

ANNUAL REPORT (2015 – 2016)



**NATIONAL INSTITUTE FOR RESEARCH IN ENVIRONMENTAL HEALTH
(Indian Council of Medical Research)
Bhopal – 462 001 (M.P.)**

National Institute for Research in Environmental Health
(Indian Council of Medical Research)
Department of Health Research
Ministry of Health & Family Welfare, Govt of India
Kamla Nehru Hospital Building
Gandhi Medical College Campus
Bhopal – 462 001 (M.P.), India
Phone: + 91 755 2533106, 2533976
Fax : + 91 755 2533976
E-mail: nirehbhopal@yahoo.in
Web site: [www/http/nireh.org](http://www.nireh.org)

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(Indian Council of Medical Research)
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GOAL

To understand the mechanisms of chemical-induced injury through basic, clinical, translational and community research and to develop diagnostic and therapeutic tools to chemical threat agents including toxic industrial and agricultural chemicals, toxins and other chemicals

CURRENT FOCUS OF RESEARCH

Continuing Health Problems of Bhopal Gas Disaster Survivors, Population Based Long term Epidemiological Study, Cytogenetics, Chronic Obstructive Pulmonary Disease, Congenital malformation

STAFF POSITION

Director -in- Charge : Dr. Anil Prakash, Scientist G

Head of the Office : Dr. N. Banerjee, Scientist C

Epidemiology Division

Scientist E (Epidemiology) : Dr. Y. D. Sabde (w.e.f 14-9-2015)
Scientist B (Med) : Dr. (Mrs.) R. Galgalekar
Scientist B (Med) : Dr. K. K. Soni
Technical Assistant : Mr. A. M. Khan
Technical Assistant : Mrs. M. Chaturvedi
Technical Assistant : Mrs. A. N. Bhavsar
Technical Assistant : Mrs. H. Saxena
Technical Assistant : Mrs. S. Khare
Technical Assistant : Md. S. Khan
Technical Assistant : Dr. V. S. Rathore
Technical Assistant : Mr. U. S. Chauhan
Technical Assistant : Mrs. R. Sen
Technical Assistant : Dr. (Mrs.) A. Shukla
Technical Assistant : Mrs. R. Yadav
Technical Assistant : Mrs. S. Azhar
Technical Assistant : Mr. D. S. Shukla
Technical Assistant : Mr. R. K. Srivastava
Technical Assistant : Mr. B.K. Dixit
MTS (Tech) : Mrs. A. Khan
MTS (Tech) : Mrs. R. Lalwani
MTS (Tech) : Mr. K. D. Sharma (Superannuated on 31-8-2015)

Biotechnology Division

Scientist E : Dr. P. K. Mishra (w.e.f 30-11-2015)

Biochemistry Division

Scientist E : Dr. K. C. Pandey (w.e.f 6-10-2015)

Pulmonology Division

Scientist E : Dr. Sajal De (w.e.f 29-3-2016)

Statistics Division

Scientist B : Mrs. M. Sharma
Technical Assistant : Mr. S. Khare
MTS (Tech) : Mr. M. Ahmed

Computer Division

Scientist C	:	Dr. S. Singh
Technician C	:	Mr. R. Chandrasekhran Pillai
Technician C	:	Mr. S. Sharma
Technician C	:	Mr. A. K. Kori
Technician A	:	Mr. R. K. Pandey
MTS (Gen)	:	Mr. S. Mishra

Administration

Private Secretary	:	Mr. Krishnadas V.K.
Section Officer (Adm) :		Mr. S. Srivastava
Section Officer (Accts)	:	Mr. M. Waldhurkar
Technician B	:	Mr. R.K. Verma Thampuram
Technician A	:	Mrs. Anitha S. Pillai

Utilities

MTS (Gen)	:	Mr. D. Ugave
MTS (Gen)	:	Mr. P. Patva
MTS (Gen)	:	Mr. A. Husain
MTS (Gen)	:	Mrs. K. Bai

Attachment from BMHRC, Bhopal

Assistant Professor	:	Dr. R. M. Samarth
Asstt Administrative Officer	:	Mr. S. Subharwal

Consultants

Consultant (Administration)	:	Dr. R. C. Sharma (up to 30-4-2015)
Consultant (Laboratory)	:	Dr. (Ms) Farida Khan (up to 31-08-2015)
Consultant (F & A)	:	Mr. S. S. Asthana

Project staff

Ms. Tanvi Chincholkar	:	Research Assistant
Ms. Priya Chitriv	:	Research Assistant
Mr. Aditya Banerjee	:	Research Assistant
Mr. Imran Khan	:	Laboratory Technician
Mr. Raza Ansari	:	Laboratory Technician
Ms. Amrita Singh Yadav	:	Field Investigator(up to 15-3-2016)
Ms. Mamta Shilpkar	:	Laboratory Attendant (up to 15-3-2016)
Ms. Poonam Sharma	:	Senior Research Fellow
Mr. Imamul Haq	:	Junior Research Fellow

From Director's Desk



It gives me immense pleasure to present the Annual Report 2015-2016 of the institute. NIREH, being the youngest member of ICMR family and established in Oct 2010, is still in its infancy. Institution building challenges before NIREH are enormous in the form of filling up of the created posts, construction of campus, infrastructure creation and above all building scientific credibility. NIREH has worked on all these fronts and fared well during the year in spite of various constraints.

In line of its short term mandate NIREH continued to work on the health problems of toxic gas exposed population of Bhopal during 1984 tragedy. Under the Long term population based epidemiological study on the health effects of toxic gas 50th and 51st rounds of six monthly surveys were completed on a cohort of about 31,000 population revealing respiratory morbidities as the predominant health problem and cause of death among gas exposed individuals. The study on Prevalence of morbidity of selected population/families with reference to the drinking water utilization in Bhopal was completed during the year. The study revealed no significant association between the observed morbidities and pattern of (allegedly contaminated) water consumption in the community. Another pilot study concluded during the year was related to the evaluation of potential biochemical markers of prognostic and mechanistic values for COPD patients. While the two ongoing studies on the genetics and cytogenetic analysis of gas exposed population of Bhopal continued, a new prospective observational study on the congenital malformation in the neonates was initiated during the year to address the perceived concern that the prevalence of congenital malformation in the children born to gas exposed survivors is high. In addition, modest services offered by NIREH to the gas exposed survivors like respiratory clinic, respiratory physiotherapy clinic and community based services continued during the year.

It is heartening to note that four senior scientists (Scientist E) joined the institute in this year and added to the scientific critical mass of NIREH. Further, with the filling up of 28 advertised posts of administrative, technical, nursing and engineering cadre, for which efforts are being made, NIREH will be strengthened which at presently is operating on skeletal man power. On the front of the construction of NIREH campus the work on boundary wall erection has been completed and now the work on core block construction will begin soon.

Dr. S. Swaminathan took over as the new Secretary, DHR and DG, ICMR during the year and NIREH was privileged to have her visited NIREH. I express my gratitude to the visionary leadership of ICMR- DG, ICMR, Sr. DDG (Admn), Sr. Financial Advisor and Head, NCD for their constant support to NIREH. I owe my gratefulness to the members of the Scientific Advisory Committee and various Research Expert Groups who have been steering this institute in its pursuit of science. Last but not the least I am thankful to my fellow scientists, technical, administrative and supporting staff of NIREH for their tireless work and immense contribution to the institute.

(DR. ANIL PRAKASH)

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EXECUTIVE SUMMARY

- Two six monthly surveys under the *Long term population based epidemiological study on the health effects of the toxic gas exposure* were completed. The 50th survey (Jan-June, 2015) covered 24,398 individuals from exposed cohort and 6,466 individuals from the unexposed cohort. Any morbidity recorded was 22.4% in severely exposed, 16.7% in moderately exposed and 16.9% in mildly exposed areas as compared to 8.6% morbidity recorded in the control areas. The 51st survey (July-Dec, 2015) covered a cohort of 24,461 individuals from exposed areas and 6,520 individuals from unexposed areas. In this survey any morbidity recorded was 22.4% in severely exposed, 17.3% in moderately exposed and 17.1% in mildly exposed areas compared to 8.8% in the control areas. Overall mortality rates in the 50th survey were found same in the exposed (2.46/1,000 population) and control areas (2.32/1,000 population) whereas it was relatively higher (3.93/1000) in exposed areas than in control areas (2.76/1,000) in 51th survey.
- The study entitled *Prevalence of morbidity of selected population/families with reference to drinking water utilization in Bhopal* was completed. In this study a total of 2,184 families (10,827 individuals) were surveyed. In Stratum I (0-1 km radius area from UCIL factory) data was collected for 5,467 individuals (1,092 families) whereas in Stratum II (2.5 – 5.0 km radius area from UCIL factory) 5,360 individuals (1,092 families) were surveyed. About 85% individuals in targeted families under Stratum I and 87% under Stratum II were examined clinically for morbidities. Correlation of morbidities, likely to be caused due to the consumption of allegedly contaminated water, with various risk factors, revealed no significant association between the morbidities and distance from UCIL factory. Also, no significant association was seen between prevalent morbidities and drinking water consumption pattern. It was concluded that the communities, irrespective of distance of their residences from UCIL factory or source of their drinking water, were equally vulnerable to various morbidities.
- The pilot study entitled *Evaluation of biochemical markers in clinically stable cases of COPD in toxic gas affected population* was completed. The study evaluated 7 biomarkers (SP-D, MMP-9, TGF β_1 , CC-16, CCL 18, CCL 16, and MCP-1/CCL2) for their expression and quantification in serum of 30 COPD cases during the acute exacerbation phase and 7 healthy subjects fulfilling the exclusion and inclusion criteria. In case of non-normally distributed markers median concentration of MCP-1 marker (p 0.029) and in case of normally distributed markers mean concentrations of CCL 18 (p<0.001) and MMP9 (p 0.031) were

found significantly raised in COPD patients suggesting that these might be the potential biomarker molecules to be considered for monitoring exacerbations of COPD cases.

- In the ongoing study on *Cytogenetic analysis in MIC exposed population and their progeny* total of 1,784 subjects generated from 123 pedigrees have been registered and blood samples collected from 320 subjects for cytogenetic analysis. The other study entitled *Long term genetic effects of MIC gas, if any, on the Bhopal population exposed in December 1984* continued during the year.
- A new study entitled *A hospital based study of congenital malformations in the neonates of gas exposed and non-exposed mothers and their first generation progenies in Bhopal* was initiated during the year.
- In the respiratory clinic being run at NIREH 46 new patients attended the clinic and 48 old patients were followed up. Under the community based health services referral and door step ambulance services were availed by 68 patients in severely exposed areas and 15 new patients of COPD availed the pulmonary rehabilitation services at the respiratory physiotherapy centre being run by NIREH in one of the severely exposed locality.
- Construction of boundary wall and security gate complex on the land allotted for NIREH campus by Government of M.P. in Bhauri village was completed during the year.
- Four new Scientist E joined NIREH during the year.

Research Work

PROJECT 1

Population Based Long Term Epidemiological Study on the Health Effects of the Toxic Gas Exposure in Bhopal

Investigators, Duration and Funding	i. Team BGDRC(Jan 1985 to May 1994): ICMR ii. Team CRS (Jan 1996 to Jan 2011):Govt. of MP iii. Team NIREH (Feb 2011 onwards): ICMR
Investigators from NIREH	Dr. N. Banerjee (PI); Dr. S. Singh, Dr. K. K. Soni, Dr. R. Galgalekar, Mrs. M. Sharma

The population based long term epidemiological study on the health effects of the toxic gas exposure was continued. This 3 decades long study has generated valuable information related to immediate and long term morbidity patterns in the gas exposed population. In this study the morbidity and mortality data is being collected at six monthly intervals in the registered study cohort of gas exposed and unexposed (control) families using a structured health survey questionnaire by trained field workers and round no. 50 and 51 were completed during the year.

To recapitulate, subsequent to the gas disaster this study was launched in 1986 under Bhopal Gas Disaster Research Centre, ICMR (BGDRC) on a cohort of 62,706 individuals from gas exposed areas (19,260, 28,261 and 15,185 from severely exposed, moderately exposed and mildly exposed areas respectively) and 13,526 individuals from unexposed areas (Control) of Bhopal. The study under BGDRC continued till 1994 and later was handed over to Centre for Rehabilitation Studies (CRS), Govt. of M.P. which carried it out between 1996 and 2010 following the same protocol on a cohort of 34,480 individuals (part of the original cohort) from exposed areas (10,816 from severely exposed areas, 14,137 from moderately exposed areas and 9,527 from mildly exposed areas) and 7,990 individuals from unexposed control areas. Since the establishment of NIREH in Oct 2010, the study is being continued under ICMR. In 2011, when NIREH took over the study from CRS, a substantial part of cohort was lost gradually due to variety of reasons such as shifting of population to different places, marriage related migrations and deaths and only a cohort of 16,860 exposed individuals (5,658, 6,533 and 4,669 from severely, moderately and mildly exposed areas respectively) and 5,741 individuals from the unexposed control areas was available for the follow up by NIREH. Special drives undertaken during 2013-2016 resulted in tracing and addition of about 8.380 individuals from the lost cohort.

1.1 Pattern of morbidities (2015 – 2016)

During the reporting year two rounds of six monthly surveys were carried out- the 50th round (January-June, 2015) and 51st round (July-December, 2015).



Snapshots of the Epidemiological Survey

1.1.1 50th round of survey

During the 50th round of survey, 24,398 individuals from exposed areas viz. severely exposed (8,209), moderately exposed (8,774) and mildly exposed (7,415) and 6,466 individuals from unexposed control areas were followed up. Any morbidity recorded was 22.4% in severely exposed, 16.7% in moderately exposed and 16.9% in mildly exposed areas as compared to 8.6% morbidity recorded in the control areas (Fig-1). Similar trends of higher morbidities of respiratory disorders, ophthalmic disorders and gastrointestinal disorders in the exposed areas as compared to control areas were recorded. The skin morbidity was, by and large, similar in severely exposed (0.46%), moderately exposed (0.35%), and mildly exposed (0.35%) areas which, however, was slightly higher than the control (0.27%) areas.

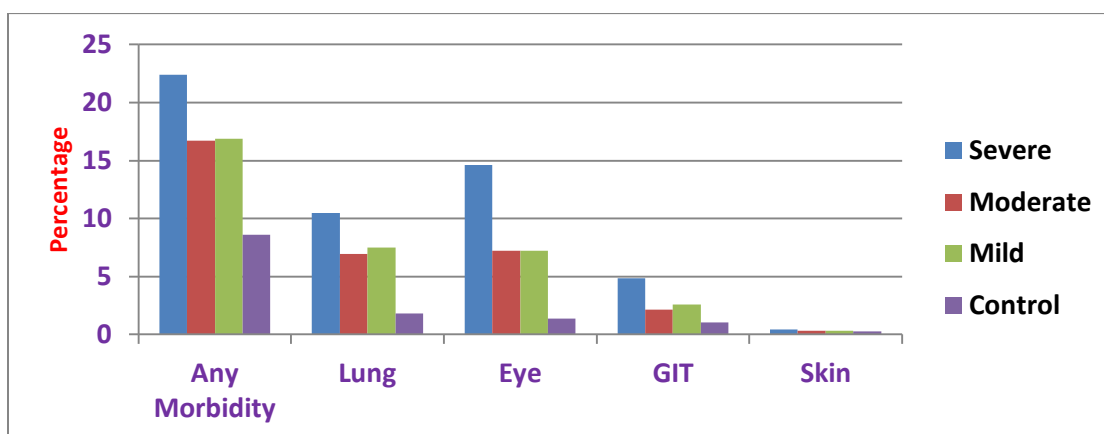


Fig-1: Morbidity trend recorded in 50th round of survey (Jan-June, 2015)

1.1.2 51st round of survey:

During the 51st round of survey, a cohort of 24,461 individuals from severely exposed (8,274), moderately exposed (8,849) and mildly exposed (7,338) areas and 6,520 individuals from control areas was followed up. Overall trend of morbidity pattern in this round (Fig-2) remained, by and large, similar to the 50th round of survey. Any morbidity recorded was 22.4% in severely exposed, 17.3% in moderately exposed and 17.1% in mildly exposed areas compared to 8.8% in the control areas. The respiratory morbidity rates remained high in the severely exposed areas (9.9%) in comparison to moderately exposed areas (6.2%), mildly exposed areas (7.7%) and control areas (1.5%) and so were ophthalmic morbidity rates (severely exposed 14.4%, moderately exposed 9.0%, mildly exposed 7.5%, control 1.4%) as well as gastro intestinal morbidity rates (severely exposed 5.1%, moderately exposed 1.9%, mildly exposed 2.9%, control 0.9%). Magnitude of skin morbidity recorded was, by and large, similar ranging from 0.5% in severely exposed to 0.2% in control areas.

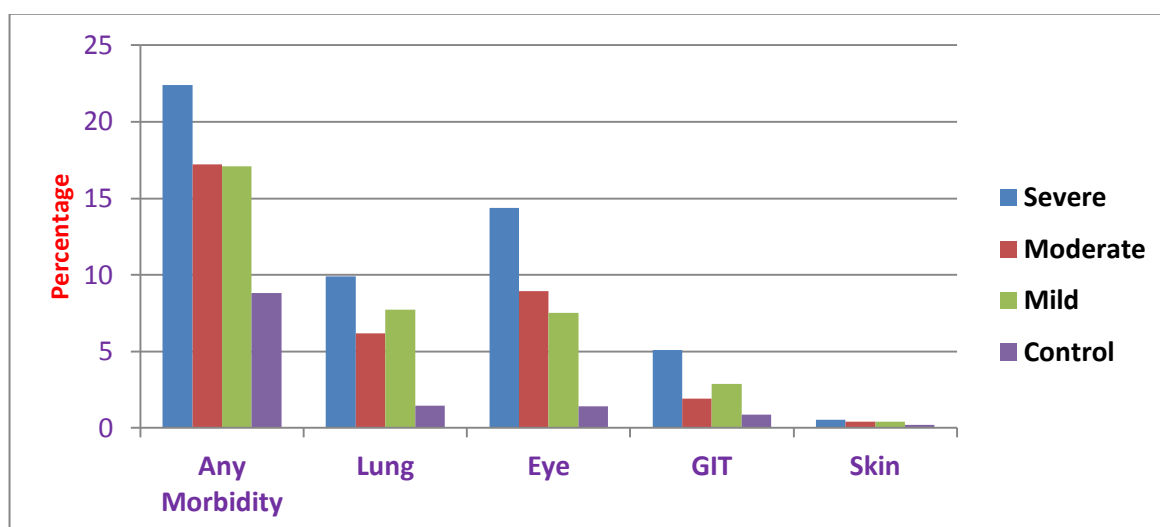


Fig-2: Morbidity trend recorded in 51th round of survey (July – Dec 2015)

1.2 Mortality Pattern (2015 – 2016)

Overall mortality rates in the 50th survey were found same in the exposed (2.46/1,000 population) and control areas (2.32/1,000 population). However, mortality due to respiratory disorders in the exposed areas (0.74/1,000 population) was nearly five times higher than the control (0.16/1,000). In 51th survey overall mortality rates were relatively higher (3.93/1000) in exposed areas than in control areas (2.76/1,000). Cause of death due to respiratory disorders in the exposed areas (1.44/1,000 population) was higher than the control (0.0/1000 population) areas (Table-1).

Table-1: Primary causes of death as recorded in 50th and 51th rounds of survey

Cause of death	Exposed areas		Control areas	
	Number (%)		Number (%)	
	50 th round	51 st round	50 th round	51 st round
Accident &Injuries	2(3.3%)	3(3.1%)	1(6.7%)	1(5.6%)
Child birth &Pregnancy	1(1.7%)	0(0.0%)	0(0.0%)	0 (0.0%)
Fever	2(3.3%)	8 (8.3%)	0(0.0%)	2(11.1%)
Digestive disorders	6(10.0%)	9 (9.4%)	2(13.3%)	2(11.1%)
Respiratory disorders	18 (30.0%)	36 (37.5%)	1(6.7%)	0(0.0%)
C.N.S. disorders	3(5.0%)	6(6.3%)	2(13.3%)	2 (11.1%)
C.V.S. disorders	7(11.7%)	15(15.6%)	1(6.7%)	0(0.0%)
Other system disorders	8(13.3)	10(10.4%)	2(13.3%)	0(0.0%)
Senility	6(10.0%)	5(5.2%)	3(20.0%)	7(38.9%)
Cause unknown	7(11.7%)	5(5.2%)	3(20.0%)	4(22.2%)
Total no. of deaths	60	96	15	18
All cause mortality rate (per 1,000)	2.46	3.93	2.32	2.76

PROJECT 2

A study on the prevalence of morbidity of selected population/families with reference to the drinking water utilization

Investigators Dr. N Banerjee (PI); Dr. S Singh, Dr. KK Soni, Dr. R Galgalekar, Mrs. M Sharma
Advisor Dr. HR Rajmohan
Duration 2 Years (June 2014-May 2016)
Funding ICMR (IM)

Following the Bhopal Gas Tragedy in the intervening night of 2/3 December, 1984 and consequent closure of Union Carbide India Limited (UCIL) factory, a large inventory of toxic chemicals remained inside the plant and factory premises. The issue of the presence of residual toxic substances in the UCIL premises was raised by several quarters fearing that percolation of the toxic substances from the factory premises down the soil might have contaminated the underground water supply resulting in adverse health effects on the residents consuming the contaminated water, especially those living nearby to UCIL factory. To address the issue of health effects, if any, which might have been caused due to long-term consumption of the allegedly contaminated underground water, a community-based epidemiological study was undertaken which aimed at determining prevalence of morbidities and their correlation with drinking water utilization pattern among the population residing at variable distances from UCIL factory premises.

2.1 Study area and sample size

Two areas located at variable distances from the UCIL factory i.e. 0-1 km radius area from the boundary wall of UCIL (Stratum-I- falling under 7 municipal wards) and 2.5-5.0 km radius area from the boundary of UCIL (Stratum II-falling under 32 municipal wards) were selected for the study (Fig-3). Sample size comprised of 1,092 families in each stratum. The targeted number of families (n=1,092 in each stratum) to achieve the calculated sample size were chosen randomly. The first family in each colony/ ward was selected randomly from the generated list of random numbers and thereafter in Stratum I every 35th family was included till the samples size in that colony/ward was achieved. Likewise, in Stratum II every 156th family, after random selection of the first family in each colony/ward, was included till the samples size in that colony/ward was achieved.

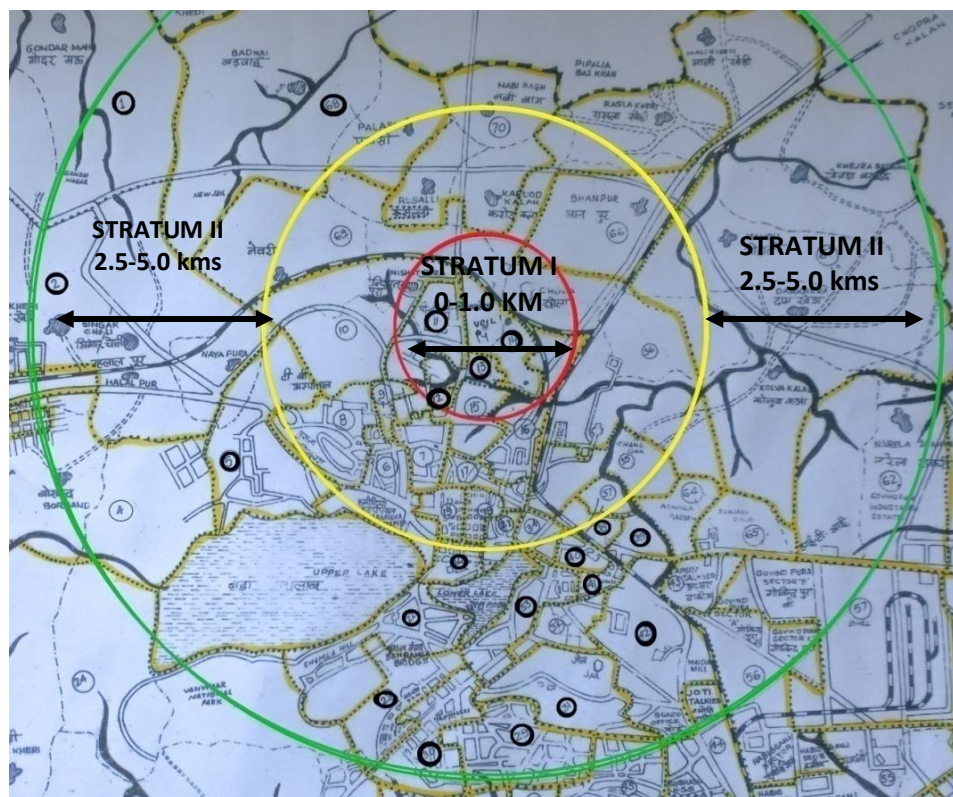


Fig-3: Map of Bhopal city showing Stratum I-Red circle and Stratum II- Green circle

2.2 Survey methodology

After identification of the household, as explained above, the family members were approached and a pretested structured questionnaire was administered to collect information on socio-demographic particulars, status of gas exposure, alcohol and tobacco use habits, disability status etc. for each individual in the family. Details regarding both past and present source(s) of water with duration of use, any treatment of water prior to drinking and its storage practices were noted. Further, a physician clinically examined the available and willing family members at the time of visit. If any individual presented with any form of morbidity, the symptoms and duration of illness was noted and a diagnosis was made. Any abnormality found during the clinical examination was recorded as 'Present morbidity'. In addition, record of any significant past morbidities/ illness (which may/ may not have resulted in hospitalization) was noted and termed as 'Past morbidity'. This information on 'past morbidity' was collected for all the individuals of the surveyed family, irrespective of their availability at the time of visit.

2.3 Results

A total of 2,184 families (10,827 individuals) were surveyed during the study. In Stratum I data was collected for 5,467 individuals (1,092 families) whereas in Stratum II 5,360 individuals

(1,092 families) were surveyed. About 85% individuals in targeted families under Stratum I and 87% under Stratum II were examined clinically for morbidities.

About 82% of the surveyed population (81% in Stratum I and 83.6% in Stratum II) was found to presently have access to the municipal drinking water supply (water supplied by Bhopal Municipal Corporation piped directly into households / yards or supplied through public taps or supplied through tankers). Previous source of municipal water for drinking purpose was significantly higher in Stratum II (74.4%) as compared to Stratum I (56.1%). On the other hand previous source of non-municipal water for drinking purpose (bore wells, tube wells, dug wells, surface waters, etc.) was significantly higher in Stratum I (43.3%) than Stratum II (25.1%).

Overall, 18.9% of individuals in each stratum were found to be suffering from one or more morbid conditions/illnesses at the time of survey. Frequency distribution shows that top 5 systems encompassing 'present morbidities' in both the strata were cardiovascular, respiratory, gastrointestinal, musculoskeletal and ophthalmic systems with cardiovascular morbidities occupying the top most position. Between the two strata, cardiovascular morbidities and endocrine related morbidities were significantly higher ($p<0.01$) in Stratum II, whereas gastrointestinal tract morbidities ($p<0.05$), auditory system/ear related morbidities ($p<0.01$), neoplasm/cancers ($p<0.01$) and congenital morbidities ($p<0.01$) were significantly higher in Stratum I. Prevalence of other present morbidities were comparable in the two strata (Fig-4).

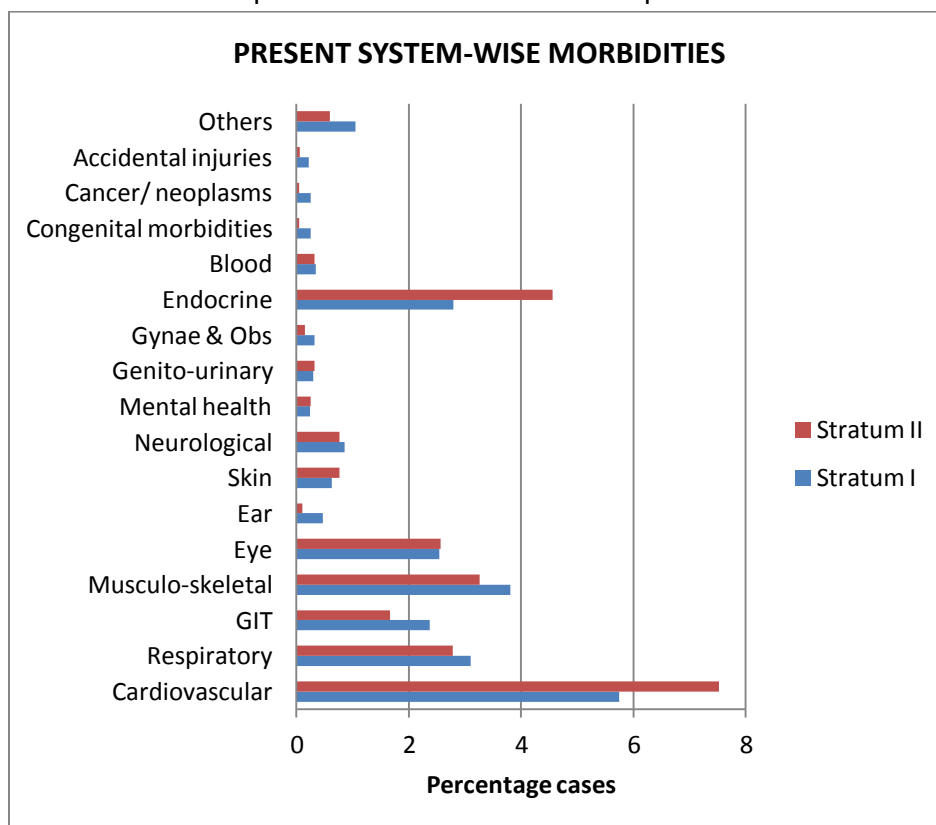


Fig-4: Present morbidities pattern in the surveyed population

Data on 'past morbidities' revealed the highest prevalence of gastrointestinal tract related morbidities, followed by respiratory and cardiovascular morbidities in both the strata, with non-significant difference between the two strata (Fig-5).

Correlation of morbidities, likely to be caused due to the consumption of water contaminated with biological or chemical contaminants with various risk factors, based on multiple logistic regression analysis, revealed no significant association between the morbidities and distance from UCIL factory. Also, no significant association was seen between prevalent morbidities and drinking water consumption pattern. It was concluded that the communities, irrespective of distance of their residences from UCIL factory or source of their drinking water, were equally vulnerable to various morbidities.

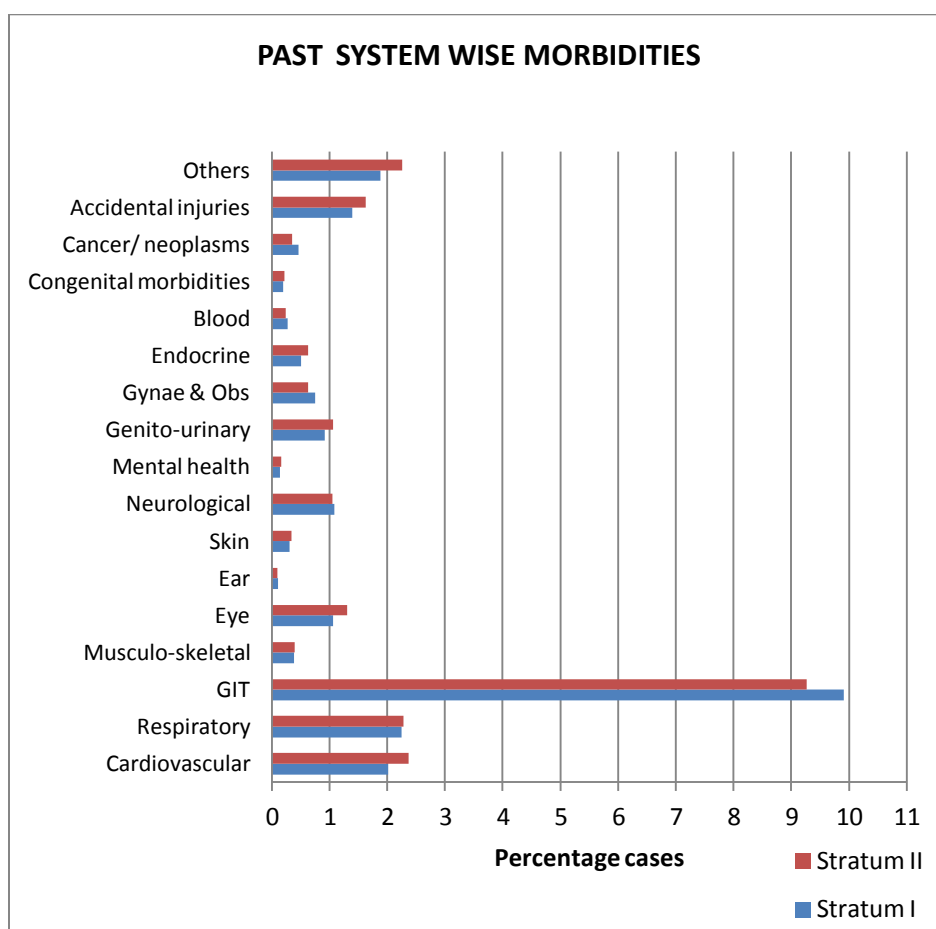


Fig-5: Past morbidities pattern in the surveyed population

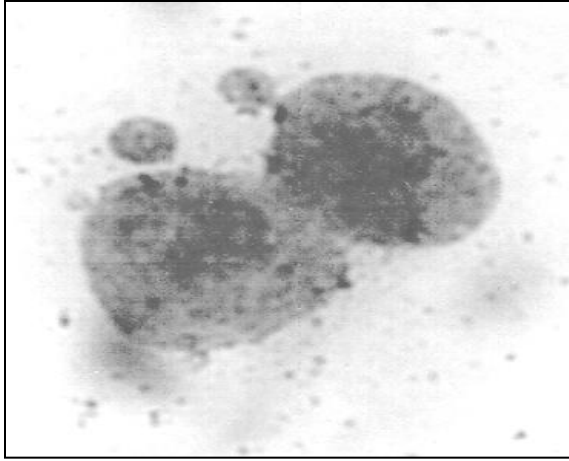
PROJECT 3

Cytogenetic analysis in Methyl Isocyanate (MIC) exposed population and their Progeny

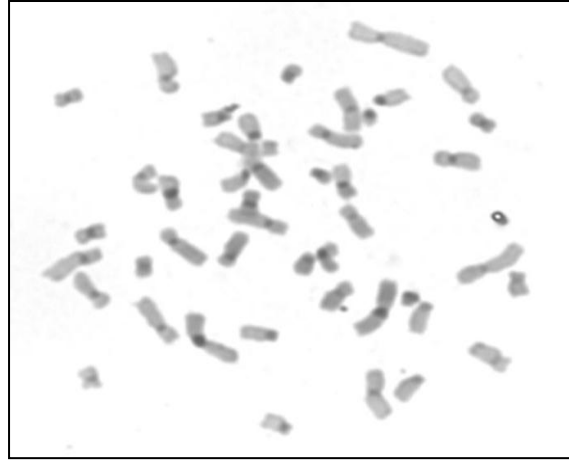
Investigators Dr. N. Ganesh, JNCHRC, Bhopal (PI)
Dr. N. Banerjee, NIREH, Bhopal (Co PI)
Duration 3 Years (Nov 2013-Oct 2016)
Funding ICMR (IM)

This study is exploring the cytogenetic status of toxic gas exposed survivors and the genetic effects on the progenies born to exposed individuals with the aim to estimate the levels of risk of developing any genetic disorders. The sample size for the study was 1,200 individuals of both sexes in 29-59 years age-range belonging to six categories viz. toxic gas exposed, unexposed, 1st and 2nd generation progeny of gas exposed born after exposure, those suffering from different ailments, and those with congenital malformation. In addition to pedigree analysis of gas exposed individuals the cytogenetic analysis involved karyotyping for spontaneous chromosomal aberrations, micronucleus scoring, GTG banding and confirmation of Trisomies on GTG banded slides through FISH, sister chromatid exchanges and C banding.

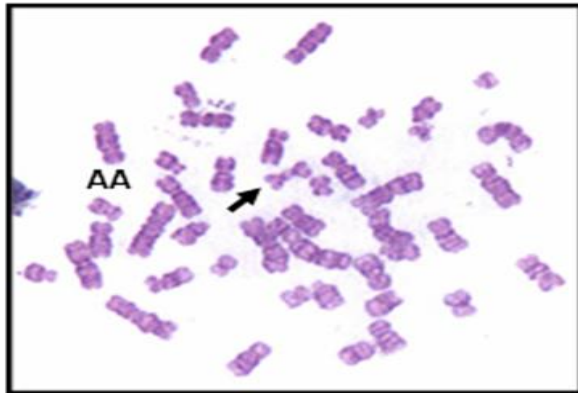
Study subjects were randomly selected from the hospital registration 2013-2015 of Jawahar Lal Nehru Cancer Hospital and Research Centre (JNCHRC) following defined inclusion and exclusion criteria. A total of 1,784 subjects generated from 123 pedigrees have been registered in the study and blood samples so far have been collected from 320 subjects. From each subject 0.5 ml blood was collected of which 0.25 ml was processed for cytogenetic analysis and 0.25 ml for micronucleus assay without interphase arrest. The frequency of micronuclei was found more in toxic gas exposed population. Though translocation was not revealed in any individual, yet the acrocentric associations between D-D, D-G and G-G group of chromosomes, premature centromeric divisions and dicentrics scored more in the toxic gas exposed population (Fig- 6). The study is in progress.



Bi-nucleate cell with micronuclei



Metaphase plate showing chromosomal aberrations



Metaphase plate showing acrocentric association

Fig -6: Cytogenetic changes in peripheral blood lymphocytes

PROJECT 4

Long term genetic effect(s) of MIC gas, if any, on the Bhopal population exposed in December, 1984

Investigators Dr. B. B. Ganguly, MGMIHS, Mumbai (PI)
Dr. N. Banerjee, NIREH, Bhopal (Co PI)
Duration 3Year (Nov 2013-Dec 2016)
Funding ICMR (IM)

This pilot study is examining the present cytogenetic status of 100 gas exposed and 100 unexposed individuals from Bhopal, among those screened earlier (1986-1990) under the multicentric genetic screening study of ICMR involving 6 centers including Bhopal, and comparing with their earlier genetic status (1986-1990) to exclude the possibility of long term genetic effects, if any, of the toxic gas exposure. Current cytogenetic status is being studied through preparation of 3-generation pedigree and karyotyping for spontaneous chromosomal aberrations in first cycle mitotic cells (M1) of PHA-stimulated lymphocyte culture, and constitutive aberrations by G-banding in second cycle mitotic cells (M2).

Among the retrievable records of 800 pre-screened (1986-1990) cases in Bhopal (543 exposed, 257 unexposed) only 174 cases (127 exposed, 47 unexposed) could be traced, contacted and their 3-generation pedigrees prepared. Information such as exposure history, family size, general health status etc. was also collected. Approximately 2 ml peripheral blood sample was collected in sterile sodium heparin vacutainer from 141 consenting individuals. Short term (72 h) peripheral blood lymphocyte culture was performed for preparation of chromosomes for various analytical endpoints. For chromosome analysis both conventional solid staining and G-banding techniques were followed. Karyotyping was done as per ISCN 2005. Chromosomal analysis and karyotyping of limited no. of blood samples (n=22) revealed cultures with low mitotic index (36% cases), assemblage of D/G group (>90% cases) and spontaneous aberration (22% cases). The study is in progress.

PROJECT 5

To evaluate biochemical markers in cases of clinically stable stages of Chronic Obstructive Pulmonary Disease (COPD) in MIC affected population

Investigators Dr. Farida Khan, Consultant, NIREH, Bhopal (PI)
Dr. R. Galgalekar, NIREH, Bhopal
Dr. K. K. Soni, NIREH, Bhopal
Duration 1^{3/4} Year (Nov 2013-Aug 2015)
Funding ICMR (IM)

Respiratory disorders in the toxic gas exposed survivors of Bhopal have been found to be high of which a good proportion are cases of Chronic Obstructive Pulmonary Disease (COPD). In view of the need for proper tools to monitor COPD disease-early onset, progression and exacerbation caused during the course of the disease, this pilot study aimed to investigate potential biochemical markers of prognostic and mechanistic value for COPD in gas exposed population. The study evaluated 7 biomarkers (SP-D, MMP-9, TGF β_1 , CC-16, CCL 18, CCL 16, and MCP-1/CCL2) for their expression and quantification in serum of 30 COPD cases during the acute exacerbation phase and 7 healthy subjects fulfilling the exclusion and inclusion criteria.

5.1 Study subjects and methodology

Initially 10 stable cases each of mild, moderate and severe COPD among the long term population based epidemiology study cohort (gas exposed) of NIREH were shortlisted for the study. However, at the time of sample collection many shortlisted subjects did not give their consent for the procedure. Therefore, as per the revised strategy, 30 cases of COPD with acute exacerbation and attending the out patients department of Pulmonary Medical Center, Jehangirabad, Bhopal, fulfilling the exclusion and inclusion criteria, were recruited with the help a pulmonologist. Available clinical and other relevant information of each subject related to disease symptoms, discomfort, occurrence/ frequency over last few months, smoking status etc. were recorded. Eight numbers of healthy volunteers with no apparent co morbidities from general population were also recruited for the comparison purpose. From each subject about 8 ml of blood was drawn under aseptic conditions. The blood samples were allowed to clot and serum separated by standard method, aliquoted and stored at -80 °C till further use. It was originally envisaged to estimate the select biochemical markers in serum as well as induced sputum of the enrolled subjects. However, because of the revised adopted strategy of subject recruitment of COPD cases during the acute exacerbation phase seeking medical attention induced sputum collection was not allowed by the pulmonologist on technical ground. Hence, select biomarkers could not be evaluated in the induced sputum as planned originally.

After standardization of laboratory protocols Enzyme-Linked Immunosorbent Assay (ELISA) kits specific for humans were used for estimation of levels of serum biomarkers. Volume and dilution of serum were used as per the manufacturer's protocol and appropriate dilution made for values that were above the estimation range. Values obtained were plotted and analyzed according to standard methods. All estimations were carried out in duplicates including standards and healthy controls and averaged for individual concentrations. These averaged values were further used for statistical analysis.

5.2 Results

Based on mean concentration values of various markers, using skewness and kurtosis test (SK test), in COPD patients and controls 3 markers (CRP, SPD, and MCP-1) were found non-normally distributed while three markers (MMP9, CCL18 and TGF- β) were normally distributed. The value of the seventh marker CCL16 was very high and extremely unpredictable hence, was not taken for analysis. In case of non-normally distributed markers median concentration of MCP-1 marker was found significantly raised in COPD patients (Mann-Whitney test; p 0.029) whereas in case of normally distributed markers mean concentration of CCL 18 (two sample independent t-test; p<0.001) and MMP9 (two sample independent t-test; p 0.031) was found significantly raised in COPD subjects (Table-2) suggesting that these might be the potential biomarker molecules to be considered for monitoring exacerbations of COPD cases. The fact that levels of these markers might be indicative of an exacerbation and alter (improve /worsen) with pathology of the disease makes them a valuable tool for monitoring the disease as well as assessing any interventional therapy. The study has been completed.

Table -2: Serum concentration of various biomarkers in the study subjects

Marker Distribution	Marker name	Group	n	Median (IQR) / Mean (SD)	p-value
Non-normal distribution	CRP	Control	8	Median (IQR) 40.4 (12.64 - 52.46)	0.361
		Patient	29	Median (IQR) 52.46 (20.25 - 52.46)	
	SPD	Control	8	Median (IQR) 3.42 (3.26 - 3.81)	0.115
		Patient	30	Median (IQR) 5.08 (2.47 - 10.4)	
	MCP1	Control	8	Median (IQR) 94.5 (56.38 - 116.82)	0.029*
		Patient	30	Median (IQR) 152.1 (130.3 - 246.0)	
Normal distribution	MMP9	Control	8	Mean (SD) 9.12 (5.11)	0.031*
		Patient	30	Mean (SD) 12.74 (4.64)	
	CCL18	Control	8	Mean (SD) 11.32 (6.38)	<0.001*
		Patient	30	Mean (SD) 29.82 (9.94)	
	TGF β	Control	8	Mean (SD) 838.64 (311.46)	0.732
		Patient	30	Mean (SD) 783.96 (190.58)	

PROJECT 6

A hospital based study of congenital malformations in the neonates of gas exposed and non-exposed mothers and their first generation progenies in Bhopal

Investigators Dr. Ruma Galgalekar (PI); Dr. K. K. Soni
Advisor Dr. V. K. Vijayan
Duration 6 months (Jan 2016 - June 2016)
Funding ICMR (IM)

Congenital malformations are single or multiple defects of the morphogenesis of organs or body identifiable at birth or during the intrauterine life. Both genetic and environmental factors, as well as their combination in a multifactorial context may induce congenital defects. Subsequent to the Bhopal Gas Disaster during the intervening night of 2/3 December, 1984 there were wide apprehensions about the fate of children born to toxic gas exposed mothers and still after 30 years of the disaster the concern that the prevalence of congenital malformations in the children born to the gas exposed survivors is high continues. To address this concern this prospective observational study was initiated with an aim to examine 1,250 deliveries each in the gas exposed mothers/first generation of gas exposed mothers and unexposed mothers to explore the difference, if any, in the prevalence of congenital malformations in children born to the two Groups of mothers.



Administration of questionnaire



Examination of a neonate for any visible congenital malformation

Two hospitals in Bhopal city viz. Indira Gandhi hospital (primarily catering to gas exposed population) and Sultania Zanana hospital (primarily catering to general population) were included in the study. Trained field staff collected detailed information from the admitted women for delivery in these hospitals on their socioeconomic status, health status and medication taken, if any, during the pregnancy period through a pretested questionnaire. The new born babies were examined for any visible congenital malformation. Till 31st March a total of 2,076 deliveries in Sultania Zanana hospital and 296 deliveries in Indira Gandhi hospital were followed up. Still births recorded were 74 and 2 respectively in the two study hospitals. The study is in progress.

Other Activities

1. Special Respiratory Clinic

Under this programme severely ill gas exposed willing subjects having respiratory ailments, identified during the epidemiological surveys, are transported to NIREH pulmonary clinic where they are clinically examined and advised treatment. Their blood investigation and X-ray are done at Kamla Nehru Hospital while ECG and PFT are carried out at NIREH. During the year 46 new patients (males 10, females 36) attended the clinic and follow up of 48 old patients (males 34, females 14) was done.



Patients' examination in NIREH respiratory clinic

2. Community based health services

Community based health services being provided by NIREH to the gas exposed people continued during the year. Under this programme on every Friday needy morbid subjects in the severely affected areas, identified during the epidemiological surveys, are examined by a physician of NIREH at their door steps and, if needed, transported to Bhopal Memorial Hospital and Research Centre (BMHRC) or referred to other government gas rahat hospitals for investigations and treatment. A total of 68 patients (males 38, females 30) availed this facility and got benefitted during the year.

3. Respiratory Physiotherapy Centre

Community based pulmonary rehabilitation activity at Kenchi Mini Unit of BMHRC was continued by NIREH. Under this activity a qualified part time Physiotherapist has been providing pulmonary physiotherapy services on regular basis at this mini unit. Gas exposed and COPD patients identified by NIREH physicians are referred for physiotherapy at this centre.. Respiratory physiotherapy has been found to be very effective in ameliorating the disability level of chronic COPD patients. During the year 15 new patients were provided respiratory physiotherapy.



A COPD patients undergoing tri flow lung volume exercise at respiratory physiotherapy centre

Important events

1. NIREH FOUNDATION DAY

National Institute for Research in Environmental Health, Bhopal celebrated its 6th Foundation Day on 11th October, 2015. After the welcome address by Dr. N. Banerjee, Scientist C, Dr. N. P. Mishra, a renowned medicine specialist of International repute and Ex Dean, Gandhi Medical College, Bhopal delivered NIREH Foundation Day Oration. Emphasizing on the need of remaining vigilant and preparedness to prevent and tackle any disaster viz. natural, man-made or accidental, he recapitulated the entire happenings following the Bhopal gas tragedy in the fateful night of 2/3 December, 1985. He graphically recalled the immense efforts of the medical fraternity of Bhopal in managing the health conditions of several thousands of people



Dignitaries on the dais



Prof. N.P. Misra with Oration Award



Address by Dr. R. S. Dhaliwal



Address by Mrs. Gauri Singh, IAS

immediately after the accident and afterwards and elaborated on various researches undertaken by ICMR under the Bhopal Gas Disaster Research Center. Mrs. Gauri Singh, IAS, Principal Secretary (Health), Govt. of M.P. and the Chief Guest of the function deliberated on the magnitude of deterioration of environment and its adverse effect on human health which

need to be tackled on priority basis. She told that for NIREH to grow to a stature of national institute of excellence in environmental health as per its mandate would demand a huge trained manpower and resources. She suggested that hub and spokes model should be followed to achieve this goal where NIREH acts as the hub for all research activities related to the environmental health and various medical colleges, other technical and research institutions would be the spokes in active collaboration with NIREH to enhance its research outreach. Dr. R. S. Dhaliwal, Scientist F, NCD Division, ICMR, New Delhi pointed out that besides working on health research needs of gas exposed people of Bhopal, NIREH has to diversify to the field of environmental health in general and health problems caused due to the exposure to the chemical threat agents such as toxic industrial chemicals, pesticides, endocrine disrupting chemicals etc. in particular. He outlined the potential research areas in the field of environmental health which can be picked out by NIREH. Dr. Anil Prakash, Director-in-Charge, NIREH briefed about the ongoing and future research activities of NIREH and called upon the members of NIREH fraternity to work with zeal, dedication and devotion to help NIREH achieve its goal. The programme ended with the vote of thanks offered by Dr. Y. Sabde, Scientist E.

2. WORLD ENVIRONMENT DAY

The 'World Environment Day' was celebrated on 5th June 2015 with enthusiasm at National Institute for Research in Environmental Health. To commemorate the occasion a poster competition was organized among the staff members and an in-house Seminar was arranged at NIREH. In his opening address, Dr. Anil Prakash, Director-in-Charge, NIREH stressed on the optimum use and conservation of natural resources. During the Seminar Prof. R. P. Khambayat, NITTTR, Bhopal delivered a lecture on 'Conservation of Environment for Human Health'. Prof. Khambayat stressed on Green Technology, Green Architecture, Green Environment and spoke on the need of environment based planning. Dr. Shyam Agrawal, a renowned Oncologist and Director, Navodya Cancer Hospital, Bhopal was the other speaker on the occasion. In his lecture 'on Environment & Cancers' he deliberated on various types of cancers likely to be caused by the environmental exposure. Green potted plants as souvenirs were presented to the speakers and winners of the poster competition as a mark of respect towards our environment. A poster on environment protection was also released on the occasion. The programme ended with the vote of thanks by Dr. R. M. Samarth.



Glimpses of World Environment Day 2015

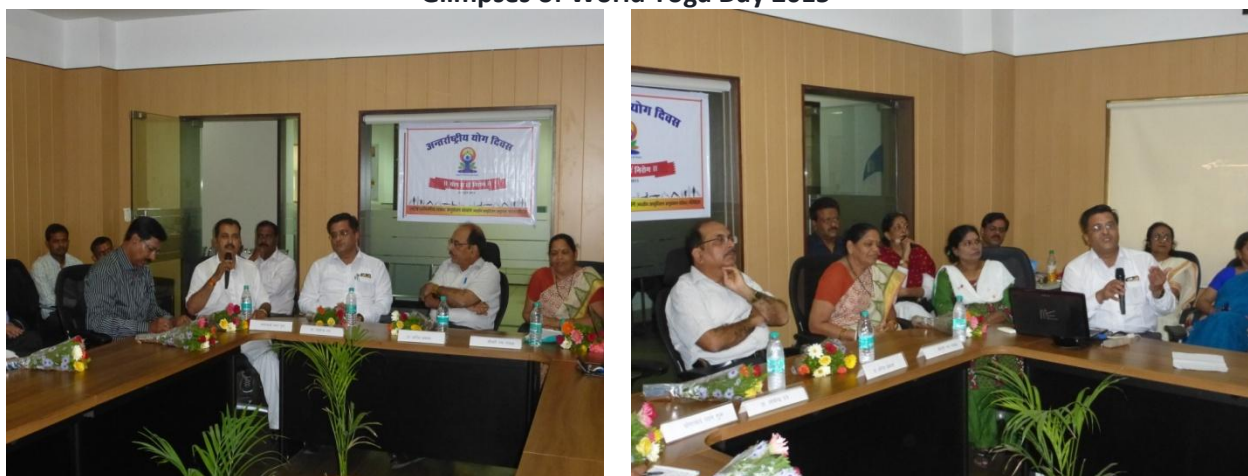


3. INTERNATIONAL YOGA DAY

National Institute for Research in Environmental Health, Bhopal observed first International day of Yoga on 21st June 2015. On this occasion, a Seminar was organized wherein lectures were delivered on Yoga by Dr. Lokendra Dave- Professor, Gandhi Medical College, Bhopal, Shri Pawan Guruji-Director, Yog Sadhna Anusandhan Kendra, Bhopal and Smt. Rama Nayak-Associate of Pathanjali Yoga Peeth, Bhopal. The speakers in the Seminar deliberated on various aspects of Yoga ranging from Vedic Philosophy to Modern science, Use of yoga in the prevention, control and management of various non-communicable diseases such as diabetes, hypertension and various types of Yogas. Mrs. Seema Khare, Technical Assistant,



Glimpses of World Yoga Day 2015



NIREH explained ways of performing various yoga asanas. On this occasion a poster entitled 'Balance is essential for Healthy Body & Environment- Let us start practicing Yoga daily' prepared by Mr. Vijay Singh Rathore, Technical Assistant, NIREH was released by Dr. Anil Prakash, Director-in-Charge. Function ended with the vote of thanks by Dr. N. Banerjee.

4. NATIONAL HINDI DIWAS

National Hindi Diwas is observed on September 14 every year to promote the 'Matra Bhasha'. Hindi language stands as a symbol of national spirit, unity, integrity and mutual harmony among citizens of India. The fortnight long events, known as Hindi Pakhwada lay emphasis on the importance of the Hindi language in India. NIREH also celebrated the Hindi Diwas Samaroh on 14th September 2015. Dr. Anil Prakash, Director in-Charge, NIREH presided over the Samaroh. Smt. Sadhana Tripathi, Head, Regional Rajbhasha Implementation Office (Central), Bhopal was the Chief Guest on the occasion. Smt. Tripathi said that the constitution provides that Hindi should be developed in such a way that it should reflect India's composite culture. Hindi has, therefore, been entrusted with a very important role. Hindi language was

helpful in enabling government policies and schemes to reach the people. Increasing use of Hindi in internet and mobile services would be helpful in reaching to the masses, Dr. Prakash added. Smt. Swapna Azhar, Technical Assistant, NIREH recited a Hindi poem on this occasion. The samaroh ended with a vote of thanks by Dr. N. Banerjee.



Observing National Hindi Diwas in NIREH

5. WORKSHOP ON e-CONSORTIA AND J-GATE PLUS

A workshop on e-Consortia and J-gate plus related to online journal services provided by ICMR was organized by P & I Division of ICMR, New Delhi in collaboration with NIREH on 23 September, 2015. The Workshop was attended by 15 participants comprising of Library staff of ICMR institutes located in the Central/Northern regions such as NIN, Hyderabad, NIRTH, Jabalpur, JALMA Agra, BMHRC and NIREH, Bhopal. Dr. V.K. Shrivastava, Scientist-G and Head, Division of Publication & Information, ICMR deliberated on the importance of Workshop- Cum- Training Programme on ICMR e- Consortia & J Gate Plus for ICMR Institutes. Representative from J- Gate Plus Company along with other companies like Pro- quest, Science and Nature, imparted the training on accessing and retrieving full text articles from ICMR e-Consortia & J- Gate Plus journals. Mr. A. Ratnakar, ALIO, ICMR provided hands on experience to the participants in retrieving information from the database in order to promote maximum utilization of e- resources by the Scientists.



Glimpses of Workshop on e-Consortia & J-Gate Plus

6. SWACCH BHARAT ABHIYAN

National Institute for Research in Environmental Health participated with enthusiasm in the nationwide Intensive National Cleanliness Campaign (25.9.2015 to 11.10.2015) organized on the first anniversary of the Swacch Bharat Abhiyan. On the day of Gandhi Jayanti i.e. 2nd October, 2015, NIREH officials and staff members carried out extensive cleanliness drive in the Institute and performed voluntary 'Kar Seva' at NIREH premises and the surrounding areas. This Kar Seva by the officials and staff members of NIREH continued on every Friday between 4.30 – 5.30 PM throughout the year to clean the vulnerable spots in the vicinity of NIREH building and its surroundings.





Glimpses of Swacch Bharat Abhiyan

Further, as a part of Swacch Bharat Abhiyan and National Cleanliness Campaign, NIREH organized lectures/seminar in Nav Niketan Higher Secondary School, Keinchi Chhola, Bhopal, on 7th October 2015 to sensitize students of primary section on the importance of cleanliness in the School premises, their homes and surrounding areas for maintaining proper health. Awareness on environment pollution and personal hygiene among students was created with the help of audio visual aids in an interactive manner. Pamphlets on importance of cleanliness and personal hygiene were also distributed among the students and teachers. Animated video film on personal hygiene was shown to the students.



7. VIGILANCE AWARENESS WEEK

The Vigilance Awareness Week (26-31 October 2015) having the theme 'Preventive Vigilance as a tool of Good Governance' was observed in National Institute for Research in Environmental Health. On 26th October 2015, Dr. Anil Prakash, Director-in-Charge administered pledge to all the officials and staff to maintain dignity, integrity and transparency in all activities to achieve the goals of the Institute. In his address Dr. Prakash emphasized on the importance of being vigilant and aware. On 30th October 2015 an invited lecture was delivered by Dr. Raka Arya, Associate Professor, National Law Institute

University, Bhopal in the Conference Hall of NIREH. Dr. Arya spoke on the importance of preventive vigilance inefficient administration. She deliberated on the concept of good governance which requires transparency, accountability and truthfulness. She listed and explained various preventive measures which may be helpful in reducing corruption, administrative delays,



Glimpses of Vigilance Awareness Week

minimizing cumbersome procedure and scope for personal discretion. The lecture of Dr. Arya was followed by an interactive discussion. The programme ended with a vote of thanks by Dr. Kailash C. Pandey, Scientist-E, NIREH, Bhopal.

8. RASHTRIYA EKTA DIWAS

The birth anniversary of Sardar Vallabhbhai Patel is observed as Rashtriya Ekta Diwas on October 31 every year. A pledge to observe and maintain national unity was administered to all officials and staff members of NIREH on 30.10.2015 by Dr. N. Banerjee, Head of the Office. After the pledge administering ceremony Dr. Banerjee in his address remembered the contribution of Sardar Patel in the merger of the then princely states in the Union of India.



Pledge taking on Rashtriya Ekta Diwas 2015

9. FIFTH SCIENTIFIC ADVISORY COMMITTEE MEETING

Fifth Scientific Advisory Committee meeting of National Institute for Research in Environmental Health was held on 15.2.2016 under the Chairmanship of Prof. V. K. Vijayan. The meeting was attended by the expert members Dr. Padam Singh, Dr. J. S. Thakur, Dr. H. N. Saiyed, Dr. Kalpana Balakrishnan, Dr. Alok Dhawan, Dr. S. Mahendale, Dr. K. Krishnamurthy and officials from the Council such as Dr. D. K. Shukla and Dr. R. S. Dhaliwal. Dr. S. Swaminathan, Secretary, DHR & DG, ICMR and Dr. B. Shah, Head, Division of NCD, ICMR joined the meeting through video conferencing. The Committee reviewed the ongoing projects and new studies proposed and provided valuable advice on various matters and activities of NIREH.



Glimpses of 5th SAC meeting

10. VISIT OF SECRETARY DHR & DG, ICMR

Dr. Soumya Swaminathan, Secretary, DHR, and Director General, Indian Council of Medical Research visited NIREH, Bhopal on 18th November 2015. She was accompanied with Mr. R.P. Meena, Joint Secretary, DHR, Mr. T.S. Jawahar, Sr. DDG (Admn) ICMR and Dr. R.S. Dhaliwal, Scientist-F, ICMR. Dr. Soumya Swaminathan, took a round of various laboratories and facilities of the Institute. During her visit she interacted with the Scientists of NIREH and appraised herself with the ongoing research activities. She also addressed the staff members of NIREH.



Visit of Director General, ICMR to NIREH

LIBRARY

Infrastructure of National Institute for Research in Environmental Health library is very basic. It is equipped with computers with internet connectivity to help researchers in carrying out their academic activities. Library is having access to various journals available in e-consortia of ICMR like Lancet, Science and Nature. ProQuest Medline Library (PML) data base is providing full text online access to 3,500 biomedical journals, and ICMR customized Journal Custom Content Consortia (JCCC-ICMR) covering 693 full text journals and 215 open access journals. Electronic Resources in Medicine (ERMED) is providing access to many online journals to the researchers. Subscription of online as well as print copy of the Journal of Environmental Health has been started this year.



Views of the library

With the addition of several new books during the year NIREH library is presently maintaining a core collection of about 150 books in the field of Bhopal Gas Disaster, Cytogenetics, Epidemiology, Pathology, Molecular Biology, Computer Science and Bio-statistics. Library also has got a good collection of various documents, publications, reports of seminars and workshops etc. related to Bhopal Gas Disaster and related environmental health issues.

Post-graduate students' Dissertation and Summer Training Programme

During the year National Institute for Research in Environmental Health introduced the Post-graduate students' dissertation and summer training programme as part of the human resources development initiative of the institute. Four students were inducted in the 6-months dissertation course (January to June). The topics assigned to the students were interdisciplinary in nature from the thematic areas of (i) environmental carcinogenesis, (ii) nanotoxicology, (iii) particulate-matter associated immune assessment and (iv) cytogenetic anomalies. Topics were formulated to draw together practical applications of cell and molecular biology, immunology and biochemistry with the objective to address a defined environmental health problem and to provide the students working knowledge of science that underpins them.

DISSERTATIONS

Evaluation of mitochondrial-nuclear cross talk upon exposure to lipid-based nano-vectors: implications for environmental health

Student: Mr. Amar Nagrade (M.Sc. Life Sciences, Devi Ahilya Vishwavidyalaya, Indore)

Supervisors: Dr. P. K. Mishra & Dr. K. C. Pandey

A comparative evaluation of mitochondrial-nuclear cross talk following treatment with three lipid nano-vectors, i.e. elastic liposomes (liposomes), ethanolic liposomes (ethosomes) and solid lipid nanoparticles (nanosomes) were examined in an *in vitro* cell culture model system. Studies were performed in two sections: dose-dependent and time-course kinetics (n=3). Dose-dependent response of the three lipid nano-vectors, were conducted with concentrations ranging from 0.1 to 100 µg, whereas time-course experiments were performed at a constant concentration of 5 µg at time intervals ranging from 1 to 24 h. Through a series of standardization assays, it was found that a dose of 5 µg is optimum to perturb the fine balance of mitochondrial-nuclear cross talk (Fig-7). Of the three nano-vectors tested, ethosomes induced dsDNA breaks, triggered intracellular mitochondrial oxidative burst with altered mitochondrial membrane depolarization (ΔΨ) finally leading to an inexorable cellular demise as evident by inter-nucleosomal DNA fragmentation. However, current evidence is primarily indirect and further in-depth molecular investigations will be required in future to substantiate these findings. A further challenge will be to extrapolate results from such studies to humans. Taken together, these findings might be helpful to better characterize the risks associated with immuno-toxic effects of lipid based nano-vectors exposure. It is expected that these data along with results from other studies would help to design better approaches in risk assessment of nano-materials used in our daily lives.

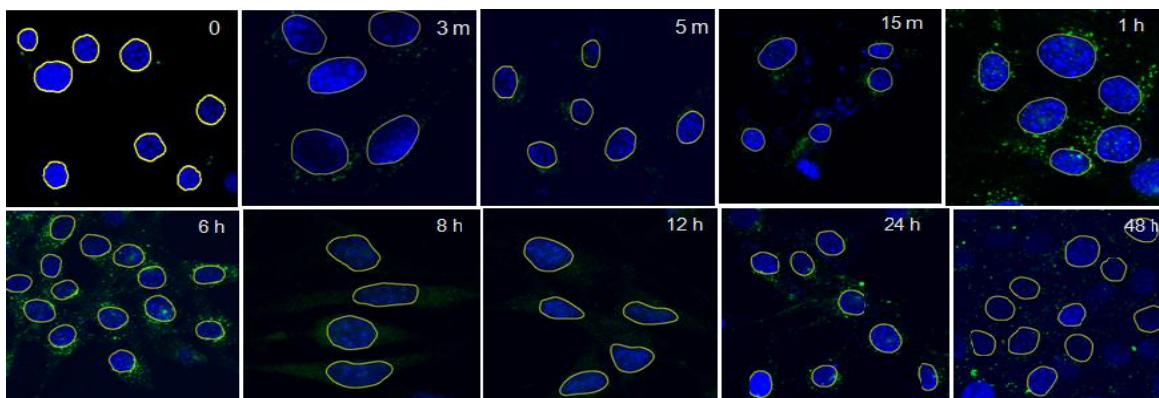


Fig - 7: Time-course kinetics of nano-vector uptake: A representative laser-scanning confocal microphotograph showing the uptake of ethosomes *in-vitro*. Note the maximum uptake at 6h.

Development of an *in vitro* model system for immune health assessment of ultrafine air aggregates

Student: Ms Hira Naz (M.Sc. Biotechnology), Rani Durgavati Vishwavidyalaya, Jabalpur

Supervisors: Dr. P. K. Mishra & Dr. K. C. Pandey

The principal objective of the study was to develop an *in vitro* model system for assessment of immune function following exposure to ultra-fine air aggregates. A comparative evaluation was done with three kinds of air aggregates of size $> 2.5 \mu\text{M}$, $< 2.5 \mu\text{M}$ and $< 0.1 \mu\text{M}$. Parameters such as (i) evaluation of double-strand DNA damage & repair response pathway (ii) quantitative analysis of *phospho-p53* by SDS-PAGE and immuno-blot (iii) intra-nucleosomal DNA fragmentation by agarose gel electrophoresis (iv) active caspase-3 assay through flow cytometry and (v) mtDNA copy number analysis by PCR were studied. All experiments were replicated thrice ($n=3$). The results demonstrated that of the three air aggregates tested, $0.1 \mu\text{M}$ had more potential to perturb the genomic integrity of the immune cells (Fig-8). The result of the study indicates a connective link between associated respiratory morbidities with ultra-fine air aggregate exposure, and might facilitate to discern the exposure-response relationship in observed deficits of impaired immune cell function in pulmonary microenvironment. However, to explicate the intra-cellular signalling pathways involved in particulate matter-induced immune health implications, molecular investigations at the level of genome, epigenome and cytochrome is imperative.

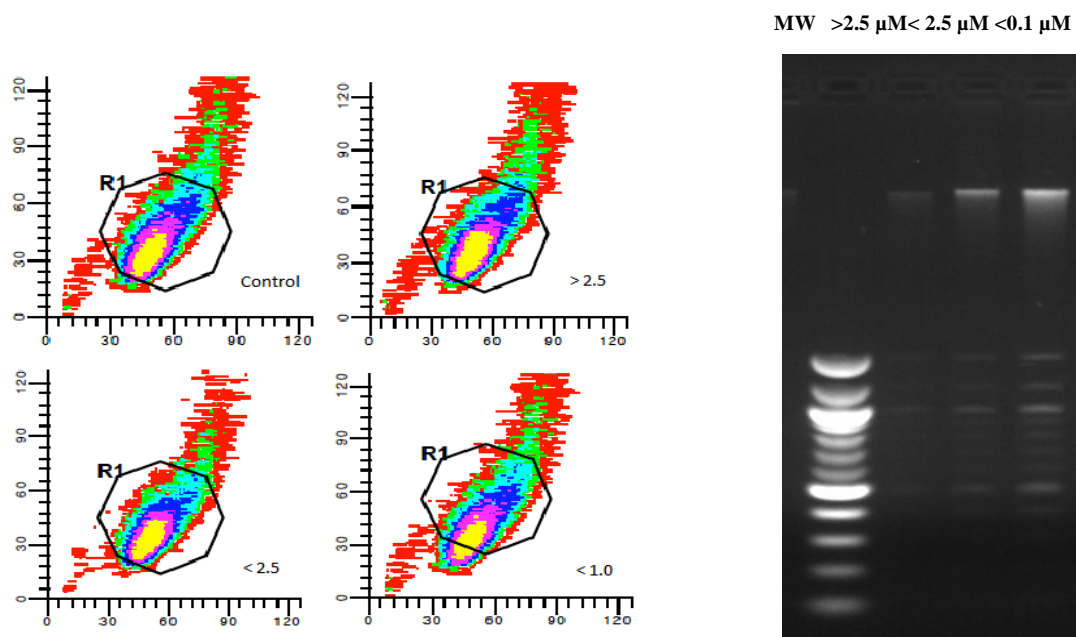


Fig- 8: Left panel showing fate of cells after phagocytosis of ultrafine air aggregates analyzed by flow cytometry. Right panel deciphering photomicrograph of inter-nucleosomal DNA fragmentation following exposure to > 2.5 μM , < 2.5 μM and < 0.1 μM air aggregates.

Cloning, expression and purification of P450 Oxido Reductase (POR) and its possible role in metabolism of carcinogens

Student: Mr. Arjun Meda (M.Sc. Biochemistry, Devi Ahilya Vishwavidhalaya, Indore)

Supervisors: Dr. K. C. Pandey & Dr. P. K. Mishra

P450 Oxido reductase (POR) is an integral membrane flavoprotein that catalyzes the transfer of electrons in the metabolism of xenobiotics such as, drugs, steroids, toxins and carcinogens. POR has four distinct domains viz. two flavin adenine dinucleotide (FAD) and one flavin mononucleotide (FMN) binding domains and a NADPH binding domain (Fig-9). There are studies on effect of POR activities on various drugs, however information on the effect of wide range of carcinogens on purified P450 reductase (POR) activity is limited. To study the role of POR in metabolism of different carcinogens the human POR gene (1.8 kB; Fig- 9A) was cloned in pET 22 b vector (Novagen, EMD Millipore). Briefly, a construct code for POR was amplified using specific primers from human POR cDNA. The EcoR1 and Xho 1 sites were inserted using specific primers, and amplified DNA fragments were purified by gel extraction, ligated into appropriately digested plasmids, pET 28 b and transformed in *Escherichia coli* DH10 α

competent cells. The sequence identity of recombinant genes was confirmed by DNA sequencing. The cloning was further confirmed by digestion of pET28b-POR with restriction digestion using EcoR1 and Xho 1 restriction enzymes. POR was expressed heterogeneously in *E.coli* cells, BL-21 DE 3 p-Lys S. Target protein of interest was further purified by ion exchange chromatography (Fig-9B). The large scale expression and detail characterization of enzyme is underway.

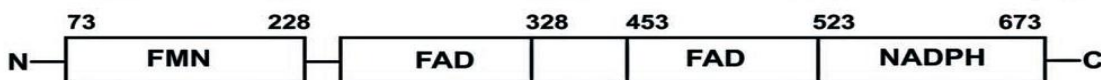


Fig-9: Schematic presentation of different domains of human POR. POR has four distinct domains: two flavin adenine dinucleotide (FAD) and one flavin mononucleotide (FMN) binding domains and a NADPH binding domain

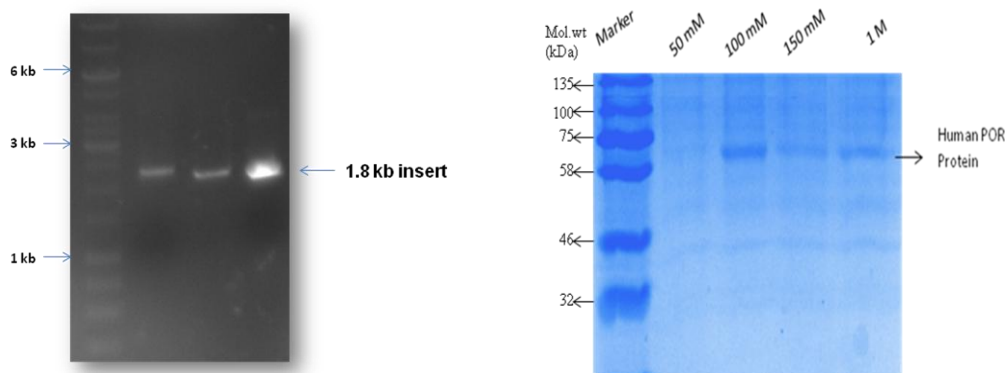


Fig-9: Expression of POR in bacterial cells: 9A (left); Cloning of P450 enzyme; an agarose gel (0.8 %) showing the amplification of POR gene. The inserts of 1.8 kb were amplified using specific primers with EcoR1 and Xho 1 restriction sites. 9B (right); Purification of POR enzyme: enzyme was expressed in BL-21 DE-3 p Lys S, using pET28b-POR construct. A 10 % SDS page gel is showing molecular wt. marker in the 1st lane and 50 mM NaCl washing in 2nd lane. Protein profile after salt elution (100 mM-1M NaCl) was seen in the gel, and purified protein visualized at 72 kDa

Evaluation of cyclophosphamide induced chromosomal abnormalities: an *in vitro* study

Student: Ms. Sharda Shrivastava (M.Sc. Biotech, Rani Durgavati Vishwavidyalaya, Jabalpur)

Supervisor: Dr. R. M. Samarth

In this study the effects of cyclophosphamide in inducing cytogenetic changes in human peripheral blood lymphocyte culture without exogenous metabolic activation were investigated. The preliminary results revealed that cyclophosphamide at concentrations of 5, 50

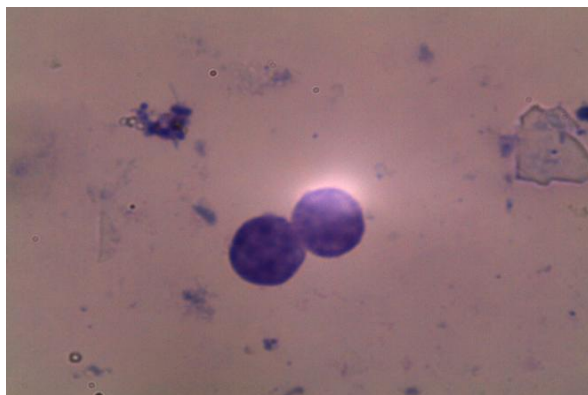
and 100 $\mu\text{g/ml}$ induced a remarkable increase in chromosomal aberrations in cyclophosphamide treatment groups in comparison to control (Fig-10). A dose dependent decrease was observed in mitotic index (MI) and nuclear division index (NDI) in lymphocytes after treatment with cyclophosphamide at the tested dosages. A dose dependent increase was observed in chromosomal aberrations and frequency of micronuclei in bi-nucleated cells in lymphocytes. These results showed that cyclophosphamide is able to induce genotoxicity in human lymphocytes.



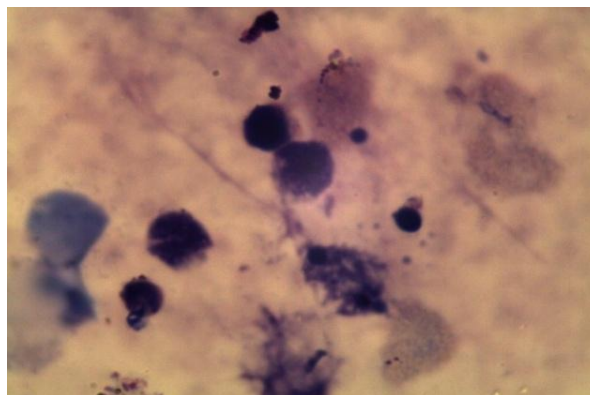
Normal metaphase plate



Metaphase showing chromosomal aberrations



Bi-nucleate cell without micronuclei



Bi-nucleate cell with micronuclei

Fig-10: Cytogenetic changes induced by cyclophosphamide in human peripheral blood lymphocytes

Short term Summer Training

Following four students were admitted for the short term (30-45 days) summer training programme wherein they were provided comprehensive hands-on-training in various techniques pertaining to the field of environmental biotechnology.

Name of the Student	Affiliation	Subject
1. Mr. Uday Bahadur Singh	Rani Durgavati Vishwavidyalaya, Jabalpur	M.Sc. Biotechnology
2. Ms. Jyoti Kumari	Devi Ahilya Vishwavidyalaya, Indore	M.Sc. Life Sciences
3. Ms. Divya Patidar	Devi Ahilya Vishwavidyalaya, Indore	M.Sc. Life Sciences
4. Ms. Roobi Yadav	Devi Ahilya Vishwavidyalaya, Indore	M.Sc. Life Sciences

Construction of NIREH Campus at Bhauri

Construction of NIREH campus on a 8.0 hectares plot of land at Bhauri village, situated on Bhopal-Indore by pass by the Capital Project Administration, Govt. of M.P. was initiated during the year. The proposed build up area of the NIREH building is 26,359 sq meters including core laboratory block, administrative block, auditorium, animal house, utility, guest house, student's hostel and residential quarters. Construction of boundary wall and security gate complex has been completed.



Boundary wall & Security gate complex of NIREH campus at Bhauri

Phase II staff recruitment for NIREH

A total of 184 permanent posts belonging to Scientific cadre (66), Technical cadre (84), Administrative cadre (26) and Engineering cadre (8) have been sanctioned by the Government of India for NIREH. Process for recruitment of 57 scientific, administrative, technical and engineering posts in Phase II was initiated at the Council level (29 posts) and NIREH (28 posts). Screening of applications received against 28 permanent Group A, B and C category posts, advertised by NIREH, was completed and preparations initiated for conducting written examination for these posts. Further, at Council level interviews were held for 6 posts of Scientist E and 4 selected candidates belonging to the disciplines of Biotechnology, Biochemistry, Epidemiology and Pulmonology joined the institute during the year. Selection process for 3 posts of Scientist C (Pathology, Ophthalmology and Pediatrics) was also completed.

Meetings / Trainings / Seminars attended

Dr. Anil Prakash, Director-in-Charge

1. *First meeting of the Working Group to develop the methodology for reporting/creation of information system of health impact of Critically Polluted Areas* (16 April, 2015) organized by Central Pollution Board at Nirman Bhawan, New Delhi
2. *12th Advisory Committee Meeting on Gas Rahat constituted by Hon'ble Supreme Court* (29 May, 2015) at Nirman Bhawan, New Delhi
3. *Meeting to discuss issues related to Bhopal center of Chronic Kidney Disease Task Force project* (26 August, 2015) at AIIMS, New Delhi
4. *Selection Committee Meetings for the posts of Scientist C of NIREH* (1 September, 2015) held at ICMR Hqts., New Delhi
5. *Meeting of the Directors/Director-in-charges of ICMR institutes* (4 September, 2015) held at NIE, Chennai
6. *Investigators meeting of ICMR Task Force CKD Project* (18 September, 2015) held at NIMS, New Delhi
7. *Workshop on ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal
8. *Workshop on Sources of Environmental Pollution in India : Influence of Municipal Solid Waste and Biomass Burning on Air Quality and the Microbiome of the Ganges* (25-26 October, 2015) at IIT, Kanpur
9. *13th Advisory Committee Meeting on Gas Rahat constituted by Hon'ble Supreme Court* (18 November, 2015) at Bhopal, New Delhi
10. *Meeting of the Joint Working Group on Indo-US collaboration in Environment and Occupational Health* (24 February, 2016) at ICMR, New Delhi
11. *Indo-US Workshop on Air Pollution and Health under the aegis of Indo-US collaboration on Environment and Occupational Health* (24-26 February, 2016) at Hotel Hyatt Regency, New Delhi
12. *Meeting of representatives of Govt. of India, Govt. of M.P. and NGOs to examine relevant issues in W.P. no. 15658/2012 along with Contempt Petition no. 832/2015 filed by BGPMUS & Ors. Vs Union of India in the Hon'ble High Court of M.P.* (14 March, 2016) at DHR, New Delhi

Dr. Y. D. Sabde, Scientist E

1. *Workshop on ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal
2. *Preconference Workshop of 43rd Annual National Conference of Indian Association of Preventive and Social Medicine* (6 January, 2016) held at GMERS Medical College, Gandhinagar, Gujarat. Delivered Key Note address on *Use of GIS in public health*.

3. *Indo-US Workshop on Air Pollution and Health under the aegis of Indo-US collaboration on Environment and Occupational Health* (24-26 February, 2016) at Hotel Hyatt Regency, New Delhi
4. *Workshop on Public Health and Mass Gathering Preparedness and Medical Management* (29 February, 2016) held at R.D.Gardi Medical College, Ujjain

Dr. Kailash C. Pandey, Scientist E

1. *5th Ramalinga Conclave* (18-20 December, 2015) held at Regional Centre for Biotechnology, Faridabad
2. *Mentors–Students Workshop on Innovation Projects, 2015 - 16* (S. No.311). Design, Synthesis and Screening of Silver Nano particles as Novel Anti-bacterial and Anti-malarial Agents, held at National Institute of Malaria Research (31 December, 2015) and Sri Venkateswara College, University of Delhi (22 February, 2016)
3. *Indo-US Workshop on Air Pollution and Health under the aegis of Indo-US collaboration on Environment and Occupational Health* (24-26 February, 2016) at Hotel Hyatt Regency, New Delhi

Dr. P. K. Mishra, Scientist E

1. *National Conference on Reproductive Health Challenges: Issues and Remedies* (11-13 September, 2015) held at IIS University, Jaipur. Delivered an Invited Talk, *Can mitochondrial ROS-mediated epigenetic alterations trigger testicular germ cell cancer?*
2. *UNESCO's Symposium on Horizons of Light in Molecules, Materials & Daily Life* (18-19 December 2015), held at School of Chemical Sciences, Central University, Sagar. Delivered an Invited Talk, *Dendritic cell engineering for selective targeting of gynecological cancers*
3. *Science Academies Lecture Workshop on Medical Biotechnology* (21-22 January 2016), held at Department of Biotechnology, Central University, Sagar. Delivered an Invited Talk, *Can we really prevent cancers? Serpent's connection from myths to modern science*
4. *International Conference on Reproductive Health with Emphasis on Occupational, Environmental & Lifestyle Factors* (18-20 February, 2016) held at National Institute of Occupational Health (ICMR), Ahmedabad. Delivered an Invited Talk, *Nano-Selaginellin : A novel strategy for reproductive cancer therapy*
5. *DST sponsored National Workshop on Next Generation Sequencing* (15-17 March, 2016) organized by Madhya Pradesh Council of Science & Technology, Bhopal. Delivered an Invited Talk, *Environmental Disasters and Testicular Cancers: Myths & Facts*

Dr. N. Banerjee, Scientist C

1. *12th Advisory Committee Meeting on Gas Rahat constituted by Hon'ble Supreme Court* (29 May, 2015) at Nirman Bhawan, New Delhi

2. 13th Advisory Committee Meeting on Gas Rahat constituted by Hon'ble Supreme Court (18 November, 2015) at Bhopal, New Delhi

Dr. Sushil Singh, Scientist C

1. Workshop on *ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal

Dr. K.K. Soni, Scientist B

1. Workshop on *ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal
2. Training-Cum-Workshop on Occupational & Environmental Diseases (11-12 Feb, 2016) organized by ROHC, Bangaluru
3. *International Conference on Water, Environment, Energy and Society* (15-18 March, 2016) organized at AISECT University, Bhopal
4. *National Conference on Environmental Concerns & Green Marketing* (19 March, 2016) organized at LNCT College, Bhopal

Dr. Ruma Galgalekar, Scientist B

1. Workshop on *ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal

Mrs. Moina Sharma, Scientist B

1. Workshop on *ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal
2. *International Conference on Water, Environment, Energy and Society* (15-18 March, 2016) organized at AISECT University, Bhopal
3. *National Conference on Environmental Concerns & Green Marketing* (19 March, 2016) organized at LNCT College, Bhopal

Dr. R. M. Samarth, Asstt Prof.

1. Workshop on *ICMR e-Consortia, Proquest & J-Gate Plus* (23 September, 2015) organized at NIREH, Bhopal
2. Symposium on *Intellectual Property Rights (IPR) Leveraging and Management* (30 November, 2015) organized by IIPRD and Khurana & Khurana at Bhopal

3. Meeting of *ICMR Technical Committee* (14January, 2016) at ICMR Headquarters., New Delhi
4. Meeting of *ICMR Expert Committee Meeting* (22March, 2016) at ICMR Headquarters., New Delhi

Mr. S. Subherwal, AAO

1. Meeting of *ICMR Technical Committee* (21 July, 2015) at ICMR Headquarters, New Delhi
2. Meeting of *ICMR Technical Committee* (14January, 2016) at ICMR Headquarters, New Delhi
3. Meeting of *ICMR Expert Committee Meeting* (22March, 2016) at ICMR Headquarters., New Delhi

Dr. V. S. Rathore, TA

1. International Conference on Water, Environment, Energy and Society (15-18 March, 2016) organized at AISECT University, Bhopal
2. National Conference on Environmental Concerns & Green Marketing (19 March, 2016) organized at LNCT College, Bhopal

Mrs. Swapna Azhar, TA

1. International Conference on Water, Environment, Energy and Society (15-18 March, 2016) organized at AISECT University, Bhopal
2. National Conference on Environmental Concerns & Green Marketing (19 March, 2016) organized at LNCT College, Bhopal

Mrs. Anita Bhawsar, TA

1. International Conference on Water, Environment, Energy and Society (15-18 March, 2016) organized at AISECT University, Bhopal
2. National Conference on Environmental Concerns & Green Marketing (19 March, 2016) organized at LNCT College, Bhopal

Ms. Anita Pillai, Tech A

1. *National Conference on Emerging issues in Environment, Occupational Health & Safety : Its national scenario and Regional Need* (22-24 July, 2015) organized by ROHC (S)-NIOH-ICMR at Bangluru
2. *International Conference on Water, Environment, Energy and Society* (15-18 March, 2016) organized at AISECT University, Bhopal
3. *National Conference on Environmental Concerns & Green Marketing* (19 March, 2016) organized at LNCT College, Bhopal

Publications

Research papers

1. Bhat HR, Singh UP, Thakur A, Ghosh SK, Gogoi K, Prakash A^{*}, Singh RK. Synthesis, antimalarial activity and molecular docking of hybrid 4-aminoquinoline-1,3,5-triazine derivatives. *Experimental Parasitology* 2015 ; 157: 59-67
2. Bunkar N, Bhargava A, Khare N, Mishra PK[®]. Mitochondrial anomalies: driver to age associated degenerative human ailments *Frontiers in Bioscience* 2016 ; 21: 769-793
3. Dhote V, Mishra DK, Mishra PK[®], Dhote K. Micropellets: A promising strategy for controlled release of lansoprazole. *Asian Journal of Biomaterial Research* 2015 1 (2) : 56-61
4. Gohain N, Prakash A^{*}, Gogoi K, Bhattacharya DR , Sarma NP Kalita MC. An ethnobotanical survey of anti-malarial plants in some highly malaria affected districts of Assam. *International Journal of Pharmaceutical Sciences* 2015 ; 7 (9) : 147-152
5. Mishra PK[®], Bunkar N, Raghuram GV, Khare, NK, Bhargava A. Epigenetic dimension of oxygen radical injury in spermatogonial epithelial cells. *Reproductive Toxicology* 2015 ; 52 : 40-56
6. Mishra PK[®], Raghuram GV, Bunkar N, Bhargava A, Khare NK. Molecular bio-dosimetry for carcinogenic risk assessment in survivors of Bhopal gas tragedy. *International Journal of Occupational Medicine and Environmental Health* 2015; 28 : 921-939
7. Mishra K, Dhote V, Bhargava A, Jain DK, Mishra PK[®]. Amorphous solid dispersion technique for improved drug delivery: basics to clinical applications. *Drug Delivery and Translational Research* 2015 ; 5 : 552-565
8. Mittra, NK, Khare G., Raghuram V, Nair NK, Mishra PK[®], Dutt A. Circulating nucleic acids damage DNA of healthy cells by integrating into their genomes. *Journal of Biosciences* 2015 ; 40 : 91-111
9. Mishra PK[®], Lohiya NK. Prioritizing reproductive health: can it be the real game changer for India? *Journal of Reproductive Health and Medicine* 2016; 2 : 1-3
10. Pillai AS. Sustainable development: A mile stone for over all development in reference to environmental protection. *Acta Biologica* 2014 ; 3 (2) : 621 – 627
11. Pillai AS, Gupta R. Disaster management with modern technology. *European Journal of Biomedical and Pharmaceutical Sciences*, 2015; 2 : 772 -780
12. Pillai AS. Waste management in India: A need of an hour. In (V.S. Adigal, Rita Kant & M. Madhvi eds) *Innovative Ideas in Business Management*. Bharat Publications, New Delhi, 2015 : 521 – 526
13. Pillai AS. The chemical and chemical industries scenarios: An evaluation. *European Journal of Biomedical and Pharmaceutical Science* 2015 ; 2 : 242 – 247
14. Pillai AS, Gupta R. A luminent living testimonial to rapacious industrialization: MIC Gas crippled Bhopal. *Shodhaytan* 2015 ; 2 : 302 - 306
15. Samarth RM, Samarth M, Matsumoto Y (2015): Utilization of cytogenetic biomarkers as tool for assessment of radiation injury and evaluation of radiomodulatory effects of various medicinal plants- A Review. *Drug Design, Development and Therapy*, 2015 ; 9 : 5355-72

16. Sarma NP, Singh S, 2, Sarma DK, Bhattacharyya DR, Kalita MC, Mohapatra PK, Dohutia C, Mahanta J, Prakash A*. Mitochondrial DNA based genetic diversity of *Anopheles nivipes* in north east India. *Mitochondrial DNA* 2015 ; 26 : 1-4
17. Sharma P, Sharma S, Mishra A, Thomas T, De TD, Rohilla S, Singh N, Pandey KC[#], Dixit R. Unraveling dual feeding associated molecular complexity of salivary glands in the mosquito *Anopheles culicifacies*. *Biology Open* 2015 ; 4 (8) : 1002-15
18. Sharma MK, Imamichi S, Fukuchi M, Samarth RM, Tomita M, Matsumoto Y. *In cellulo phosphorylation of XRCC4 Ser320 by DNA-PK induced by DNA damage*. *Journal of Radiation Research* 2016 ; 57: 115-120
19. Singh AK, Rajendra V, Pant A, Ghosh PC, Singh N, Latha N, Garg S, Pandey KC[#] et al . Design, synthesis and biological evaluation of functionalized phthalimides; a new class of anti-malarials and inhibitors of falcipain-2, a major hemogloninase of malaria parasite. *Bioorganic and Medicinal Chemistry* 2015 ; 23 : 1817 -1827
20. Thomas T, De TD, Sharma P, Lata S, Saraswat P, Pandey KC[#], Dixit R . Hemocytome: deep sequencing analysis of mosquito blood cells in Indian malarial vector *Anopheles stephensi*. *Gene*. 2016 ; 585 : 177-190
21. Verma S, Dixit R, Pandey KC[#]. Cysteine Proteases: Modes of activation and future prospects as pharmacological targets. *Frontier Pharmacology*, 2016 ; 7 : 107 doi: 10.3389/fphar.2016.00107

* Based on work carried out by Dr. Anil Prakash, Scientist G at RMRC, Dibrugarh

Based on the past work of Dr. K. C. Pandey, Scientist E at NIMR, New Delhi

@ Based on the past work of Dr. P. K. Mishra, Scientist E at Central University, Sagar

Research work abstracted/presented

1. A. S. Pillai. *The chemical and chemical industries scenarios: An evaluation*. Presented in National Conference on Emerging issues on Environment, Occupational Health & Safety - its National scenario and Regional Needs (22-24 July, 2015) organized by ROHC (S)-NIOH-ICMR at Bengaluru
2. S. Singh, N. Banerjee, K. K. Soni, R. Galgalekar, M. Sharma, A. Prakash. *Persistently high respiratory morbidity 25 years after Bhopal disaster*. Abstracted in International Environmental Epidemiology conference (30 August- 4 September, 2015) organized by International Society for Environmental Epidemiology at Sao Paulo, Brazil
3. A. S. Pillai. *Need of a multi-sectoral approach to environmental problems: An analysis*. Presented in *International Conference on Water, Environment, Energy and Society* (15-18 March, 2016) organized at AISECT University, Bhopal
4. A. S. Pillai. *Transition to green economy in to sustainable development*. Presented in *National Conference on Environmental Concerns & Green Marketing* (19 March, 2016) organized at LNCT College, Bhopal

Institutional Committees

5th Scientific Advisory Committee

1	Dr. VK Vijayan, Kozhikode	Chairperson
2	Prof. NK Mehra, New Delhi	Member
3	Dr. Padam Singh, New Delhi	Member
4	Dr. Raj Lakshmi Gope, NIMHANS, Bangalore	Member
5	Dr. Kalpana Balakrishnan, SRU, Chennai	Member
6	Dr. HN Saiyed, Ahmedabad	Member
7	Dr. JS Thakur, PGIMER, Chandigarh	Member
8	Prof. IS Thakur, School of Environmental Sciences, JNU, New Delhi	Member
9	Prof. YK Gupta, Deptt of Pharmacology, AIIMS, New Delhi	Member
10	Director / Nominee CSIR-NEERI, Nagpur	Ex Officio Member
11	Director / Nominee CSIR-NITR, Lucknow	Ex Officio Member
12	Director, National Institute of Epidemiology, Chennai	Ex Officio Member
13	Director, National Institute of Occupational Health, Ahmedabad	Ex Officio Member
14	Director, National Institute for Environmental Health, Bhopal	Member Secretary
15	Director General, ICMR, New Delhi	ICMR Headquarters
16	Sr. DDG (Admn)/Sr Financial Advisor, ICMR, New Delhi	ICMR Headquarters
17	Head, Division of NCD, ICMR, New Delhi	ICMR Headquarters
18	Programme Officer for NIREH, ICMR, New Delhi	ICMR Headquarters
19	Dean, Gandhi Medical College, Bhopal	Special Invitee
20	Director, Kamla Nehru Gas Rahat Hospital, Bhopal	Special Invitee
21	Director / Nominee, AIIMS, Bhopal	Special Invitee
22	Director, BMHRC, Bhopal	Special Invitee

Epidemiologic Research Expert Group

1	Dr. Padam Singh, New Delhi	Chairperson
2	Dr. Arvind Pandey, Director, NIMS, New Delhi	Co-chair
3	Dr. DCS Reddy, Hyderabad	Member
4	Dr. PSS Sunder Rao, Bangalore	Member
5	Dr. JS Thakur, PGIMER, Chandigarh	Member
6	Dr. SN Dwivedi, AIIMS, New Delhi	Member
7	Director, National Institute of Epidemiology, Chennai	Member
8	Director, NIREH, Bhopal	Member
9	Dr. Sushil Singh, Scientist C, NIREH, Bhopal	Member Secretary

Clinical Research Expert group

1	Prof. D. K. Behera, PGIMER, Chandigarh	Chairperson
2	Dr. S. K. Sharma, AIIMS, New Delhi	Co-chair
3	Prof. R. V. Azad, AIIMS, New Delhi	Member
4	Prof. L. K. Dhaliwal, PGIMER, Chandigarh	Member

5	Prof. Sanjay Agarwal, AIIMS, New Delhi	Member
6	Dr. P. Kulhara, PGIMER, New Delhi	Member
7	Dr. V. K. Vijyan, Kozhikode	Member
8	Director, NIREH, Bhopal	Member
9	Dr. N. Banerjee, Scientist C, NIREH, Bhopal	Member Secretary

Basic Research Expert group

1	Prof. N. K. Mehra, AIIMS, New Delhi	Chairperson
2	Dr. Sunita Saxena, Director, NIOP, New Delhi	Co-chair
3	Dr. (Mrs) S. Chiplunkar, Director, ACTREC, Mumbai	Member
4	Dr. Ravi Mehrotra, Director, ICPO, NOIDA	Member
5	Dr. R. K. Pillai, Rajiv Gandhi Centre for Biotechnology, Kerala	Member
6	Dr. Rameshwaran, ICGB, New Delhi	Member
7	Dr. Rama Chaudhury, AIIMS, NEW Delhi	Member
8	Director, NIREH, Bhopal	Member Secretary

Genetics Research Expert Group

1	Dr. Shubha Phadke, SGPGI, Lucknow	Chairperson
2	Dr. Raj Lakshmi Gope, NIMHANS, Bangalore	Co-chair
3	Dr. Madhulika Kabra, AIIMS, New Delhi	Member
4	Dr. B. K. Thelma, New Delhi	Member
5	Dr. Gajendra Singh, IMS, BHU, Varanasi	Member
6	Dr. R. Raman, Genetic Centre, BHU, Varanasi	Member
7	Prof. Bidyut Roy, ISI, Kolkata	Member
8	Director, NIREH, Bhopal	Member
9	Dr. R. Galgalekar, Scientist B, NIREH, Bhopal	Member Secretary

Institutional Ethics Committee

1	Dr. P. S. Chauhan, Former District & Session Judge, Bhopal	Chairperson
2	Dr. S. C. Dubey, Ex Jt. Director, HSADL, Bhopal	Member
3	Prof. S. D. Seth, Consultant (CTRI), IRMS, N. Delhi (Basic Scientist)	Member
4	Dr. N. P. Mishra, Former Dean, GMC, Bhopal	Member
5	Prof. Reeni Malik, HOD, Pathology, GMC, Bhopal	Member
6	Prof. Ravi Kant, Deptt of Surgery, AIIMS, Bhopal (Clinician)	Member
7	Dr. Raka Arya, Asstt. Prof. NLIU, Bhopal (Clinician)	Member
8	Prof. Ranjana Srivastava, Govt. MLB College, Bhopal	Member
9	Dr. Nandini K. Kumar, Ex DDG (SG), ICMR, Chennai	Member
10	Pandit A.K. Dwivedi, Mahakal, Shiv Mandir, Bhopal (Lay Person)	Member
11	Dr. N. Banerjee, Scientist C, NIREH, Bhopal	Member Secretary

Building Advisory Committee

1	Prof. N. K. Mehra, AIIMS, New Delhi	Chairperson
2	Dr. H. Murugkar, Principal Scientist & Biosafety Officer, NIHSAD	Member
3	Prof. Savita Raje, School of Planning & Architecture, Bhopal	Member
4	Prof. Subrata Roy, Head, Civil & Environ Engineering, NITTTR, Bhopal	Member
5	Sr. DDG (Admn), ICMR Headquarter, New Delhi	Member
6	Sr. Financial Advisor, ICMR Headquarters, New Delhi	Member
7	Executive Engineer/ Representative of CPA , Bhopal	Member
8	Dr. R. C. Sharma, Ex Director, DMRC, Jodhpur	Member
9	Dr. N. Banerjee, Scientist C, NIREH, Bhopal	Member
10	Dr. Anil Prakash, Director I/C, NIREH, Bhopal	Convener

Building Construction Monitoring Committee

1	Dr. Anil Prakash, Director-in-Charge, NIREH, Bhopal	Chairperson
2	Dr. J. P. Tagar, Head, Civil & Environ. Engr., NITTR, Bhopal	Member
3	Mr. Devendra Singh, Sr. Mgr (Engr. Serv), BMHRC, Bhopal	Member
4	Dr. R. C. Sharma, Consultant (Admn), ICMR Hqts	Member
5	Dr. V. S. Rathore, TA, NIREH, Bhopal	Member
6	Dr. N. Banerjee, Sc C, NIREH, Bhopal	Member Secretary

Purchase / Technical Committee

1	Prof. Sudhir Goel, Deptt of Biochemistry, AIIMS, Bhopal	Chairperson
2	Prof. Reeni Malik, HOD, Pathology, GMC, Bhopal	Member
3	Mr. Arun Agarwal, Consultant, BMHRC, Bhopal	Member
4	Dr. Anil Prakash, Director-in-Charge, NIREH, Bhopal	Member
5	Dr. N. Banerjee, Scientist C, NIREH, Bhopal	Member
6	Mr. Sudhir Srivastava, S.O. (Admn), NIREH, Bhopal	Member
7	Mr. S. Subherwal, AAO	Member Secretary

Local Procurement Committee

1	Dr. R. Galgalekar, Sc B, NIREH, Bhopal	Chairperson
2	Dr. R. M. Samarth, Asstt. Prof	Member
3	Mr. R. K. Verma, Technician B, NIREH, Bhopal	Member
4	Mr. S. Subherwal, AAO	Member
5	Mr. M. Waldhurkar, So (Acctts), NIREH, Bhopal	Member Secretary

Staff Grievance Committee

1	Dr. Sushil Singh, Scientist C, NIREH, Bhopal	Chairperson
2	Mrs. Moina Sharma, TO (B), NIREH, Bhopal	Member
3	Mr. Sudhir Srivastava, SO, NIREH, Bhopal	Member
4	Dr. V. S. Rathore, Technical Assistant, NIREH, Bhopal	Member
5	Mr. Anand Kori, Technician C, NIREH, Bhopal	Member

6	Mr. Shrikant Mishra, MTS (Gen) NIREH, Bhopal	Member
7	Mr. Dilip Kumar Ugwe, MTS (Gen), NIREH, Bhopal	Member

Transport Committee

1	Dr. K. K. Soni, Scientist B, NIREH, Bhopal	Chairperson
2	Mr. Mohd. Shoaib Khan, TA, NIREH, Bhopal	Member
3	Mr. Sudhir Srivastava, SO (Adm), NIREH, Bhopal	Member Secretary

Committee on Sexual Harassment of Working Women

1	Mrs. Moina Sharma, Sc B, NIREH, Bhopal	Chairperson
2	Dr. R. Galgalekar, Sc B, NIREH, Bhopal	Member
3	Prof. Manju Toppo, Deptt of PSM GMC, Bhopal	Member
4	Dr. K. K. Soni, Sc B, NIREH, Bhopal	Member
5	Dr. Anita Shukla, TA, NIREH, Bhopal	Member Secretary

Swacch Bharat Campaign Committee

1	Dr. K. K. Soni, Sc B, NIREH	Chairperson
2	Mrs. Moina Sharma, Sc B, NIREH	Member
3	Mr. Krishnadas V.K., PS, NIREH	Member
4	Mr. S. Shrivastava, SO, NIREH	Member
5	Mr. A. M. Khan, TA, NIREH	Member
6	Mrs. Swapa Azhar, TA, NIREH	Member
7	Dr. R. Galgalekar, Sc B, NIREH	Member Secretary

Maintenance Committee

1	Dr. Y. D. Sabde, Sc E, NIREH	Chairperson
2	Mr. D. S. Shukla, TA, NIREH	Member
3	Dr. V. S. Rathore, TA, NIREH	Member
4	Mr. S. Subherwal, AAO (BMHRC/NIREH)	Member
5	Mr. D. Ugawe, MTS, NIREH	Member
6	Mr. S. Shrivastava, SO, NIREH	Member Secretary

Scientific Committee

1	Dr. P. K. Mishra, Sc E, NIREH	Chairperson
2	Dr. Y. D. Sabde, Sc E, NIREH	Member
3	Dr. K. C. Pandey, Sc E, NIREH	Member
4	Dr. R. M. Samarth, Asstt. Prof (BMHRC/NIREH)	Member
5	Dr. N. Banerjee, Sc C, NIREH	Member
6	Dr. S. Singh, Sc C, NIREH	Member Secretary

Official Language Implementation Committee

1	Dr. Anil Prakash, Director-in-Charge, NIREH	Chairperson
2	Head, Regional Rajbhasha Implementation Office, Bhopal	Member
3	Dr. N. Banerjee, Sc C, NIREH	Member
4	Mr. Shoaib Khan, TA, NIREH	Member
5	Mr. Anand Kori, Tech C, NIREH	Member
6	Dr. R. Galgalekar, Sc B, NIREH	Member Secretary

Medical Reimbursement Committee

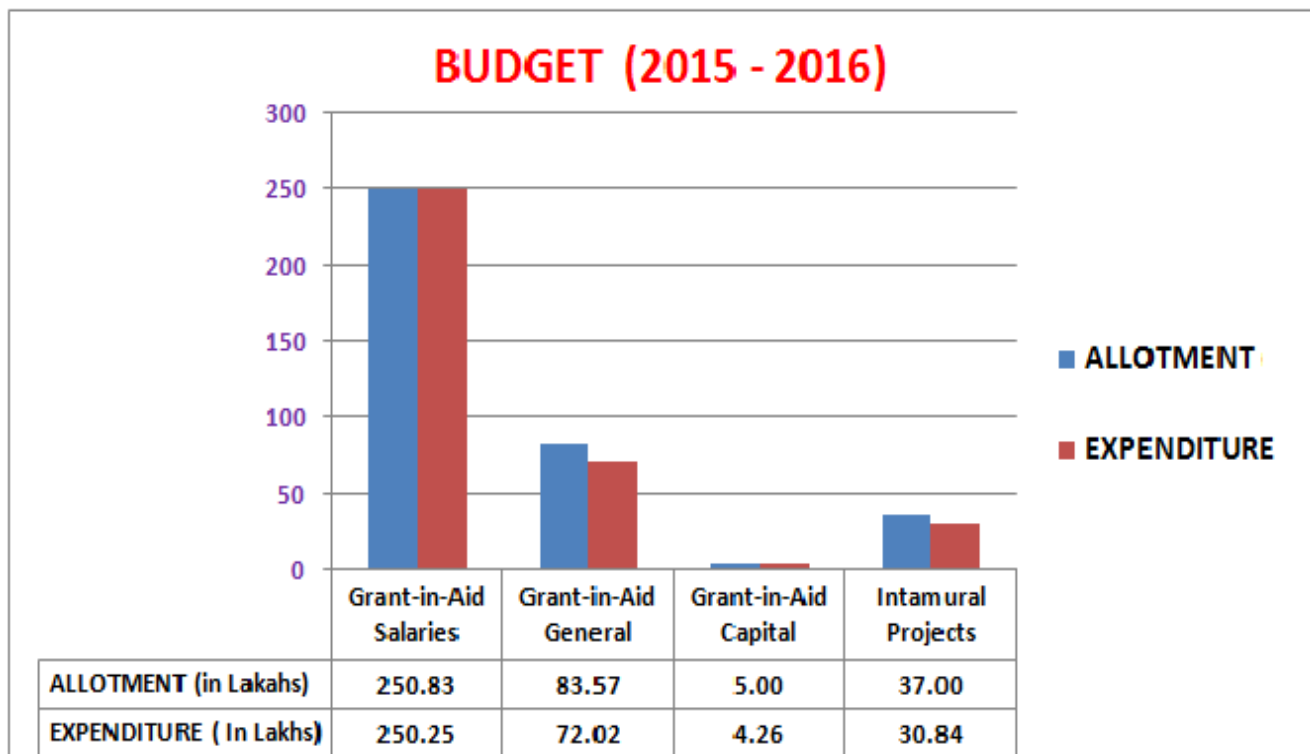
1	Dr. N. Banerjee, Sc C, NIREH	Chairperson
2	Dr. K. K. Soni, Sc B, NIREH	Member
3	Dr. R. Galgalekar, Sc B, NIREH	Member
4	Mr. S. Subherwal, AAO (BMHRC/NIREH)	Member
5	Mr. S. S. Asthana, Consultant (F/A), NIREH	Member Secretary

Condemnation Committee

1	Prof. Sudhir Goel, Deptt of Biochemistry, AIIMS, Bhopal	Chairperson
2	Prof. R. Nigam, Deptt of Pathology, GMC, Bhopal	Member
3	Mr. Atul Jain, DD (Finance), BMHRC, Bhopal	Member
4	Mr. Pramod Nilange, Biomedical Engineer, BMHRC, Bhopal	Member
5	Mr. S. Subherwal, AAO (BMHRC/NIREH)	Member
6	Dr. N. Banerjee, Sc C, NIREH	Member Secretary

DISTINGUISHED VISITORS

1. Dr. Saumya Swaminathan, Secretary, DHR & Director General, ICMR, New Delhi
2. Mr. T. S. Jawahar, IAS, Sr. DDG (Admn), ICMR, New Delhi
3. Mr. R. P. Meena, IPS, Jt. Secretary, DHR, New Delhi
4. Mr. Sanjiv Dutta, Ex FA & Advisor to DG, ICMR, New Delhi
5. Dr. V. K. Vijayan, Former Director, Vallabh Bhai Patel Chest Institute, New Delhi
6. Dr. Padam Singh, Ex ADG, Indian Council of Medical Research, New Delhi
7. Prof. N. K. Mehra, C. G. Pandit Chair, ICMR, New Delhi
8. Prof. Shridhar Sharma, Emeritus Professor, IHBAS, Delhi
9. Dr. Ulka Shrivastava, Dean, Gandhi Medical College, Bhopal
10. Mrs. Gauri Singh, IAS, Principal Secretary (Health), Govt of M. P., Bhopal
11. Mr. Abhishek Singh, IAS, Commissioner-Cum-Director, Gas Relief & Rehabilitation Deptt, Govt of M. P., Bhopal
12. Dr. P. S. Chauhan, Ex District & Session Judge, Bhopal
13. Justice V. K. Agarwal, Chairperson, Gas Rahat Monitoring Committee, Bhopal
14. Mr. K. K. Dube, Director, Kamla Nehru Gas Rahat Hospital, Bhopal



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