An Introduction to the Safety Case Joint Work Group (SC JWG)

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Why Safety Case Regime?

Safety Case Regime shall help MHI's to progress from "We Think" to "We Know" for the prevention and mitigation of major accidents

Safety Case Gov.- Ind. Joint Work Group (SC JWG)

Role

- Support **enhancement of Process Safety Regulatory Framework in S'pore** by developing implementation proposals for Safety Case Regime
- Coordinate with SRMC/SCIC QRA Work Group to ensure revised QRA Guidelines are fit for adoption into Safety Case Regime

Gov. Reps	**MOM**	Mdm Jaime Lim *(Co-Lead)*	Acting Deputy Director (MHD)
	SCDF	LTC Ng Geok Meng	Assistant Dir (HazMat)
		Maj Lo Wai Mun	Assistant Dir (Licensing)
	NEA	Mr. Chen Fu Yi	Sr Engineer (Central Building Plan)
Ind Reps	**SCIC**	Mr. Amit Bhatnagar *(Co-Lead)*	Singapore Refining Company
		Mr. Evert Klein	ExxonMobil
		Ms. Gloria Wang	Shell

SRMC = Safety & Risk Management Centre; MHD = Major Hazard Dept; QRA = Quantitative Risk Assessment

SC JWG Team Objective

- **Collaborative effort** by regulators and industry members under SCIC to developed guidance documents to support SC regime implementation.
- **Guiding principal** during document development:
  - SC regime should be **value driven, fit-for-purpose regime to prevent or mitigate Major Process Safety Accidents**
  - SC regime helps to enhance **Process Safety knowledge and competency** of MHI's.
  - Development of SC regime related **systems, processes and documents should be done in-house by MHI's staff** to increase in-house **Process Safety competency.**
  - Consultant services should only be used for **limited scope, specialised activities** (e.g. Quantitative Risk Assessment studies etc.)

Activities of JWG

Activities	Status
Develop **Technical Guidance (TG)** for SC regulatory regime, consistent with European Seveso Directives	Completed
Develop SC **Assessment Guide (AG)**	Completed
Develop strategy to build **industry capability** in implementing SC	Completed
Identify potential opportunities to **harmonise SC regime** with existing **regulatory requirements**	Completed

By Regulators

- **WSH (MHI) Regulations**
- **Guide to MHI Regulations**

By SC JWG

SC Technical Guidance

- **SC Technical Guidance**
- **SC Assessment Guide**

- **Technical Guidance & Assessment Guide** being developed based on **UK HSE's guidance documents**
  - Health & Safety Guide HSG 190 – Preparing Safety Reports

Status of JWG Activities

- **50 SC JWG meetings** conducted since 1st meeting on 5th June 2015 (3~4 hrs. every Thursday)
- **SC TG document released by MHD**. Soft copy available at MOM website.
- **SC AG development and review completed**. Draft copy released.
- **Preliminary list of existing regulations** to be harmonised with SC regime prepared. MHD is following up for inter-agencies alignment and way forward.
- **1 SC Leadership forum and 4 Knowledge workshop conducted** (91% MHI's and 185 participants attended)
- Industry members of JWG working with SCIC to develop **Practitioner Training program (4 ~ 5 days)** for MHI engineers involved in detailed development of SC related processes/ documents.

Harmonisation of Regulatory Requirements under Safety Case

Following requirements identified for potential harmonisation:

- Requirements with similar work processes and common objectives
- Streamline to avoid duplication of efforts, e.g. inspection

Regulations	Agency	Comments

✓**WSHA**
• Dangerous Occurrence reporting
• Statutory Inspections (yearly subject to CLA)
• Factory Registration (5 yearly)
  • PHA (5 yearly)
  • SS506 Pt 3 SHMS - Audit (2 yearly)
• Design for Safety
	MOM	-

EPMA – Hazardous Substances • Licensing - Storage / Use (yearly)	NEA	Exclude : Transport
FSA – Petroleum & Flammable Materials • Licensing - Storage (yearly) • Storage tank inspection	SCDF	Exclude : Transport & pipeline
✓**EPMA & FSA** – Revised QRA Guidelines	NEA/SCDF	-

Main Components of a Safety Case

1. **Descriptive information of MHI**
2. **Major Accident Prevention Policy (MAPP)**
3. **Safety Management System (SMS) description**
4. **Risk assessment,** including predictive aspects & identification of Major Accident Scenarios (MASs)
5. **Technical aspects of a Safety Case,** including controls (prevention and mitigation measures) to prevent MASs from occurring
   - **Process safety**
   - **Mechanical**
   - **Electrical, controls and instrumentation**
   - **Human factors**
6. **Emergency Response Plan (ERP)**
7. **ALARP demonstration for selected MASs**
8. **Review MAPP & ERP in light of any new domino info received**

*SC contains all information required to **demonstrate** that the MHI can be **operated safely**.*

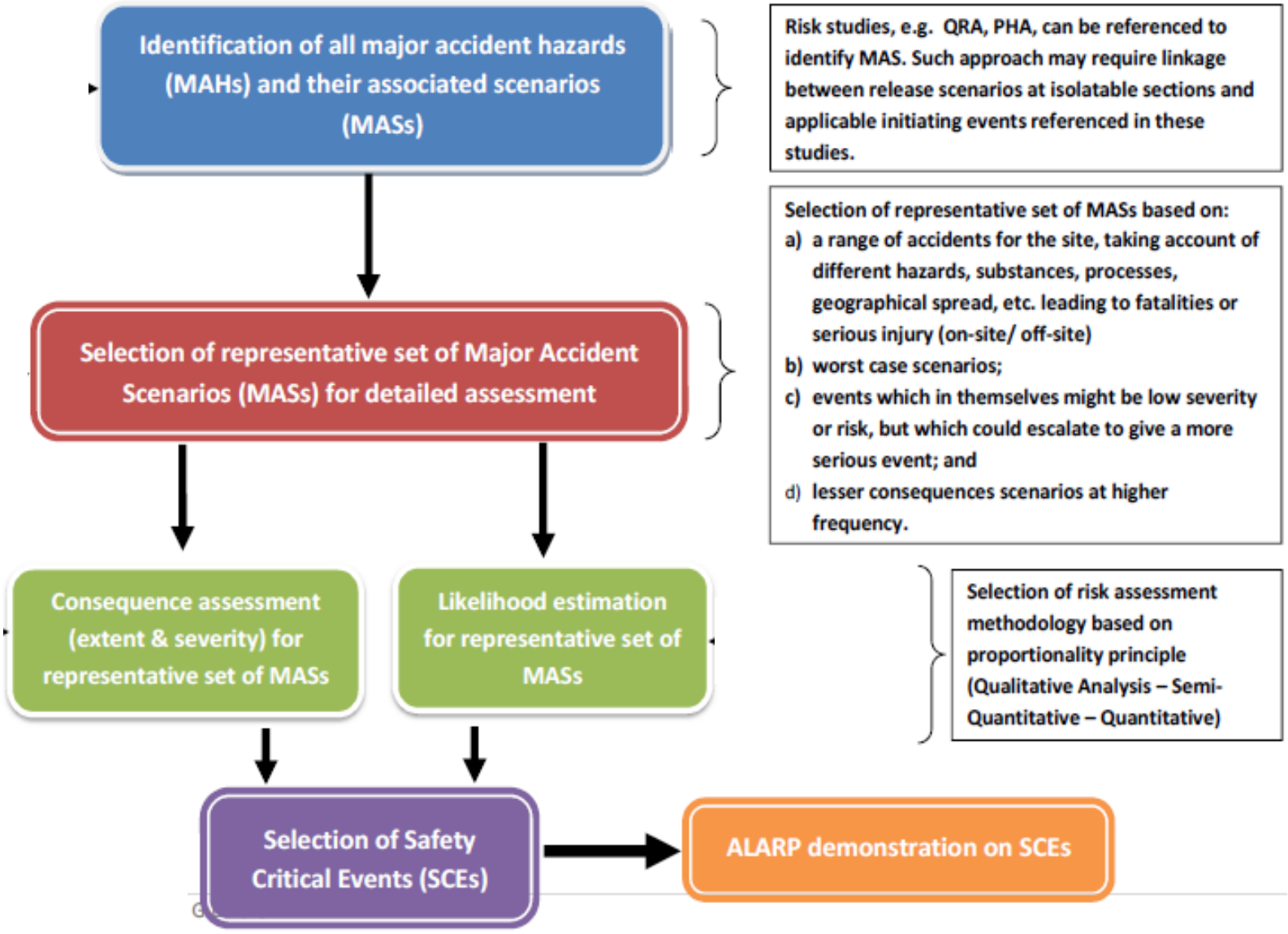
Descriptive Info of MHI

1. **Overview of the installation**, its activities/processes and products
2. **MHI details** include main hazards due to dangerous substances as per 2nd Schedule of new WSH (MHI) Regulations
3. **Maximum inventory details of dangerous substances** above threshold quantities
   - As raw materials, product, by-product, residue, waste or intermediates handled during normal or during abnormal foreseeable process excursions
4. **Physical distribution of dangerous substances** across the MHI
5. **Physical & chemical properties** of all listed dangerous substances, processes, MASs
6. **Short & long term effects** of dangerous substances present at MHI
7. **Description of MHI's vicinity** including details of sensitive receptors
8. **External factors** which may lead to or exacerbate major accidents
9. **Administrative details** of the MHI including address and other information.

Predictive Aspects of SC (Risk Assessment) (1/3)

1. Identification of **Major Accidents Hazards (MAHs)** & **MASs** at an MHI, based on **risk to people onsite and off-site**
2. **Risk assessment** of identified **MASs** using
   - **Qualitative**
   - **Semi-quantitative**
   - **Quantitative methods** or
   - A combination of these (based on proportionality principle)
3. Selection of **representative set of MASs** for detailed assessment
4. **Consequence & likelihood assessment** of representative set of MASs
5. Selection of **Safety Critical Events** from **MASs** for **ALARP demonstration**.
   - Proportionality rule
   - It might be impractical to perform case specific demonstrations for all MASs.
   - This is a more pragmatic option, with the remaining risk generators being monitored by the MHI in a rolling programme, leading up to the time of the next SC submission.

Predictive Aspects of SC (Risk Assessment) (2/3)



Developing Linking Table (3/3)

- Linking table **may** be developed when quantitative methodology (QRA) is used to conduct detailed risk assessment for Safety Case.
- Linking table connect **scenarios used for modeling** in quantitative methodology (QRA) to **initiating causes identified in qualitative studies** like PHA, Hazid, Hazop etc.
- Identifying **initiating causes helps to identify the control measures** which are critical to prevent or mitigate this Safety Critical Events

Example Of Linking Table

Identified Safety Critical Event (from quantitative study)	Equivalent Scenarios from Hazop Studies	Initiating Event from Hazop/ Hazid Studies
Loss Of Containment of Hydrocarbon leading to major fire and explosion in section A of the plant **(equipment catastrophic failure)**	Gas breakthrough from high pressure system to low pressure vessel leading to its overpressurisation and catastrophic failure and loss of containment	**1. LCV yyyy from high pressure system to low pressure vessel fails to open position**
		2. High pressure feed pump mmmm tripped
	Catastrophic failure of high pressure vessel ZZZZ	**3. General thinning of vessel due to corrosion**

Control Measures identified in Hazop study for these initiating events to be reviewed for adequacy

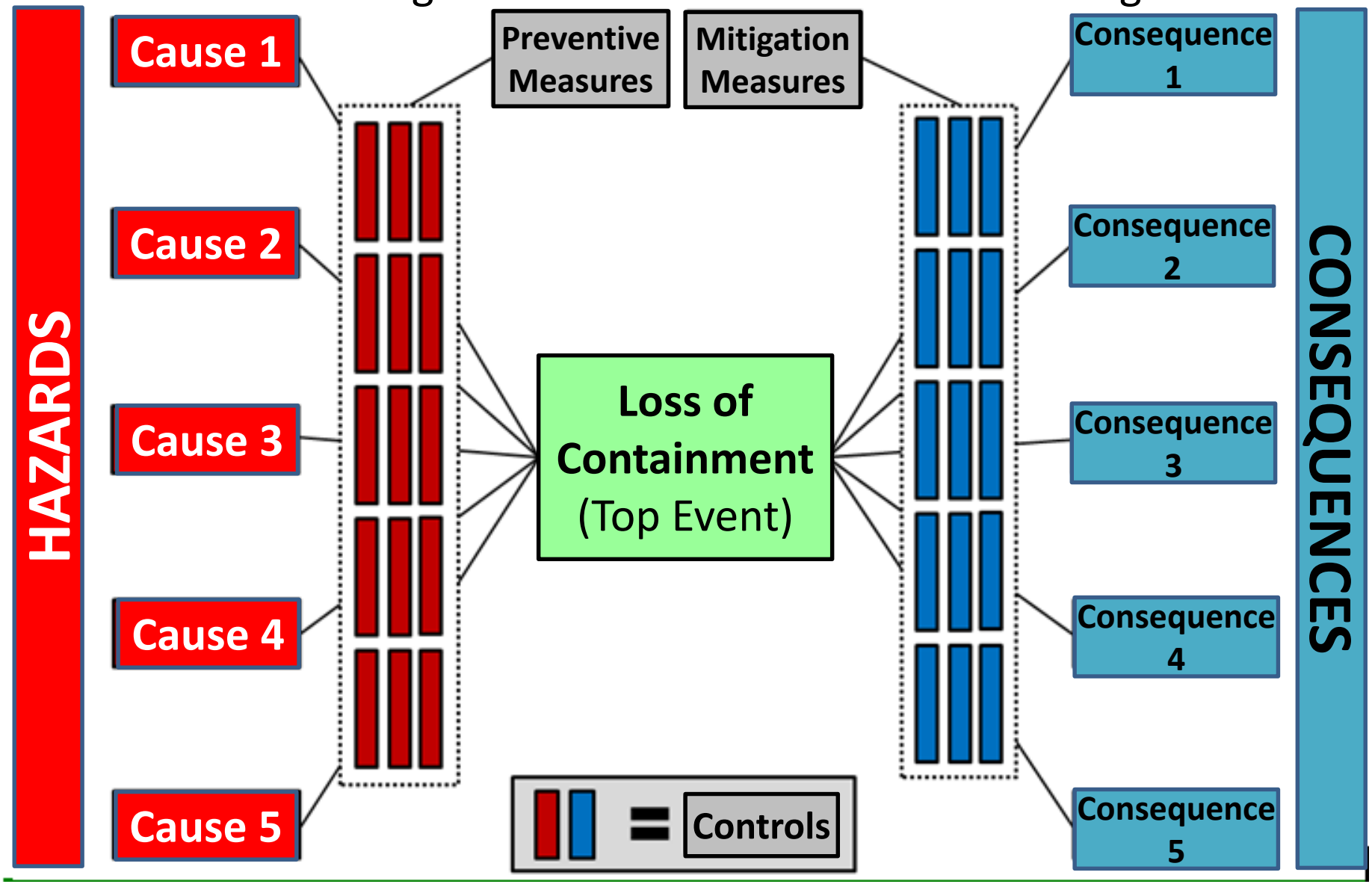
Note: Paragraph 98 on page 28 provides more details on linking tables

Technical Aspects of SC (Preventive & Mitigation Measures)

1. **Necessary & adequate control measures** (preventive & mitigation barriers) implemented to prevent MASs and limit their consequences to **people on- & off-site**
2. **Adequate safety** incorporated into control measures to prevent MASs during facility's lifetime
3. **Five main elements** to show **sufficient safety** built into control measures:
   - **Design**: Plant layout, process and mechanical design of equipment
   - **Construction**: Manufacture, installation, construction, testing of equipment, structures.
   - **Operation**: Start-up, shutdown, normal/ abnormal/ emergency operations
   - **Maintenance**: PM programme, inspection regime, replacement philosophy
   - **Plant Modification**: Managing changes, including decommissioning

Technical Aspects of SC (Preventive & Mitigation Measures)

Preventive & Mitigation Measures: Use of Bow Tie Diagrams



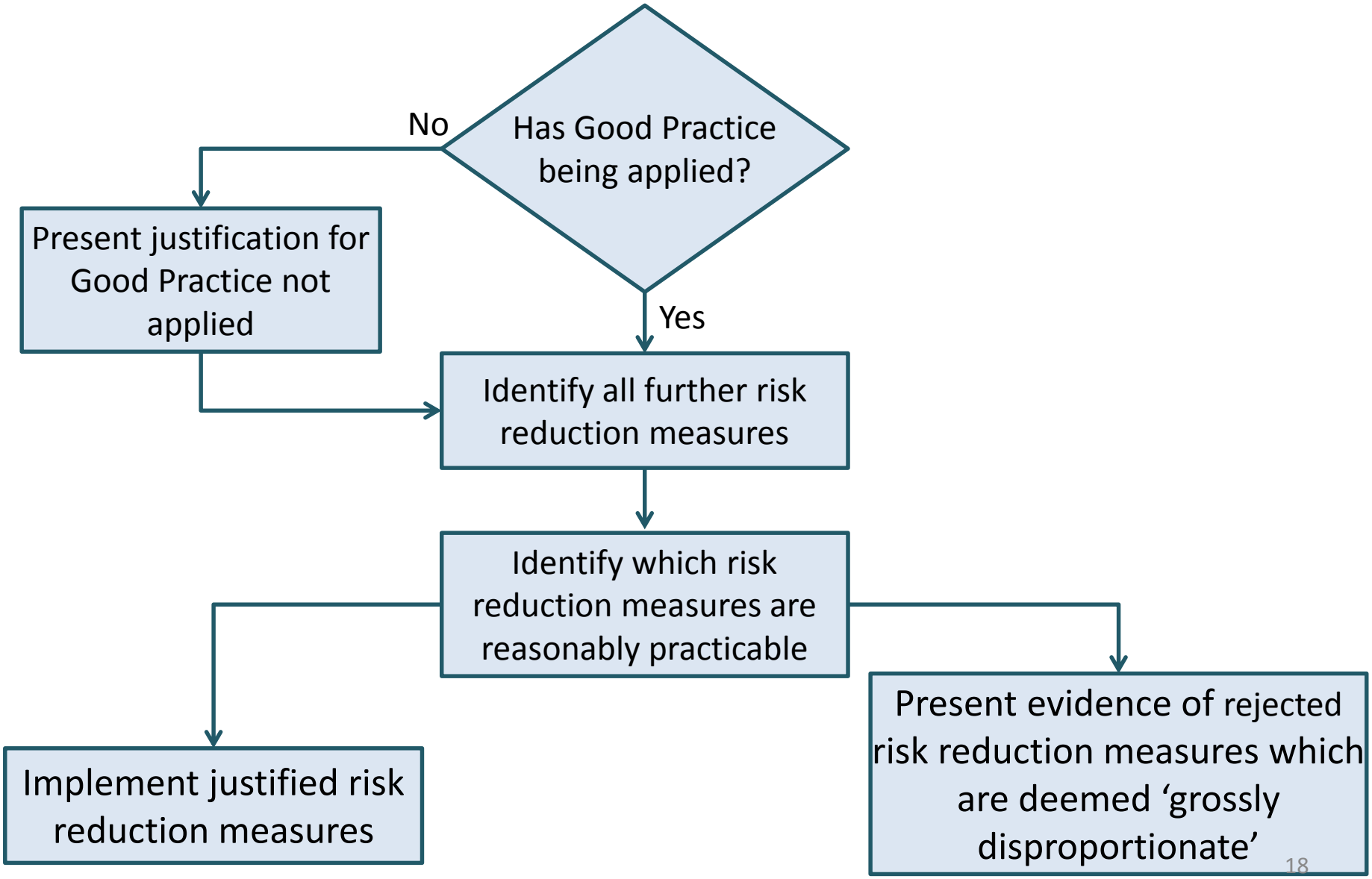
Emergency Response Plan

1. Detailed description of MHI emergency response measures for all MASs
2. SC to demonstrate that MHI has taken all necessary measures to limit the consequences of a Major Accident should it happen and on-site emergency plans have taken these into account

ALARP Demonstration (1/2)

1. **ALARP demonstration** is a **new concept** for Singapore
2. Demonstration that risks from MAHs are reduced to **ALARP** is a **critical part** of SC regime
   - MHIs to demonstrate risks arising from **SCEs** are reduced to ALARP
3. Demonstrating a risk is ALARP requires MHI to justify that it is **not reasonably practicable** (technology, time, money, effort) to reduce the risk further
4. Different methodologies/approaches based on **proportionality principle** may be used for ALARP demonstration

Example Of ALARP Demonstration Process (2/2)



SC Joint Work Group Activities

End Of Presentation