

**Statutory Requirements for Pressure
Vessels and Systems in Singapore
&
Introduction of the Workplace Safety
and Health Act 2006**

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Scope of Presentation

- **Definition of Pressure Vessel**
- **Statutory Pressure Vessels**
- **Other Pressure Systems**
- **Requirements for Fabrication of Pressure Vessel**
- **Requirements for Registration & Inspection of Statutory Pressure Vessel**
- **Repair of Pressure Vessel**
- **Requirements for Installation of Steam Piping**
- **Introduction of the Workplace Safety and Health Act**

Definition of Pressure Vessel

Legal Definition -

“any container or vessel used for containing any substance under pressure and includes any *steam boiler, steam receiver, steam container, air receiver, refrigerating plant pressure receiver and gas cylinder,*

A pressure vessel is potentially hazardous and could explode due to

- design fault
- fabrication fault
- misuse

Statutory Pressure Vessel

Air receiver - a container of air under pressure;

Steam receiver - any vessel or apparatus which contains steam under pressure;

Steam boiler - a closed vessel in which steam is generated at a pressure greater than atmospheric pressure;

Refrigerating plant pressure receiver - a container of refrigerant under pressure; and

Cast iron underfired vulcaniser - a steam boiler in which steam is generated within it for the purpose of vulcanising rubber products.

Other Pressure Systems

Includes the following:

- PV which contains corrosive, toxic, explosive or flammable products;
- Pipeline, pump, compressor and any other eqpt used to convey steam, air, refrigerant or any corrosive, toxic, explosive or flammable substance;
- Gas plant (any eqpt used for the manufacture or storage of gas.

Legal requirements –

- Designed to conform to approved codes;
- Surveyed by approved inspection agency during construction

Requirements for Fabrication of Pressure Vessel

Has to be:

- designed and manufactured to an acceptable code
- surveyed during the construction stage (statutory PVs)
 - by inspectors appointed by Commissioner if fabricated locally
 - approved inspector from Third Party Inspection Agency approved by Commissioner if fabricated overseas

Requirements for Fabrication of Pressure Vessel

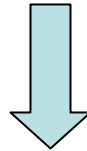
Acceptable Codes for use in the design of pressure vessels

- American Society of Mechanical Engineers (ASME); and
- British Standards Institute

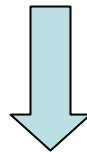
Use of other pressure vessel codes will require prior approval from the Commissioner.

Requirements for Registration & Inspection of Statutory Pressure Vessel

Make an online application to OSHD, MOM



Examined and tested by Authorised Examiner



Report of examination issued by AE

Requirements for Registration & Inspection of Statutory Pressure Vessel (Con't)

Application to OSHD for approval:

- Submits an online application
- Survey Certificate issued by approved third party inspector (if fabricated overseas) or MOM approved inspector
- Approved Construction Drawings showing welding details
- For boilers,
 - approved design calculations endorsed by surveying inspector
 - A layout plan of the boiler house/room conforming to Singapore Standards CP 27
 - A steam piping layout plan and design calculations
 - A detailed gas train layout for gas-fired boiler
 - Approval letter from the Ministry of Environment for installation of chimney and blow-down pit.

Requirements for Registration & Inspection of Statutory Pressure Vessel (Con't)

Testing and Examination:

- Based on the submissions, additional tests may be imposed to determine integrity/condition of vessel
- Minimum tests are visual examination and running (functional) test
- For boilers,
 - the boiler house/room to conform to Singapore Standards CP 27
 - steam piping to be surveyed to steam piping guide
 - gas train layout and components to comply with basic gas train requirement and to be tested
- The tests imposed to be carried out by Authorised Examiner
- Report of Examination of Pressure Vessel by AE

Frequency of Subsequent Periodic Examinations

Type of PV	Inspection Frequency
Air Receiver & Steam Receiver	24 months
Steam Boiler & Cast Iron Underfired Vulcaniser	12 months

Every 10 years - to conduct at least one hydrostatic test and thickness gauging

Periodic Examinations

The examination of a steam boiler during the statutory inspection or after any repair shall consist —

- (a) of an examination of the boiler when it is cold and the interior and exterior have been prepared in the manner specified by the Commissioner; and
- (b) except in the case of an economiser or a superheater, of an examination when it is under normal steam pressure which —
 - (i) must be made as soon as possible after the examination of the boiler when cold; and
 - (ii) must include an examination to determine whether the safety valve is so adjusted as to prevent the boiler from being worked at a pressure greater than the safe working pressure, unless prior written permission has been obtained from the Commissioner.

Repair of Pressure Vessel

Where the repair of any pressure vessel when improperly done, may lead to a dangerous occurrence, prior approval must be obtained from the Commissioner.

The Commissioner may specify conditions or requirements for the repair.

Steam Piping Guide:

- Design Requirements
- Duty of the factory occupier to ensure that code requirements and the inspection guidelines stipulated by the Commissioner are complied with.
- Category of Steam Piping
- Application Requirements
- Inspection Requirements
- Requirements for Inspectors to survey the installation

Steam Piping Guide:

Design Requirements

All steam piping shall be designed, fabricated and installed in compliance with a Code approved by the Commissioner.

Acceptable codes for the design of steam piping issued by

- the American Society of Mechanical Engineers; and
- the British Standards Institute

Use of other piping design codes will require prior approval from the Commissioner.

Category of Steam Piping

Category of piping	Design Pressure or Design Temperature
Low Pressure (LP)	Less than 500 kN/m ² (5 Bar)
Medium Pressure (MP)	500 – 3500 kN/m ² (5 - 35 Bar)
High Pressure (HP)	Above 3500 kN/m ² (35 Bar) or above 400 °C

Application Requirements

Make an application to OSHD for approval to install steam piping

Approval of the Commissioner must be obtained before steam piping installation commences

Application Requirements (Con't)

Information on Inspectors:

- For LP piping, the proposed in-house inspector to inspect the installation of the steam piping.
- For MP and HP piping, the proposed third party inspector or Authorised Examiner (AE) to survey the piping fabrication and installation.

Inspection Requirements (Con't)

In-house inspectors / AE / 3rd party inspectors are to carry out:

- Review and approval of the piping design (pipe supporting elements) to meet design codes used.
- Identification and verification of all materials
- Review WPS, PQR & welders' qualifications
- Review qualifications of personnel conducting Non Destructive Examination (NDE), NDE procedures & results
- Witness hydrostatic pressure tests

Inspection Requirements (Con't)

The appointed Inspectors are also to ensure that the survey and in-progress inspections are carried out satisfactorily

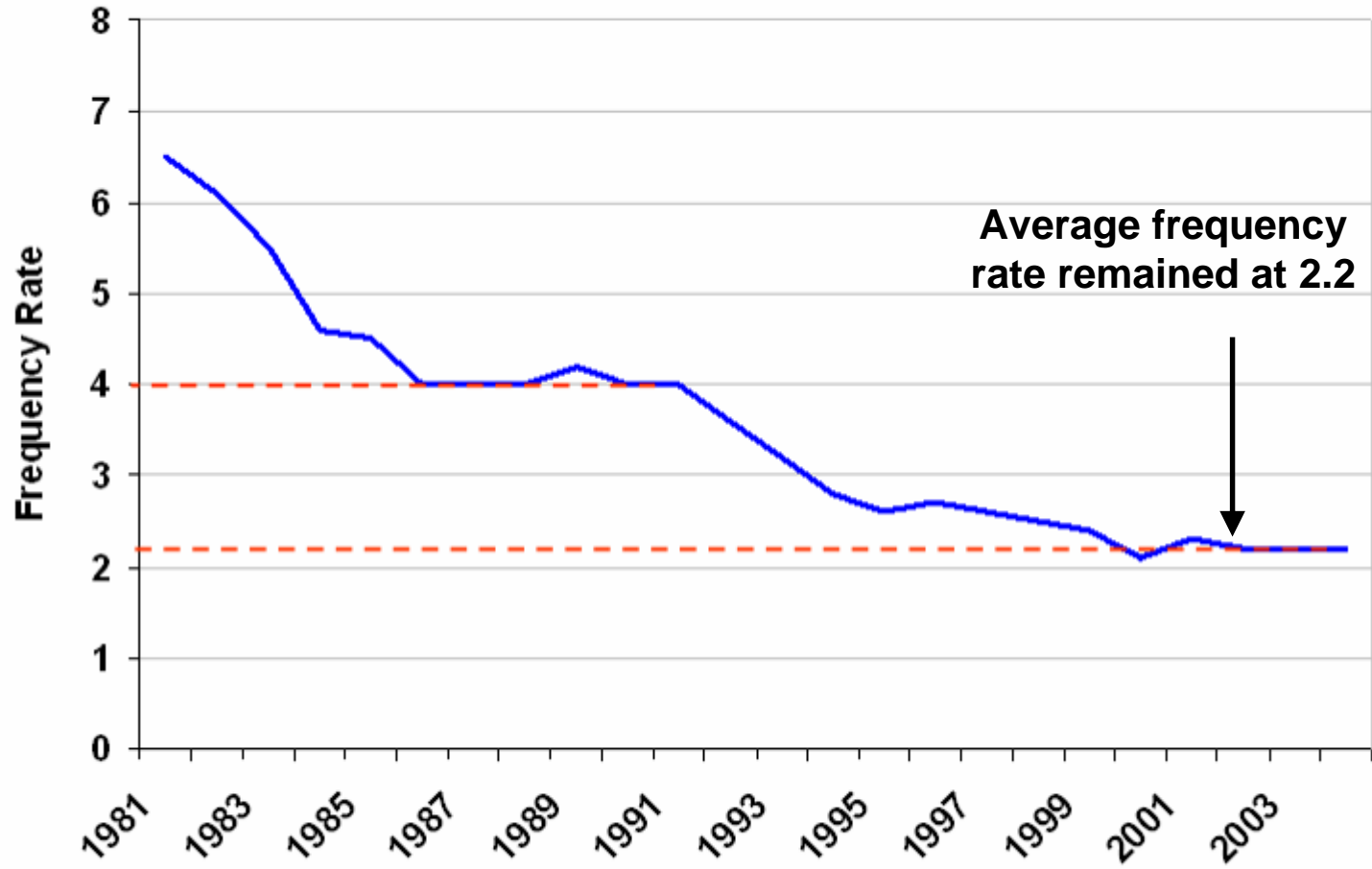
- as indicated 'Steam Piping Guide' for relevant category of steam piping;
- any other additional inspections stipulated in the Design Codes used; and
- any other additional inspections as required by the Commissioner.

Put up a full report on piping installation survey, certifying that all welding and NDE are carried out according to required standards and that the piping is of sound material, good construction, free from defects and meets the required standards.

Introduction to the Workplace Safety & Health Act 2006

The Need for Reform...

Our accident rates have stagnated...



Accident Frequency Rate = No. of accidents per million man-hours worked

The Need for Reform...(Con't)

Major workplace accidents in 2004 had shaken public's confidence in workplace safety and health.

To restore confidence Government formulated the New OSH framework

Target

To halve the occupational fatality rate from **4.9 (in 2004)** to **2.5 by 2015**

To attain standards of the top 10 developed countries with good safety records.

Comparison of Occupational Death Rates, 2002

Country / Region	Occupational Fatality Rate #
Sweden	1.2
United Kingdom	1.3
Australia	2.0
USA (2000)	2.2
<i>EU15 Average</i>	2.5
Japan	2.6
Singapore (2004)	4.9
Taiwan (2001)	6.9
Hong Kong SAR	8.6
Malaysia	10.8

Occupational Death per 100,000 workers

Principles of New OSH Framework

- **Reduce Risks at Source**. Emphasise the importance of good OSH management systems, especially the need for comprehensive risk assessments. Assign liability to those who are in control of workplace risks.
- **Promote Industry Ownership of Standards and Outcomes**. Shift industry mindset from following the letter of the law to taking responsibility of standards and outcomes.
- **Higher Penalties for Poor Safety Management**. Penalties must be sufficient to reflect the cost of poor safety management and to deter risk-taking behaviour.

Workplace Safety and Health Act

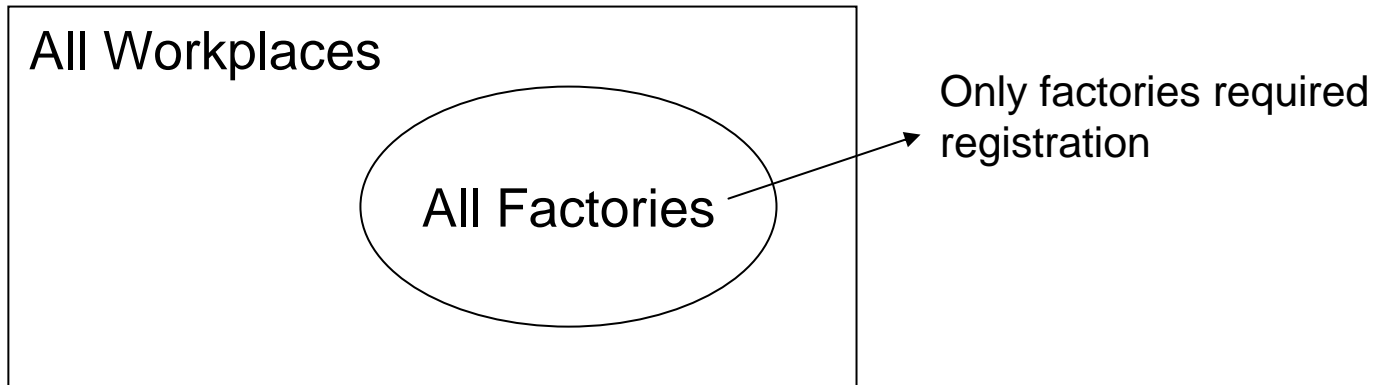
- The WSHA is the key legal instrument to effect the principles of the new OSH framework
 - Administered by the Commissioner for Workplace Safety and Health.
 - Came into force on **1 March 2006**
- Presentation will cover the following key features:
 - Scope of Act.
 - Better defined liability regime along lines of control.
 - Stronger personal accountability.
 - Move from prescription to performance based
 - Higher Penalties for Poor Safety Management and Performance

Scope of the Act

- Section 2 read with [First Schedule](#) limits the present scope of the Act to coverage of the former Factories Act, including the high-risk workplaces:
 - Construction Sites
 - Shipyards
 - General factories (e.g. metalworking factories)
 - Any lab or other premises where testing, examinations or analysis of any article is carried out.
- Eventually all workplaces will be covered under the Act.
 - MOM will consult industry sectors and work with the Workplace Safety and Health Advisory Committee, when expanding the scope of the Act in phases over the next 3 – 5 years.

Workplaces vs Factories

- Workplaces [S5(1)] – any premises where a person is at work and includes a factory
- Factory [S5(2)] – any premises where persons are employed to:
 - Making of article or part of any article;
 - Altering, repairing, ornamenting, finishing, cleaning or washing, or breaking up or demolition of any article;
 - The adapting for sale of any article
 - List of 19 premises that are deemed as factories [S5(3)]



Better Defined Liability Regime to Reduce Risks at Source

- Factories Act imposed liability primarily on the registered factory occupier.
- The WSHA assigns legal responsibility to those who **create** and **have control** over safety and health risks
 - Part IV – General Duties of Persons at Workplaces
- Imposed a general duty to take ***reasonably practicable*** measures to protect people affected
 - Employees, workers as well as members of public

Stakeholders under the New Liability Regime (Part IV of the WSHA)

- Occupiers for the physical workplace, means of access and egress and any machinery, equipment etc. (S. 11)
- Employers (including self-employed) for work processes. (S. 12 and 13)
- Principals for their contractors or workers supplied by 3rd party labour suppliers where they direct *the manner* of work. (S. 14)

Stakeholders under the New Liability Regime (Part IV of the WSHA)

- Measures that employers and principals are required to undertake include:
 - providing and maintaining a safe work environment;
 - ensuring adequate safety measures are taken at work;
 - ensuring persons are not exposed to hazards arising from the workplace or areas under the employer's control;
 - developing and implementing emergency procedures;
 - providing adequate instructions, information, training and supervision to employees;

Stakeholders under the New Liability Regime (Part IV of the WSHA)

- Employees (persons at work) to co-operate with employers and not endanger the safety and health of others. (S. 15)
- Manufacturers & supplier of dangerous machinery, equipment and hazardous substances to ensure so far as is reasonably practicable that they are safe, without risks to health when properly used (S. 16).
- Persons who erect, install, modify or maintain such machinery to ensure that so far as is reasonably practicable that they are safe, without risks to health when properly used (S. 17).

DEFINITION OF MACHINERY AND EQUIPMENT

1. Scaffolds and any materials or components used to erect them
2. All lifting equipment
3. Forklifts
4. Power presses
5. Bar-benders
- 6. Any equipment or piping intended for operation under pressure, including all statutory pressure vessels**
- 7. Any equipment or piping intended to contain corrosive, toxic or flammable substances**
8. Welding equipment, including any accessory, apparatus or fitting necessary to enable its use
9. Materials or components used for the construction of support structures
10. Explosive powered tools
11. Equipment used for abrasive blasting, including any accessory, apparatus or fitting necessary to enable its use and operation.

Strengthened Personal Accountability

- To engender a strong safety culture, commitment of top management is critical
- WSHA holds managers and directors of companies personally accountable for safety and health practices at their workplace (S. 48)

Moving to a Performance- based regime

- Factories Act is prescriptive in nature
 - *“the law prescribes what must be done in order to be safe”*
 - Safety measures listed are not exhaustive;
 - It is simply not effective to prescribe detailed requirements applicable for every scenario, across different industry sectors.

Moving to a Performance- based regime

Comprehensive Risk Management Systems

- Companies will be required under the WSH (Risk Management) Regulations to:
 - Conduct Risk Assessments
 - Take steps to eliminate or minimise the identified risk
 - Disseminate information to employees and others
- Regulations had been *gazetted* but will come into force on 1 September 2006.

Moving to a Performance- based regime

- Risk Assessment guidelines available
- Government will continue to work closely with industry in standard setting and provide guidance for compliance.
- Codes of practices will be established together with industry that will serve as guidelines on reasonably practicable measures for compliance.

General Duties to be Discharged by...

- Management of stakeholders must show that they have taken active steps to:
 - Implement sound OSH management systems;
 - Conduct comprehensive Risk Assessments and implement control measures to eliminate or reduce the risks;
 - Provide adequate resources;
 - Provide information to affected persons;
 - Comply with existing Regulations, Codes of Practice and industry practices.
- Companies are expected to engage 3rd-party OSH professionals if they lack the capabilities to help better manage their workplace safety and health.

Higher Penalties for Poor Safety Management and Performance

“We need to ensure that the penalties for non-compliance are sufficiently high to effect a cultural change towards OSH on the ground.

Penalties should be set at a level that reflects the true cost of poor safety management, including the cost of disruptions and inconvenience to members of the public which workplace accidents may cause.

The collapse of Nicoll Highway not only resulted in the loss of 4 lives, but also caused millions of dollars in property damage and led to countless lost working hours and great inconvenience to the public. The maximum penalty of \$200,000 under the present Factories Act is therefore inadequate.”

Manpower Minister Dr Ng Eng Hen during 2nd reading of WSHA

Higher Penalties for Poor Safety Management and Performance

“The Factories Act contains a stepped penalty regime based on the harm done. The inadequacy of this regime is that it does not allow for meaningful penalties in cases where there are severe lapses, but fortuitously no accidents have occurred.”

Manpower Minister Dr Ng Eng Hen during 2nd reading of WSHA

Penalties under the Factories Act-

■ Minor (Technical Offence)	Max. fine - \$5,000 / \$2,000
■ Likely to cause injury	Max. fine - \$20,000 and/or 1/2 yr jail
■ Results in serious injury	Max. fine - \$35,000 and/or 1 yr jail
■ Results in one death	Max. fine - \$50,000 and/or 1 yr jail
■ Results in 2 or > death	Max. fine - \$200,000 and/or 1 yr jail
■ For Repeat Offender	Max. fine of <u>twice</u> the amount that is specified in the Act

Higher Penalties for Poor Safety Management and Performance

The penalties have been increased in-line with other leading OSH countries, but generally consistent with other similar offences;

Enhanced General Penalties under the WSH Act-

- For Individuals - \$200,000 and/or **24 months' jail.**
- For Corporations - **\$500,000 fine.**
- For repeat offenders where a fatality occurs during a previous offence and a 2nd fatality is caused – Max. fine is doubled

- The WSHA hence allow the court to impose penalties *“taking into account all the relevant circumstances, including the culpability of the offender, the potential harm that could have been caused, and the harm actually done.”*

[WSHA 2nd Reading speech]

Some frequently asked questions...

- **How comprehensive must the risk assessment be?**
 - The RA should cover whatever risks that are foreseeable.
- **What if my contractor “disobey” instructions and subsequently meet with an accident? What if it is my own employee who is involved in the accident? What if?Who is to be held responsible?**
 - The fundamental principle is whether you had control over the safety and health risks. There is no **“cookie-cutter”** answer to such **“what if”** questions. Any liability will be ascertain pending investigation findings.
- **Who will go to jail if an accident happened?**
 - Custodial sentence is typically reserved for individual who had willfully or reckless committed an act which endangers the lives of others

***If you are serious about safety and health,
you do not need to worry about liability or jail.***

Thank You

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