

REPORT ON

**IUPAC-UNESCO-UNIDO SAFETY AND ENVIRONMENTAL
MANAGEMENT TRAINING PROGRAM**

At

**mitsui chemicals, inc. (mci),
j a p a n**

From 13th June to 3rd July, 2007

By

Godfred Ansah Nyarko

PROGRAM CO-ORDINATORS:

- **Dr. Mark C. Cesa**, Co-ordinator, IUPAC-UNESCO-UNIDO Safety Training Program, and Chair, IUPAC Committee on Chemistry and Industry.
- **Dr. Akira Ishitani**, Co-ordinator, Committee on Chemistry and Industry, Japan, and Executive Director, Kanagawa Academy of Science and Technology, Kanagawa, Japan.
- **Mr. Osamu Usui**, Co-ordinator, ESM Training Program, and General Manager, Safety & Environmental Division, Mitsui Chemicals, Inc. (MCI), Japan.
- **Mr. Hideki Fujimori**, Co-ordinator at ESM Training Centre, Iwakuni-Ohtake Works, Mitsui Chemicals, Inc. (MCI), Japan.

TRAINER:

Mr. Masayuki Shimizu, Management Advisor/Planning Director, Impress Tech. Company Limited, Nishisakae, Ohtake-City, Japan.

Supported by:

- **Mr. Yoshinori Taniguchi**, Safety & Environment Department, Iwakuni-Ohtake Works, MCI, Japan.
- **Mr. Teruo Takahashi**, Safety & Environment Dept., Iwakuni-Ohtake Works, MCI, Japan.
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TRAINEES:

1. **Fabian Benzo Moreira**, Lecturer, Faculty of Chemistry, University of Seguridad, Uruguay.
2. **Kenny Yip Kai Pui**, Production Superintendent, Mitsui Phenols Singapore PTE Limited, Singapore.
3. **Godfred Ansah Nyarko**, Health, Safety & Environmental Co-ordinator, Tema Lube Oil Company Limited, Tema, Ghana.

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1.0 INTRODUCTION

With the rapid changes taking place in the world today, there is an ever-increasing need to understand and control the problems associated with the working environment and hazards to man. Environmental and Safety issues and concerns are major emphasis of the workplaces agenda. Consequently, environmental and safety issues are now taking a central position in political, social and economic lives of the people.

It is upon these concerns that IUPAC-UNESCO-UNIDO organises this Environmental and Safety Management Training Program to allow safety experts globally to participate and learn more about safety and environmental protection measures by visiting and working with other counterparts at IUPAC Company Associates facilities.

I was privileged to be selected for the training program, which started on 13th June, and end on 3rd July 2007 at Mitsui Chemicals Inc. (MCI) in Japan. MCI is a Chemical Manufacturing Company that contributes broadly to society by providing high-quality products and services to customers through innovations and the creation of materials with the wonder of Chemistry, while keeping harmony with the global environment.

2.0 TRAINING PROGRAM

The training program consisted of the following:

- i. Plant tours
- ii. Sightseeing
- iii. Lectures

2.1 PLANT TOURS

Trainees visited the entire Iwakuni-Ohtake Works to learn and understand how they handle the environmental and safety issues. Work areas toured include the Plant's Installations, Safety Laboratory, Utility Sections, Landfill Facility and Wastewater Treatment Facilities.

Trainees also visited the MCI's Research and Development Centre at Sodegaura Centre in Tokyo. The Sodegaura Centre is one of the largest Research Centres in Japan and engages in generating new products and technologies with much concern about its implications on the environment.

2.2 SIGHTSEEING

Trainees visited some of the most memorable and important places in Japan that are World Cultural Heritage Sites and Natural Treasures of Japan. It was realised that safety and environmental concerns were incorporated in the construction of those places visited. The good maintenance culture of those places also solidifies the safety of the structures and promotes environmental conservation.

The places visited included:

- **The Kintai Bridge** at Iwakuni – the bridge is renowned as one of Japan’s “three celebrated bridges”. It is worthy seeing because of wonderful combination of its structurally sophisticated wooden framework and the surrounding natural scenic beauty of fresh greenery of nearby mountain and stream, testifying how safety and environmental concerns were taken during its construction.
- **Iwakuni and Nijo Castles** – the most significant figure of both Castles is that most of the materials used to construct them were wood with much safety considerations.
- **Kikko Park** – it is a garden full of different and beautiful flowers that are in bloom throughout the year. It shows how Nature, when well preserved, makes the environment healthy.
- **Bamboo Forest** – Trainees were pleased to see a very large bamboo forest, which characterises how good maintenance culture can help preserve a natural resource.
- **Hiroshima Peace Memorial Meseum**
Trainees visited the Peace Memorial Museum to learn that elimination of nuclear weapon of any type will bring peace to the world community and thereby protecting the environmental resources.

2.3 LECTURES

The lectures were organised at Iwakuni-Ohtake Works (at Iwakuni), one of the subsidiary Companies of MCI Group. The principal lecturer was Mr. Masayuki Shimizu, a Japanese.

Topics treated were:

2.3.1 Environmental and Safety Management (ESM) Audits Checklist

Environmental and Safety Management (ESM) Audits Checklists of trainees’ organisations were reviewed to identify the weak points in health, safety and environmental activities and find ways of improving them using the six (6) M Aspects approach.

The 6M Aspects are Management, Man, Method, Machine, Material and Media (i.e. the working environments). It was learnt that all the aspects have to be considered important in conducting or investigating an organisation’s ESM activities to ensure proper assessment because they all work together in chain.

2.3.2 Production Plants’ Safety Activities

a) **Protective Barriers of Accident**

In this subject, it was learnt that there are three (3) Protective Barriers of Accident and these are: Protective Safety, Preventive Safety and Proactive Safety.

- **Protective Safety** – this is a type of safety in which measures are only taken as corrective actions after an accident has occurred. Types of accident under the protective safety are Lost Work Cases and Restricted Work Cases.

- *Preventive Safety* – in this type of safety, control measures that are taken as preventive actions are not so effective. Accidents such as like Medical Treatment Cases, First Aid Cases and Near-misses normally occur.
- *Proactive Safety* – in this type of safety, the control measures are so effective that only Near-misses, most of the times, are reported.

b) Basic Thoughts on Prevention of Accidents

We learnt about the Principles of Safety Control and Implementation of Safety Activities.

i) In Principles of Safety Control, there are **five (5) causes of Accident** in any workplace. These are:

- Management Causes
- Safety Control Causes
- Human Causes
- Unsafe Behaviour Causes
- Unsafe State Causes

Each of these causes of accident has its corresponding factor of safety control making **five (5) factors of Safety Controls**. These are:

- Top Ware (safety policy, leadership, job control human relations and morals)
- Soft Ware (control system and standardisation)
- Human Ware-1 (knowledge, skill, carelessness anxiety and fatigue, etc.)
- Human Ware-2 (work behaviour, work position & danger, approaches to danger and lack of co-worker)
- Hard Ware (equipment, tools, working conditions and work methods).

Subject on **Safety Measures by 5M techniques** was also studied. The 5 M techniques are *measure for management, measure for man, measure for machines/ equipment, measure for media (work environment), and measure for materials and parts*. Each of the five measures intersects with the measure for management to form effective safety control system.

ii) In Implementation of Safety Activities, there are **four (4) Pillars of Safety Management**. These are:

- Establishment of whole Safety Control System
- Thorough Line Management
- Self- Management by Each Worker
- Equipment management (100% Safety)

Each of the four pillars has its corresponding direction of activities and this makes **four (4) Directions of Implementing Safety Activities**.

These are:

- Establishment of Safety Control Promotion System
- Unusual Situations Measures and Strengthen Training
- Improvement Activities, Danger Prediction and Finger Pointing Calls
- Accident Prevention Activities

It was also realised that the Total Percentage Causes of Accident are distributed as illustrated below:

- Unsafe State = 5%
- Unsafe Behaviour = 15%
- Unsafe Behaviour & Unsafe State = 75%
- Natural Disaster = 5%

c) Accident Investigation

In investigating an accident, a 5W1H approach is used and these are **when, where, why, who, what and how**. These are used in connection with the 6M Aspects as indicated in section 2.3.1 above.

d) Danger Prediction and Finger Pointing Calls

Danger Prediction is a means of perceiving a danger ahead of an operation/action i.e. danger factors that are hidden in the existing condition. Finger pointing calls is a surety way of confirming safety prior to an action is taken and the finger is pointed only to the object under focus. Danger Prediction and Finger Pointing Calls is a recognition and confirmation of an accident prevention and works as a strong weapon to prevent human errors.

A video clip was shown as an illustration of how danger is predicted and a finger is pointed to the object with calls. Each trainee was similarly asked to illustrate the action.

It was realised therefore that there are **five (5) ways of encouraging Finger Pointing and Calling** in an organisation.

- i. The top management and supervisors should practise it to set as an example to the general work force.
- ii. Everyone in a workplace should participate it, i.e. everyone does it.
- iii. The main objects concerned should be chosen, and then each object is called one by one.
- iv. Staff at workplaces should practise and discuss the finger pointing calling daily.
- v. Finger Pointing and Calling should be made part of hazard prediction program.

2.3.3 Works' ESM

a) Establishment of ESM Yearly Plan

In this subject, I learnt how to establish ESM Yearly Plan using two different methods known as the T-type Matrix and the PDCA. The PDCA stands for Plan, Do, Check and Action. The T-type Matrix is used for setting yearly Health, Safety and Environmental targets while the PDCA is used for establishing yearly Continuous Improvement Procedures.

Each trainee was asked to develop his organisation's ESM year plan using these methods based on his own organisational policy.

Each plan was dully discussed and recommendations were made. Sample of an organisational ESM chart was discussed to indicate how health, safety and environment play an important role in any organisation. Both methods of establishing ESM yearly plan are very useful as they provide responsibilities of executing ESM activities, training, emergency action management, verification and monitoring/measurement, nonconformities and internal audits.

b) Levels of Thought

We also learnt something about Levels of Thought that are used in daily activities to ensure proper planning and good results. There are **four (4) Levels of Thoughts**:

- **Belief** – what one believes in a certain matter.
- **Principle**- overall guidance while one takes an action.
- **Concept** – something that one thinks about and wants to achieve.
- **Design** – conclude the plan with 5W1H (refer 2.3.2c) to achieve the matter.

2.3.4 Process Accident Prevention

a) Static Electricity

In this study, a static electricity is generated by contact, separation and friction. Practical illustration of static electricity was demonstrated at the laboratory where its principles of generation were shown. The hazards and failures caused by static electricity are explosion and fire, electrical shock and production failures.

The Safety Measure for static electricity is the prevention measures of explosion and fire. These are:

- Removal and isolation of ignition source
- Removal of air and oxygen
- Handling of flammable material in enclosed space
- Ventilation system of explosive synthesis gas
- Replacement and sealing of flammable material by inert gas
- Stoppage of deliveries and blocking flammable material
- Power exhaust and forced cooling of flammable material

b) HAZOP Studies

HAZOP is a technique that is used in new plant construction/installation and expansion, and maintenance of plant machinery to estimate plant hazard degree. HAZOP comes from the words **Hazard** and **Operability** Studies; where hazard is the physical condition suspected which can cause damage to life and property. Operability means operation and operationality.

i) Basic Procedures of HAZOP Study

There are **nine (9) basic procedures in the application of HAZOP studies** to ensure total plant safety. The procedures are in this order of stages -

Stage 1: Selection of object line and equipment.

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Stage 2: Application of guidewords.

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Stage 3: Assortment of guidewords and process parameter (i.e. assumption of deviations).
Stage 4: Research of the first cause (i.e. production process).
Stage 5: Studying of the results and affection to the system.
Stage 6: Studying of the existing safety countermeasures (i.e. detection, prevention and protective equipment)
Stage 7: Studying additional countermeasures and extraction of separate studying items.
Stage 8: Recording of the above studied results.
Stage 9: Utilization of the results.

ii) *The Position of Safety Evaluation Techniques in HAZOP Study*

A Process Safety of a chemical production plant was used as a case study to explain and determine the safety evaluation position techniques from the plant's basic design to the engineering works through to the official run. The case study enabled me to apply the principles of HAZOP study in identifying hazards associated with new plant installation.

2.3.5 Environmental Management

a) *Environmental Management*

The purpose of establishing, implementing and maintaining an Environmental Policy was studied using that of Iwakuni-Ohtake Works (MCI) as reference. Wastes effluent treatment processes were studied, also using the treatment processes of activated sludge of Iwakuni-Ohtake Works as case study. The operations incineration processes, boiler house activities and landfill facilities of Iwakuni-Ohtake Works were taught with discussions and with video clips. The studies and discussions were to determine the Environmental Measures for industries particularly the chemical industries.

The concept of 3R (Reduce, Reuse and Recycle) in Plant's operation was taught as the best way of controlling industrial wastes to prevent environmental pollution.

3.0 APPLICATION OF TRAINING ITEMS

<u>Training Items</u>	<u>Points of Training</u>	<u>Application</u>
1. ESM Audit	ESM audits by Six (6)M Aspects	To use as an auditing tool to identify weak points in my company's HSE activities and make recommendations for improvement.
2. Production Plant Safety Activity	i. Accident Pyramid and Prevention of Human Errors ii. Pillars of Safety Management iii. Danger Prediction iv. Finger Pointing Calls	To set workplace Accident Preventive Measures using the 5W1H techniques and the System Diagram approach. To use as effective tool for Plant-wide Safety. To use as key to Accident Prevention at my workplace. To establish Finger Pointing Calls culture Plant-wide as Safety confirmation.
3. Work's ESM	i. ESM Yearly Plan by T-type Matrix ii. ESM Yearly Plan using PDCA	To set yearly HSE targets for my company To establish Continuous Improvement Procedures for my company
4. Process Accident Prevention	i. HAZOP Study ii. Static Electricity	To introduce Safety Evaluation Position Techniques in equipment installation and maintenance. To create awareness of dangers caused by Static Electricity.
5. Environment Management	i. Wastes Management Procedures and Facilities ii. 3R: Reduce, Reuse & Recycle	As an additional guide for Plant's Wastes monitoring To apply the 3R concept in the Plant 's operations
6. Hazard Evaluation	Hazard Evaluation of reactions and explosions by test equipment	To use as an effective tool for ensuring Laboratory and Chemical Stores' Safety

I will make great use of the training items to organise educational seminars for members of SHEPA (Safety, Health & Environmental Practitioners Association of Ghana), and GIPAC (Ghana Institute for Pure and Applied Chemistry). I will also establish a Chemical Health and Safety Division in GIPAC.

4.0 COMMITMENTS

i. Place of Work

The new learnt items from the training will be used to strive for continuous improvement in achieving higher standards of Safety and Environmental Management at Tema Lube oil Company Limited.

ii. Other Places of Work and Professional Bodies

The acquired knowledge from the training will be used to help promote Proactive Safety at other Workplaces in Ghana and organise educational seminars for members of chemistry-related professional bodies.

5.0 EVALUATION OF TRAINING PROGRAMME

The training program was very useful as it provided new techniques and ideas that can be used to promote and improve the Health, Safety and Environmental Management Systems of industries, educational institutions and other places of work.

The training was very interactive and interesting. The principal trainer taught with practical experience and examples. Trainees were allowed to contribute effectively and that ensured high trainer-trainee participation.

As we look toward the future with the sustained trainees, the possibilities of improving safety, health and environment in the workplace and at home are remarkable.

6.0 RECOMMENDATIONS

To further help improve and maintain the Safety Training Program, the following recommendations are made for consideration:

- Trainees to be contacted regularly, supported materially such as mobile computers, and be used as supporting trainers for future programs.
- Extension of program period from three (3) to four (4) weeks to allow enough time for the program.
- Information Technology should be added to the program content to enable trainees to upgrade their knowledge.

I thank all for your kind support.

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