Strategies for Preventing Occupational Diseases & Program Implementation in Metropolitan Regions and Cities

職業病預防策略及都會地區執行重點

David K. N. Leong*, 梁嘉南

Ph.D., P. Eng., CIH, ROH, C. Chem. C. Sci.

Toronto, Ontario, Canada

Tel: 1-416-733-2152

Email:david_leong888@yahoo.ca

November 11, 2013

Taipei City Labor Inspection Office, Taipei

Taiwan (ROC)

***Chair, ACGIH Air Sampling Instruments Committee**

Greetings

The Urgency for Preventing Occupational Diseases

Global Occupational Diseases & Injuries (WHO, 2006)

Annual work-related diseases, injuries & deaths:

- More than 100 million cases & over 2 million deaths (i.e. *about 228 workers have died from occupational diseases & work related injuries globally during the past hour*)
- **Occupational diseases cause about 4 times as many deaths (1.7 million/year) as occupational injuries**

Global Occupational Diseases & Injuries (WHO, 2006) cont'd

Annual work-related diseases, injuries & deaths: cont'd

- The most common workplace illnesses are
  - **Cancers** from exposure to **hazardous substances**
  - Musculoskeletal diseases
  - **Respiratory diseases**
  - Hearing loss
  - **Circulatory diseases**
  - Communicable diseases

Global Occupational Diseases & Injuries (WHO, 2006) cont'd

Annual work-related diseases, injuries & deaths: cont'd

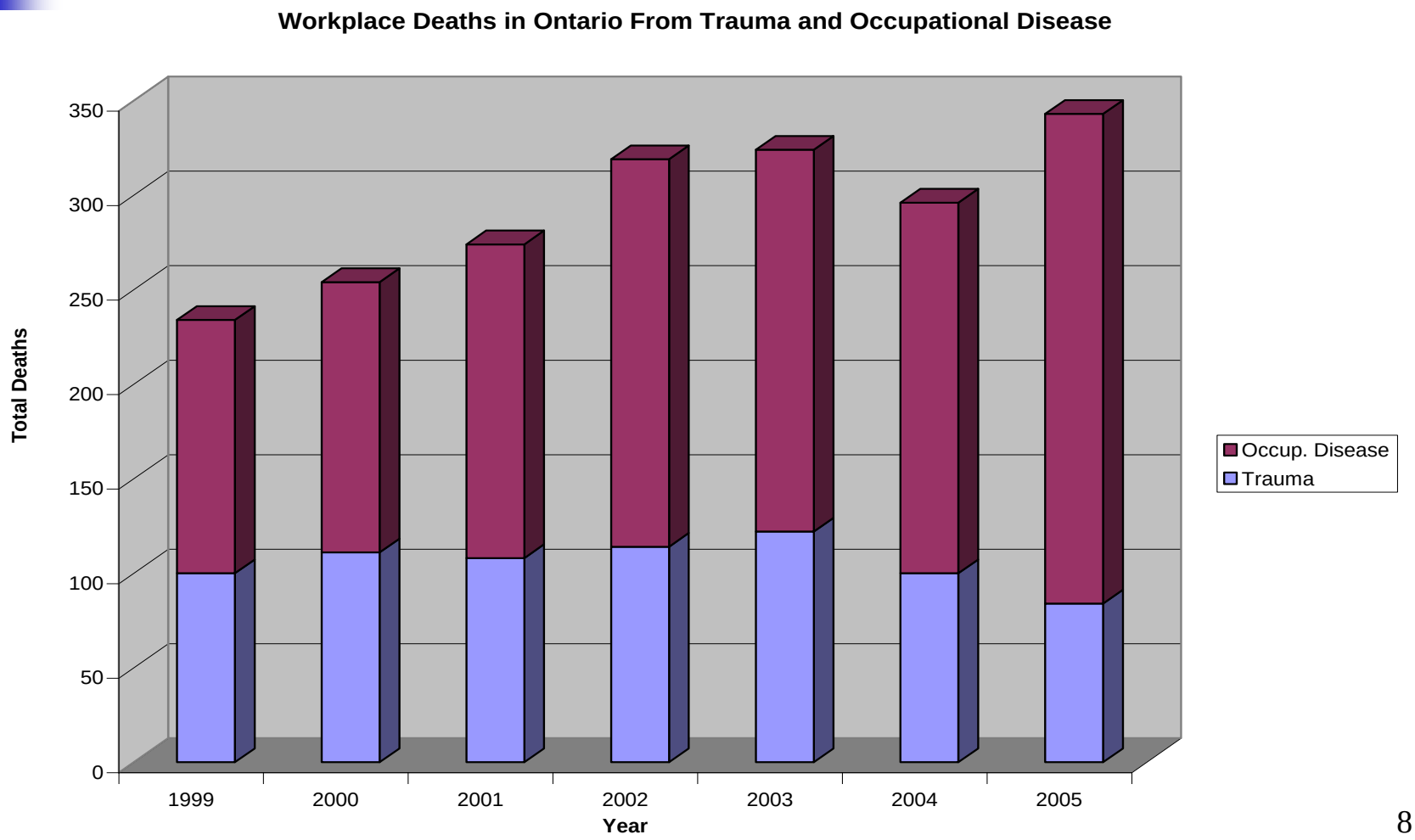
- 152,000 deaths from exposure to carcinogens
- 386,000 deaths from airborne particulates
- 37% of lower back pain related to work
- Cases will rise due to rapid industrialization in developing countries
- By 2025, occupational diseases & injuries may be doubled

Occupational Fatalities in Ontario, Canada during 1999-2005

- The trend of occupational fatalities in Ontario during 1999-2005 with respect to occupational diseases and occupational injuries is consistent with the WHO/ILO conclusions
- In 2006, occupational **diseases** accounted for **71.2 %** of the allowed occupational fatality compensation claims in contrast to the occupational traumatic **injuries** for the remaining **28.8%**

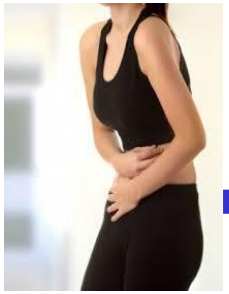
Source: Workplace Safety Insurance Board of Ontario (WSIB), Statistical Supplement to the Annual Report 2006

Occupational Fatality Claims in Ontario (1999- 2005)



What cause Occupational Diseases?

Harmful Health Effects of Hazardous Chemicals



- **Chemical Burns** caused by
  - **Corrosive liquids** (e.g. *strong acids & alkalis*)
  - **Severe Irritants** (e.g. *chlorine, phosgene*)
- **Chemical Poisonings**
  - Pesticide poisoning, arsenic poisoning
  - Carbon monoxide poisoning, cyanide poisoning (***chemical asphyxiation***)
- **Simple Asphyxiation** (e.g. *carbon dioxide, methane, nitrogen,* etc.)

Harmful Health Effects of Hazardous Chemicals (cont'd)

- **Lung Diseases**
  - **Pneumoconiosis** or "dusty lung" (*Dusts & Fibers*)
  - **Silicosis** (*Crystalline* s*ilica*)
  - **Asthma** (*Isocyanates*)
- **Cancers**
  - **Lung Cancer** (*Asbestos*)
  - **Leukemia** (*Benzene*)
  - **Skin cancer** (***coal tar pitch***), increased by **ultraviolet radiation** acting as a promoter & vice versa

Harmful Health Effects of Hazardous Chemicals (cont'd)

- **Kidney Diseases**
  - ***Acute*** Kidney Failure (*Chloroform*)
  - ***Chronic*** Kidney Failure (*Lead, Mercury, Cadmium*)
- **Skin Diseases**
  - ***Allergic*** Contact Dermatitis (*Chromic Acid*)
  - ***Irritant*** Contact Dermatitis (*Fibrous Glass*)

Harmful Health Effects of Hazardous Chemicals (cont'd)

- **Liver Diseases**
  - Acute Toxic Hepatitis (*Halogenated Aromatics*)
  - Chronic Liver Disease (*Arsenic*)
  - Liver Cancer (*Vinyl Chloride*)
- **Cardiovascular Diseases**
  - Acute Chemical Asphyxia (*Carbon Monoxide, Cyanide, Methylene Chloride*)
  - Coronary Artery Disease or heart disease (*Carbon Disulfide, Arsenic*)

Harmful Health Effects of Hazardous Chemicals (cont'd)

- **Nervous System Diseases**
  - Central & Peripheral Nervous System Impairment with Mental & Psychological Disorders (*Mercury, Carbon Disulphide*)
  - Central Nervous System Impairment & Mimics Parkinsonism (*Manganese*)
- **Reproductive Disorders**
  - Reduced Fertility (*Lead, Chemotherapeutic Agents*)
  - Spontaneous Abortion (*Lead*)
  - Birth Defects (*Waste Anesthetic Gases*)

Other Kinds of Hazardous Agents & Factors causing Harmful Health Effects

HAZARDOUS AGENTS/FACTORS	EXAMPLES
Biological agents	Viruses, Bloodborne pathogens etc.
Physical agents	Noise & vibration Heat & cold Electromagnetic fields, lighting etc.
Ergonomic factors	Lifting, stretching & repetitive motion
Psychosocial factors	Stress, workload & work organisation

When will a Person at Work be harmed?

- A hazardous substance/agent will cause harm or adverse effects, and eventually occupational diseases when
  - **Exposure** to a hazard **occurs**, and
  - Exposure **continues** for a sufficient period

When will a person at Risk?

- **Risk** is the **probability** or **likelihood** that the harm or adverse effects caused by an occupational hazard will occur
- Water spilled in a room would present a slipping hazard to persons passing through it
- If access to that area was prevented by a physical barrier then the hazard would remain though the risk would be minimized

When will a person at Risk? (cont'd)

- **Risk** of an occupational hazard is the probability or **likelihood** that any worker may be **exposed** to and **harmed** by the **hazard**, causing bodily injury, work-related illness or occupational disease
- **Risk** is related to both **hazard** & **exposure**:

Risk = Hazard x Exposure, or

Risk = *f* (Hazard, Exposure)

When will a person at Risk? (cont'd)

- If there is **no exposure** (e.g. *a truck driver shipping, moving & loading lead ingots*) there is **no risk**
- Worker is at **risk** when there is an **exposure** (e.g. *lead ingots are melted with emissions of lead fumes to which the furnace worker is exposed*)

When will a person at Risk? (cont'd)

- The **risk** of harm to worker's health from chemical exposure can be reduced by minimizing:
  - **Hazard** (by ***elimination, substitution***)
  - **Exposure** (by ***controls, personal protection***, etc), or
  - **Both**

Occupational Hygiene Hazard-Based vs. Risk-Based Approach

Hazard/Exposure ➔	➔➔ **Risk**
Anticipation & Recognition	**Identification**
Evaluation	**Assessment**
Control	**Management**
Communication	**Communication**

Can Occupational Diseases be Prevented?

Control of Silicosis in Singapore

- **Silicosis** was the leading occupational disease in the early 1970s, & was also the leading occupational respiratory disease in the 1970s & 1980s
- By the end of 1995, 362 cases of silicosis had been verified, 80 % of which were contracted in **granite quarries** 花崗岩採石場

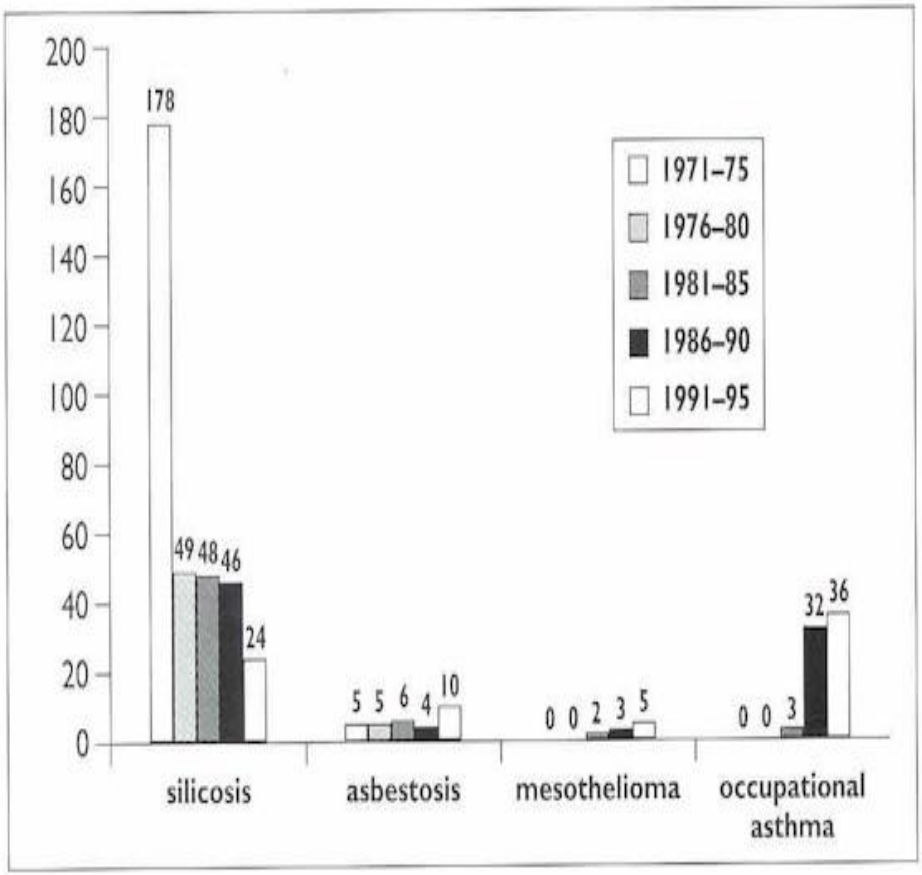


Figure 1. Cases of occupational lung diseases in Singapore.

Control of Silicosis in Singapore (cont'd)

- In 1973 the Ministry of Labour launched a **Silicosis Prevention Campaign** which included a mobile exhibition & media coverage
- Quarry owners were called upon to take preventive measures to protect the health of their workers

Table 1. Silicosis by industry 1970–1995.

Industry	No. of cases (%)
Granite quarries	282 (77.9)
Rubber factories	43 (11.9)
Kaolin quarries	11 (3.0)
Foundries	10 (2.8)
Brickworks	6 (1.7)
Others	10 (2.8)
Total	362 (100)

Mr Sia Kah Hui, Minister of State for Labour arrives for the opening ceremony of the CAMPAIGN ON SILICOSIS, organised by the Industrial Health Unit to draw attention of the public & granite quarry management and workers in particular to the silicosis hazard.

Control of Silicosis in Singapore (cont'd)

- The Sand and Granite Quarries Regulations were enacted in 1971, requiring licensees of any quarry to install **dust control systems**, provide **respirators** and to provide quarry workers with annual **chest X-ray** examinations
- The Abrasive Blasting Regulations enacted in 1974 prohibited the use of sand as an abrasive for blasting
- By 1979, all granite quarries had installed dust control systems

Control of Silicosis in Singapore (cont'd)

- There was a significant decline in dust levels, particularly after the implementation of dust control measures in 1973

Table 2. Exposure to respirable dust levels (8-hr TWA) among crusher workers at granite quarries.

Year	No. of samples	Mean (mg/m^3)	% > 1 mg/m^3
1973	116	3.1	85.3
1976	141	1.3	42.5
1977	296	1.3	48.6
1978	291	1.1	50.1
1985	270	1.3	55.2
1986	217	1.0	34.6
1987	114	0.8	25.4

Control of Silicosis in Singapore (cont'd)

- There was a sharp decline in the number of new cases of silicosis after 1975, and a further decline after 1990
- Phasing out of granite quarries has further reduced the risk of silicosis
- Silicosis is no longer an important disease in Singapore

What are the Key Strategies for Prevention of Occupational Diseases?

Key Strategies for Prevention of Occupational Diseases

- Identify the occupational hazards that cause harm, and set priorities for risk management
- Evaluate the priority hazards and assess their severity
- Evaluate or estimate the exposure and likelihood of exposure

Key Strategies for Prevention of Occupational Diseases (cont'd)

- Evaluate the risk
- Manage the risk with the risk control method
- Monitor the workers at risk
- Conduct health surveillance of exposed workers
- Risk management of occupational hazards for occupational disease prevention

What are the Priority Occupational Hazards for Prevention of Occupational Diseases?

Very High Concern Harmful Chemicals

- Very high concern harmful chemicals in workplaces are those substances
  - that can cause **severe occupational diseases**, illnesses, disorders or adverse health effects
  - are widely set as **regulatory priorities** by various government agencies for risk management, and
  - are the **highest-ranked health hazards** in control banding, requiring specialist's advice for risk control

Very High Concern Harmful Chemicals (cont'd)

- These substances include
  - **Carcinogens** (*tumorigen* or *oncogen*)
  - **Mutagens**
  - **Teratogens** & **Embryotoxins**
  - **Reproductive toxins**
  - **Sensitizers**

Other Priority Occupational Hazards

- **Infectious Diseases**
  - Viral Illnesses e.g. influenza (various viral strains: H1N1,…H5N7,..) & SARS
  - Bloodborne infectious diseases
- **Musculoskeletal Disorders**
- Workplace **violence**
- Other hazards may be identified from the analysis of inspection data, exposures and compensation claims for occupational illnesses & claims

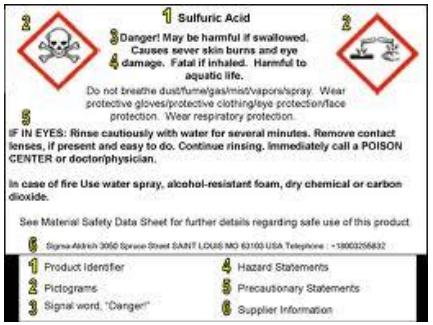
What is the Process for Evaluation, Assessment and Communication of Occupational Hazards?

Hazard Communication Legislations for Workplace Chemicals

Information on hazardous chemical products & safe uses transmitted from

Suppliers & ***Importers*** through

Labelling & SDSs (*MSDSs*)



to

Workplace ***Employers***

to

Workers through **Education & Training**

GHS Hazard Classification

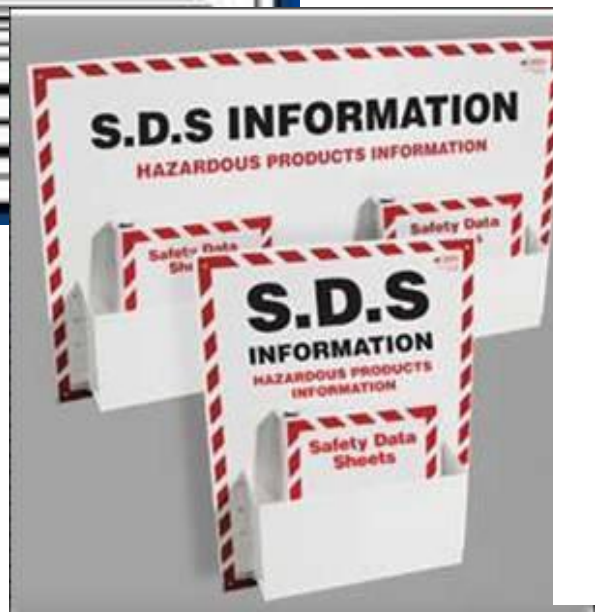
- Labelling and SDSs in hazard communication legislations are based on GHS classification of chemical products
- Each hazard (physical, health or environmental) is a "**hazard class**" (e.g., carcinogenicity is a hazard class)

GHS Hazard Classification

- A “hazard class” may be sub-divided in the classification criteria into several “**hazard categories**” based on the degree of severity of the hazard, and the hazard potential in decreasing order
  - e.g. A product classified in acute toxicity category 1 is more hazardous than another product in acute toxicity category 3, if acute toxicity is the only hazard class for which both products meet the classification criteria

GHS Hazard Classification (cont'd)

- Assigning a chemical into a "hazard class", and where necessary, a "hazard category", is the **classification process** for determining not only the **hazard**, but also the **severity** of the effect



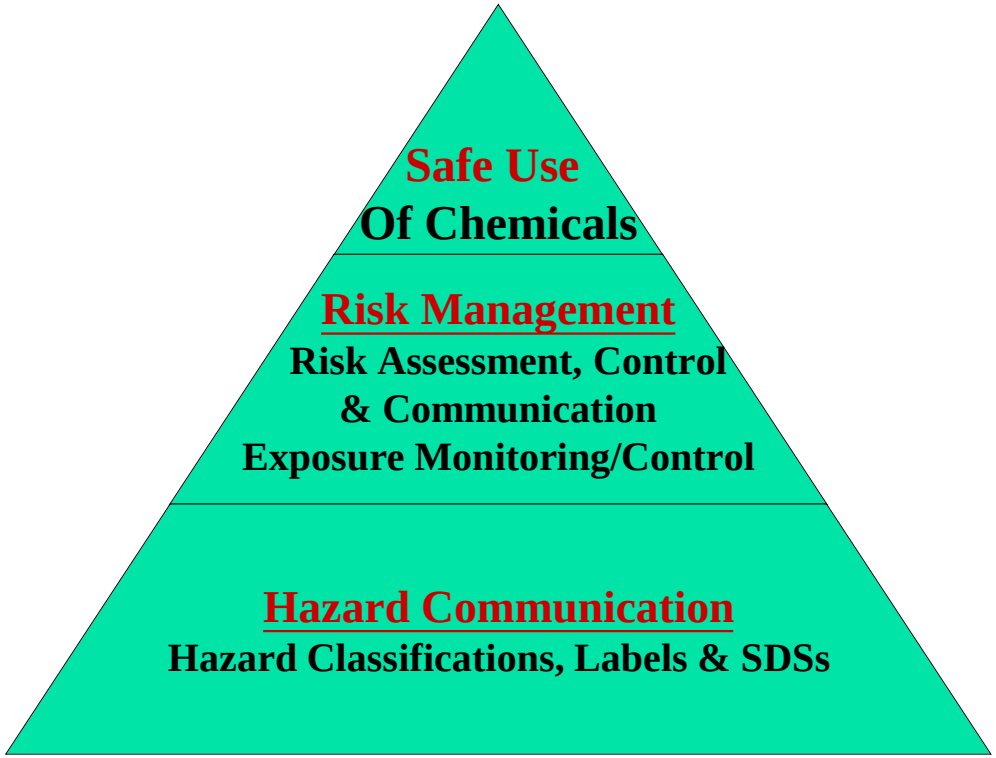
GHS →→From MSDS to SDS

Significance of Hazard Communication

- **Hazard classifications, labels** & **SDSs** of chemicals are primarily the **documented** & widely available **hazard assessment**, which is the **first** step in a **risk management** process
- Other than fulfilling the ***worker right-to-know*** & ***right-to-understand*** obligations, hazard communication
  - facilitates the **risk identification**, **risk assessment** & the **risk management**
  - alerts users to the presence of a hazard, and the need to minimize exposures & risks, and
  - leads to the **safe use** of chemicals in workplaces

危害通識法規促進風險認知，風險評估和風險管理, 並最終導致工作場所化學品的安全使用

Hazard Communication as the Foundation of Chemical Safety & Health



Classification, Evaluation and Communication of Other Hazards

- Approach similar to GHS may be used to classify, evaluate and communication of other occupational hazards

How is the Risk evaluated?

Evaluation of Risk

Risk = Hazard x Exposure, or

Risk = Exposure Likelihood x Severity

- To relate **risk level** to an identified hazard, 3 main aspects to look at:
  - **Likelihood** of exposure
  - **Severity** of exposure (***consequences***)
  - Existing **risk control** measures in place

Evaluation of Risk (cont'd)

- **Risk evaluation** can be carried out by:
  - **Qualitative** methods
  - **Quantitative** methods
  - **Semi-quantitative** methods

Quantitative Risk Evaluation

- **Numerical** values are used for both quantifying consequences & likelihood
- Quality of analysis depends on accuracy & completeness of numerical values and validity of models used
- **Consequences** may be determined by **modelling** the outcomes of events or extrapolation from **past studies** or data

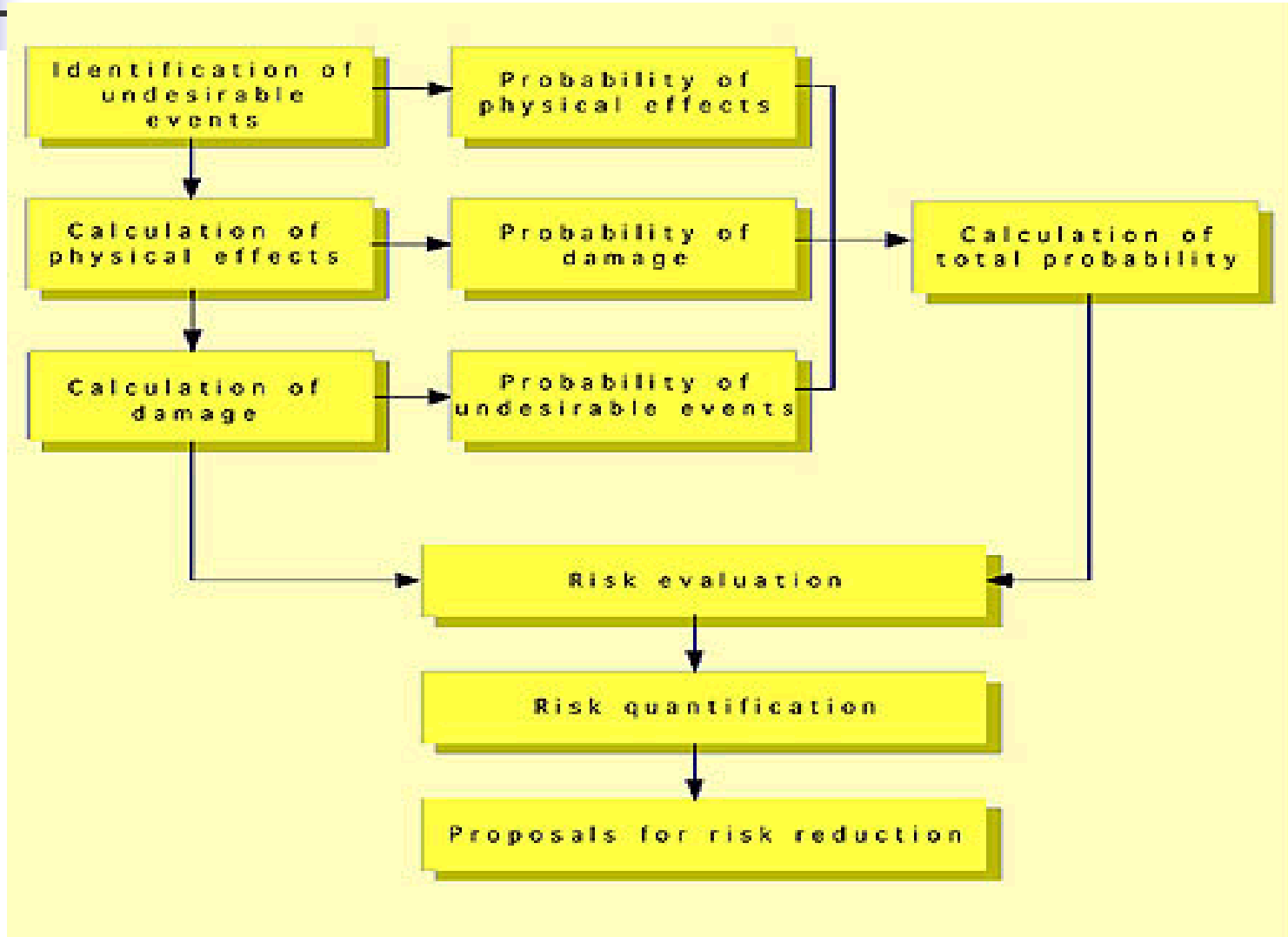
Risk of dying in Transportation Accident in US on a Population Basis

Type of Accident	Year	Deaths	Population	Crude rate per 100,000 population	Annual Odds (1 in n)	Lifetime Odds (1 in)
All transport accidents	2004	47,385	293,656,842	16.14	6,197	80
Motor vehicle accidents	2005	43,443	281,421,906	15.44	6,478	82
Cyclist killed	2005	784	281,421,906	0.28	358,957	4544
Car user killed	2005	18,440	281,421,906	6.55	15,261	193
Passenger airline	2003	66	290,809,777	0.02	4,406,209	55078
Passenger train	2006	2	299,398,484	0.0007	149,699,242	1871241

Quantitative Risk Evaluation (cont'd)

- **Quantitative Risk Analysis** can be used for industries with major hazard installations to establish **health and safety zones** to:
  - Prevent knock-on effects of neighbouring hazardous installations and
  - Protect the public from
    - Fire, explosion or toxic fumes dispersal hazards
    - Detrimental effects on health, and
    - Chemical contamination

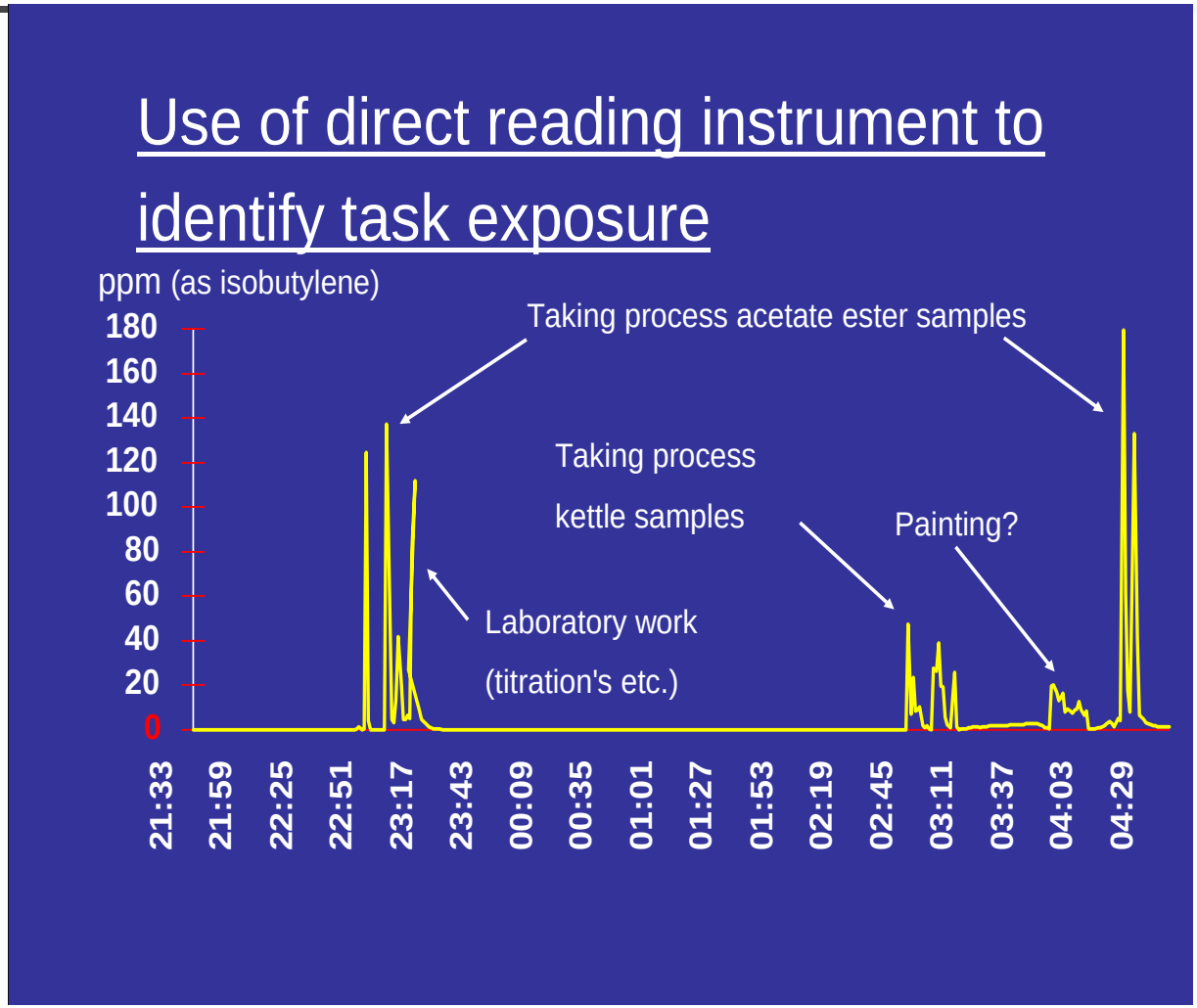
Schematic of Quantitative Risk Analysis



Quantitative Risk Evaluation (cont'd)

- Quantitative risk evaluation can also be carried out in walk-through inspections or investigations using **direct-reading instruments** or devices to determine the likelihood & level of exposure and assess the existing control measures
  - Carbon monoxide levels are determined in poorly ventilated semi-enclosed workplaces where propane or gasoline-powered equipment or tools are used
  - Oxygen deficiency & explosive & hazardous atmospheres are tested in confined space prior to entry
- Air and biological monitoring can be included

Quantitative Risk Evaluation (cont'd)



Quantitative Risk Evaluation (cont'd)

- With the **Video Exposure Monitoring** technique, worker **exposures** are monitored with direct-reading **instruments** while workplace **task** activities are ***simultaneously*** recorded on **videotape**
- A program is available that reads a real-time data file, generates a bar or plot to represent the magnitude of the exposure, and then displays the bar or plot on the screen
- When the program is run through a video overlay system, a video recording graphically shows how a worker's exposure is influenced by work activity

Video Exposure Monitoring (cont'd)

Wet Abrasive Blasting

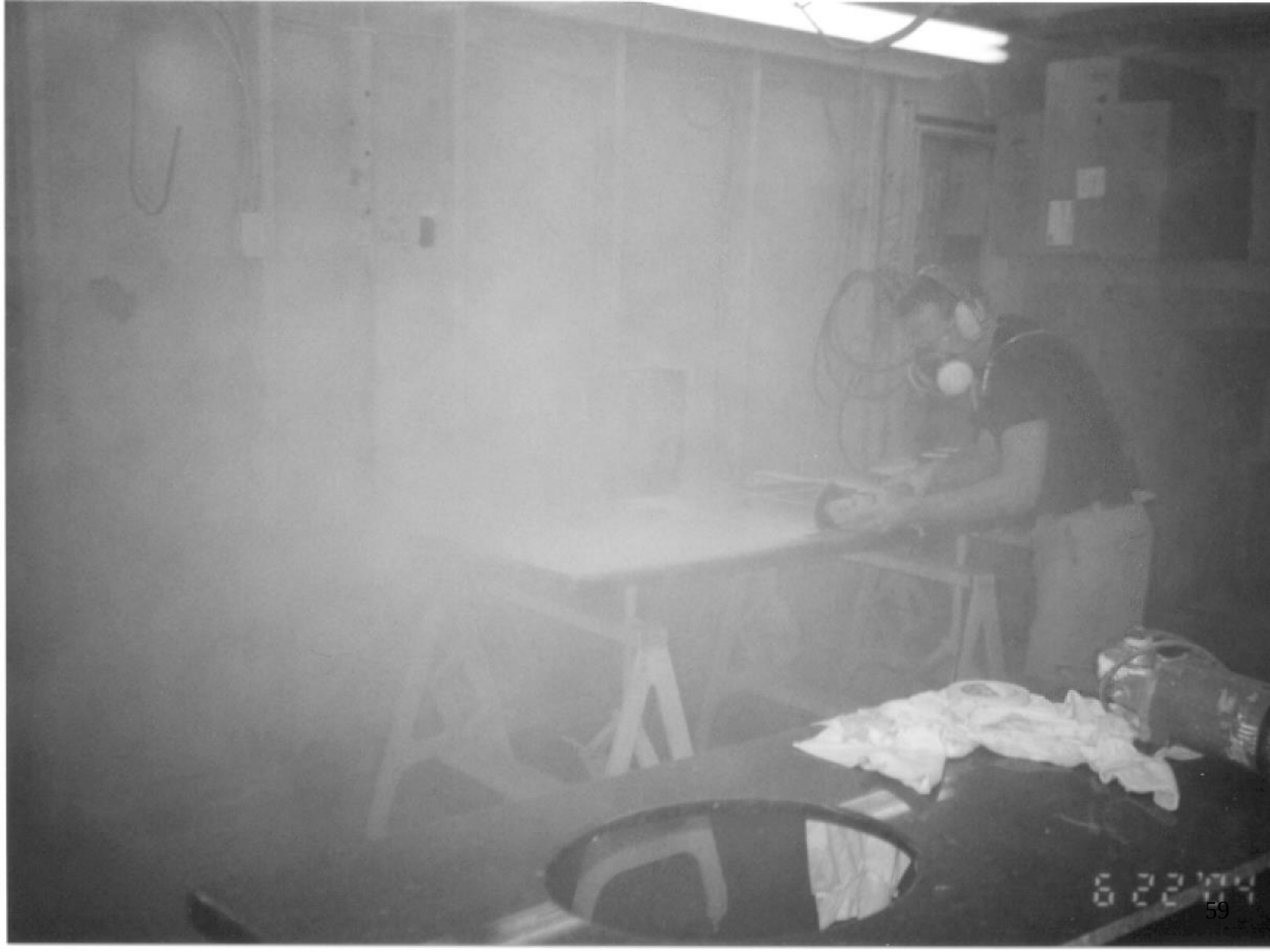
Qualitative Risk Evaluation

- Exposure likelihood, severity & risk level are each **classified** & **ranked** into three categories
- Risk levels are then related to exposure likelihood & severity of exposure by the use of a 3 x 3 **risk matrix**
- Taking existing **risk control** measures into consideration, **exposure likelihood** can be categorized & ranked as
  - **Frequent** (*Common or **repeating** occurrence*)
  - **Occasional** (***Possible** or known to occur*)
  - **Remote** (***Not likely** to occur*)

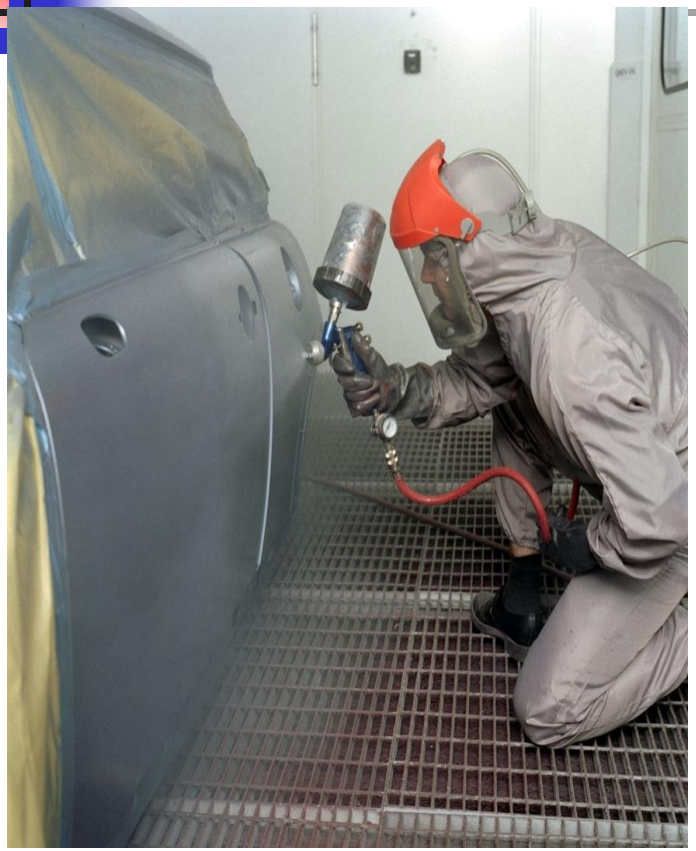
Qualitative Risk Evaluation (cont'd)

- To minimise the subjectivity of estimating exposure likelihood, the following should also be taken into consideration:
  - Past workplace incident & accident records
  - Industry practice & experience
  - Observations & professional judgment during inspection
  - Literature, **hard alerts**, etc (e.g. obstructive lung diseases among workers in US microwave popcorn manufacturing facilities)


中文世界王
haina365.com



Qualitative Risk Evaluation (cont'd)



No observation of aerosols by naked eyes

Use of HSE dust Lamp for visualization of aerosols

Qualitative Risk Evaluation (cont'd)

Severity is classified and ranked into 3 categories:

Severity	Description
Major	**Fatal, serious injury or life-threatening occupational disease** including amputations, major fractures, multiple injuries, occupational cancer & acute poisoning & fatal diseases
Moderate	**Injury requiring medical treatment or ill-health leading to disability** including lacerations, burns, sprains, minor fractures, dermatitis, deafness, work-related upper limb disorders
Minor	**No injury, injury or ill-health requiring first aid treatment only** including minor cuts & bruises, irritation, ill-health with temporary discomfort

Qualitative Risk Evaluation (cont'd)

Risk level can be ranked into 3 categories as high, medium and low

Risk Level 風險等級	Risk Acceptability 風險的可接受性
Low Risk	Acceptable
Medium Risk	Moderately Acceptable
High Risk	Not Acceptable

Qualitative Risk Evaluation (cont'd)

Risk = Exposure Likelihood x Severity

Risk = Hazard x Exposure

- Risk levels can be related to **exposure likelihood** and another risk factor such as **severity** of exposure or hazard potentials by the use of a **Risk Matrix**

Qualitative Risk Evaluation (cont'd)

Risk Matrix (3 X 3)

Likelihood / Severity	*Remote* 微小	*Occasional* 偶爾	*Frequent* 經常
Major	Medium Risk	High Risk	High Risk
Moderate	Low Risk	Medium Risk	High Risk
Minor	Low Risk	Low Risk	Medium Risk

Control Banding 控制分級法

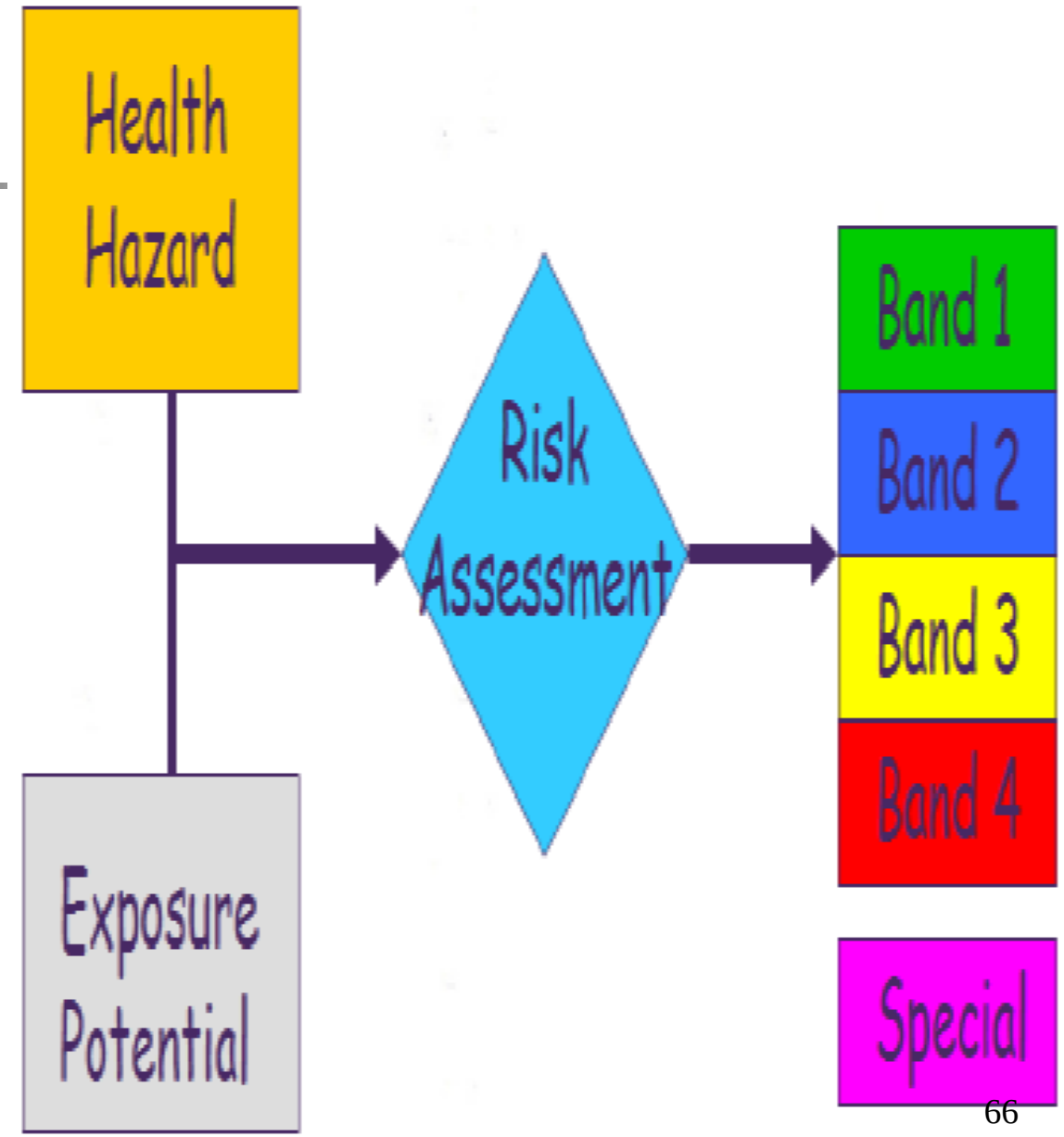
- |"**Control band**" 控制等級 for **Health** Hazards is based on the **Level of Risk** 風險等級

  Risk = Hazard x Exposure

- **Hazard Levels** and **Exposure Levels** can each be ***grouped*** into a few ***Hazard Bands*** and ***Exposure Bands*** respectively, and ***ranked*** in the order of increasing levels
- The resulting **risk level** from a hazard band and an exposure band can be associated with a **control band**

  健康**危害**和職業**暴露**可各**分為幾組**,並可依其逐漸增加的**危害程度**和**暴露高低度分級**;由此產生的**風險等級可與控制等級關聯**

Control Banding (cont'd)



Singapore's MOM Semi-Quantitative Risk Assessment (*SQRA*) Method

- In the MOM ***SQRA*** method, the risk level without available exposure data is derived from
  - Exposure factor calculations that consider **vapor pressure** or **particle size**
  - **Ratio** of the **odor threshold** to the applicable **PEL**
  - Amount of chemical used
  - **Duration** of **work** per week
  - Hazard **control** measures

MOM Semi-Quantitative Risk Assessment (*SQRA*) Method (cont'd)

- **ILO** Tool Kit estimates a **higher risk** than **SQRA**, and suggests a higher level of control
- SQRA method is published in MOM guideline: "A Semi-quantitative Method to Assess Occupational Exposure to Harmful Chemicals"
  http://www.mom.gov.sg/Documents/safety-health/factsheets-circulars/A%20Semiquantitative%20Method%20to%20Assess%20Occupational%20Exposure%20to%20Harmful%20Chemicals.pdf

Steps in Semi-Quantitative Evaluation of Risk

- Breakdown of work **process**
- Identification of **chemicals**
- Determination of **Hazard Rating**
- Conducting work **inspections** & **interviews**
- Obtaining information on frequency & duration of **exposure**

Steps in Semi-Quantitative Evaluation of Risk (cont'd)

- Determination of **Exposure Rating**
- Evaluation of **Risk**
- Implementing control measures
- Keeping records of assessment
- Reviewing assessment & monitoring as needed

What is the Role of Biological Monitoring in Health Surveillance and What are the Issues?

Biological Monitoring in the Health Surveillance Program

- Biological monitoring is included as an integral part of **health surveillance program** to assess, review or monitor workers' health in order to identify or detect any significant changes from normality at an early stage
- Due to the variable nature of concentrations in biological specimens, action should be based on measurements of **multiple sampling**, or an analysis of **repeat specimen**

Biological Monitoring in the Health Surveillance Program (cont'd)

- It may be appropriate to **remove** the worker from exposure following a single high result if there is reason to believe that an overexposure may have occurred
- Conversely, levels below the ACGIH BEI or other biological monitoring exposure guideline do not necessarily indicate a lack of health risk

Biological Monitoring (cont'd)

- In **UK**, any **biological monitoring** undertaken needs to be conducted on a **voluntary** basis (i.e. with the fully informed **consent** of all concerned)
  - The tested worker understands what the test results mean & what action might be taken on the basis of them
  - The tested worker can decide who has **access** to the biological monitoring results (e.g. doctor, safety representative, health & safety manager)

Biological Monitoring (cont'd)

- In **UK**, any **biological monitoring** undertaken needs to be conducted on a **voluntary** basis (i.e. with the fully informed **consent** of all concerned) cont'd
  - The tested worker can decide whether people see the **individual** result or whether the result is **anonymous** & **pooled** with other workers' results
  - The worker understands that the sample taken will only be analyzed for the chemical (or its metabolite) exposed to at work
  - The test result will not affect the conditions of employment

Biological Monitoring (cont'd)

- **Ethical** & **confidentiality** issues include the following:
  - Biological sampling procedures should not threaten the health of workers
  - The worker is assured that the sample provided will only be analyzed for the chemical (or its metabolite) exposed to at work
  - Biological monitoring results & personal information must be kept **confidential** between occupational health professionals & workers

Should the Strategies for Preventing Occupational Diseases different for Metropolitan Regions and Cities?

Strategies for Preventing Occupational Diseases

- Approach to strategy setting
  - National vs. Regional
  - Regional vs. Metropolitan
  - Urban vs. Rural
- Strategies should be developed at the national level but work plan for each region or city should target the local priority hazards, sectors, working populations for risk management and disease prevention

Characteristics of Metropolitan Regions and Cities

- Larger general & working populations
- More working opportunities
- Higher population density
- Increased commuting time to work
- Reduced time for quality rest
- Workforce spreading over multi-sectors

Characteristics of Metropolitan Regions and Cities (cont'd)

- More white-collar workers employed in non-industrial sectors
- More mobile workforce
- More intense competiveness among colleagues for outperforming each other
- Extended work hours
- More stressors in life and at work

Impact of Metropolitan Characteristics on Health and Well-being

- Greater challenge to track the exposed workers who are under health surveillance
- Psychosocial factors more evident
- Faster spread of infectious diseases (e.g. SARS in Hong Kong, Toronto, Taipei, Singapore)
- More persons at work covered under the new Occupational Safety and Health Act (職業安全衛生法) in Taiwan (ROC)

Impact of Metropolitan Characteristics on Health and Well-being (cont'd)

- Multi-hazard, non-industrial sectors in metropolitan regions and cities are likely to be impacted the most by the new Act

Approach to Prevention Strategies

- New Occupational Safety and Health Act (職業安全衛生法) and extended coverage
- Multi-hazard, non-industrial sectors impacted by the New Act in metropolitan regions and cities
- Risk management of occupational hazards for occupational disease prevention

New Occupational Safety and Health Act in Taiwan (ROC)

- Increased coverage from 6,700,000 to 10,670,000 persons
- Persons covered include “persons at work” (工作者)
  - Trainees
  - Volunteers
  - Family members as helpers
  - Temporay & seasonal employees
  - Self-employed

Sectors covered under the New Act

- 農、林、漁、牧業
- 礦業及土石採取業
- 製造業
- 營造業
- 水電燃氣業
- 運輸、倉儲及通信業
- 旅館業
- 機械設備租賃業
- 環境衛生服務業
- 大眾傳播業
- 醫療保健服務業
- 修理服務業
- 洗染業
- 國防事業
- 其他

Multi-Hazard, Non-Industrial Sectors in Metropolitan Regions & Cities impacted most by the New OSH Act in Taiwan

- 醫療保健服務業
- 營造業
- 環境衛生服務業
- 大眾傳播業

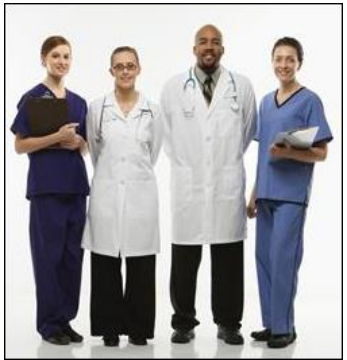
Why are we concerned of Health Care Industry?

Healthcare Facilities

- Hospitals
- Clinics
- Dental offices
- Out-patient surgery centers
- Birthing centers
- Emergency medical care
- Home healthcare
- Nursing homes

Healthcare Workers (HCW)

- Doctors
- Nurses
- Pharmacists
- Physiotherapists
- Infection control staff
- Mechanical maintenance
- Medical equipment maintenance



- Housekeeping
- Food service
- Building & grounds maintenance
- Laundry
- Orderlies
- Administrative staff
- Trainees & students
- Volunteers

Why are we concerned of Health Care Industry (?)

- US National Safety Council (NSC) reported that US hospital workers are 41 % more likely to need time off due to injury or illness than workers in other industries

- Workers" Compensation Board of British Columbia (BC) reported the health care industry is associated with more days lost per claim & a higher injury rate than the provincial average for all BC industries

Why are we concerned of Health Care Industry (?) cont'd

- As the general population is aging worldwide & the demand for health care workers is increasing, either an increasing number of healthcare workers will be at risk or the existing workers will face increased risk
  - About 4 % of the total U.S. work force is employed by hospitals (1988)
  - As of June 2011 in Singapore, 87,400 (4.4 %) residents are employed in health & social services (total workforce 1,998,900) & most of them are in the 20-29 age group (21,300)

Why are we concerned of Health Care Industry (?) cont'd

- Health care restructuring, increased workloads, staff shortages, extended work hours, burnout and diminished leadership contribute to unsafe work environments leading to increased injuries & illness
  (Yassi, Gilbert & Cvitkovich, 2005; Laschinger, 2006)
- Canadian study of critical incidents/adverse events - 7.5% per cent of hospitalized clients/patients experienced an adverse event; 36.9% were preventable (Baker et al., 2004)

Why are we concerned of Health Care Industry (?) cont'd

- **Health care workers** are exposed to many health hazards, including
  - **Chemicals** (e.g. sterilants, latex proteins)
  - **Hazardous drugs** (e.g. antineoplastic drugs)
  - **Bloodborne pathogens** (e.g. hepatitis viruses)
  - **Workplace violence**
  - Ergonomic hazards (e.g. patient lifting & transfer)
  - Physical agents (e.g., radiation)

Hazards in Healthcare Facilities

- **Chemicals** commonly in use or associated with the products (e.g. rubber gloves) used, and to which health care workers are exposed include
  - Ethylene oxide
  - Formaldehyde & Glutaraldehyde
  - Nitrous oxide & Waste anesthetic gases
  - Antineoplastic and other hazardous drugs
  - Latex proteins

Chemical Hazards in Healthcare Facilities (cont'd)

- Exposure to **ethylene oxide** can cause
  - **Miscarriages**
  - Increased risk of **leukemia** & other **cancers** (stomach, breast)
    - IARC Group 1 carcinogen (carcinogenic to humans)
    - ACGIH A2 suspected human carcinogen

Chemical Hazards in Healthcare Facilities

- Exposure to **formaldehyde** can cause
  - **Respiratory sensitization** & **allergic contact dermatitis (**glutaraldehyde also**)**
  - Increased risk of **cancer** (lung, nasopharynx, nasal passages)
    - IARC Group 1 carcinogen (carcinogenic to humans)
    - ACGIH A2 suspected human carcinogen

Chemical Hazards in Healthcare Facilities (cont'd)

- **Waste anesthetic gases** include **nitrous oxide** & various **halogenated anesthetics** (e.g., halothane, enflurane, isoflurane, desflurane)
- Exposure to **nitrous oxide** can cause
  - **Embryo/fetal damage** & **reproductive effects** (male & female)
  - **Liver** & **kidney** disease
  - **Bone marrow depression**

Chemical Hazards in Healthcare Facilities (cont'd)

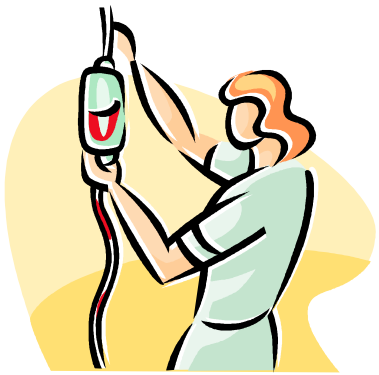
- Exposure to **halothane** can cause
  - **Liver damage**
  - **Cardiac arrhythmias** (i.e. irregular heartbeat) or **cardiac impairment** (for enflurane)

Chemical Hazards in Healthcare Facilities (cont'd)

- **Antineoplastic drugs** 抗腫瘤藥物 (e.g. cytosine, mitomycin, vincristine, dacarbazine, arabinoside, & fluorouracil) used in the treatment of cancer & tumors, are usually given as intravenous fluids
- Mixing usually occurs in the pharmacy area of the hospital in a biological safety cabinet, & exposure may occur during preparation, administration or disposal of the drug & equipment

Chemical Hazards in Healthcare Facilities (cont'd)

- Adverse health effects from **hazardous drug** exposure may include
  - Damage to the **reproductive** system
  - **Genetic** damage
  - **Birth defects**
  - Increased risk of **cancer**
    - **Cyclophosphamide** is IARC Group 1 carcinogen (carcinogenic to humans)
    - Uracil Mustard is IARC Group 2B carcinogen (possibly carcinogenic to humans)



Chemical Hazards in Healthcare Facilities (cont'd)

- When **hazardous drugs** are prepared & administered, best practices that can minimize potentially harmful exposure should be followed, and such practices include the use of
  - **Engineering controls** such as biological safety cabinets, closed system transfer devices, needleless systems
  - **Personal protective equipment** such as gloves, masks & gowns

Chemical Hazards in Healthcare Facilities (cont'd)

- In order to use the control equipment appropriately & effectively, healthcare workers need to know which **hazardous drugs** pose a hazard
- The **NIOSH List** of Antineoplastic and Other Hazardous Drugs in Healthcare Settings 2012 is available online at

http://www.cdc.gov/niosh/docs/2012-150/pdfs/2012-150.pdf

Chemical Hazards in Healthcare Facilities (cont'd)

- Healthcare workers exposed to **latex gloves** & other latex-containing medical devices are at risk of developing **latex allergy** (乳膠過敏)
- Three types of reactions can occur when using **latex products**
  - **Irritant Contact Dermatitis** causing dry, itchy & irritated skin, most often on the **hands**
  - **Allergic Contact Dermatitis** (***delayed hypersensitivity***) causing skin reaction looking like the rash from contact with poison ivy & usually showing up 24–96 hours after contact

Chemical Hazards in Healthcare Facilities (cont'd)

- Three types of reactions can occur when using **latex products** (cont'd)
  - **Latex Allergy (*immediate hypersensitivity*)** causing reaction usually within minutes of exposure, but symptoms can also show up a few hours later ranging from skin redness, hives, or itching to runny nose, sneezing, itchy eyes, scratchy throat, wheezing, coughing, or difficulty with breathing and in extreme cases, **anaphylaxis**, a potentially life-threatening condition, and death if left untreated

Chemical Hazards in Healthcare Facilities (cont'd)

- **Latex allergy** can be prevented by
  - Providing workers with **non-latex gloves** when there is little contact with infectious material
  - Considering the use of vinyl, nitrile, or polymer gloves appropriate for infectious materials
  - Providing **reduced-protein**, **powder-free gloves**, if latex gloves are selected for use with infectious materials

Chemical Hazards in Healthcare Facilities (cont'd)

- **Latex allergy** can be prevented by (cont'd)
  - Providing **training** to workers on latex allergy
  - Promptly arranging a **medical evaluation** for workers with symptoms of latex allergy and providing these employees with non-latex gloves

Viral Illnesses

- **Viral illnesses** in humans may include flu or a cold to something more life-threatening like HIV/AIDS
- Examples of **Viral illnesses** include
  - e.g. influenza (various viral strains: H1N1,…H5N7,..) & SARS
    - In Singapore, 42% of the probable **SARS** cases were healthcare workers, of whom over half were nurses

Pandemic Influenza

- Most infectious disease experts have been predicting one outbreak of **pandemic influenza** after another for years
- Pandemic influenza may occur in 2-3 waves, each lasting 8-12 weeks and may span over 12-18 months
- Outbreaks of past pandemic influenza include:

1918-1919	H1N1 (not the same as 2009 virus)
1957-1958	**H2N2**
1968-1969	H3N2
2009	**H1N1**

Impact of Pandemic Influenza

Years	Deaths	Affected
1918-1919	500,000	Young healthy adults
1957-1958	70,000	Infants & elderly
1968-1969	34,000	Infants & elderly
H1N1(2009)	>16.000	Children, young adults
Seasonal	36,000	Infants & elderly

2009 H1N1 Pandemic Influenza

- 2009 H1N1 pandemic influenza was caused by a unique **combination** of **swine**, **bird** & **human** influenza virus
- First case was reported in Mexico in **April** and the influenza spread to 33 countries by **May 2009**, and to over 213 countries by **January 2010**
- In **June 2009** WHO declared that the world was in the midst of a **pandemic** caused by the H1N1 virus
- WHO announced in **August** 10, **2010** that the H1N1 influenza virus has moved into the **post-pandemic period** but localized outbreaks of various magnitudes are likely to continue

Seasonal Influenza

- **Seasonal influenza** is the periodic outbreaks of acute onset viral respiratory infection, caused by circulating strains of **human influenza A** and **B viruses**
- Each year, the Flu Vaccine is prepared in advance to protect against viral strains that are expected to circulate that season
- **Influenza A** viruses are found in many different **animals**, including ducks, chickens, pigs, whales, horses & seals

Avian Influenza or "Bird Flu"

- **Avian influenza** is caused by **type A viruses**, it infects birds and can spread to domestic poultry
- There are two groups of **pathogenic** viruses:
  - **Low** pathogenic viruses that occur naturally in wild birds, can spread to domestic birds and pose little threat to humans
  - **Highly** pathogenic viruses that spread rapidly and cause high death rate in poultry

Avian Influenza or "Bird Flu" (Cont'd)

- **H5N1** strain has crossed the species barrier to infect **humans**, and is the most deadly of the viruses that has done this
- Most H5N1 cases involved contact with infected poultry

Avian Influenza A (H7N9) Virus

- Human infections with a **new** avian influenza A (**H7N9**) virus continue to be reported in China since March 31, 2013
- The virus has been detected in poultry in China as well
- As of June 7 2013, a total of 132 laboratory-confirmed cases of **human infection** with avian influenza A (H7N9) virus have been reported to WHO; 131 cases by China and one case by Taiwan

Avian Influenza A (H7N9) Virus (cont'd)

- Thirty-seven people have died, and most of the other cases were considered severe
- Most people are being infected after exposure to **birds** or to environments that might be contaminated with bird flu virus (e.g. **live bird markets**)
- There have been no cases of H7N9 outside of China

Avian Influenza A (H7N9) Virus (cont'd)

- Currently there is no ongoing person-to-person spread
- Based on WHO risk assessment reported on June 7 2013, the virus does **NOT** appear to cause sustained human-to-human transmission, and hence an extensive community spread is unlikely

Avian Influenza A (H7N9) Virus (cont'd)

- Three of 14 patients treated for H7N9 in a Shanghai hospital were tested positive for **resistance** to the antiviral drug "**Tamiflu**" (oseltamivir)
- These three patients were also the most severely ill, two died, and the third was still on mechanical ventilation at the time the finding was published in *Lancet*

Bloodborne Diseases

- Bloodborne diseases are caused by **bloodborne pathogens** (or viruses) in blood, semen, vaginal secretions & body fluids (e.g. pleural & cerebrospinal fluids), and include
  - Hepatitis B
  - Hepatitis C
  - AIDS (Acquired Immune Deficiency Syndrome)

Bloodborne Diseases (cont'd)

- Both **Hepatitis B** & **Hepatitis C** are
  - Inflammation (swelling) of the liver due to infection with the hepatitis B virus (**HBV**) & hepatitis C virus (**HCV**) respectively
  - Transmitted primarily through "**blood to blood**" contact

Bloodborne Diseases (cont'd)

- **AIDS** (Acquired Immune Deficiency Syndrome), is caused by the human immunodeficiency virus (**HIV**)
- HIV attacks the body's **immune system**, weakening it so that it cannot fight other deadly diseases
- Once a person has been infected with HIV, it may take many years before AIDS actually develops

Bloodborne Diseases (cont'd)

- The **risk** of **occupational infection** by a bloodborne pathogen is related to:
  - The type of **pathogen** involved & the type/**route** of exposure
  - The nature & frequency of **occupational blood contact**
  - The amount of **infected blood** in the exposure
  - The concentration of **virus** in **blood**
  - Prevalence of the **virus** in the **patient population**

Bloodborne Diseases (cont'd)

- The risk of occupational infection by a bloodborne pathogen is related to: (cont'd)
  - **Efficiency** of virus **transmission** after a single contact with infected fluid/tissue
  - Whether **post-exposure treatment** was taken
  - Specific **immune response** of the infected individual

Bloodborne Diseases (cont'd)

- To protect from bloodborne pathogens, **universal precautions** are taken to avoid blood-to-blood contact with the underlying **assumption** that all **body fluids** are **infected** with bloodborne pathogens
- Donning of personal protective equipment (**PPE**) including gloves, eye goggles, face shields, etc prevents skin or mucous membrane contact with body fluids
  - PPE should be inspected for cracks, holes or other damage before use and put on at all times

Universal Precautions

- When using **sharps** such as scalpels, needles, etc, a ***puncture-resistant container*** must be used for storage & disposal after use
- Ensuring all equipment is appropriately **sterilized**
- **Wash** hands or other skin surfaces thoroughly and immediately when contaminated
- **Covering** cuts & wounds with a waterproof dressing
- **Safe disposal** of infected material

Workplace Violence

- Attempted or actual exercise of any intentional physical force that causes or may cause physical injury to a worker
- Any threats which give a worker reasonable grounds to believe he or she is at risk of physical injury

Workplace Violence (Cont'd)

Violence includes

- Assault (threat or injury)
- Battery (unlawful force)
- Threats (intent to harm)
- Sexual harassment (unwelcome advances)
- Verbal abuse

Ontario Nurses' Association

Workplace Violence (Cont'd)

Violence also includes:

- Name-calling
- Swearing
- Hitting
- Biting, scratching and pinching
- Using a weapon

British Columbia Nurses' Union

Four Types of Workplace Violence in Healthcare Sector (Cal/OSHA 1995)

- **Type I (Criminal Intent)**
  - Perpetrator has no relationship to the workplace
- **Type II (Client/Customer)**
  - Perpetrator is a client who becomes violent towards a worker or another client
  - Majority of threats and assaults against caregivers come from patients/families/visitors
- **Type III (Worker-to-Worker)**
  - Perpetrators are employees or past employees
- **Type IV (Personal Relationship)**
  - Perpetrator usually has a relationship with an employee (e.g. domestic violence in the workplace)

Risks of Workplace Violence

The risks are greater in jobs that involve:

- Working with unstable or volatile people
- Working alone, or with just a few people
- Working late nights or very early mornings
- Public or community contact
- Handling cash
- Protecting or securing valuables
- Transporting people and goods
- A mobile workplace (such as a vehicle)

Risks of Workplace Violence (Cont'd)

Risks are greater in workplaces that involve:

- Health care
- Social services
- Hospitality
- Transportation
- Education
- Retail
- Financial institutions
- Police, security and corrections

Statistics & Trends for Violence in Healthcare Sector

- More than ½ of the Registered Nurses have been physically assaulted in the workplace

Study from the Registered Nurses' Associations in Manitoba and Ontario

Statistics and Trends for Violence in Healthcare Sector (Cont'd)

- Of the 400 Nurses surveyed, 63% had experienced verbal abuse in the past year
- 35% experienced attempts at physical harm
- 21% had been victims of physical attack

Nova Scotia Study

Statistics and Trends for Violence in Healthcare Sector (Cont'd)

- Of the 800 Ontario Nurses surveyed, 59% had been physically assaulted on the job in their career
- 35% in 12 months prior to the survey

Ontario Nurses' Association, 1995

Statistics and Trends for Violence in Healthcare Sector (Cont'd)

- Younger clinicians and nurses are more often the target of client aggression, due to limited experience and lack of training
- Health care workers face similar level of risk to that of police

(Boyd 1995)

Healthcare workers at risk

Healthcare workers are especially at risk when:

- Working alone, especially at night
- Interacting with violent clients
- Dealing with public complaints
- Providing care & advice that impact on a client's life
- Handling money or medications

Other Practices that increase Vulnerability to Violence

- Understaffing in busy clinics or emergency departments
- Letting staff work alone with clients
- Having staff work at night in high-risk areas
- Failing to provide sufficient training
- Failing to provide communication devices

Musculoskeletal Disorder (MSD)

- MSDs represent 42 % of all work-related lost time compensation claims in Ontario, Canada
- Four groups in the top 30 lost-time injury rates related to MSD are in the healthcare sector:
  - Homes for Nursing Care
  - Homes for Residential Care
  - Group Homes
  - Nursing Services

Occupations in Ontario Healthcare Facilities reporting MSDs in top 30 Lost-time Injury Rates

- Healthcare Aids (patient lifting)
- Nurse supervisors/registered nurse
- Cleaners (floor mopping)
- Childcare & home support
- Chefs & cooks

Is Patient Safety related to Employee Safety in Health Care Industry?

Patient Safety vs. Employee Safety

- Patient safety & employee safety are traditionally viewed as separate entities
- Evidence beginning to close gap in working conditions & relationship between employee and patient safety
- Quality patient care is dependent upon a healthy & safe work force and environment
- Injuries & illnesses have impacts on the workers, their families, healthcare institutions& ultimately on patient safety

Institute of Medicine (IOM) report in 1999, *To Err is Human: Building a Safer Health Care System*

- While patient safety or "quality of care" became a national priority, a safer environment for patients would also be a safer environment for workers and vice versa
  - Both are tied to many of the same underlying cultural & systemic issues
  - Hazards to HCWs because of lapses in infection control, fatigue, or faulty equipment may result in injury or illness not only to workers but also to patients and others in the institution

Institute of Medicine (IOM) report in 1999, *To Err is Human: Building a Safer Health Care System* (cont'd)

- While patient safety, or "quality of care" became a national priority, a safer environment for patients would also be a safer environment for workers and vice versa (cont'd)
  - Workers who are concerned for their safety or physical or psychological health in a work environment and yet their safety & health is not perceived as a priority, will not be able to provide error-free care to patients
  - System failures & benefits of a strong safety culture plays a pivotal role in the prevention of such errors

Institute of Medicine (IOM) report in 1999, *To Err is Human: Building a Safer Health Care System* (cont'd)

- While patient safety, or "quality of care" became a national priority, a safer environment for patients would also be a safer environment for workers and vice versa (cont'd)
  - Efforts to reduce the rate of medical error must be linked with efforts to prevent work-related injury and illness if they are to be successful

Linking Patient Care and Employee Safety

- Taub et al. (2006) concluded that long working hours lead to poor patient care and serious consequences
- Agency for Healthcare Research and Quality (AHRQ) provided evidence of these linkages:
  - Relationship on workload & on patient safety
  - Effect of workload & extended work hours on patient safety
  - Effects of working conditions on medication safety
  - Effects of fatigue & stress on skills and error rates

Organizational Factors

- Several studies have found organizational factors to be the most significant predictor of safe work behaviors
- Compliance with standard precautions was increased when
  - Workers felt that their institution had a strong commitment to safety, and
  - Institutions targeted interventions at improving organizational support for employee health & safety

Safety Culture

- US CDC & its Prevention's Healthcare Infection Control Practices Advisory Committee has noted that
  - Several hospital-based studies have linked measures of safety culture with both employee adherence to safe practices & reduced exposures to blood & body fluids
  - Organizational characteristics, including safety culture, influence healthcare personnel adherence to recommended infection control practices and, therefore, are important factors in preventing transmission of infectious agents

Safety Culture (cont'd)

- The lack of a safety culture has been found to be a contributing factor to HCW non-compliance with recommended infection control guidance
- Safety culture has an important influence on implementation of training skills and knowledge

Ontario SARS Commission Report, 2006

Justice Campbell's SARS Commission Report:

"The health system's capacity to protects its workers was in a state of neglect"

Ontario SARS Commission Report, 2006 (Cont'd)

Some recommendations from Campbell Commission:

- Health & Safety Management System (HSMS)
- Safety first and the precautionary principle to be used as reasonable steps to reduce risk

Benefits of HSMS

- Most successful injury & illness prevention programs include a similar set of common-sense basic elements
  - Management leadership
  - Worker participation,
  - Hazard identification and assessment,
  - Hazard prevention and control,
  - Education and training, and
  - Program evaluation and improvement

Benefits of HSMS (cont'd)

- Each element is important in ensuring the success of the overall program, and the elements are interrelated and interdependent
- Since every healthcare facility is different, the elements must be scaled & adapted to meet the needs of each facility
- Programs with strong management commitment & active worker participation are effective in reducing injury risk, while "paper" programs are ineffective

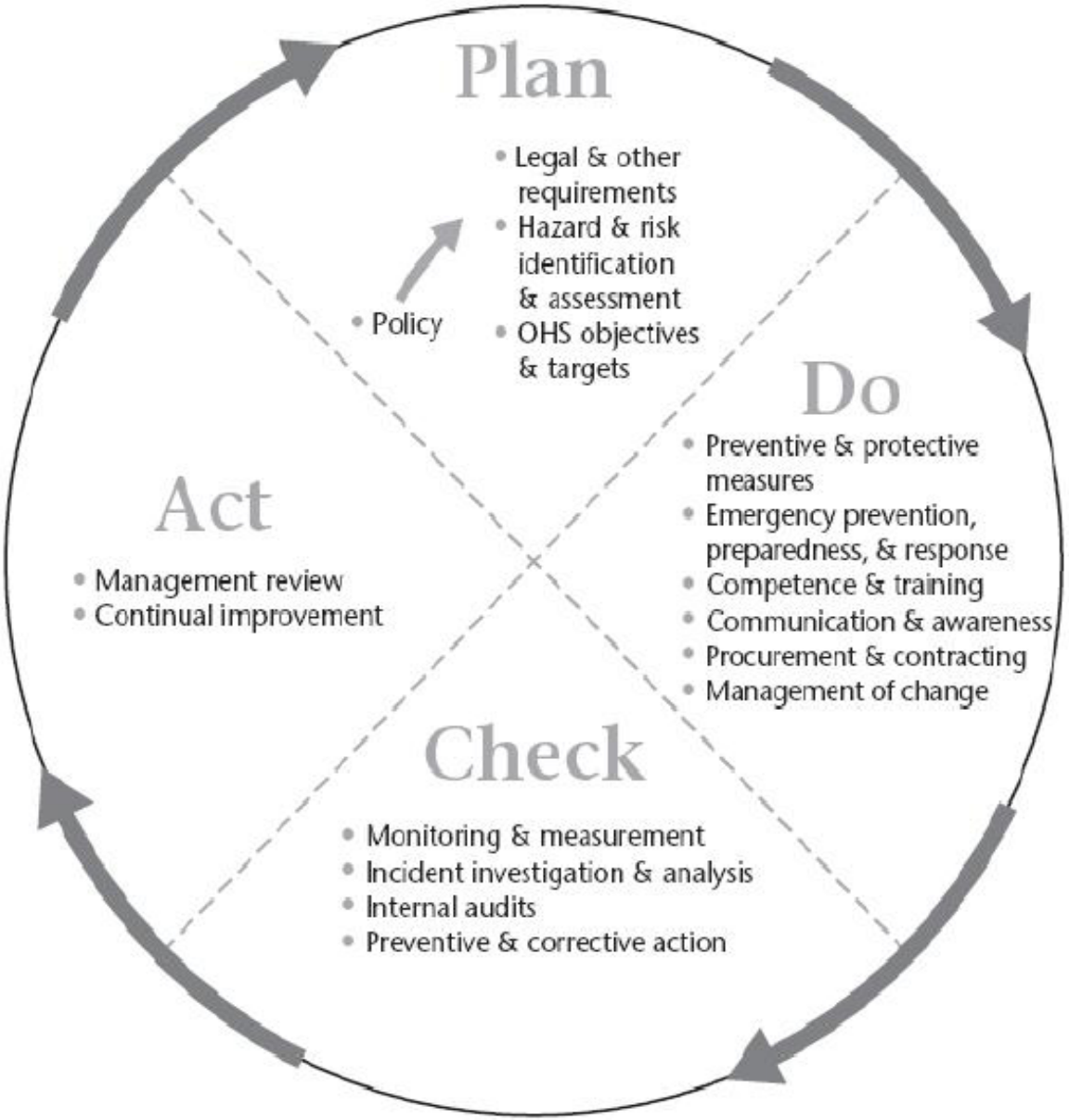
Benefits of Health & Safety Management System (cont'd)

- Strong & visible management leadership is the most critical element of an effective injury & illness prevention program.
- Worker participation is a significant contributing factor and when workers are encouraged to offer their ideas and see their contributions being taken seriously, they tend to be more satisfied and more productive

Ontario Safety Association for Community and Healthcare (OSACH) HSMS

- OSACH HSMS was developed from the Canadian Safety Association (CSA) Z1000 Occupational Health & Safety Management System (OHSMS) Standard
- The plan-do-check-act principle (i.e. Deming cycle) is used in the CSA Z1000 Standard

CSA Z1000 Standard Model



Ontario Safety Association for Community and Healthcare (OSACH) HSMS

Goal

Build a culture of organizational health, safety and wellness

OSACH Health and Safety Management System: Building a Culture of Health, Safety and Wellness

OSACH HSMS : Objectives

- Building a **system of care** that links the relationship between environment, culture, system/design and human factors to achieve safety solutions and quality outcomes
- Promoting the potential benefits for a linked **employee-client/patient system** of a safety culture:
  - Greater work satisfaction, improved quality of service/care, decreased injury/illness related costs

OSACH HSMS : Objectives (Cont'd)

- Providing a holistic approach to guide organizations to achieve a healthy and safe environment for:
  - Employees
  - Patients
  - Public
- Developing a **Blueprint** to build one culture of safety and health for both clients/patients and staff

Key Requirements for Labor OSH Programs

- Building capacities and competence levels for labor OSH inspections in healthcare facilities through practical training and pilot projects
- Building partnership with associations of healthcare sector (e.g. hospital association, health care association) and professionals (nurses' association, physiotherapists, pharmacists etc)

Key Requirements for Labor OSH Programs (cont'd)

- Giving priority considerations to persons with work experience in healthcare sector when recruiting new hires
- Effective GHS implementation will help prevent occupational diseases caused by chemical exposures

Summary

- Risk management of occupational health hazards is the key to occupational disease prevention
- Multi-hazard, non-industrial sectors in metropolitan regions & cities will be impacted the most by the new OSH Act in Taiwan, particularly the healthcare sector

Summary (cont'd)

- **Health care workers** are exposed to many health hazards, including **chemicals, hazardous drugs, bloodborne pathogens, workplace violence,** ergonomic hazards & physical agents
- Quality patient care is dependent upon a healthy & safe work force and environment

Summary (cont'd)

- Patient care should be linked with employee care through implementing occupational safety & health management system

Thanks and Wishes

- Thanks for the invitation and attention
- Best Wishes to all