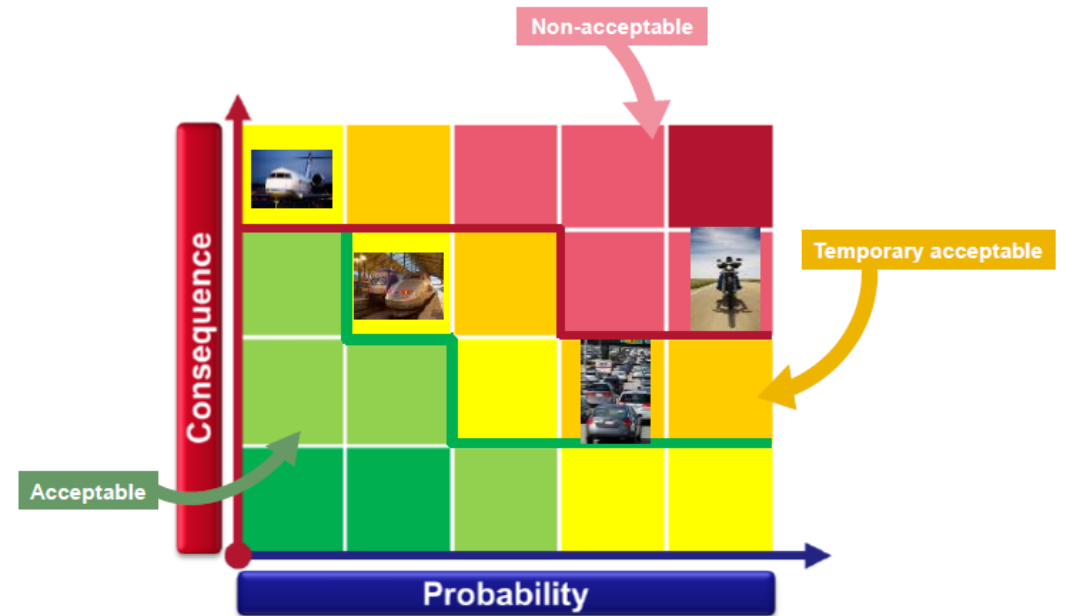
OPERATIONAL ERRORS

- **Develop/Improve SOP**
- Operational review/critiques
- **Training - (Formal/OJT)**
- Internal compliance audits

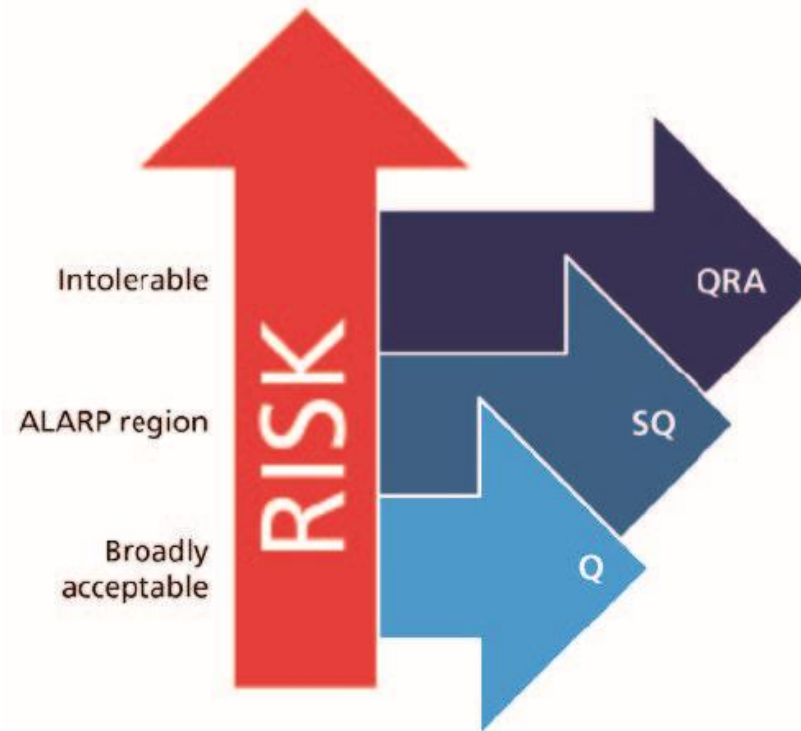
DEFECTIVE FABRICATION WELD

- **Hydrotest**
- **Leak testing**
- **Weld repair / replacement**
- **Defect removal by grinding/NDE**
- Welding procedure selection
- Welding procedure qualification
- Field/Shop QA & QC
- **Welder qualification**
- Welder/Inspector training
- Internal compliance audit
- Design/stress analysis

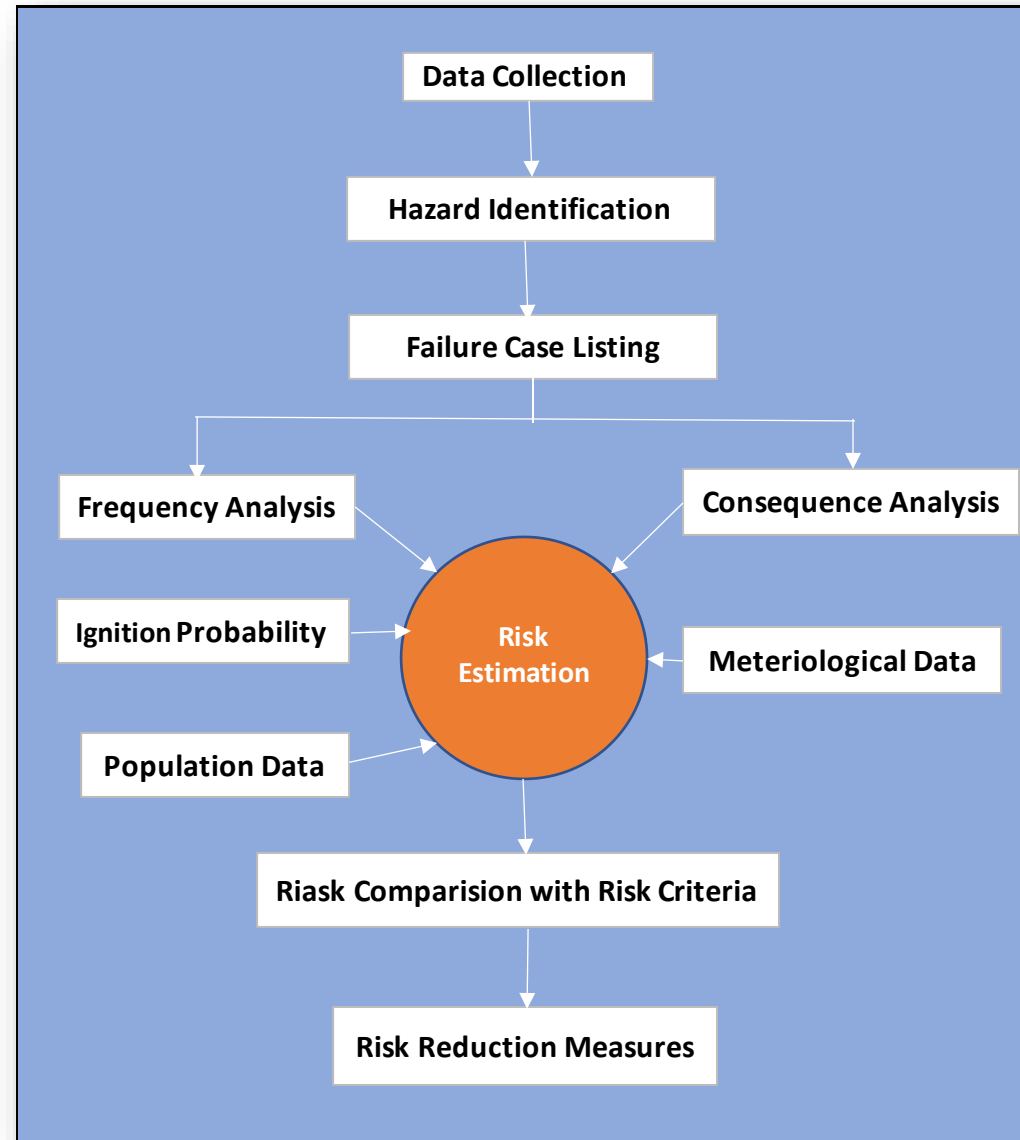
Which mode of transport you would choose?



Risk Management and Risk Assessment Methods



Quantitative Risk Assessment



Quantitative Risk Assessment

1. DATA COLLECTION+ REGISTER

- Scope | Inventory & SOC | IMD site specific data | Population
- Safety systems
- consequence modelling | Frequency assessment| Evacuation & Exit

2. HAZARD IDENTIFICATION

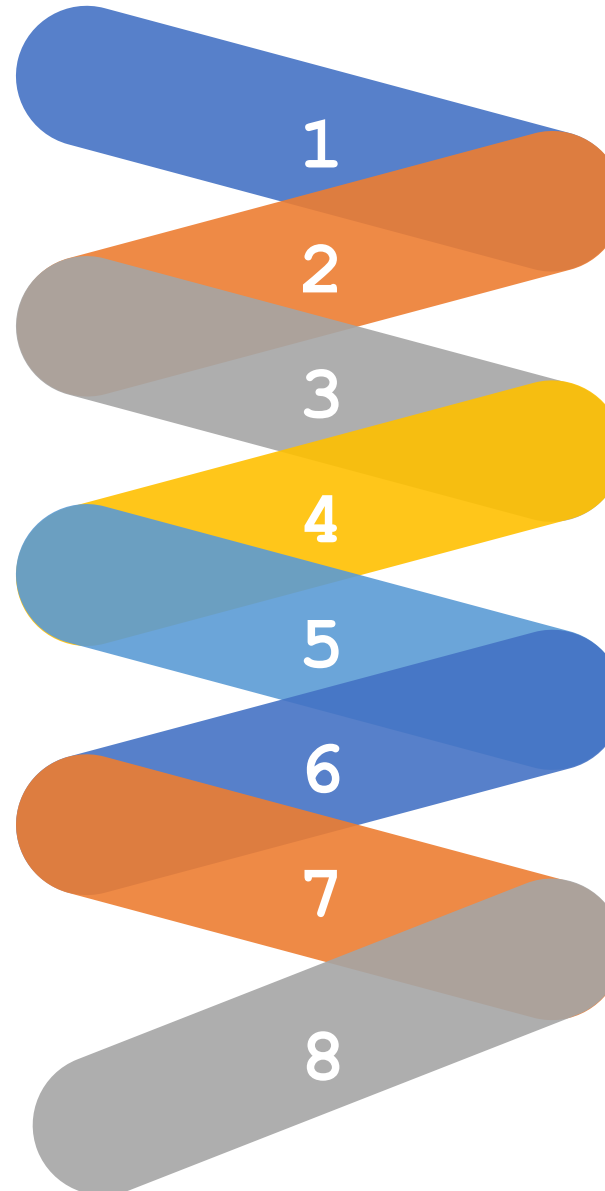
- Site visits | Past incidents
- HAZOP/ QRA/ PHA reports
- Incidents from similar industries

3. FREQUENCY ESTIMATION

- Total leak frequency estimation
- Use of Data Base (UK HSE, OGT etc.)
- ETA for calculating frequency of consequences
- Condition modifier - Ignition, wind rose, safety system failure/success

4. LEAK SIZE SELECTION

- Small : dia. \leq 20 mm
- Medium : dia. \geq 20mm
- Large : Full Bore rupture.



5. WEATHER CONDITIONS

- D: 3 - 5 m/sec
- F : 1.5 m/sec.

6. CONSEQUENCE ANALYSIS

- Possible physical effects resulting from release of HM
- Gas cloud, fire , explosion, toxic release, environmental damage
- Fatality/Injury/Ill health

7. IMPACT ASSESSMENT

- Thermal Impact
- Over Pressure impact.

8. RISK ESTIMATION

- Individual Risk
- Societal Risk

Risk Comparison and Acceptable Criteria

IRPA (Individual Risk per Annum)

