IUPAC – UNESCO - UNIDO

Safety Training Programme
at
NOVOZYMES, A/S

Bagsvaerd, DENMARK
(16th June 2008 to 27th June 2008)

Report of the visit and training

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1.0 Introduction:

The IUPAC-UNESCO-UNIDO Safety Training Program is designed for safety experts from developing countries to learn more about safety and environmental protective measures by visiting and working in plants of IUPAC Company Associates in the industrialized world.

IUPAC, with the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the United Nations International Development Organization (UNIDO), have established and maintained the Safety Training Program to promote interactions between developed countries and the developing world to disseminate state-of-the-art knowledge on safety and environmental protection in chemical production.

Each scientist or an engineer selected into the Safety training programme is assigned to an IUPAC Company associate in an industrialized country. The period of the training is generally 2-3 weeks. The trainees are provided with travel expenses, subsistence and accommodation.

I have been very fortunate to be selected to undertake the safety training at Novozymes, A/S Denmark, who have been very kind and gracious to accept my nomination and spend two weeks at their site at Copenhagen, Denmark. The training programme was conducted for two weeks during 16th June 2008 and 27th June 2008.

2.0 List of persons met at Novozymes:

1. Ms. Nadia El-Salanti: Manager, Working Environment, Organizational psychologist
2. Dr. Mr. Ture Damhus, Senior Science Manager in R&D
3. Ms. Anne Mette Nissen Lykke: Safety adviser, Working environment, Specialist in Enzyme Safety
4. Ms. Ulla Muller: Safety adviser, Working Environment, Specialist in chemical safety and lab safety
5. Dr. Mr. Anders Ingemann Larsen: Manager, Medical Centre
6. Ms. Marianne Kjellow Andersen; Occupational Nurse, Medical Centre
7. Mr. Kjeld Bagge: Safety adviser, Working Environment, Ergonomic safety
8. Mr. Lars Peter Jepsen: Manager, Quality Assurance and Quality Management
9. Ms. Julie Rosbo: Management System Specialist in the Dept. for Quality Systems Development
10. Mr. Arne Nielsen: Safety Adviser, Working environment, Specialist in ventilation systems and indoor climate
11. Mr. Thomas Ellegaard, Fire-& Security adviser
12. Mr. Kent Nybo Molsted, Manager, Environmental Services
13. Dr. Finn Joensen (Research Director, Haldor Topsoe).

14. Dr. Sven E. Harnung (Former HOD, Chemistry Department, University of Copenhagen)

3.0 Training highlights:

The training programme undertaken at Novozymes was held in an atmosphere of utmost cordiality. Ms. Nadia El-Salanti, Dr. Mr. Ture Damhus and Ms. Anne Mette Nissen Lykke were the main coordinators of the programme who had devised the whole itinerary and made arrangements for the meetings, discussions and visits to facilities and pilot plant at Novozymes.
Brief visits were also organized to Haldor Topsoe and the University of Copenhagen. A copy of the itinerary from the host company is attached as Annexure 1.

The topics covered during the training programme at NOVOZYMES include:

- OH& S systems
- Risk assessment
- MSDS, PPE, storage of chemicals, ventilation etc
- Health risk assessment
- Ergonomics
- Quality assurance
- Accident reporting and investigation
- Crisis and disaster management
- Environmental services

In addition visit to labs and pilot plant facility for the fermentation processes and granulation of enzymes. A summary of various topics covered during the safety training is as under:

3.1 Occupational Health and Safety systems:

Ms. Nadia El-Salanti and Ms. Anne Mette Nissen Lykke presented an overview of Novozymes, its vision, and businesses and of course the Occupational Health and Safety systems at Novozymes, and the role of "Working Environment" department, that takes lead in the development, monitoring and review of all safety systems.

Since Novozymes is an enzyme production facility along with related R & D activities, the main focus of OH&S systems and protocols are focused on prevention of enzyme exposure (dermal or inhalation) that may lead to allergy. However, OH&S systems, documentation and procedures are being strictly observed in all departments.

I had interactions with other group leaders from each of the functions to gain deeper insights. It was during this that I realized that the working environment

division is very effective and a dynamic department. It has a good written (& declared) policy with defined roles and responsibilities. It therefore serves a very useful tool for reference to fall back upon leaving no ambiguity for staff and workers. Although it apparently, makes the system quite complicated!!

3.2 Risk assessment:

Risk assessment is the fundamental pillar of any safe operation in a production facility or research environment and is very effectively implemented at Novozymes.
A case study of a risk assessment carried out in the lab for the import and use of a chemical was presented followed by discussions. Since the chemical involved was a heavy metal with proven carcinogenic activity, the control procedures recommended for handling and use of the chemical were very stringent, often running to extremes.

In another case of risk assessment from an activity in the detergent chemistry lab involving exposure to detergent, repetitive work, use of hot plates for heating large volume liquids was evaluated. In the process, several suggestions were also made for consideration.

I was also nominated as a part of the team conducting a risk assessment for the activity of total shifting of a working laboratory from one building to new premises.

I realized that risk assessment is an important and integral part of all activities, however trivial or complex. A thorough (although qualitative) risk evaluation and actions proposed to mitigate the situation is essential and rewarding.

3.3 Material Safety Data Sheets (MSDS)**:**

The material safety data sheet is a very important document with essential information about the chemical / formulation that lets the user know about its properties, hazards, reactivity and information about transport, handling, storage and emergency actions. The discussions at Novozymes revealed the importance the organization attaches to this humble but powerful document. At Novozymes, before the MSDS is issued for the employees; 3 experts from the designated field validate the data and also include Novozymes specific advice and notes. This was something unique and praiseworthy.

In India, the supplier of a chemical is not obliged to give a copy of the MSDS along with the material. Nevertheless, his employee provides the end user with the MSDS or he can access it through open sources/ Internet. However, it is observed that there is a general neglect in the use of MSDS in academic institutions and research centers. This situation is alarming and needs correction.

3.4 Ergonomics:

During the meeting and discussions with Dr. Kjeld Bagge, the company's policy and guidelines for physical work, computer work and laboratory activities were presented. He also highlighted the importance of this aspect with reference to reduce work related injuries and also improve efficiency.
Proper procedures for experimental work are very important. Even more important is the role of the manager to identify the work related hazards and provide solutions to the same.

3.5 Accident reporting and investigation:

Accident reports and analysis forms the basis for understanding weaknesses, both in man and machine. In an industry accident reporting is mandatory as per the law. Once in the database, it gets more visibility for incident investigation and remedial measures.

Novozymes has a unique system for accident reporting. This is an online system, which allows the user to report occupational accidents, near misses and hazardous conditions as per format. Accident investigation is both science and an art. But to make it perfect, a sequence has been incorporated in the reporting format. That includes incident description, recommendations / proposals for improvements and preventive measures. Time targets follow this up with responsibility for actions. Features in the system for accident investigation logs, reports, analysis and links to other databases make the system complete. The call is closed only after a review of the actions taken in one year.

3.6 Crisis and disaster management:

The meeting and discussions with Mr. Thomas Ellegaard, Fire & Security advisor were very stimulating and useful. We shared experiences in handling emergency situations of chemical fires, toxic gas leakage etc. He presented a detailed account of the systems and procedures of the management of disasters and preparedness for these. In order to see that the number of incidents is kept to a minimum, he also participates in the risk assessment exercises. Insurance of the organisation was also discussed.
The key component to a crisis being the contingency and recovery plans. This is one strong lesson that I am going to take with me and arrange to implement this. We also agreed to share information in future.

3.7 Environmental services:

Novozymes actively contributes to the environmental protection and thus contributing to social responsibility in its own unique way. Besides meeting the

regulatory requirements of gaseous, solid and liquid discharges, it transforms its solid waste into manure that is used effectively in agricultural lands in Denmark.

4.0 Path forward:

4.1 Local institution:

In view of the large number of staff and students engaged in research activities in many disciplines of chemistry, chemical engineering and biochemistry, and the gaps that now seem wider than before, there is an urgent need to strengthen the application of safety systems in the work place. Accordingly, the following activities are proposed for implementation:

1. To create lasting awareness about hazardous, toxic or flammable nature of chemicals that may have far reaching implications. It is therefore proposed to popularize the utilization of MSDS on a regular basis.
2. Introduce the practice of risk assessment in key operations.
3. Develop and apply controls for such operations (including SOP's)
4. Develop emergency evacuation plans and conduct drills.
5. Appropriate solvent storage facilities in labs.
6. Create and standardise toxic and hazardous waste disposal systems.
7. Strengthen local systems & solutions.
8. Regulate procedures & documentation.

4.2 Plans for local / state level:

It is observed that there is virtually no awareness on the hazards and toxicity of most chemicals at high school and junior college level. Accordingly the following activities are proposed for implementation in that order:

1. Create basic awareness of safety in a chemistry lab, with emphasis on hazards and toxic behavior of chemicals generally used. This may be achieved by holding seminars, group discussions and exhibitions etc.
2. Specifically, one school & a college may be chosen to initiate an awareness drive for understanding hazards and toxicity behavior of chemicals. This may be followed by a systematic education on the fundamental principles of health and safety to make them aware of the benefits of safe operations.
3. Recommend revision of the practical lessons in textbooks to substitute / exclude the use of hazardous and toxic reagents and include safe procedures.

5.0 Suggestions for improvement of the programme:

The structure of the programme in the present form is very good with excellent support form IUPAC and the host company, at times exceeding expectations and needs. I have the following suggestions:

1. Since the programme is meant for experts at the supervisory or managerial levels, the training level bar needs to be raised further.

2. The title of the programme may also be suitable amended from "IUPAC-UNESCO-UNIDO Training programme to " IUPAC-UNESCO-UNIDO Fellowship programme".

3. IUPAC should provide an official mandate in the form of a "mission project" to implement safety awareness programme. Such an official mandate will lend genuine credibility, wider acceptability and respect to the trainer and IUPAC both.

4. The follow-up and implementation of the plan of work must be appropriately funded.

6.0 Evaluation of the training programme at Novozymes:

I consider myself to be very fortunate to have been selected for the training at Novozymes. The staff at the department of working environment led by Ms. Nadia El -Salanti along with the able cooperation of Ms. Anne Mette Nissen Lykke and Dr. Ture Damhus had made superb arrangements and facilities (providing office space, laptop & a telephone) that I felt just at home. Right from the time I landed, I had the excellent company in Ture, Nadia and Anne Matte. They took exceptional care of me both in Novozymes and outside with social trips and family dinners.

Professionally, it was quite a rewarding exercise to learn about the safety systems, procedures and its implementation at Novozymes through meetings, discussions, presentations and visits to pilot facilities. I appeared to be the most privileged guest at Novozymes with all facilities open to me.

Although it was not a part of the preset programme, but just because I wished, I also got to briefly tour the department of chemical engineering at Haldor Topsoe and the department of chemistry at the University of Copenhagen, as a bonus. Thanks are due to Dr. Ture Damhus for his efforts to fix up last minute appointments and make the visits possible.

The training programme was very well organized with meetings and discussions fixed with all relevant sectional heads related to SHE. There were plenty of fruitful discussions and exchange of information.

During the visit, a seminar was also organized for a chemistry research group where I had an opportunity to show case the research activities of NCL and my research interests. In addition, I also gave a seminar to the working environment group on my last day at Novozymes, summarizing my visit and experiences. A copy of these two presentations is attached as Annexure2 and Annexure 3.

7.0 Acknowledgements:

I express my deep sense of gratitude to IUPAC, UNESCO & UNIDO for giving me the rare opportunity to undertake the safety training at Novozymes A/S, Denmark. I am particularly obliged to Dr. Mark Cesa, Chairman, IUPAC Committee on Chemistry and Industry & Coordinator, IUPAC-UNESCO-UNIDO Safety Training Program for taking personal interest in my candidature and seeing it through till the end.

I am thankful to Mr. Flemming Funch, Vice President in Novozymes and responsible for Quality, Environment and Safety for having agreed to accept and host my visit at Novozymes. I sincerely thank and appreciate Ms. Nadia El-Salanti, Dr. Mr. Ture Damhus and Ms. Anne Mette Nissen Lykke for gracious hospitality, articulate planning and arrangements with their personal and professional commitment to make my stay and training a success. I gratefully acknowledge the support and cooperation that I received form all the members of Novozymes and in particular at the Working Environment department, without which the stay and training would have been pale and tasteless.

I thank Dr. Finn Joensen (Research Director, Haldor Topsoe) and Dr. Sven E. Harnung (Former HOD, Chemistry Department, University of Copenhagen) for taking time out and guiding me through their departments. These visits provided me with a glimpse of the working environment in a R & D laboratory and an academic institution.

I am obliged to Dr. S.Sivaram, Director, National Chemical Laboratory, Pune for introducing and nominating me to the IUPAC safety-training programme. I also thank him for his ever inspiring guidance, advice, support and encouragement to see that safety at NCL always gets a first priority.

Annexures (see separate attached files)

Annexure 1: A copy of the training schedule at Novozymes.

Annexure 2: A copy of the slides used for a seminar to the chemistry research group at Novozymes on 26th June 2008.

Annexure 3. A copy of the slides used for a seminar to the “working environment” group on the last day of training at Novozymes on 26th June 2008.