

# **PROJECT REPORT**

## **IUPAC**

### **SAFETY TRAINING PROGRAM – INDIA REGIONAL PROJECT**

### **(PROJECT #2017-032-3-022)**

**By**

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## **1.0 INTRODUCTION AND BACKGROUND**

With a few exceptions, Indian universities and other R & D institutions generally have a rather slack safety set up and the focus and attention on laboratory safety is minimal and so is the investment. The society is generally unaware, unwilling and unable to follow safe practices either for want of resources or an inherent carefree attitude.

The prime objective of the project therefore is to undertake safety awareness programs, sensitize and alert teachers, managers and students to follow and comply with standard safety norms while working with chemicals, with consequential benefits of personal safety and good health at a workplace / chemical laboratory.

In order to have a wider reach, it was proposed to travel and reach out to varied audiences at their doorsteps at an average of about 6 visits per year (target of approx. 300 – 400 subjects). With this challenging approach, it is expected to touch a larger and a varied section of the audience.

This project also acts as a link to create an IUPAC assisted setup in India and to achieve the broader objectives of IUPAC, under the Safety Training Program (STP) of Committee on Chemistry and Industry (COCI). Thus, the visibility of IUPAC and its mandate also gets highlighted.

## **2.0 APPROACH AND METHODOLOGY ADOPTED**

It is a common practice to organise conferences and workshops at a selected site and invite participants to attend. India is a large country and geographically spread out. Thus, inviting participants from all parts of the country would not only entail problems on travel, accommodation but also host of other logistics problems, the organisation of which requires large funding and manpower.

It was therefore felt prudent to travel and reach out to the college and university students, institutions in almost all regions in India, by visiting and conducting in-service safety seminars. With this challenging approach, it is expected to touch a larger and a varied section of the audience. Further, this also gives an opportunity to visit the colleges, their laboratories and experience the facilities, infrastructure and working practices. With such a personal approach and with suggestions pertaining to their set up, it is also expected that the students will get to know more on hazards and risks of chemical operations, while the visited institutions will assign priority to safety.

The benefits of visiting the colleges and institutions and giving in service seminars also include IUPAC's enhanced visibility pan India and its commitment to Safety Health and Environment.

As a first step, letters were sent across India, to several heads of institutions of Universities, colleges, R&D organizations from academia and industry. In addition, contacts were established with fellow friends and colleagues known to be active and supporting the cause of laboratory safety. Although, the response to the formal letters sent out was poor, in contrast, the personal contacts responded very enthusiastically and thus the program on safety orientation took off.

### **3.0 IN SERVICE SEMINARS**

During the course of one year's tenure of the project, 8 in-service seminars were held. Most in-service seminars were of more than 2 hours duration followed by discussions. Laboratory visits and tours were also taken to understand the ground reality of the laboratory facilities and working practices. In-service seminars conducted in outstation were of generally 3-5 days duration. In such cases besides conducting multiple seminars for a wide selection of audiences, safety inspections were also carried out and suggestions given to improve.

Being an India central project, efforts were made to initiate in-service seminars all around the country, as is indicated below:

1. Central India: Have continued to conduct safety orientation seminars for UG & PG students in and around Pune, (Maharashtra) including Kolhapur (~350Km.) and Nanded (~550 Km)
2. East India: Have also travelled outside Pune to conduct safety orientation – at IISER Kolkata, (West Bengal) (~1800Km)
3. North India: Visit to IIT Mandi (Himachal Pradesh) (~1500Km).
4. South India: Proposal forwarded by IUPAC100 to conduct safety orientation at a Women's college in Kerala (~1200Km), is currently on hold, due to non availability of suitable dates and other local issues within the host college. I am in touch with the champion at the Women's college and it is hoped that the proposal will be revived soon.

Table 1 lists the institutions visited during the project duration. Details of the in service seminars conducted are as under:

1. 27<sup>th</sup> September 2018 : Invited as a resource person in the Workshop on 'Safety in Laboratory' conducted at the Department of Chemistry, Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016. The workshop was sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India. The targeted participants included Non -Teaching staff of Science faculty of the Modern College as well as 8 other science colleges from Pune. The medium of communication was in the local language – Marathi and Hindi.

Non teaching staffs in a science college are generally science undergraduates (and work as laboratory attendants and helpers who normally assist the students in preparation of stock solutions, distribution of laboratory supplies during an experiment, maintenance of laboratory facilities, receipt and storage of chemicals and much more. With so much of a responsibility, the amount of formal training that these receive is minimal.



It is therefore challenging to address and train them and sensitise and alert them of the hazards of chemicals, risk assessment, their health and safety etc. But the three hours presentation and discussions during and after the seminar were indications that the job was done.

2. Friday, 5th October 2018: Invited by the Department of Chemistry, MES Abbasaheb Garware College, Pune 411004 (Maharashtra) for a series of two lectures for M.Sc. students from the Department of Biotechnology, Biodiversity, Chemistry and Microbiology who have opted for safety as an additional credit course at Part II level. About 100 students were expected to attend.

Accordingly, a series of two seminars was delivered entitled “Developing Health and Safety Culture in a Science laboratory” with a total duration of 3 hours. The students were briefed about the unsafe conditions and practices in laboratories and elsewhere and the need to identify these and respond in time. The seminar included learning of hazards, their information, risk assessments and simple ways to stay safe in a laboratory by understanding the chemicals and following SOPs. Finally, actions to be taken in case of an emergency were also included.

The lectures were supplemented with examples, case studies and video clips.

3. Friday 12th October 2018: Invited for delivering a talk on 'Laboratory Safety' for the Post graduate students at the Department of Chemistry, Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016. The prospective students were M.Sc. Part II Chemistry and M.Sc. Part II Microbiology and the seminar would for a part of their 4 credit coursework under Skill based Extra credit course.

90 students participated in the seminars and interacted very enthusiastically during the more than 3 hours time. The theme of the seminars was to ensure lab safety

and good health. The lectures were supplemented with examples, case studies and video clips.

4. Tuesday, 22<sup>nd</sup> January 2019 : Invited to be the Chief Resource person for a one day workshop on Laboratory Safety at the School of Science at the Sanjay Ghodavat University, Hatkanangale, Kolhapur 416118 (Maharashtra). The theme of the workshop was “BE AWARE, TAKE CARE! PRACTICE SAFE SCIENCE.”

Undergraduate and postgraduate students and the respective science faculty attended the safety workshop from a) School of Science, Sanjay Ghodavat University, Kolhapur, Maharashtra b) Jaysingpur College, Jaysingpur, Kolhapur, Maharashtra c) DKA Science College, Ichalkaranji, Kolhapur, Maharashtra, d) Students and faculty from the departments of Physics and Engineering of Sanjay Ghodavat University, Kolhapur. The total no of registered participants were 381 (B.A. 271, M.Sc. 110).

Ahead of the workshop and the seminars, a meeting was held with the University Management, Principal and other faculty members. A visit to different science laboratories was also undertaken to see the facilities and work practices.

The seminar conducted in the auditorium was attended by more than 250 students in addition to faculty and management. The seminars lasted more than 3 hours without a break. The lectures were well taken and followed by question answer session.



A demonstration of Fire safety with hands on exposure to handling portable fire extinguishers was also arranged in which students participated. Many concepts and practical skills on operation of fire extinguishers were shared with students and the Fire safety expert.

5. Monday, 28<sup>th</sup> January 2019 to Friday 1<sup>st</sup> February 2019 (5 days): Invited to visit Indian Institute of Science Education and Research, Kolkata (IISER-K) for a week and to interact with faculty, researchers and other staff, deliver safety training seminars etc.

A seminar was organised by the Department of Chemical Science for all students of BS-MS (4th and 5th year) and all research students. The seminar entitled “Joining the dots for lab safety” was attended by 205 students, besides faculty members. The seminar was aimed at sensitizing the researchers to stay alert towards several unknown hazards of the chemicals and risks involved in chemical transformations.

The basic aim of a safe lab is to have no accidents (including spillage and exposure), which are generally caused by unsafe conditions and unsafe practices. The fundamental principles of good health and safety in a chemical lab - Hazards identification, Risk assessment, and Risk controls were briefed with examples and video presentations. It was repeatedly told that all accidents are preventable, provided we follow some ground rules and practice self discipline. A quick guide to Fire safety was also presented. It was quite an interactive seminar with students responding well to questions all through.

Besides, a seminar was also held with the staff of the security and safety (about 25 no). They were briefed the general guidelines of fire safety, with particular reference to flammable and toxic materials present in labs. A mock demo was also given for quenching a small fire with the use of a fire blanket or a jute bag. The guards were advised to seek instructions and advise from respective researchers, while attending to an emergency involving chemicals and take care of their health and safety by following all protocols. Suggestions were also given to the Security Officer for upgrading the facilities for fire fighting.



A discussion meeting with a general lab safety presentation was also held with the faculty and researchers of Department of Physical Science, Department of Environmental Science, and Department of Biological Science.

The total number of attendees to all seminars and discussion meetings was ~200.

6. Wednesday, 20<sup>th</sup> February 2019: Invited by the Department of Chemistry, MES Abbasaheb Garware College, Pune 411004 (Maharashtra). A seminar was organised on lab safety for the students of MSc part 1 (Chemistry, Biotechnology, Electronics and Physics) in the college auditorium. A total of 125 students attended the seminar titled "Adopting a safety culture". The high mark of the lecture was explaining to the students the importance of safety measures while doing experiments, understanding the properties of chemicals and the risk assessment. Actions to be taken in case of an emergency, like spillage in eyes, on body or a fire or burns on hands etc were also explained. Several case studies dominated the lecture with examples taken from the incidents happening within such colleges, the responses and the misconceptions about a correct response. There were plenty of interactions with students during and

after the lecture. A quick visit to the chemistry labs was also undertaken at the end of the lecture that had lasted for 2 hours and 30 minutes.

7. Wednesday 26<sup>th</sup> June 2019 : Invited to Indian Institute of Technology, Kamand, Mandi (IIT Mandi) - 175005 (Himachal Pradesh), (an autonomous premiere engineering and technology University) with an objective to provide safety training to the students and staff of Advanced Materials Research Centre (AMRC) of IIT Mandi that has 2 chemical synthesis laboratories, a Biology lab (BioX lab) and more than 50 sophisticated instruments.

During the quick visits to some of the labs, a few situations where safety concerns were observed, corrective actions and suggestions were shared on the spot with lab mates. However, it requires a rigorous safety inspection / audit to see through every lab and record the inadequacy of



facilities. Similarly, one needs to spend more time with researchers to review their activities and working practices.

Had the pleasure of having the audience of the Director IIT Mandi, who is fully committed to have the highest standards of laboratory safety being implemented and followed. During discussions on aspects of laboratory safety, he agreed to a suggestion that a separate budget allocation must be made to ensure that safety facilities and infrastructure is kept updated.

The seminar entitled “Scientific Excellence and Workplace Safety” was attended by 82 students, besides faculty members. Fire fighting skills and emergency preparedness was reviewed with respective coordinators.

8. Saturday 21<sup>st</sup> September 2019: Invited to deliver a seminar on laboratory safety during a Two day conference on “Emerging trends in Chemical Sciences” at the Science College, Nanded - 431605,(Maharashtra).

The safety seminar attended by more than 200 students of Science College, The Swami Ramanand Teerth Marathwada University – Nanded and Nanded Pharmacy College, Nanded with a duration of more than 2 hours. Students and faculty had

several queries regarding the handling of certain corrosive chemicals. Discussions were also held on the appropriate emergency response to an incident involving a spillage, exposure or a fire. The institutes currently have a very basic infrastructure but aim at improving and moving to the next higher level with appropriate guidance and resources.

#### **4.0 IMPACTS**

As was described in the proposal, within a span of 12 months of the project, it will be too early to evaluate and judge the real changes on the ground with up gradation in the laboratory set up and facilities.

However, realization and change in mind set by the working students and researchers that lab safety is important, by itself is a measure of some success. Further, a similar realization and admission of the fact by the institute managers that the laboratories do not have the desired safety set up, facilities and lack safety training, in itself is an achievement. This will definitely help them in improving.

A change in attitude to consider safety as an important aspect of laboratory experiments and chemistry education is definitely expected. Of course, the number of people (of students, teachers, managers etc.) touched will be a measure of results of the program. Numbers alone are not a measure of impact or success, but have been able to touch > 1100 students, researchers and staff during the past 12 months.

One of the colleges that were visited again after a gap of 4/5 months, some changes was obviously visible. These included provision and implementation of use of PPE, laboratory supervision while the students carry on an experiment, use of MSDS ahead of performing an experiment etc.

Larger institutes that already have modern laboratories with good infrastructure had lacked in safety training programs and a few other issues, are reported to have initiated the desired activities and have also corrected unsafe conditions and practices.

More feedbacks are coming in. However, it is felt that the concept of in-service seminars has done wonders in reaching out for a generally socially unacceptable subject (mind set of not disclosing your weaknesses) and bringing in the benefits for education and training in laboratory safety practices at their doorsteps, without any obligation. It is felt that even if, 25% of the subjects / institutes start adopting the suggested safety measures and start looking at it, as an opportunity to improve statistics and rankings, the objective of this Safety Training Program-India Regional Project of IUPAC (2018) has been achieved.

It is therefore proposed that there must be a repeat visit to all the organizations already visited and reinforce the fundamental principles of laboratory safety.

## 5.0 EXPENDITURE

The Committee on Chemistry and Industry (COCI) approved the project with a sum of USD 1500 to be allocated for the project over its lifetime of one year. It suggested that a matching support from the Indian Chemical Industry be taken during the project duration. It also mentioned that the committee will commit another USD 1500 for the next one year, if satisfied with the progress and impacts during the current year.

The allocation received from COCI was very welcome, and as per suggestion, sincere and serious efforts were made to varied contact sources in industry to support the project with funds. However, it is regretted that despite attempts, no commitment came through. It was therefore decided to cut the expenditure and seek part support from the hosting institutions in the form of local hospitality, while using IUPAC funds for travel, if required. This would serve the purpose, as well as satisfy the suggestion to get matching external funds.

Accordingly, for all in-service seminars in Pune city, no expenditure was claimed as it involved only local travel.

Air travel expenditure to outstation centres (Kolkata, West Bengal and Mandi, Himachal Pradesh) is to be borne by IUPAC. However, accommodation and local hospitality was requested and graciously provided by the hosts and accordingly, the related expenditure is not charged to IUPAC but has been considered as notional expenditure by hosts. Such expenditure may be considered as a contribution to the overall expenditure.

Similarly, travel to outstations i.e Kolhapur and Nanded (both within Maharashtra) the travel, accommodation and local hospitality were requested and courteously provided by the hosts. And accordingly, the related expenditure is not charged to IUPAC but has been considered as notional expenditure by hosts. Such expenditure may be considered as a contribution to the overall expenditure. Detailed statement of the expenditure is provided in Table 2. However, a summary of the same is as under.

1. Funds sanctioned: USD 1500
2. Project start date : August / September 2018
3. Duration : One year (extendable to 2nd year)
4. IUPAC Funds utilized: INR 37974 (~USD 541.21)
5. **Notional expenditure by Indian Hosts: INR 59300 ( ~ USD 845.15)**

IUPAC very promptly settled the bills and reimbursed the expenditure for travel to IISER Kolkata (INR 14216) on 21<sup>st</sup> May 2019 and for travel to IIT Mandi (INR 23758) on 25<sup>th</sup> September 2019. I graciously acknowledge the support of IUPAC.

It may thus be seen that the expenditure on account of IUPAC has been USD 541.21, the corresponding notional expenditure by Indian hosts has been USD 845.15, which is ~156% more than the IUPAC expenditure.

## **6.0 CONCERNS, CHALLENGES AND PATH FORWARD**

1. The in-service seminars under this project were designed with a focus on audience of researchers, teachers and science students at all levels. High school students in urban and semi urban areas; UG and PG students in cities and towns, and doctoral students in R & D organizations spread all over the country. It is well known that the formal safety education and training in most educational institutes is lacking. Thus, letters were written and contacts established with educational institutes all over the country, describing the IUPAC assisted project, its scope, the topics to be covered and overall contents, the methodology to be followed and the benefits that the institute would accrue – both short and long term. However, despite follow up, the response to such enquiry was not very encouraging.
2. The in-service seminars began on a happy note with invitations coming from regional science colleges in Pune and elsewhere. Annual exams and yearend holidays in educational institutes all over in India during March till June limited the audiences, when University and affiliated colleges stay away from many of such extra activities.
3. Although, 8 in-service seminars have been conducted during the year (as against 6 in the proposal), it is felt that more could have been achieved.
4. It is believed that there is need to continue to drives for Safety awareness in schools / colleges, where injuries & discomfort are taken for granted (spillage, gas smell). The infrastructure is poor with no appropriate model for proper application of chemical safety guidelines / regulations (reference to MSDS, use of PPE etc) and one of the reasons is a financial crunch to implement the standard codes.
5. In view of the problems and difficulties that are faced by the colleges, it would be most appropriate to seek an extension of the project by another year to continue with in-service safety orientation programs vigorously in other locations. Involve more experts from local area to have wider appeal. The extension may be granted by topping up the funds to USD 1500.
6. Besides looking at item 4 above, it is also proposed to revisit some of these organizations and Influence the management to infuse funds for better facilities and encourage faculty to adopt safer practices and bring down exposures and incidents.

## **7.0 CONCLUSIONS**

The objectives of the Safety Training Program, India Regional Project that was initiated in September 2018 with the aim at sensitizing teachers, managers & students to follow & comply with standard safety norms while working with chemicals with a focus audience at High Schools, Universities, Colleges and doctoral students in R & D organizations all over India by reaching out to such Indian institutions and give safety awareness (orientation) in-

service seminar and discussions has been largely achieved. During the year, 8 such in-service seminars were conducted. The impacts of the seminars felt through the feedbacks received have been quite encouraging with local colleges and institutions, some even with a better safety record also implementing the suggestions to move to a next higher level in safety compliance for the health and safety of their researchers and students.

## **8.0 ACKNOWLEDGEMENTS**

First and foremost, I wish to thank Dr Mark Cesa who was instrumental in approving and making extra efforts to bring me to the fold of IUPAC –STP in the year 2008 and under whose leadership and guidance, the Safety Training Program has flourished into the 20<sup>th</sup> year. I thank Dr Bernard West for initiating this India Regional Project, with constant support and encouragement all these years. I thank Dr Robert Audette for his spontaneous guidance and courteous cooperation during the course of this project. I am grateful to Dr Carolyn Ribes, Dr. Fabienne Meyers and all others in the COCI, whose contributions and support has been a dominant factor for the initiation and continuation of this project.

Here in India, I am privileged to have Dr S Sivaram, former Director CSIR-National Chemical Laboratory, Pune as the best mentor. I must dutifully thank Dr P P Wadgaonkar, Scientist Emeritus, CSIR-National Chemical Laboratory, Pune and a task group member of this project for recommending me to local colleges in Pune, Kolhapur and Nanded for undertaking safety programs. I am thankful to Dr Bipulbehari Saha for his suggestions and advise from time to time.

I thank and shall be ever grateful to the host organisations for the kind invitations for the in-service seminars, organisations for conducting the same and providing very warm welcome and arranging and bearing local hospitality.

Finally, I must thank my wife and family members for their support, understanding and patience.

(G S Grover)

**TABLE 1.LIST OF SAFETY AWARENESS (ORIENTATION) IN-SERVICE SEMINARS**

No	Dates	Site	Participants	Remarks
1.	27 <sup>th</sup> Sept. 2018	Modern College of Arts, Science & Commerce, Pune	75 Nos. Laboratory support staff (Non teaching) from departments of chemistry, physics, life sciences, earth sciences disciplines, from 8 colleges in Pune	Durations :3 hours Medium of instructions: Mainly local languages (HINDI and MARATHI).
2.	5 <sup>th</sup> October 2018	MES Abasaheb Garware College of Arts, Science and Commerce, Pune	105 Nos. M. Sc students of Chemistry, Biotechnology, Biodiversity and Microbiology.	Duration: 3 hours A quiz with 20 questions (multiple choice answers) was also handed over to the attendees
3.	12 <sup>th</sup> October 2018	Modern College of Arts, Science & Commerce, Pune	90 No MSc students of Chemistry and Microbiology departments.	Duration :L 3 hours Part of the 4 credit course work for lab safety.
4.	22 <sup>nd</sup> January 2019	Sanjay Ghodavat University (SGU), Kolhapur.	250 Nos. School of Science, Department of Chemistry.	Duration : 3 hours Students and faculty from SGU and 4 adjoining colleges in Kolhapur.
5.	28 <sup>th</sup> January 2019 to 1 <sup>st</sup> Feb. 2019	Indian Institute of Science Education and Research, Kolkata (IISER-K) West Bengal.	A) postgraduate and PhD students of chemistry department. (125Nos) b) Laboratory support staff and emergency response teams (30Nos) c) Students and faculty from Earth sciences, Physics and Life sciences department. (45 No)	Durations a) 2 hours; b) 1.5 hours and c) 2 hours. Laboratory visits, inspections, discussions with students, faculty and three safety orientation lectures. Total no of attendees to all safety lectures: 200.
6.	20 <sup>th</sup> February 2019	MES Abasaheb Garware College of Arts, Science and Commerce, Pune	125 Nos. MSc part 1 students of Chemistry, Biotechnology, Physics and Electronics.	Duration: 2.5 hours Total no of attendees to safety lectures: 125.
7.	26 <sup>th</sup> & 27 <sup>th</sup> June 2019	Indian Institute of Technology, Mandi (IIT Mandi),	Students and researchers of the Advanced Materials Research Centre (AMRC), including the Chemistry department and the BioX Centre.	82 students and several faculty members.
8.	21 <sup>st</sup> September 2019	Science College, Nanded , Maharashtra	>200 No Students and faculty of Pharmacy College, Chemistry colleges during a 2 day conference.	Duration : 2 hours