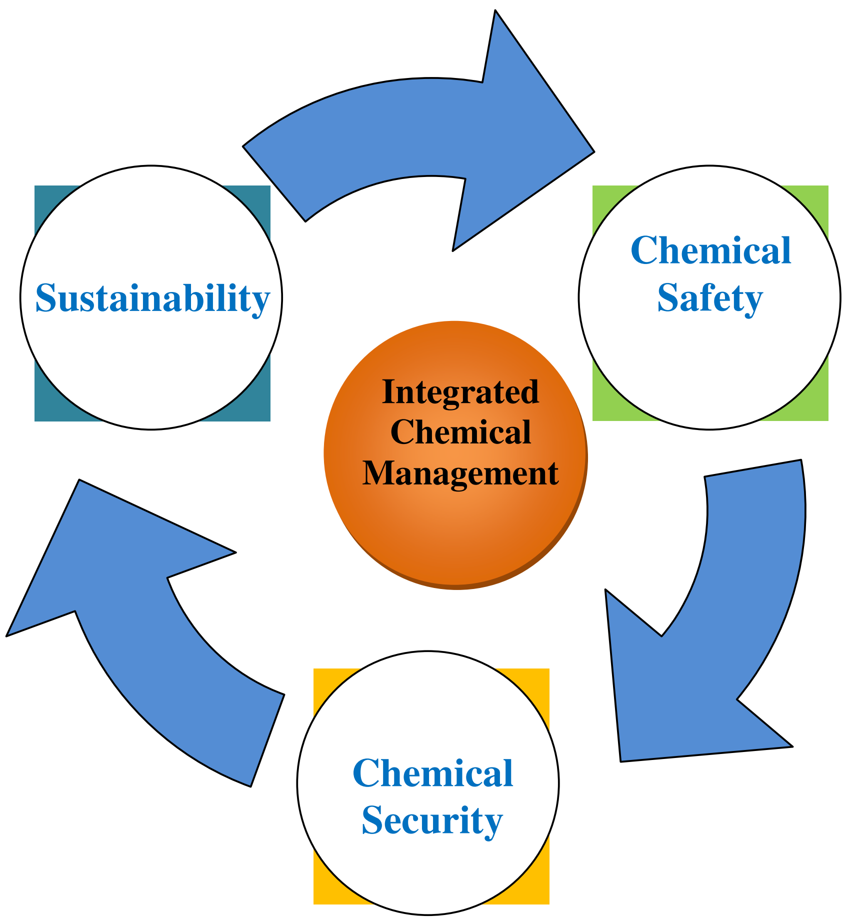
Organisation for the Prohibition of Chemical Weapons

CWC and Chemical Safety and Security Management



National Committee for the Prohibition of Weapons
Doha Regional Centre for CBRN Training

DOHA, QATAR
23 - 25 FEBRUARY 2016

Major General Staff (Pilot)
Nasser Mohammed Al-Ali
Message from the Chairman of NCPW

I am so pleased to welcome you to the Seminar on the Chemical Weapons Convention (CWC) and Chemical Safety and Security Management. This Seminar is held within Article XI of the CWC. This Article reflects the interest of the Convention in Economic and Technological Development.

According to Article XI, the implementation of the Convention shall not hamper the economic or the technological development of the States Parties. Also, it enhances international cooperation for peaceful purposes including the international exchange of scientific and technical information and chemicals and equipment. Hence, the CWC provisions are not limited to Chemical Weapons issues but cover other issues of great importance in developing the life of the mankind.

I hope that the Seminar will be a step in the capacity building of the participants in the field of Chemical Safety and Security. I consider this discipline as one of the most important factors in the industrial development. It enables the States Parties to get the maximum benefits of Chemical Industries and to avoid the hazardous effects of Chemicals.

I would like to thank the OPCW and its Director General H.E Ambassador Ahmet Üzümcü for holding this Seminar in Qatar, and I wish you all a successful Seminar and a happy stay in Doha.

Ambassador Ahmet Üzümcü
Message from the Director – General

I am pleased to welcome you to the Regional Meeting on CWC, Chemical Safety and Security Management of States Parties in Asia being held at the Doha Regional Centre for CBRN Training. The regional meeting is being organised with the gracious support of the Government of the State of Qatar. This is a joint initiative of the Technical Secretariat and the Doha Regional Centre for CBRN Training.

The meeting aims to enhance capacities of State Parties in chemical safety and security measures and the effective national implementation of the Chemical Weapons Convention. Hence, the Technical Secretariat continues to provide support to States Parties through various means including courses such as this, in order to help their efforts to implement the Convention in partnership with the chemical industry. An active engagement with all the stakeholders is therefore important for effective implementation of the Convention.

The meeting is also aimed at facilitating the sharing of experiences and best practices besides creating networks among stakeholders who are dealing with chemical safety and security aspects in the region. The Secretariat remains available to provide any further support and assistance that may be required by chemical industries in this endeavour.

I wish to thank and compliment Major-General Staff (Pilot) Nasser Mohammad Al-Ali, Chairman, Qatar National Committee for the Prohibition of Weapons and all the members of his team as well as H.E. Mr. Khalid Fahad Al-Khater, Ambassador and Permanent Representative of the State of Qatar to the OPCW for their valuable support and contribution to this meeting.

I wish you a pleasant and fruitful stay in Doha.

(Ahmet Üzümcü)

Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region
National Committee for the Prohibition of Weapons
Doha Regional Centre for CBRN Training

DOHA, QATAR
23 - 25 FEBRUARY 2016

PROGRAMME

Time	Activity
Tuesday, 23 February 2016	
08:30 – 09:00	Registration
09:00 – 09:30	Welcome Address – Chairman/NCPW Welcome Address– Head/ICB/OPCW Video on NCPW and Doha CBRN Centre Group Photograph
09:30 – 09:45	*Coffee/tea break*
Session 1: Chairman	
09:45 – 10:00	**NCPW Presentation by First Lt. Abdul Aziz Hamdan AL-AHMAD**
10:00 - 10:30	**Presentation of the Host Country - Qatar**
10:30 – 11:15	**Presentation by International Cooperation Branch (ICB), Mrs. Xiaohui Wu, Head/ICB/OPCW**
11:15 – 12:00	**Physical Protection of Chemicals** **Dr. Nancy Jackson/Sandia National Lab, US State Department**
12:00 – 12:30	*Coffee/Pray break*
Session 2: Chairman	
12:30 – 13:15	**Enhancing Process Safety Culture** **Mr. David Moore, AcuTech Consulting Group**
13:15 – 14:00	**Responsible Care-An Initiative for All Stakeholders,** **Mr. Tahir Jamal Qadir, AcuTech Consulting Group**
Wednesday, 24 February 2016	
Session 1: Chairman	
08:00 – 08:45	**Chemical Safety and Security: Lessons Learnt** **Rohan P Perera/ ICB/OPCW**
08:45 – 09:10	Presentation by Mrs. Farangis Pardes - Afghanistan
09.10 – 9.30	Presentation by Mr. Abdullah-Al-Mamun - Bangladesh
09.30 -09.50	Presentation by Mr. Jochu Thinley - Bhutan
09:50 – 10:15	Presentation by Dr. Zhiqian Wang - China
10:15 – 10:45	*Coffee/tea break*

Time	**Activity**
Session 2: Chairman	
10:45 – 11:30	**Security Risk Assessment** **Mr. David Moore, AcuTech Group**
11:30– 11.45	Presentation by Mr. Tilak Raj Arora - India
11.45-12.00	Presentation by Ms. Nunsi Bella Pranawiti - Indonesia
12.00 - 12.15	*Coffee/Pray break*
Session 3: Chairman	
12.15-12.30	Presentation by Mr. Amir Reza Ahmadi Khoy - Iran
12.30- 1.00	**Decision Making on Chemical Management** **Mr. Brandon Turner , UNITAR/IOMC**
13.00 – 13.15	Presentation by Mr. Ramzi Shasha - Lebanon
13.15 – 13.30	Presentation by Ms. Saleha Abdul Rahman @ Ngah - Malysia
13.30 – 13.45	Presentation by Dr. Syed Abdul Mannan Gilani - Pakistan
13.45 – 14.00	Presentation by Mr. Don Kingsley Rajapaksha - Sri Lanka
Thursday, 25 February 2016	
Session 1: Chairman	
08:00 – 08:45	**Overview of the UNECE Industrial Accidents Convention and How It is Implemented in the European Union and at a National Level in the UK** **Ms. Sandra Ashcroft / UNECE**
08.45 -9.00	Presentation by Dr. Carmel Gacho - Philiphines
09.00-09.30	Break Out Group discussions on: • Chemical Safety Best Paractises for Chemical Industries - Group 1 (David, Tahir) • Chemical Security (How to Promote?) – Group 2 (Nancy, Rohan) • Implementation Mechanism of Safety and Security Best Practises– Group 3 (Sandra, Brandon)
09:30 – 10:00	*Coffee/tea break*
Session 2: Chairman	
10:00 – 11:00	Discussions
11:00 – 11:30	Preparation of Group Presentations
11:30 – 12:30	Presentations by Break Out Groups and Discussion
12:30 – 13:15	Plenary Discussion on Way Forward and Recommendations
13:15 – 14:00	Evaluation and Feedback and Closing of the Meeting

Integration of Chemical Safety, Security and Sustainability

Mrs. Xiaohui Wu
Head
International Cooperation Branch
Organization for the Prohibition of Chemical Weapons

Chemical Safety and Security is one of the primary activities related to the implementation of Article XI of the Chemical Weapons Convention (CWC), which focuses on the promotion of peaceful chemical activities. Ensuring chemical safety and security remains fundamental in our effort to prevent the re-emergence of chemical weapons and the misuse of toxic chemicals.

Through industry-outreach activities, the International Cooperation Branch of the OPCW seeks to meet the needs of OPCW Member States in the field of chemical safety and security management--an emerging area vital for the peaceful use of chemicals and sustainable industrial development.

The seminar intends to provide a platform for States Parties in the Asian Region to discuss specific safety and security management issues related to process safety, security risk assessment, management and mitigation, responsible care, , Industrial Accidents Convention and its effective implementation for chemical security: and relevant lesson learned that have a direct bearing on the effective implementation of the CWC, particularly these related to the industry. . The seminar also creates a platform to foster partnership among key stakeholders in Asia to further strengthen the activities related to chemical safety and security across the region.

This programme includes informative presentations from internationally recognised experts in the field of chemical safety and security. We encourage open and interactive discussions at this meeting to address chemical safety and security concerns at the national and regional levels. The OPCW remains committed to working with partners in the region to advance the peaceful, safe, secure and sustainable uses of chemistry.

Xiaohui Wu is Head, International Cooperation Branch of the Organization for the Prohibition of Chemical Weapons (OPCW). Prior to this, she worked for the United Nations on a wide range of peace- and security-related issues, including CBRN, counter-terrorism, and conflict prevention. Mrs. Wu joined the United Nations from Harvard University where she was a scholar with the Belfer Center for Science and International Affairs. She has published extensively on non-proliferation, regional security, and preventive diplomacy. Prior to join Harvard, Mrs. Wu was a career diplomat with the Ministry of Foreign Affairs of China, last serving as the Director of Political and Press Office in China's Embassy in Singapore. Mrs. Wu received her M.P.A. from John F. Kennedy School of Government of Harvard University.

Chemical Safety and Security: Lessons Learnt

Rohan P Perera, BS, MS, PhD (WSU, USA)
Senior International Cooperation Officer
International Cooperation Branch
Organization for the Prohibition of Chemical Weapons

Today researchers, academics and industrialist have greater responsibilities on chemical safety and security in at their institutions than before. A large number of chemicals are being used in day to day activities, research and manufacturing industries. Chemical industries and laboratories have become the hub for gaining knowledge, developing new materials and for monitoring and controlling these chemicals. These chemicals are further routinely used in thousands of commercial processes.

Furthermore, there are a large number of high risk chemicals* used in chemical industries and laboratories for various purposes such as; Hydrogen Peroxide, Potassium Chlorate, Nitric Acid, Potassium Nitrate etc. which has great security concerns. It is pivotal for researchers and industrialist to be aware of the potential for accidental misuse of chemicals, as well as their intentional misuse for activities such as used by non-State actors or illicit drug manufacturing. Recent global incidents provide substantial evidences that laboratory chemicals have been utilized to manufacture chemical weapons and explosives. Enabling proper chemical safety and security management practices in laboratories and industries could mitigate potential risk factors. Threats faced by laboratories and industries on the dual use of chemicals and high end equipment, could be prevented by developing a safety and security culture within the organisation, by providing employee trainings and workshops.

The development of a safety and security culture results in laboratories and industries providing a safe and secure environment in which to conduct research and manufacture chemicals. Fostering a Culture of Chemical Safety and Security depends on the recognition of welfare and safety of each person, based on both teamwork and individual responsibility. In other words, a safety and security culture must be something that each person maintains and not just an external expectation driven by institutional rules.

Lessons learnt and recent examples from past misuse of chemicals by non-State actors are; Sarin gas attack in Tokyo subway (1995), Bali bombing (2002), Delhi bombing (2011), Oslo bombing (2011) and the Hyderabad blast in (2013). Similarly some common industrial chemicals are responsible for large industrial disasters in recent years. Hence daily commitment from everyone in institutions, laboratories and industries is essential, in order to make a safety and security program a success.

*http://www.dhs.gov/sites/default/files/publications/appendix-a-to-part-27-508.pdf

*http://www.nationalsecurity.gov.au/ChemicalSecurity/Documents/Chemicals%20of%20Security%20Concern.pdf

Chemical Safety and Security Management

David Moore, BSc (UMd) MBA (NYU) Registered Professional Engineer
President, CEO, and Founder of the AcuTech Consulting Group,
Vienna, Virginia, USA

Enhancing Process Safety Culture

Process safety management (PSM) has been focused primarily on technical and management systems that must be implemented that are essential to managing the risks of catastrophic releases of highly hazardous chemicals. Missing so far has been a clearly defined process for focusing on the underlying PSM culture necessary to facilitate the management system to be effective. CCPS recognized this and formed a committee to understand the issues and recommend an approach. This culminated in 2014 in the start of a new CCPS guideline project "Essential Practices for Developing, Strengthening and Implementing Process Safety Culture". This paper will explain the development of the guideline and the key findings of the research behind the recommended practice AcuTech developed for CCPS, which will be published in 2016.

ANSI/API Standard 780
Security Risk Assessment Methodology for
The Petroleum and Petrochemical Industry

The American National Standards Institute (ANSI)/American Petroleum Institute (API) Standard 780 Security Risk Assessment (SRA) Methodology has been published in June 2013 as a standard for security risk assessments on petroleum and petrochemical facilities. The standard represents a model standard for evaluating security risks of Middle East critical infrastrucutre. The standard assists the petroleum and petrochemical industries in more thoroughly and consistently conducting SRAs.

The new standard describes the most efficient approach for assessing security risks widely applicable to the types of facilities operated by the industry and the security issues they face in the Middle East. It is adopted by the Kingdom of Saudi Arabia Ministry of Interior High Commission for Industrial Security as the required security risk assessment methodology. AcuTech developed the methodology under contract to the API. This paper examines the key elements of the ANSI/API SRA process and discusses how forward thinking organizations may use risk-based performance metrics to systematically analyze facility security postures and identify appropriately scaled and fiscally responsible countermeasures based on current and projected threats.

Introduction to the IOMC Toolbox for Decision Making in Chemicals Management

Mr. Brandon Turner
United Nations Institute for Training and Research (UNITAR)
Palais des Nations, CH-1211 Geneva 10, Switzerland

This presentation will provide an introduction to the IOMC Toolbox for Decision Making in Chemicals Management (http://iomctoolbox.oecd.org), its contents, and guidance on how to use the collaboration and navigation features.

***The Challenge*:** IOMC (Inter-Organization Programme for the Sound Management of Chemicals) Participating Organizations have developed hundreds of tools and guidance documents that are relevant for countries in their efforts to implement SAICM. However, finding the most appropriate tool or guidance document to address specific national issues can be a challenge.

***The Solution*:** The internet-based IOMC Toolbox enables countries to identify the most relevant and efficient national chemicals management actions. The IOMC Toolbox takes into account the resources available and guides users towards cost-effective solutions adapted to the country. At each implementation step, the IOMC Toolbox presents the relevant IOMC resources, guidance documents, and training material, all available online and free of charge.

***The Scope*:** The IOMC Toolbox identifies appropriate actions and guidance for:

- A national management scheme for pesticides
- An occupational health and safety system
- A chemical accidents prevention, preparedness, and response system for major hazards
- An industrial chemicals management system
- A classification and labeling system
- A system to support health authorities which have a role in the public health management of chemicals
- Pollutant release and transfer registers

The IOMC Toolbox also provides links to five new online toolkits:

- OECD Environmental Risk Assessment Toolkit
- WHO Human Health Risk Assessment Toolkit
- FAO Toolkit for Pesticides Registration Decision Making
- UNIDO Toolkit on Chemical Leasing
- UNIDO Toolkit on Innovative Approaches to Environmentally Sound Management of Chemicals and Chemicals Waste

***A Platform for Collaboration*:** The new version of the IOMC Toolbox provides a set of interactive features allowing governments to use it as a platform for collaboration among ministries, agencies, and other stakeholders such as industry. Users can save their information, add comments, and share and discuss issues with colleagues and partners.

Implementation for the UNECE Industrial Accidents Convention

Ms. Sandra Ashcroft

Head of Chemical Industries Policy
Health and Safety Executive
Hazardous Installations Directorate - Chemical Industries Policy
Chair of the Working Group on Implementation for the United Nations Economic Commission for Europe (UNECE) Industrial Accidents Convention

The presentation will cover the UNECE Industrial Accidents Convention, giving an overview of the Convention itself, the key requirements of the Convention and how they can be implemented to ensure safety and security management practices at country level and for individual sites.

It will refer to the European Seveso Directive on the control of major accident hazards involving dangerous substances, as well as examples from examples of implementation in other countries such as the UK. It will also refer to the development of the Convention and the potential to extend to a global instrument.

Physical Protection of Chemicals

Chemical Security Risk Management

Nancy B. Jackson, Ph.D.
Sandia National Laboratories

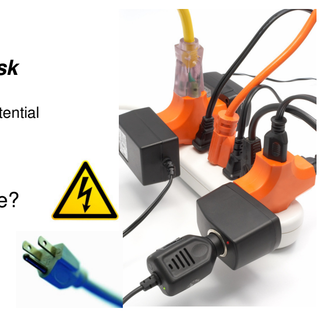
Chemical Security Failures
(specific examples)

- Acquired precursor chemicals from black market
  Hired chemist produced tabun (Iraq 2003)
- Stole precursor chemicals and equipment from his former laboratory
  Chemist produced mustard gas to sell to crime ring (Russia 1997)
- Precursor chemicals purchased from legitimate suppliers
  Chemist recruited from university and produced Sarin (Japan 1995)
- Precursor chemicals purchased from legitimate suppliers
  Recruited chemist aimed to produce multiple chemical weapons (Afghanistan 2001)
- Precursor chemicals stolen from supply routes and from warehoused supplies
  Former military leader aimed to produce multiple chemical weapons (Chechnya 2001)

Key Principles of Chemical Security Risk Management

Risk Basics: Hazard vs. Risk

- There is a difference between ***hazard*** and ***risk***
  - Hazard
    - Something that has the potential to do harm
- Is there a hazard in this picture? If so, what type?
- Is it a risk? If so, how much of a risk?
  - Depends on the situation



Risk Basics: Hazard vs. Risk

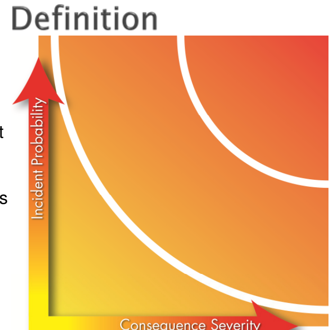
- What is wrong?
  - Overloaded circuit
- What are the possible scenarios?
  - Blown fuse
  - Electrical shock
  - Fire
- What is the likelihood?
  - Factors that lead to an event
    - Plugged in, broken/frayed cords, near oily rags
- What are the consequences?
  - Other factors and things that follow an event
    - Voltage, fire alarms, evacuation

Hazard

Risk

Risk Basics: Definition

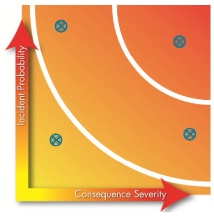
- Risk is a function of
  - Probability that an incident will occur (**likelihood**)
  - Severity if the event occurs (**consequence**)



Risk = *f* (Likelihood, Consequence)

Safety Risk Characterization

1. Low
   - Laboratory procedures are routine; staff is trained and experienced; materials used are mostly benign and/or present in microscale amounts only
   - An incident would not likely be an emergency
2. Moderate
   - Procedures are not routine; staff may be partially trained or have limited experience; materials are reactive, flammable, toxic, and/or present in moderate quantity
   - An incident could constitute or develop into an emergency
3. High
   - Procedures are novel or extremely delicate; staff may be untrained or inexperienced; materials are highly reactive, toxic, explosive and/or present in large quantities
   - An incident would be a life and facility-threatening emergency



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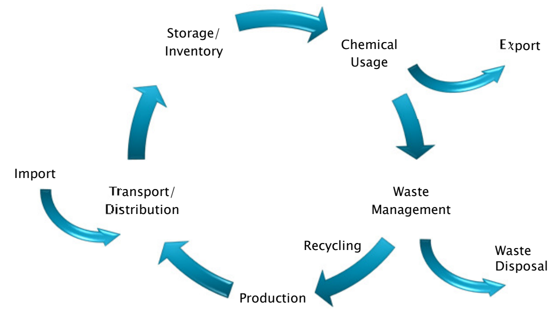
Chemical Life cycle: Procurement to Disposal



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Key Principles of Chemical Security Risk Management

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Threat Analysis

- Supports defining the risk
  - Who are the entities aiming to cause security issues?
    - Examples
      - an unauthorized person stealing chemicals for malicious use
      - an authorized person stealing chemicals for malicious use
      - an unauthorized person stealing chemicals for personal gain
      - an authorized person stealing or destroying chemicals for personal gain
      - an unauthorized person stealing equipment
      - an authorized person stealing equipment
      - an unauthorized person stealing an institution's intellectual property (in the form of information) or confidential information
      - an authorized person stealing institution intellectual property (in the form of information) or confidential information

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Inventory Management

- Knowledge of what you have and where it is
  - Database of chemicals
    - Computer/web-based
      - Barcodes/readers
    - ID, location, owner, hazards, etc.
  - Control access to database
    - Different degrees of access
  - Maintain with inspections & verification
  - Ensure control and accountability
    - No orphan chemicals

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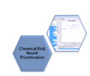
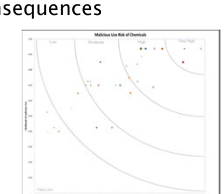
Chemical Risk Based Prioritization



- Knowledge of how scary what you have really is (Safety and Security Risks)
  - Prioritization of safety and security risk associated with chemicals based upon evaluation of both the likelihood and consequences



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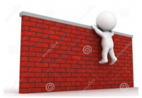
Security Risk and Vulnerability Assessments

- Supports understanding how our defined threats could achieve their goal
  - Current level of security
  - Current level of safety
  - Capabilities of threat



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Key Principles of Chemical Security Risk Management

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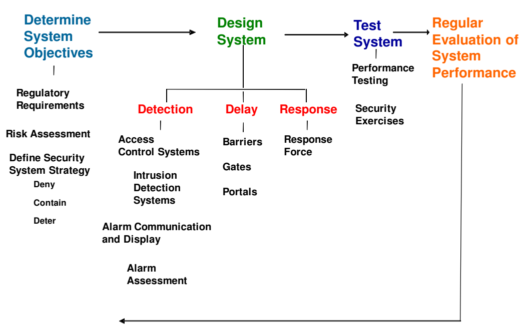
Physical Security System



Define System Objectives

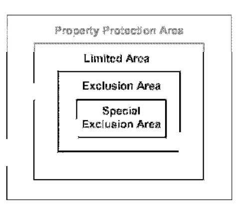
- Management responsible for meeting all international, national, and local regulatory requirements
- Risk assessment allows management to decide which scenarios to actively protect against
- Management determines security system strategy:
  - Deny: prevent adversary from gaining access
  - Contain: prevent adversary from leaving facility while in possession of stolen asset (chemical or equipment)
  - Deter: discourage adversary from stealing a particular asset by making theft appear very difficult

Denial and Containment strategies may only be appropriate when Outsider presents a very high risk

Deterrence generally most appropriate strategy for academic laboratories and many industries because Insiders are typically largest risk

Graded Protection

- Property Protection Areas
  - Low and Very Low Risk Assets
    - Grounds
    - Public access areas
    - Warehouses
- Limited Areas
  - Moderate Risk Assets
    - Most laboratories
    - Administrative offices
    - Hallways adjoining Exclusion Areas
- Exclusion Areas
  - High Risk Assets
    - Chemical warehouses
    - Some laboratories
    - Computer network hubs
- Special Exclusion Areas
  - Very High Risk Assets
    - Extremely valuable intellectual property
    - Scheduled precursor chemicals



Property Protection Areas

- Objective: Announce your intent to protect the property
- Perimeters mark the boundaries
  - Signs
  - Fences
    - Elicit strong statement of intent by adversary
  - Building walls
  - Terrain features

Limited Access and Exclusion Areas

- Objective: Provide reasonable assurance that only authorized individuals have access
- Limited Access Area requires unique credential for access
  - Electronic key card or
  - Controlled key
- Exclusion Area requires unique credential and unique knowledge for access
  - Electronic key card and keypad or biometric device, or
  - Controlled key and second individual to verify identity
- Gradations in other elements of physical security
  - Intrusion detection, alarm assessment, delay, and response

Balanced Protection

- Many unique paths to assets
- System only as effective as weakest path
- Example pathways in chemical laboratories:
  - Normal entryways
  - Emergency exits
  - Equipment interlocks
  - Service elevators
  - Others?

Considerations for Possible Failures in Physical Security System

- Does risk warrant redundant equipment, such as
  - Multiple complementary sensors
  - Central Alarm System and Secondary Alarm Stations
- Contingency and incident response plans
  - Spare parts
  - Compensatory measures
  - Agreement with local law enforcement
- Fail-safe and fail-secure

Physical Security Procedures

- Impose consequences for security violations
- Log personnel (including visitor) access to restricted areas including entry and exit times
- Establish controls on waste handling and purchasing
- Enforce escort policies
  - Visitors
  - Maintenance and cleaning personnel
  - Delivery personnel
- Train personnel on what to do about:
  - Unrecognized persons
  - Unusual or suspicious activity

Performance Testing and Maintenance

- Create security performance test plan and procedures
- Schedule periodic testing of hardware and policy implementation
- Periodic testing of response force procedures
- Document test results
- Take corrective action
  - Schedule maintenance and repair of hardware
  - Corrective training and policy adjustments as appropriate for policy implementation failures
  - Corrective training and exercises for guard force

Considerations in Designing a Physical Security System

- Physical security system must be carefully designed to ensure that the system:
  - Is the best allocation of resources
  - Supports, not conflicts with, safety
- Physical security systems should be performance-based
  - Physical security may be implemented by electronic and/or mechanical means
    - Either must be augmented by people and procedures
- Physical security is only one aspect of a chemical security risk management system
- Risk Assessment is the key!

Purpose of Access Controls

- Allow entry of
  - Authorized persons
- Prevent entry of
  - Unauthorized persons
- Allow exit of
  - Authorized persons

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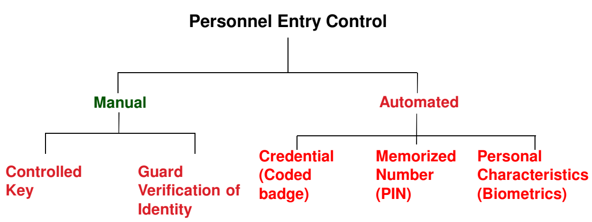
Basis of Access Controls

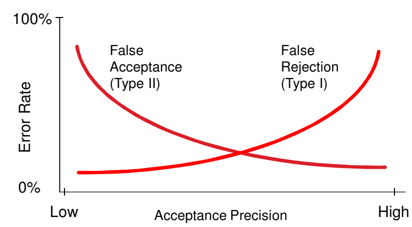
- Something you have
  - Key
  - Card
- Something you know
  - Personal Identification Number (PIN)
  - Password
- Something you are
  - Biometric feature (i.e., fingerprints)
- Combining factors greatly increases security
  - Combinations typically used for Exclusion or Special Exclusion Areas

Access Control Techniques



Errors for Access Control

- False rejection – Type I
  - Authorized persons are not allowed to enter
  - Easy to quantify
- False acceptance – Type II
  - Unauthorized persons are allowed to enter
  - Difficult to quantify



Manual Access Controls

- Mechanical Keys
  - Controlled keys
  - Pros
    - Familiar to user
    - Inexpensive
  - Cons
    - Can be copied
    - May be lost or stolen
    - Relatively easy to defeat
    - Must be recovered when authorization is terminated

- Guard verification of identity
  - May use photo badges or id cards
  - Pros
    - Easy to implement
    - Recognize personnel
  - Cons
    - Labor intensive
    - Easy to tamper with badge

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Coded Badges

Positive Features	Negative Features
• Control access by area and time	• Identify badge, not person
• Record each access	• Require maintenance
• Have low false rejection rate	• May be defeated by counterfeit badge
• Perform consistently	
• Easy to Change Authorization	

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Proximity Badges

- Induction powered
  - Coded RF transmitter
- Pros
  - Hands-free operation
  - Can be worn under Personal Protective Equipment
  - Difficult to counterfeit
- Cons
  - Requires maintenance
  - Identifies the badge, not the person

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Characteristics of Magnetic Stripe Badges

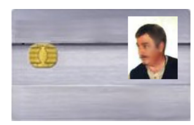
- Two magnetic "strengths" (coercivity)
  - Low coercivity, 300 Oerstead (e.g., bank card stripes)
  - High coercivity, 2500 to 4000 Oerstead, typically used for badges
- Pros
  - Widespread use of magnetic stripes
  - Users are familiar with the technology
  - Easy to use
  - Difficult to counterfeit high coercivity card
- Cons
  - Requires maintenance (replacement cards)
  - Easy to counterfeit low coercivity card
  - Identifies the badge, not the person

Characteristics of Wiegand Cards

- Card consists of a series of embedded wires with special magnetic properties
- Position of wires and their magnetic polarities determine the encoding
- Pros
  - Widespread use
  - Easy to use; card is read via a "swipe" action similar to magnetic stripes
  - Output format is an industry standard
  - Average ease to counterfeit
- Cons
  - Average ease to counterfeit
  - Requires maintenance (replacement cards)
  - Identifies the badge, not the person

Characteristics of Smart Cards

- Credit-card-sized device with CPU, memory, I/O, and operating system
- Onboard EEPROM allows storage of ID information, including
  - PIN / password
  - biometric template
- Pros
  - Easy to use
  - Difficult to counterfeit
  - Capable of doing encryption
- Cons
  - Relatively high cost
  - Requires maintenance (replacement cards)

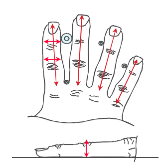


Fingerprint Scanner

- Reads Fingerprint
  - Different types:
    - Direct contact with chip
    - Ultrasound
    - Can combine with pin number **or badge swipe**
  - Verification time: fast (approx 5 seconds)
  - Cost per terminal: approx $1200 per unit + software and installation costs
- Pros
  - Easy to use
  - Low False Acceptance error rate (0.001%)
- Cons
  - Cannot be wearing gloves
  - Tests have shown higher False Reject rates for laborers with dirty hands or worn fingerprints
    - 1% is normal, dirty hands can increase up to 40%
  - Requires maintenance – keep it clean
  - 1-3% of the population is incompatible with any biometric device

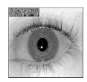
Hand Geometry Scanner

- 90 readings of length, width, thickness, and surface area of the fingers
  - Can combine with pin number or badge swipe
  - Verification time: fast (approx 5 seconds)
  - Cost per terminal: $1500 per unit + software and installation costs
- Pros
  - Most popular Biometric device
  - Easy to use
  - Low False Accept and False Reject error rate (0.1% for both errors)
  - Relatively inexpensive and reliable
  - Can use with some types of gloves
- Cons
  - Requires maintenance



Retinal or Iris Scanner

- Iris scanner uses camera to look at patterns of the iris
  - Verification time: Approx. 5-10 seconds
  - Cost per terminal: Approx. $3,000 - $5000 + software / installation
  - Pros:
    - False Accept error of 0.0%
    - Operates in “Recognize Mode” - no need for pin number or card
    - Can use with Glasses, Contacts, or PPE
    - No physical contact between face and scanner (10 inch / 25cm away)
  - Cons:
    - False Reject error is 1% (some people have an iris that is so dark that the TV camera and software cannot enroll them)
    - Eyeglasses / PPE will interfere if have a reflection
    - Does not operate in “Verification Mode”



Key Considerations in Selecting Access Controls

- Access control systems
  - Can be low or high tech
  - Give varying levels of assurance of person’s identity
    - Risk assessment!
  - Have error rates and enrollment issues
    - 1-3% of the population is incompatible with any biometric device
    - Must have secondary method for those who cannot pass automated inspection
  - Needs to accommodate peak loads
  - Should be designed for both entry and exit

Intrusion Detection

- Objective: Detect unauthorized access
- Many types of intrusion detection
  - Personnel notice unauthorized access attempt
    - Training
  - Boundary sensors most applicable for bioscience facilities
    - Magnetic switches on doors
    - Glass break sensors on windows
  - Volumetric sensors may be appropriate for low-use areas of high risk (e.g. culture collection storage rooms)
    - Microwave
    - Passive infrared

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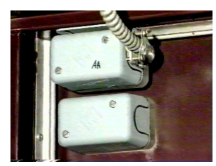
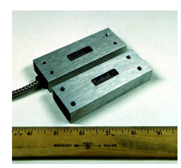
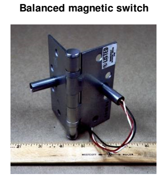
Magnetic Switches



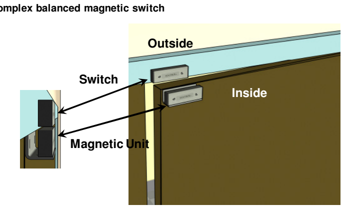
Balanced magnetic switch



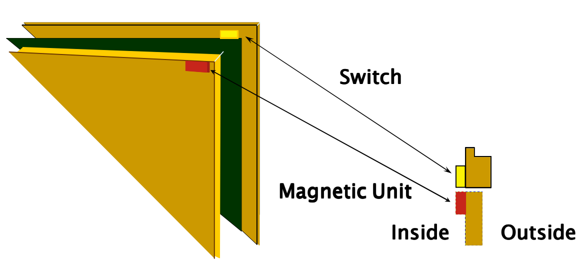
Complex balanced magnetic switch



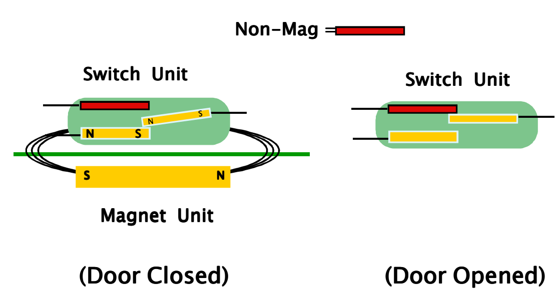
Covert magnetic switch



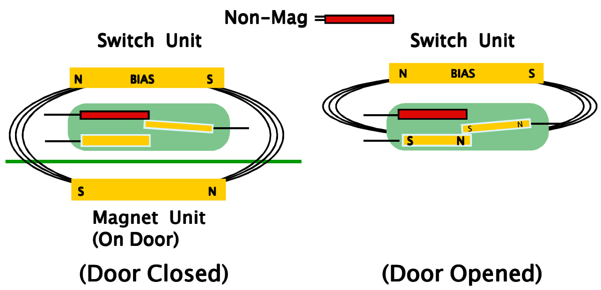
Magnetic Switch



Magnetic Reed Switch

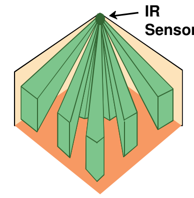


Balanced Magnetic Switch (BMS)



Volumetric Sensors

- Microwave
  - Most sensitive to movement toward or away from sensor
  - Nuisance alarms include: movement of metallic objects, fluorescent lighting, insects, movement outside of room
- Passive infrared
  - Most sensitive across field of view
  - Nuisance alarms include: heaters, thermal gradients, animals, sunlight, vibrations
- Limited applications in bioscience facilities:
  - Most appropriate for low use, high risk areas
    - E.g. Storage area for culture collection with very high risk pathogens



Alarm Communication and Assessment

Sensor Activated → Alarm Signal Initiated → Alarm Reported → Alarm Assessed

- Designer must decide:
  - What information should be presented to the operator?
  - How should the information be presented?
  - How does the operator interact with the system?
  - How should the equipment be arranged at the operator's workstation?
- Alarms must be communicated and displayed
- Alarms must be assessed before response is dispatched
  - Can be direct (guards) or remote (video)
  - Determine cause of each sensor alarm
    - Valid or nuisance alarm
  - Requires adequate lighting
    - Deters opportunistic adversaries

Alarm Assessment

Direct observation by guards

- Can be campus police or other on-site security
- Takes time and can put guard in danger
- Can provide immediate response
- Can only tolerate low rate of nuisance alarms
- Labor intensive

Remote assessment by video

- Video is immediate and focused
- Video is displayed to an alarm station operator for assessment
- Assessment of an alarm can occur almost immediately
  - Pre-event and post-event recording possible
- Later audit and review
- Efficient use of people
- Requires video infrastructure
- Can have high initial expense
- Maintenance can be expensive

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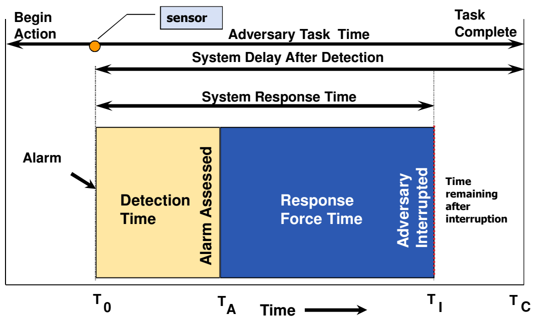
Video Assessment vs. Video Surveillance

- Assessment
  - Alarm information triggered by sensor activation and directed to a human to determine if unauthorized access has occurred in a sensored area
  - Cameras located at sensor locations – e.g. pointed at doors
- Surveillance
  - Continuous use of a human as a intrusion detector to monitor several restricted areas that are NOT sensored by intrusion technologies
  - Systems often have many cameras
  - Someone must watch all video screens all the time
    - Personnel can only watch a few screens for a limited amount of time before fatigue

Adversary Time vs. Response Time



Response Force Options

- On-site guard force
  - Can serve intrusion detection and alarm assessment roles in mechanically-based physical security systems
  - Supports electronic systems:
    - Monitors Alarm Communication & Display (AC&D) system
    - Assesses electronic alarms at alarm console or at alarm location
  - Patrols perimeter and buildings
  - Summons and directs local law enforcement
- Local law enforcement (police)
  - Reinforces on-site guard force
    - Responds according to plan when summoned
    - Equipped and authorized to confront adversary

Response Force Requirements

- Qualification and training
  - Enforcement responsibilities and skills
  - Equipment familiarity and training
  - Familiarity with facility features and operations
  - Knowledge of restricted area access and biosafety
- Guard Force Post Orders
  - List specific duties and limits of authority
  - Procedures for response to specific alarm conditions
  - Emergency response procedures
  - Notification list
- Memorandum of understanding with local law enforcement
  - Specific instructions and agreements
  - On-site training and orientation

Security Considerations

- Administrators have full control
  - The ultimate insider
- Protect the system using procedures
  - Two person control
  - Configuration management
  - Password control
- Restrict operator privileges
- Provide physical protection for equipment
- Backup equipment and procedures must be provided to maintain security
- Emergency power and uninterruptible power supply required for computers

Conclusions

- Physical security systems will vary based on:
  - Resources
  - Choice of technology
  - Security system strategy
    - Physical security is more substantive for deny or contain than deter
  - Risk Assessment!
- Physical security systems should be performance based
  - Low and higher technology options
- Must consider unique aspects and requirements of the facility

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Enhancing Process Safety Culture

Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region

National Committee for the Prohibition of Weapons
Doha Regional Centre for CBRN Training

DOHA, QATAR
23 - 25 FEBRUARY 2016

David A. Moore
President & CEO
dmoore@acutech-consulting.com

AcuTech Group, Inc.
Washington DC | Houston | Philadelphia | San Francisco
Dubai | Shanghai | Mumbai
www.acutech-consulting.com

Outline

- Need for improved PSM culture to improve overall PSM performance
- CCPS PSM Culture Guidelines Overview
  - Definitions
  - Models
  - Next step
- Conclusions and Q&A

Process Safety Management (PSM)

- Process Safety Management (PSM) is a “blend of engineering and management skills focused on preventing catastrophic accidents, particularly explosions, fire and toxic releases associated with the use of chemicals and petroleum products” (AIChE, CCPS, 2010)

Challenge - Improvement of Performance in the Management of Risk

- Requires **good corporate governance**
- This requires the establishment of:
  - Objectives and targets
  - Metrics to monitor and review performance
  - Audits and management reviews
  - The right culture facilitated by:
    - collaborative efforts to learn, share and address issues
    - an operating discipline
    - A mindset of improvement and Operational Excellence

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Challenge - Improvement of Performance in the Management of Risk

- Simply put, culture is often referred to as the inherent personality of an organization.
- A culture is established when a group of people with a common purpose (e.g., co-workers, team mates, families, etc.) identifies a set of beliefs, customs, and behaviors that become embedded in how the group thinks, works, or co-exists.
- As the group repeatedly practices these beliefs and behaviors, and becomes accustomed to their consequences, these beliefs and behaviors become reinforced and integrated into the group’s value system (Ref. Schein, RBPS).

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Challenge - Improvement of Performance in the Management of Risk

- In a sound culture, deeply held values are reflected in the group’s actions, and the group’s members, particularly newcomers, are expected to adopt or “buy into” these values in order to demonstrate that they are part of the team and can remain part of the group.
- Conversely, in negative cultures, these values result in attitudes and actions (or the lack of action) whose consequences are also negative, and peer pressure is often used to reinforce these negative behaviors.
- An example: berating a new co-worker for wasting time because he/she is carefully following an approved procedure and instead then instructing the new co-worker to take short-cuts that save time and effort, but result in a reduced safety margin.

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US Refinery National Emphasis Program Year 1 Results

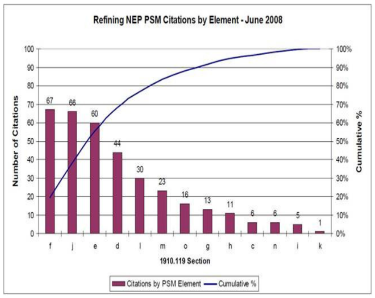

Figure 1. Number of Citations and Cumulative Percentages, By PSM Element

CCPS PSM Culture Guidelines

- Process safety management (PSM) has been focused primarily on technical and management elements that must be implemented as essential to managing the risks of catastrophic releases of highly hazardous chemicals.
- Devoid so far has been a clearly defined process for focusing on the underlying PSM culture necessary to facilitate the management system to be effective.
- CCPS recognized this and formed a committee to understand the issues and recommend an approach.
- This culminated in 2014 in the start of a new CCPS guideline project "Essential Practices for Developing, Strengthening and Implementing Process Safety Culture – Project # 249".
- AcuTech is preparing the guidelines with the assistance of Echo Strategies.

CCPS PSM Culture Guidelines

- A significant amount of literature addresses working culture in industry, however, little literature exists which is solely dedicated to the process safety culture in the processing and allied industries.
- This book itemizes *"essential practices,"* to assess and strengthen process safety culture, but it is not expected to provide the comprehensive guidance for defining detailed management systems, as is often provided in a CCPS "guidelines" book.

CCPS PSM Culture Guidelines

- The primary objective of this book is to provide a useful tool that can be used by any industrial company that handles hazardous chemicals to understand and improve their process safety culture. Secondly, the book provides some tools and guidance on approaches to process safety culture.
- The book is intended for chemical site managers, process safety engineers, chemists, regulators, engineering educators, and others responsible for chemical safety and interested in improving process safety management.

Organization of the Book

- The book covers the evolution of process safety culture by examining key incidents that have shaped the process safety culture discussion and examining definitions that have been proposed over the years.
- A key aspect of the book is the development of a model of nine Core Principles.
- These principles are described in detail, including means to ascertain the status of the principles. Practical applications will then be presented for each principle. The guideline will be organized into the following chapters:
- Introduction – including a discussion of Process Safety Culture definitions and a review of key incidents that have impacted the culture discussion.
  - Process Safety Core Principles
  - Leadership for Process Safety Culture within the Organizational Structure
  - Process Safety Culture Applications – organized by the Core Principles
  - Continuum - this chapter will discuss sustaining process safety culture improvements and maintaining a good culture. Warning signs of cultural degradation and remedies will be discussed

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Definition of PSM Culture

- An early definition of safety culture was made by the International Nuclear Safety Advisory Group (INSAG) of the International Atomic Energy Agency (IAEA) in the investigation of the aftermath of the Chernobyl accident in 1986. (Ref. IAEA)
  - "Safety Culture is that assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance".
- In the wake of the *Challenger* and *Columbia* disasters, NASA (Ref. NASA, Ref. Rogers) defined organizational culture as:
  - "Organizational culture refers to the basic values, norms, beliefs, and practices that characterize the functioning of a particular institution. At the most basic level, organizational culture defines the assumptions that employees make as they carry out their work; it defines "the way we do things here." An organization's culture is a powerful force that persists through reorganizations and the departure of key personnel."
- David Jones and Shakeel Kadri (Ref. Jones and Kadri) offer the following definition of culture as it applies to process safety management in the chemical, processing, and allied industries:
  - "For process safety management purposes, we propose the following definition for process safety culture: *The combination of group values and behaviors that determine the manner in which process safety is managed."* (emphasis added).

AIChE CCPS 20/20 Vision

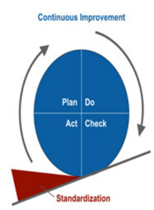
- CCPS, in its 20/20 Vision project document, stated that a committed culture consists of three aspects (McCavit):
  - Felt leadership from senior executives - Felt leadership means more than a periodic mention of process safety in speeches and town hall meetings. It means that the executives are personally involved in process safety activities.
  - Operational discipline - the performance of all tasks correctly every time.
  - Maintaining a sense of vulnerability – essential to motivate and to set priorities.

CCPS Guidelines Definition of PSM Culture

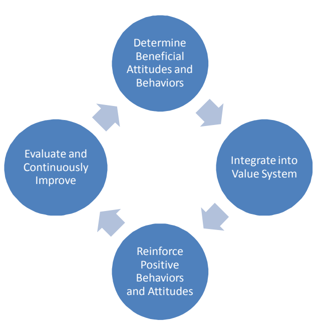
- ***Process Safety Culture: The pattern of shared written and unwritten attitudes and behavioral norms that positively influence how a facility or company collectively supports the development and execution of the management systems that comprise its process safety management program.***
  - This definition is a distilled statement of a number of positive concepts regarding how people in a facility with a PSM program would think, feel, and act regarding that program and their role in it.
  - It is not an end unto itself and requires the development and implementation of other, but related concepts to become a reality.

Typical Approach to Process Safety Excellence

- Ordinarily follows a classic Deming Plan-Do-Check-Act approach for the development, implementation and management of multiple tasks and disciplines to manage risk:
  - **Plan**
    - Documenting the management system
    - Defining requirements and objectives
    - Regulatory, Internal, Industry Best Practices
  - **Do**
    - Implementation of the system
  - **Check**
    - Audits, risk assessments, internal review
    - Checklists
    - Key performance indicators review
  - **Act**
    - Management review
    - Setting of improvement objectives
    - Monitoring progress on implementation or action items



CCPS PSM Culture Lifecycle



Core Principles and Relation to RBPS Framework

- AcuTech mapped key PSM culture references and developed a new CCPS model for essential elements of a PSM culture initiative. These included the prior publications of the CCPS Core PSM Culture Principles based on the Columbia Space Shuttle Investigation (Kadri/Jones), the PSM culture goals of the CCPS Vision CCPS 2020 statement (CCPS Vision 2020), and the 12 key principles from the Culture Chapter of the RBPS Book (Chapter 3, 2007). These formed the basis of a holistic model based on nine Core Principles:
- Establish an Imperative for Safety
- Provide Strong Leadership
- Maintain a Sense of Vulnerability
- Understand and Act Upon Hazards/Risks
- Empower Individuals to Successfully Fulfill their Safety Responsibilities
- Ensure Open and Frank Communications
- Foster Mutual Trust
- Combat the Normalization of Deviance
- Learn to Assess and Advance the Culture

Integration of PSM Culture and Organizational Culture

- In most cases, the holistic nature of corporate culture and its values are absent from process-safety thinking. This research also concluded a major shortcoming with most safety culture models is the lack of their integration into general models of corporate culture. Three well-known process-safety culture models (CCPS – Jones/Kadri, CCPS Vision 2020, and RBPS) were compared to the University of Michigan Denison corporate-culture model. The analysis identified four culture voids in most process-safety culture models:
- ***Strategic Direction and Intent:***
  – Organizations that have a clear mission that gives meaning and direction to their work.
  – The organization has a long-term purpose and direction that is documented with a clear strategy for the future.
- ***Adaptability:***
  – Adaptability means that the organization's culture helps them manage internal change well.
  – These organizations are very responsive and incorporate change easily, such as a change of internal leadership or regulatory requirements.
  – Adaptable organizations continually adopt new and improved ways to do work, and the different units or groups in these organizations often cooperate to create change.

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Integration of PSM Culture and Organizational Culture

- ***Team Orientation:***
  – Teams are the primary building blocks.
  – Cooperation and collaboration across cross-functional roles.
  – Work is sensibly organized in these organizations so that each person can see the relationship between his/her work and the goals of the organization.
  – Horizontal control and coordination to get work done, rather than hierarchy.
- ***Vision:***
  – Know what their organization will be like in the future and that vision is shared among its members.
  – That vision creates excitement and motivation for the employees.
  – The leaders in these organizations have a long-term orientation
  – The organization is able to meet short-term demands without compromising their long-term vision.

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Benefits to the Organization

- The reward for global culture leadership is clear. CEOs and executives who can define their culture and manage its strengths and weaknesses create better places to work, and they make more money.
- Those leaders understand that culture does trump strategy.
- Healthy culture is essential to effectiveness and business sustainability.
- When culture and sustainability strategies go beyond economics and unite ecology, corporate social responsibility and safety, corporations can do well by doing good. (Ref. Musante, 2014)

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AcuTech Consulting Group
1919 Gallows Road
Suite 900
Vienna, VA 22182 USA
www.acutech-consulting.com

About the Presenter

David Moore is the President and CEO of the AcuTech Consulting Group, a process risk management consulting firm based in Vienna, Virginia, and founded in 1994 (www.acutech-consulting.com). AcuTech has been a sponsor of CCPS since inception and serves on the Technical Steering Committee. AcuTech has developed four previous guidelines for CCPS (Inherent Safety, Metrics, Auditing, and Security Vulnerability Analysis) and is now preparing the CCPS PSM guidelines.

Mr. Moore has over 35 years of experience in chemical safety and security management and is a recognized expert in and frequent speaker on these topics. He has provided risk consulting services and training to industrial companies globally. Mr. Moore has taught process safety and security courses to many of the world's largest corporations and to US and foreign governments.

Mr. Moore was formerly a Senior Engineer with Mobil Corporation and a Fire Protection Engineer with the National Fire Protection Association and has been a PSM consultant for 28 years. Mr. Moore is a Registered Professional Engineer. He has an MBA, (NYU 1987), and a B.Sc., Fire Protection Engineering (University of Md, 1979).

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Security Risk Assessment

Seminar on the CWC and
Chemical Safety and Security
Management for Member
States in the Asia Region

National Committee for the
Prohibition of Weapons
Doha Regional Centre for
CBRN Training

DOHA, QATAR
23 - 25 FEBRUARY 2016

David A. Moore
President & CEO
dmoore@acutech-consulting.com

AcuTech Group, Inc.
Washington DC | Houston | Philadelphia | San Francisco
Dubai | Shanghai | Mumbai
www.acutech-consulting.com

Objectives

- Background on API/NPRA SVA Methodology and future ANSI/API Standard 780
- Risk assessment principles and key variables
- Explain the steps of the API SRA Methodology
- Applications and future direction

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Management System for Petroleum and Petrochemical Security

- The handling, storing, or processing of hazardous chemicals must be managed in a holistic risk management framework using a risk-based approach
- Paramount to that process is the need for a standardized risk assessment approach
- Regulations alone do not meet the needs of industry for defining risk management approaches
- There remains a need for global private sector leadership on chemical and energy security guidance and best practices
- Companies have to develop an internal strategy to address security risk management

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Managing Security Risk In Challenging Economic Times

- Given the need to progress risk reduction, several challenges exist:
  - Uncertainty of investment value, particularly for terrorism risk assessment where the likelihood of an attack is seen as unrealistic or at least unpredictable.
  - High cost of protecting a facility to this standard of care and current gap of most critical infrastructure being less secure than is required.
  - Competing requirements for limited resources.
  - The need to present security considerations to management in a business context while under economic pressures.
- – A standardized Security Risk Assessment methodology can provide a basis for these decisions

API Standard 780 Overview

- Prepared by the Security Risk Assessment (SRA) Committee of the American Petroleum Institute (API)
- Objective to improve on the methodology and to make it an American national standard
- Purpose is to assist the petroleum and petrochemical industries in understanding security risk assessment and in conducting SRAs.
- Describes an approach for assessing security risk that is:
  - – Widely applicable to the types of facilities operated by the industry
  - – Addresses the security issues the industry faces.
- New title – "Security Risk Assessment Methodology for the Petroleum and Petrochemical Industry"
- Published in 2013

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Scope of Security for the Petroleum and Petrochemical Industry

- Protection of employees and the public from harm
- Protection of corporate physical and cyber assets from loss or theft
- Prevent theft or diversion of chemicals with potential dual purpose
- Economic and continuity of operations –
  - – Internal: Economically critical to organization
  - – Codependent: Critical materials or operations in supply chain
  - – National Critical infrastructure - economic importance to nation

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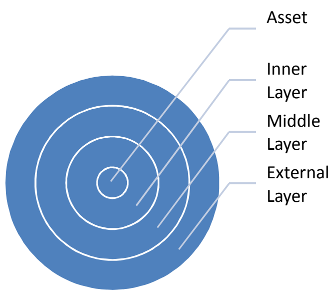
Layers of Security
(Security Principle)



International Security Requirements

- International Ship and Port Security
  - Expanded on Safety of Life At Sea (SOLAS) 1974
  - International Application
  - Security Risk Assessment Required
  - Established Common Basis to Exchange Security Information
  - Communications Protocols
  - Interfacing Ship Security Plans & Port Security Plans based on Security Assessments and Current Threat Data
  - Waterside Considerations
  - Prevent Unauthorized Access
  - Includes Training and Drills

SRA Methods Strengths and Limitations

- Strengths:
  - Helps the Team Understand the Security Risks
  - Helps Prioritize Recommendations for Management
  - Optimizes and Justifies Expenditures of Resources
- Limitations:
  - Not exact
  - Poor data IN = Poor results OUT
  - Team Effort: Needs Operations + Security

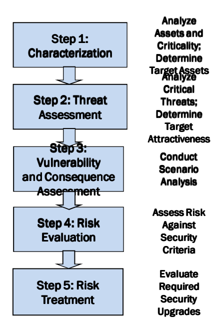
Evolution of the API SRA Methodology

CCPS (2002)	API/NPRA (2003, 2004)	ANSI/API (2013)

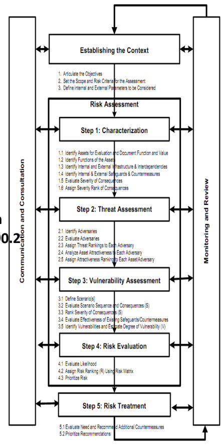
Benefits of SRA Methodology

- Awareness of security-related risks & mitigation opportunities to address threats articulated in an organizational context
- Compliance with requirements using recommended practices
- Confident and rigorous decision making and planning
- Effective allocation and use of resources
- Enhanced security; improved incident management
- Improved corporate governance and financial reporting
- Improved operational effectiveness & stakeholder confidence
- Improved organizational learning, culture, and resilience
- Shows responsibility and advocacy on security issues

API SRA Methodology



API SRA Methodology in context with ANSI/ASSE Z690.2



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SRA Steps – Step 1 Characterization

- Facility / Asset Characterization
  – Process units
  – Tanks and storage vessels
  – Control systems
  – Utilities
  – Feedstock
  – Export systems
  – Transportation system

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Step 1 - Identify the Assets

- For example, during a SRA of a distribution terminal the SRA scope with include a review of:
  – Security responsibilities
  – Means of transportation for receiving products
  – Docks / piers, mooring equipment, cargo transfer equipment
  – Vessel interface procedures with the terminal
  – Security countermeasures and how they are operated
  – Communications capabilities
  – Cyber controls and security
  – Utilities and the effects of their loss
  – Security-related incidents
  – Previous security-related inspections of the terminal

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SRA Steps – Step 1 Characterization

- Facility Characterization
  – Intentional Events Can Exceed Safety Assumptions
  – Simultan
    Damage

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SRA Definitions of Consequences of the Security Event

Description	Ranking
A. Possible for any offsite fatalities from large-scale toxic or flammable release; possible for multiple (> 3) onsite fatalities B. Major environmental impact onsite and/or offsite (e.g., large-scale toxic contamination of public waterway, persistent reduction in ecosystem function) C. Over $100,000,000 property damage D. Very long term (> 3 years) business interruption/expense; Large-scale disruption to the national economy, public or private operations; Loss of critical data; Loss of reputation or business viability E. International negative press	5
A. Possible for 1 to 3 onsite fatalities; possible offsite injuries B. Very large environmental impact onsite and/or large offsite impact (>50 acres / 10 miles) C. Over $10,000,000 – 100,000,000 property damage D. Long term (1 year - 3 years) business interruption/expense E. Extensive negative national press	4
A. No fatalities or injuries anticipated offsite; possible widespread onsite serious injuries B. Environmental impact onsite and/or minor offsite impact C. Over $1,000,000 -$10,000,000 property damage D. Medium term (6 months – 12 months) business interruption/expense E. Negative national press	3
A. Onsite injuries that are not widespread but only in the vicinity of the incident location; No fatalities or injuries anticipated offsite B. Minor environmental impacts to immediate incident site area only C. $100,000-$1,000,000 loss property damage D. Short term (>1 week - 6 months) business interruption/expense E. Significant negative local press	2
A. Possible minor injury onsite; No fatalities or injuries anticipated offsite B. No environmental impacts C. Up to $100,000 Property Damage D. Very short term (up to 1week) business interruption/expense E. Local negative press only	1

95

Asset Characterization Form

Date: Facility/ Operation: Reference:	Analyze Assets and Criticality; Determine Target Assets									
Assets	Asset Type	Function	Infrastructure Interdependence	Casualties	Environment	Replacement	Business	Reputation	Consequence	Asset Severity Ranking

- Column 1 is for the team to list relevant assets. Similar assets within a facility with similar geographic locations on the property, common vulnerabilities, and common consequences can be grouped for efficiency and to consider the value of an entire functional set;
- Column 2 is the type of asset (pathway, asset, activity)
- Column 3 is to document the function of the asset, pathway, or activity;
- Column 4 is to document the Infrastructure / Dependence and Interdependence of the asset;
- Columns 5a/5b/5c/5d/5e are for rating (VL-L-M-H-VH) the hazards and Consequences that would be realized if the asset was damaged, compromised, or stolen (this is a maximum expected damage screening assessment for casualties, environment, replacement cost, business interruption, and damage to reputation);
- Column 6 may be used to summarize ratings from columns 5a through 5d and to further document any asset-specific consequence information
- Column 7 ranks the estimated overall severity of the loss of the asset, using a five-level Severity Ranking scale for Consequence to determine the initial severity of consequence without consideration of any existing countermeasures (C)

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Step 2: Threat Identification

- Identify the potential adversaries
  - Insiders
  - Outsiders
  - Collusion
- Conduct adversary characterization
  - Capabilities?
  - Characteristics?
- Make use of available intelligence

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Step 2: Threat Identification

Threat Ranking Criteria	
Threat Level	**Description**
5 – Very High	Indicates that a credible threat exists against the asset or similar assets and that the adversary demonstrates the capability and intent to launch an attack, and that the subject asset or similar assets are targeted or attacked on a frequently recurring basis and that the frequency of an attack over the life of the asset is very high (for example, > or = 1 attack/year of the asset's operation)
4 – High	Indicates that a credible threat exists against the asset or similar assets based on knowledge of the adversary's capability and intent to attack the asset or similar assets and some indication of the threat specific to the company, facility, or asset exists (for example, > or = 1 attack/5 years)
3 – Medium	Indicates that there is a possible threat to the asset or similar assets based on the adversary's desire to compromise similar assets but no specific threat exists for the facility or asset (for example, > or = 1 attack/10 years)
2 – Low	Indicates that there is a low threat against the asset or similar assets and that few known adversaries would pose a threat to the asset (for example, > or = 1 attack/100 years)
1 – Very Low	Indicates little or no credible evidence of capability or intent and no history of actual or planned threats against the asset or similar assets (for example, > No expected attack or < 1 attack/100 years)

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SRA Steps – Step 2 Threat Assessment

THREAT ASSESSMENT FORM

Threat Category	Source	General Threat History	Site Specific Threat History	Potential Actions	Capability	Motivation/ Intent	Overall Assessment	Threat Ranking

- Column 1 provides the descriptions and names of the major threats to be considered;
- Column 2 is threat category (EXT – External (outsider), INT – Internal (insider), COL – collusion;
- Column 3 documents the general threat of that type against this or similar assets regionally, nationally, or worldwide;
- Column 4 documents the site specific threat history for the facility being evaluated;
- Column 5 documents the potential actions that the threat could take;
- Column 6 documents the level of capability of the threat;
- Column 7 documents the threat's level of motivation and intent;
- Column 8 provides an overall threat ranking assessment, and;
- Column 9 provides the numeric rating per the 5-point Threat Ranking scale.

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Asset Attractiveness Factors

Target Attractiveness Ranking Definitions			
Ranking Levels	**Descriptors**	**Conditional Probability of the Act**	**Threat Ranking**
1	Very Low	0.0 to **0.2**	Threat would have little to no level of interest in the asset.
2	Low	> 0.2 to **0.4**	Threat would have some degree of interest in the asset, but it is not likely to be of interest compared to other assets.
3	Medium	> 0.4to **0.6**	Threat would have a moderate degree of interest in the asset relative to other assets.
4	High	> 0.6 to **0.8**	Threat would have a high degree of interest in the asset relative to other assets.
5	Very High	> 0.8 to **1.0**	Threat would have a very high degree of interest in the asset, and it is a preferred choice relative to other assets.

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ASSET ATTRACTIVENESS FORM

Asset Name & Description	Asset Severity Ranking	Asset Attractiveness								
		Threat 1	AR	Threat 2	AR	Threat 3	AR	Threat 4	AR	Target Ranking

- Columns 1 (Assets) and column 2 (Asset Severity Ranking) are repeated from Form 1 for reference.
- Column 3 is a documented rationale for why the particular asset is attractive (or unattractive) to each applicable threat,
- Columns 3a1/3b1/3c1/3d1/ etc. reflect the rationale for the ranking, and columns 3a2/3b2/3c2/3d2/ etc. are the rankings of that related attractiveness on a 5-point relative Attractiveness Ranking scale. This is repeated for each of the other credible threats identified in the Threat Assessment.
- The last column is an overall Target Ranking (TR) per the 5-point scale, and is considered to be the highest attractiveness of any of the individual threat rankings but also considers that the sum of the different threats' interests may make the asset even more attractive. The Target Ranking is used to judge the degree of attractiveness of the target considering all the threats. It is used to identify the assets with the highest aggregate unconditional threat profile

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Step 3 Vulnerability Assessment

- Identify a **CREDIBLE** Scenario
  - Select event type (example = release of material)
  - Pair it with the adversary list (example = terrorist)
  - Identify credible threat scenarios by evaluating undesired acts (example = VBIED at process unit)
  - Evaluate potential consequences (casualties, cost, business interruption, environmental impact, damage to reputation)
  - List planned safeguards (barriers, CCTV, detection sensors, vehicle screening, response forces)
  - Identify gaps / potential vulnerabilities (inadequate barriers, lack of detection, delayed response, procedural issues, cyber vulnerability)

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Vulnerability Analysis

- Evaluate credibility of scenarios involving:
  - Damage / destruction of the facility or moored vessel
  - Hijacking or seizure of a moored vessel or crew
  - Tampering with cargo, essential equipment or systems
  - Unauthorized access
  - Smuggling dangerous substances and devices into facility
  - Use of a vessel moored at the facility to carry those intending to cause a security incident
  - Use of a vessel at the facility as a weapon
  - Blockage of entrances, approaches, or waterway access

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Step 3 - Analyze Vulnerability

- SRAs provide a structured method through which security risk to a facility or process can be defined as:
- Security Risk (R_S) is a function of Consequences, Threat, Vulnerability
- R_S = a function of (C, T, V) or [C, (A x T), V]
  - –**Likelihood of the act (L1)**: The potential for a threat to target and to attempt to execute a security event against an asset. **TxA = L_1**
  - –**Likelihood of success of the act (L2)**: The potential for causing the consequences estimated by performing the act and defeating the countermeasures. **L_2 = V**

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Likelihood and Consequence

(L_1 = A x T) * (L_2 = V) yields overall Likelihood (L)

- **Consequence Assessment:** Product or process of identifying or evaluating the worst-credible scenario-specific effects of an event, incident, or occurrence

Worst-credible Scenario-Specific Consequence = (C)

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Vulnerability Ranking Criteria

Vulnerability Ranking Criteria			
Vulnerability Level	**Descriptor**	**Conditional Probability of Success**	**Description**
1	Very Low	0.0 to 0.2	Indicates that multiple layers of effective security measures to Deter, Detect, Delay, Respond to, and Recover from the Threat exist, and the chance that the adversary would be readily able to succeed at the act is very low.
2	Low	> 0.2 to 0.4	Indicates that there are effective security measures in place to Deter, Detect, Delay, Respond, and Recover, however, at least one weakness exists that a Threat would be able to exploit with some effort to evade or defeat the countermeasure.
3	Medium	> 0.4 to 0.6	Indicates that although there are some effective security measures in place to Deter, Detect, Delay, Respond, and Recover, but there is not a complete and effective application of these security strategies and so the asset or the existing countermeasures could still be compromised.
4	High	> 0.6 to 0.8	Indicates there are some security measures to Deter, Detect, Delay, Respond, and Recover, but there is not a complete or effective application of these security strategies and so the adversary could succeed at the act relatively easily.
5	Very High	> 0.8 to 1.0	Indicates that there are very ineffective security measures currently in place to Deter, Detect, Delay, Respond, and Recover, and so the adversary would easily be able to succeed.

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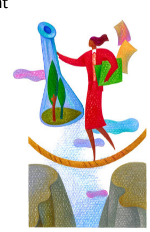
Step 4 – Determine Risk

- Risk Assessment
  - – SRAs are NOT quantitative risk analyses but use team judgment based on assumptions and parameters
  - – The SRA provides the basis for establishing priorities to apply additional countermeasures
  - – It is also useful to understand criticality of the facility, vulnerabilities, expected effectiveness of countermeasures



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Example SRA Risk Matrix

			Likelihood (L)				
Consequences (C)			VL	L	M	H	VH
			1	2	3	4	5
	VH	5	5	4	3	2	1
	H	4	6	5	4	3	2
	M	3	7	6	5	4	3
	L	2	8	7	6	5	4
	VL	1	9	8	7	6	5
	Frequency		10^{-6} /yr or lower	>10^{-6} to 10^{-5}/yr	>10^{-5} to 10^{-4}/yr	>10^{-4} to 10^{-3}/yr	>10^{-3} to 10^{-2} /yr
	Probability		10^{-6} or lower	>10^{-6} to 10^{-5}	>10^{-5} to 10^{-4}	>10^{-4} to 10^{-3}	>10^{-3} to 10^{-2}
	Descriptive		VL	L	M	H	VH
	Numeric		1	2	3	4	5

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Step 5 – Identify Countermeasures

- Gap Analysis
  - Evaluate planned security measures and practices
  - Evaluate procedures and practices
  - Question: “How easily can we defeat this system?”
- Identify Business Prudent Countermeasures

Vulnerability and Risk

Vulnerability Assessment and Risk Evaluation															
Conduct Scenario Analysis and Assess Risk Against Security Criteria															
Security Event Type	Threat	Threat Type	T	A	L1	Scenario	Consequences	Existing Counter-measures	Vulnerability	V	L = L1 x V	C1	R1	Proposed Counter-measures

Form 4 - Vulnerability Analysis and Risk Assessment Form

- Column 1 is the Security Event Type (common security events including unauthorized access, loss of containment, degradation of the asset, theft, contamination, disruption of operations, etc.).
- Column 2 is the Threat Category (Threat type such as terrorist, disgruntled individual, criminal, or activist).
- Column 3 is the Type of Threat (Insider/External/Collusion).
- Column 4 is the Threat (T) number imported from the Threat Worksheet using the Threat scale 1-5
- Column 5 is the Attractiveness (A) number imported from Attractiveness Worksheet using the Attractiveness scale 1-5 captured as a decimal value 0.0-1.0
- Column 6 is the “likelihood of the Act” (T x A) the product of Column 4 and Column 5
- Column 7 describes the scenario that the identified Threat perpetrates to attack the identified critical asset.
- Column 8 describes the consequences of destruction, loss, or theft of the asset.
- Column 9 captures the Existing Safeguards / Countermeasures, which considers the strategies to Deter, Detect, Delay, Respond and Recover.
- Column 10 captures the Vulnerability of the critical asset to the postulated scenario taking into account the existing countermeasures (col 6).
- Column 11 is the ranking of vulnerability (Column 10) as Likelihood of attack success (L_2 = V) using the Likelihood scale 1-5
- Column 12 is the **scenario-specific Consequence** (based on the initial Consequence from column 8) using the severity scale 1-5
- Column 13 is the calculation for overall Likelihood which includes $L_1 \times L_2$ [T x A (col 10 x col 11)] times Vulnerability (**V**)
- Column 14 is the Risk (R_1) to the asset, derived from plotting the overall Likelihood from Column 13 on the Likelihood axis, and C1 from column 12 on the Consequence severity axis of the SRA Risk matrix to yield a color and a corresponding 1-5 risk number
- If additional measures are needed to reduce the Risk to a more acceptable level, Column 15 captures the recommended scenario-specific security upgrades and Countermeasures proposed by the team

Determine Residual Risk

Preliminary Recommendations								
Determine Residual Risk Based on Implementation of Proposed Countermeasures								
Scenario	Existing Risk			Proposed Countermeasures	Residual Risk			Comments
	C1	L_1 x V	R1		C2	V2	R2	

Determine Residual Risk Based on Implementation of Proposed Countermeasures

- Column 1 describes the scenario under analysis.
- Columns 2, 3, 4, and 5 are repeated from Form 4 for reference.
- Column 6 (C_2) is the new ranking of the Consequences specific to the scenario, presuming the implementation of all recommendations.
- Column 7 (V_2) is the revised ranking for the Likelihood of expected attack success [retaining the original value for L_1], presuming the implementation of all recommendations.
- Column 8 is the ranking for Residual Risk, considering the changes in Consequences and likelihood achieved through the recommended countermeasures, as expressed in C_2 (col 6) and V_2 (col 7).
- Column 9 captures additional comments.

Determine Residual Risk

Proposed Countermeasures/Risk Reduction/Priority															
Proposed Countermeasures	Place(s) Used	Very Low	Low	Medium	High	Very High	Before Mitigation	Very Low2	Low2	Medium2	High2	Very High2	After Mitigation	Risk Reduction	Priority	Comments
1.		0	0	0	0	0		0	0	0	0	0				

Proposed Countermeasure Risk Score and Priority Form

- Column 1 identifies each unique proposed additional security upgrade or countermeasure
- Column 2 provides the reference number for each scenario within the SRA where the countermeasure in Column 1 is recommended
- Column 3a/3b/3c/3d/3e captures the initial Risk (R1) across a scenarios before the recommendation was implemented
- Column 4 presents a mathematical total of all R1 exposures where the recommendation was to be applied to reduce Risk
- Column 5a/5b/5c/5d/5e captures the residual Risk (R2) across all scenarios after the recommendation was implemented
- Column 6 presents a mathematical total of all R2 residual exposures where the recommendation was implemented to reduce Risk
- Column 7 reflects the expected overall “Risk Reduction” from R1 to R2 if the proposed recommendation is implemented
- Column 8 is the assigned priority ranking of each Proposed Recommendation as determined by the SRA Team.
- Column 9 captures additional comments.

Prioritize Recommendations

- Prioritize Proposed Recommendations
  - Order the recommendations based on Risk Reduction addressing Very High, High, and Moderate exposures
  - Determine the frequency of recommendations across all scenarios (risk scores)
  - Balance higher order recommendations with overall security program enhancements
  - Select most business-prudent ranking of recommendations based on risk reduction

Applications and Future Direction

- US National Standard (ANSI) for security risk assessment for the petroleum and petrochemical industry
- Recognized and used globally (Chevron, Reliance, Shell, CPChem)
- Adoption by foreign governments (Saudi Arabia)
- Potential value of a standardized methodology

Chemical Safety and Security: Lessons Learnt

Rohan Perera, PhD

Senior International Cooperation Officer
International Cooperation Branch

SEMINAR ON CWC AND CHEMICAL SAFETY AND SECURITY MANAGEMENT

DOHA REGIONAL CENTRE FOR CBRN TRAINING
DOHA, QATAR, 23 –25 FEBRUARY 2016

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

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Chemical Safety and Security Management

Chemical safety and security is one of the primary activities related to the implementation of the Article XI of the Chemical Weapons Convention.

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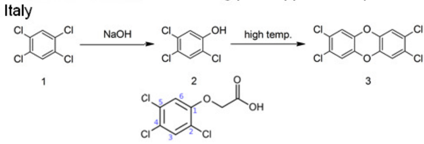
The **Seveso disaster** was an industrial accident that occurred around 12:37 pm on July 10, 1976, in a small chemical manufacturing plant approximately 15 km north of Milan in Italy



2,4,5-Trichlorophenoxyacetic acid

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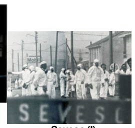
Flixborough (UK)
June 1974

Beek (NL)
November 1975



Seveso (I)
July 1976

Enschede (NL)
May 2000

Mexico City (MEX)
November 1984

Bhopal (India)
December 1984

Basel (CH)
November 1986

Texas City (USA)
March 2005

Jaipur (India)
October 2009

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April 20, 2010
The Deepwater Horizon drilling rig explosion, Gulf of Mexico

January 2011
storage tanks explosion, Moerdijk, Netherlands

May 2012 Explosion petrochemical factory at Map Ta Phut Industrial Estate in Rayong

April 2013
Texas West fertilizer plant explosion

May 2013
Toxic train crash 'leaves one dead and 17 injured' in northern Belgium

June 2013
Williams Olefins chemical plant in Geismar, Louisiana, USA

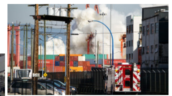
June 2014
Explosion and fire in Rotterdam, the Netherlands

August 2014 Kunshan explosion China,. As of December 30, 2014, the explosion killed 146 workers and injured 114 others

13 February 2015 - A chemical accident at a factory in Spain has injured three people and cloaked large swathes of the region in an orange chemical cloud, forcing over 60,000 people to stay indoors

16 February 2015 - The 109-car train was carrying more than three million gallons of Bakken oil from North Dakota when 27 cars near the Kanawha River. Residents of Mount Carbon, which has a population of some 400 people

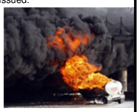
18 February 2015 - An explosion and fire ripped through a gasoline processing unit at an Exxon Mobil refinery in Torrance, California, near Los Angeles on Wednesday, slightly injuring four workers and shattering windows of surrounding buildings.



5 March 2015 - A hazardous chemical fire that engulfed several containers at Vancouver's Port Metro has prompted a partial evacuation of the smoke-cloaked waterfront. Rescue services have been deployed to contain the incident and health warnings have been issued.

April 6, 2015, oil that had leaked from a xylene facility caught fire and led to blasts at three nearby chemical oil tanks at Tenglong Aromatic Hydrocarbon Company, located on the city's Gulei Peninsula.

12 August 2015 Tianjin Blast Hazardous chemical storage facility for calcium carbide, sodium nitrate, sodium cyanide and potassium nitrate. Nevertheless, the authorities admitted that poor record keeping, damage to the office facilities and "major discrepancies" with customs meant that they were unable to identify the substances stored.



18th Septembe 2015 Death toll in South Sudan oil tanker blast rises to 182

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Near Misses

Crude Tank Oil Leak Accident (2014. 4.) in Korea

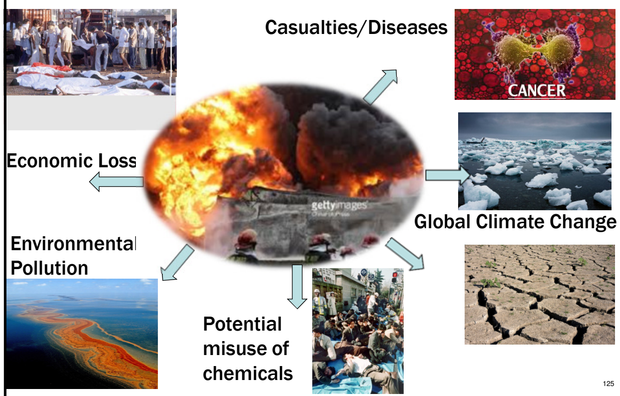
- **Design Capacity: 750,000 bbl**
- **At the time of accident : 570,000 bbl(90,573㎘)**

Side Mixer Destroyed

Tank Size : D 84.75m × H 21.945m (F.R.T)

- **Installed: 2011. 1.**
- **Leak Qt'y : 150,000 bbl**

※ 20t tank lorry 1,225 truck quantity



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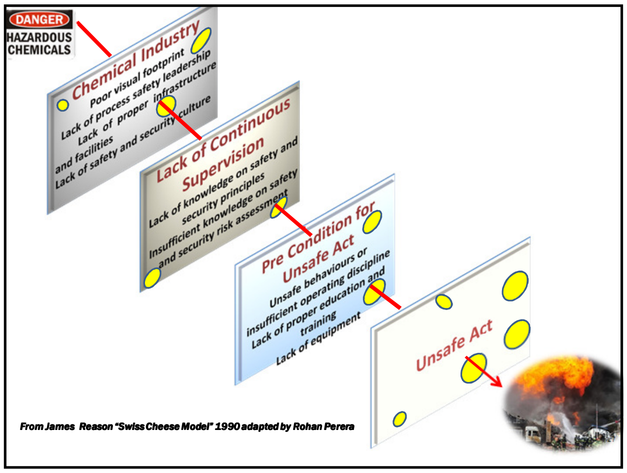
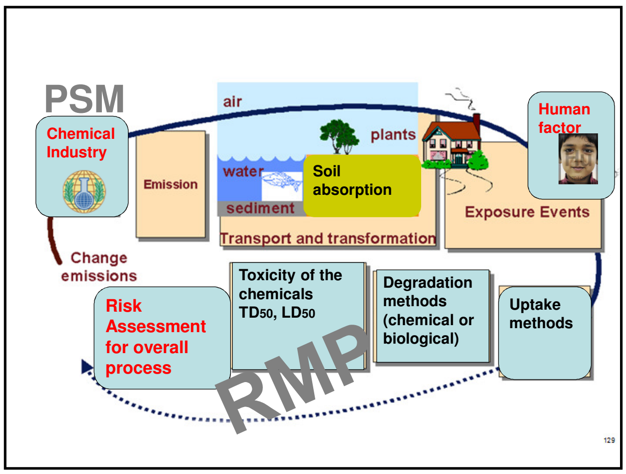
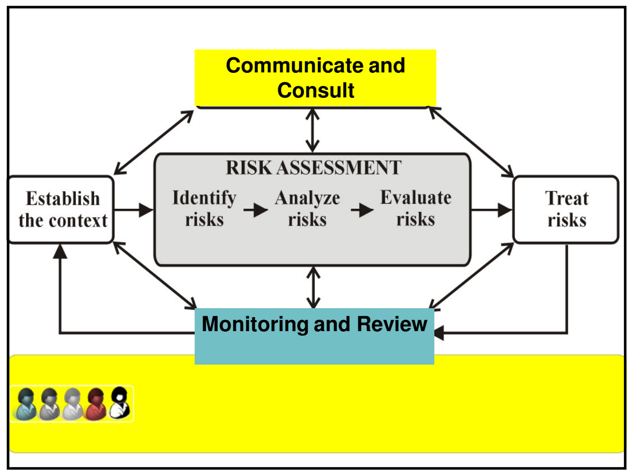
Accidents/ misuse of chemicals are failures of one or more defences (protection layers) leading to disasters

Accidents/ misuse of chemicals therefore can be completely avoided in principle ("zero goal")

Although in reality this goal may not completely reached, it should be the target







Failure Modes and Effect Analysis

- For each component's functions, *every conceivable mode of failure (safety and security) including near misses* is identified and recorded.
- The failure rate for each failure mode identified.
- The potential consequences for each failure must be identified.
- It is then necessary to record preventative measures that are in place or may be introduced to correct the failure.

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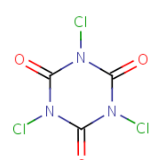
Case Studies



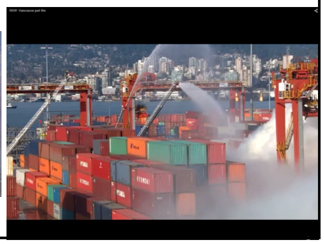
Trichloroisocyanuric acid (TCA)

Case Study 1

Fire at the Port of Metro Vancouver

5 th March 2015

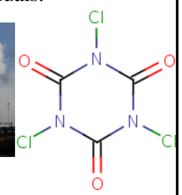
A fire at the Port of Metro Vancouver prompted a Hazmat response, the evacuation of hundreds of people and forced the closure of the port.



Case Study 1

Container with large quantities of **Trichloroisocyanuric acid** leaked chlorine gas (2015)

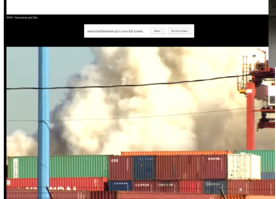
The accident resulted in the leakage of large amount of chlorine gas . The chlorine leakage inflicted many individuals.

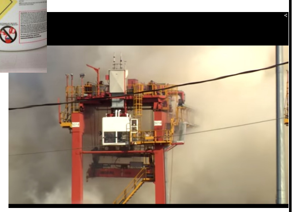


Case Study 1

Container with large quantities of **Trichloroisocyanuric acid** leaked chlorine gas (2015)

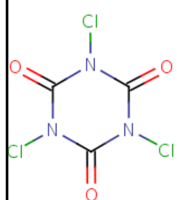
Water reacts with TCA





Case Study 1

Water reacts with TCA.



$$+ \; H_2O \longrightarrow Cl_2 + COCl_2 + ?$$

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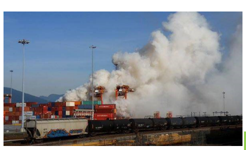
Case Study 1

Container containing Chemical Trichlorocynuric acid



Confirm the chemical ? Check the shipping document

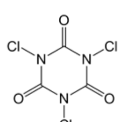
Check the MSDS ? Identify the Hazardous nature

Check the Quantity ? Shipping document

Check the Placard ? Shipping document

Identify the IPE? Experience and Training

Decontamination? ERG Book / MSDS



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Sunday May 23, 2010 | HOME | VIDEOS | CARTOON | BLOG

News SUNDAY TIMES

Wrong methods used to control toxic fumes

Gas emissions at the Dangerous Cargo Yard

By Malik Gunatilleke, Pix by Saman Kariyawasam

The Government Analyst Department revealed the Colombo City fire fighters who were rushed to contain the fire in a chemical-laden container at the Colombo harbour on Tuesday night aggravated the situation by using the wrong method to control the toxic fumes.

It was revealed fire fighters used water to try contain the fumes whereas they should never have used it --the effect of water mixing with the chemicals within the transit container resulted in poisonous fumes being emitted-- which began flowing into the city and caused concern amongst the residents. Additional Government Analyst, W.D.G.S. Gunathilaka who was at the scene told the Sunday Times the chemical found in the container was Trichloroisocyanuric Acid which is chlorine based disinfectant used for swimming pools.

He said when acid mixes with water the immediate reaction was the emission of a high heat chlorine gas which was toxic and caused dangerous side effects to people directly exposed to it including throat and eye irritation, vomiting and respiratory problems.

Clouds of poisonous fumes billowing from the Dangerous Drugs Yard at the Colombo Port caused concern to residents in the vicinity of the port. Below a resident, her face covered with a mask, said the fumes made it difficult to breathe, disputing claims by officials that problems caused to the public were minimal.

"The heavy rains and flooding in the area led to the chemical being exposed to water and caused the release of emissions," he said. He said once it was understood the contents of the container could not be salvaged, the authorities attempted to contain the chemical reaction.

"The following day an unknown party had attempted to hose down the chemicals causing 25 barrels to explode. At this point I stepped in and ordered them to put dry sand over the contents after which we were able to control the situation," he said.

Dr. Rohan Perera from the Department of Chemistry at the University of Colombo said the chemical reacted to water and emissions could not be contained by the addition of water. Water only worsened the situation.Chairman of the Ports Authority, Dr. Priyath Wickrema said several attempts were made to bring the situation under control.

According to data sheets provided water had to be used to flush the contents of the container. "There were several different opinions at this time on how to contain it. Finally we managed to control the emissions with sand," he said.

Material Safety Data Sheet of Trichloroisocyanuric acid

Section 1 - Chemical Product

Chemical Name: Trichloroisocyanuric acid

Synonyms: Symclosene; 1,3,5-Trichloro-1-triazine-2,4,6(1H,3H,5H)-trione.

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent
87-90-1	Trichloroisocyanuric Acid	90+

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: white powder or granular,tablet.

Danger! Strong oxidizer. Contact with other material may cause a fire. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. Contact with acids liberates toxic gas. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Hygroscopic (absorbs moisture from the air).

Target Organs: Kidneys, liver, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes eye irritation.

Skin: Causes skin irritation. Harmful if absorbed through the skin.

Ingestion: Harmful if swallowed. May cause irritation of the digestive tract.

Inhalation: Harmful if inhaled. Causes respiratory tract irritation.

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Case Study 2

The AZF explosion of Toulouse, France

September 2001 Toulouse, France

NH_4NO_3

The explosion of 350 tonnes of ammonium nitrate

30 people died in the explosion, 2500 were seriously wounded, and 30,000 homes were devastated.

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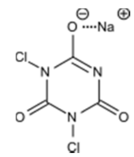
Case Study 2

The results of the official enquiry were that a warehouse of ammonium nitrate had exploded following improper handling of this dangerous material.

A mislabeled 500 kg bin of sodium dichloroisocyanurate mistakenly thought to be ammonium nitrate was dumped in the ammonium nitrate warehouse.



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Case Study 2

Under sufficiently hot and humid conditions it could have reacted with the ammonium nitrate to form nitrogen trichloride.

NCl_3 an exceedingly unstable compound. The decomposition of the nitrogen trichloride could have provided the heat and pressure required to detonate the ammonium nitrate

$2NCl_3 \dashrightarrow N_2 + 3Cl_2$ **Exothermic**

NCl_3

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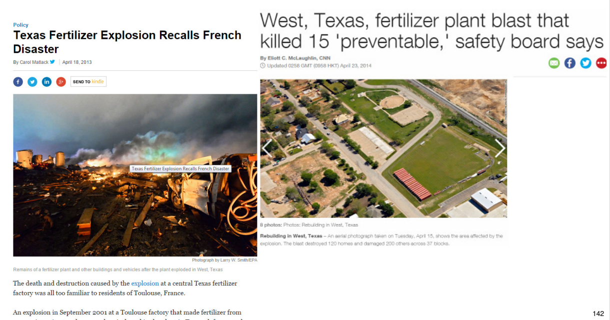
West Texas Fertilizer Plant Explosion 2013

NH_4NO_3


Policy

Texas Fertilizer Explosion Recalls French Disaster

West, Texas, fertilizer plant blast that killed 15 'preventable,' safety board says

The death and destruction caused by the explosion at a central Texas fertilizer factory was all too familiar to residents of Toulouse, France.

An explosion in September 2001 at a Toulouse factory that made fertilizer from

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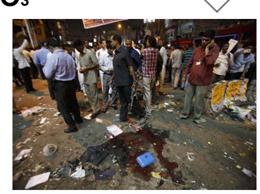
Case Study 1

Ammonium nitrate-based explosives were used in the **Oklahoma City in 1995** and **2011 Delhi bombings**, **2011 bombing in Oslo** and the **2013 Hyderabad blasts**

Ammonium Nitrate (a common fertilizer) used for the blast.

NH_4NO_3

2011 bombing in Oslo



2013 Hyderabad blasts

Photos from public domain

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Case Study 2

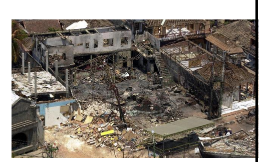
Use of laboratory/industrial chemicals by non-State actors

Potassium Chlorate - Bali bombing *12 October, 2002*

- **Amrozi purchased chemicals used to make bombs**
- **One ton of potassium chlorate* purchased in three transactions from the Toko Tidar Kimia fertilizer and industrial chemicals store in Jalan Tidar, Surabaya, owned by *Sylvester Tendean*.**

$KClO_3$ $2\,KClO_{3(s)} \rightarrow 3\,O_{2(g)} + 2\,KCl_{(s)}$

Tendean lacked proper permit to sell this chemical, didn't know the chemical would be used to make a bomb.



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Case Study 3

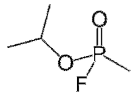
Tokyo subway sarin attack – *20 March 1995*

The odourless, colourless, and highly toxic nerve gas sarin was released in the city's subway system. The attack resulted in the deaths of 12 (later increased to 13) people, and some 5,500 others were injured to varying degrees.

PCl_3 ?

Shoko Asahara

Toru Toyoda Ken'ichi Hirose Ikuo Hayashi



What are the chemicals could be easily diverted into toxic/explosive materials ?

Common laboratory/industrial chemicals that would be targeted by someone for illegal reasons such as making explosives, illegal drugs, or chemical weapons. (206 Chemicals as high risk chemicals)

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Solutions

Raise the awareness

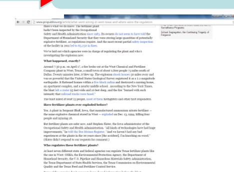
education

training

of the workers

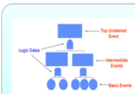
Encourage reporting of deviations, near misses and even minor incidents as well as suggestions for improvements. Consider contests and awards for groups working together

Have a system for following up such reports /suggestions



Chemical Safety and Security – Education and Outreach Programme

- Understanding of high risk chemicals
- Placards , symbols, UN numbers and HS codes
- Process safety management elements and PSM standards
- Chemical plant and transportation security/risk diagnostic and analysis
- Qualitative and quantitative risk assessment, planning and management tool
- Risk treatment /reduction
- Loss prevention and safety promotion in the process industries
- Chemical disaster management preparedness and response plan
- Chemical threat vulnerability assessment
- Chemical threat reduction and mitigation measures for chemical industries
- Responsible Care® and security code
- Medical counter measures
- SITREP
- Lessons Learnt/event analysis/crisis management



Root Cause Analysis identifies failures on all layers of protection

This allows **comprehensive learning** and corrective measures, leading to optimal prevention of disasters

Share the knowledge and experience is the key to prevent further disasters in the working environment

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Improve safety /security accountability and oversight


Improve training and awareness


Provide proper protective equipment and monitoring


Improve safety and security culture in the organization


Conduct unannounced safety/security inspections

http://e-test.byethost13.com

Thank you

icb@opcw.org

rohan.perera@opcw.org

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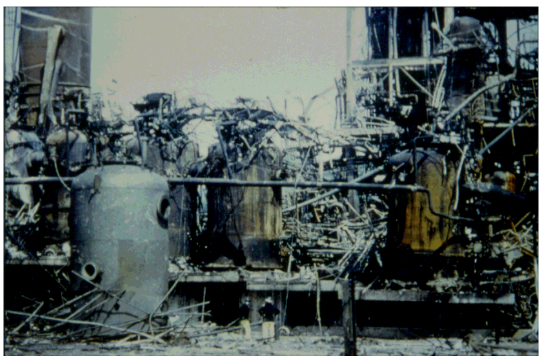
The European & UK experience of onshore major hazard regulation
25 February 2016

Sandra Ashcroft,
Head of Chemical Industries Policy
UK Health & Safety Executive
Sandra.ashcroft@hse.gsi.gov.uk

Onshore Major Accident Hazard Regulation in the UK

- The UK has a long history of industrial regulation beginning with the Factories Acts in the 1800s and culminating in the Health and Safety at Work Act in 1974.
- The Flixborough Disaster in 1974 led to significant tightening of the UK's regulations covering hazardous industrial processes.
- Major onshore hazard regulation in the UK comes primarily from the EU's Seveso Directives and is implemented by the Control of Major Accident Hazard (COMAH) Regulations
- The Directive deals implements the UNECE Industrial Accidents Convention – and has a broader scope
- It is a highly respected piece of EU legislation

Flixborough – 1 June 1974



The Seveso Directive

- Aims to **prevent** major accidents involving dangerous substances and **limit** consequences to **people** and the **environment** of any that do occur

The Seveso Directive

- Three part strategy
  - Identification of sites
    - Notification
  - Proportionate controls
    - Measures taken most be proportional to the risk
  - Mitigation measures
    - internal and external emergency plans
    - information to the public
    - land use planning

Application of Seveso Directive

- Depends on dangerous substances inventory
  - Uses **G**lobally **H**armonised **S**ystem of chemical classification
  - List of named substances and hazard categories
  - Applies at 2 levels:
    - upper and lower-tier
    - In UK around 900 sites in scope, of which about a third are upper-tier
- Industries include: chemical manufacturing, chemical storage, oil and gas refining and storage, explosives and fireworks manufacture and storage, pharmaceuticals, metal finishing

Proportionate Controls

- Lower Tier Sites
  - Major Accident Prevention Plan (MAPP)
  - Proportionate emergency planning
  - Proportionate public information
- Upper Tier Sites
  - Safety reports
  - Emergency plans
  - Public information

Land Use Planning

- Seveso Directive requires that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into account in land-use planning.
- Land use planning in the UK is a devolved matter but legislation requires that HSE be consulted.
- Objectives of Directive require consideration of;
  - The site of new establishments
  - Modifications to existing establishments
  - Developments around existing establishments
  - Maintaining appropriate safety distances between sites and residential areas
  - Protecting areas of particular natural sensitivity or interest.

UK implementation of Seveso Directive

Department for Work and Pensions

HSE – safety law

- Health and Safety at work etc Act 1974
  - **Control of Major Accident Hazards Regulations 2015 (COMAH)**
    - COMAH enacted via HSWA and other law that allows environment duties to be included alongside safety duties
    - Regulation 27 on enforcement gives environment agencies' officers powers
    - Regulations 13-16 require local authorities to make emergency planning regulations

Department for Communities and Local Government

Local Government – planning law

- Planning (Hazardous Substances) Regulations 2015
- Development Management Procedure Order 2015

Cabinet Office

Emergency response law

Department of Environment

Environmental protection law

The COMAH Regulations 2015

- Seveso is implemented in the UK through the COMAH Regulations 2015.
- COMAH Regulation 5 outlines the fundamental duty on the operator of a site to "take all measures necessary to prevent major accidents and limit their consequences to persons and the environment".
- Measures must be proportional under "ALARP" principle – as low as reasonably practicable.
- "Semi-permissioning" – not licensing

The Role of the Regulator

Competent Authority Strategic Management Group

Health and Safety Executive | Environment agencies

The Competent Authority (CA)

COMAH Reg. 22-25

- The CA shall:
  - Organise a system of site inspections
  - Assess the safety report
  - Prohibit the operation of sites whose major accident prevention is seriously deficient
  - Investigate serious issues and major accidents
  - Provide information to the EC on major accidents
  - Identify 'domino groups'
- HSE acts as the leading authority within the CA delegated by informal agreement at Ministerial level

Planned Inspections

- The CA must:
  - Organise a system of site inspections
- Planned Inspection
  - Targeted risk based inspections based on intrinsic hazard and performance
  - Annual inspection plans linked to strategic priorities, safety report assessment findings (upper tier) and recent performance, shared with operators
  - Carried out by general and specialist inspectors

Inspection strategic priorities

- •On-Site / Off-site Emergency Preparedness and Response
- •Site Performance Indicators
- •Demonstration of senior leadership
- •Ageing Plant and continued Integrity
- •Secondary and Tertiary containment
- •Staff competence

the Competent Authority

HSE Environment Agency SEPA

Inspection guides

- •set out arrangements for inspection
- •used by inspectors
- •available on the internet
- •sites know what to expect
- •sites can be prepared for inspection

For more information on the CA Delivery Guides visit: www.hse.gov.uk/comah/ca-guides.htm

the Competent Authority

HSE Environment Agency SEPA

Investigations

- Investigate serious incidents
  - Complaints, accidents near & misses, non-compliance
- Investigate major accidents

Major accident
Buncefield – 11 December 2005

Q&A

Further information:

The Seveso Directive

http://ec.europa.eu/environment/seveso/

The Control of Major Accident Hazards Regulations (COMAH) in the UK

http://www.hse.gov.uk/comah/index.htm

Guidance on the COMAH Regulations

http://www.hse.gov.uk/pubns/books/l111.htm

Any Questions ?

Thank you for your attention.

Industrial Accidents Convention

Doha, Qatar
25 February 2016

Sandra Ashcroft – Chair of Working Group of Implementation

Industrial Accidents Convention

- Convention on the Transboundary Effects of Industrial Accidents
- Adopted in 1992
- Entered into force in 2000
- Now has 41 Parties, including EU, in ECE region
- Not nuclear, military, dams (but tailings dams?), transport (but pipelines?), GMOs, marine environment
- Implemented in the EU by Seveso

Rationale

- To protect human beings and the environment against the effects of industrial accidents,
- To help authorities and industries prevent, prepare and respond to major industrial accidents,
- To contribute to cross-border cooperation and better environmental governance by increasing coordination among the authorities in different countries




Competent Authority

- The party establishes one or more competent authorities for the purpose of the Convention
- Often a lead authority, eg Minister of Environment
- Other authorities likely to be involved include, Minister of Labour, Minister of Interior,

Six priority working areas of the Convention

- Identification of hazardous activity
- Notification of hazardous activities
- Prevention
- Preparedness
- Response and mutual assistance
- Information to the public and public participation

1. Identification of hazardous activity

- Arrangements for collecting data to be able to identify hazardous activities – based on Annex I of the Convention setting out the hazardous substances and categories for the purposes of defining hazardous activities.
- Analysis of data – to establish the relevant hazardous substances used in the country, and how industry uses them. This information is then available at national level and to neighbouring countries.
- Data review and revision – arrangements to review and revise the use of relevant hazardous substances in the country.

2. Notification of hazardous activities

- Legal arrangements for transboundary notification and consultation on hazardous activities to neighbouring countries.
- Procedures for allowing Competent Authorities to notify potentially affected neighbouring countries of existing and/or planned hazardous activities.

3. Prevention

- Legal arrangements to oblige hazardous activity operators:
  - to be responsible for the safe operation of activities on their site, and
  - to demonstrate the safe operation to the competent authority and the public using defined methodologies, methods and models.
- Legal arrangements for allowing Competent Authorities to manage industrial accident hazards by:
  - Setting safety goals,
  - organising the scope of major accident hazards in the country,
  - Organising the monitoring of hazardous activities (eg.review of safety documentation, licencing, inspection controls, prohibition of operation)

4. Preparedness

- Legal arrangements setting out responsibilities for emergency preparedness of hazardous activity operators – establishing the on-site plan:
  - Preparation of on-site emergency plans
  - Coordination as needed,
  - Testing, and
  - Regular review
- Legal arrangements for allowing Competent Authorities to manage industrial accident hazards by:
  - Setting safety goals,
  - organising the scope of major accident hazards in the country,
  - Organising the monitoring of hazardous activities (eg.review of safety documentation, licencing, inspection controls, prohibition of operation)

4. Preparedness

- Legal arrangements and procedures for transboundary emergency plans ensuring that competent authorities of concerned parties cooperate with each other to coordinate emergency plans and make sure they are compatible.

5. Response and mutual assistance

- Arrangements to ensure that competent authorities activate the relevant measures promptly in the event of an accident or of an imminent threat of an accident.
- Arrangements to ensure that the competent authorities use the UNECE Industrial Accident Notification (IAN) system to obtain information and transmit notifications of industrial accidents at an international level – usually done by a lead authority.
- Arrangements to ensure that local authorities or competent authorities have suitable systems to receive and transmit information on industrial accidents at the bilateral level.
- Arrangements at country level for sending requests for assistance, and for responding to requests for assistance from another country quickly and reliably.

6. Information to the public and public participation

- Arrangements to provide information to the public potentially affected by an industrial accident:
  - Placing responsibility on the relevant authorities and/or the hazardous activities operator
  - Potentially affected public should receive this information without them having to request it.
- Arrangements for public participation in the Party of origin as well as the affected Party:
  - For the public to be able to express their concerns on prevention and preparedness measures

Notable achievements

- **Increased awareness** of industrial safety – including EU member states and countries with economies in transition
- **Assistance Programme** to respond to the deman technical assistance created by increased awarenes including inspections and workshops
- **Fact-finding missions** to establish baselines for new parties to the Convention
- **Enhanced enforcement** and better legislation
- **Internet-based** Industrial Accidents Notification System
- **Codification of good practices** and practical tools to respond to the growing awareness of industrial safety

Increased awarenes s

Good practice

Cooperation across the Region

- Facilitate the exchange of information and technology related to prevention, preparedness and response, and emphasis the promotion of:
  - exchange of available technology
  - Direct industrial contacts and cooperation
  - exchange of information and experience
  - Provision of technical assistance

  In the event of an industrial accident requests for assistance
  - Dealing promptly with requests
  - Establishing the terms of the assistance
  - Cooperating on the provision of assistance
- Collaboration in research and development

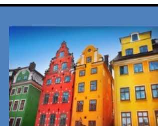
Exchange of info

Cooporat e

Assistance Programme

- Solidarity among the Parties and UNECE countries – key to the success of the Convention
- Assistance programme:
  - Provides support to Parties and countries with economies in transition to increase industrial safety through implementation of the Convention,
  - More advanced countries support others through financial aid and in-kind sharing of expertise,
  - Discussions on different instruments and policies,
  - Sharing experience, good practices and challenges on cooperation between stakeholders from UNECE countries,

Governance



- Bureau, Working Groups on Implementation & Development
- UNECE secretariat
- 9th Conference of the Parties to the Convention, 28 - 30 November 2016, Ljubljana, Slovenia, including
  - Seminar on linkages between Convention, SDGs and Sendai Framework for Disaster Risk Reduction on 28 November 2016
  - Invitation to observers to attend
- Conference of the Parties to the Convention: important decisions also to be taken on
  - Financing
  - Workplan
  - Amendments to Convention
  - Opening of the Convention

Modernising the Convention

- Amendments
  - **Annex I in line with GHS – came into force Dec 2015**
  - Strengthened public participation
  - Accession by other Member States of the United Nations
- Strengthening through guidance
  - Governance structures under the Convention – revised terms of references
  - Provisions on the review of compliance
  - Clarified or strengthened reporting obligatio
  - Clarification on scope of mutual assistance
  - Provisions on land-use planning

The project is implemented by IOMC

The project is funded by The European Union

Introduction to the IOMC Toolbox for Decision-Making in Chemicals Management

Seminar on the CWC and Chemical Safety and Security Management for Member States of the OPCW in the Asia Region
23-25 February 2016, Doha, Qatar

Brandon Turner, UNITAR

IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among FAO, ILO, UNDP, UNEP, UNIDO, UNITAR, WHO, World Bank and OECD

Inter-Organization Programme for the Sound Management of Chemicals (IOMC)

- Established in 1995
- Objective: To strengthen international cooperation in the field of chemicals and to increase the effectiveness of the organisations' international chemicals programmes

The project is implemented by IOMC

The project is funded by The European Union

IOMC Toolbox: The Challenge

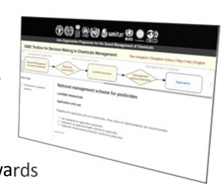
- IOMC Participating Organizations have developed hundreds of tools and guidance documents that are relevant for countries in their efforts to implement SAICM
- However, finding the most appropriate tool or guidance document to address specific national issues can be a challenge

The project is implemented by IOMC

The project is funded by The European Union

IOMC Toolbox: The Solution

- The internet-based IOMC Toolbox enables countries to identify the most relevant and efficient national chemicals management actions
- The Toolbox takes into account the resources available and guides users towards cost-effective solutions adapted to the country
- At each implementation step, the Toolbox presents the relevant IOMC resources, guidance documents, and training material, all available online and free of charge



The project is implemented by IOMC

The project is funded by The European Union

IOMC Toolbox: The Scope

- The IOMC Toolbox identifies appropriate actions and guidance for:
  - A national management scheme for pesticides
  - An occupational health and safety system
  - A chemical accidents prevention, preparedness, and response system for major hazards

IOMC Toolbox: The Scope

- An industrial chemicals management system
- A classification and labeling system
- A system to support health authorities which have a role in the public health management of chemicals
- Pollutant release and transfer registers

INDUSTRIAL CHEMICALS MANAGEMENT SCHEME

- Key technical elements
  - Information/data
  - Hazard assessment
  - Risk assessment
  - Risk management
  - Poison centres
- Technical elements key for producing countries
  - Hazard data generation
- Key functional elements
  - Evaluation
  - Awareness raising
  - Adequate resources
  - Compliance
  - Enforcement
- Additional technical elements
  - Authorisation
  - Licensing
  - Notification/registration of chemicals
  - Reporting of mixtures or articles containing high priority chemicals
  - Import permits
- Additional functional elements
  - Training customs officials and inspectors
  - Education/training of public and workers

Visit the IOMC Toolbox
http://iomctoolbox.oecd.org

IOMC Toolbox: The Scope

- The IOMC Toolbox also provides links to five new online toolkits:
  - OECD Environmental Risk Assessment Toolkit
  - WHO Human Health Risk Assessment Toolkit
  - FAO Toolkit for Pesticides Registration Decision Making
  - UNIDO Toolkit on Innovative Approaches to Environmentally Sound Management of Chemicals and Chemicals Waste
  - UNIDO Toolkit on Chemical Leasing

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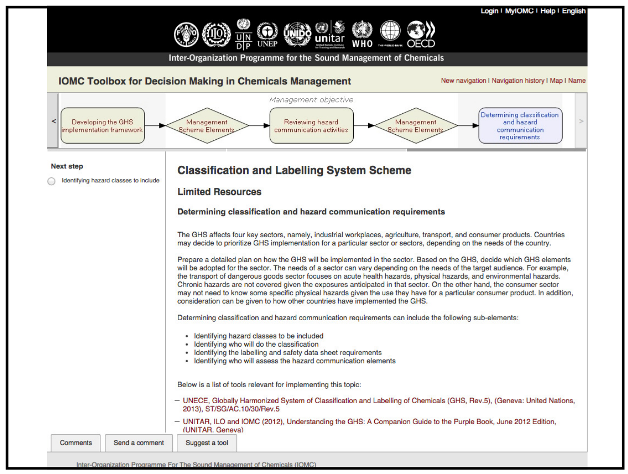
The project is funded by The European Union



IOMC Toolbox: A Platform for Collaboration

- The new version of the IOMC Toolbox provides a set of interactive features allowing governments to use it as a platform for collaboration among ministries, agencies, and other stakeholders such as industry
- Users can save their information, add comments, and share and discuss issues with colleagues and partners

The project is implemented by IOMC

The project is funded by The European Union

The project is implemented by IOMC

The project is funded by The European Union

Responsible Care-
An Initiative For All Stakeholders

OPCW Conference
February 23-25, 2016
Doha, Qatar

Tahir J. Qadir
Executive Director

AcuTech Global Services Ltd
www.acutech-consulting.com

Bio

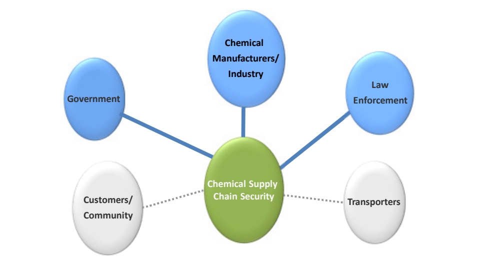
Tahir Jamal Qadir

- Executive Director for AcuTech Middle East
- Expert on Management Systems Development and Implementation
- 33+ years experience, majority of which based in Middle East
- Led the establishment of Responsible Care Management System in six GCC Countries as Director Responsible Care GPCA
- Author of the first fully integrated management system
- Expert on Sustainability

Topics

1. Major Stakeholders in Chemical Supply Chain Security
2. Responsible Care Initiative
3. SAICM & Responsible Care
4. Business Processes & Value Chain
5. Management System & Responsible Care
6. Responsible Care Standard and Supply Chain Security
7. Role of Industry Associations in Chemical Supply Chain Security

Stakeholders In Chemical Supply Chain Security

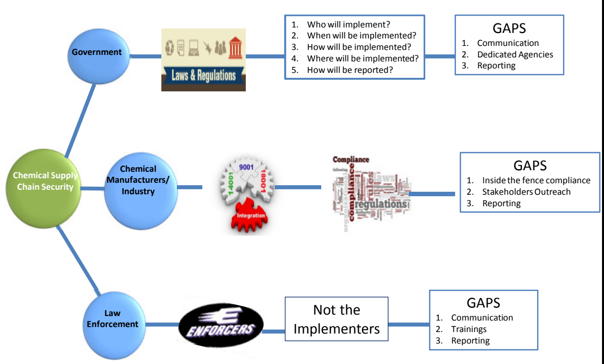


Government
Stakeholder with great influence in terms of developing regulations

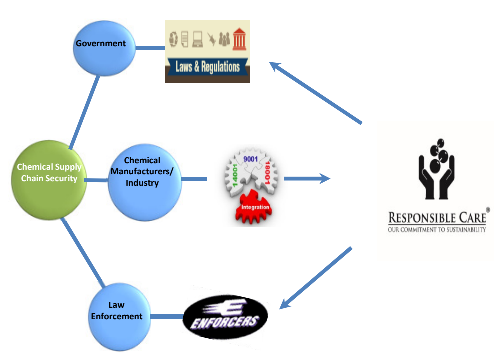
Law Enforcement
Stakeholder with big responsibility for enforcing regulations

Chemical Industry
Stakeholder which can actually implement regulations across all value chain elements

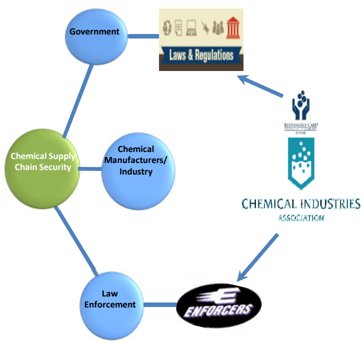
Stakeholders In Chemical Supply Chain Security



Stakeholders In Chemical Supply Chain Security



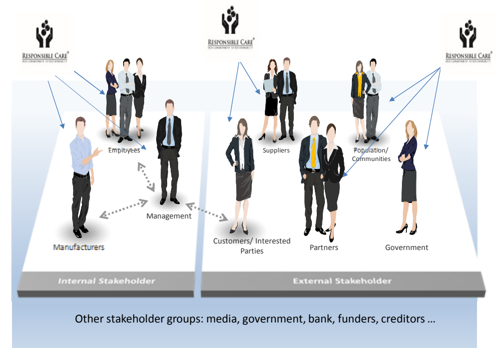
Stakeholders In Chemical Supply Chain Security



Association

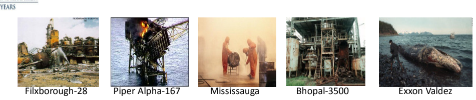
1. RC Implementation
2. Stakeholders Outreach & Networking
3. Reporting
4. Codes Development & Implementation
5. Regulatory Compliance Assistance
6. Transportation & Distribution
7. Customer Feedback & Communications
8. Community Outreach
9. Contractor Control
10. Dialogue with Government
11. Communication with Law Enforcements
12. Liaison with First & Emergency Responders

Internal & External Stakeholders



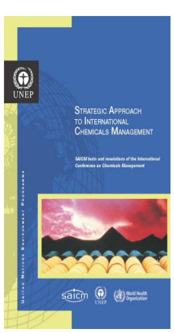
Responsible Care Initiative

Responsible Care Initiative



- ✓ First developed in Canada by the Canadian Chemical Producers Association in 1985.
- ✓ ACC adopted Responsible Care in 1988
- ✓ International Council of Chemical Associations (ICCA) provides oversight for the program globally
- ✓ Today it is implemented by chemical federations and their member companies in 65 nations.

SAICM & Responsible Care Initiative



Dubai Declaration on International Chemicals Management

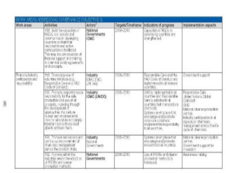
We, the ministers, heads of delegation and representatives of civil society and the private sector, assembled at the International Conference on Chemicals Management in Dubai from 4 to 6 February 2006, declare the following:

3. The private sector has made considerable efforts to promote chemical safety through **voluntary** programmes and **initiatives** such as **product stewardship** and the chemicals industry's **Responsible Care** programme;

20. We stress the responsibility of **industry** to make available to **stakeholders** such **data and information on health and environmental effects of chemicals** as are needed safely to use chemicals and the products made from them;

SAICM & Responsible Care Initiative

Global Plan of Action



Work Area

Promote industry participation and responsibility.

Activities

189. Encourage use of voluntary initiatives (e.g., **Responsible Care** and FAO Code of Conduct).
190. Promote corporate social responsibility for the safe production and use of all products, including through the development of approaches that reduce human and environmental risks for all and do not simply transfer risks to those least able to address them.
191. Promote innovations and continuous improvement of chemicals management across the product chain.
192. Promote within the industrial sector the adoption of PRTRs and cleaner production methods.

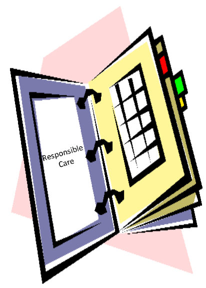
Responsible Care Initiative

Safeguarding People and the Environment by continuously improving our environmental, health and safety performance; the security of our facilities, processes and technologies; and by driving continuous improvement in chemical product safety and stewardship throughout the supply chain

Strengthening Chemicals Management Systems by participating in the development and implementation of lifecycle-oriented, sound-science and risk-based chemical safety legislation and best practices

Engaging Stakeholders, understanding and responding to their concerns and expectations for safer operations and products and communicating openly on our performance and products

Responsible Care Initiative

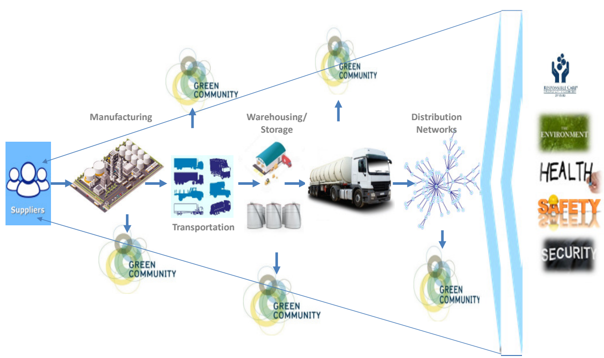


An initiative to continuously improve and protect the **environment and health, safety, and security** (EHSS) of its members and the community

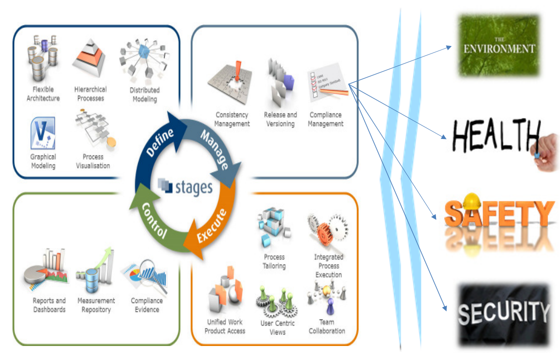
Increased **product stewardship** focus

A system to **manage and communicate** EHSS issues

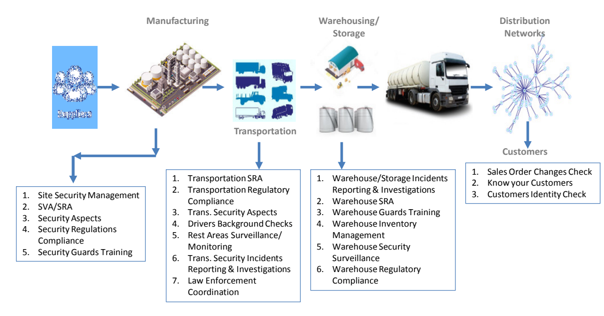
Business Processes & Value Chain



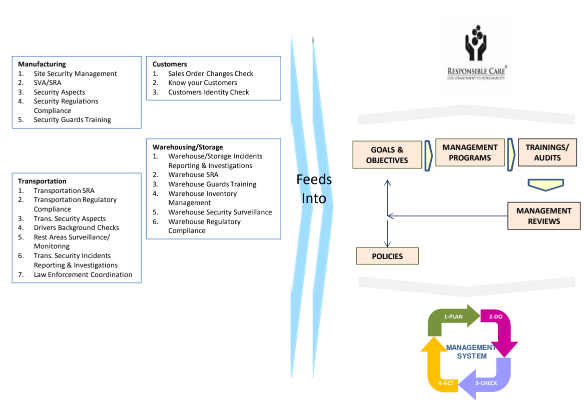
Business Processes & Value Chain



Example-How Responsible Care Ensures Security



Example-How Responsible Care Ensures Security



AMERICAN CHEMISTRY COUNCIL	RC14001®: 2015
TITLE: RC14001® TECHNICAL SPECIFICATION Document Number: RC151.06	Issue Date: September 25, 2015

RC14001
TECHNICAL SPECIFICATION

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

Lets go a little deeper into Responsible Care

Responsible Care Standard

AMERICAN CHEMISTRY COUNCIL	RC14001®: 2015
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RC14001
TECHNICAL SPECIFICATION

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OUR COMMITMENT TO SUSTAINABILITY

4 Context of the Organization

4.2 Understanding the needs and expectations of **interested parties**

Definition: person or *organization (3.1.4) that can affect, be affected by, or perceive itself to be affected by a* decision or activity:

- Customers,
- Communities,
- Suppliers,
- Regulators,
- Non-governmental organizations,
- Investors and
- Employees.

Responsible Care Standard

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RC14001
TECHNICAL SPECIFICATION

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6.1.2 EHSS Aspects

Additional Responsible Care Requirements

Include Responsible Care/health, safety and security in all above.

The organization shall:

- Assess and prioritize transportation **risk;**
- Maintain current information related to hazards and risks for:
  - Products;
  - Chemical-related processes; and
  - Activities associated with its operations;
- Take into account operational energy efficiency and waste minimization, reuse and recycling when identifying its aspects and impacts

Responsible Care Standard

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RC14001
TECHNICAL SPECIFICATION

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6.1.3 Compliance obligations

The organization shall:

a) Determine and have access to the compliance obligations related to its EHSS aspects;
b) Determine how these compliance obligations apply to the organization;
c) Take these compliance obligations into account when establishing, implementing, maintaining and continually improving its EHSS management system.

The organization shall maintain documented information of its compliance obligations.

NOTE Compliance obligations can result in risks and opportunities to the organization.

Responsible Care Standard

AMERICAN CHEMISTRY COUNCIL	RC14001®: 2015
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RC14001
TECHNICAL SPECIFICATION

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7.4 Communication
7.4.1 General
The organization shall establish, implement and maintain the process(es) needed for internal and external communications relevant to the environmental management system, including:
a) On what it will communicate;
b) When to communicate;
c) With whom to communicate;
d) How to communicate.

When establishing its communication process(es), the organization shall:

- Take into account its compliance obligations;
- Ensure that environmental information communicated is consistent with information generated within the environmental management system, and is reliable.

The organization shall respond to relevant communications on its environmental management system.

The organization shall retain documented information as evidence of its communications, as appropriate.

Responsible Care Standard

AMERICAN CHEMISTRY COUNCIL	RC14001®: 2015
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RC14001
TECHNICAL SPECIFICATION

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

7.4 Communication
7.4.1 General

Additional Responsible Care Requirements

Include Responsible Care/health, safety and security in all above.

The organization shall establish and maintain dialogue with employees and other interested parties about its impact on human health, safety, security and the environment, its Responsible Care

Management System performance, plans for improving the organization's performance and management of relevant risks for:
- Products
- Chemical-related processes
- Activities associated with its operations

Responsible Care Standard

AMERICAN CHEMISTRY COUNCIL | RC14001®: 2015

RC14001
TECHNICAL SPECIFICATION

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

9.1.2 Evaluation of compliance

The organization shall:

a) Determine the frequency that compliance will be evaluated;
b) Evaluate compliance and take action if needed;
c) Maintain knowledge and understanding of its compliance status.

The organization shall retain documented information as evidence of the compliance evaluation result(s).

Additional Responsible Care Requirements

Include Responsible Care/health, safety and security in all above.

Responsible Care Standard

AMERICAN CHEMISTRY COUNCIL | RC14001®: 2015

RC14001
TECHNICAL SPECIFICATION

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

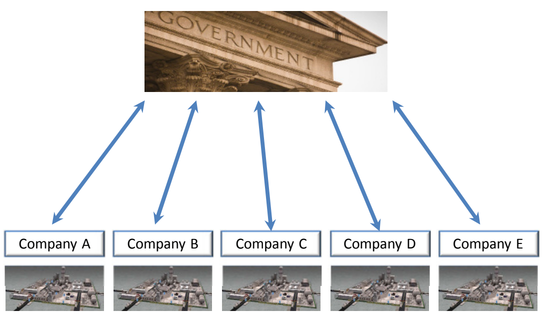
9.3 Management Review

Top management shall review the organization's EHSS management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness.

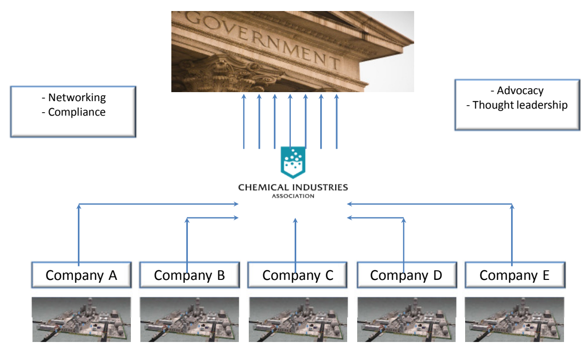
The management review shall include consideration of:

a) The status of actions from previous management reviews;
b) Changes in:
   1) External and internal issues that are relevant to the EHSS management system;
   2) The needs and expectations of interested parties, including compliance obligations;
   3) Its significant EHSS aspects;
   4) Risks and opportunities;
c) The extent to which EHSS objectives have been achieved;
d) Information on the organization's EHSS performance, including trends in:
   3) fulfilment of its compliance obligations;
   4) audit results;
e) Adequacy of resources;
f) Relevant communication(s) from interested parties, including complaints;

The Importance of Industry Association



The Importance of Industry Association



Questions?
General Discussion

AcuTech

Contact:
Tahir J Qadir
tqadir@acutech-consulting.com
+971 567799281

Chemical Safety and Security Case Studies

Name: Col Abdullah-Al-Mamun
Country: Bangladesh
Position: Colonel Staff to Chairman, Bangladesh National Authority for Chemical Weapons Convention(BNACWC)

What is 'Safety'?

- In industry the word "safety" used to mean worker safety: accident prevention through the use of hard hats, safety shoes, and a variety of rules and regulations
- Much more recently, "safety" has been replaced by "loss prevention" : the prevention of accidents through the use of appropriate technologies to identify hazards in a chemical plant and eliminate them before an accident occurs

Chemical Safety and Its Importance

- Chemical/Process Safety deals with toxic chemical exposures, chemical related fire and explosion
- It is different from occupational safety that primarily covers the management of personal safety: creating working conditions that prevent injuries in general
- Immediate effects
  - Fatalities within the boundary and surrounding communities
  - Property damage
- Long term effects
  - Environment
  - Future generation

Chemical/Process Industries in Bangladesh
(Public Sector)

- BCIC: Bangladesh Chemical Industries Corporation
  - Fertilizer factories: Urea (2,895,700 tons/yr production capacity), TSP, DAP
  - Glass/ ceramics/ insulators/cement factories
  - Paper mills
- BPC: Bangladesh Petroleum Corporation
  - Crude oil refinery
- Petrobangla:
  - Gas processing and distribution

Chemical/Process Industries in Bangladesh
(Private Sector)

- Urea Fertilizer factory: KAFCO
- Gas drilling and processing: Gazprom, Chevron, NIKO, ConocoPhillips, Santos
- Glass and ceramics
- Cement factories
- Condensate refineries
- Salt and sugar
- Pulp and paper
- Soap and detergents
- Beauty products
- Food processing
- Gas transmission
- Basic Chemicals
- Pharmaceuticals

Accidents in Chemical Plants

- UFFL (Ghorasal) (September 11, 1974): Ammonia Control Room Explosion
- UFFL (Ghorasal) (June 20, 1991):Carbon Dioxide Stripper Failure
- Magurchhara (June 15, 1997):Gas Well Blowout (Occidental)
- Tangratilla (Jan. 7, 2005 and June 24, 2005): Gas Well Blowout (NIKO)
- Nimtoli fire: (June 3, 2010): Fire in chemical storage in residential area
- Global Heavy Chemicals limited (16 Oct 2011): Chlorine leakage from a pipe

Chemical Accidents and Toxic Exposures

- Chemical Plants
- Chemical storage and transport
- Gas cylinders/oil tankers explosion
- Textile and garments industries
- Ship-breaking industries
- Tanneries
- Pesticides in farming

Case Study 1

- Global Heavy Chemicals limited (16 Oct 2011): Chlorine leakage from a pipe

Chlorine Leakage in Global Heavy Chemicals Limited

- At least 100 people fell sick as toxic gas leaked out of cracked rusty pipe on 16 Oct 2011: among them were13 firemen
- Fire Service and Civil Defense teams did not have sufficient training to deal with toxic chemicals

Case Study 2

- Nimtoli fire: (June 3, 2010): Fire in chemical storage in residential area

Fire in Chemical Storage in Residential Area

- Nimtoli fire: The fire killed as many as 123 people and injured 200 others on June 3, 2010 as it spread through inflammable chemicals stored on the ground floor of a residential building

Rules and Regulations

- Industrial rules and regulations 1961
- Bangladesh Standards and Testing Institution (BSTI) Ordinance, 1985
- Bangladesh National Building Codes,1993
- The Environment Conservation Rules,1997
- Bangladesh Labour Act, 2006
- National Occupational Health and Safety Policy, 2013

Legislation

	Legislation	Enforcing agency
1.	The Factories Act, 1965 and the Factories Rules 1979	Department of Inspection for Factories and Establishment
2	Dock Labourers Act 1934	Department of Inspection for Factories and Establishment
3	Dock Labourers Regulations 1948,	Department of Inspection for Factories and Establishment
4	Tea Plantation Labourers Ordinance 1962 and the rules thereunder	Department of Inspection for Factories and Establishment
5	The Workmen's Compensation Act 1923 as amended in 1980 and 1983	Department of Inspection for Factories and Establishment
6	The Shops and Establishments Act 1965,	Department of Inspection for Factories and Establishment
7	Employment of Children Act 1938	Department of Inspection for Factories and Establishment
8	The Maternity Benefit Tea Estates Act 1950	Department of Inspection for Factories and Establishment
9	The Maternity Benefit Act 1939	Department of Inspection for Factories and Establishment
10	The Maternity Benefit Rules 1953.	Department of Inspection for Factories and Establishment
11.	The Boilers Act 1923	Chief Inspector of Boilers under Ministry of Industry
12	Nuclear Safety and Radiation control Act !993	Atomic Energy Commission. Bangladesh

Organizations

- Bangladesh National Authority of CWC, Armed Force Division
  - Training/documentation/projects
- Department of Chemical Engineering, Bangladesh University of Engineering and Technology (BUET)
  - Offers courses/Carries out safety research/project works/safety assessment/
  - Collaboration with Mary Kay O'Connor Process Safety Center, Texas A & M University, US
- Industrial Safety Board, The institution of Engineers, Bangladesh
  - Training/assessment/certification/documentation

Challenges

- Scarcity of qualified safety personnel
- Absence of comprehensive safety regulations and monitoring body
- Inadequate toxic management
- Absence of safety culture
- Not being in the national priority list

Conclusion

- Bangladesh is currently observing rapid growth of chemical process industries with a trend towards large and highly integrated production units with complex processes
- These necessitate detailed and advanced safety technology
- **'Chemical Safety' is important for Bangladesh**
- National prioritization along with regional/global cooperation will facilitate the adaptation and implementation of chemical safety and measures

* Chemical Safety and Security Case Studies

PHILIPPINES

Carmel C. Gacho, Ph.D., ASEAN Eng.
Supervising Science Research Specialist
Department of Science and Technology

INTRODUCTION

In the Philippines, chemical safety and security are embodied in several laws which are being implemented by government regulatory bodies. These are as follows:

The **Department of Environment and Natural Resources** (DENR) establishes rules, regulation and programs for controlling chemical substances and hazardous wastes in the Philippines.

Legal Instrument /Name	Objective/ Nature of Legislation	Description of the Legislation
Republic Act 6969 Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990	To control the importation, manufacturing, processing, sale, distribution, use and disposal of toxic substances and hazardous and nuclear wastes. ² Compile and maintain the inventory of all chemical substances in the country.	Compile and maintain the inventory of all chemical substances in the country
Presidential Decree 1586 Environmental Impact Assessment System	For EIA/ECC compliance monitoring.	Hazard Identification and risk assessment be undertaken from the earliest stages of design and construction, throughout operation and maintenance, and should address the possibilities of human or technological failures, as well as releases resulting from natural disasters or deliberate acts.

Legal Instrument/ Implementing Department	Nature of Legislation
Labor Code of the Philippines Book IV (Article 162),1974 ***Department of Labor and Employment***	administration and enforcement of Occupational Safety and Health Standards (OSHS) in all places of employment (all categories of chemicals used in industry and agriculture, except consumer chemicals) .
Republic Act No. 9516 (Acquisition or Disposition of Firearms, Ammunition or Explosives) ***Philippine National Police***	regulate the illegal or unlawful possession, manufacture, dealing in, acquisition or disposition of firearms, ammunition or explosives, or instruments used in the manufacture of firearms, ammunition or explosives (i.e. chlorates, nitrates, nitric acid, sulfuric acid and hdrochloric acid) ***- Need police escort during the transportation of these chemicals***
PD 857 , Article XVII (Dangerous Goods) ***Philippine Ports Authority***	classification of dangerous goods, general requirements for security, storage of loading and unloading dangerous goods, handling of explosives, handling/storing of flammable and combustible liquids and poisonous substances, radioactive materials.
Presidential Decree No. 881 ***Food and Drugs Authority***	regulate the labelling, sale and distribution of hazardous substances. (drugs and chemotherapeutics).
Presidential Decree 1185	prevention and suppression of all destructive fires on: buildings, houses and other structures; forestland transportation vehicles

During chemical incidents,

Key players (usually the regulatory bodies) involved in chemical safety that should be called upon for the safety of the responders and the general public when a chemical incident arises are as follows:

Department of Environment and Natural Resources- monitor the level of a specific chemical during the chemical incident for the safety of the people and supervise the disposal of the hazardous waste.

Department of Labor and Employment– investigate the workplace within 24 hours upon receipt of the initial report of the accident/incident and conduct plant inspection to determine company's compliance with the provisions of the OSH standards.

Bureau of Fire Protection- first responder when called upon in the event of chemical incident or emergency and controls the spill and prevents fire that may be caused from the hazardous materials.

Department of Health - provide the necessary healthcare service to victims and affected communities.
Others: Local Government Units , Non Government Organizations

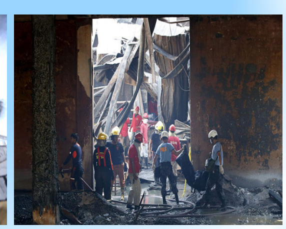
Case Study 1

Place of Accident: Valenzuela, Metro Manila
Date: May 13, 2015
Situation Summary:

Kentex company is a shoe and slippers factory located in Metro Manila. On May 13, 2015, a fire broke out due to an explosion attributed to a torch being used to repair the factory doors, sparks from the welding activity caused the chemicals in the factory to explode.

* The welder admitted that he was repairing the factory's roll-up metal gate, which was near the place where highly combustible chemicals were stored.
* The flammable chemical was identified as azodicarbonamide, commonly used as a blowing agent to expand rubber.
* The welder recounted that the office secretary of the factory, assured him it would be safe to do welding repairs in the area since the chemicals were already covered with canvas.
* But the first spark, immediately ignited the chemicals, causing a small fire.
* The secretary allegedly tried to douse the small fire by pouring water on it, but she didn't stop the welder from doing his work.
* Fire ripped through bottom floor of factory, forcing some workers to flee upstairs where they became trapped because all windows have steel grills.
* The fire just went out of control until it consumed the entire factory and several dozens of lives into ash.

Death trap: Relatives of the dead say that once on the top floor, workers were trapped by metal bars placed across the windows, which are commonly installed in Philippine buildings to deter thieves.



Firefighters and police pulled dozens of corpses out of the ruins of the two-storey shoe factory building

Kentex tragedy hugging almost all the daily newspapers' headline

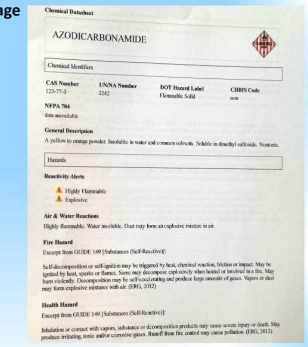
Torched: Authorities say the rubber and chemicals used to manufacture slippers are highly flammable, which meant the blaze spread very quickly through the lower levels of the factory.

Reasons for the Chemical Accident and Scientific Analysis

1. Mishandling and improper storage of flammable chemical used as a rubber emulsifier.

- The welding spatter coming from the roll up door being repaired at the second floor near the stairs reacted with the chemicals improperly stored on the factory's ground floor and were only covered by nylon canvas.

- Chemical data sheet of azocarbonamide, reveals that the chemical is highly flammable and dust may form explosive mixture in air. Further, self –ignition may be triggered by sparks or flames, among others.


Chemical Datasheet
AZODICARBONAMIDE
Chemical Identifiers
CAS Number 123-77-3 | UN/NA Number 3242 | DOT Hazard Label Flammable Solid | CHRIS Code none
NFPA 704
data unavailable
General Description
A yellow to orange powder. Insoluble in water and common solvents. Soluble in dimethyl sulfoxide. Nontoxic.
Hazards
Reactivity Alerts
Highly Flammable
Explosive
Air & Water Reactions
Highly flammable. Water insoluble. Dust may form an explosive mixture in air.
Fire Hazard
Excerpt from GUIDE 149 [Substances (Self-Reactive)]:
Self-decomposition or self-ignition may be triggered by heat, chemical reaction, friction or impact. May be ignited by heat, sparks or flames. Some may decompose explosively when heated or involved in a fire. May burn violently. Decomposition may be self-accelerating and produce large amounts of gases. Vapors or dust may form explosive mixtures with air. (ERG, 2012)
Health Hazard
Excerpt from GUIDE 149 [Substances (Self-Reactive)]:
Inhalation or contact with vapors, substance or decomposition products may cause severe injury or death. May produce irritating, toxic and/or corrosive gases. Runoff from fire control may cause pollution. (ERG, 2012)

Chemical data sheet of Azodicarbonamide

2. No proper storage facility for hazardous chemicals.

3. Workers, including the welders contracted from outside, were unaware that the chemical is highly flammable as it was not properly labelled.

4. The factory showed no functioning or proper fire exits, in clear violation of the Philippine Occupational Health and Standards .

5. Kentex factory appeared to have neither a proper smoke and fire alarm nor a regular fire and safety drill among workers.
6. No occupational health and safety officer to educate and train the workers, especially on the nature of the chemicals that they are handling.

Future Mitigation Measures

* Construction of a proper storage facility for hazardous chemicals.
* Proper labelling of all types of chemicals
* Installation of appropriate engineering controls and fire exits
* Inspection and maintenance of building and facility
* Conduct of 5S
* Conduct of regular occupational health and safety training of employees, with emphasis on chemical safety (use of MSDS).
* Strict enforcement of Occupational Health and Safety Standards and other related permitting requirements by concerned government regulatory bodies and the company management.

Case Study 2

Where: Dr. Fabella Hospital, Manila
When: August 8, 2013

Situation Summary:

Fabella Hospital is the biggest maternity hospital in the Philippines. This healthcare facility has stopped using mercury containing devices in compliance with a gradual ban imposed by the Department of Health from 2008 to 2010. The phase-out chemicals and devices containing mercury were temporarily stored while waiting for the Department of Environment and Natural Resources to collect and dispose them.

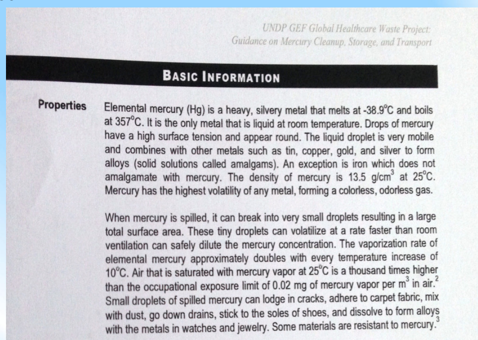
However, on August 3, 2013, unacceptable levels of ambient mercury were detected in and around the storage room of Fabella Hospital in Manila when mercury-tainted amalgam spilled from a broken container, seeped into the wooden floor of the second floor and trickled into the ground floor.

The ground floor was full of medical supplies while the second floor was used as storage room for the decommissioned mercury devices. The mercury apparently evaporated after it spilled from its container in the second and ground floors of the hospital building. Consequently, some 40 patients from Fabella Pediatric Ward, which was adjacent to the contaminated rooms, have been transferred to other wards.

The DOH claimed that 80 hospital personnel and Hazmat members underwent blood tests for mercury contamination as part of the SOP during a chemical spill. Fortunately, all affected victims were tested negative of mercury contamination, however complete clean-up of the area took several days.

The incident became the hot topic of the daily newspaper and television.

Reasons for the Chemical Accident and Scientific Analysis:



UNDP GEF Global Healthcare Waste Project:
Guidance on Mercury Cleanup, Storage, and Transport

BASIC INFORMATION

Properties Elemental mercury (Hg) is a heavy, silvery metal that melts at -38.9°C and boils at 357°C. It is the only metal that is liquid at room temperature. Drops of mercury have a high surface tension and appear round. The liquid droplet is very mobile and combines with other metals such as tin, copper, gold, and silver to form alloys (solid solutions called amalgams). An exception is iron which does not amalgamate with mercury. The density of mercury is 13.5 g/cm^3 at 25°C. Mercury has the highest volatility of any metal, forming a colorless, odorless gas.

When mercury is spilled, it can break into very small droplets resulting in a large total surface area. These tiny droplets can volatilize at a rate faster than room ventilation can safely dilute the mercury concentration. The vaporization rate of elemental mercury approximately doubles with every temperature increase of 10°C. Air that is saturated with mercury vapor at 25°C is a thousand times higher than the occupational exposure limit of 0.02 mg of mercury vapor per m^3 in air.[2] Small droplets of spilled mercury can lodge in cracks, adhere to carpet fabric, mix with dust, go down drains, stick to the soles of shoes, and dissolve to form alloys with the metals in watches and jewelry. Some materials are resistant to mercury.[3]

***Basic information on the volatility of mercury during spillage*.**

Reason for the Chemical Accident/Incident and Scientific Analysis:

Storage room is not properly designed to handle phased-out mercury and mercury containing devices.

Inappropriate container for storing mercury. Under the Department of Health guidelines, the banned devices should be kept in plastic and not breakable containers.

Glass or plastic vessels should have a secondary container around them in case the vessel fails.

There is inadequate engineering controls in the store room.

No regular education and training of all hospital personnel on handling of mercury product and phased-out mercury devices.

Failure to look at the whole picture of mercury-phase out implementation, in particular phase-out, on-site storage of phased-out mercury, and regular monitoring of the storage area.

Future Mitigation Measures :

Construction of a properly designed interim storage facilty for the phased-out mercury products or devices.

Training of personnel on the proper storage, specifically container type and labelling of hazardous chemical.

Review of proper and safe storage of phased-out mercury devices from health care facilities.

Strictly enforce proper storage requirement of phased-out mercury products and devices.

The government thru the Department of Environment and Natural Resources-Environmental Management Bureau (DENR-EMB) must expedite the infrastructure or system in the collection and proper storage for the Philippines.

The DENR must provide for safe and long term-storage solution for phased-out mercury.

Concerned government agencies and other stakeholder should review the whole picture of mercury phase-out implementation, phase-out, on-site storage of phased-out mercury, and regular monitoring of the storage area and develop a policy or program that would address issues on these areas.

CONCLUSION:

Lessons learned from chemical incidents in the Philippines have demonstrated the importance of chemical accident prevention through information and education campaign , the strict enforcement of laws and inter-agency cooperation in the timely resolution of the problem.

There should be enhanced understanding of the roles and responsibilities of the concerned government entities in chemical incidents and preparedness program which will increase knowledge and strengthen capabilities of the various sectors for chemical incident preparedness and response.

Alerting and responding to a chemical incident or emergency also entail involvement of different government and nongovernment entities.

There should be utmost coordination among government and nongovernment entities including public and private partnerships to answer the technology and manpower needs in addressing health and environment issues of a chemical incident.

One of the identified gaps in the National Profile on Chemical Safety and Management is the R & D component where our research institute can play significant role.

In particular, our research programs and other projects will have to focus on the following:

- Hazardous material substitution
- Development of low-cost hazardous materials spill kits from indigineous or locally available materials.
- Development or fabrication of low-cost sensors for the rapid detection of contaminants
- Remediation technologies
- Hazardous waste utilization
- Conduct information and education campaign thru seminars and workshops to various stakeholders, with emphasis on new approaches on chemical safety and security management including new lessons that I can learn from the various case studies that will be presented in this seminar.

*Thank you.

"Chemical Safety and Security"

TILAK RAJ ARORA
Technical Officer , NACWC, India

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Importance Of Chemical Safety and Security in Indian Perspective

- Presence of small, medium and large scale Industries
- 17.6% Contribution in Manufacturing Sector
- 13 -14 % in total Exports
- 8-9% in total imports
- 3% of GDP
- 1861 Major Accident Hazard (MAH) Units
- Last Decade- 130 Chemical accidents, 259 deaths, 563 major injuries.

272

Chemical Safety of CWC Scheduled Chemicals

- As on Dec 2015:
- Schedule 2 Chemicals Facilities-32
- Schedule 3 Chemicals Facilities-41
- DOC facilities-513
- Target Zero Accidents

273

Chemical Safety

- Chemical accidents and spills can be devastating to humans, wildlife, and the environment. The best way to reduce the harm caused by chemical accidents is to design plants with better safety controls that operate at lower temperatures and pressures, and to use and manufacture less toxic compounds, a field that is being pursued by "green" chemists and engineers.

274

Chemical Safety

- But until toxic chemicals are routinely replaced by less harmful substitutes, the emergency response procedures developed by environmental scientists and engineers help lessen the human health and ecological effects of chemical spills and accidents.

275

Hazards & Risks

- Fire
- Explosion
- Toxicity
- Corrosion
- Asphyxiation

276

Safety arrangement in CWC Chemicals Facilities

- Safety is one of core values and the facilities are committed to continually improve the safety performance by targeting "Zero injury" through world class safety practices
- Process Safety Management and Behavior Based Safety are two key areas in which facility is working passionately and heading towards benchmarking these processes

277

Safety arrangement in CWC Chemicals Facilities

Most of the facilities are one of the active members in different committees of ICC (RC, SHE & Sustainability), FICCI, CII, Bombay Chambers, who' contributes in spreading Safety awareness among Chemical industries and other stakeholders by conducting various workshops/ seminars

278

Safety Arrangements in CWC Chemicals Facilities

- "Safety First" is the slogan of most of the units and the same is reflected in the EHS policy. Safety & Health systems of the unit is certified under the standard OHSAS 18001 : 2007 in most of the cases.
- Adherence to safe practices is a condition of employment. There have not been any major accidents, both reportable and non reportable, since 2014.
- The facilities are in the pursuit of 'ZERO ACCIDENTS' by choice.

279

Chemical Safety in Schedule 2, Schedule 3 and DOC facilities

- Security
- Training
- Maintenance
- work permit
- Personal Protection Equipments
- Exposure Prevention and control measure for Schedule 2 Chemicals

280

Security

- Security 24X7
- CCTV
- Electronic / Manual operated : Entry of Staff and visitor

281

Training

- Awareness creation and training are the main foundation for the workforce to take all of them to an INTERDEPEDENT Stage to bring in safety culture in the DNA of everyone.
- Periodical training to all Operating staff by the Internal/External Safety Agencies.
- Training for Instrumental Engineer in calibration of the equipment.
- First aid training for all the personnel's.

282

Maintenance

- Service of Electrical appliances/equipments should be carried out periodically.
- Service/replacement of Valves should be carried out periodically.
- Instruments should be calibrated by qualified engineer.
- Work of maintenance should be carried out under personal supervision of competent engineer.

283

Work Permit

- All work permit systems related to hot work and height at work are granted under the supervision of Safety Engineer.
- Permit for hazardous chemicals should only be issued to experienced persons.

284

Personal Protection Equipment

- All the employees should be provided with personal protection equipments like helmet, goggles, nose masks and safety lockers.
- Each production block should be provided with eye wash and safety shower.

285

Safety arrangement in CWC Chemicals Facilities

- Management process is driven under 5 categories: Safety Organization, Management Control Systems, Risk Control systems, Loss Prevention systems and Work Place Implementation.
- Most of the facilities have also adopted the Management Practices under Responsible Care Codes : Employees Health & Safety, Emergency Preparedness, Process Safety, Product Stewardship & Distribution
- Major Accident reported during last two years - NIL

286

Exposure Prevention and Control Measure for Schedule 2 Chemicals

- Enclosed process: yes.
- Scrubber system: provided
- Acid /Alkali: handled in closed pipeline.
- HAZOP Study: Carried out and implemented
- Risk Analysis: carried out
- Ambulance Van : Available in most of the facilities.
- Emergency Response Team: Industrial civil defence unit (ICDU) trained ,members available in each shift.

287

Risk Based Process Safety Management

- Top Management Involvement & commitment
- Institutionalization of risk based approach to PSM
- Process safety competency
- Process safety knowledge management
- Process Safety Information
- Process Hazard Analysis

288

Mock drills

- There should be continuous activities going on in the plant.
- To check the readiness of tackling any emergency situation, mock drills are conducted periodically.
- In a year, around 7 to 8 surprise mock drills should be organized. These are conducted in the plant to judge the effectiveness of the system.
- Abnormalities should be recorded and noted by management.
- Observers are senior executives of the Company. The mock drill reports are discussed.
- The feed back report of the mock drill is sent to concerned groups for compliance .

289

Nine Golden Safety Rules

- Permit to Work
- Confined Work Space Entry.
- Working at Height.
- Lifting Operations
- Ground Disturbance (Excavation).
- Energy Isolation
- Management of Change
- Driving Safety
- Storage of Hazardous Materials

290

Accident Response

- FP water pipelines
- Fire Alarm system
- Fire Extinguishers
- Video surveillance

291

Case 1 the fire broke out at factory of M/s Cimteche Systems Private Limited.

- The fire broke out on April 13, 2015 at a chemical factory in Jeedimetla
- The chemicals stored in the barrels inside the factory exploded.
- Resulting in the loss of property worth lakhs of rupees.
- The fire personnel took five hours to douse the flames
- Human loss : Nil.

292

Root Cause of Accident

- Explosion was due to inflammable solvent having low Flash point.
- Lack of SOP for chemical safety.
- Storage facilities
- Human Error
- Absence of Functional Fire Protection and Control Measure
- lack of maintenance of electrical equipment

293

Remedial Measure

- Implementation of requisite provision for process safety.
- All the hazardous storage tanks to be in dykes
- All flammable storage tanks to be provided with fixed foam installation.

294

Case No 2
Fire at M/s Srini Pharmaceutical Industry, Choutuppal in Nalgonda

- Fire accident broke out on 15 Dec. 2015 after a blast in one of the reactor
- The fire-fighters took about three hours to put off the fire.
- Workers saved their lives since they have expected a blast after noticing the smoke emanating from the reactor.
- None of the workers were injured in the incident

295

Root Cause Of Accident

- Process safety.
- Human Error.
- Short circuit

296

Remedial Action

- Safety parameters to be implemented for root cause.
- Training for operator
- All the hazardous storage tanks to be in dykes
- All inflammable storage tanks to be provided with fixed foam installation

297

Case No 3:
Road Accident of Chemical Tanker

- The tanker caught a major fire in the road accident **on Dec. 14, 2014**
- Chemicals(Butanol) caught fire and exploded after a collision with a truck packed with motorcycles.
- There was a major noise after the collision in the accident.
- Several cars were burnt down as the fire from the tanker spread very quickly.
- As many as ten cars were burnt down in the process.
- 15 people were affected in the accident.

298

Root Cause of Accident

- Tanker was caring low flash point organic solvent
- caught fire and exploded after a collision
- Lack of Training
- Label- not as per specification.
- Tanker specification.
- Lack of Emergency Preparedness .

299

Remedial Measure

- Education to Transporter.
- Proper Labelling.
- Stringent legal action.
- Emergency Preparedness .

300

Explosion in M/s Meghmani Industries Ltd. Dahej

- A major fire following an explosion during recovery process of Ethylene dichloride in one of the reactor.
- The unit is manufacturer of Agro chemicals.
- 7 people injured during this accident.

301

Root Cause of the Accident

- Explosion occurred in reactor of solvent recovery plant of Ethylene dichloride.
- Ethylele dichloride is an explosive chemical.
- .the spark from electrical appliance due to short circuit.

302

Remedial Action

- Process Safety
- Training for operator
- All the hazardous storage tanks to be in dykes
- All inflammable storage tanks to be provided with fixed foam installation

303

Some New Initiatives in India on Safety and Security

- Chemical Safety Rating System
- Chemical Transport Safety, Emergency Response & Security
- Responsible Care

304

Indian Legislation on Chemical Safety & Security

- **Explosive Act 1884**
- **Petroleum Act 1934**
- **Factories Act 1948**
- **Insecticides Act 1968**
- **Environmental Protection Act 1986**
- **Motor vehicle Act 1988**
- **Public Liability Insurance Act 1991**
- **Chemical Weapons Convention Act 2000**
- **Disaster Management Act 2005 & many Others**

305

Thank you

306

Chemical Safety and Security
Case Studies

Kingsley Rajapaksha
B.Sc. M.Sc.in Disaster analysis Management & Mitigation (UoC)
Sri Lanka

Introduction-Background information

Definition of Hazard

A dangerous phenomenon, substance human activity or condition that may cause of loss of life, injury or other health impacts,property damage , loss of livelihoods and services, social and economic disruption, or environmental damage.

Comment : Hazard events can be :
Characterized by Their Magnitude or intensity, speed of onset , duration , Frequency and area of extent

UNISDR April 2009

Introduction-Background information

Definition of Biological hazard

Process or phenomenon of organic origin or conveyed by biological vectors, including exposure to pathogenic micro-organisms, toxins and bioactive substance that may cause loss of life, injury. Illness or other health impacts, property damage,loss of livelihood and services ,social and economic disruption or environmental damage

Comment : example of biological hazards include outbreak of epidemics, diseases, plant or animal contagion, insect or other animal plagues and infestation.

UNISDR April 2009

Introduction-Background information

Definition of Hazardous chemicals

Chemical substance that might be employed because of their direct toxic effects on man , animal and plants (United Nation 1969)

Definition of Disaster

A serious disruption of the functioning of a community or a society involving widespread human material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.

(UNISDR April 2009)

Introduction-Background information

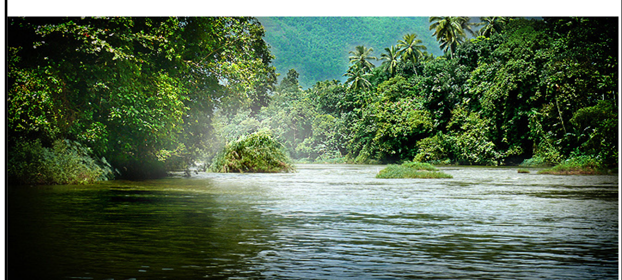
It is known that by their nature, the manufacture, storage and transport of chemicals indicate potential accidents and that major factors leading to chemical industrial accidents are

- **Human factors; Improper or dangerous operation can cause the leakage of chemical containers and pipes**.
- Chemical facility failure;. Failure or absence of security equipment aging or defect of facilities
- Electronic equipment failure ; Both circuit short and transformer failure can cause the chemical production procedure to go out of control
- Storage factors,
    a. Improper storage conditions
    b. Improper storage containers
    c Improper storage management

(Source: Organization of prevention of chemical weapons 2014)

Introduction-Background information

Kelani river water basin



Fourth longest river in the country

145 Km length and 2292 Sq/Km water basin

Introduction-Background information

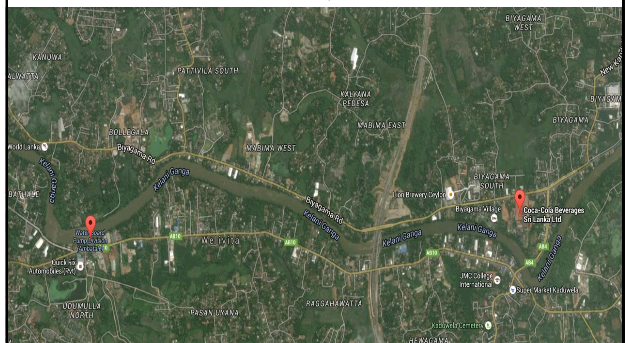
Ambatale water intake

Purifying capacity -500,000-550,000 m3/day

Catering to over 1 m people in the Colombo district

Case study # 01 :

Coca-Cola's Kelani river Oil spill



Coca-Cola's Kelani river Oil spill

Problem Analysis :

Date: 16th August 2015

Venue : Coca-Cola beverage production facility(close proximity Kelani river)

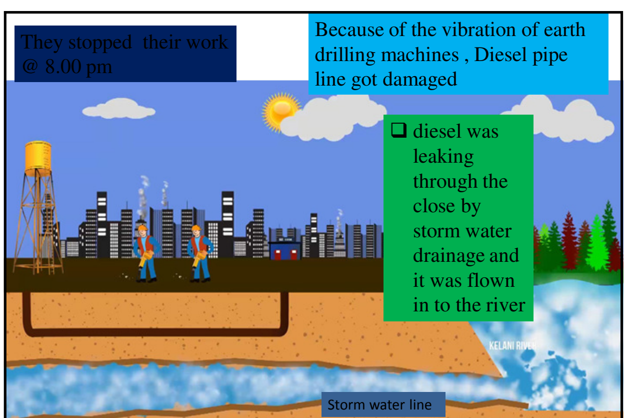
Duty assigned : few men were allocated for drilling the earth to set up an equipment

Problem Analysis :

They just carried out the earth drilling but non of them did not have an idea about

- Storm water drainage system lay out which direct to Kelani river .
- Under ground Pipe line system which supply diesel for day to day works of fork-lift from primary tank(Inside the production premises they store 25,000 Liters of Diesel for their fork life operation)

❑ Note : Storm water and Diesel pipe lines lay out are not displayed and violating guidelines as both line have been set up paralley and close to each other



Images of Kelani river after Oil spill , 17th August and few days further

Coca-Cola's Kelani river oil spill

Coca-Cola's Kelani river oil spill

Date: 17^{th} August 2015
Venue : Ambatale water intake(NWSDB)
time : 6.00 am
the officials at the water treatment plant in Ambatale noticed pools of oil floating on the water, and announced a water cut at 6.30 a.m. to carry out an investigation.

Coca-Cola's Kelani river oil spill

Once they identified the oil spill, National Water Supply & Drainage Board(NWSDB), Central Environment Authority (CEA) and the Marine Environment Protection Authority (MEPA) joined forces to flush water away from the area

The government incurred a huge cost to clean up the mess: in addition to stopping water distribution and engaging in an extensive clean-up process,

CEA also had to release water from the Laxapana reservoir to flush out the contaminated river water.

Coca-Cola's Kelani river oil spill

Corrective & precautionary measures taken (as per the Company)

- Discontinuing the use of affected fuel pipe line
- Blocking the Storm water drainage
- Informed the relevant authorities

Lesson learned

- Over 900,000 people of Colombo Municipal Council area and 400,000-450,000 of floating population affected in receiving drinking water over 10 days period of time
- Coca-Cola's Environment Protection License was suspended due to this issue, and production stopped for a few weeks,
- Local top management were asked to resign
- Paid 130 m Rs(~ 1.0 m US$) to National Water Supply & Drainage Board (NWSDB) for their equipment damages and process losses
- Central Environmental Authority (CEA)claim yet to be finalized

Conclusion

Finally the company is willing to funding to set up latest equipped laboratory in the selected area of the river under the supervision of CEA and NWSDB

Also to set up skimming tank in the Ambatale water intake premises to separate floating objectives

Case Study # 02 :

Problem Analysis :

Date: 22nd Dec 2015
Venue : Paint factory @ Panadaura)

What cause : Thinner pipe line explosion

Case Study # 02 :


PIPELINE BURSTS IN PAINT COMPANY

BY INDIKA MANOJ COORAY, SIRI MAHABELLANA AND KUSAL CHAMATH

Nearly 50 employees were affected when a pipeline carrying thinner at a paint factory in Keselwatta, Panadura had burst, Police said.

SEE REST OF THE STORY ON A2

The "Thinner" pipe explosion that occurred at a paint factory in Keselwatta, Panadura.

The number of patients hospitalized 50

They have been admitted to the Panadura Base Hospital after complaining of breathing difficulties due to the gas that escaped after the 'Thinner' pipe exploded.

Case Study # 02 :

What impacts:

50 employers hospitalized because of breathing difficulties)-many had attempted to take away the 'Thinner' that had leaked from the pipe

50 numbers of neighbouring householders evacuated the area

Lesson learned(overall) :

Chemical accidents can take place any where at any time but the situation can be lessened /mitigated and most of the time we need to have precaution measures to prevent it with the comprehensive and innovative approaches.

Continuation of Education, Training and Awareness in chemical safety & security management is required

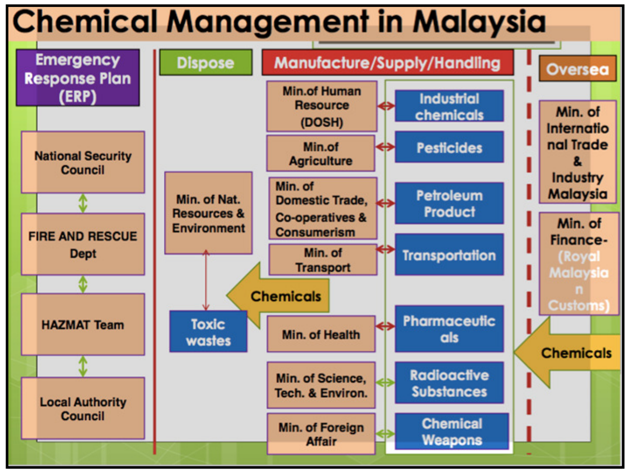
A SAFER World

Chemical Security and Safety

Thank you

Case Study: Chemical Accidents in Malaysia

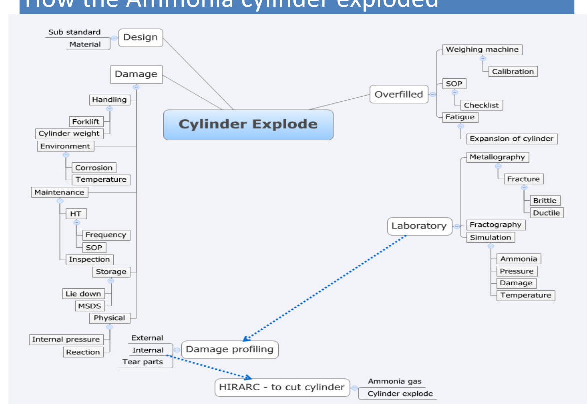
by
Hamidi bin Saidin
Malaysia



Case Study 1: Ammonia Gas Cylinders Explosion

- On 8 August 2015 at 4.45 pm, Ammonia gas cylinder exploded at one of the ice maker manufacturer in Sungai Besi, Kuala Lumpur .
- The incident happens when a worker was conducting the work of filling the Ammonia gas from the gas cylinder to the receiver tank.
- It involves 7 cylinders (4 full cylinder was in reclining position , 3 empty cylinders was in upright position)
- Most of these cylinders were older than 20 years old.
- A worker was killed by the explosion.


How the Ammonia cylinder exploded



Measures that can be taken to prevent the re-occurrence of the similar incident.

- Fully comply with the requirements contained in anhydrous Ammonia SDS,
- To carry out periodic inspections and testing of gas cylinders accordance with recognized codes or standards.
- Conducting a comprehensive maintenance schedule for ammonia gas cylinders.
- Gas cylinders should be stored outdoors on the ground to prevent corrosion. If extreme temperatures prevail, cylinders should be stored and protected from the direct rays of the sun.

Measures that can be taken to prevent re-occurrence of the similar incident.

- Ammonia gas cylinders should always be stored or arranged in upright position and held firmly to prevent it from falling, overturning and knocked over.
- Use appropriate cage and hand truck to lift or carry the cylinders. Do not roll, drag, pull or slide the cylinders.
- Workers should be given proper training, written guidance and information on safe procedure and method of handling ammonia gas cylinders followed by close supervision by their supervisor.

Seminar for CBRN training, Doha, Qatar

Chemical Safety and Security
Case Studies—China

Dr. Zhiqian Wang
State Key Laboratory of Chemical Resource Engineering
Beijing University of Chemical Technology
People's Republic of China

Seminar for CBRN training, Doha, Qatar

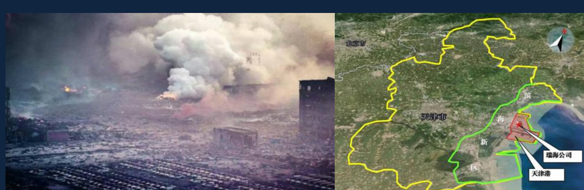
Case in China:
8.12 Tianjin blasts

Education

Research

Seminar for CBRN training, Doha, Qatar

8.12 Tianjin blasts:



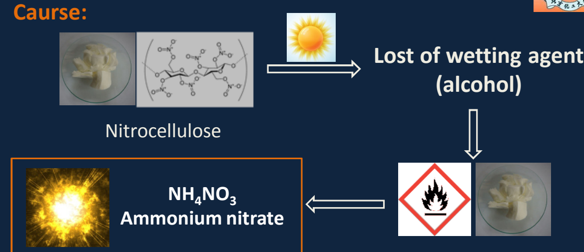
165 killed, 798 injured, 8 missing
304 buildings, 12,428 cars, 7,533 containers, 1.1billion US dollar

>120 people have been held responsible

By 02/06/2016

Seminar for CBRN training, Doha, Qatar

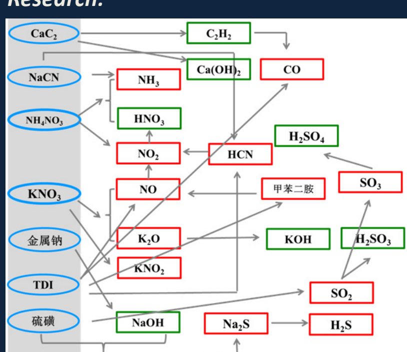
Caurse:



Oxidant 1300t NH_4NO_3, KNO_3	Toxic Compd. 700t NaCN	Flamable Compd. 500t CaC_2, Na, S

Seminar for CBRN training, Doha, Qatar

Research:



1. Index
2. Prevention

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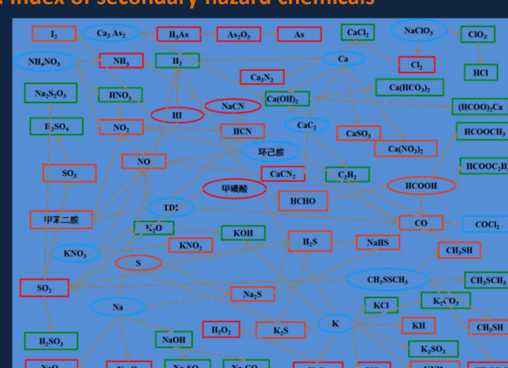
1. Index of secondary hazard chemicals



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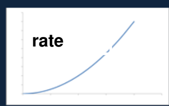
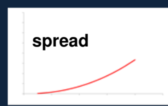
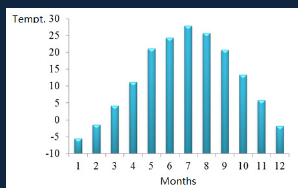
2. Prevention of long-term pollution and spread:







Date	Tempt.
8/12/2015	35°C
9/6/2015	26°C
1/1/2016	-5°C
4/*/2016	12°C

Research from Chao Lv, Feng Wang, Xue Duan

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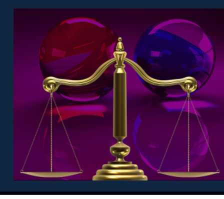
Research:

Before?? ⇦  ⇨ **After**

Seeking safe **succedaneums** of dangerous chemical

Reactivity  **Stability**

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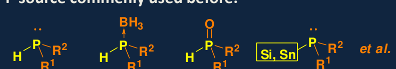
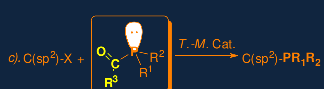
Transition-metal-catalyzed *C(sp2)-P* coupling:

P source commonly used before:



R1, R2 = aryl, allyl, hydrogen or alkyoxy

Safe succedaneums of P source

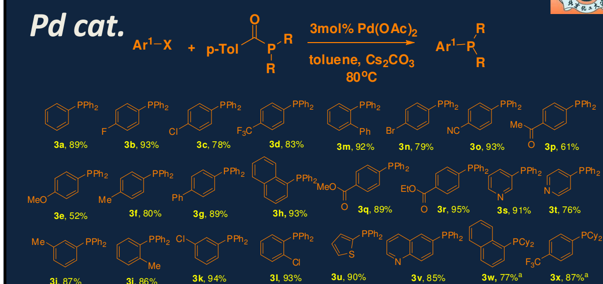


Stable *to O_2 & H_2O*
Reactive *in reaction*

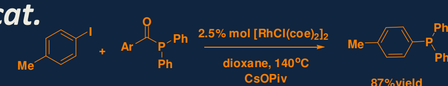
Research from Zhiqian Wang

Seminar for CBRN training, Doha, Qatar

Pd cat.



Rh cat.



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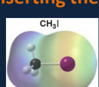
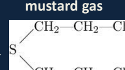
Education:

1. Inserting the elements of chemical safety into the classes



⟸ Alkylation ⟹

mustard gas



2. Offering students a curriculum on chemical safety and security

3. Setting-up training programs for international collaboration

Seminar for CBRN training, Doha, Qatar

From Society For Society

Acknowledgement:

Prof. Xue Duan
Prof. Chao Lv
Prof. Fang Wang
Prof. Feng Wang
Prof. Dongsheng Chen
Prof. Lixin Mao
Mr. Yinong Zhao

Panel of Speakers: Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region, Doha, Qatar 2016

Mrs. Xiaohui Wu
Head
International Cooperation Branch
International Cooperation Assistance Division
Organisation for the Prohibition of Chemical Weapons (OPCW)
The Hague, the Netherlands

Dr. Rohan P Perera, PhD
Senior International Cooperation Officer
International Cooperation Branch
International Cooperation Assistance Division
Organisation for the Prohibition of Chemical Weapons (OPCW)
The Hague, the Netherlands

Dr. Nancy B Jackson, PhD
International Chemical Threat Reduction
Sandia National Laboratories
Albuquerque, NM, USA

Ms. Sandra Ashcroft
Head of Chemical Industries Policy
Health and Safety Executive
Hazardous Installations Directorate - Chemical Industries Policy
United Nations Economic Commission for Europe (UNECE)

Mr. David Moore
The President and CEO of the AcuTech Consulting Group
Vienna, Virginia, USA

Mr. Brandon Turner
United Nations Institute for Training and Research (UNITAR)
Inter-Organization Programme for the Sound Management of Chemicals (IOMC)
Geneva, Switzerland

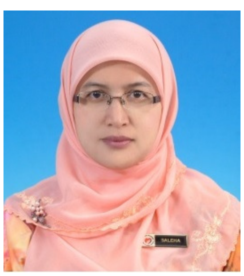
Mr. Tahir Jamal Qadir
Executive Director
AcuTech Consulting Group UAE

Participants: Seminar on the CWC and Chemical Safety and Security Management for Member States in the Asia Region, Doha, Qatar 2016

Ms. Rinzin Pemo works as a Deputy Collector under the Department of Revenue and Customs, Ministry of Finance, Bhutan. She has 11 years of working experience and look after Enforcement and Compliance Section at the Head Office. She has obtained Masters in International Customs Law and Administration from the University of Canberra, Australia. Email: rinzicus@gmail.com, rpemo@mof.gov.bt

Mr. Amir Reza Ahmadi Khoy is PhD candidate of international relations at university of Guilan, Iran. He earned his MA degree in diplomacy and international organizations from School of International Relations of IR Iran Ministry of Foreign Affairs.

His area of work is Chemical Weapons Convention and he works in Iran National Authority for CWC. His task deals with declaration as well as inspections. Safety and security of chemical industries which yearly declare their productions and routinely inspected is one of his responsibilities which through cooperation of other national organizations and some international centers which actively involved in chemical safety and security, is achieved. Email: amirahmadi1984@gmail.com



Ms. Saleha Abdul Rahman @ Ngah was born in Kuala Terengganu, Terengganu, Malaysia. She received her Bachelor (Hons) Science and Practice of Pharmacy from Liverpool John Moore University, United Kingdom and obtained her Master of Enforcement Law from the University of Technology MARA, Malaysia. She is the Undersecretary of the National Authority for Chemical Weapons Convention (NACWC) of Malaysia since 2015 and Board Member for the Pharmacy Jurisprudence Advisory Committee. Prior to that, she has extensive experience as a Pharmacist at the State of Negeri Sembilan and Terengganu. She was formerly the Head of Pharmacy Enforcement of the State of Terengganu from 2009-2014 and Lead Auditor for MS ISO 9001 in Terengganu State Health Department, and Pharmacy Innovation and Creativity Committee under the Ministry of Health, Malaysia. She was also the Alternate Member for Strategic Trade Act 2010 Committee in 2015.

Email: saleha@kln.gov.my

Dr. B. Asiri Perera graduated from the University of Colombo with Honours in Chemistry in 1996. She obtained a MS and a PhD in Analytical Chemistry from the Wichita State University, Kansas, USA.

She has over 15 international research publications related to the chemical analysis by spectroscopic methods and more than 15 abstracts. She has presented several papers on analysis of heavy metals and other toxic compounds in food products and other consumable materials. Presently she works as a Senior Lecturer at the Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka. Email: basirip@yahoo.com

Mr. K. Gamage, graduated from the University of Colombo in 1985. He obtained a post Graduate Diploma in writer-ship and Communication also obtained Master in Mass communication from University of Sri Jayawardhanapura, Sri Lanka.

He has over 10 years of experience in writing, planning and implementing projects and programmers on community and rural development, production of media programmers, and he has over 22 years of experience in prevention and control of drugs related work in National Dangerous Drugs Control Board (NDDCB) of Sri Lanka. Presently he works as the Director General of NDDCB and also he is a visiting lecture on Diploma in Drugs Abuse Management Studies at University of Colombo. Further he is a Commissioner of International centre for credentialing and Education of Addiction professionals of The Colombo Plan. Email: kgamage@nddcb.gov.lk

Mr Keo Vuthy graduated with Bachelor Degree in Business Management, National University of Management, Phnom Penh. After he completed Master of Business Administration, Norton University, Phnom Penh in 2008. He completed the training course of transmission strategy of staff, High Command Headquarters in Cambodia. In October he presented the report of situation of the chemical safety and security management Seoul workshop on the peaceful development and use of Chemistry for member state of the OPCW in Asian Region. Presently, he is working as Assistant Secretariat of Administration Department of the National Authority of Chemical Weapons, Cambodia. Email: vuthy_general@yahoo.com

Mr. Muhammad Setyabudhi ZUBER graduated from Institut Teknologi Bandung or Bandung Institute of Technology (ITB) in Chemistry in 1979. Zuber got a master's degree from the University of Sriwijaya.

He was one of the founders of the National Committee for Responsible Care Indonesia (RCI). He is a practitioner of Responsible Care more than 20 years, and was directly involved in developing the RC Security Code to be applied by the chemical industry in Indonesia. Zuber is also a member of the National Chemistry Taskforce coordinated by the Directorate General of Chemical Industry, the Ministry of Industry of the Republic of Indonesia. Presently he works as Vice Chairman for International Affairs, of Federation of the Indonesian Chemical Industry (FIKI) and Executive Director for the RCI. He also actively assists the National Authority for the Prohibition of Chemical Weapons. Since more than 10 years actively involved in promoting the Chemical Safety and Security Program in Indonesia, and as a speaker at several seminars and workshops at home and abroad. Email: setyabudhi@responsiblecare-indonesia.or.id

Dr. Carmel C. Gacho, ASEAN Eng. received her BS in Chemical Engineering at the Pamantasan ng Lungsod ng Maynila in 1990. She obtained her MS in Chemistry at De La Salle University and Ph.D. degree in Environmental Science cognate in Chemical Engineering and Chemistry at the University of the Philippines, Los Banos.(graduating with Honors, Academic Achievement Medalist).

She has presented and published several papers on biological and chemical treatment of industrial wastes and wastewater, and hazardous waste utilization technologies in both international and local conferences and journals. She is currently a supervising science research specialist at the Environment and Biotechnology Division, Industrial Technology Development Institute (ITDI) of the Department of Science and Technology (DOST) of the Philippines, the Vice President for the National Capital Region of the Philippine Institute of Chemical Engineers (PIChE) and the Treasurer of the Women Engineers Network-Philippines. Further, Engr. Gacho is a qualified expert of the UN Secretary General for the investigation of chemical, biological and toxin weapons where she where she completed the basic and advanced training courses in France, Sweden, United Kingdom and Germany.

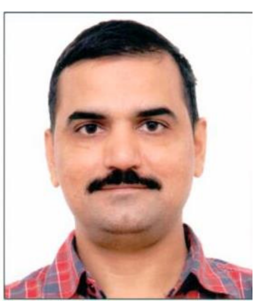
Email: carmelcg@yahoo.com, ccgacho@itdi.dost.gov.ph

Dr. Zhiqian Wang graduated from East China Normal University in chemistry in 2004, Shanghai, China. He obtained his PhD degree in organic chemistry from Shanghai Institute of Organic Chemistry in 2009, and maintained his research career as a postdoc fellow in UT Austin, TX till 2013.

He has over 15 international publications, including 3 on *JACS* and *Angew*. He has presented several international symposiums on organic chemistry and organic synthesis, on one of them he was invited to give a presentation on seeking safe succedaneums of dangerous chemical. Presently, he is an associate professor, vice dean of organic chemistry department from college of science, Beijing University of Chemical Technology. His research is focused on developing air-stable phosphination reagent and new methodologies for phosphines syntheses. Email: wangzhq@mail.buct.edu.cn

Mr. ADAM WIRYAWAN graduated from Brawijaya University, Indonesia in 1982. He studied Graduate Diploma in Chemistry at Tasmania University, Australia in 1988 and he obtained MS in Analytical Chemistry at Bandung University of Technology, Indonesia in 1991. Now he is studying for PhD in Environmental Chemistry.

He has nine international research publications in several journals. He has presented fourteen papers on Analytical and Environmental Chemistry in International conferences. He has written two books in Analytical Chemistry. Presently he is a Senior Lecturer at Department of Chemistry, Brawijaya University, East Java, Indonesia. He attended Chemical Safety and Security Workshop by CRDF USA at Chulalongkorn University, Bangkok, Thailand in 2011 and International Meeting on Chemical Safety and Security by OPCW and ICCSS at Tarnów, Poland in 2012. Email: adammipa@ub.ac.id, awiryawan58@yahoo.com



Mr. Sunil Kumar Sharma is graduated in Electronic Engineering with a First Class Honours, and MBA (Finance) from Faculty of Management Studies (FMS), University of Delhi. He joined Indian Engineering Service in 1998. He has served in Nepal for 2 years in the Safety and Transportation of the sophisticated equipment in difficult terrain.

Presently he is working as Director (Chemicals) in the Ministry of Chemicals and Fertilizers, Department of Chemicals and Petrochemicals, Govt. of India. He is looking after the work of administrative policy and other aspects of chemical industries, Chemical Weapons Convention and Chemical Safety and Security on Hazardous Chemical Management. Apart of these activities he is also working on National Chemical policy which will envisage new trends in chemical sector. Policy has provisioned for safety and security in chemical sector along with promotion of indigenous chemical production with focus on international standards of sector.
Email: sunil.sharma74@gov.in

Mr. Kingsley Rajapaksha graduated his B.Sc. from University of Kelaniya, Sri Lanka in 1996. He obtained his Master degree in Disaster Analysis, Management & Mitigation from the University of Colombo in 2015. His research mainly focused on "A safe chemical transportation & effective response mechanism for chemical accidents in Sri Lanka".

He has a vast experience on supply chain management especially Operation Management, Logistics, and Procurement. By working with chemical and environmental sector professionals, he is contributing towards the country to establish safe chemical transportation mechanism. He participated in Seoul workshop on the Peaceful Development and use of Chemistry for member state of the OPCW in Asian region October 2014. Presently he is working as a Head of the Commercial Dept., in one of the leading chemical related production facility in Sri Lanka. Email: kingslymsa@gmail.com

Mr. Jochu Thinley graduated from the University of Pune, India with a degree in Bachelors of Commerce in 2004, and the following year he cleared the Royal Civil Service Examination and studied Post Graduation Certificate in Finance Management at the Royal Institute of Management, Bhutan.

He is nominated as a Core Team/Task Force member of the following national policy initiatives; Core team, Chemical Weapons Convention, Ministry of Foreign Affairs, Task force, Development of National Chemical Profile, Ministry of Health and Employment Creation Task Force and Ministry of Labour and Human Resources. Presently he works as the General Secretary of the Association of Bhutanese Industries. Email: jochuthinley@gmail.com

Mr. Hamidi bin Saidin graduated from the University of Science, Malaysia in Mechanical Engineering in 1999 and Master Degree in Engineering (Occupational Safety, Health and Environment) from University of Malaya in 2009. Presently, he works as Occupational Safety & Health Inspector at Department of Occupational Safety and Health Terengganu, Malaysia since year 2000. Email: hamidi@mohr.gov.my

Mr. Khandaker Ruhul Amin graduated from the University of Dhaka Bangladesh and Masters in Commerce from same University major in Management Studies in 1980. After completing his Master's degree he has started his own business. Now he is the chairman of Khandaker Group and Director "The Federation of Bangladesh Chamber of Commerce and Industry (FBCCI)". And executive member of SARRC chamber of commerce and industry.

Email: khandakergroup@yahoo.com

Mr. Xuan Tu Nguyen graduated from the University of Natural Sciences, Ha Noi, Viet Nam in the field of organic chemistry. He obtained the bachelor degree in 2004, then the master degree in 2006.

He has experienced more than 11 years in the synthesis of bio-active compounds and riot control agents. Presently he works as a researcher and technical consultor in the Institute of Technical Chemistry, Biology and Special Documents, Ministry of Public Security, Vietnam in which the management of hazardous chemicals is one of their duties. Email: xuantue17@gmail.com

Col Abdullah-Al-Mamun is a senior officer of Bangladesh Army who has been serving in Army for 25 years. He passed Civil Engineering with Major in Chemical Analysis of Environmental Hazards in the year 2002 from Bangladesh University of Engineering and Technology. Col Mamun is a Master in Defence Studies and he also obtained Masters in Business Administration.

Col Mamun served at Bangladesh National Authority for Chemical Weapons Convention for three and half years as Chief Coordination Officer. He attended training courses and seminars related to Chemical Weapons Convention at home and abroad. He has number of articles published in National daily and journals to his credit. He has attended number of programmes at national media as spokesman of Bangladesh Armed Forces. Presently Col Mamun is serving as Senior Staff Officer at Armed Forces Division of Prime Minister's Office at Bangladesh and as the adviser on Civil Military Relation matters to Chairman, Bangladesh National Authority for Chemical Weapons Convention. Email: bnacwc@yahoo.com, mamun3921@yahoo.com

Ms. Nunsi Bella Pranatiwi graduated from the University of Gadjah Mada Indonesia with a Bachelor's Degree in Chemical Engineering in 2011. She works as an industrial analyst and staff in Directorate of Basic Chemical Industry, Directorate General of Chemical, Textile and Various Industry, Ministry of Industry, Republic of Indonesia.

She assist implementation of duties an obligation of national authority of Republic Indonesia. She also involved in regional cooperation related to chemical management, preparation of chemical database and preparation of OPCW The Field Exercise on Assistance and Emergency Response in Indonesia. Email: nunsipranatiwi@gmail.com, nunsipranatiwi@kemenperin.go.id

Ms. Melivia Demetriou is a career diplomat with the Ministry of Foreign Affairs of Cyprus since 2008. She is serving in the Security Policy Department, which is also the National Authority for Disarmament and Non Proliferation of Weapons of Mass Destruction, since June 2015. Melivia coordinates the Task Force on the first National Security Strategy of the Republic of Cyprus and covers, among other things, the EU Global Strategy process and Cyprus' bilateral cooperations on security matters. Prior to returning to the Ministry, Melivia completed a nine-month tour as a Transatlantic Diplomatic Fellow at the US Department of State, a four year posting in the Mission of Cyprus to the UN and before that, she served in the Cyprus Problem and Turkish Affairs Division and in the European Affairs Division of the Ministry. Melivia is a barrister-at-law, holds a MA (Oxon) in Jurisprudence from Oxford University and an MA in International Relations from Kings College, London. Email: mdemetriou@mfa.gov.cy

Mr.Tilak Raj Arora graduated from Kurukshetra University (India) with a first class in Chemistry in 1978. He obtained post-graduate degree with a first class in Chemistry from Institute of Chemist (India) in 1982.

He has over 30 years of work experience in development of new molecule of organo phosphorus, organo chlorine and their safe packaging and is actively involved in management & enforcement of chemical safety and security for schedule 2, schedule 3 and PSF chemicals. He is a member of Inter-Ministerial Working group (IMWG) for export of SCOMET items (transfer of scheduled chemicals). Presently he works as Technical Officer in National Authority of Chemical Weapons Convention, Cabinet Secretariat, Government of India.
Email: tilakr.arora@nic.in

Mr. Mohammad Hematyar was born in Tehran, Iran, in 1982. He completed M.Sc. in political affairs from the school of International relations affiliated to the ministry of foreign affairs, Tehran, Iran, in 2010.

He is an expert in the National Authority for Chemical Weapons Convention of I.R of Iran and he has also been taking responsibility as a member of special commission on chemical safety. His current research includes arm limitation and disarmament, safe use of chemicals and chemicals waste management. E mail: hematyar22@gmail.com

Eng. Ramzi Shasha graduated from the University of Technology (UOT) – Baghdad – Iraq, with a BSc degree in Chemical Engineering, in 1986. He joined the Ministry of Industry, his current employer, in 2008 and is following ever since the environmental and industrial concerns and all related conventions, particularly the CWC. He Introduced the draft of establishing the Lebanese National Authority to the Presidency of the Council of Ministers (PCM), in 2012, of which, and based on that draft, the PCM issued the decree No. 121/2012 in Aug. 2012, forming the National Authority which was later named as Lebanese Commission for Implementing of

CWC (LCIC). Eng. Shasha was assigned as a member of it and is following, ever since, the implementation of many of Lebanon's obligations towards the Convention, to name few; the Annual Declarations, Control on Scheduled Chemicals, Supervision on the Capacity Building Programs. He has also contributed in raising the safety measures among industries in general and in chemical industries particularly. Email: ramzi_shasha@yahoo.com, rshashaopcw@gmail.com

Ms. Farangis Pardes graduated from the University of Kabul in Pharmacy.

Presently she works as a chemical weapons prohibition officer in Afghanistan Atomic Energy High Commission, Kabul Afghanistan.

Email: farangis@aaehc.gov.af, farangis_pds@yahoo.com

Dr. Sadia Zaidi graduated from the University of Karachi in Chemistry in 2001. She obtained Ph.D in Organic Chemistry from H.E.J Research Institute of Chemistry, International Center for Chemical and Biological Sciences, University of Karachi.

She has 13 international publications. She participates and delivers lectures in national and international courses on Assistance and Protection against Chemical Weapons. She has presented the contribution of her country in Chemical Safety and Security Management in international forum. Presently her research interest mainly focuses on method development for the synthesis of organic compounds and their characterization through advance instruments. She is also responsible to ensure the safety and security of chemicals as a senior member of Chemical Laboratory Safety Committee at Defence Science and Technology Organization, Islamabad, Pakistan. Email: sadiazaidi124@yahoo.com

Mr. Vangchai VANG graduated Judicial Law from the National University of Laos in 2007. He received the francophone scholarship to continue his studies in International Law at University of Hanoi, Vietnam where he obtained his master degree in 2009. He works at the Ministry of Industry and Commerce. He is mainly responsible for coordinating with relevant agencies to review and revise the list of products subjected to import and export licensing regime in Lao PDR. He is also appointed as a focal point for the EU CBRN Centre of Excellence outreach program on the Export Control. Currently he works as a Deputy Director of Import and Export Management Division, Department of Import and Export in the Ministry of Industry and Commerce, Lao PDR. Email: vangchai.v@laomoic.org

Mr. Syed Abdul Mannan Gillani

Email: mannan_gilani73@yahoo.com

Group 1 Chemical Safety Best Practices for Chemical Industries	**Group 2** Chemical Security Practises (How to Promote)	**Group 3** Implementation Mechanism of Safety and Security Best Practises
Mr Khandaker Ruhul Amin **Rapporteur**	Mr Muhammad Zuber **Rapporteur**	Mr Vuthy Keo **Rapporteur**
Ms Rinzin Pemo **Presenter**	Mr Vangchai Vang **Presenter**	Ms Saleha Abd Rahman **Presenter**
Mr Zhiqian Wang	Ms Melivia Demetriou	Mr Zhaohui Yang
Mr Tilak Raj Arora	Ms Nunsi Pranatiwi	Mr Sunil Sharma
Mr Adam Wiryawan	Ms Farangis Pardes	Mr Amir Reza Khoy
Mr Ramzi Shasha	Mr Hamidi Bin Saidin	Mr Abdullah Mamun
Ms Sadia Zaidi	Mr Hamed Al-Bartumani	Mr Syed Abdul Gillani
Ms Asiri Perera	Mr Karunadasa Gamage	Ms Carmel Gacho
Mr Hamad Alsamahi	Mr Mohamed Alnuaimi	Mr Kingsley Rajapaksha
Mr Mohammad Hematyar	Mr Jochu Thinley	Mr Tu Nguyen

Questions to be addressed during the group discussion

Are you aware about chemical safety and security best practices?

Who is the implementation authority for best practices?

Do you have a National task force for investigation of safety and security incidents?

Do you teach/promote best practices in your country? Do you have a curriculum on safety and security for high school/undergraduate/ graduate level?

Do you have records/documents related to accident investigation?
Please provide any documents/ publications related to this.

How do you intend to contribute towards future chemical safety/ security in your country?

Do you have opportunities to meet with industrialists or to visit chemical industries, in order to support their initiatives and to promote best practices?

According to your understanding, what is the best implementation mechanism for chemical safety and security practices?