

# Lessons Learned in Chemical Safety: Bangladesh Perspective

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# Strategic Location of Bangladesh in South Asia



# Chemical Process Industries in Bangladesh

## (Public Sector)

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### ☀ 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 well drilling, gas processing and distribution

# Chemical/Process Industries in Bangladesh (Private Sector)

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- ☀ 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

**Textile Chemical manufacturing facilities will increase**

# Chemical Safety in Bangladesh

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Chemical safety deals with toxic chemical exposures, fire and explosion. In **Bangladesh** chemical accidents are related to following industries/facilities:

Chemical Process Industries

Textile and garments industries

Tanneries

Pesticides in farming

Gas cylinders/oil tankers (filling, transport and storage)

Chemical storage and transport

Chemical Disposal

# Accidents in Chemical Plants

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- ☀ 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

# Stripper Accident at the Urea Fertilizer Factory Ltd

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- ✱ An accident occurred with the stripper in the renovated 1,422 tons/day Urea Fertilizer Factory Limited (UFFL), located in Ghorashal, Bangladesh at 00:10 am on June 20, 1991
- ✱ 11 employees of UFFL died, several others including employees of Toyo Engineering Corporation (TEC), Japan, (the General Contractor) were injured
- ✱ Material loss: Estimated USD 62.5 million

# Incident Description

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- The plant was operated according to the start-up plan. CO<sub>2</sub> gas was flowing through the stripper. Liquid ammonia feed pump and recycle solution pump were started. The pressure of the ACES loop reached 160 kg/cm<sup>2</sup>G
- There were two loud explosion sounds. The high pressure stripper leaked to atmosphere. The stripper bottom fell out and the main body of the stripper was lifted up 30-35 ft and fell on the ground penetrated 14ft into the ground



# Consequences

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- ✱ The severed pipes released ammonia, CO<sub>2</sub> gases and urea and carbamate solutions
- ✱ The power in the control and adjoining areas went off
- ✱ About 50 people in and near the control room were affected and 7 (of total 11) died on spot

# Findings

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- ☀ **Defective fabrication** (i.e., welding) of stripper column
- ☀ **HAZOP** (or safety analyses) of the process was not done by the engineering contractor or the client
- ☀ Faulty facility layout and **poor design of control room** (inadequate exit facilities)
- ☀ Safety drills and procedures were not followed
- ☀ Absence of **emergency response procedure**

# Photographs



Stripper found after  
accident



Control room was 21 m away from the  
stripper, was on the second floor and  
with single exit stair

# 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 were 13 firemen**
- Fire Service and Civil Defense teams did not have sufficient training to deal with toxic chemicals



# 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



# Sundarbans Oil Spill

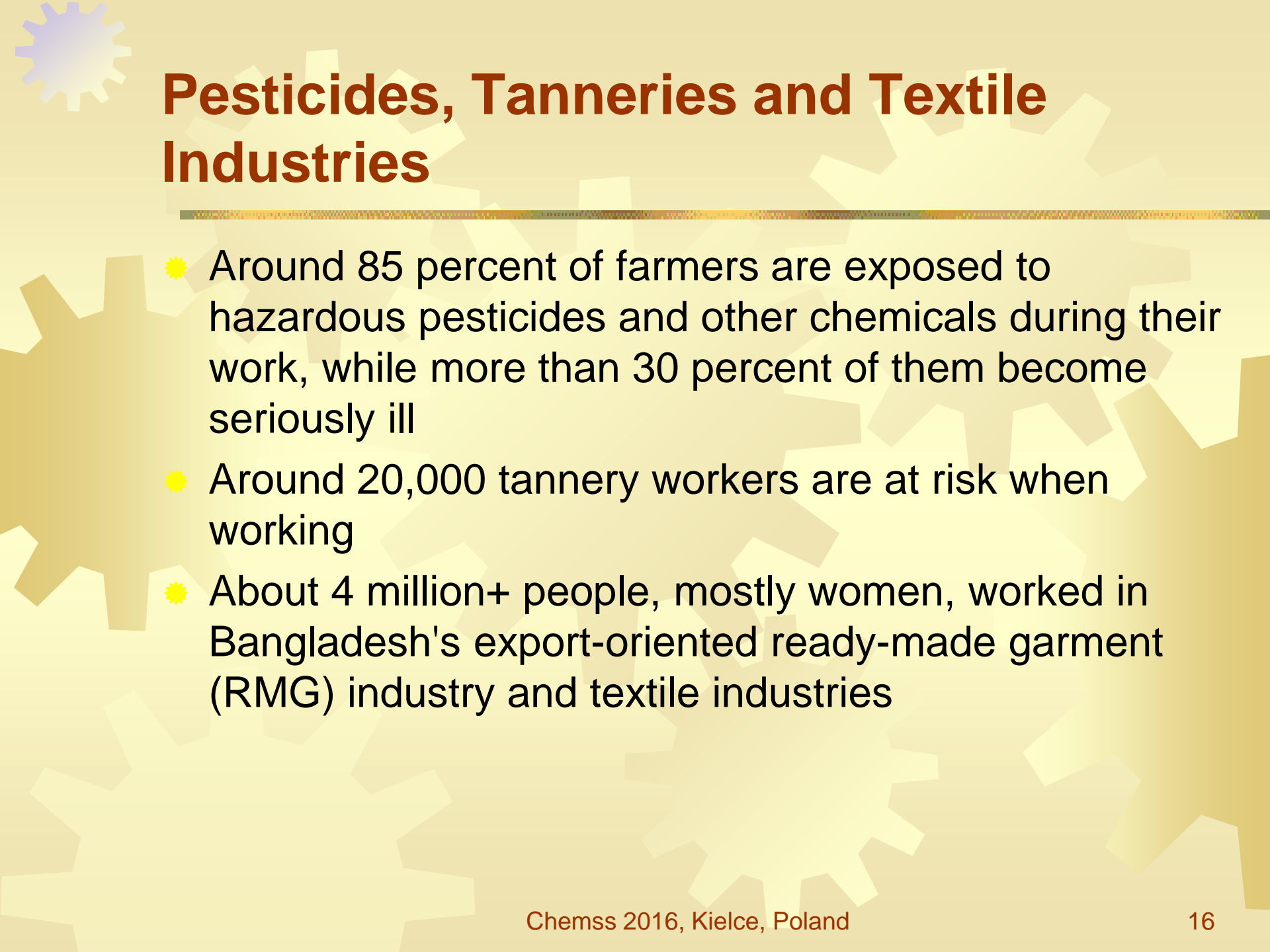
- Occurred on 9 December 2014 at the Shela River in Sundarbans, Bangladesh, a UNESCO World Heritage site. The spill occurred when an oil-tanker carrying 350,000 litres of furnace oil, was in collision with a cargo vessel and sank in the river. By December 17, the oil had spread over a 350 km<sup>2</sup> area.



# Cylinder/tanker Explosions

- ✦ Filling stations, factories, vehicles are susceptible to such explosions
- ✦ Ship-breaking yards in Chittagong is at high risk of explosion of gas cylinders and oil tankers





# Pesticides, Tanneries and Textile Industries

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- ✱ Around 85 percent of farmers are exposed to hazardous pesticides and other chemicals during their work, while more than 30 percent of them become seriously ill
- ✱ Around 20,000 tannery workers are at risk when working
- ✱ About 4 million+ people, mostly women, worked in Bangladesh's export-oriented ready-made garment (RMG) industry and textile industries



# Rules and Regulations

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- ✦ 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

	<b>Legislation</b>	<b>Enforcing agency</b>
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 1993	Atomic Energy Commission. Bangladesh

# Organizations Involved with Chemical and Industrial Safety Research/ Training/Assessment

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- ☀ **Bangladesh National Authority of CWC**, Armed Force Division
- ☀ **Industrial Safety Board**, The institution of Engineers, Bangladesh
- ☀ **Department of Chemical Engineering**, Bangladesh University of Engineering and Technology (BUET)
  - ☀ Offers courses/specialization at the graduate and undergraduate level
  - ☀ Carries out safety research/project works
  - ☀ Involves in safety assessment/certification/policy making
  - ☀ Just launched first ever formal industrial advisory board
  - ☀ Collaboration with **Mary Kay O'Connor Process Safety Center, Texas A & M University, US**



# Chemical Security/Crisis Management

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- ☀ Theft and diversion of chemicals to make a weapon
  - ☀ National Authority for CWC
- ☀ Catastrophic and intentional release of chemicals by sabotaging chemical processes/hazardous goods transport
  - ☀ Fire brigade, disaster management department

# Role of National Authority of CWC

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- ❖ Declaration
- ❖ Enrolment of Chemical Facilities
- ❖ Control and monitoring by Port Authority
- ❖ Inspections
- ❖ Training/Workshop

# Issues and Challenges Regarding Chemical Safety and Security

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- ❖ Lack of awareness/education and absence of safety culture
- ❖ Not being in the national priority list
- ❖ Coordination among different ministries
- ❖ Inadequate analytical capacity
- ❖ Scarcity of qualified/trained personnel
- ❖ Absence of comprehensive regulations and monitoring system

# Conclusion

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- ✦ Bangladesh is currently observing rapid growth of chemical process industries with a trend towards large and highly integrated production units with complex processes
- ✦ **‘Chemical Safety and Security’ is important for Bangladesh**
- ✦ National prioritization along with **regional/global cooperation** will facilitate the adaptation and implementation of chemical safety and security measures